
# Novato General Plan 2035

## Draft Environmental Impact Report

*prepared by*

**City of Novato**
Community Development Department
922 Machin Avenue
Novato, California 94945
Contact: Steve Marshall, AICP, Planning & Environmental Services Manager

*prepared with the assistance of*

**Rincon Consultants, Inc.**
449 15th Street, Suite 303
Oakland, California 94612

**February 2020**

RINCON CONSULTANTS, INC.
Environmental Scientists | Planners | Engineers
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# Table of Contents

## Tables

## Figures

## Appendices

# Executive Summary

This section summarizes the characteristics of the proposed project, as well as the environmental impacts and recommended mitigation measures for General Plan 2035, the Industrial Parks Master Plan/Precise Development Plan Amendment, and implementing ordinances.

## Project Synopsis

### Project Applicant

City of Novato
922 Machin Avenue
Novato, California 94945

### Lead Agency

City of Novato
922 Machin Avenue
Novato, California 94945

### Project Location

Novato is located in the greater North Bay region of the San Francisco Bay Area and is the northernmost city in Marin County. The City is located northwest of San Pablo Bay approximately 29 miles north of San Francisco, 37 miles northwest of Oakland, and approximately 35 miles north of the San Francisco International Airport. The City is bordered by unincorporated areas of Marin County. The closest cities are the City of Petaluma in Sonoma County to the north and the City of San Rafael to the south. San Pablo Bay lies to the east of the City.

General Plan 2035 applies to all lands within the Novato City limits, within the City's Urban Growth Boundary (UGB), and within the City's Sphere of Influence (SOI). The City's UGB was originally approved by Novato voters in November 1997 and remained in effect until November 4, 2017. In the November 2017 election Novato voters amended and extended the term of the UGB, thus the UGB will remain in effect until the end of 2042.

The SOI is a boundary defining the probable future physical boundaries and service areas of the City. This area is defined as the "Plan Area" for the proposed project in this EIR. The City's SOI, and thus Plan Area, extends in a few areas past the current City limits and UGB boundary into nearby unincorporated areas as determined by the Marin Local Agency Formation Commission (LAFCO).

### Project Description

General Plan 2035 is a comprehensive update of the City's 1996 General Plan and establishes the community's vision for future development of the City through 2035. As part of the general plan process, General Plan 2035 has been reorganized and reformatted, with updated goals, policies, and programs that reflect the community's vision of Novato. The City's General Plan Land Use Map has also been updated to reflect the community's vision to permit new growth in four specific focus areas in the City, which are most likely to change in the next 17 years and would benefit from careful planning. The four focus areas include Downtown; North Redwood Corridor; North, North Redwood Corridor; and the Northwest Quadrant Neighborhood. In addition to the four focus areas, expanded development could occur in the Novato Industrial Park – Hamilton Park and Ignacio Park per the Industrial Parks Master Plan/Precise Development Plan Amendment (Industrial Parks MPA) area. The Industrial Parks MPA is proposed to be modified to allow an increased floor area ratio and building height limit for designated "Life Science Campus" development for the biotechnology industry, subject to a cap of 500,000 square feet.

Growth and development in Novato would be guided by General Plan 2035. General Plan 2035 would maintain the City's small-town character, while respecting natural resources. Growth within the City limits is supported by General Plan 2035 with consideration of the ability to provide public services, fiscal impacts, and infrastructure capacity including water and wastewater capacity and transportation. The General Plan land use map would correct currently known errors (e.g., commercial designations applied to residentially developed property) to reflect existing uses or acknowledge a shift to public/open space/ownership. In addition, it is the City's intent to adopt a number of the implementing zoning provisions and modify Novato's zoning map to be consistent with the policies and programs contemplated in General Plan 2035 as part of the proposed project.

### *Project Objectives*

The General Plan 2035 vision is as follows:

> We, the citizens of Novato, love our community: its natural beauty, quaint downtown and small-town character, safe, quiet neighborhoods, excellent schools and parks, and above all, our friendly, caring people. We envision a sustainable community that fits naturally into the environment and provides for our basic needs so that all can continue to enjoy the benefits of living in this very special place.
>
> This General Plan Vision has two fundamental purposes: to preserve and enhance those characteristics of our City that we hold dear, and to provide guidance for the future of our City, based on sustainable principles.

The 2035 General Plan sets the following guiding principles:

We wish to preserve and enhance:

- The open space, hillsides, ridgelines, creeks, wetlands and other natural features that give our City its scenic beauty, quality of life and define our borders;
- Our small-town character and historical heritage;
- The safe, quiet and individual character of our distinct neighborhoods, where our residents can raise their families and send their children to excellent schools;
- The many small businesses throughout our City that provide our residents with essential goods, services and jobs; and
- The financial integrity of our City government so that it may continue to serve the civic needs of all of our residents.

As we look to the future, we wish to encourage and promote:

- Sustainable development that is in harmony with its the natural and built environment;

- A variety of housing types dispersed throughout the community, portions of which are affordable, for our commercial workforce, public employees, seniors, and those with special needs;
- Creation of public gathering places, parks, recreational facilities and community gardens that provide a sense of community, and allow enjoyment of our natural amenities;
- Creation of venues to enrich the visual and performing arts;
- Development that meets the needs of our residents and supports quality public services;
- Encouragement of interconnected modes of local transportation, including bicycle and pedestrian paths and trails, shuttles, buses, and paratransit.

The objectives of the Industrial Parks MPA are as follows:

- Strengthen and expand the biotech and life sciences industries in Novato
- Economic development in Novato
- Promote job orientation in Novato with higher paying jobs

The objective of the zoning modifications and zoning map changes is to implement and maintain consistency with the policies and programs contemplated in General Plan 2035.

### *Required Discretionary Approvals*

With recommendations from the City's Planning Commission, the Novato City Council will need to take the following discretionary actions in conjunction with the proposed project:

- Certification of the Final EIR
- Approval of the proposed General Plan 2035
- Approval of the revisions to the Zoning Map and Zoning Ordinance amendments to implement select programs of General Plan 2035
- Approval of the Industrial Parks Master Plan Amendment

These actions are referred to herein collectively as the proposed project. Novato adopted its current Housing Element in November 2014, covering the period 2015-2023. This Housing Element was submitted to the California Department of Housing and Community Development (HCD) for review and comment, and the City received certification of the Housing Element from HCD in January 2015. No updates to the Housing Element are necessary or proposed at this time.

## Alternatives

As required by the California Environmental Quality Act (CEQA), this EIR examines alternatives to General Plan 2035. Studied alternatives include the following four alternatives. Based on the alternatives analysis, Alternative 3, Proposed General Plan 2035 with 300,000 square foot Industrial Parks MPA, was determined to be the environmentally superior alternative.

- Alternative 1: No Project Alternative
- Alternative 2: Proposed General Plan 2035 without Industrial Park MPA
- Alternative 3: Proposed General Plan 2035 with 300,000 square foot maximum development cap in the Industrial Park MPA

- Alternative 4: Proposed General Plan 2035 but same land use as 1996 General Plan for the North Redwood Corridor and North, North Redwood Corridor

CEQA requires that an environmentally superior alternative be identified among those analyzed. It further states that if the No Project Alternative is identified as environmentally superior, the next most environmentally superior alternative must also be identified. When taking into account every environmental impact area, Alternative, Proposed General Plan 2035 with 300,000 square foot Industrial Parks MPA, is the environmentally superior alternative.

# Summary of Impacts and Mitigation Measures

Table ES-1 outlines the potential environmental impacts of proposed project, the proposed mitigation measures, and residual impacts or significance after mitigation. Impacts are defined as significant and unavoidable impacts that require a statement of overriding considerations, pursuant to Section 15093 of the *CEQA Guidelines* if the proposed project is approved; less than significant impacts with mitigation that can be feasibly mitigated to less than significant levels and that require findings to be made under Section 15091 of the *CEQA Guidelines*; less than significant impacts allowed by adopted significance thresholds; and no impact.

**Table ES-1 Summary of Environmental Impacts, Mitigation Measures, and Residual Impacts**

| Impact | Mitigation Measure(s) | Residual Impact |
|---|---|---|
| **Aesthetics** | | |
| **Impact AES-1.** The proposed project would not facilitate development that substantially obstructs scenic vistas or views or scenic natural or architectural resources. The impact on scenic vistas and resources would be less than significant. | None required. | Less than significant. |
| **Impact AES-2.** The proposed project would maintain Novato's existing visual character by prioritizing development in focus areas and preserving single-family residential neighborhoods. Proposed policies also would improve the visual quality of automobile-oriented areas. The impact on visual character and quality would be less than significant. | None required. | Less than significant. |
| **Impact AES-3.** New development associated with the proposed project could increase light and glare effects on sensitive receptors, such as residential uses. However, new development would be subject to existing regulations in the City's Municipal Code and proposed General Plan policy to protect dark skies at nighttime. Therefore, the project would have a less than significant impact associated with light and glare. | None required. | Less than significant. |

| Impact | Mitigation Measure(s) | Residual Impact |
|---|---|---|
| **Air Quality** | | |
| **Impact AQ-1.** The proposed project would not conflict with BAAQMD's 2017 Clean Air Plan. Impacts would be less than significant. | None required. | Less than significant. |
| **Impact AQ-2.** Operation of the proposed project would not violate any air quality standard, contribute substantially to an existing air quality violation, or result in a cumulatively considerable net increase in any criteria pollutant resulting from operational emissions. Impacts would be less than significant. | None required. | Less than significant. |
| **Impact AQ-3.** Implementation of the proposed project would result in the temporary generation of air pollutants during construction, which may contribute to existing air quality violations in the basin. Impacts would be potentially significant. | **AQ-1 Construction Emissions Measures**. New discretionary projects in the Plan Area that exceed the construction screening criteria of the Bay Area Air Quality Management District (BAAQMD) shall be conditioned to reduce construction emissions of reactive organic gases, nitrogen oxides, and particulate matter ($PM_{10}$ and $PM_{2.5}$) by implementing the BAAQMD's Basic Construction Mitigation Measures (described below) or equivalent, expanded, or modified measures based on project and site specific conditions.<br>Basic Construction Mitigation Measures<br>1. All exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) shall be watered two times per day, with priority given to the use of recycled water for this activity when feasible.<br>2. All haul trucks transporting soil, sand, or other loose material off-site shall be covered.<br>3. All visible mud or dirt track-out onto adjacent public roads shall be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweeping is prohibited.<br>4. All vehicle speeds on unpaved roads shall be limited to 15 mph.<br>5. All roadways, driveways, and sidewalks to be paved shall be completed as soon as possible. Building pads shall be laid as soon as possible after grading unless seeding or soil binders are used.<br>6. Idling times shall be minimized either by shutting equipment off when not in use or reducing the maximum idling time to 5 minutes (as required by the California airborne toxics control measure Title 13, Section 2485 of California Code of Regulations [CCR]). Clear signage shall be provided for construction workers at all access points.<br>7. All construction equipment shall be maintained and properly tuned in accordance with manufacturer's specifications. All equipment shall be checked by a certified visible emissions evaluator.<br>8. A publicly visible sign shall be posted with the | Less than significant with mitigation incorporated. |

| Impact | Mitigation Measure(s) | Residual Impact |
|---|---|---|
| | telephone number and person to contact at the lead agency regarding dust complaints. This person shall respond and take corrective action within 48 hours. The Air District's phone number shall also be visible to ensure compliance with applicable regulations. | |
| **Impact AQ-4.** Implementation of the proposed project may expose sensitive receptors to additional sources of toxic air contaminants. Impacts would be potentially significant. | **AQ-2 Health Risk Assessments.** Projects that may result in additional toxic air contaminants that are located within 1,000 feet of a sensitive receptors(s) or would place sensitive receptors within 1,000 feet of uses generating toxic air contaminants, such as roadways with volumes of 10,000 average annual daily trips or greater, shall implement Bay Area Air Quality Management District Guidelines and State Office of Environmental Health Hazard Assessment policies and procedures requiring health risk assessments (HRAs) for residential development and other sensitive receptors; screening area distances may be increased on a case-by-case basis if an unusually large source or sources of hazardous emissions are proposed or currently exist. Based on the results of the HRA, identify and implement measures (such as air filtration systems) to reduce potential exposure to particulate matter, carbon monoxide, diesel fumes, and other potential health hazards. Measures identified in HRAs shall be included into the site development plan as a component of a proposed project.. | Less than significant with mitigation incorporated. |
| **Impact AQ-5.** The proposed project may create objectionable odors that could affect a substantial number of people from light industrial/office development. Impacts related to odors would be potentially significant. | **AQ-1 Construction Emissions Measures** (see Impact AQ-1 above)<br>**AQ-3 Odor Reduction.** Require new manufacturing and laboratory development to be designed and constructed in a way that reduces the potential for future odors. Ensure prompt response to complaints about odor projects reported by residences and businesses by developing a website link that directs users to BAAQMD's odor reporting and inspection program. | Less than significant with mitigation incorporated. |
| **Biological Resources** | | |
| **Impact BIO-1.** With implementation of the Goals and Policies in General Plan 2035, sensitive biological resources would be preserved and enhanced. However, General Plan 2035 does not require assessment of sensitive biological resources for development in sensitive biological areas; therefore, the proposed project could affect sensitive resources or areas. Impacts would be potentially significant. | **BIO-1 Incorporation of Sensitive Species.** Environmental Legacy Goal 1 shall be updated in General Plan 2035 to read:<br>Preserve, enhance and restore natural areas <u>and features</u>, including Novato's scenic hillsides, waterways, riparian corridors, ~~and~~ baylands<u>, and special-status species</u>.<br>**BIO-2 Biological Studies for New Development.** Project applicants shall be required to provide a biological assessment for projects on parcels with indicators of sensitive biological features, such as waterways. The purpose of these assessments is to identify appropriate measures to avoid or minimize harm to sensitive biological resources and to incorporate the recommended measures as conditions of approval for the project. Detailed assessments are not necessary in locations where past and existing development have eliminated natural habitat and the potential for the | Less than significant with mitigation incorporated. |

| Impact | Mitigation Measure(s) | Residual Impact |
|---|---|---|
| | presence of sensitive biological resources.<br>**BIO-3 Biological Resources Inventory for New Development.** A detailed inventory of biological resources conducted by an independent, professionally qualified biologist, plant ecologist, arborist, or appropriately qualified specialist shall be required for projects in sensitive and vulnerable habitats. If sensitive resources are identified on the project site, recommendations to protect the sensitive resources shall conform with applicable State and federal regulations regarding their protection and may include avoidance of the resource, providing setbacks, clustering development onto less sensitive areas, preparing restoration plans, off-site mitigation, and/ or similar measures as determined on a project specific basis. | |
| **Impact BIO-2.** Implementation of the proposed project would not result in a reduction in nesting opportunities for resident and migratory avian species of specific concern because of preservation and enhancement policies in General Plan 2035 and compliance with the Migratory Bird Treaty Act. However, development projected by General Plan 2035 may impact special-status nesting birds; impacts would be potentially significant. | **BIO-4 Nesting Bird Protection.** All discretionary projects shall retain the services of a qualified biologist(s) to conduct a pre-construction nesting bird survey during the nesting season (February 1 through August 31) prior to any and all development that may remove trees or vegetation that may provide suitable nesting habitat for migratory birds or other special-status bird species. If nests are found the qualified biologist(s) shall identify and the project sponsor shall implement appropriate avoidance measures, such as fenced buffer areas or staged tree removal periods.. | Less than significant with mitigation incorporated. |
| **Impact BIO-3.** While implementation of the proposed project would not facilitate development that would directly impact riparian and wetland habitats, there would be potential for adverse impacts from such development on wetlands and areas under the jurisdiction of CDFW and USACE. However, compliance with existing regulations, and implementation of General Plan 2035 policies would reduce potential impacts to a less than significant level. | None required. | Less than significant. |
| **Impact BIO-4.** Implementation of the proposed project would largely avoid impacts on wildlife movement corridors by conserving natural areas through policies in General Plan 2035. However, there are no specific policies preserving wildlife movement corridors and impacts would be potentially significant. | **BIO-5 Wildlife Movement Corridors Protection Policy.** The General Plan Environmental Legacy Policy EL 3 shall be updated to read:<br>**Policy EL 3 *Wildlife Habitat.*** Endeavor to preserve and enhance wildlife habitat areas <u>and important wildlife movement corridors</u> in watercourse areas and control human use of these areas as necessary to protect them.<br>**BIO-6 Biological Studies for Wildlife Movement Corridors.** All discretionary projects on parcels with indicators of wildlife movement corridors shall retain the services of a qualified biologist(s) to conduct a biological assessment prior to any and all development that may impact wildlife movement. If movement corridors are potentially impacted by the proposed | Less than significant with mitigation incorporated. |

| Impact | Mitigation Measure(s) | Residual Impact |
|---|---|---|
| | project, the qualified biologist(s) shall identify appropriate mitigation measures to avoid or minimize the impact. Such measures shall be a condition of approval and implemented by the project sponsor. | |
| **Impact BIO-5.** Implementation of the proposed project would conform with applicable local policies protecting biological resources and underscore their importance with strengthened policy statements. Impacts would be less than significant. | None required. | Less than significant. |
| **Impact BIO-6.** Implementation of the proposed project would not conflict with any habitat conservation plan or natural community conservation plan because there are no such plans in Novato. There would be no impact. | None required. | No impact. |
| **Cultural Resources** | | |
| **Impact CUL-1.** Implementation of the proposed project has the potential to impact historical resources. Impacts would be potentially significant. | **CUL-1 Historical Resources Study Program.** All discretionary projects shall investigate the potential to impact historical resources. A historical resources evaluation shall be performed to confirm the presence of historical resources within the project site when there is a structure(s) or feature of a type, period, and/or method of construction that could be qualified as having historic status. The study shall, at a minimum, be conducted by a qualified professional meeting the Secretary of the Interior's (SOI) Professional Qualification Standard (PQS) for architectural history (NPS 1983). The study shall include a pedestrian survey of the project site and background research including a records search at the Northwest Information Center (NWIC), building permit research, and/or research with the local historical society(ies). The subject property(ies) shall be evaluated for federal, state, and local designation on California Department of Parks and Recreation 523 series forms, included as an appendix to the study. If historical impacts are identified, the study shall include recommendations to avoid or reduce impacts on historical resources and the project sponsor shall implement the recommendations or conduct additional environmental review. | Less than significant with mitigation incorporated. |
| **Impact CUL-2.** Implementation of the proposed project has the potential to impact archaeological resources. Impacts would be potentially significant. | **CUL-2 Archaeological Resources Study Program.** All discretionary projects shall investigate the potential to disturb archaeological resources. If preliminary reconnaissance suggests that cultural resources may exist, a Phase I cultural resources study shall be performed by a qualified professional meeting the Secretary of the Interior's (SOI) Professional Qualification Standard (PQS) for archaeology (NPS 1983). A Phase I cultural resources study shall include a pedestrian survey of the project site and sufficient background research and, as necessary, field sampling to determine whether archaeological resources may be present. Archival research shall include a records search at the Northwest | Less than significant with mitigation incorporated. |

| Impact | Mitigation Measure(s) | Residual Impact |
|---|---|---|
| | Information Center (NWIC) and a Sacred Lands File (SLF) search with the Native American Heritage Commission (NAHC). The Phase I technical report documenting the study shall include recommendations to avoid or reduce impacts on archaeological resources. The project sponsor shall implement the recommendations. | |
| **Impact CUL-3.** Development under the proposed project has the potential to impact paleontological resources. Impacts would be potentially significant. | **CUL-3 Paleontological Resource Studies.** Avoidance and/or mitigation for potential impacts to paleontological resources shall be required for any development in Novato that occurs within high sensitivity geologic units (Pleistocene alluvium [Qpa] and Pleistocene alluvium [Qoa] deposits), whether they are mapped at the surface or occur at the subsurface. When paleontological resources are uncovered during site excavation, grading, or construction activities, work on the site will be suspended until the significance of the fossils can be determined by a qualified paleontologist. If significant resources are determined to exist, the paleontologist shall make recommendations for protection or recovery of the resource.<br>The City shall require the following specific measures for projects that could disturb geologic units with high paleontological sensitivity:<br>▪ **Retain a Qualified Paleontologist to Prepare a PMMP.** Prior to initial ground disturbance, the project applicant shall retain a Qualified Paleontologist, as defined by the SVP (2010), to direct all mitigation measures related to paleontological resources and design a Paleontological Mitigation and Monitoring Program (PMMP) for the project. The PMMP shall include measures for a preconstruction survey, a training program for construction personnel, paleontological monitoring, fossil salvage, curation, and final reporting, as applicable. | Less than significant with mitigation incorporated. |
| **Impact CUL-4.** Ground disturbing activities associated with implementation of the proposed project could result in damage to or destruction of human burials. However, with compliance with existing regulations, impacts would be less than significant. | None required. | Less than significant. |
| **Geology and Soils** | | |
| **Impact GEO-1.** Implementation of the proposed project could result in exposure of people or structures to a risk of loss, injury, or death from seismic events. However, adherence to existing requirements would reduce this impact to a less than significant level. | None required. | Less than significant |

| Impact | Mitigation Measure(s) | Residual Impact |
|---|---|---|
| **Impact GEO-2.** The proposed project would include ground disturbance such as excavation and grading that would result in loose or exposed soil. However, compliance with existing regulations and implantation of the goals and policies of General Plan 2035 would reduce impacts to a less than significant level. | None required. | Less than significant. |
| **Impact GEO-3.** Implementation of the proposed project may result in the construction of structures on expansive soils, which could create substantial risk to life or property. However, development would be required to comply with the California Building Code, which would ensure that expansive soils are remediated or that foundations and structures are engineered to withstand the forces of expansive soil. Compliance with the requirements of the California Building Code would reduce this impact to a less than significant level. | None required. | Less than significant. |
| **Impact GEO-4.** Implementation of the proposed project would occur primarily where existing sewer systems are in place. However, some new development may require the use of septic systems or alternative wastewater disposal systems. With proper site investigations, these systems would be constructed on soils capable of adequately supporting their use. Impacts would be potentially significant. | **GEO-1 Soil Investigation Report.** New development projects not connected to the municipal sewer system and requiring the use of septic tanks or alternative wastewater disposal systems shall complete a soil investigation report to be submitted to the City of Novato for review and approval prior to issuance of grading and building permits. The study shall demonstrate the capability of the underlying soils to support the use of septic tanks or alternative wastewater disposal systems. Such report shall be prepared by a registered professional geologist and shall include soil type characteristics, percolation rates, and design recommendations. | Less than significant with mitigation incorporated. |
| **Greenhouse Gas Emissions** | | |
| **Impact GHG-1.** Implementation of General Plan 2035, which serves as the City's Climate Action Plan, would generate annual GHG emissions of approximately 191,003 MT of CO2e per year, or 2.29 MT of CO2e per SP per year, which would not exceed the 2035 efficiency threshold of 2.38 MT of CO2e per SP per year. Impacts would therefore be less than significant. | None required. | Less than significant. |

| Impact | Mitigation Measure(s) | Residual Impact |
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| **Impact GHG-2.** The proposed project would be consistent with GHG reduction goals contained in the city of Novato 2009 Climate Change Action Plan and the ABAG/MTC Plan Bay Area 2040 and would not conflict with State policies or regulations. impacts would be less than significant. | None required. | Less than significant. |
| **Hazards and Hazardous Materials** | | |
| **Impact HAZ-1.** Implementation of the proposed project could result in an incremental increase in the overall routine transport, use, storage, and disposal of hazardous materials within the City and increase the risk of release of hazardous materials. However, compliance with applicable regulations related to the handling and storage of hazardous materials and compliance with General Plan 2035 policies would minimize the risk of spills and the public's potential exposure to these substances. Impacts would be less than significant. | None required. | Less than significant |
| **Impact- HAZ-2.** Implementation of the proposed project could result in hazardous emissions or handling of hazardous or acutely hazardous materials, substances, or waste within ¼ mile of an existing or proposed school, but compliance with existing regulatory requirements would minimize risks to schools and students, result in a less than significant impact. | None required. | Less than significant. |
| **Impact-HAZ-3.** Implementation of the proposed project could result in development on sites contaminated with hazardous materials. However, compliance with applicable regulations relating to site cleanup and General Plan 2035 policies would minimize impacts from development on contaminated sites. Impacts would be less than significant. | None required. | Less than significant. |
| **Impact HAZ-4.** The northern portion of Novato is inside the area of influence for Gnoss Field-Marin County Airport and could result in safety hazards for people working or residing in the area of influence. Impacts would be avoided through implementation of goals and policies in General Plan 2035 and hazardous impacts on people working and residing within the airport area of influence would be less than significant. | None required. | Less than significant. |

| Impact | Mitigation Measure(s) | Residual Impact |
|---|---|---|
| **Impact HAZ-5.** General Plan 2035 policies address maintaining a Local Hazard Mitigation Plan and emergency access implementation. Therefore, the proposed project would not result in interference with these types of adopted plans. Impacts would be less than significant. | None required. | Less than significant. |
| **Impact HAZ-6.** Implementation of the proposed project could result in development in urbanized areas adjacent to wildlands. However, implementation of policies included in General Plan 2035 would reduce the exposure of people or structures to a significant risk of loss, injury, or death involving wildland fires. Impacts would be less than significant. | None required. | Less than significant. |
| **Hydrology and Water Quality** | | |
| **Impact HWQ-1.** Implementation of the proposed project could result in a discharge of pollutants to surface waters or contamination of shallow groundwater through increased soil disturbance and erosion, discharge of contaminated wastewater or storm water, or accidental spills or leaks of hazardous materials. Compliance with applicable laws and regulations and implementation of the goals and policies of General Plan 2035 would minimize the potential for water quality degradation. Impacts would be less than significant. | None required. | Less than significant. |
| **Impact HWQ-2.** Implementation of the proposed project would result in new impervious surfaces that could interfere with groundwater recharge, resulting in a lowering of the local groundwater table level. However, compliance with applicable laws and regulations and implementation of the goals and policies contained in General Plan 2035 would minimize runoff and maximize infiltration of stormwater. Impacts would be less than significant. | None required. | Less than significant. |
| **Impact HWQ-3.** The proposed project could alter the existing drainage patterns in the City and potentially result in erosion and siltation. However, compliance with applicable regulations, including the Clean Water Act, and implementation of the goals and policies contained in General Plan 2035 would minimize the potential for | None required. | Less than significant. |

| Impact | Mitigation Measure(s) | Residual Impact |
|---|---|---|
| erosion and siltation. Impacts would be less than significant. | | |
| **Impact HWQ-4.** Implementation of the proposed project could alter the existing drainage patterns and increase the amount of runoff throughout the City, which could result in flooding on- or off-site, exceeding the capacity of existing or planned storm water drainage systems, or create substantial additional sources of polluted runoff. Compliance with applicable regulations and implementation of the goals and policies included in General Plan 2035 would minimize the potential for increased runoff and flooding. Impacts would be less than significant. | None required. | Less than significant. |
| **Impact HWQ-5.** Implementation of the proposed project could place housing or structures in a flood hazard area or expose people or structures to a significant risk of loss, injury, or death involving flooding. Compliance with applicable regulations and implementation of the goals and policies of General Plan 2035 would protect structures from adverse effects related to flooding, and would minimize the exposure of people or structures to flooding and construction of new storm water drainage facilities would not be required. Impacts would be less than significant. | None required. | Less than significant. |
| **Impact HWQ-6.** Implementation of the proposed project could place housing or structures in an area that could be flooded during the failure of a levee or dam. Compliance with applicable regulations and implementation of the goals and policies of General Plan 2035 would protect structures from adverse effects related to flooding. Impacts would be less than significant. | None required. | Less than significant. |
| **Impact HWQ-7.** Implementation of the proposed project could expose people or structures to a significant risk of loss, injury, or death involving a mudflow. Compliance with applicable regulations and implementation of the goals and policies included in General Plan 2035 would minimize the potential for adverse effects related to mudflow and would reduce this potential impact to a less-than-significant level. | None required. | Less than significant. |

| Impact | Mitigation Measure(s) | Residual Impact |
|---|---|---|
| **Land Use and Planning** | | |
| **Impact LU-1.** Implementation of the proposed project would provide for orderly development in the City of Novato and would not physically divide an established community. Impacts would be less than significant. | None required. | Less than significant. |
| **Impact LU-2.** Implementation of the proposed project would be generally consistent with applicable regional land use plans, policies, and regulations such as ABAG/MTC's Plan Bay Area 2040. Impacts would be less than significant**.** | None required. | Less than significant. |
| **Impact LU-3.** Implementation of the proposed project would not conflict with the Marin County, Gnoss Field Airport Land Use Plan. Impacts would be less than significant. | None required. | Less than significant. |
| **Noise** | | |
| **Impact N-1.** Implementation of the proposed project could expose new development to ambient noise levels that exceed the City's noise compatibility standards. However, implementation of General Plan 2035 goals and policies would reduce impacts to a less-than-significant level. | None required. | Less than significant. |
| **Impact N-2.** Implementation of the proposed project could incrementally increase traffic and associated noise levels along City roadways and railroads, thus exposing existing and future noise-sensitive land uses to incrementally greater noise levels. However, implementation of General Plan 2035 policies would reduce impacts to a less than significant level. | None required. | Less than significant. |
| **Impact N-3.** Implementation of the proposed project would introduce new on-site noise sources associated with residential, commercial and industrial land uses. The continued regulation of on-site noise, consistent with the Novato Municipal Code, and implementation of goals and policies in General Plan 2035 would minimize disturbance to adjacent land uses. Impacts would be less than significant. | None required. | Less than significant. |

| Impact | Mitigation Measure(s) | Residual Impact |
|---|---|---|
| **Impact N-4.** Implementation of the proposed project would temporarily produce noise levels potentially affecting adjacent noise-sensitive land uses. Although the Novato Municipal Code's timing restrictions on construction activity would limit noise disturbance, high noise levels during working construction hours could potentially disturb nearby receptors. Impacts would be potentially significant. | **N-1 Construction Noise Reduction Measures.** The following measures to minimize exposure to construction noise shall be included as standard conditions of approval for applicable projects involving construction:<br>1. *Mufflers*. During excavation and grading construction phases, all construction equipment, fixed or mobile, shall be operated with closed engine doors and shall be equipped with properly operating and maintained mufflers consistent with manufacturers' standards.<br>2. *Stationary Equipment*. All stationary construction equipment shall be placed so that emitted noise is directed away from the nearest sensitive receptors.<br>3. *Equipment Staging Areas*. Equipment staging shall be located in areas that will create the greatest distance feasible between construction-related noise sources and noise-sensitive receptors. | Less than significant with mitigation incorporated. |
| **Impact N-5.** Construction of the proposed project could temporarily generate groundborne vibration that may impact nearby receivers. Impacts would be potentially significant. | **N-2 Construction Vibration Reduction Measures.** The following measures to minimize exposure to construction vibration shall be included as standard conditions of approval for applicable projects involving construction:<br>1. *Building Examination*. The pre-existing condition of any buildings within 25 feet of any construction activities shall be recorded in order to evaluate damage from project-related construction. Fixtures and finishes within a 25-foot radius of construction activities susceptible to damage will be documented (photographically and in writing) prior to construction. All damage will be repaired back to its pre-existing condition.<br>2. *Stationary Equipment*. All vibratory stationary construction equipment shall be placed as far as possible from the nearest sensitive receptors.<br>3. *Equipment Staging Areas*. Equipment staging shall be located in areas that will create the greatest distance feasible between construction-related vibration sources and noise-sensitive receptors. | Less than significant with mitigation incorporated. |
| **Impact N-6.** Implementation of the proposed project could be affected by noise generated by the Gnoss Field Airport. However, goals and policies contained in General Plan 2035 and Gnoss Field Airport Land Use Plan and compliance with the Novato Municipal Code would ensure that future development is compatible with existing noise conditions and that noise-sensitive uses would not be exposed to excess airport noise. Impacts would be less than significant. | None required. | Less than significant. |

| Impact | Mitigation Measure(s) | Residual Impact |
|---|---|---|
| **Population and Housing** | | |
| **Impact PH-1.** Implementation of the proposed project would not include substantial population growth directly or indirectly. Therefore, population and growth inducing impacts would be less than significant. | None required. | Less than significant. |
| **Impact PH-2.** Implementation of the proposed project would not result in the displacement of substantial numbers of housing or people. To the contrary, the proposed project would facilitate the development of new housing in accordance with State and local housing requirements, while preserving existing residential neighborhoods. Impacts would be less than significant. | None required. | Less than significant. |
| **Public Services** | | |
| **Impact PS-1.** Implementation of the proposed project would increase population, generating additional need for Novato Fire Protection District Services. However, adherence to General Plan 2035 policies would reduce impacts associated with the provision of fire protection services to a less than significant level. | None required. | Less than significant |
| **Impact PS-2.** Implementation of the proposed project would increase population, generating additional need for Novato Police Department Protection Services. However, adherence to General Plan 2035 policies would reduce impacts associated with the provision of police protection services to a less than significant level. | None required. | Less than significant. |
| **Impact PS-3.** Development associated with the proposed project would facilitate development that would add school aged children. However, facilities have adequate capacity and new development would be required to pay impact fees which would result in less than significant impact with regard to the provision of school facilities. | None required. | Less than significant. |
| **Impact PS-4.** Development associated with the proposed project would result in an increase in the City's population and increased demand for library services, which could result in the provision of new or physically altered | None required. | Less than significant. |

| Impact | Mitigation Measure(s) | Residual Impact |
|---|---|---|
| library facilities. Impacts would be less than significant. | | |
| **Recreation** | | |
| **Impact REC-1.** Development projected by the proposed project would allow for an increase in the City's population. This would increase demand for parks and recreation facilities and potentially create the need for new park and recreation facilities. However, compliance with the policies in General Plan 2035 and payment of mandatory parkland dedication fees would reduce impacts related to parks and recreation to less than significant. | None required. | Less than significant |
| **Transportation and Traffic** | | |
| **Impact T-1**. New development facilitated by the proposed project is expected to increase traffic volumes in Novato, which may conflict with measures of effectiveness pertaining to motor vehicle delay at intersections. Increased delay to motor vehicle traffic at some intersections during the AM and PM peak travel hours would conflict with traffic level of service (LOS) standards. Impacts would be potentially significant. | **T-1 Intersection Delay Mitigations.** The following additional intersection improvements are necessary to maintain acceptable operation under Existing plus Project and Cumulative conditions with the proposed project.<br>▪ San Marin Drive/Simmons Lane (Intersection #1)<br>▫ Signalize the intersection; restripe both San Marin Drive approaches to include separate left-turn, through, and right-turn lanes.<br>▫ Alternative Mitigation: install a roundabout; the westbound approach would have two lanes, one serving through/right movements and one serving left-turn movements, and the remaining three approaches would have single lanes.<br>▫ The alternative roundabout mitigation may require minor right-of-way acquisitions on one or more intersection corners.<br>▪ Redwood Boulevard/San Marin Drive (Intersection #4)<br>▫ Widen the SMART railroad overpass to provide space on the westbound approach for two left-turn lanes, two through lanes, and one right-turn lane, as well as bike lanes and a widened sidewalk on the south side of the overpass.<br>▫ Widen the southbound Redwood Boulevard approach to include a left-turn lane, shared left-turn/through lane, and right-turn lane.<br>▫ Restripe the northbound Redwood Boulevard to include a left-turn lane, left-turn/through lane, and two right-turn lanes.<br>▫ Add right-turn overlap signal phasing on the northbound and westbound approaches.<br>▫ This mitigation would entail roadway and overpass widening that could require right-of-way acquisition.<br>▫ To make this intersection function acceptably, additional improvements would be needed at the | Significant and unavoidable |

| Impact | Mitigation Measure(s) | Residual Impact |
|---|---|---|
| | US 101 South Ramps/San Marin Drive intersection, as described in the next bullet.<br>▪ US 101 South Ramps/San Marin Drive (Intersection #5)<br>▫ Modify the eastbound San Marin Drive approach (the SMART railroad overpass) to include a through lane, a shared through/right-turn lane, and a right-turn lane.<br>▫ Provide an enhanced bicycle-pedestrian crossing at the on-ramp entrance, including modified signal phasing to include protected pedestrian and bicyclist movements across the ramp.<br>▫ This mitigation would entail roadway and overpass widening that could require right-of-way acquisition, and potentially affect areas that appear to be wetlands between the SMART rail corridor and the off-ramp.<br>▪ US 101 North Ramps/Atherton Avenue (Intersection #6)<br>▫ Widen the northbound off-ramp to include two left-turn lanes and a shared through/right-turn lane.<br>▪ Novato Boulevard/San Marin Drive-Sutro Avenue (Intersection #9)<br>▫ Signalize the intersection.<br>▫ Alternative Mitigation: install a single-lane roundabout with a southbound right-turn “slip” lane.<br>▫ The alternative roundabout mitigation may require minor right-of-way acquisition on one or more intersection corners.<br>▪ Diablo Avenue/Novato Boulevard (Intersection #14)<br>▫ Restripe the eastbound and westbound Diablo Avenue approaches to include separate left-turn, through, and right-turn lanes.<br>▫ Restripe the northbound Novato Boulevard Approach to include a left-turn lane, through lane, and through/right-turn lane.<br>▫ Widen and modify southbound Novato Boulevard to include dual left-turn lanes and a shared through/right-turn lane.<br>▫ Modify the signal phasing to protected left-turns on all approaches plus a westbound right-turn overlap phase.<br>▫ The mitigation may require minor right-of-way acquisition on Novato Boulevard to the northwest of the intersection.<br>▪ South Novato Boulevard/Redwood Boulevard (Intersection #30)<br>▫ Signalize the intersection.<br>▫ Alternative Mitigation: install a single-lane roundabout with an eastbound right-turn “slip” lane. | |

| Impact | Mitigation Measure(s) | Residual Impact |
|---|---|---|
| | ▫ The alternative roundabout mitigation may require minor right-of-way acquisition on one or more intersection corners.<br>▪ US 101 South Ramps/Ignacio Boulevard-Enfrente Road (Intersection #32)<br>▫ On the southbound US 101 "loop" off-ramp, extend the length of the dual right-turn pockets to 500 feet.<br>▫ Optimize signal timing on the coordinated Ignacio Boulevard-Bel Marin Keys Boulevard corridor.<br>▪ Bel Marin Keys Boulevard/Digital Drive (Intersection #35)<br>▫ Restripe the westbound approach to include a left-turn lane and a left-turn/through/right-turn lane, and modify the signal to operate with split phasing in the eastbound and westbound directions. | |
| **Impact T-2.** New development facilitated by the proposed project is expected to increase traffic volumes in Novato, potentially leading to non-compliance with the standards set forth in the County of Marin Congestion Management Program. Reduced vehicle speeds by 2035 would conflict with the roadway segment LOS standard on Bel Marin Keys Boulevard. Impacts would be potentially significant. | Implement Mitigation Measure T-1. | Significant and unavoidable |
| **Impact T-3.** The proposed Project would not result in a change in air traffic patterns or safety risks pertaining to air traffic. Impacts to air traffic would be less than significant. | None required. | Less than significant. |
| **Impact T-4.** The proposed project is a program-level plan that does not directly address project-level design features. Roadway improvements and site access measures would be designed and reviewed in accordance with City standards. Impacts would be less than significant. | None required. | Less than significant. |
| **Impact T-5.** The proposed project identifies circulation improvements and policies that will support emergency access. Impacts would be less than significant. | None required. | Less than significant. |
| **Impact T-6.** The proposed project supports the goals and policies identified in applicable plans regarding complete streets, public transit, bicycle facilities, and pedestrian facilities. This impact would be less than significant. | None required. | Less than significant. |

| Impact | Mitigation Measure(s) | Residual Impact |
|---|---|---|
| **Tribal Cultural Resources** | | |
| **Impact TCR-1.** Implementation of the proposed project may involve excavation, which has the potential to impact previously unidentified tribal cultural resources. Impacts on tribal cultural resources would be potentially significant. | **TCR-1 Tribal Cultural Resources.** The following policy shall be added to Community Character Goal 1 in the General Plan 2035:<br>**Tribal Cultural Resources Protection**. The City shall comply with AB 52, which may require formal tribal consultation on a project-by-project basis. | Less than significant with mitigation incorporated. |
| **Utilities and Service Systems** | | |
| **Impact UTL-1.** Development facilitated by the proposed project would increase demand for wastewater collection and treatment but goals and policies in the General Plan 2035 would ensure sufficient wastewater treatment capacity is available. Impacts would be less than significant. | None required. | Less than significant. |
| **Impact UTL-2.** Development facilitated by the proposed project would increase demand for water supply. However, with adherence to General Plan 2035 policies, the proposed project would not result in the construction of new water facilities or the expansion of existing facilities. Impacts would be less than significant. | None required. | Less than significant. |
| **Impact UTL-3.** Implementation of the proposed project would increase demand for water supply. However, with adherence to General Plan 2035 policies, the City would have sufficient water supplies to support new development from existing entitlements and resources. Impacts would be less than significant. | None required. | Less than significant. |
| **Impact UTL-3.** Implementation of the proposed project would increase demand for solid waste sent to area landfills. However, landfills serving the City of Novato have adequate capacity to accept the additional waste. Further the General Plan 2035 contains policies to increase recycling. Impacts would be less than significant. | None required. | Less than significant. |

# 1 Introduction

This document is an Environmental Impact Report (EIR) that examines the potential environmental effects associated with adoption and implementation of the proposed City of Novato General Plan 2035, its implementing ordinances, and amendments to the Industrial Park Master Plan/Precise Development Plan defined as the proposed project for purposes of this environmental review. This section:

1. Provides an overview of the background behind the proposed project
2. Summarizes the process involved in developing the proposed project
3. Describes the purpose of and legal authority for the adoption of the EIR
4. Summarizes the scope and content of the EIR
5. Lists lead, responsible, and trustee agencies for the EIR
6. Describes the intended uses of the EIR
7. Provides a synopsis of the environmental review process required under CEQA

The contents of other EIR sections are as follows:

- Section 2, *Project Description*, provides a detailed discussion of the proposed project
- Section 3, *Environmental Setting*, describes the existing environmental and geographic conditions within the City of Novato
- Section 4*, Environmental Impact Analysis*, describes the potential environmental effects associated with implementation of the proposed project, and provides mitigation measures when potentially significant effects are identified
- Section 5*, Other CEQA Required Sections*, discusses issues such as growth inducement, energy and significant irreversible environmental effects
- Section 6, *Alternatives*, discusses alternatives to the proposed project, including the CEQA-required "no project" alternative
- Section 7, *References and Report Preparers*, lists informational sources for the EIR and persons involved in the preparation of the document

## 1.1 Overview of General Plan 2035

State law (Government Code Section 65300) requires that each city and county adopt a comprehensive general plan. The current City of Novato General Plan was adopted by the City Council on March 8, 1996. The City of Novato General Plan 2035 is a comprehensive effort to update the existing 1996 General Plan and respond to current local and regional conditions, as well as changes in state law that may not have been in place when the General Plan was last updated. General Plan 2035 has been organized into five chapters: Great Places, Environmental Stewardship, Living Well, Economic Vitality, and A City that Works. These five chapters cover all of the topics that are required to be included in a General Plan under state law (Land Use, Open Space, Conservation, Housing, Circulation, Safety, and Noise).

The General Plan defines the framework by which Novato's physical and economic resources are to be managed and used until the General Plan horizon year of 2035. City decision-makers will use General Plan 2035 as a blueprint for:

- Choices about the use of land
- Protection of environmental resources
- Conservation and development of housing
- Provision of supporting infrastructure and public and human services
- Protection of people and property from natural and man-made hazards

General Plan 2035 clarifies and articulates the City's intentions with respect to the rights and expectations of the various Novato communities, including residents, property owners, and businesses. Through the General Plan, the City informs these groups of its goals, policies, and programs, thereby communicating expectations of the public and private sectors for meeting community objectives.

Since General Plan 2035 is the constitution for all future development in Novato, any decision by the City affecting land use and development must be consistent with the respective plan. This includes any development projects proposed in the future. An action, program, policy, or project would be considered consistent with the General Plan if, considering all of its characteristics, it will further the applicable goals and policies of the General Plan or not obstruct their attainment.

Each of the General Plan 2035 chapters contains goals, policies, and programs. Goals are statements that provide direction and state the desired end condition. Policies establish basic courses of action to achieve these goals, and directly guide the response of elected and appointed officials to development proposals and related community actions. Programs are specific actions, procedures, or techniques for the city to help achieve a specified goal or implement an adopted policy.

## 1.2 Purpose and Legal Authority

The proposed project requires discretionary approval by the Novato City Council; therefore, the project is subject to the environmental review requirements of CEQA. This EIR has been prepared in accordance with CEQA and the *CEQA Guidelines*. In accordance with Section 15121 (a) of the *State CEQA Guidelines* (California Code of Regulations, Title 14, Division 6, Chapter 3), the purpose of an EIR is to:

> "…inform public agency decision-makers and the public generally of the significant environmental effects of a project, identify possible ways to minimize the significant effects, and describe reasonable alternatives to the project."

This EIR fulfills the requirements for a Program EIR. Although the legally required contents of a Program EIR are the same as those of a Project EIR, Program EIRs are necessarily more general and may contain a broader discussion of impacts, alternatives, and mitigation measures than a Project EIR. As provided in Section 15168 of the *CEQA Guidelines*, a Program EIR may be prepared on a series of actions that may be characterized as one large project. Use of a Program EIR provides the City (as Lead Agency) with the opportunity to consider broad policy alternatives and program-wide mitigation measures and provides the City with greater flexibility to address environmental issues and/or cumulative impacts on a comprehensive basis. Agencies generally prepare Program EIRs for programs or a series of related actions that are linked geographically, are logical parts of a chain of contemplated events, rules, regulations, or plans that govern the conduct of a continuing program, or are individual activities carried out under the same authority and having generally similar environmental effects that can be mitigated in similar ways. By its nature, a Program EIR considers the largescale effects associated with implementing a program (such as a General Plan or Specific Plan) and does not, and is not intended to, examine the specific environmental effects associated with individual actions that may be undertaken under the guise of the larger program.

Once a Program EIR has been prepared, subsequent activities within the program must be evaluated to determine what, if any, additional CEQA documentation needs to be prepared. If the Program EIR addresses the program's effects as specifically and comprehensively as possible, many subsequent activities could be found to be within the Program EIR scope and additional environmental documents may not be required (*CEQA Guidelines* Section 15168(c)). When a Program EIR is relied on for a subsequent activity, the Lead Agency must incorporate feasible mitigation measures and alternatives developed in the Program EIR into the subsequent activities (*CEQA Guidelines* Section 15168(c)(3)). If a subsequent activity would have effects not within the scope of the Program EIR, the Lead Agency must prepare a new Initial Study leading to a Negative Declaration (ND), Mitigated Negative Declaration (MND), or a project level EIR. In this case, the Program EIR still serves a valuable purpose as the first-tier environmental analysis. The *State CEQA Guidelines* (Section 15168(h)) encourage the use of Program EIRs, citing five advantages:

1. Provision of a more exhaustive consideration of impacts and alternatives than would be practical in an individual EIR
2. Focus on cumulative impacts that might be overlooked in a case-by-case analysis
3. Avoidance of continual reconsideration of recurring policy issues
4. Consideration of broad policy alternatives and programmatic mitigation measures at an early stage when the agency has greater flexibility to deal with them
5. Reduction of paperwork by encouraging the reuse of data (through tiering)

As a wide-ranging environmental document, the Program EIR uses macro level thresholds as compared to the project-level thresholds that might be used for an EIR on a specific development project. It should not be assumed that impacts determined not to be significant at a macro level would not be significant at a project level. In other words, determination that implementation of the proposed project as a broad program would not have a significant environmental effect does not necessarily mean that an individual project would not have significant effects based on project-level CEQA thresholds, even if the project is consistent with the General Plan 2035.

This EIR has been prepared to analyze potentially significant environmental impacts associated with future development resulting from implementation of the proposed project and its associated action with direction to review the project description section for details, and also addresses appropriate and feasible mitigation measures or project alternatives that would minimize or eliminate these impacts.

This EIR is intended to provide decision-makers and the public with information that enables them to consider the environmental consequences of the proposed project. This EIR identifies significant or potentially significant environmental effects, as well as ways in which those impacts can be reduced to less-than-significant levels, whether through the imposition of mitigation measures or through the implementation of specific alternatives to the proposed project. In a practical sense, this document functions as a tool for fact-finding, allowing citizens, decision makers, and agency staff an opportunity to collectively review and evaluate baseline conditions and project impacts through a process of full disclosure.

## 1.3 Scope and Content

In accordance with the *CEQA Guidelines*, a Notice of Preparation (NOP) of a Draft EIR was circulated to the State Clearinghouse, responsible, and trustee agencies and persons requesting notice on December 19, 2016. The NOP, included in Appendix A, indicated that all issues on the city's environmental checklist would be discussed in the EIR. These include:

- Aesthetics
- Agriculture Resources
- Air Quality
- Biological Resources
- Cultural Resources
- Geology/Soils
- Greenhouse Gas Emissions
- Hazards & Hazardous Materials
- Hydrology/Water Quality
- Land Use/Planning
- Mineral Resources
- Noise
- Population/Housing
- Public Services
- Recreation
- Transportation/Traffic
- Tribal Cultural Resources
- Utilities
- Mandatory Findings of Significance

This EIR evaluates potential impacts in each of these areas.

The City received written responses to the NOP regarding the scope and content of the EIR. The responses, included in Appendix A, are addressed in the analysis contained in the topical subsections of Section 4, *Environmental Impact Analysis*.

The City held an EIR scoping meeting on January 12, 2017 at Novato City Hall with a number of members of the public in attendance. A summary of the written comments received at this meeting is included at the end of Appendix A. Oral and written comments associated with the scoping meeting are addressed, as appropriate, in the analysis contained in the topical subsections of Section 4, *Environmental Impact Analysis*.

In preparing the EIR, use was made of pertinent City policies and guidelines, certified EIRs and other adopted CEQA documents, and other background documents. A full reference list is contained in Section 7, *References and Preparers*.

The alternatives section of the EIR (Section 6) was prepared in accordance with *CEQA Guidelines* Section 15126.6 and focuses on alternatives that are capable of eliminating or reducing significant adverse effects associated with the project while feasibly attaining most of the basic project objectives. In addition, the alternatives section identifies the environmentally superior alternative among the alternatives assessed. The alternatives evaluated include the CEQA-required "No Project" alternative and four alternative development scenarios.

The level of detail contained throughout this EIR is consistent with the requirements of CEQA and applicable court decisions. *CEQA Guidelines* Section 15151 provides the standard of adequacy on which this document is based. The *Guidelines* state:

> "An EIR should be prepared with a sufficient degree of analysis to provide decision-makers with information which enables them to make a decision which intelligently takes account of environmental consequences. An evaluation of the environmental effects of the proposed project need not be exhaustive, but the sufficiency of an EIR is to be reviewed in light of what is reasonably feasible. Disagreement among experts does not make an EIR inadequate, but the EIR should summarize the main points of disagreement among the experts. The courts have looked not for perfection, but for adequacy, completeness, and a good faith effort at full disclosure."

It should be noted that the *CEQA Guidelines* were recently updated and adopted (went into effect in January 2019). According to the Governor's Office of Planning and Research, the updated *CEQA Guidelines* apply prospectively only, and do not apply to projects that have commenced environmental review prior to adoption of the updated *CEQA Guidelines* (Governor's Office of Planning and Research 2017). Therefore, because the NOP for this EIR was published in December 2016, prior to circulation of the draft guidelines and adoption of the updated *CEQA Guidelines*, the City has elected to forego use of the updated *CEQA Guidelines*. However, responses to new impact questions in the updated guidelines have been incorporated into individual environmental impact sections. Specifically, impacts relating to wildlife are analyzed in Section 4.7, *Hazards and Hazardous Materials*, and impacts to energy are analyzed in Section 5, *Other CEQA*. The updated *CEQA Guidelines* and Senate Bill 743 changed the criteria for determining what constitutes a significant transportation-related environmental impact to rely upon quantification of vehicle miles traveled (VMT) instead of level of service. A VMT Analysis for Novato General Plan Update EIR wascompleted by Fehr & Peers in April 2018 to provide VMT forecasts for the City as well as descriptionoptions for adopting VMT thresholds for future development and transportation projects in Novato.Therefore, VMT was reviewed as part of the General Plan EIR analysis and is included as Appendix E to the EIR. While VMT was included as part of the EIR analysis the City has elected to apply the levelof service criteria for determining an environmental impact in this EIR and wait to implement VMTstandards until 2020 once further VMT guidance is available as allowed by *CEQA Guidelines* Section15064.3(c).

# 1.4 Lead, Responsible, and Trustee Agencies

The *CEQA Guidelines* define lead, responsible, and trustee agencies. The City of Novato is the lead agency under CEQA for this EIR because it has primary discretionary authority to determine whether or how to approve the proposed project.

## 1.4.1 Responsible and Trustee Agencies

*CEQA Guidelines* Section 15381 defines responsible agencies as other public agencies that are responsible for carrying out/implementing a specific component of a proposed project or for approving a project (such as an annexation) that implements the goals and policies of a General Plan.

There are no responsible agencies for the proposed project.

Although there are no responsible agencies under CEQA with respect to adoption of General Plan 2035, several other agencies may have review or approval authority over aspects of projects that could potentially be implemented in accordance with various goals, policies, and programs included in the 2035 General Plan. These agencies and their roles are listed below.

- The State Geologist is responsible for the review of the city's program for minimizing exposure to geologic hazards and for regulating surface mining activities.
- The California Department of Transportation (Caltrans) has responsibility for approving future improvements to the state highway system, including Highway 101.
- The California Department of Fish and Wildlife (CDFW) has responsibility for issuing take permits and streambed alteration agreements for any projects with the potential to affect plant or animal species listed by the State of California as rare, threatened, or endangered or that would disturb waters of the State.
- Any other public agencies, such as: Novato Fire Protection District, Novato Sanitary District, North Marin Water District, Novato Unified School District, Marin Local Agency Formation Commission, County of Marin, Marin Airport Land Use Commission, San Francisco Bay Regional Water Quality Control Board, Bay Area Air Quality Management District, Army Corps of Engineers, Department of Water Resources, and California Department of Housing and Community Development.

Trustee agencies have jurisdiction over certain resources held in trust for the people of California but do not have a legal authority over approving or carrying out the project. Potential trustee agencies for the proposed project may include CDFW, North Marin Water District – Potable Water Service, and the Novato Fire Protection District – EMS and Fire Suppression.

## 1.5 Intended Uses of the EIR

This EIR is an informational document for use in the City's review and consideration of the proposed project. It is to be used to facilitate creation of a General Plan that incorporates environmental considerations and planning principals into a cohesive policy document. The General Plan 2035 will guide subsequent actions taken by the City in its review of new development projects. This EIR discloses the possible environmental consequences associated with the proposed project. The information in this EIR will be used by the Novato City Council, the general public, and potentially the trustee and responsible agencies.

The focus of this EIR is to:

- Provide information about General Plan 2035 and implementing ordinances for consideration by the City Council in its selection of the proposed project, an alternative to the proposed project, or a combination of various chapters from the proposed project and its alternatives, for approval
- Review and evaluate the potentially significant environmental impacts that could occur as a result of the growth and development envisioned in General Plan 2035 and as part of the implementing ordinances
- Identify feasible mitigation measures that may be incorporated into the proposed project in order to reduce or eliminate potentially significant effects
- Disclose any potential growth-inducing and/or cumulative impacts associated with the proposed project
- Examine a reasonable range of alternative growth scenarios that could feasibly attain the basic objectives of the proposed project, while eliminating and/or reducing some or all of its potentially significant adverse environmental effects

- Provide review and evaluation of the amendments to the Industrial Park Master Plan/Precise Development Plan and determine potentially significant environmental impacts that could occur as a result of development envisioned in the Industrial Park Master Plan/Precise Development Plan

## 1.6 Environmental Review Process

The environmental impact review process required under CEQA is summarized below. The steps appear in sequential order.

1. **Notice of Preparation (NOP) and Initial Study**. Immediately after deciding that an EIR is required, the lead agency must file a NOP soliciting input on the EIR scope to "responsible," "trustee," and involved federal agencies; to the State Clearinghouse, if one or more state agencies is a responsible or trustee agency; and to parties previously requesting notice in writing. The NOP must be posted in the County Clerk's office for 30 days. A scoping meeting to solicit public input on the issues to be assessed in the EIR is not required, but may be conducted by the lead agency.
2. **Draft EIR Prepared.** The Draft EIR must contain: a) table of contents or index; b) summary; c) project description; d) environmental setting; e) significant impacts (direct, indirect, cumulative, growth-inducing and unavoidable impacts); f) alternatives; g) mitigation measures; and h) irreversible changes.
3. **Public Notice and Review.** A lead agency must prepare a Public Notice of Availability of an EIR. The Notice must be placed in the County Clerk's office for 30 days (Public Resources Code Section 21092) and sent to anyone requesting it. Additionally, public notice of Draft EIR availability for a regional document such as a general plan must be given through publication in a newspaper of general circulation. The lead agency must consult with and request comments on the Draft EIR from responsible and trustee agencies, and adjacent cities and counties. The minimum public review period for a Draft EIR is 30 days. When a Draft EIR is sent to the State Clearinghouse for review, the public review period must be 45 days, unless a shorter period is approved by the Clearinghouse (Public Resources Code 21091). Distribution of the Draft EIR may be required through the State Clearinghouse.
4. **Notice of Completion.** A lead agency must file a Notice of Completion with the State Clearinghouse as soon as it completes a Draft EIR.
5. **Final EIR**. A Final EIR must include: a) the Draft EIR; b) copies of comments received during public review; c) list of persons and entities commenting; and d) responses to comments.
6. **Certification of Final EIR**. According to Section 15090 of the *State CEQA Guidelines* prior to approving a project the lead agency shall certify that: “(1) the final EIR has been completed in compliance with CEQA; (2) the final EIR was presented to the decision-making body of the lead agency, and that the decision-making body reviewed and considered the information contained in the final EIR prior to approving the project; and (3) the final EIR reflects the lead agency's independent judgment and analysis.”
7. **Lead Agency Project Decision**. According to Section 15092 of the *State CEQA Guidelines*:
   (a) After considering the final EIR and in conjunction with making findings under Section 15091, the Lead Agency may decide whether or how to approve or carry out the project.
   (b) A public agency shall not decide to approve or carry out a project for which an EIR was prepared unless either:

(1) The project as approved will not have a significant effect on the environment, or

(2) The agency has:

(A) Eliminated or substantially lessened all significant effects on the environment where feasible as shown in findings under Section 15091, and

(B) Determined that any remaining significant effects on the environment found to be unavoidable under Section 15091 are acceptable due to overriding concerns as described in Section 15093.

(c) With respect to a project which includes housing development, the public agency shall not reduce the proposed number of housing units as a mitigation measure if it determines that there is another feasible specific mitigation measure available that will provide a comparable level of mitigation.

8. **Findings/Statement of Overriding Considerations**. According to Section 15091 of the *State CEQA Guidelines*:

(a) No public agency shall approve or carry out a project for which an EIR has been certified which identifies one or more significant environmental effects of the project unless the public agency makes one or more written findings for each of those significant effects, accompanied by a brief explanation of the rationale for each finding. The possible findings are:

(1) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the final EIR.

(2) Such changes or alterations are within the responsibility and jurisdiction of another public agency and not the agency making the finding. Such changes have been adopted by such other agency or can and should be adopted by such other agency.

(3) Specific economic, legal, social, technological, or other considerations, including provision of employment opportunities for highly trained workers, make infeasible the mitigation measures or project alternatives identified in the final EIR.

(b) The findings required by subdivision (a) shall be supported by substantial evidence in the record.

(c) The finding in subdivision (a)(2) shall not be made if the agency making the finding has concurrent jurisdiction with another agency to deal with identified feasible mitigation measures or alternatives. The finding in subsection (a)(3) shall describe the specific reasons for rejecting identified mitigation measures and project alternatives.

(d) When making the findings required in subdivision (a)(1), the agency shall also adopt a program for reporting on or monitoring the changes which it has either required in the project or made a condition of approval to avoid or substantially lessen significant environmental effects. These measures must be fully enforceable through permit conditions, agreements, or other measures.

(e) The public agency shall specify the location and custodian of the documents or other material which constitute the record of the proceedings upon which its decision is based.

(f) A statement made pursuant to Section 15093 does not substitute for the findings required by this section.

In addition Section 15093 of the State CEQA Guidelines state:

(a) CEQA requires the decision-making agency to balance, as applicable, the economic, legal, social, technological, or other benefits of a proposed project against its unavoidable environmental risks when determining whether to approve the project. If the specific economic, legal, social, technological, or other benefits of a proposed project outweigh the unavoidable adverse environmental effects, the adverse environmental effects may be considered "acceptable."

(b) When the lead agency approves a project which will result in the occurrence of significant effects which are identified in the final EIR but are not avoided or substantially lessened, the agency shall state in writing the specific reasons to support its action based on the final EIR and/or other information in the record. The statement of overriding considerations shall be supported by substantial evidence in the record.

(c) If an agency makes a statement of overriding considerations, the statement should be included in the record of the project approval and should be mentioned in the notice of determination. This statement does not substitute for, and shall be in addition to, findings required pursuant to Section 15091.

9. **Mitigation Monitoring/Reporting Program**. When an agency makes findings on significant effects identified in the EIR, it must adopt a reporting or monitoring program for mitigation measures that were adopted or made conditions of project approval to mitigate significant effects.

10. **Notice of Determination**. An agency must file a Notice of Determination after deciding to approve a project for which an EIR is prepared. A local agency must file the Notice with the County Clerk. The Notice must be posted for 30 days and sent to anyone previously requesting notice. Posting of the Notice starts a 30-day statute of limitations on CEQA challenges.

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# 2 Project Description

The proposed project involves the adoption of the City of Novato General Plan 2035 and several implementing ordinances, referred to throughout this EIR as General Plan 2035. This section of the EIR describes the key characteristics of General Plan 2035, including the project proponent/lead agency, the geographic extent of the planning area, project objectives, required approvals and types and extent of development forecasted under General Plan 2035.

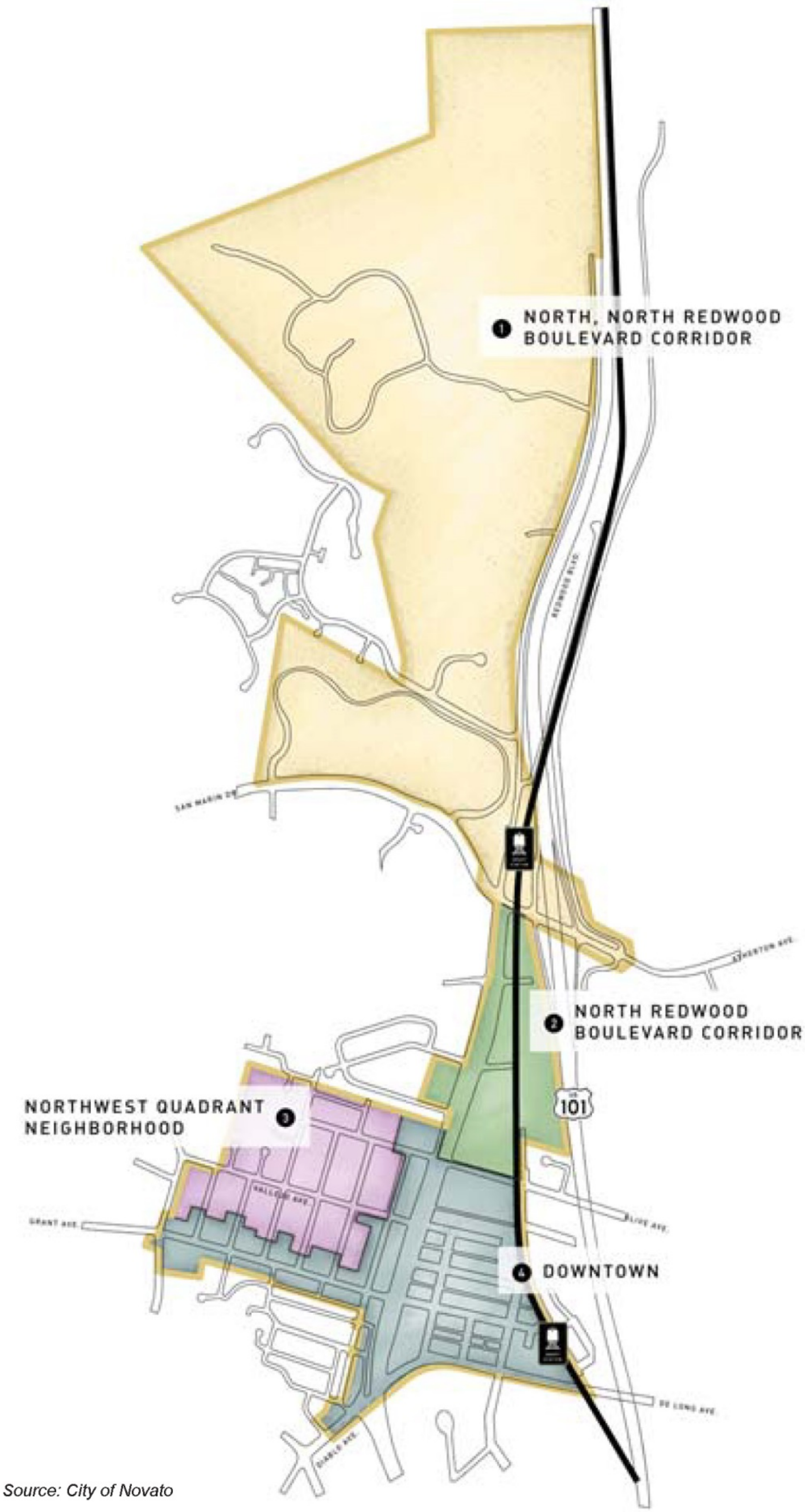
## 2.1 Proposed Project

### 2.1.1 General Plan 2035

General Plan 2035 is a comprehensive update of the City's 1996 General Plan, and establishes the community's vision for future development of the City through 2035. As part of the general plan process, General Plan 2035 has been reorganized and reformatted, with updated goals, policies, and programs that reflect the community's vision of Novato. The City's General Plan Land Use Map has also been updated to reflect the community's vision to permit new growth in four specific focus areas in the City, which are most likely to change in the next 17 years and would benefit from careful planning. The four focus areas are shown in Figure 2-1 and include:

- **Downtown.** Downtown Novato is the commercial core of the community. The area is maintained as a pedestrian-oriented shopping and dining destination. The General Plan 2035 vision for the Downtown is to maintain the area as the civic and economic center of the community, blending historic buildings and new construction, and adding housing in mixed-use developments.
- **North Redwood Boulevard Corridor.** The North Redwood Corridor provides an opportunity for the City to address an identified retail sales leakage pattern and address community shopping needs by creating a lively retail area with a unique sense of place. General Plan 2035 envisions the North Redwood Corridor as a place that would also feature inviting gathering places, restaurants, and entertainment uses.
- **North, North Redwood Corridor.** The North, North Redwood Corridor area contains predominately non-residential development set back from the street with landscaped buffers. The corridor could be developed with high-quality office and research and development uses, as well as supporting uses such as local-serving retail and recreational uses.
- **Northwest Quadrant Neighborhood.** In the Northwest Quadrant Neighborhood lots are usually small, and homes are in close proximity to one another. The General Plan 2035 promotes retaining some existing single family homes, along with reinvestment and revitalization of this district through development of carefully designed housing through adoption of a neighborhood-specific zoning code that would ensure compatibility with the scale and diversity of residences.

## Figure 2-1 General Plan 2035 Focus Areas




*Source: City of Novato*

In addition to the four focus areas, expanded development could occur in the Novato Industrial Park area, specifically Hamilton Industrial and Ignacio Industrial Parks, through the proposed Master Plan/Precise Development Plan Amendment (Industrial Parks MPA). The Industrial Parks MPA provides common development objectives and parameters for future improvements in the industrial parks. The Industrial Parks MPA is proposed to be modified to allow an increased floor area ratio and building height limit for designated "Life Science campus" development for the biotechnology industry, subject to a cap of 500,000 square feet. The development standards for the Life Science campus would include building coverage not to exceed 60 percent of the total lot area, a floor area ratio of 1.2, maximum building height of 68 feet, and creation of a Transportation Demand Management Plan. The Life Sciences campus would be permitted in the Hamilton Industrial and Ignacio Industrial portions of the Novato Industrial Park and are expected to consist of a mix of office space, lab space, and manufacturing space. The campuses would consist of one or more parcels with two or more buildings that have interrelated operations and could have shared parking, employee amenities, and interconnected access to facilitate collaboration.

General Plan 2035 includes the following five Chapters, collectively encompassing the seven required elements of the General Plan: Great Places, Environmental Stewardship, Living Well, Economic Vitality, and A City that Works. These five chapters describe the existing conditions and context for the related topic areas, followed by goals, policies, and programs to guide the City's management and development over the next 17 years.

### 2.1.2 Implementing Ordinances

It is the City's intent to adopt a number of the implementing zoning provisions and modify Novato's zoning map to be consistent with the policies and programs contemplated in General Plan 2035 as part of the proposed project. There are 15 General Plan implementing ordinances as show in Table 2-1.

**Table 2-1 General Plan Implementing Ordinances**

| Number | Ordinance Description |
|---|---|
| 1 | Modify Novato Industrial Park Master Plan and Precise Development Plan to:<br>a. Allow ancillary retail sale of products made or commonly wholesaled on-site; up to 10% of total floor area may be devoted to retail sales and display area.<br>b. Allow existing non-conforming recreational uses to expand provided other zoning requirements (e.g., parking) are met.<br>c. Modify the auto related uses conditionally permitted in the Bel Marin Commerce Park and Ignacio Industrial Park areas to allow commercial auto restoration.<br>d. Create an allowance for life science/biotech campuses comprised of proximate, related properties with approval of a use permit and offering an allowable increase in maximum FAR from 0.6 to 1.2 (up to maximum net increase of 500,000 sq. ft. of additional floor area above an FAR of 0.6) and an increase in building height from a maximum of 42 feet to 68 feet (plus allowance for 8' additional height for mechanical equipment screening of up to 10% of roof area). |
| 2 | Modify Hillside/Ridgeline Ordinance (Municipal Code Division 19.26) to clarify development standards (e.g., height, maximum home size, and home placement) for lots created prior to January 13, 2004. |
| 3 | Modify Downtown Core Retail (CDR) and Downtown Core Business (CDB) zoning regulations (Novato Municipal Code Section 19.12.030) to eliminate tobacco product shops as an allowed use in these zoning districts. |
| 4 | Modify General Commercial (CG) zoning regulations (Novato Municipal Code Section 19.12.030) to allow tobacco product shops as a conditionally permitted use. |

| Number | Ordinance Description |
|---|---|
| 5 | Modify Downtown Overlay Zoning District (Novato Municipal Code Section 19.14.040) to:<br>a. Eliminate reference to compliance with design guidelines as being mandatory.<br>b. Eliminate references to Downtown Specific Plan. |
| 6 | Modify procedures and findings in Novato Municipal Code 19.56.070.B relating to the Urban Growth Boundary based on voter approval of Measure D on November 7, 2017. |
| 7 | Modify Municipal Code Section 19.20.030 to prohibit gated communities consistent with 1996 General Plan Community Identity Policy 1A. |
| 8 | Modify woodland tree removal mitigation requirements (Novato Municipal Code Section 19.39.040.G) to prioritize replacement planting of native species and to allow consideration of requiring fewer, but larger replacement trees based on site conditions. |
| 9 | Modify animal keeping regulations (Novato Municipal Code Section 19.34.060) to allow beekeeping in all residential zoning districts, subject to performance standards limiting number of hives based on site area (min. two hives), orientation of entrance, setbacks, maintenance and on-site water source. |
| 10 | Modify parking lot landscape requirements (Novato Municipal Code Section 19.30.70.H) to increase the minimum interior parking lot tree well dimension from 4-feet to 6-feet (exempting parking lots in the Downtown area and the renovation of existing parking lots) and requiring on-site monitoring and certification by a landscape architect of interior parking lot tree installation to verify maximum soil compaction of 75% and proper soil amendments. Adopt a list of recommended 20'+ canopy shade trees for parking lot interiors. Allow deviation from parking lot design standards through Design Review. |
| 11 | Amend the Wetland Protection and Restoration Ordinance (Novato Municipal Code Section 19.36.070.A) to include the protection of special status species as a reason to require an expanded wetland buffer area. |
| 12 | Modify Tables 2-8 and 2-10 of Novato Municipal Code Sections 19.12.040 and 19.14.040 to allow hotels to have a maximum FAR of 0.7 (increased from 0.4) in LIO, BPO, MU, CN and CG zoning districts. |
| 13 | Modify lighting performance standards (Novato Municipal Code Section 19.22.060) to eliminate 11 PM curfew on non-essential interior and exterior lighting, and call for Dark Sky certified exterior lighting fixtures in new development subject to Design Review. |
| 14 | Add new solar facility permitting section to the Novato Municipal Code allowing commercial solar panels, solar carports, and ground-mounted solar installations in specified zoning districts, subject to height and size limits, setbacks and performance standards. |
| 15 | Allow community gardens as a permitted use in all zoning districts. Allow market gardens (small commercial garden) as a conditional use in all residential zoning districts. Limited on-site retail sales allowed for both garden types. |

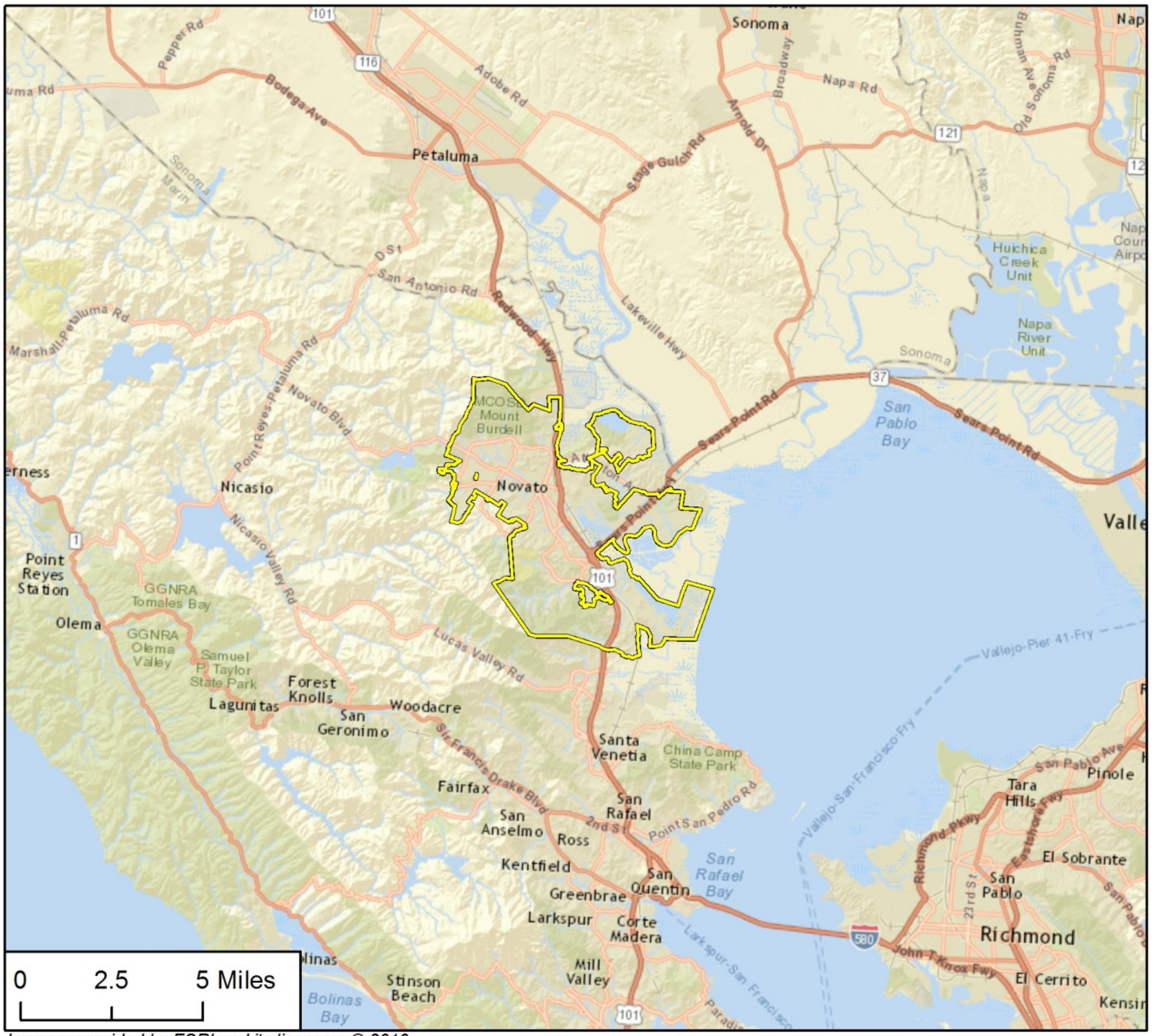
## 2.2 Project Proponent

The City of Novato is both the project proponent and the lead agency for the proposed General Plan 2035. The City's Community Development Department, located at 922 Machin Avenue, Novato, California, 94945, directed preparation of this EIR with the assistance of Rincon Consultants, Inc.

## 2.3 Project Location

Novato is located in the greater North Bay region of the San Francisco Bay Area and is the northernmost city in Marin County (Figure 2-2). The City is located northwest of San Pablo Bay approximately 29 miles north of San Francisco, 37 miles northwest of Oakland, and approximately 35 miles north of the San Francisco International Airport. The City is bordered by unincorporated areas of Marin County. The closest cities are the City of Petaluma in Sonoma County to the north

**Figure 2-2 Regional Location**

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Project Location

N


Fig 2-1 Regional Location

and the City of San Rafael to the south. San Pablo Bay lies to the east of the City. Figure 2-2 shows a regional map of the City's relationship to nearby cities, communities, and the regional transportation system.

Novato is accessible from US Highway (Highway) 101 which transverses the City from north to south. State Route (SR) 37 also provides regional access to the City connecting Novato to the City of Vallejo and points east. The City is also served by a surface street system ranging from wide, four-lane streets with medians to narrow, winding two-lane streets in the hills. A traditional grid street pattern serves Downtown and older residential areas near Downtown. However, the predominant street pattern in the City is curvilinear. Novato also has a system of bike lanes, paths and routes throughout the City, mostly west of Highway 101, that connect neighborhoods to schools, parks, shopping centers and Downtown.

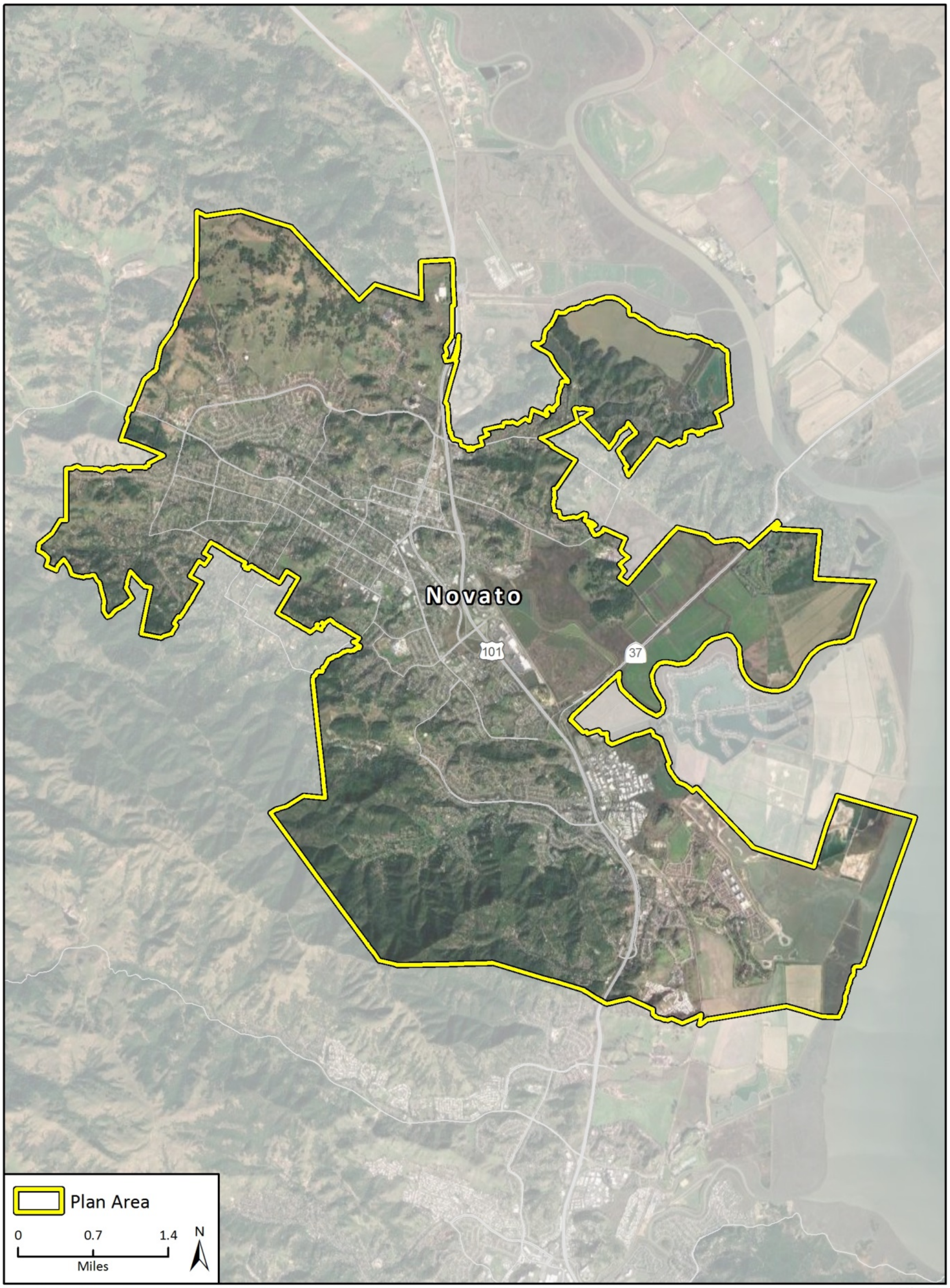
With an estimated 2016 population of approximately 54,749, Novato is the second most populous of the county's 11 cities, second only to the City of San Rafael (California Department of Finance [DOF] 2017). The City has a population density of about one-half of San Rafael and nearly one-third of the cities of Petaluma or Vallejo. Novato has a semi-rural character as a result of the low population density and high amount of open space and parks in and near the City (City of Novato 2016).

General Plan 2035 applies to all lands within the Novato City limits within the City's Urban Growth Boundary (UGB), and within the City's Sphere of Influence (SOI). The City's UGB was originally approved by Novato voters in November 1997 and remained in effect until November 4, 2017. The voter-adopted measure amended the General Plan by establishing a land use objective, policies and programs aimed at limiting the expansion of development requiring extension of sewer and water utilities into the rural areas surrounding the incorporated City limits. In the November 2017 election Novato voters amended and extended the term of the UGB, thus the existing UGB will remain in effect until the end of 2042.

The SOI is a boundary defining the probable future physical boundaries and service areas of the City. This area is defined as the "Plan Area" for the proposed project in this EIR. The City's SOI, and thus Plan Area, extends in a few areas past the current City limits and UGB boundary into nearby unincorporated areas as determined by the Marin Local Agency Formation Commission (LAFCO). Figure 2-3 illustrates the Plan Area boundaries, inclusive of the incorporated limits of Novato, Novato's UGB, and Novato's SOI as delineated by LAFCO.

Table 2-2 includes a description of land use and zoning changes as part of the proposed project and the policy implications of the changes. The areas identified in Table 2-2 are areas where specific land use changes are proposed. In addition, as described in Section 2.1, *Proposed Project*, land use changes would occur in the four focus areas and in the Master Plan/Precise Development Plan area.

**Figure 2-3 Plan Area**

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### Table 2-2 General Plan Land Use Map and Zoning Map Revisions

| Description | Policy Implications |
|---|---|
| General Plan land use map and zoning map change for 15 parcels on both sides of Redwood Boulevard between Vallejo Avenue and Pinheiro Circle from General Commercial (CG) to Downtown Core (CD) with Downtown Core Business (CDB) as the implementing zoning district. | Changes in allowable uses: precludes auto uses (several become non-conforming) and allows residential mixed use development.<br>Increases maximum FAR from 0.4 to 2.0 (with potential to include housing in a mixed-use project).<br>Increases maximum height limit from 42-feet to 45-feet. |
| General Plan land use map and zoning map change for seven parcels on the east side of Redwood Boulevard between Olive Avenue and Rush Creek Place from Commercial Industrial (CI) to General Commercial (CG). | Changes allowable land uses from industrial activities to retail. Decreases FAR from 1.0 to 0.4, with exception of hotels assigned an FAR of 0.7. |
| General Plan land use map change for five parcels on the west side of Redwood Boulevard between San Marin Drive and the Novato city limits from Light Industrial Office (LIO) to Business and Professional Office (BPO). | Changes allowable land uses from industrial activities to offices. |
| General Plan land use map and zoning map change for a property owned by North Marin Water District located off of Reservoir Drive and Oleander Lane (APN 153-111-15) from Business and Professional Office (BPO) to Very Low Density Residential (RVL) and application of Planned District (PD) zoning. | Projected development potential of one (1) single-family residence due to hillside constraints. |
| Rezone two parcels owned by North Marin Water District located off of Spinosa Way (APNs: 141-110-06 & 07) from Community Facilities (CF) to Low Density Residential (R1) with a minimum lot size of 40,000 sq. ft. (R1-40). | Parcels are assigned Low Density Residential (R1) land use designation. Rezone would correct inconsistency between land use designation and zoning classification. Projected development potential of one (1) single-family residence due to hillside constraints. |
| General Plan land use map and zoning map change for 12 parcels on Clayton Court from Medium Density Multiple Family Residential (R10) to Low Density Residential (R1) and R10-4.5 zoning to R1-7.5 zoning. | Places existing single-family homes in a single-family land use category and zoning district. |
| General Plan land use map and zoning map change for 12 parcels on the west side of First Street between Vallejo Avenue and Olive Avenue from Mixed Use (MU) to Medium Density Multiple Family (R10) and Mixed Use (MU) zoning to R10-2.2 zoning. | Sites currently developed with multi-family uses. Change would eliminate the requirement for commercial uses when redevelopment occurs. |
| Rezone 200 parcels in the Northwest Quad from R10-4.5 to R10-NWQ. | Retains existing General Plan land use designation and density allowing up to 20 du/acre. However, rescinds previous zoning limitation requiring retention of existing single-family homes.<br>New zoning is projected to increase redevelopment by 10 multi-family units by 2035. |
| Change boundary of Downtown Overlay on General Plan Land Use Map and Zoning Map to remove three parcels from the Overlay, including APNs 153-390-01, 153-091-10, and 153-121-03. | Parcels will be regulated by standard Mixed-Use (MU) zoning. |
| General Plan land use map and zoning map change for two parcels in Bahia (APNs 143-151-20 and 153-151-24) from Low Density Residential (R1) and Planned District (PD) zoning to the Conservation (CON) land use designation and zoning classification. | These parcels are owned by the Marin County Open Space District and Marin Audubon and are held for conservation. Accordingly, a residential land use designation is no longer appropriate. This action reduces the development potential of these properties. |

| Description | Policy Implications |
| --- | --- |
| Change GP Land Use Map for five parcels at Hamilton from Multi-Family to Open Space (APNs 155-500-66; 157-180-53; 157-180-72) and one parcel from Single Family and Multi-Family to Community Facilities (157-860-04). | Reduces development potential of publically owned property. |
| General Plan land use map and zoning map change for three parcels (APNs 155-400-01, -02, -04, -06, and -07) south of Marin Valley Mobile Country Club from Low Density Residential (R1) to Open Space (OS). | Property acquired by the City of Novato for open space. |

## 2.4 Land Use and Regulatory Setting

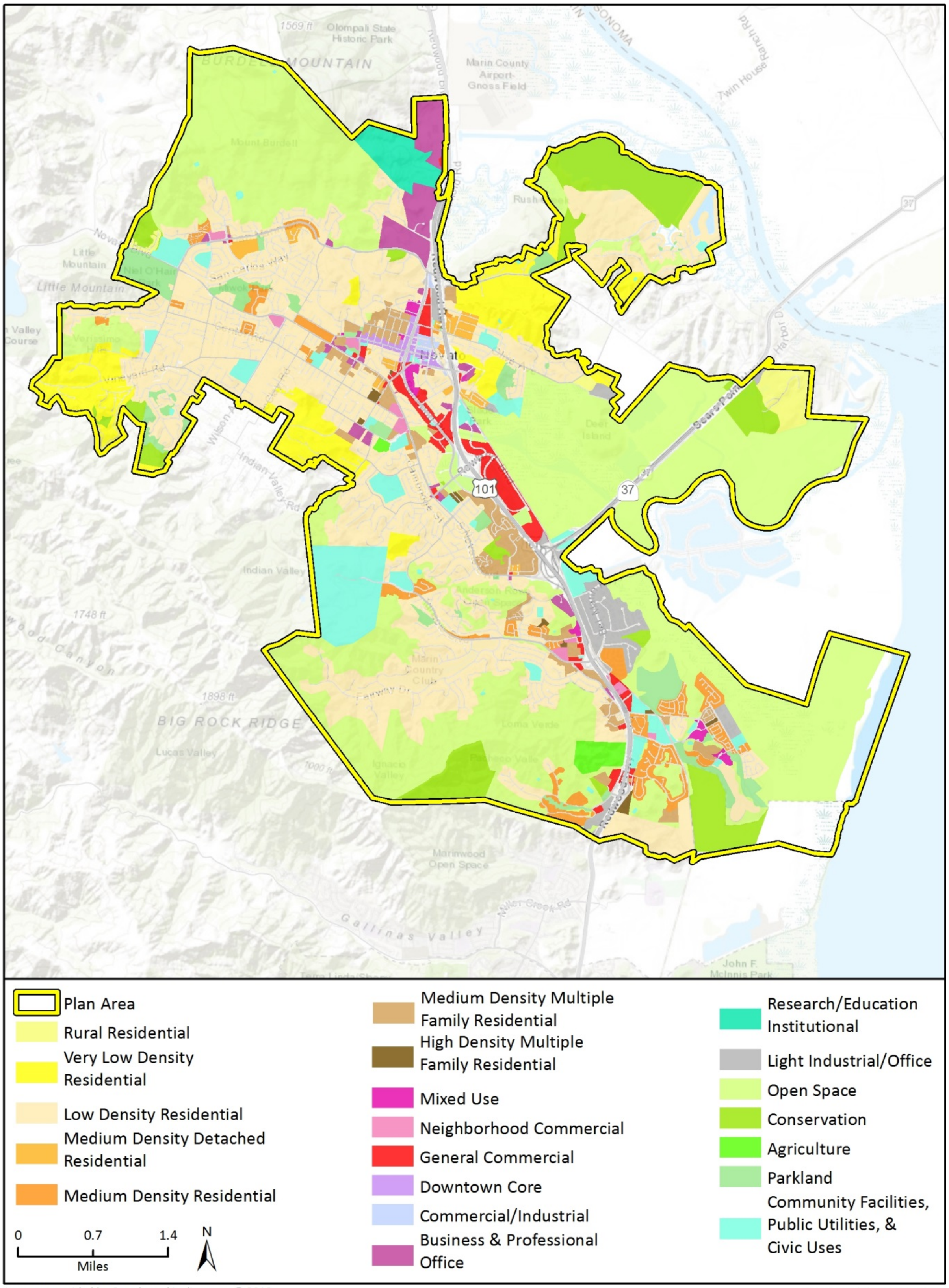
General Plan 2035 is a comprehensive update of the City's 1996 General Plan. The current Novato General Plan is made up of nine chapters: Land Use; Economic Development and Fiscal Vitality; Housing; Human Services; Environment; Safety and Noise; Transportation; Public Facilities and Services and Community Identity. The current land use plan specifies twenty separate land use designations, as shown in Figure 2-9. Figure 2-4 shows the 2035 General Plan Land Use Map and Figure 2-5 through Figure 2-8 show the 2035 General Plan Land Use Map in greater detail focused on the four map quadrants. These land use designations define the basic categories of land uses allowed in the City, but are implemented through the City's Zoning Ordinance and Zoning Map, which are part of the City's Municipal Code and contain more specific regulations and standards governing development on individual properties.

The Novato General Plan 2035 is made up of five chapters: Great Places, Environmental Stewardship, Living Well, Economic Vitality, and A City that Works. The Great Places chapter (Land Use Element) describes the general distribution, location, and extent of various land uses. It contains a statement of the standards of population density and building intensity, types of permissible uses with reference to compatible zoning designations, and special development and permit review requirements. Twenty separate land use designations have been established to provide a mixture of land uses for the City, as shown on the General Plan Land Use Map (Figure 2-4).

Under State law, a property's zoning is required to be consistent with its General Plan land use designation (Government Code §65860). Section 65860(c) of the Government Code requires that when a General Plan is amended in a way that makes the Zoning Ordinance inconsistent with the General Plan, "the zoning ordinance shall be amended within a reasonable time so that it is consistent with the general plan as amended" but it does not define a specific time period that would constitute a reasonable time. In this instance, it is the City's intent to adopt a number of the implementing zoning provisions and modify Novato's zoning map to be consistent with the policies and programs contemplated in General Plan 2035 as part of the proposed project (see Tables 2-1 and 2-2 for a summary of these items) .

There are 13 General Plan implementing ordinances (see Appendix B) being considered concurrently with General Plan 2035, including the Industrial Parks MPA. The regulatory setting for these amendments is represented by the existing version of the Novato Municipal Code, in particular Chapter 19, Zoning, and the Novato Industrial Parks Master Plan/Precise Development Plan as it relates to the Industrial Parks MPA. The existing land use designation for parcels in the Industrial Parks MPA is Light Industrial/Office (LIO). The Industrial Parks MPA area is currently developed with offices and a variety of industrial uses, including life science laboratories and pharmaceutical manufacturing. The implementing zoning amendments either modify existing zoning regulations to

## Figure 2-4 General Plan 2035 Land Use Map

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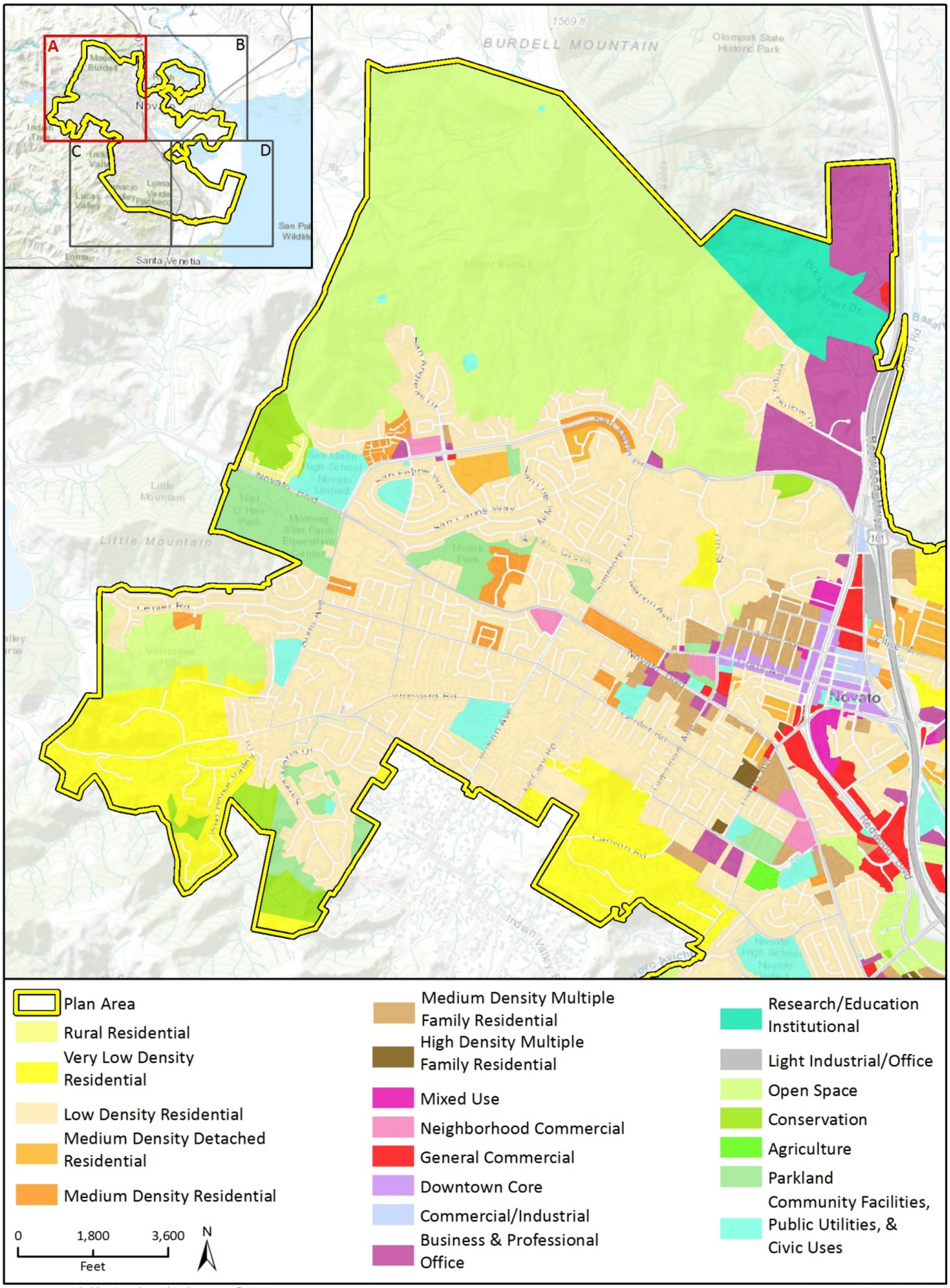
*Additional data provided by Marin County 2018.*

Fig 1 General Plan 2035 Land Use

## Figure 2-5 2035 General Plan Land Use Map Northwest Area

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## Figure 2-6 2035 General Plan Land Use Map Northeast Area

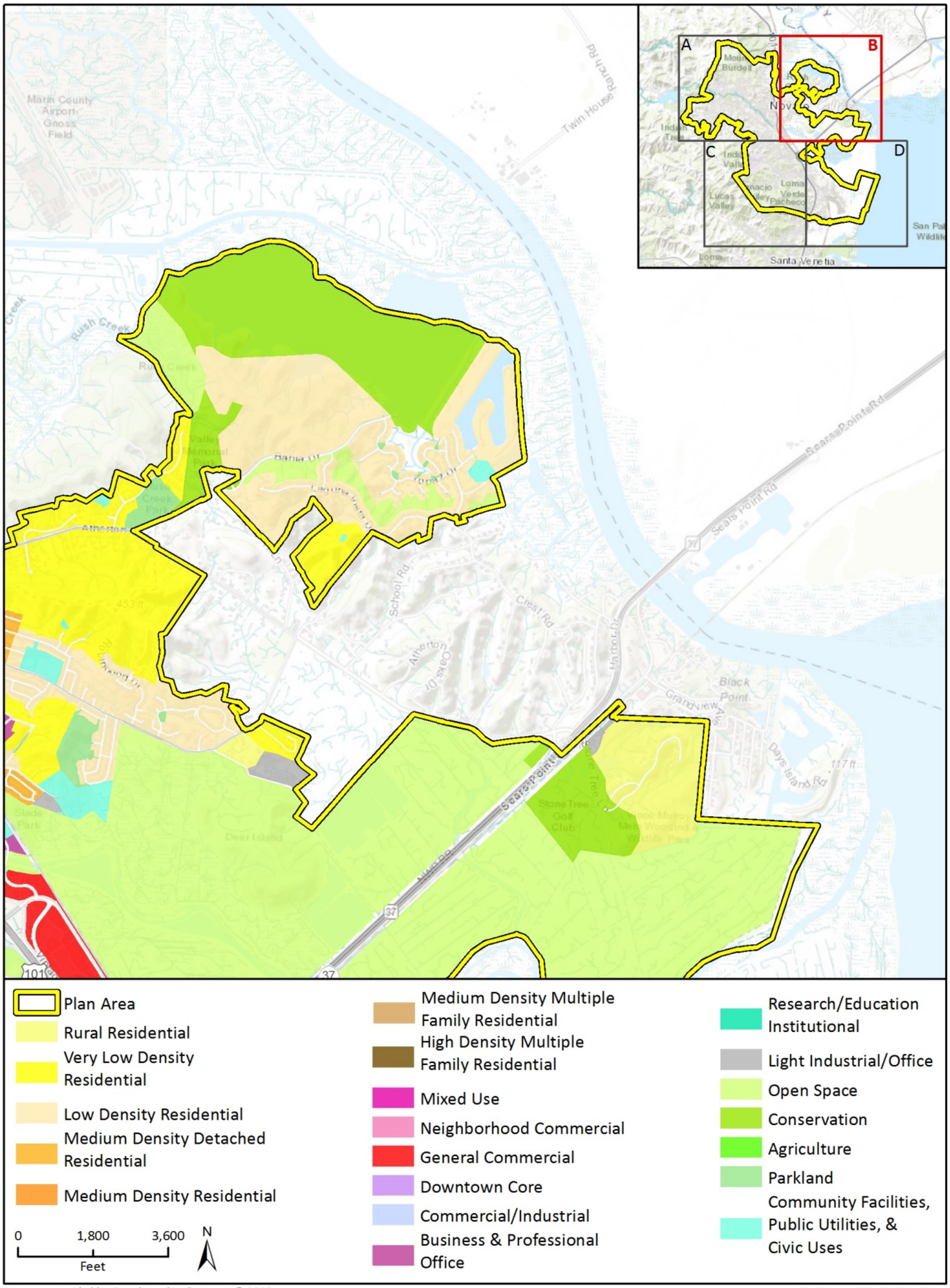


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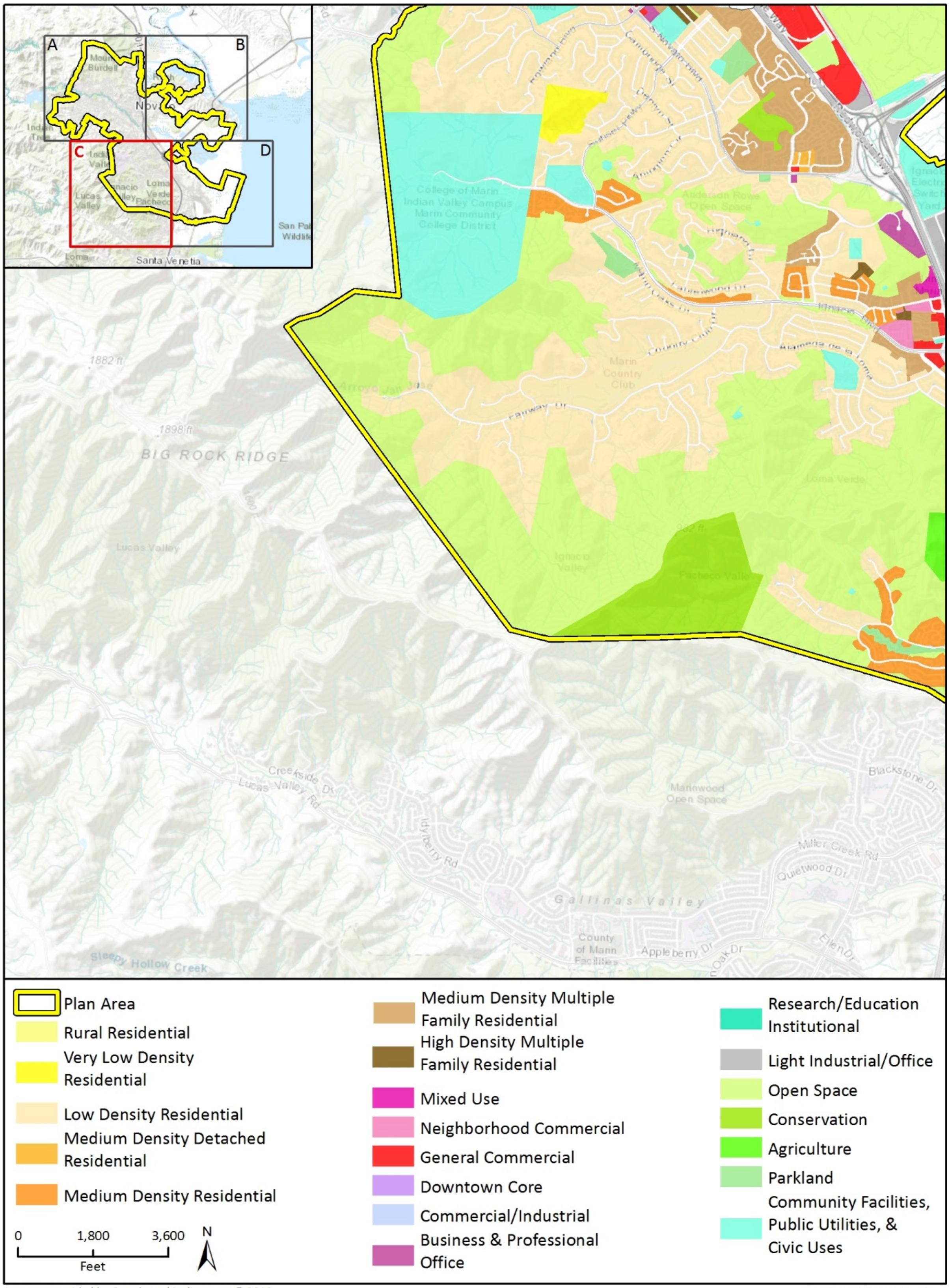
**Figure 2-7 2035 General Plan Land Use Map Southwest Area**

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## Figure 2-8 2035 General Plan Land Use Map Southeast Area

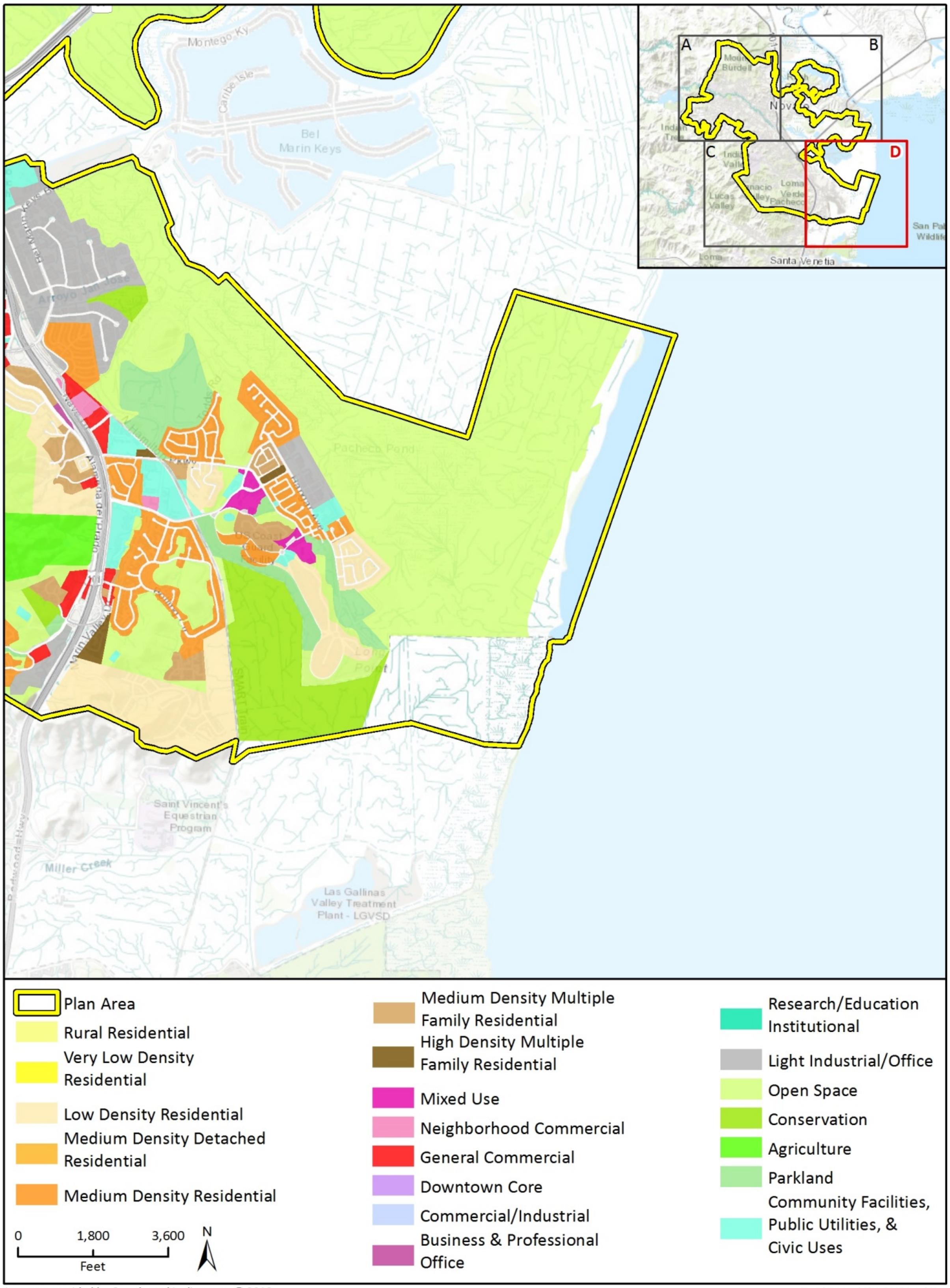


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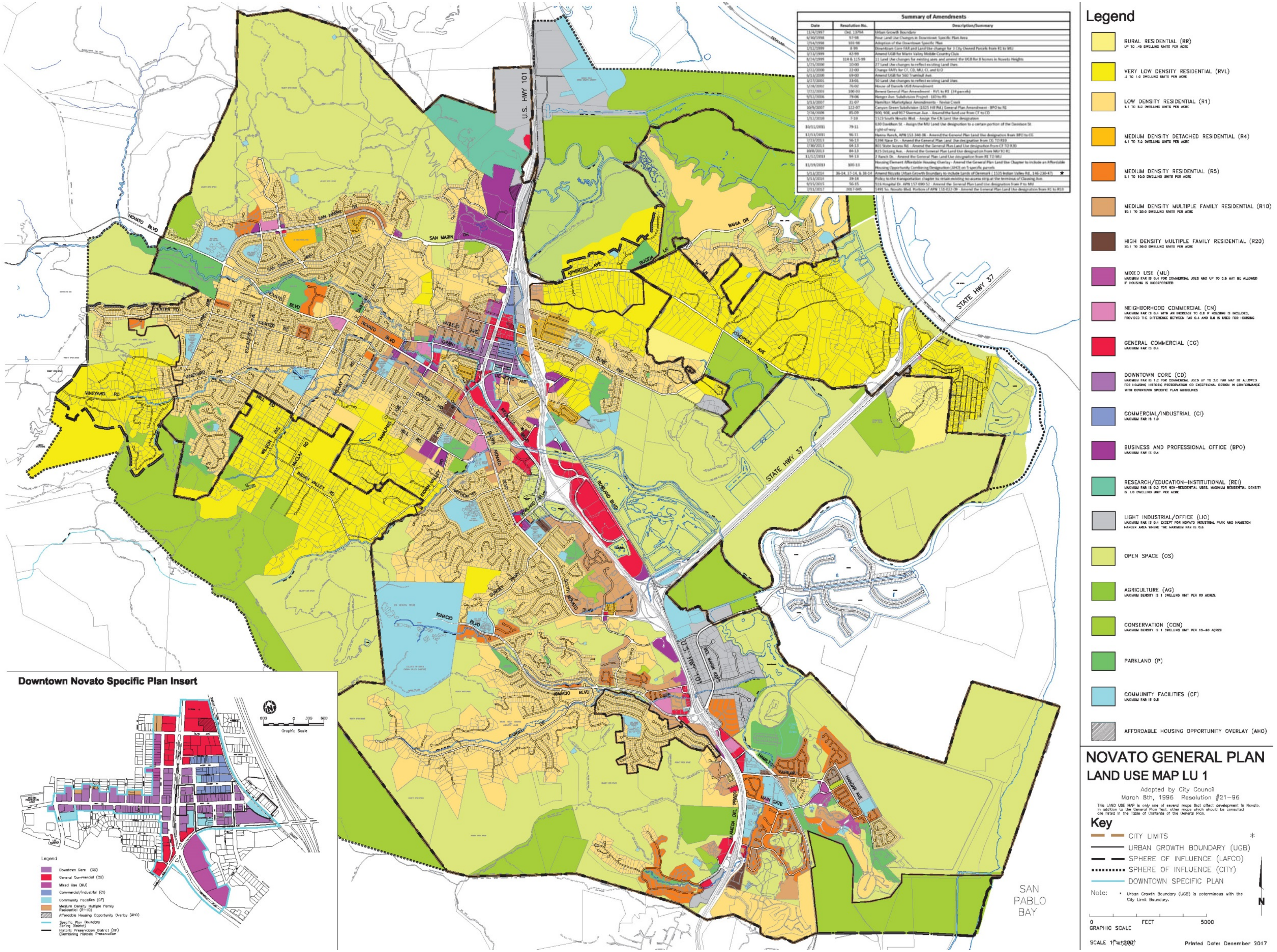
**Figure 2-9 Existing (1996) General Plan Land Use Map**




*Source: City of Novato*

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clarify or adjust regulation of the subject activity or adding new standards and regulations addressing activities not currently allowed and/or regulated by the Municipal Code.

## 2.5 Characteristics of the Proposed 2035 General Plan

General Plan 2035 provides a blueprint for the City through 2035 guiding future growth and development. General Plan buildout and the five chapters included in General Plan 2035 are further described below.

## 2.6 General Plan Buildout

General Plan 2035 designates land uses defining the type of development that can occur throughout the City through the planning horizon year of 2035 (over approximately 17 years). Development projections for the General Plan were determined by analyzing vacant and underutilized parcels within the City and the reasonable level of development potential that is allowed under the applicable land use designation factoring for known physical and/or regulatory requirements (e.g., Hillside and Ridgeline Protection Ordinance). The development projections include the development potential of General Plan 2035, the four General Plan focus areas, Industrial Parks MPA, as well as the housing development potential in the available land inventory of the City's Housing Element. General Plan 2035 development projections are shown in Table 2-3.

Potential residential development in the four focus areas would include 99 residential units, the majority of which would be in the Downtown focus area. Potential commercial development includes approximately 395,000 square feet and projected office development would occur only in the North, North Redwood Corridor focus area and includes approximately 379,000 square feet of development. Potential industrial development would be reduced in both the North Redwood Corridor and the North, North Redwood Corridor. Compared to the overall development projections shown in Table 2-3, development in the four focus areas would be an incremental increase compared to the existing built environment. In addition, estimated buildout in the four focus areas would be reduced for residential, commercial, and industrial development as compared to the 1996 General Plan buildout projections. Office development would increase as compared to the 1996 General Plan; however, only 395,000 square feet of office development would occur in the four focus areas. In addition to development in the four focus areas, an additional 500,000 square feet of life science/biotech uses would be permitted in the Industrial Parks MPA.

The 1996 General Plan identified theoretical buildout capacities for residential, commercial, industrial, and office land uses as shown in Table 2-3. The buildout estimates are in most cases substantially higher than actual development in place at the time of the Notice of Preparation and the amount of development that is being projected in 2035. The proposed project uses a 20-year development projection for long range planning.

**Table 2-3 General Plan 2035 Development Projections**

| Land Use | 1996 General Plan Estimated Buildout | Existing Built and Under Construction 2015[2] | Additional Development Projected through 2035 | Total Development Projected through 2035 |
|---|---|---|---|---|
| Residential (units) | 26,509 | 21,469 | 930 | 22,399 |
| Commercial[1] (sf) | 9,579,455 | 3,756,960 | 694,797 | 4,451,757 |
| Industrial (sf) | 2,215,778 | 1,082,314 | 332,312[3] | 1,414,626 |
| Office (sf) | 2,392,641 | 3,427,918 | 646,353 | 4,074,271 |

[1] Includes all development not strictly defined as Industrial or Office and includes retail, flex, and specialty space as defined and reported by CoStar Realty Information, Inc.

[2] Includes development issued building permits as of December 2015

[3] Net increase of 332,312 sf factoring for the addition of 500,000 sq. ft. of life science/biotech uses in the Novato Industrial Park Master Plan less industrial development projected (167,688 sf) under the 1996 General Plan that will not be built under 2035 General Plan.

Notes: sf = square feet

Source: General Plan 2035

**Table 2-4 Focus Area Development Projections**

| Focus Area | Residential (units) | Commercial (square feet) | Office (square feet) | Industrial (square feet) |
|---|---|---|---|---|
| North Redwood Corridor | 15 | 190,968 | 0 | (32,323) |
| North, North Redwood Corridor | 0 | 182,865 | 379,365 | (135,365) |
| Northwest Quadrant Neighborhood | 8 | 0 | 0 | 0 |
| Downtown | 76 | 21,200 | 0 | 0 |
| Total | 99 | 395,033 | 379,365 | 0 |

Notes: () = negative number

## 2.6.1 Great Places Chapter

This chapter presents a framework for governing future decisions about context-appropriate land use and desirable development patterns to maintain and enhance the character of Novato by identifying and defining land use designations for the City. This framework aims to effectively manage growth and provide needed housing, jobs and services while encouraging the use of quality design and infill strategies for new development. By drawing from and building upon the community's distinct history, neighborhoods, and commercial areas, the Great Places chapter sets the stage for maintaining an economically, socially and environmentally sustainable Novato. The Great Places chapter includes the following sections: Community Character; Demographics and Growth Projections; Land Use; Growth Management and Development Projections; and Housing. The Housing Element was adopted in 2014 and is not being revised. This chapter addresses state requirements for the housing element and the land use element of the general plan. Specific land use designations in the Great Places chapter are show in Table 2-5.

### Table 2-5 Description of Land Use Designations

| Land Use Designation | Building Density and Intensity | Description | Compatible Zoning Districts |
|---|---|---|---|
| Rural Residential (RR) | Up to 0.49 dwelling unit per gross acre.<br>Maximum FAR for non-residential uses is 0.2. | The Rural Residential land use designation applies to areas appropriate for the development of single family homes and related accessory residential uses in rural, low density settings. Additionally, certain agriculture, recreation, education, resource, assembly, lodging, day care and utility uses may be allowed. | Rural Residential (RR) |
| Very Low Density Residential (RVL) | 0.5 to 1.0 dwelling unit per gross acre.<br>Maximum FAR for non-residential uses is 0.2. | The Very Low Density Residential designation applies to areas appropriate for the development of single family homes and related accessory residential uses on larger lots. Additionally, certain agriculture, recreation, education, assembly, lodging, day care and utility uses may be allowed. | Very Low Density Residential (RVL) |
| Low Density Residential (R1) | 1.1 to 5.0 dwelling units per gross acre.<br>Maximum FAR for non-residential uses is 0.4. | The Low Density Residential land use designation is applied to areas appropriate for single family homes and related accessory residential uses. Additionally, certain agriculture, recreation, education, assembly, lodging, day care and utility uses may be allowed. | Low Density Residential (R1) |
| Medium Density Detached Residential (R4) | 4.1 to 7.0 dwelling units per gross acre.<br>Maximum FAR for non-residential uses is 0.4. | The Medium Density Detached Residential land use designation is applied to areas appropriate for single family homes and related accessory residential uses. Additionally, certain agriculture, recreation, education, assembly, lodging, day care and utility uses may be allowed. | Medium Density Detached Residential (R4) |
| Medium Density Residential (R5) | 5.1 to 10.0 dwelling units per gross acre.<br>Maximum FAR for non-residential uses is 0.4. | The Medium Density Residential land use designation applies to areas appropriate for a mix of housing types on smaller lots. Typical residential land uses include single and two-family homes, either detached or attached, and related accessory residential uses. Additionally, certain agriculture, recreation, education, assembly, lodging, day care and utility uses may be allowed. | Medium Density Residential (R5) |
| Medium Density Multiple-Family Residential (R10) | 10.1 to 20.0 dwelling units per gross acre.<br>Maximum FAR for non-residential uses is 0.4, and up to 0.6 for residential care facilities for the elderly. | The Medium Density Multiple-Family Residential land use designation applies to areas appropriate for single family, two-family and multi-family homes and related accessory residential uses. Additionally, certain education, assembly, lodging, day care and utility uses may be allowed. | Medium Density Multi-Family Residential (R10) |

| Land Use Designation | Building Density and Intensity | Description | Compatible Zoning Districts |
|---|---|---|---|
| High Density Multiple-Family Residential (R20) | 20.1 to 30.0 dwelling units per gross acre.<br>Maximum FAR for non-residential uses is 0.4, and up to 0.6 for residential care facilities for the elderly. | The High Density Multiple-Family Residential land use designation applies to areas appropriate for multi-family housing and related accessory residential uses. Additionally, certain education, assembly, lodging, day care and utility uses may be allowed. | High Density Multi-Family Residential (R20) |
| Mixed Use (MU) | 10.1 to 20.0 dwelling units per gross acre in mixed use for live-work developments. Maximum FAR is 0.4 and up to 0,7 for hotel uses, with the potential for an increase to 0.8 when housing is incorporated into a project | The Mixed Use land use designation is appropriate for sites where the surrounding area is currently developed with a mix of commercial and residential land uses. Certain retail, office, research and development, service, recreation, assembly, education, and utility facilities may be allowed.<br>Housing development may be permitted only in conjunction with either commercial and/or office uses. | Mixed Use (MU) |
| Neighborhood Commercial (CN) | 10.1 to 20.0 dwelling units per gross acre in mixed use development. Maximum FAR is 0.4, with an additional 0.2 only for housing. The maximum FAR for residential care facilities for the elderly is 0.6 and up to 0.7 for hotel uses.. | The Neighborhood Commercial land use designation is applied to neighborhood shopping areas including a mix of retail, service, , office, and utility uses. Additionally, certain recreation, assembly, education and residential uses may be allowed. | Neighborhood Commercial (CN) |
| General Commercial (CG) | Maximum FAR 0.4 and up to 0.7 for hotel uses.<br>10.1 to 20.0 dwelling units per gross acre for live-work developments. | The General Commercial land use designation is applied to areas appropriate for a broad range of retail, service, research and development, office, recreation, assembly, education, and live-work uses. Additionally, certain manufacturing and utility uses may be allowed. | General Commercial (CG) |
| Downtown Core (CD) | 20.1 to 30.0 dwelling units per gross acre in mixed use and for live-work developments. Maximum FAR is 1.2 with the potential for a maximum of 2.0 where housing is incorporated. | The Downtown Core land use designation is applied to the downtown area suitable for a mix of retail, service, office, recreation, assembly, and education uses. Additionally, residential (mixed use and live-work) and utility uses may be allowed. | Downtown Core Retail (CDR)<br>Downtown Core Business (CDB) |
| Commercial/Industrial (CI) | Maximum FAR 1.0<br>10.1 to 20.0 dwelling units per gross acre for live-work developments. | The Commercial/Industrial land use designation is applied to areas suitable for intensive commercial land uses, including certain manufacturing, processing, warehousing, retail, service, office, research and development, recreation, education, utility uses, and live-work use. | Commercial/ Industrial (CI) |

| Land Use Designation | Building Density and Intensity | Description | Compatible Zoning Districts |
|---|---|---|---|
| Business and Professional Office (BPO) | Maximum FAR 0.4 and up to 0.7 for hotel uses.<br>10.1 to 20.0 dwelling units per gross acre for live-work developments | The Business and Professional Office land use designation is applied to areas appropriate for a variety of office, research and education activities. Additionally, certain limited retail, service, residential (live-work) and utility uses may be allowed. | Business and Professional Office (BPO) |
| Research/Education Institutional (REI) [1] | Maximum FAR 0.2 ; up to 1.0 dwelling unit per acre | The Research/Education-Institutional land use designation is applied to areas suitable for a mix of medical research, educational and laboratory uses, with related multi-family residential, recreation, office and commercial uses in a campus setting. | Research/ Education-Institutional (REI) |
| Light Industrial/Office (LIO) | Maximum FAR is 0.4 and up to 0.7 for hotel uses. In the Hamilton Landing hangar areas and the Novato Industrial Park, the maximum FAR is 0.6, except in the Ignacio and Hamilton subareas of the Novato Industrial Park, FAR up to 1.2 may be allowed for a designated life sciences campus.[2]<br>10.1 to 20.0 dwelling units per gross acre for live-work developments | The Light Industrial/Office land use designation is applied to areas appropriate for light industrial and manufacturing uses, including warehousing, office, retail, live-work and utility uses that will not create objectionable noise, smoke, odor, dust and other nuisances. Additionally service, education, residential (live-work) and recreation uses may be allowed. | Light Industrial/ Office (LIO) |
| Open Space (OS) | Development is not allowed in this designation, so there is no applicable density range. | The Open Space land use designation applies to publicly-owned land and privately-owned land subject to conservation easements that is largely unimproved and devoted to the preservation of natural resources, agriculture, and outdoor recreation. Additionally, caretaker quarters and utility uses may be allowed. | Open Space (OS)<br>Restricted Open Space (ROS) |
| Conservation (CON) | The allowable density of detached single-family dwelling units ranges from one dwelling unit per 10 acres to one dwelling unit per 60 acres. | The Conservation land use designation is intended to conserve natural resources and is applied to privately-owned land that is mainly unimproved. Additionally, certain agriculture, recreation, residential, service and utility uses may be allowed. | Conservation (C) |
| Agriculture (AG) | Single-family dwellings are allowed at a maximum density of one dwelling unit per 60 acres. | The Agriculture land use designation is applied to lands that are intended to largely be maintained in agricultural use. Additionally, certain recreation, service, assembly, residential, and utility uses may be allowed. | Agricultural (A) |

| Land Use Designation | Building Density and Intensity | Description | Compatible Zoning Districts |
|---|---|---|---|
| Parkland (P) | Maximum FAR is 0.4. | The Parkland land use designation is applied to areas suitable for parks, playgrounds and other recreational uses. Additionally, certain agriculture, open space, assembly and utility uses may be allowed. | Parkland (PL) |
| Community Facilities, Public Utilities and Civic Uses (CF) | 10.1 to 20.0 dwelling units per gross acre in mixed use development. Maximum FAR 0.8.[3] | The Community Facilities, Public Utilities and Civic Uses land use designation is applied to areas suitable for public land uses including certain open space and recreation uses may be allowed. Additionally, education, assembly, medical, research and development, , service, residential and utility uses may be allowed. | Community Facilities (CF) |
| Affordable Housing Opportunity Combining Designation | 20.0 to 23.0 dwelling units per gross acre for multi-family housing in accordance with Housing Element Program 9.B and, for area(s) of the property not utilized for Affordable Housing Opportunity Combining Designation uses, the density range or maximum floor-area-ratio shall be as allowed in the primary land use designation. | Multi-family dwellings, accessory retail and service uses, recreation, home occupations, community facilities and other similar uses to serve residents of multi-family dwellings, or any land use normally allowed in the primary land use designations | Affordable Housing Overlay District (AHO) |

[1] As applicable to the Buck Institute property, the REI designation was approved by public vote.

[2] Within the Ignacio and Hamilton subareas of the Novato Industrial Park, previously approved life science campuses built above 0.6 may be reoccupied by other permitted or conditionally permitted use pursuant to the procedures set forth in the Master Plan/Precise Plan.

[3] A mixed use project must comply with both the FAR and the allowable density range.

Source: City of Novato General Plan 2035

## 2.6.2 Environmental Stewardship Chapter

This chapter presents a framework for governing future decisions about how Novato will sustain open space and natural resources for current residents, as well as future generations. Natural resources are the lands, habitat, wildlife, plants and trees, air, water, minerals and other resources that occur naturally in the environment, undisturbed by human activity. These natural resources and open space lands can provide biodiversity, recreation, agricultural and managed natural resources production, flood risk reduction, protection from hazardous conditions, and climate change mitigation and adaptation. Development of open space lands can degrade natural resources and impact the many benefits provided by these areas, thus General Plan 2035 discourages the conversion of open space land to urban uses. The chapter focuses on the protection, maintenance and enhancement of Novato's natural resources and open spaces, while conserving resources and reducing greenhouse gas emissions. This chapter partially addresses the state requirements for the open space and conservation elements of the general plan, which are also addressed in the Living Well and A City that Works chapters. Together with the city's Zoning Ordinance regulations related to open space, this chapter constitutes the city's open space plan. The Environmental Stewardship chapter includes the following sections: Natural Communities and Ecological Resources; Open Space and Scenic Resources; Agricultural Land; Water Quality; Air Quality; Mineral Resources; and Climate Change.

### 2.6.3 Living Well Chapter

Novato offers a wide variety of parks, recreational facilities, and social service programs that provide recreational amenities for residents and support a healthy environment. This chapter presents a framework for governing future decisions about how Novato will develop and maintain recreation facilities, parks, trails, and social services while promoting healthy eating and active living to improve community health, well-being and physical activity. The chapter also provides guidelines to protect the community from excessive or harmful noise and ensure a high quality of life in Novato. This chapter addresses the requirements of the state-mandated noise element and portions of the open space element, which is also addressed in the Environmental Stewardship chapter. This chapter includes the following sections: Parks; Recreational and Cultural Facilities and Programs; Healthy Eating, Active Living; and Noise.

### 2.6.4 Economic Vitality Chapter

This chapter presents a framework for governing future decisions about how the city will encourage a thriving business environment with high-paying industries, a vibrant downtown, and a healthy economy. The chapter aims to create a climate where business and innovation flourishes and a city that draws visitors and provides residents with attractive options for shopping, recreation and working. This chapter includes the following sections: Local Employment; Office and Industrial Market; and Retail Market.

### 2.6.5 A City that Works Chapter

This chapter presents a framework for governing future decisions about how the city will provide a safe and well-connected community and deliver services and infrastructure to today's residents, as well as future generations. The chapter aims to maintain and improve Novato's circulation network and protect the community from natural and man-made hazards. It also seeks to maintain and improve community facilities, infrastructure and services, and provide effective and responsive governance. This chapter addresses the requirements of the state-mandated circulation and safety elements and partially addresses the requirements of the land use and conservation elements of the general plan, which are also addressed in the Living Well and Environmental Stewardship chapters. This chapter includes the following sections: Mobility; Public Safety; Public Services and Facilities; and Governance.

### 2.6.6 Implementing Ordinances

Implementing ordinances would be adopted as part of the General Plan update. Table 2-1 includes a description of changes to the Novato Municipal Code as part of the proposed project and the policy implications of the changes. Implementing ordinances that could result in a physical impact include:

- Ordinance #2 would allow increased development in hillside areas;
- Ordinance #8 would require replanting with native species;
- Ordinance #11 would expand wetland buffer for special status species; and

- Ordinance #13 would allow commercial lights to be turned on at night but requires night sky fixtures.

# 2.7 Project Objectives

The vision of the General Plan 2035 and implementing ordinances is as follows:

> "We, the citizens of Novato, love our community: its natural beauty, quaint downtown and small town character, safe, quiet neighborhoods, excellent schools and parks, and above all, our friendly, caring people. We envision a sustainable community that fits naturally into the environment and provides for our basic needs so that all can continue to enjoy the benefits of living in this very special place.
>
> This General Plan Vision has two fundamental purposes: to preserve and enhance those characteristics of our City that we hold dear, and to provide guidance for the future of our City, based on sustainable principles."

The 2035 General Plan sets the following guiding principles:

"We wish to <u>preserve and enhance</u>:

- The open space, hillsides, ridgelines, creeks, wetlands and other natural features that give our City its scenic beauty, quality of life and define our borders;
- Our small town character and historical heritage;
- The safe, quiet and individual character of our distinct neighborhoods, where our residents can raise their families and send their children to excellent schools;
- The many small businesses throughout our City that provide our residents with essential goods, services and jobs; and
- The financial integrity of our City government so that it may continue to serve the civic needs of all of our residents.

As we look to the future, we wish to <u>encourage and promote</u>:

- Sustainable development that is in harmony with its natural and built environment;
- A variety of housing types dispersed throughout the community, portions of which are affordable, for our commercial workforce, public employees, seniors, and those with special needs;
- Creation of public gathering places, parks, recreational facilities and community gardens that provide a sense of community, and allow enjoyment of our natural amenities;
- Creation of venues to enrich the visual and performing arts;
- Development that meets the needs of our residents and supports quality public services;
- Encouragement of interconnected modes of local transportation, including bicycle and pedestrian paths and trails, shuttles, buses, and paratransit.

The objectives of the Industrial Parks MPA are as follows:

- Strengthen and expand the biotech and Life Sciences industries in Novato
- Economic development in Novato
- Promote job orientation in Novato with higher paying jobs

The objectives of the implementing ordinances are as follows:

- Implement the goals, policies, and programs of GP 2035
- Clarify existing regulations of the Novato Municipal Code
- Strengthen existing zoning regulations for certain land uses and development activities
- Allow new regulated activities reflecting changes in community land use preferences

## 2.8 Required Discretionary Approvals

With recommendations from the City's Planning Commission, the Novato City Council will need to take the following discretionary actions in conjunction with the proposed project:

- Certification of the Final EIR
- Approval of the proposed General Plan 2035
- Approval of the revisions to the Zoning Map and Zoning Ordinance amendments to implement select programs of General Plan 2035 (see Table 2-1)
- Approval of the Industrial Parks Master Plan/ Precise Development Plan Amendment

Novato adopted its current Housing Element in November 2014, covering the period 2015-2023. This Housing Element was submitted to the California Department of Housing and Community Development (HCD) for review and comment, and the City received certification of the Housing Element from HCD in January 2015. No updates to the Housing Element are necessary or proposed at this time.

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# 3 Environmental Setting

According to Section 15125 of the State CEQA Guidelines, an EIR must include a description of the existing physical environmental conditions in the vicinity of a project to provide the baseline condition against which project-related impacts are compared. In order to fulfill this requirement and to inform the reader of the context in which the proposed project would be carried out, this section describes current environmental conditions in the planning area of the City of Novato. More detailed setting information is included within the impact analysis for each issue area.

## 3.1 Regional Setting

Novato is located in the greater North Bay region of the San Francisco Bay Area and is the northernmost city in Marin County. The North Bay region is topographically varied, with mountains, valleys, agricultural land, and distinct urban areas all within close proximity of the Pacific Ocean and bays. The Mediterranean climate and coastal influence produce moderate temperatures year round, with rainfall concentrated in the winter months. The region is subject to a range of natural hazards, including earthquakes, flooding, landslides, and wildfires.

## 3.2 Physical Setting

### 3.2.1 General Geographic Setting

Novato, located in north Marin County in the San Francisco Bay Area, is a suburban-scaled city framed by undeveloped hillsides and the open water of San Pablo Bay. The City is located northwest of San Pablo Bay approximately 29 miles north of San Francisco, 37 miles northwest of Oakland, and approximately 35 miles north of the San Francisco International Airport. The City is bordered by unincorporated areas of Marin County. The closest cities are the City of Petaluma in Sonoma County to the north and the City of San Rafael to the south. The City's edges are defined by major geographical features including Mount Burdell to the north, Big Rock Ridge to the west, Indian Valley open space to the southwest, Pacheco Valle and Loma Verde open space to the south, Bel Marin Keys wetlands to the southeast and the bay plains and Petaluma River to the northeast. Much of the urbanized area of Novato occupies a flat northwest-trending valley that follows Novato Creek, Vineyard Creek, Warner Creek and other tributaries flowing southeast from the hills to the Bay.

Highway 101 transverses the City from north to south and SR 37 transverses the eastern portion of the City. Rail lines are located in the Downtown area west of Highway 101. The rail line connects to the City of Petaluma to the north and the City of San Rafael to the south and connections to a national rail line to the east via the railroad tracks along SR 37. The Sonoma-Marin Area Rail Transit (SMART) train is a passenger rail service project that connects Sonoma and Marin Counties with full service anticipated by 2021. SMART currently operates two rail stations in Novato – Novato San Marin Station (north) and Novato Hamilton Station (south). A third station, Novato Downtown Station, was completed in December 2019. Additionally, freight train services operated by the North Coast Railroad Authority use SMART's right-of-way and head east at the Highway 101 and SR 37 interchange, toward the national rail system.

Novato is a primarily a residential community where most of the development is single-family one- and two-story buildings. As shown in General Plan 2035 residential land use comprises 37.3 percent of existing development, commercial and mixed-use consist of 2.4 percent, and another 5 percent is business and industrial. The remaining 55.3 percent is 54.3 percent community and natural resource land use with 1 percent undesignated land.

### 3.2.2 Topography and Drainage

Elevations in Novato range from sea level to approximately 1,558 feet above mean sea level (amsl) at the highest point on Burdell Mountain. The Downtown is at 18 feet amsl. The drainage network in Novato consists of a number of lakes, streams, and creeks, including the Petaluma River, Stafford Lake, Novato Creek, Rush Creek and San Pablo Bay. Novato Creek is the dominant perennial stream in the Novato area, extending about 17 miles from its headwaters at Stafford Lake to San Pablo Bay. Man-made drainage systems within the City of Novato include earthen drainage swales and concrete ditches, major street culverts and bridges, and drainage facilities and basins that are part of city-owned open spaces (City of Novato 2014a).

### 3.2.3 Climate

Novato is located within the Marin County subregion of the San Francisco Air Basin (Basin). Due to the proximity of the San Francisco Bay and Pacific Ocean, the climate in the Basin is characterized by warm dry summers and cool moist winters. In summers, temperatures in Novato generally range from the 50s to high 70s and low 80s. In winter, temperatures range from the 30s to the 50s (City of Novato 2014a).

The major large-scale weather feature controlling climate in the Novato area is a large high pressure system located in the eastern Pacific Ocean, known as the Pacific High. During winter months marine air trapped in the lower atmosphere is often condensed into fog by the cool Pacific Ocean. Stratus-type clouds usually form offshore and move into the area during the evening hours.

During winter months, the Pacific High becomes weaker and shifts south, allowing weather systems associated with the polar jet stream to affect the region. Low pressure systems produce periods of cloudiness, strong shifting winds and precipitation. Novato, which lies mostly on the lee side of the coastal mountains in Marin County, receives about 30 inches (762 mm) of precipitation per year. Mountains to the west receive 40 to 50 inches (1,016 to 1,270 mm). Most rainfall occurs from November through April. High-pressure systems are also common in winter, with low-level inversions that produce cool stagnant conditions. Radiation fog and haze trapped near the surface are common during extended winter periods where high-pressure systems influence the weather (City of Novato 2014a).

### 3.2.4 Demographics

The City of Novato was incorporated in 1960 with an initial population of 17,881. The City experienced a rapid rise in population between 1960 and 1980 and increased by 26,035 persons to a population of 43,916 in 1980. The population increased by about eight percent between 1980 and 1990, and grew by only 45 people from 1990 to 2000. Between 2000 and 2010, the population increased by 4,247 people. Much of the increase in that last decade can be attributed to the re-use of Hamilton Air Force Base, which added over 1,170 new housing units to the City (City of Novato 2014a). As of 2017 there are approximately 54,522 persons in Novato.

According to the California Department of Finance, the City had 21,158 dwelling units (20,279 of which were occupied) as of May 1, 2017, including 15,844 single-family dwelling units (75 percent ), 4,766 units within multi-family buildings (23 percent), and 548 mobile homes (2 percent )The average number of persons per household in Novato is 2.65 (DOF 2017).

Novato benefits from a gradually expanding economy, with rising employment and growing industry diversification. Novato generates approximately 20 percent of Marin County's economic value, and experienced jobs gains over the past decade in a broad array of sectors including health care, private education and professional/scientific services. As of 2015 there were approximately 21,770 jobs and approximately 25,090 employed residents in Novato. Employment forecasts for Novato estimate that there will be approximately 23,840 jobs in the City by 2035 (Association of Bay Area Governments [ABAG] 2013). Therefore, many residents work outside of the City.

## 3.3 Cumulative Development

CEQA defines cumulative impacts as two or more individual actions that, when considered together, are considerable or will compound other environmental impacts. Cumulative impacts are the changes in the environment that result from the incremental impact of development of the proposed project and other nearby projects. For example, traffic impacts of two nearby projects may be insignificant when analyzed separately, but could have a significant impact when analyzed together. Cumulative impact analysis allows an EIR to provide a reasonable forecast of future environmental conditions and can more accurately gauge the effects of a series of projects.

Because the proposed project is comprised of a General Plan, implementing ordinances, and Industrial Parks MPA cumulative impacts are treated somewhat differently than would be the case for a project-specific development. Section 15130 of the State *CEQA Guidelines* provides the following direction relative to cumulative impact analysis:

> Impacts should be based on a summary of projections contained in an adopted general plan or related planning document, or in a prior environmental document which has been adopted or certified, which described or evaluated regional or areawide conditions contributing to the cumulative impact.

By its nature, a general plan considers cumulative impacts insofar as it considers cumulative development that could occur within a city's plan area over a defined time-frame. Therefore, the analysis of project impacts also largely constitutes the cumulative analysis. In addition to cumulative development within the City of Novato, the analysis of traffic and related impacts (such as noise) considers the effects of regional traffic growth occurring outside of the Plan Area. Whereas the Plan Area constitutes the bulk of the common geography of the region for Marin and South Sonoma counties, cumulative impacts will be discussed in individual sections.

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# 4 Environmental Impact Analysis

This section discusses the possible environmental effects of the proposed project for the specific issue areas that were identified through the scoping process as having the potential to experience significant effects. "Significant effect" is defined by the *CEQA Guidelines* §15382 as:

> "…a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project including land, air, water, minerals, flora, fauna, ambient noise, and objects of historic or aesthetic significance. An economic or social change by itself shall not be considered a significant effect on the environment, but may be considered in determining whether the physical change is significant."

The assessment of each issue area begins with a discussion of the environmental setting related to the issue, which is followed by the impact analysis. In the impact analysis, the first subsection identifies the methodologies used and the "significance thresholds," which are those criteria adopted by the City and other agencies, universally recognized, or developed specifically for this analysis to determine whether potential effects are significant. The next subsection describes each impact of the proposed project, mitigation measures for significant impacts, and the level of significance after mitigation. Each effect under consideration for an issue area is separately listed in bold text with the discussion of the effect and its significance. Each bolded impact statement also contains a statement of the significance determination for the environmental impact as follows:

- **Significant and Unavoidable**. An impact that cannot be reduced to below the threshold level given reasonably available and feasible mitigation measures. Such an impact requires a Statement of Overriding Considerations to be issued if the project is approved per §15093 of the CEQA Guidelines.
- **Less than Significant with Mitigation Incorporated**. An impact that can be reduced to below the threshold level given reasonably available and feasible mitigation measures. Such an impact requires findings under §15091 of the CEQA Guidelines.
- **Less than Significant**. An impact that may be adverse, but does not exceed the threshold levels and does not require mitigation measures. However, mitigation measures that could further lessen the environmental effect may be suggested if readily available and easily achievable.
- **No Impact.** The proposed project would have no effect on environmental conditions or would reduce existing environmental problems or hazards.

Following each environmental impact discussion is a list of mitigation measures (if required) and the residual effects or level of significance remaining after implementation of the measure(s). In cases where the mitigation measure for an impact could have a significant environmental impact in another issue area, this impact is discussed and evaluated as a secondary impact. The impact analysis concludes with a discussion of cumulative effects, which evaluates the impacts associated with the proposed project in conjunction with other planned and pending developments in the area listed in Section 3.0, *Environmental Setting*.

The Executive Summary of this EIR summarizes all impacts and mitigation measures that apply to the proposed project.

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# 4.1 Aesthetics

This section addresses potential impacts on aesthetics, including scenic vistas, scenic resources, visual character and quality, and light and glare from implementation of the proposed project.

## 4.1.1 Setting

### a. Definitions

Most communities identify scenic resources as important assets that form community identity. Scenic natural resources include hillsides, Bay plains, and Bay shorelines that frame the City of Novato (City of Novato 2014a). Scenic resources also typically include natural open spaces, unique topographic formations, natural landscapes, and aspects of the built environment such as parks, trails, cultural resources, and architecturally significant buildings.

Viewsheds also contribute to aesthetic value, as they establish the context in which scenic resources may be observed. They are typically defined by physical features that frame one or more scenic resources. For example, an area's topography can contribute to aesthetic value through the creation of view corridors and/or scenic vistas consisting of ridgelines and mountains, which can form a community's visual backdrop. Viewsheds can also include a range of resources (including natural and/or man-made elements) and thus natural and man-made environments can be considered important scenic resources worthy of preservation.

### b. Existing Visual Conditions

The City of Novato is a suburban community in northern Marin County in the San Francisco Bay Area (City of Novato 1996). Single-family residential neighborhoods with one- and two-story homes predominate, in addition to some multi-family housing that is dispersed mainly along arterial and collector streets (City of Novato 2014a). Commercial uses are concentrated downtown along Grant Avenue, along Redwood Boulevard, in pockets along Highway 101, and in various small clusters and convenience centers (City of Novato 1996). Much of the urbanized area of Novato occupies a flat northwest-trending valley that follows Novato Creek, Vineyard Creek, Warner Creek and other tributaries flowing southeast from the hills to the Bay (City of Novato 2014a). The topography of Novato varies from eastern flatlands at the margins of San Pablo Bay to hillsides and valleys to the west.

The City finds that views from Novato to the surrounding scenic resources, as shown in Figure 4.1-1, are extremely important to Novato residents (City of Novato 2014a). These views provide physical orientation and are integral to the city's character and sense of place. Mt. Burdell, located north of the city, is a natural landmark that dominates views of Novato from Highway 101 and most areas north and west of State Route (SR) 37. The 1,508-foot-high Mt. Burdell is part of an open space preserve, managed by the Marin County Department of Parks and Open Space, that offers expansive views of Novato from a number of hiking and biking trails. Hillsides provide a scenic backdrop for developed areas. Designated open space is the largest single land use within Novato's sphere of influence (with 8,383 acres, or 37 percent of total land), followed by residential land uses (8,355 acres, or 37 percent of total land).

The visual character of Novato varies by geography, the presence of scenic resources, and the pattern of development. Figure 4.1-2 through Figure 4.1-6 show photographs of existing conditions in each focus area of General Plan 2035, as well as in the Bel Marin Keys area.

- **Downtown.** Downtown Novato is the commercial core of the community, with a pedestrian-oriented streetscape and examples of historic architecture. Photograph 1 shows a clock tower located at the corner of Grant Avenue and Sherman Avenue. Photograph 2 shows a typical view of Downtown Novato along Grant Avenue, including commercial storefronts, prominent street trees, and angled on-street parking spaces.
- **North Redwood Corridor.** The North Redwood Corridor is characterized by automobile-oriented development along Redwood Boulevard, a divided roadway with a landscaped median. Photograph 3 shows an auto sales and retail store in this corridor, while Photograph 4 shows a vacant lot north of Pinheiro Circle.
- **North, North Redwood Corridor.** The North, North Redwood Corridor area is an approximately mile-long corridor containing most of the City's remaining vacant commercially zoned land. This area is characterized by existing commercial development, including offices, a hotel, warehouse space, and a SMART rail station, as well as natural undeveloped properties. Photograph 5 shows oak woodland on a property north of Wood Hollow Drive. Photograph 6 shows Novato's SMART station to east of Redwood Boulevard and north of San Marin Drive.
- **Northwest Quadrant Neighborhood.** The Northwest Quadrant is a residential neighborhood with primarily small lots and homes in close proximity to one another. Photographs 7 and 8 show representative single- and multi-family residences in this area.
- **Bel Marin Keys.** The Bel Marin Keys area has industrial parks and residential neighborhoods that front on wetlands and waterways. Photograph 9 shows a BioMarin building on Digital Drive, which is representative of life sciences development in the area, and Photograph 10 shows typical views of waterways from a residential street.

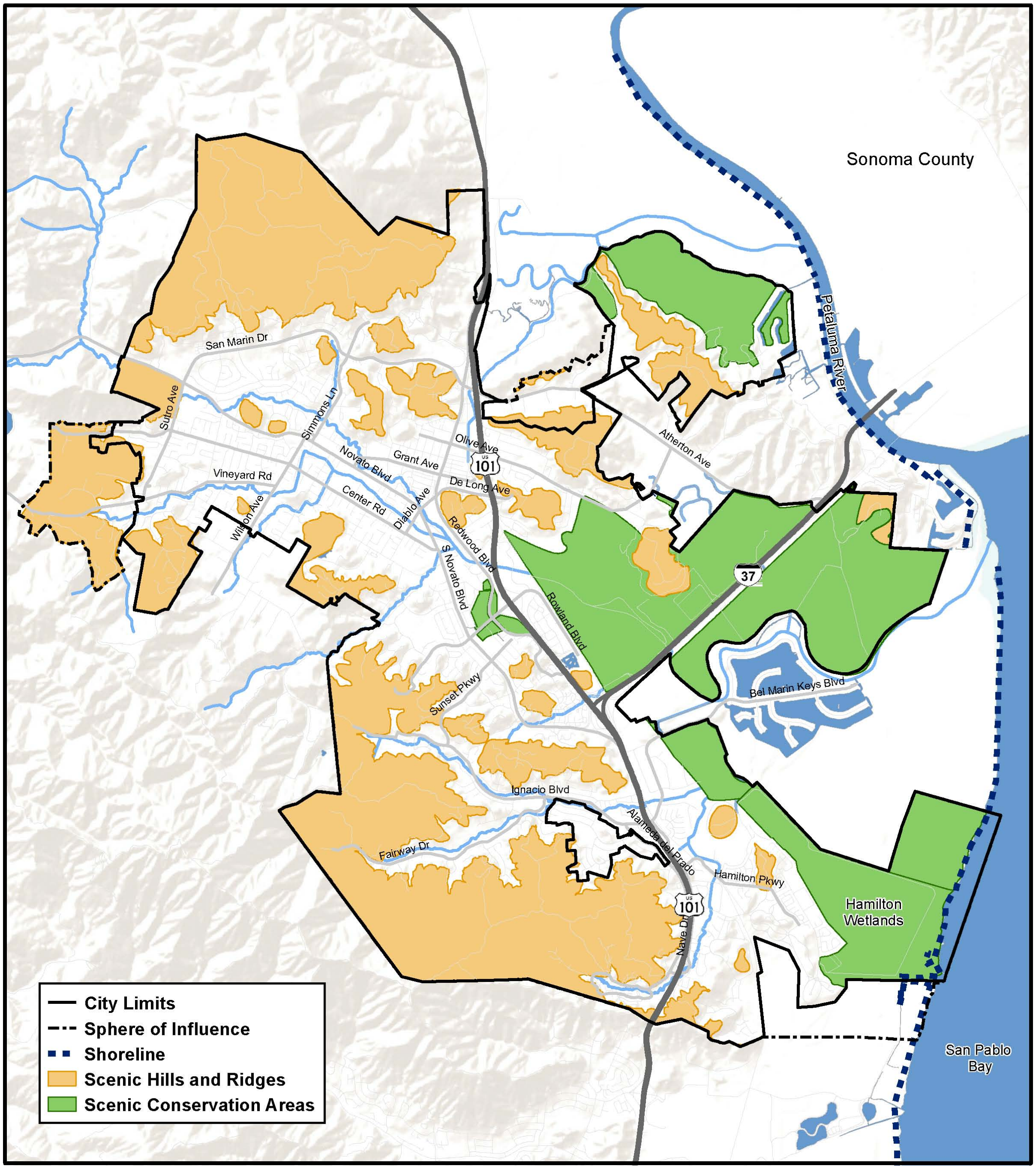
## c. Scenic Corridors

Scenic corridors provide an opportunity for the public to take advantage of the natural environment's aesthetic value. Scenic corridors typically pertain to roadways and visible lands outside the roadway right-of-way. California's Scenic Highway Program designates scenic highways with the intention of protecting their corridors from change that would diminish the aesthetic value of adjacent lands. While there are no State-designated scenic highways in Marin County, a 1.8-mile segment of U.S. Highway 101 (Highway 101), from mile marker 19.1 to 20.9, is eligible for State designation as a scenic highway to the north of SR 37 in Novato (California Department of Transportation [Caltrans] 2017a). This segment of Highway 101 provides scenic views of hillsides and ridgelines to the south, west, and north, and of wetlands and plains connected to San Pablo Bay to the east. The Bay plains are a key component of scenic views from Highway 101 (City of Novato 1996).

## d. Light and Glare

Existing development and motor vehicles in Novato produce light and glare. Primary sources of light are streetlights, parking lot lighting, and automotive headlights. Glare refers to the discomfort or impairment of vision experienced when a person is exposed to a direct or reflected view of a light source, causing objectionable brightness that is greater than that to which the eyes are adapted (Pennsylvania Outdoor Lighting Council n.d.). General sources of glare include reflected sunlight from the windows of buildings, from automobiles, and from glass building facades.

## Figure 4.1-1 Ridgelines and Scenic Resources



## Figure 4.1-2 Site Photographs: Downtown Novato

**Photograph 1.** Northward view of clock tower on Grant Avenue across from Sherman Avenue

**Photograph 2.** Eastward view of storefronts and sycamore street trees on Grant Avenue near Machin Avenue

**Figure 4.1-3 Site Photographs: North Redwood Boulevard Corridor**

**Photograph 3.** View to northwest of auto sales and repair store on Grant Avenue north of Olive Avenue

**Photograph 4.** Westward view of vacant lot adjacent to Redwood Boulevard and north of Pinheiro Circle

## Figure 4.1-4 Site Photographs: North, North Redwood Boulevard Corridor

**Photograph 5.** Northward view of natural undeveloped land on property to west of Redwood Boulevard and north of Wood Hollow Drive

**Photograph 6.** Northward view of SMART station to east of Redwood Boulevard and north of San Marin Drive

**Figure 4.1-5 Site Photographs: Northwest Quadrant Neighborhood**

**Photograph 7.** Northward view of single- and multi-family residences on Clayton Court

**Photograph 8.** Northward view of First Street and adjacent single-family residences to north of Vallejo Avenue

## Figure 4.1-6 Site Photographs: Bel Marin Keys


**Photograph 9.** Eastward view of BioMarin buildings at end of Digital Drive

**Photograph 10.** Eastward view from Caribe Isle cul-de-sac

## e. Regulatory Setting

### Federal

No existing federal regulations pertain to the visual resources within the Plan Area.

### State

The Caltrans defines a scenic highway as any freeway, highway, road, or other public right-of-way, that traverses an area of exceptional scenic quality. Suitability for designation as a State scenic highway is based on vividness, intactness, and unity, as described in Caltrans Guidelines for Official Designation of Scenic Highways (Caltrans 1995):

- Vividness is the extent to which the landscape is memorable. This is associated with the distinctiveness, diversity, and contrast of visual elements. A vivid landscape makes an immediate and lasting impression on the viewer.
- Intactness is the integrity of visual order in the landscape and the extent to which the natural landscape is free from visual intrusions (e.g., buildings, structures, equipment, grading).
- Unity is the extent to which development is sensitive to and visually harmonious with the natural landscape.

As discussed above, no officially designated scenic highways occur in Marin County; however, Highway 101 is eligible for State designation as a scenic highway to the north of SR 37 in Novato (Caltrans 2017a).

### Local

#### *2005 Downtown Novato Design Guidelines*

The Downtown Novato Design Guidelines are intended to guide site and architecture design for new buildings, additions and renovations of existing buildings to optimize the look and function of each building and its aesthetic and functional contribution to the greater Downtown area. The application of these Guidelines is intended to clarify the City's design objectives and expectations for development and redevelopment within the Downtown. The goal is to optimize the look and function of each building and its aesthetic and functional contribution to the greater Downtown area.

#### *General Design Objectives*

1. Provide the business and/or development community with a clear and comprehensive set of architectural design criteria applicable to the Downtown.
2. Create a very attractive and vibrant downtown through the physical design of structures and space, and maximize pedestrian access to and use of commercial uses and public spaces.
3. Facilitate pedestrian friendly spaces through appropriate site and architectural design including measures to mitigate negative impacts associated with automobile circulation, loading/unloading and parking.
4. Preserve and invigorate structures that are distinctive due to their age, historical or cultural importance or architectural character.

5. Ensure that all new buildings, additions and renovations incorporate outstanding architectural design and detailing that includes high quality finish materials.

### *Novato Municipal Code*

The City of Novato's Municipal Code has standards to protect scenic resources, hillsides, and ridgelines, and to minimize light trespass and glare. Section 19.20.080 (Scenic Resources Protection) of the Municipal Code requires that all new development on sites designated by the Scenic Resources Map in the City's General Plan protect existing scenic views from public vantage points, maintain side yards as open access visual corridors, minimize change to natural topography, and maintain views from roadways of the scenic backdrop provided by hillsides. Section 19.26 (Hillside and Ridgeline Protection) sets standards for development on parcels with an average slope of at least 10 percent, for the purpose of protecting scenic resources, preserving ridgelines and scenic vistas, and retaining natural topographic features and vegetation. However, Implementing Ordinance 2 would remove some development restrictions on Novato's hillsides.

Pursuant to the general development standards in Section 19.22.060 (Light and Glare), light or glare from exterior lighting must be shielded or modified to prevent emission of light or glare beyond the property line. The placement of exterior lights is required to eliminate spillover illumination or glare onto adjoining properties to the maximum extent feasible, and not interfere with the normal operation or enjoyment of adjoining properties.

# 4.1.2 Impact Analysis

## a. Methodology and Significance Thresholds

The assessment of aesthetic impacts involves qualitative analysis that is inherently subjective in nature. Reactions to the same aesthetic conditions vary according to the viewer. This section evaluates the anticipated changes in the City's visual environment from existing conditions to buildout of the proposed project, including the General Plan, development in the four focus areas and the Industrial Parks MPA, and application of the new implementing ordinances. It is important to underscore that the proposed project does not contain specific development proposals. This analysis therefore focuses on land use changes envisioned in the proposed project, and their aesthetic impacts on the community in terms of arrangement of built to natural undeveloped land, density and intensity of development according to the thresholds of significance discussed below.

The proposed project would have a significant impact if it could facilitate physical changes that would:

1 Have a substantial adverse effect on a scenic vista.

2 Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway.

3 Substantially degrade the existing visual character or quality of the site and its surroundings.

4 Create a new source of substantial light or glare than would adversely affect day or nighttime views in the area.

## 4.1.3 Project Impacts and Mitigation Measures

| | |
|---|---|
| **Threshold 1:** | Would the project have a substantial adverse effect on a scenic vista? |
| **Threshold 2:** | Would the project substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway? |

**Impact AES-1 THE PROPOSED PROJECT WOULD NOT FACILITATE DEVELOPMENT THAT SUBSTANTIALLY OBSTRUCTS SCENIC VISTAS OR VIEWS OF SCENIC NATURAL OR ARCHITECTURAL RESOURCES. THE IMPACT ON SCENIC VISTAS AND RESOURCES WOULD BE LESS THAN SIGNIFICANT.**

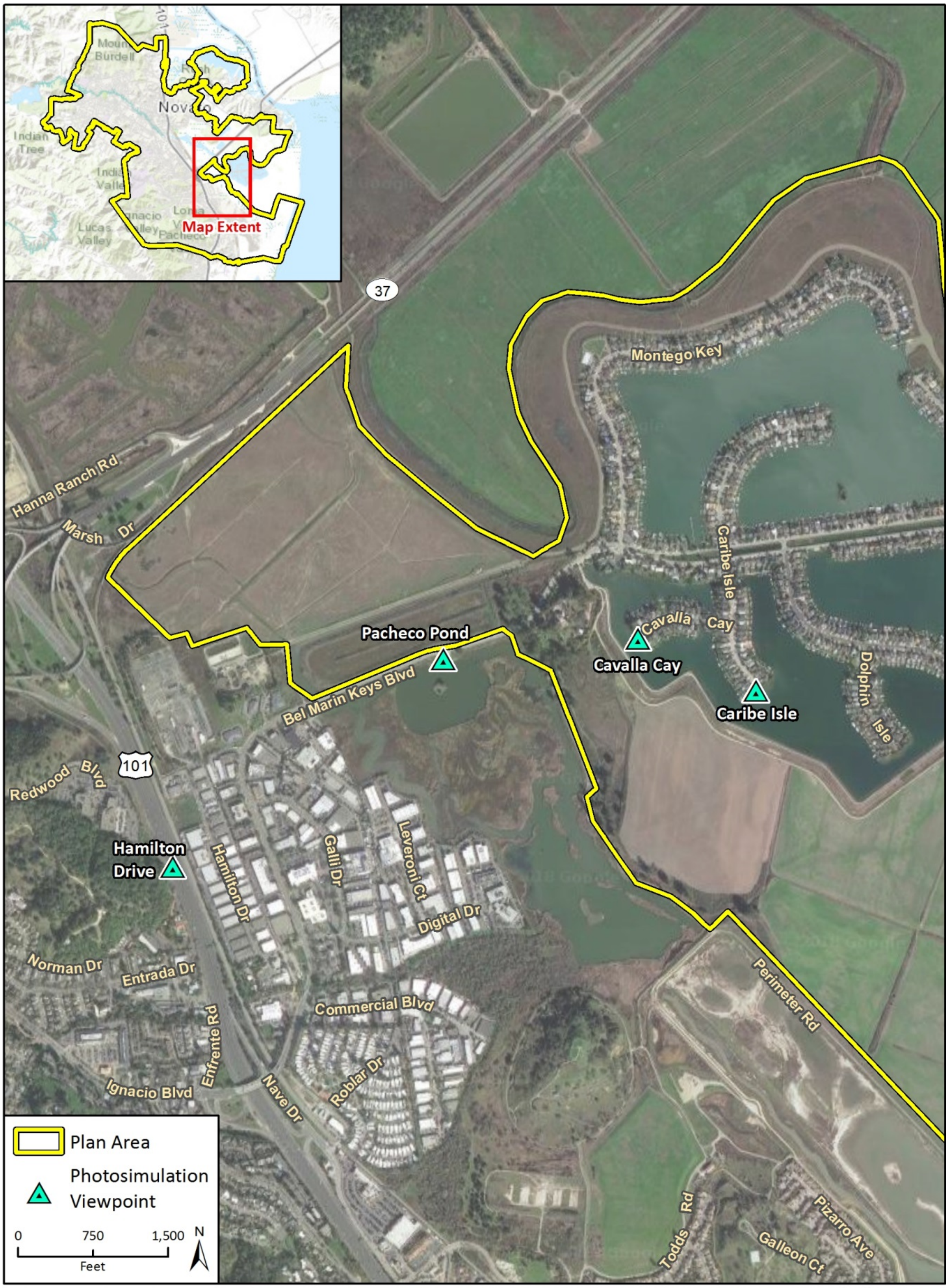
New development associated with the proposed project could occur within view of a 1.8-mile segment of Highway 101 in Novato that is eligible for State designation as a scenic highway. This segment, located north of SR 37 and south of De Long Avenue, provides scenic views of hillsides and ridgelines to the south, west, and north, and brief views of wetlands and plains connected to San Pablo Bay to the east. General Plan 2035 would focus new growth in specific areas of Novato which are not immediately adjacent to this highway segment: Downtown Novato; the North Redwood Boulevard Corridor; the North, North Redwood Corridor; the Northwest Quadrant Neighborhood; and the Industrial Parks MPA area. To the south of De Long Avenue, an intervening hillside cut obstructs Downtown Novato from the view of motorists on Highway 101. The proposed project would not increase height limits in areas between the segment of Highway 101 and scenic resources, and therefore would not facilitate the development of buildings that could obstruct scenic views available to motorists on the highway.

Expanded development could occur in the Industrial Parks MPA area, which would alter existing scenic views from nearby recreational areas and residences. The Pacheco Pond Wildlife Protection Area, accessible by a parking lot on the south side of Bel Marin Keys Boulevard, is the nearest scenic viewpoint to the Industrial Parks MPA area. This viewpoint is approximately one-quarter mile northeast of land that could be redeveloped in the Industrial Parks MPA area. Scenic views include open water at Pacheco Pond and wetlands in the foreground, and forested hillsides and ridgelines in the background. Residential neighborhoods in unincorporated Bel Marin Keys, located as close as 0.5 mile from the Industrial Parks MPA area, have similar scenic views. Photograph 10 in Figure 4.1-6 is representative of existing residential views of waterways near the Hamilton Wetlands.

Under General Plan 2035, the Industrial Parks MPA would be modified to allow expanded “Life Science Campus” development for the biotechnology industry. The life sciences campuses are expected to consist of a mix of office space, lab space, and manufacturing space. The maximum building height would increase from 42 to 68 feet, plus an allowance for mechanical equipment screening extending eight feet higher over up to 10 percent of the roof area. An additional 500,000 square feet of life science/biotech development is anticipated in the Industrial Parks MPA area.

To demonstrate the effect of new life science/biotech development on scenic views, Rincon Consultants prepared photosimulations from four key viewpoints. Figure 4.1-7 shows the locations of the photosimulation viewpoints. These photosimulations show the anticipated location, height, and massing of new development in the Industrial Parks MPA area, assuming buildout up to the proposed maximum height of 68 feet and FAR of 1.2. Figure 4.1-8 through Figure 4.1-11 compare existing views at each key viewpoint to anticipated conditions upon buildout. The color and architectural features of new buildings are not rendered because these details would be determined when future projects are proposed during implementation of General Plan 2035.

## Figure 4.1-7 Photosimulation Viewpoints




*Imagery provided by Google and its licensors © 2018.*

**Figure 4.1-8 Photosimulations: Pacheco Pond Wildlife Protection Area**

Existing view of Industrial Parks MPA area from Pacheco Pond

Visual simulation of potential new development in Industrial Parks MPA area from Pacheco Pond

## Figure 4.1-9 Photosimulations: Cavalla Cay Cul-de-Sac

Existing view of Industrial Parks MPA area from the Cavalla Cay cul-de-sac

Visual simulation of potential new development in Industrial Parks MPA area from Cavalla Cay

### Figure 4.1-10 Photosimulations: Carib Isle Cul-de-Sac

Existing view toward Industrial Parks MPA area from the Carib Isle cul-de-sac

Visual simulation of potential new development in Industrial Parks MPA area from Carib Isle

## Figure 4.1-11 Photosimulations: Highway 101 near Hamilton Drive

Existing view of Hamilton Drive potential development site from northbound Highway 101

Visual simulation of potential new development on Hamilton Drive from northbound Highway 101

Source: Google Street View 2018

The photosimulations indicate that new development in the Industrial Parks MPA area would be most visible from the Pacheco Pond recreational area and Highway 101. As shown in Figure 4.1-8, new life science/biotech buildings would be prominent foreground features that partially obstruct approximately to 5 to 10 percent of foothill views from Pacheco Pond. However, new buildings would not substantially block scenic views of hillsides, and ridgelines would remain fully visible. New development also would not obstruct foreground views of wetlands at Pacheco Pond. As shown in Figure 4.1-11, motorists on Highway 101 currently have views of industrial development along Hamilton Drive to the east. Potential new development on a vacant site on Hamilton Drive would intensify the industrial character of eastward views from this segment of Highway 101. Nonetheless, new development would not affect scenic westward views of forested hillsides.

Life science/biotech development would have a minor effect on scenic views from residential neighborhoods in Bel Marin Keys. As shown in Figure 4.1-9, new buildings up to 68 feet tall would incrementally obstruct background views of lower foothills from the Cavalla Cay cul-de-sac but would not affect hillside or ridgeline views. New development would barely be visible from the perspective of the Carib Isle cul-de-sac, located approximately 0.6 mile east of the Industrial Parks MPA area. Therefore, based on photosimulations of maximum buildout of the Industrial Parks MPA area, General Plan 2035 would not facilitate growth that substantially obstructs scenic views from Bel Marin Keys and Pacheco Pond.

The proposed project also would facilitate redevelopment in Downtown Novato that could affect the setting of scenic architectural resources. Proposed policies in General Plan 2035 would encourage design features that maximize the compatibility of new buildings with existing architecture in the area. Policy LU 8 (Retail Environment) states that new building should be oriented toward the sidewalk with large display windows and highlighted pedestrian entries. In addition, Policy LU 16 (Scale of Development) states that buildings should be broken into modules that reinforce the traditional storefront character of Downtown Novato. Implementation of these policies during the design of new buildings would maintain the existing scenic character of the built environment of Downtown Novato as shown by Photographs 1 and 2 in Figure 4.1-2. Therefore, development would not adversely affect the setting of scenic historic architecture.

The proposed project includes a land use map and zoning map change involving 15 parcels distributed along both sides of Redwood Boulevard between Vallejo Avenue and Pinheiro Circle. The land use designations applicable to these parcels would be changed from General Commercial (CG) to Downtown Core (CD) with Downtown Core Business (CDB) assigned as the implementing zoning district. The CG and CDB zoning districts permit a base height limit of 35-feet, with additional height, 42-feet and 45-feet respectively, available with design review approval. Given this circumstance, the land use and zoning changes for these parcels result in a potential three foot height limit increase (42-feet to 45-feet).

Parcels that may result in the three foot height limit increase are located in an urbanized area of Novato that offers intermittent views of Mt. Burdell from Redwood Boulevard and connecting streets. The majority of these properties are developed with existing buildings.

Achieving a height of 45-feet is contingent upon obtaining design review approval and demonstrating consistency with the proposed policies and programs assigned to the Downtown focus area, which encourage a pedestrian friendly, traditional store front character. Policy LU 21 states the scale of development should be compatible with the small store front character of downtown Novato, particularly that found along Grant Avenue. Accordingly, Program LU 21a requires updating and formally adopting the Downtown Design Guidelines to articulate the desired design criteria for new construction and building renovations. The Design Guidelines currently include direction on assessing appropriate building height, including observing that the mass and form of new buildings should be proportional to street width.

It is speculative at this time to assume any particular impact associated with any possible future development or re-development of these affected parcels as building placement, actual height and the granting of additional height would all be fact specific to a future project. In addition, future development of these parcels, if any, would also be subject to project specific environmental review at which time analysis of the potential impacts to scenic resources would be evaluated pursuant to CEQA.

Based on the above, including implementation of the noted policy, program, design criteria, and review procedures, the proposed land use and zoning change affecting the noted parcels would have a less than significant impact with respect to obstructing scenic vistas or views of scenic natural or architectural resources. In the North, North Redwood Corridor, new office and research and development uses envisioned in General Plan 2035 would result in conversion of natural undeveloped land that has a scenic character. As shown by Photograph 5 in Figure 4.1-4, oak woodlands and wetlands are adjacent to Redwood Boulevard to the north of Wood Hollow Drive. Under Policy LU 27 in General Plan 2035, the preferred land use concept in this area is office buildings and research and development uses. Despite the anticipated urban development in the North, North Redwood Corridor, Policy LU 27 also requires the protection of existing wetlands and oak trees in the design of individual projects. Implementation of this policy would minimize the adverse effect of new development on scenic resources visible from Redwood Boulevard. Similarly, Policy CC 3 (Hillsides) in General Plan 2035 would protect Novato's scenic hillsides and ridgelines from visual impacts by limiting the extent and location of new development, and ensuring that new development complies with the requirements of the Hillside and Ridgeline Protection ordinance in the Zoning Code.

The proposed project would alter the City's existing Hillside and Ridgeline Protection ordinance, which sets standards for development on parcels with an average slope of at least 10 percent. This implementing ordinance sets siting and height restrictions for structures that are placed adjacent to ridgelines or knolls. Structures shall not be placed so they are silhouetted against the sky when viewed from a public street, and shall be placed at least 25 feet below the top five feet of ridgelines. The maximum allowable building height also shall be 25 feet for residential buildings and 35 feet for non-residential buildings. Under the proposed project, this ordinance would be modified to allow adjustments to the above siting and height restrictions for residential structures built before 2004. However, these adjustments would be limited to sites outside of Scenic Conservation Areas or Scenic Hills and Ridges identified in General Plan 2035; to areas where the location, height and size of the proposed addition is appropriate for the site and existing configuration of the structure; and where the addition is substantially similar in size and height of structures in the immediate vicinity. These proposed constraints on new development subject to the Hillside and Ridgeline Protection ordinance would substantially protect Novato's scenic hillsides and ridgelines from visual impacts.

New development associated with the proposed project would not substantially alter scenic vistas, as shown in Figure 4.1-8 through Figure 4.1-11. In addition, the proposed project would implement Policies LU 8 and LU 16 to appropriately scale development. In addition, the proposed project would not substantially damage any scenic resources, in accordance with the City's Hillside and Ridgeline Protection ordinance and Policy CC 3. Impacts would be less than significant.

The proposed project would not have a substantially adverse effect on scenic views of waterways, wetlands, hillsides, ridgelines, or historic architecture, the impact on scenic vistas and resources would be less than significant.

## Mitigation Measures

No mitigation measures are required.

| | |
|---|---|
| **Threshold 3:** | Would the project substantially degrade the existing visual character or quality of the site and its surroundings? |

### Impact AES-2 THE PROPOSED PROJECT WOULD MAINTAIN NOVATO'S EXISTING VISUAL CHARACTER BY PRIORITIZING DEVELOPMENT IN FOCUS AREAS AND PRESERVING SINGLE-FAMILY RESIDENTIAL NEIGHBORHOODS. PROPOSED POLICIES ALSO WOULD IMPROVE THE VISUAL QUALITY OF AUTOMOBILE-ORIENTED AREAS. THE IMPACT ON VISUAL CHARACTER AND QUALITY WOULD BE LESS THAN SIGNIFICANT.

The existing visual character of Novato is suburban with prominent hillsides and ridgelines that provide a natural ambience. The overall vision of General Plan 2035 would largely preserve this visual character by prioritizing new development in focus areas and Industrial Parks MPA, with the balance of other developable areas in Novato being carried forward from the 1996 General Plan with no changes in permitted land uses or development intensity. As discussed in Impact AES-1, proposed policies and adjustments to implementing ordinances would protect the scenic natural resources that contribute to the City's visual character. Policy CC 3 (Hillsides) would protect Novato's hillsides and ridgelines from visual impacts by limiting the extent and location of new development and ensuring that new development complies with the requirements of the Hillside and Ridgeline Protection ordinance in the Zoning Code. In addition, Policy ES 15 (Scenic Resources) states that development should be located and designed to protect visual values on hillsides, ridgelines, and other scenic resources.

As noted in the analysis for Impact AES-1, the proposed project includes modifications to Novato's existing Hillside and Ridgeline Ordinance. These modifications include adjusting siting and height restrictions for additions to residential structures built before enactment of the Hillside Ordinance in 2001 and its substantive revision in 2004. The changes affect hillside settings already modified by development

The adjusted standards would apply to sites outside of Scenic Conservation Areas or Scenic Hills and Ridges identified in General Plan 2035, to areas where the location, height and size of the proposed addition is appropriate for the site and existing configuration of the structure, and where the addition is substantially similar in size and height of structures in the immediate vicinity. These changes would be consistent with and implement General Plan Policies CC 3 and ES 15 and ensure the protection of visual values on hillsides, ridgelines, and other scenic resources.

Based on the above, including implementation of the noted policies and development standards, the proposed changes to the Hillside Ordinance would have a less than significant impact with respect to diminishing the visual character or quality of a given site or its surroundings.

General Plan 2035 also would maintain and improve the small-town atmosphere of Downtown Novato. Consistent with existing conditions in Downtown Novato, Policy LU 8 (Retail Environment) would encourage retail uses to create a continuous and lively streetscape for pedestrians, particularly along Grant Avenue and Redwood Boulevard, with large display windows and highlighted pedestrian entries. Implementation of Policy LU 13 (Pedestrian Amenities) would improve visual conditions by installing pedestrian-oriented features like benches, planters, street furniture, and large canopy street trees.

In Novato's residential neighborhoods, General Plan 2035 would primarily maintain existing zoning for single-family residential uses. Twelve parcels on Clayton Court would be rezoned from multi-family to single-family residential uses. One exception is approximately 200 parcels in the Northwest Quadrant Neighborhood, where General Plan 2035 would create a neighborhood specific zoning district that removes a requirement to retain single-family residential development. It is anticipated that this rezone would facilitate the addition of 10 multi-family residences in the focus area. However, proposed Policy CC 12 (Compatibility of Development with Surroundings) would ensure that new development is sensitive to the surrounding architecture, topography, landscaping, character, scale, and ambiance of the surrounding neighborhood. In addition, Policy CC 15 (Gates on Private Streets and Gated Communities) would protect the City's sense of community by prohibiting the creation of gated communities.

In existing automobile-oriented areas of Novato, General Plan 2035 would improve visual quality. Redwood Boulevard, in particular, is currently characterized by generic commercial development with surface parking lots fronting on the arterial roadway and automobile-serving uses in Downtown Novato and the North Redwood Boulevard Corridor. Policy CC 8 (Pedestrian-Oriented Land Uses) would encourage pedestrian-oriented, rather than auto-dependent, uses in Downtown Novato and other activity centers. Policy CC 18 (Parking Standards) also would reduce the visibility of parking facilities and the amount of land necessary for them, to the extent feasible. New gateway design elements at several intersections, pursuant to Policy LU 15 (Gateway Treatment), also would introduce a greater sense of place at entry points to Downtown Novato.

New life science/biotech campuses would intensify the scale and massing of urban development in the Industrial Parks MPA area. Photo simulations were prepared for the Industrial Parks MPA and are described in detail under Impact AES-1. As shown by the photosimulations in Impact AES-1, this development would be visible from recreational and residential areas along Bel Marin Keys Boulevard. However, it would be consistent in character with existing industrial and biotech development in the Industrial Parks MPA area, and would not substantially obstruct views of scenic hillsides, ridgelines, and wetlands. Most existing buildings have a relatively plain, utilitarian design, as acknowledged in the General Plan 2035. Therefore, while the scale of development would intensify, it would not degrade visual quality in the Industrial Parks MPA area.

As discussed above, the proposed project would protect Novato's visual character by guiding new development to focus areas and Industrial Parks MPA while maintaining development intensities in most single-family residential neighborhoods. All new development and modification to existing structures would also be subject to design, density, and height standards applicable to particular land use and zoning designations. Compliance with established standards and the above policies proposed in General Plan 2035 would ensure that new development complements and enhances the City's existing visual character and quality. Therefore, new development associated with General Plan 2035, the focus areas, the Industrial Parks MPA, and implementing ordinances would have a less than significant impact on visual character and quality.

## Mitigation Measures

No mitigation measures are required.

| | |
|---|---|
| **Threshold 4:** | Would the project create a new source of substantial light or glare than would adversely affect day or nighttime views in the area? |

**Impact AES-3** NEW DEVELOPMENT ASSOCIATED WITH THE PROPOSED PROJECT COULD INCREASE LIGHT AND GLARE EFFECTS ON SENSITIVE RECEPTORS, SUCH AS RESIDENTIAL USES. HOWEVER, NEW DEVELOPMENT WOULD BE SUBJECT TO EXISTING REGULATIONS IN THE CITY'S MUNICIPAL CODE AND PROPOSED GENERAL PLAN POLICY TO PROTECT DARK SKIES AT NIGHTTIME. THEREFORE, THE PROJECT WOULD HAVE A LESS THAN SIGNIFICANT IMPACT ASSOCIATED WITH LIGHT AND GLARE.

The proposed project would facilitate new development that could introduce new sources of light and glare in Novato, resulting in increased ambient nighttime lighting. New sources of light and glare could be installed for infill development, new development in currently vacant or undeveloped lots, or modification of existing buildings. Specific sources would include streetlights, light fixtures in parking lots, signage on businesses, exterior building illumination, interior lighting passing through building fenestration, and outdoor lighting at recreational facilities. Reflective building and vehicles surfaces, and the headlights of motor vehicles, could generate additional glare.

Compliance with proposed General Plan policies and existing Zoning Ordinance requirements would minimize adverse effects from light spillover to nearby properties and glare. Policy CC 12b (Lighting Design Guidelines) in General Plan 2035 would include standards for exterior lighting in design guidelines that support Dark Sky principles for appearance, intensity, and light spillage. In addition, existing general development standards in Section 19.22.060 of the Novato Municipal Code requires shielding or modification of exterior lighting to prevent the emission of light or glare beyond the property line. The placement of exterior lights is required to eliminate spillover illumination or glare onto adjoining properties to the maximum extent feasible, and not interfere with the normal operation or enjoyment of adjoining properties.

New exterior lighting associated with future projects would be regulated by the City's Municipal Code. Adherence to existing City lighting requirements and proposed General Plan policy would reduce impacts from new development associated with the proposed project, including General Plan 2035, the focus areas, and the Industrial Parks MPA to a less than significant level.

## Mitigation Measures

No mitigation measures are required.

### *Cumulative Impacts*

Cumulative development in the Plan Area would intensify urban development in several focus areas. This new development would incrementally contribute to regional urbanization in Marin County and the North Bay. However, the overall land use vision and policies in General Plan 2035 would ensure the visual compatibility of new development with the existing community and would minimize degradation of scenic resources. For example, Policies LU 8 and LU 16 to appropriately scale development to ensure that development is consistent with the surrounding area and would not block any scenic views. Novato's Hillside and Ridgeline Protection ordinance, which sets standards for development on parcels, would ensure that there would be no cumulative aesthetic impacts for hillside development and Section 19.22.060 of the Novato Municipal Code would ensure that there would not be cumulative impacts from lighting by requiring shielding or modification of exterior lighting. Therefore, General Plan 2035 would not have a considerable contribution to a significant cumulative impact on aesthetics.

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# 4.2 Air Quality

This section analyzes the effects of the proposed project on air quality emissions and the associated impacts. This section analyzes both temporary air quality impacts relating to construction activity and possible long-term air quality impacts associated with implementation of the proposed project. The analysis herein is based partially on the traffic modeling and analysis prepared by W-Trans (June 2018) and vehicle miles traveled (VMT) data provided by Fehr & Peers (April 2018). Greenhouse gas emissions and global climate change impacts are discussed in Section 4.6, *Greenhouse Gas Emissions*.

## 4.2.1 Setting

### a. Regional Climate and Meteorology

Novato is located in Marin County, which is a subregion of the San Francisco Bay Area Air Basin (SFBAAB). The SFBAAB includes the counties of San Francisco, Santa Clara, San Mateo, Marin, Napa, Contra Costa, and Alameda, along with the southeast portion of Sonoma County and the southwest portion of Solano County. Marin County is bounded on the west by the Pacific Ocean, on the east by the San Pablo Bay, on the south by the Golden Gate Bridge, and on the north by the Petaluma Gap.

Due to the proximity of the San Francisco Bay and Pacific Ocean, the climate in the SFBAAB is characterized by warm dry summers and cool moist winters. In summers, temperatures in Novato generally range from the 50s to high 70s and low 80s (Fahrenheit). In winter, temperatures range from the 30s to the 50s.

The major large-scale weather feature controlling climate in the Novato area is a large high pressure system located in the eastern Pacific Ocean, known as the Pacific High. During winter months, marine air trapped in the lower atmosphere is often condensed into fog by the cool Pacific Ocean. Stratus-type clouds usually form offshore and move into the area during the evening hours. During winter months, the Pacific High becomes weaker and shifts south, allowing weather systems associated with the polar jet stream to affect the region. Low pressure systems produce periods of cloudiness, strong shifting winds and precipitation. Novato, which lies mostly on the lee side of the coastal mountains in Marin County, receives about 30 inches of precipitation per year. Mountains to the west receive 40 to 50 inches. Most rainfall occurs from November through April. High-pressure systems are also common in winter, with low-level inversions that produce cool stagnant conditions. Radiation fog and haze trapped near the surface are common during extended winter periods where high pressure systems influence the weather.

The prevailing wind in most of Novato is primarily from a westerly direction, especially during spring and summer. In winter, winds become variable with more of a southeasterly orientation. Nocturnal winds and land breezes during the colder months of the year prevail with variable drainage out of the mountainous areas. Wind speeds are highest during the spring and early summer and lightest in the fall. Winter storms bring relatively short episodes of strong southerly winds (City of Novato 2017a).

### b. Air Pollutants of Primary Concern

Primary criteria pollutants are emitted directly from a source (e.g., vehicle tailpipe, an exhaust stack of a factory, etc.) into the atmosphere. Primary criteria pollutants include carbon monoxide (CO), reactive organic gases (ROG), nitrogen oxides ($NO_X$), fine particulate matter ($PM_{10}$ and $PM_{2.5}$), sulfur dioxide ($SO_2$), and lead (Pb). Secondary criteria pollutants are created by atmospheric chemical and photochemical reactions; ROGs together with $NO_X$ form the building blocks for the creation of photochemical (secondary) pollutants. Secondary pollutants include oxidants, ozone ($O_3$) and sulfate and nitrate particulates (smog). The characteristics, sources and effects of critical air contaminants are described below.

## Ozone

$O_3$ is produced by a photochemical reaction (triggered by sunlight) between $NO_X$ and ROG. Nitrogen oxides are formed during the combustion of fuels, while reactive organic compounds are formed during combustion and evaporation of organic solvents. Because $O_3$ requires sunlight to form, it mostly occurs in concentrations considered serious between the months of April and October. $O_3$ is a pungent, colorless, toxic gas with direct health effects on humans including respiratory and eye irritation and possible changes in lung functions. Groups most sensitive to $O_3$ include children, the elderly, people with respiratory disorders, and people who exercise strenuously outdoors.

## Carbon Monoxide

CO is a local pollutant that is found in high concentrations only near the source. The major source of CO, a colorless, odorless, poisonous gas, is automobile traffic. Elevated concentrations, therefore, are usually only found near areas of high traffic volumes. CO's health effects are related to its affinity for hemoglobin in the blood. At high concentrations, CO reduces the amount of oxygen in the blood, causing heart difficulties in people with chronic diseases, reduced lung capacity and impaired mental abilities.

## Nitrogen Dioxide

Nitrogen dioxide ($NO_2$) is a by-product of fuel combustion, with the primary source being motor vehicles and industrial boilers and furnaces. The principal form of nitrogen oxide produced by combustion is nitric oxide (NO), but NO reacts rapidly to form $NO_2$, creating the mixture of NO and $NO_2$ commonly called $NO_X$. Nitrogen dioxide is an acute irritant. A relationship between $NO_2$ and chronic pulmonary fibrosis may exist, and an increase in bronchitis in young children at concentrations below 0.3 ppm may occur. Nitrogen dioxide absorbs blue light and causes a reddish brown cast to the atmosphere and reduced visibility. It can also contribute to the formation of $PM_{10}$ and acid rain.

## Suspended Particulates

$PM_{10}$ is particulate matter measuring no more than 10 microns in diameter, while $PM_{2.5}$ is fine particulate matter measuring no more than 2.5 microns in diameter. Suspended particulates are mostly dust particles, nitrates and sulfates. Both $PM_{10}$ and $PM_{2.5}$ are by-products of fuel combustion and wind erosion of soil and unpaved roads, and are directly emitted into the atmosphere through these processes. Suspended particulates are also created in the atmosphere through chemical reactions. The characteristics, sources, and potential health effects associated with the small particulates (those between 2.5 and 10 microns in diameter) and fine particulates ($PM_{2.5}$) can be very different. The small particulates generally come from windblown dust and dust kicked up from mobile sources. The fine particulates are generally associated with combustion processes, as well as being formed in the atmosphere as a secondary pollutant through chemical reactions. Fine particulate matter is more likely to penetrate deeply into the lungs and poses a health threat to all groups, but particularly to the elderly, children, and those with respiratory problems. More than half of the small and fine particulate matter that is inhaled into the lungs remains there. These materials can damage health by interfering with the body's mechanisms for clearing the respiratory tract or by acting as carriers of an absorbed toxic substance.

## c. Air Pollution Regulation

The federal and state governments have authority under the federal and state Clean Air Acts to regulate emissions of airborne pollutants and have established ambient air quality standards (AAQS) for the protection of public health. The U.S. Environmental Protection Agency (US EPA) is the federal agency designated to administer air quality regulation, while the California Air Resources Board (CARB) is the state equivalent in California. Federal and state standards have been established for six criteria pollutants, including $O_3$, CO, $NO_2$, $SO_2$, $PM_{10}$ and $PM_{2.5}$, and Pb.

Air quality monitoring stations measure pollutant ground-level concentrations (typically, ten feet above ground level). Depending on whether the standards are met or exceeded, the local air basin is classified as in "attainment" or "non-attainment." Some areas are unclassified, which means no monitoring data are available. Unclassified areas are considered to be in attainment. Table 4.2-1 lists the current federal and state standards for each of these pollutants as well as the attainment status of the SFBAAB. California air quality standards are identical to or stricter than federal standards for all criteria pollutants.

**Table 4.2-1 Federal and State Ambient Air Quality Standards**

| | | California Standards | | National Standards | |
|---|---|---|---|---|---|
| Pollutant | Averaging Time | Concentration | Attainment Status | Concentration | Attainment Status |
| Ozone | 8 Hour | 0.070 ppm | N | 0.070 ppm | N |
| | 1 Hour | 0.09 ppm | N | | |
| Carbon Monoxide | 8 Hour | 9.0 ppm | A | 9 ppm | A |
| | 1 Hour | 20 ppm | A | 35 ppm | A |
| Nitrogen Dioxide | 1 Hour | 0.18 ppm | A | 0.100 ppm | U |
| | Annual Arithmetic Mean | 0.030 ppm | | 0.053 ppm | A |
| Sulfur Dioxide | 24 Hour | 0.04 ppm | A | 0.14 ppm | A |
| | 1 Hour | 0.25 ppm | A | 0.075 ppm | A |
| | Annual Arithmetic Mean | | | 0.030 ppm | A |
| Particulate Matter ($PM_{10}$) | Annual Arithmetic Mean | 20 µg/$m^3$ | N | | |
| | 24 Hour | 50 µg/$m^3$ | N | 150 µg/$m^3$ | U |
| Particulate Matter - Fine ($PM_{2.5}$) | Annual Arithmetic Mean | 12 µg/$m^3$ | N | 12 µg/$m^3$ | U/A |
| | 24 Hour | | | 35 µg/$m^3$ | N |
| Sulfates | 24 Hour | 25 µg/$m^3$ | A | | |
| Lead | Calendar Quarter | | | 1.5 µg/$m^3$ | A |
| | Rolling 3 Month Average | | | 0.15 µg/$m^3$ | |
| | 30 Day Average | 1.5 µg/$m^3$) | | | A |
| Hydrogen Sulfide | 1 Hour | 0.03 ppm | U | | |
| Vinyl Chloride (chloroethene) | 24 Hour | 0.010 ppm | No information available | | |
| Visibility Reducing particles | 8 Hour(10:00 to 18:00 PST) | | U | | |

A=Attainment N=Nonattainment U=Unclassified; mg/$m^3$=milligrams per cubic meter ppm=parts per million µg/$m^3$=micrograms per cubic meter
Source: BAAQMD 2017a, http://www.baaqmd.gov/research-and-data/air-quality-standards-and-attainment-status

Local control in air quality management is provided by CARB through county-level or regional (multi-county) Air Pollution Control Districts (APCDs). CARB establishes statewide air quality standards and is responsible for control of mobile emission sources, while the local APCDs are responsible for enforcing standards and regulating stationary sources. CARB has established 15 air basins statewide. The City of Novato is located in the SFBAAB, which is under the jurisdiction of the Bay Area Air Quality Management District (BAAQMD).

## d. Current Air Quality

CARB and the U.S. EPA established ambient air quality standards for major pollutants, including $O_3$, CO, $NO_2$, $SO_2$, Pb, and $PM_{10}$ and $PM_{2.5}$. Standards have been set at levels intended to be protective of public health. California standards are more restrictive than federal standards for each of these pollutants except for lead and the eight-hour average for CO. The local APCDs are required to monitor air pollutant levels to ensure that air quality standards are met and, if they are not met, to develop strategies to meet the standards.

The City of Novato is located within the SFBAAB under the jurisdiction of BAAQMD. As the local air quality management agency, the BAAQMD is required to monitor air pollutant levels to ensure that state and federal air quality standards are met and, if they are not met, to develop strategies to meet the standards.

The San Rafael Monitoring Station is the only BAAQMD-operated monitoring station located in Marin County and is approximately five miles south of the City of Novato. Table 4.2-2 summarizes the representative annual air quality data for the project site over the years 2014 through 2016 at the San Rafael Monitoring Station for all criteria pollutants. As shown in Table 4.2-2, $PM_{2.5}$ exceeded the federal threshold once in 2014 and twice in 2015. No other thresholds were exceeded in the years 2014 through 2016.

### Table 4.2-2 Ambient Air Quality Data

| Pollutant | 2014 | 2015 | 2016 |
|---|---|---|---|
| Ozone (ppm), Worst 1-Hour | 0.088 | 0.081 | 0.088 |
| Number of days of State exceedances (>0.09 ppm) | 0 | 0 | 0 |
| Ozone (ppm), 8-Hour Average | 0.068 | 0.070 | 0.067 |
| Number of days of State exceedances (>0.07 ppm) | 0 | 0 | 0 |
| Number of days of Federal exceedances (>0.07 ppm) | 0 | 0 | 0 |
| Carbon Monoxide (ppm), Highest 8-Hour Average | * | * | * |
| Number of days of above State or Federal standard (>9.0 ppm) | * | * | * |
| Particulate Matter <10 microns, $\mu g/m^3$, Worst 24 Hours | 39.0 | 42.2 | 26.6 |
| Number of days above State standard (>50 $\mu g/m^3$) | 0 | 0 | 0 |
| Number of days above Federal standard (>150 $\mu g/m^3$) | 0 | 0 | 0 |
| Particulate Matter <2.5 microns, $\mu g/m^3$, Worst 24 Hours | 38.1 | 36.3 | 15.6 |
| Number of days above Federal standard (>35 $\mu g/m^3$) | 1 | 2 | 0 |

ppm = parts per million; $\mu g/m^3$ = micrograms per cubic meter

* There was insufficient (or no) data available to determine the value.

San Rafael Monitoring Station was used for all pollutants.

Source: CARB 2018a https://www.arb.ca.gov/adam/topfour/topfour1.php

## e. Regulatory Setting

The Federal Clean Air Act governs air quality in the United States. In addition to being subject to federal requirements, air quality in California is also governed by more stringent regulations under the California Clean Air Act. At the federal level, the U.S. EPA administers the Clean Air Act (CAA). The CAA is administered by the CARB at the state level and by the AQMDs at the regional and local levels. The BAAQMD regulates air quality at the regional level, which includes the nine-county Bay Area.

### Federal

The U.S. EPA is responsible for enforcing the federal CAA. The U.S. EPA is also responsible for establishing the National Ambient Air Quality Standards (NAAQS). The NAAQS are required under the 1977 CAA and subsequent amendments. The EPA regulates emission sources that are under the exclusive authority of the federal government, such as aircraft, ships, and certain types of locomotives. The agency has jurisdiction over emission sources outside state waters (e.g. beyond the outer continental shelf) and establishes various emission standards, including those for vehicles sold in states other than California. Automobiles sold in California must meet the stricter emission standards established by the CARB.

### State

In California, the CARB, which became part of the California Environmental Protection Agency in 1991, is responsible for meeting the State requirements of the federal CAA, administering the California CAA, and establishing the California Ambient Air Quality Standards (CAAQS). The California CAA, as amended in 1992, requires all air districts in the state to endeavor to achieve and maintain the CAAQS. The CAAQS are generally more stringent than the corresponding federal standards and incorporate additional standards for sulfates, hydrogen sulfide, vinyl chloride and visibility reducing particles. The CARB regulates mobile air pollution sources, such as motor vehicles. The agency is responsible for setting emission standards for vehicles sold in California and for other emission sources, such as consumer products and certain off-road equipment. CARB established passenger vehicle fuel specifications, which became effective on March 1996. CARB oversees the functions of local APCDs, which in turn administer air quality activities at the regional and county level.

### Regional

The BAAQMD is responsible for assuring that the federal and state ambient air quality standards are attained and maintained in the Bay Area. The BAAQMD is also responsible for adopting and enforcing rules and regulations concerning air pollutant sources, issuing permits for stationary sources of air pollutants, inspecting stationary sources of air pollutants, responding to citizen complaints, monitoring ambient air quality and meteorological conditions, awarding grants to reduce motor vehicle emissions, conducting public education campaigns, as well as many other activities.

The BAAQMD adopted the 2017 Clean Air Plan (2017 Plan) on April 19, 2017 as an update to the 2010 Clean Air Plan. The 2017 Plan, which focuses on protecting public health and the climate, defines an integrated, multi-pollutant control strategy that includes all feasible measures to reduce emissions of ozone precursors (including transport of ozone and its precursors to neighboring air basins), PM, and toxic air contaminants (TACs). To protect public health, the control strategy will decrease population exposure to PM and TACs in communities that are most impacted by air pollution with the goal of eliminating disparities in exposure to air pollution between communities. The control strategy will protect the climate by reducing GHG emissions and developing a long-range vision of how the Bay Area could look and function in a year 2050 post-carbon economy (BAAQMD 2017b).

### f. Sensitive Receptors in the Plan Area

Ambient air quality standards have been established to represent the levels of air quality considered sufficient, with an adequate margin of safety, to protect public health and welfare. They are designed to protect that segment of the public most susceptible to respiratory distress, such as children under 14, the elderly over 65, persons engaged in strenuous work or exercise, and people with cardiovascular and chronic respiratory diseases. Most sensitive receptor locations are therefore residences, schools, and hospitals and are located throughout the City.

The BAAQMD recommends that general plans include buffer zones to separate sensitive receptors from sources of air toxic contaminants and odors. In April 2005, CARB released the final version of the *Air Quality and Land Use Handbook*, which is intended to encourage local land use agencies to consider the risks from air pollution prior to making decisions that approve the siting of new sensitive receptors (e.g., homes or daycare centers) near sources of air pollution. Unlike industrial or stationary sources of air pollution, siting of new sensitive receptors does not require air quality permits, but could create air quality problems. The primary purpose of the handbook is to highlight the potential health impacts associated with proximity to common air pollution sources, so that those issues are considered in the planning process. CARB makes recommendations regarding the siting of new sensitive land uses near freeways, truck distribution centers, dry cleaners, gasoline dispensing stations, and other air pollution sources. These recommendations are based primarily on modeling information and may not be entirely reflective of conditions in the Plan Area. The *Air Quality and Land Use Handbook* notes that siting of new sensitive land uses within these distances may be possible, but recommends that site-specific studies be conducted to identify actual health risks. CARB acknowledges that land use agencies have to balance other siting considerations such as housing and transportation needs, economic development priorities and other quality of life issues.

## 4.2.2 Impact Analysis

### a. Methodology and Significance Thresholds

This analysis uses the BAAQMD's May 2017 *CEQA Air Quality Guidelines* to evaluate air quality. The plan-level thresholds specified in the May 2017 BAAQMD *CEQA Air Quality Guidelines* were used to determine whether General Plan 2035 impacts exceed the thresholds identified in *CEQA Guidelines* Appendix G.

### Significance Thresholds

Based on Appendix G of the *CEQA Guidelines* a project may be deemed to have a significant impact on air quality if it would:

1. Conflict with or obstruct implementation of the applicable air quality plan
2. Violate any air quality standard or contribute substantially to an existing or projected air quality violation

3. Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is nonattainment under an applicable federal or state ambient air quality standard (including releasing emissions, which exceed quantitative thresholds for ozone precursors)
4. Expose sensitive receptors to substantial pollutant concentrations
5. Create objectionable odors affecting a substantial number of people

## Short-Term Emissions Thresholds

The BAAQMD's May 2017 *CEQA Air Quality Guidelines* have no plan-level significance thresholds for construction air pollutants emissions. However, they do include the individual project-level thresholds for temporary construction-related and long-term operational emissions of air pollutants. These thresholds represent the levels at which a project's individual emissions of criteria air pollutants or precursors would result in a cumulatively considerable contribution to the SFBAAB's existing air quality conditions (BAAQMD 2017c). However, short-term emissions associated with General Plan 2035 are discussed qualitatively to evaluate potential air quality impacts.

## Long-Term Emissions Thresholds

The BAAQMD's 2017 *CEQA Air Quality Guidelines* contain specific operational plan-level significance thresholds for criteria air pollutants. Plans must show the following over the planning period:

- Consistency with current air quality plan control measures
- Vehicle miles traveled (VMT) or vehicle trips (VT) increase is less than or equal to the plan's projected population increase

If a plan can demonstrate consistency with both of these criteria then impacts are considered less than significant.

## Methodology for Estimating Emissions

### *Short-Term Emissions*

Construction-related emissions are generally short-term in duration, but may still cause adverse air quality impacts. Construction of development associated with the proposed project would generate temporary emissions from three primary sources: the operation of construction vehicles (e.g., scrapers, loaders, dump trucks, etc.); ground disturbance during site preparation and grading, which creates fugitive dust; and the application of asphalt, paint, or other oil-based substances.

At this time, most General Plan 2035 projects, including projects in the four focus areas and the Industrial Parks MPA, do not have sufficient detail to allow project-level analysis and thus it would be speculative to analyze project-level impacts. Rather, construction impacts for the proposed project are discussed qualitatively and emissions are not compared to the project-level thresholds.

### *Long-Term Emissions*

Per plan-level guidance from the BAAQMD 2017 *CEQA Air Quality Guidelines,* long-term operational emissions associated with implementation of the proposed project are discussed qualitatively by comparing the proposed project to the 2017 Plan goals, policies, and control measures. In addition, comparing the rate of increase of plan VMT and population is recommended by BAAQMD for determining significance of criteria pollutants. If the proposed project does not meet either criterion then impacts would be potentially significant.

### *4.2.1.2 Project Impacts*

| | |
|---|---|
| **Threshold 1:** | Would the project conflict with or obstruct implementation of the applicable air quality plan? |

**Impact AQ-1 THE PROPOSED PROJECT WOULD NOT CONFLICT WITH BAAQMD'S 2017 CLEAN AIR PLAN IMPACTS WOULD BE LESS THAN SIGNIFICANT.**

## General Plan 2035 Consistency with Current Air Quality Plan

The most recently adopted air quality plan in the SFBAAB is the 2017 Clean Air Plan (2017 Plan). The 2017 Plan is a roadmap showing how the San Francisco Bay Area will achieve compliance with the State one-hour ozone standard as expeditiously as practicable, and how the region will reduce transport of $O_3$ and $O_3$ precursors to neighboring air basins. The 2017 Plan does not include control measures that apply directly to individual development projects; instead, the control strategy includes stationary-source control measures to be implemented through the BAAQMD regulations; mobile-source control measures to be implemented through incentive programs and other activities; and transportation control measures to be implemented through transportation programs in cooperation with the Metropolitan Transportation Commission (MTC), local governments, transit agencies, and others. The 2017 Plan also represents the Bay Area's most recent triennial assessment of the region's strategy to attain the state one-hour ozone standard. In this, the 2017 Plan replaces the 2010 Plan. Under BAAQMD's methodology, a determination of consistency with CEQA Guidelines thresholds should demonstrate that a project:

- Supports the primary goals of the 2017 Plan
- Includes applicable control measures from the 2017 Plan
- Does not disrupt or hinder implementation of any 2017 Plan control measures

The following includes a discussion of consistency with these criteria.

### *Support the Primary Goals of the 2017 Clean Air Plan*

The primary goals of the 2017 Plan are to:

- Protect air quality and health at the regional and local scale; and
- Protect the climate

Any project that would not support these goals would not be considered consistent with the 2017 Plan. On an individual project basis, consistency with BAAQMD quantitative thresholds is interpreted as demonstrating support for the 2017 Plan goals. Policies contained in the General Plan 2035 Environmental Stewardship and A City that Works Chapters are aimed at reducing vehicle emissions and energy use, which are the two major drivers of criteria air pollutant emissions. Specifically, Policy ES 25 would increase energy efficiency and conservation in City buildings, equipment and operations and Policy ES 26 would support on-site renewable energy facilities in the City to reduce community energy demand.

General Plan 2035 goals, policies, and programs in the A City that Works Chapter would limit air quality impacts through reduction in vehicle trips and emissions by providing alternate modes of transportation. Development associated with the proposed project would be designed to promote active transportation in the community, further reducing vehicle emissions through Policies MO 8, MO 18, and MO 19. Approval of the proposed project would not result in significant criteria pollutant emissions or other significant air quality impacts because it would be consistent with the goals of the 2017 Plan.

### *Include Applicable 2017 Clean Air Plan Control Measures*

The 2017 Plan contains 85 control strategies aimed at reducing air pollution and protecting the climate in the Bay Area. For consistency with climate planning efforts at the State level, the control strategies in the 2017 Plan are based on the same economic sector framework used by CARB, which encompass stationary sources, transportation, energy, buildings, agriculture, natural and working lands, waste management, water, and super-GHG pollutants. Table 4.2-3 identifies applicable control measures and correlates the measures to specific elements and policies of General Plan 2035.

**Table 4.2-3 2017 Clean Air Plan Control Measures**

| Control Measures | Consistency |
|---|---|
| **Transportation** | |
| **TR2: Trip Reduction Programs**. Implement the regional Commuter Benefits Program (Rule 14-1) that requires employers with 50 or more Bay Area employees to provide commuter benefits. Encourage trip reduction policies and programs in local plans, e.g., general and specific plans while providing grants to support trip reduction efforts. Encourage local governments to require mitigation of vehicle travel as part of new development approval, to adopt transit benefits ordinances in order to reduce transit costs to employees, and to develop innovative ways to encourage rideshare, transit, cycling, and walking for work trips. Fund various employer-based trip reduction programs. | **Consistent**: The proposed project would promote compatible land uses which would reduce vehicle trips and emissions associated with those trips. One of the guiding principles of General Plan 2035 is to establish diverse interconnected modes of transportation including bicycle and pedestrian paths and trails, shuttles, and buses.<br>General Plan 2035 goals and policies would reduce vehicle trips in the City. Specifically, Goals MO 2 and MO 4 of the A City that Works Chapter and related policies, listed above, would promote alternative modes of transportation. Additionally, Policy MO 12 would promote transportation demand management through the programs listed below.<br>▪ **MO 12a**: *Trip Reduction Program*. Review and amend as necessary the existing Travel Demand Reduction Ordinance applicable to businesses in new or remodeled commercial development.<br>▪ **MO 12b**: *City Employees*. Create and implement a Trip Reduction Incentive Program for City staff to increase participation in alternative modes of transportation to and from work.<br>▪ **MO 12c**: *Ride Sharing and Car Sharing Programs*. Facilitate ride sharing programs for employment centers, including City staff, and citywide car-sharing programs. |
| **TR9: Bicycle and Pedestrian Access and Facilities**. Encourage planning for bicycle and pedestrian facilities in local plans, e.g., general and specific plans, fund bike lanes, routes, paths and bicycle parking facilities. | **Consistent**: Policies in General Plan 2035 support an efficient and safe bicycle and pedestrian system that would improve the connectivity and accessibility throughout the City and thus reduce vehicle trips and emissions associated with those trips. A City that Works Chapter Goal MO 5 would provide a safe and convenient bicycle and pedestrian network that accommodates all ages and abilities. Policies listed below would encourage bicycle and pedestrian facilities.<br>▪ **MO 18 Comprehensive Bicycle Network**. Establish and maintain a bicycle network that is consistent with the adopted Bicycle/Pedestrian Plan.<br>▪ **MO 19 Bicycle Parking**. Assure the provision of adequate bicycle parking to encourage bicycle use.<br>▪ **MO 20 Safe and Convenient Pedestrian Facilities**. Promote, provide and maintain a safe and convenient pedestrian system, including consideration of lighting, sidewalk condition, road surface |

| Control Measures | Consistency |
|---|---|
| | conditions, roadway crossings, access points, signage, shade landscaping, and street furniture. |
| **TR13: Parking Policies**. Encourage parking policies and programs in local plans, e.g., reduce minimum parking requirements; limit the supply of off-street parking in transit-oriented areas; unbundle the price of parking spaces; support implementation of demand-based pricing (such as "SF Park") in high-traffic areas. | **Consistent**: Policy MO 10 discourages installation of excess parking by considering revisions to parking standards to promote parking for carpools and non-vehicular traffic. Additionally, General Plan 2035 A City That Works Policy MO 19 listed above would provide additional bicycle parking to reduce the need for vehicle use. |
| **Energy** | |
| **EN2: Decrease Electricity Demand**. Work with local governments to adopt additional energy-efficiency policies and programs. Support local government energy efficiency program via best practices, model ordinances, and technical support. Work with partners to develop messaging to decrease electricity demand during peak times. | **Consistent**: Part of the Sustainability theme of General Plan 2035 is to conserve energy and water and shift reviewable energy sources. Other overarching sustainability strategies to decrease electricity demand include adopting green building requirements with an ultimate goal of achieving energy-efficient buildings that offset the their remaining energy use through renewable energy production. The following Environmental Stewardship Chapter policies would reduce energy in the City:<br>▪ **ES 25 Energy and Water Conservation.** Increase energy and water efficiency and conservation in City buildings, equipment and operations. Promote energy and water conservation and building upgrades to the community.<br>▪ **ES 26 On-site Energy Production.** Support on-site renewable energy facilities that help reduce community energy demand.<br>Development projected by General Plan 2035 would be required to comply with all energy standards of Title 24 that are in effect at that time. The 2016 Title 24 standards are approximately 28% more efficient than the 2013 standards. The 2013 Title 24 standards were approximately 30% more efficient than the 2008 standards, which in turn were approximately 15% more efficient than the 2005 standards. |
| **Buildings** | |
| **BL1: Green Buildings**. Collaborate with partners such as KyotoUSA to identify energy-related improvements and opportunities for on-site renewable energy systems in school districts; investigate funding strategies to implement upgrades. Identify barriers to effective local implementation of the CALGreen (Title 24) statewide building energy code; develop solutions to improve implementation/enforcement. Work with ABAG's BayREN program to make additional funding available for energy-related projects in the buildings sector. Engage with additional partners to target reducing emissions from specific types of buildings. | **Consistent**: Implementation of Environmental Stewardship Chapter policies listed above would promote green building standards. In addition, future projects would be required to comply with all energy standards of Title 24, as part of Policy ER 5.15, that are in effect at the time of development. |

| Control Measures | Consistency |
|---|---|
| **Water Control Measures** | |
| **WR2: Support Water Conservation**. Develop a list of best practices that reduce water consumption and increase on-site water recycling in new and existing buildings; incorporate into local planning guidance. | **Consistent**: Part of the Sustainability theme of General Plan 2035 is to conserve energy and water and shifting reviewable energy sources. The following Environmental Stewardship Chapter and A City that Works Chapter (Pubic Facilities and Services) policies and programs would support water conservation in the City:<br>▪ **ES 25 Energy and Water Conservation**. Increase energy and water efficiency and conservation in City buildings, equipment and operations. Promote energy and water conservation and building upgrades to the community.<br>▪ **ES 25a:** *Reduce Resource Use in Buildings*. Require new development to minimize impacts on the environment, including use of energy and water-efficient design features and materials consistent with local building codes and Water District regulations. Strive to achieve sustainable development that, through on-site conservation and renewable energy generation or off-site offsets, has no increased demand on energy and water resources pursuant to the Water District's Urban Water Management Plan.<br>▪ **PF 3a:** *Water Conservation*. Assist the North Marin Water District in implementing water conservation programs for Novato residents and businesses. Use treated wastewater for irrigation of City facilities and expansion of the recycled water system to the maximum extent practical. |

The proposed project would be consistent with applicable 2017 Plan control measures because General Plan 2035 would implement similar measures through specific goals and policies that would reduce criteria pollutant emissions as detailed Table 4.2-3 above. In addition, development in the four focus areas and the Industrial Parks MPA would be consistent with the 2017 Plan because development in the four focus areas and Industrial Parks MPA would be required to be consistent with the goals and policies of General Plan 2035, including those addressing pollutant emissions. Therefore, the proposed project would be consistent with the applicable control measures contained in the 2017 Plan for the SFBAAB.

### *Hinder Implementation of CAP Control Measures*

Table 4.2-3 demonstrates that the proposed project would not disrupt or hinder implementation of any 2017 Plan control measures. Implementation of the proposed project, including development in the four focus areas and the Industrial Parks MPA, would not preclude any planned transit or bike pathways, and would not otherwise disrupt regional planning efforts to reduce VMT and meet federal and state air quality standards. Therefore, the proposed project would not hinder implementation of any 2017 Plan control measures.

## General Plan VMT and Population

According to the BAAQMD 2017 *CEQA Air Quality Guidelines,* the threshold for criteria air pollutants and precursors includes an assessment of the rate of increase of plan VMT and population. The proposed project would result in a decrease in VMT in the year 2035 by 233,097 miles daily, which is an approximately 13 percent decrease compared to existing conditions (1,850,065 daily VMT). The proposed project is projected to increase population by 3,340 residents through the year 2035, see Section 4.11, *Population and Housing*. Compared to the existing population in the Plan Area of

52,290, the proposed project would increase population by approximately six percent. Because the proposed VMT associated with the proposed project would decrease (approximately 13 percent) it would not exceed the rate of increase from the proposed population (approximately six percent). Therefore, impacts on criteria pollutants would be less than significant.

## Mitigation Measure

No mitigation measures are required.

| | |
|---|---|
| **Threshold 2:** | Would the project violate any air quality standard or contribute substantially to an existing or projected air quality violation? |
| **Threshold 3:** | Would the project result in a cumulatively considerable net increase of any criteria pollutant for which the project region is nonattainment under an applicable federal or state ambient air quality standard (including releasing emissions, which exceed quantitative thresholds for ozone precursors? |

### Impact AQ-2 OPERATION OF THE PROPOSED PROJECT WOULD NOT VIOLATE ANY AIR QUALITY STANDARD, CONTRIBUTE SUBSTANTIALLY TO AN EXISTING AIR QUALITY VIOLATION, OR RESULT IN A CUMULATIVELY CONSIDERABLE NET INCREASE IN ANY CRITERIA POLLUTANT RESULTING FROM OPERATIONAL EMISSIONS. IMPACTS WOULD BE LESS THAN SIGNIFICANT.

Long range plans often contain development strategies for 20-years or longer and provide a wide range of potential land uses and densities that accommodate all types of development. Therefore, BAAQMD has developed specific plan level impacts for operational emissions. As stated in the BAAQMD May 2017 *CEQA Air Quality Guidelines,* the operational threshold for plans (e.g., general plans, community plans, specific plans, etc.) within the Basin is consistency with the current AQMP and whether projected VMT or vehicle trip increase is less than or equal to projected population increase. As discussed under Impact AQ-1 the proposed project, including the Industrial Parks MPA, would be consistent with the 2017 Plan and the increase in VMT would not exceed the projected population increase from General Plan 2035 per the BAAQMD CEQA Guidelines for operational emissions from plans. Therefore, impacts to operational emissions would be less than significant.

## Mitigation Measure

No mitigation measures are required.

| | |
|---|---|
| **Threshold 2:** | Would the project violate any air quality standard or contribute substantially to an existing or projected air quality violation? |

### Impact AQ-3 IMPLEMENTATION OF THE PROPOSED PROJECT WOULD RESULT IN THE TEMPORARY GENERATION OF AIR POLLUTANTS DURING CONSTRUCTION, WHICH MAY CONTRIBUTE TO EXISTING AIR QUALITY VIOLATIONS IN THE BASIN. IMPACTS WOULD BE POTENTIALLY SIGNIFICANT.

Construction activity associated with the proposed project may involve activities that result in air pollutant emissions. Construction activities such as demolition, grading, construction worker travel, delivery and hauling of construction supplies and debris, and fuel combustion by on-site construction equipment would generate pollutant emissions. These construction activities would temporarily create emissions of dust, fumes, equipment exhaust, and other air contaminants, particularly during site preparation and grading. The extent of daily emissions, particularly ROGs and $NO_X$ emissions, generated by construction equipment, would depend on the quantity of equipment used and the hours of operation for each project. The extent of $PM_{2.5}$ and $PM_{10}$ emissions would depend upon the following factors: 1) the amount of disturbed soils; 2) the length of disturbance time; 3) whether existing structures are demolished; 4) whether excavation is involved; and 5) whether transporting excavated materials offsite is necessary. Dust emissions can lead to both nuisance and health impacts. According to the 2017 BAAQMD *CEQA Air Quality Guidelines,* during construction $PM_{10}$ is the greatest pollutant of concern.

As discussed above, BAAQMD's 2017 *CEQA Air Quality Guidelines* have no plan-level significance thresholds for construction air pollutant emissions that would apply to the proposed project because it is a plan level document. However, the guidelines include project-level thresholds for construction emissions. If a project's construction emissions fall below the project-level thresholds, the project's impacts on regional air quality would be individually and cumulatively less than significant. The BAAQMD has also identified feasible fugitive dust control measures for construction activities. These Basic Construction Mitigation Measures are recommended for all projects (BAAQMD 2017c). In addition, the BAAQMD and CARB have regulations that address the handling of hazardous air pollutants such as lead and asbestos. Lead and asbestos emissions could occur from demolition activities. BAAQMD rules and regulations address both the handling and transport of these contaminants. Project construction, including construction in the four focus areas, would temporarily increase air pollutant emissions, possibly creating localized areas of unhealthy air pollution levels or air quality nuisances. Construction of the Industrial Parks MPA would temporarily increase air quality emissions resulting from construction of the life science campus. Goals and policies included in General Plan 2035 do not include implementation of feasible measures to reduce construction emissions associated with the proposed project. BAAQMD has identified feasible fugitive dust control measures for construction activities because $PM_{10}$ is the greatest pollutant of concern (BAAQMD 2017a). Therefore, impacts related to construction emissions would be significant and mitigation would be required.

## Mitigation Measures

Temporary construction impacts associated with the proposed project would be reduced through implementation of Mitigation Measure AQ-1.

### *AQ-1 Construction Emissions Reduction*

New discretionary projects in the Plan Area that exceed the construction screening criteria of the Bay Area Air Quality Management District (BAAQMD) shall be conditioned to reduce construction emissions of reactive organic gases, nitrogen oxides, and particulate matter ($PM_{10}$ and $PM_{2.5}$) by implementing the BAAQMD's Basic Construction Mitigation Measures (described below) or equivalent, expanded, or modified measures based on project and site specific conditions.

Basic Construction Mitigation Measures

1. All exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) shall be watered two times per day, with priority given to the use of recycled water for this activity when feasible.
2. All haul trucks transporting soil, sand, or other loose material off-site shall be covered.
3. All visible mud or dirt track-out onto adjacent public roads shall be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweeping shall be prohibited.
4. All vehicle speeds on unpaved roads shall be limited to 15 mph.

5. All roadways, driveways, and sidewalks to be paved shall be completed as soon as possible. Building pads shall be laid as soon as possible after grading unless seeding or soil binders are used.
6. Idling times shall be minimized either by shutting equipment off when not in use or reducing the maximum idling time to 5 minutes (as required by the California airborne toxics control measure Title 13, Section 2485 of California Code of Regulations [CCR]). Clear signage shall be provided for construction workers at all access points.
7. All construction equipment shall be maintained and properly tuned in accordance with manufacturer's specifications. All equipment shall be checked by a certified visible emissions evaluator.
8. A publicly visible sign shall be posted with the telephone number and person to contact at the lead agency regarding dust complaints. This person shall respond and take corrective action within 48 hours. The Air District's phone number shall also be visible to ensure compliance with applicable regulations.

## Significance After Mitigation

Impacts would be less than significant with implementation of Mitigation Measure AQ-1 to require the BAAQMD Basic Construction Measures for all projects.

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|---|---|
| **Threshold 4:** | Would the project expose sensitive receptors to substantial pollutant concentrations? |

### Impact AQ-4 IMPLEMENTATION OF THE PROPOSED PROJECT MAY EXPOSE SENSITIVE RECEPTORS TO ADDITIONAL SOURCES OF TOXIC AIR CONTAMINANTS. IMPACTS WOULD BE POTENTIALLY SIGNIFICANT.

Pursuant to the recent ruling in the *California Building Industry Association (CBIA) v BAAQMD* (2015), impacts of the environment on the project is not an impact under CEQA. Nonetheless, BAAQMD's *CEQA Guidelines* include methodology for jurisdictions wanting to evaluate the potential impacts from placing sensitive receptors proximate to major air pollutant sources. For assessing community risk and hazards for siting a new receptor, sources within a 1,000-foot radius of a project site are typically considered. Sources are defined as freeways, high volume roadways (with volume of 10,000 vehicles or more per day or 1,000 trucks per day), and permitted sources (BAAQMD 2017).

The proposed project could result in additional sources of TACs including new auto service/sales uses, dry cleaners, or gas stations. Specifically, the Downtown focus area would result in additional commercial development that may include these uses and expose sensitive receptors to additional sources of TACs. Therefore, the proposed project could increase the number of stationary or permitted sources that emit TACs in the Plan Area. Development in the Industrial Parks MPA may result in new sources of TACs including diesel generators and may affect residences within 1,000 feet of Hamilton Park and Ignacio Park. Additionally, there are several high volume roadways and freeways in and around the Plan Area, including Highway 101, SR 37, Novato Boulevard, and Redwood Boulevard. The proposed project may place new sensitive receptors in proximity to these high volume roadways and freeways. The proposed project does not include any goals or policies to minimize health risk of sensitive receptors near stationary sources and/or freeways and high volume roadways. Therefore, mitigation would be required to ensure that the proposed project would not expose sensitive receptors to substantial pollutant concentrations.

## Mitigation Measures

Impacts on sensitive receptors would be reduced with implementation of Mitigation Measure AQ-2.

### *AQ-2 Health Risk Assessments*

Projects that may result in additional toxic air contaminants that are located within 1,000 feet of a sensitive receptors(s) or would place sensitive receptors within 1,000 feet of uses generating toxic air contaminants, such as roadways with volumes of 10,000 average annual daily trips or greater, shall implement Bay Area Air Quality Management District Guidelines and State Office of Environmental Health Hazard Assessment policies and procedures requiring health risk assessments (HRAs) for residential development and other sensitive receptors; screening area distances may be increased on a case-by-case basis if an unusually large source or sources of hazardous emissions are proposed or currently exist. Based on the results of the HRA, identify and implement measures (such as air filtration systems) to reduce potential exposure to particulate matter, carbon monoxide, diesel fumes, and other potential health hazards. Measures identified in HRAs shall be included into the site development plan as a component of a proposed project.

## Significance After Mitigation

Impacts would be less than significant with implementation of Mitigation Measure AQ-2 to require HRAs and mitigation measures for projects that may expose sensitive receptors to substantial pollutant concentrations.

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| **Threshold 5:** | Would the project create objectionable odors affecting a substantial number of people? |

**Impact AQ-5 THE PROPOSED PROJECT MAY CREATE OBJECTIONABLE ODORS THAT COULD AFFECT A SUBSTANTIAL NUMBER OF PEOPLE FROM LIGHT INDUSTRIAL/OFFICE LAND DEVELOPMENT. IMPACTS RELATED TO ODORS WOULD BE POTENTIALLY SIGNIFICANT.**

As stated in the BAAQMD *CEQA Guidelines,* land uses typically producing objectionable odors include agricultural uses, wastewater treatment plants, food manufacturing plants, chemical plants, composting, refineries, landfills, and confined animal facilities. Projected development in the four focus areas would include commercial, residential, and mixed-use development. These land uses typically do not produce objectionable odors. In addition, for the majority of the Plan Area (including the four focus areas), the proposed project would not add additional light industrial/office land uses that would have the potential to expose sensitive receptors, such as residences, to odors. Buildout of the proposed project would increase light industrial/office land development in the Industrial Parks MPA. Development in the Industrial Parks MPA would include a life sciences campus with laboratory, manufacturing, and office buildings. Manufacturing in the Industrial Parks MPA would include development of products used to analyze, detect, cure, and/or treat various diseases, disorders, syndromes, and other medical conditions. Manufacturing may include chemical odors or odors from food manufacturing, as identified by BAAQMD as land uses that typically produce odors. Impacts would be potentially significant.

Implementation of the proposed project could emit odors associated with construction vehicle and engine exhaust and idling. These odors may affect nearby receptors. However, Mitigation Measure AQ-1 would reduce construction air quality impacts reducing idling times and making sure construction equipment is in proper working order.   Therefore, impacts would be less than significant with mitigation incorporated.

## Mitigation Measure

Impacts on sensitive receptors would be reduced with implementation of Mitigation Measures AQ-1 and AQ-3.

### *AQ-3 Odor Reduction*

Require new manufacturing and laboratory development to be designed and constructed in a way that reduces the potential for future odors. Ensure prompt response to complaints about odor projects reported by residences and businesses by developing a website link that directs users to BAAQMD's odor reporting and inspection program.

## Significance After Mitigation

Impacts would be less than significant with implementation of Mitigation Measure AQ-1 to reduce construction odors and Mitigation Measure AQ-3 to reduce odors from new manufacturing and laboratory buildings by requiring construction design to reduce odor and establishing a complaint line for odors.

## Cumulative Impacts

The Novato region falls within the jurisdiction of BAAQMD, while the cities and counties to the north fall within the jurisdiction of the Northern Sonoma Valley Air Pollution Control District. Each of these air districts has prepared an air quality plan to improve conditions and meet federal and state air quality standards. While each air district is primarily responsible for regulating its own emissions, the transport of emissions in one area can affect another area's ability to achieve attainment of pollutant standards. The two air districts currently exceed at least one federal and/or state air quality standard. Construction activities associated with implementation of the proposed project would create fugitive dust and ozone precursor emissions and have the potential to result in temporary adverse impacts on air quality. However, implementation of Mitigation Measures AQ-1 and AQ-2 would reduce impacts related to construction and TAC emissions. Further, the proposed project would result in an approximately 13 percent reduction of VMT, which would reduce mobile emissions. Implementation of Mitigation Measures AQ-1 and AQ-3 would ensure that the proposed project would not result in cumulative odors from both construction and operation. Therefore, the proposed project would not have a cumulatively considerable contribution to regional air quality impacts.

# 4.3 Biological Resources

This section addresses direct and indirect impacts on the following special-status biological resources: regulated waterways and wetlands, sensitive habitats and mature native trees, sensitive plants and animals, and wildlife movement corridors from implementation of the proposed project.

## 4.3.1 Setting

### a. Plan Area Habitat Types

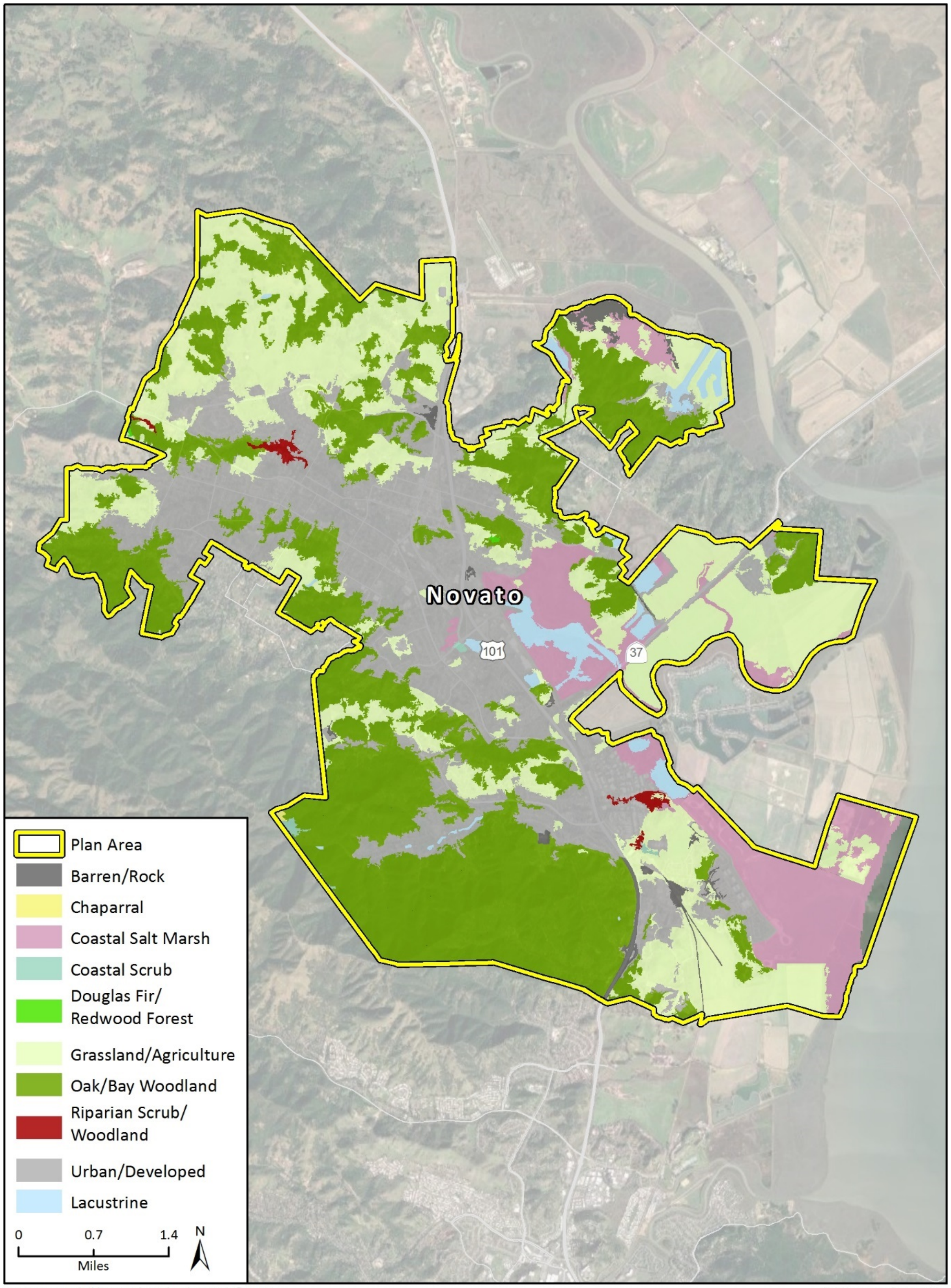
The City of Novato is located in the Central Coast Region which supports a wide range of terrestrial and aquatic habitat types. The central portion of Novato along the Highway 101 corridor is largely developed within urban and suburban uses, occupying the valley floors and lower elevations of the surrounding hillsides. These developed areas are bisected by the remaining natural riparian and marshland habitats along major drainages such as Ignacio, Novato, and Rush Creeks. The open water of the San Pablo Bay forms the eastern edge of the Novato area, bordered by large expanses of marshland habitat and diked baylands which support primarily grasslands. A mosaic of grassland and woodland habitats cover the hillsides that form the northern, western, and southern edges of the Novato vicinity (City of Novato 2014a). Figure 4.3-1 shows the vegetation communities within the Plan Area.

Historic land use has altered much of the landscape in the Novato vicinity, including the plant communities and wildlife habitat. Native perennial grasslands in the Novato vicinity and throughout California have been largely replaced by non-native annual grasslands, and a number of invasive species. Although some natural areas remain in local parks, open space, stream corridors, hillsides, ridgelines, and baylands, there are considered fragmented by urban development. Nevertheless, the remaining natural communities in the Novato vicinity continue to support a diverse assemblage of plant and animal species (City of Novato 2014a). The following paragraphs describe habitats in the Plan Area that contain significant biological resources.

### Wetlands

Wetlands in the Novato vicinity include areas of coastal salt marsh and coastal brackish water marsh along the baylands of San Pablo Bay, riparian habitat along creeks and streams, and scattered freshwater seeps, springs, and ponds. Figure 4.3-1 shows the extent of major wetland habitat types in the Novato vicinity mapped as part of the National Wetlands Inventory (NWI), which consists of a range of characteristic wetland types, together with streams mapped by Marin County. These wetland habitats include the marine and estuarine systems of San Pablo Bay and the lower reaches of Novato Creek, Petaluma River, Black John Slough and Rush Creek; major creeks and channels; and freshwater marsh, riparian scrub, woodland and scattered stock ponds. Some wetland features, such as freshwater seeps and springs, were generally not identified as part of the NWI because of the general scale of the mapping effort. Detailed wetland delineations would be required to determine the extent of any jurisdictional wetlands and other waters at specific locations. The USACE holds the responsibility of making a final determination on the extent of jurisdictional waters for a particular site (City of Novato 2014a).

## Figure 4.3-1 Vegetation Communities




*Imagery provided by Google and its licensors © 2018.*

FigX Vegetation Communities

## Salt/Brackish Water Marshland

Coastal salt marsh and coastal brackish marsh occupy large expanses of the Novato vicinity along the fringe of San Pablo Bay. They are part of the important wetland ecosystem that comprises the San Francisco Bay Estuary system, of regional and statewide significance. Vegetation associated with the remaining marshlands in the Novato vicinity differs in relation to tides and salinity levels depending on elevation. California cord grass (*Spartina foliosa*) occurs at the lower elevations on the bayward edge of the mudflats that are exposed at low tides. Dense stands of pickleweed (*Salicornia* spp.) occur at the middle elevations of the coastal salt marsh. Transitional marsh species such as salt grass (*Distichlis spicata*), jaumea (*Jaumea carnosa*), salt bush (*Atriplex patula* var*. Hastata*), and gum plant (*Grindelia humilis*) occur at the upper elevations of the salt marsh, together with ruderal grassland species. Areas of brackish water marsh occur at the upper limits of the tidal range, dominated by tules (*Scirpus* spp.) and cattails (*Typha* spp.). Suitable habitat for a number of special-status plant species associated with brackish and coastal salt marsh habitat also occurs in the Novato vicinity, such as Point Reyes bird's-beak (*Cordylanthus maritimus* ssp. *palustris*), soft bird's-beak (*Cordylanthus mollis* ssp. *mollis*), and Marin knotweed (*Polygonum marinense*). The marshlands provide important foraging and breeding habitat for a wide variety of aquatic and terrestrial species, and contribute to the health of larger baylands ecosystem (City of Novato 2014a).

## Freshwater Marsh

Freshwater marsh occurs along the larger creeks and tributary drainages, scattered seeps and springs, ephemeral and vernal pools, and margins of the stock ponds and other freshwater bodies in the Novato vicinity. Some segments of larger streams support emergent marsh vegetation such as cattails, tules, nut sedge (*Cyperus eragrostis*), monkey flower (*Mimulus guttatus*), narrow-leaved rush (*Juncus xiphioides*) and toad rush (*Juncus bufonius*). Rushes, Douglas' meadowfoam (*Limnanthes douglasii*), prickly buttercup (*Ranunculus muricata*), popcorn flower (*Plagiobothrys stiptatus*), and other wildflowers occur around the seeps, springs, creek margins, and mesic grasslands and seasonal pools, and the showy display of flowers stands out from the surrounding grasslands in the spring. Heavy grazing and trampling by cattle can severely impact vegetative cover and diminish the value of the freshwater marsh habitats in the Novato vicinity, including the margins of ponds, drainages, seeps and springs. Wildlife value of freshwater marsh habitat is generally high, due to the available surface water, abundance of insect, algae, and plant foliage, and the protective cover when emergent vegetation is present (City of Novato 2014a).

## Grasslands

Much of the remaining undeveloped portions of the Novato vicinity support grasslands dominated by non-native grasses and forbs. Grasslands occupy much of the diked baylands that continue to be used as grazing lands in the eastern portion of the Novato vicinity, as well as the lower slopes of Mount Burdell and the rolling hills of eastern Novato. Species composition in the grasslands varies, depending on the extent of past disturbance, depth to groundwater, and frequency and duration of soil saturation. Highly invasive species, particularly Himalayan blackberry (*Rubus discolor*), poison hemlock (*Conium maculatum*), French broom (*Genista monspessulana*), Scotch broom (*Cytisus scoparius*), and fennel (*Foeniculum vulgare*), are spreading into grassland habitat along road margins and edges of developed areas. These species contribute to the risk of fire through increased fuel loads, and compromise the wildlife habitat values of areas they occupy (City of Novato 2014a).

## Woodlands

Oak woodlands and other hardwood woodlands occupy much of the remaining undeveloped hillsides at Black Point, Deer Island, and the lower slopes of Mount Burdell and Big Rock Ridge in the Novato vicinity. The woodlands vary in species composition and structure, from dense tree cover with a continuous canopy and little understory, to open woodlands with a lush understory of grassland and shrubs, to a widely spaced savanna surrounded by grasslands. Most of the woodlands are dominated by several species of oak and other native tree species, including black oak (*Quercus kelloggii*), valley oak (*Q. lobata*), coast live oak (*Q. agrifolia*), blue oak (*Q. douglasii*), California bay (*Umbellularia californica*) and madrone (Arbutus menziesii). Where the woodland canopy is closed, understory vegetation is generally sparse, composed of poison oak (*Toxicodendron diversilobum*), coyote brush (*Baccharis pilularis*), toyon (*Heteromels arbutifolia*) and other shrub and groundcover species. Where the canopy is open or sparse, the understory is dominated by a relatively dense cover of non-native grassland species (City of Novato 2014a).

## Riparian Woodland/Scrub

Riparian woodland and scrub occurs along the larger creeks and tributaries in the Novato vicinity, including Ignacio, Novato, and Rush Creeks. Native willow (*Salix* spp.), valley oak, coast live oak, and California bay form the dominant native tree cover along these riparian corridors. Other tree species include native California buckeye (*Aesculus californica*), white alder (*Alnus rhombifolia*), box elder (*Acer negundo* var. *californicum*), Fremont cottonwood (*Populus fremontii*) and black walnut (*Juglans hindsii*), as well as a number of non-native invasive species such as silver wattle (*Acacia dealbata*), black locust (*Robinia pseudoacacia*) and plum (*Prunus* sp.). Several highly invasive, non-native species have become well-established along the creeks and tributary drainages, creating impenetrable thickets of Himalayan blackberry in some locations, scattered stands of arundo (*Arundo donax*), and a dense groundcover of periwinkle (*Vinca major*) in other locations. Riparian habitat is relatively scarce because it only forms along watercourses and lakes, and in California much of this habitat has been lost to agricultural uses, urbanization and channelization for flood control. The riparian habitat can be of high resource value to wildlife, due to the complex structure of the vegetation, available surface water, and the transition to other habitat types which border the creek corridors, sometimes referred to as “edge” habitat (City of Novato 2014a).

## Chaparral and Coastal Scrub

Northern mixed chaparral and coastal scrub occurs in patches in the southwest of the Novato vicinity. Most of the stands of chaparral are associated with shallow soils along the upper slopes of Big Rock Ridge, and are dominated by chamise (*Adenostoma fasciculatum*), coyote brush (*Baccharis pilularis*), poison oak, manzanita (*Arctostaphylos manzanita*), monkey flower (*Diplacus aurantiacus*), California sagebrush (*Artemesia californica*) and squaw bush (*Rhus trilobata*) (City of Novato 2014a).

## Developed Area/Ornamental Landscaping

Buildings, roadways, parking lots, other impervious surfaces, turf and ornamental landscaping occupy the developed portions of the Novato vicinity. Existing landscaping consists of a mixture of native and non-native trees, shrubs, and groundcovers. Ornamental landscaping includes a wide range of introduced, commercially available species that provide shade and contribute to the aesthetics of the urban landscape. As noted previously, several highly invasive plant species occur in developed areas and are spreading along roadways and into nearby undeveloped lands (City of Novato 2014a).

## b. Special Status Resources

The term special-status biological resources includes those plants, animals, vegetation communities, jurisdictional drainages and other sensitive biological resources that are governed under federal, state, and local laws and regulations. Information regarding the occurrences of special-statusspecies in the vicinity of the Plan Area was obtained from searching the California Department ofFish and Wildlife's (CDFW) Natural Diversity Data Base (CNDDB, March 2018), U.S. Fish and WildlifeService's (USFWS) Information for Planning and Conservation (IPaC) (March 2018), and CaliforniaNative Plant Society's (CNPS) Electronic Inventory (CNPS March 2018) for the U. S. Geological SurveyUSGS *Novato* and eight surrounding 7.5-minute quadrangles. These databases contain records ofreported occurrences of federal- or state-listed endangered, threatened, rare, or proposedendangered or threatened species, federal species of concern, state species of special concern, orotherwise sensitive species or habitat that may occur within a five-mile radius of the Plan Area. Listsfrom the USFWS and CDFW were also reviewed, and lists of common and sensitive wildlife and plantspecies potentially occurring within the Plan Area were created. This search range encompasses asufficient distance to accommodate for regional habitat diversity and to overcome the limitations ofthe CNDDB (the CNDDB is based on reports of actual occurrences and does not constitute anexhaustive inventory of every resource). See Appendix C for detailed species lists.

### Listed Species

Federal, State, and local authorities under a variety of legislative acts share regulatory authority over biological resources. The CDFW has direct jurisdiction under law for biological resources through the State Fish and Game Code and under the California Endangered Species Act (CESA). The federal Endangered Species Act (FESA) also provides direct regulatory authority over specially designated organisms and their habitats to the USFWS. These acts specifically regulate listed and candidate endangered and threatened species, which are defined as:

- **Endangered Species:** any species that is in danger of extinction throughout all or a significant portion of its range
- **Threatened Species:** any species that is likely to become an endangered species within the foreseeable future throughout all or a significant part of its range

### Special-Status Wildlife

Several reptile, bird, amphibian, fish, invertebrate, and mammal species of concern are known or possibly found in the Plan Area, based on a search of the CNDDB. Table 1 of Appendix C identifies these animal species that are known to occur or have the potential to occur within the Plan Area, six of which have federal and State listing status. These include the Federal Endangered and State Endangered California freshwater shrimp (*Syncaris pacifica*), coho salmon-central California coast sub-population (*Oncorhynchus kisutch*), California clapper rail (*rallus longirostris obsoletus*), California Ridegway's rail (*Rallus obsoletus*), and salt-marsh harvest mouse (*Reithrodontomys ravinventris*); and Federal Threatened and State Threatened California tiger salamander(*Ambystoma califomiense*). Seven wildlife species with the potential to occur in the Plan Area haveeither federal or State protection status. These include the Federal Endangered tidewater goby(*Eucyclogobis newberri*), Federal Threatened, steelhead-central California coast sub-population(*Oncorhynchus mykiss iridenus*), Eulachon (*Thaleichthys pacificus*), and western snowy plover(*Charadrius alexandrines nivosus*), and State Threatened longfin smelt (*Spirinchus thaleichthys*),California black rail (*Laterallus jamaicensis cotumiculus*), and Swainson's hawk (*Buteo swainsoni*)(CNDDB 2018). State or federally listed species are accorded the highest protection status.

## Special-Status Plant Species

Special-status plant species are either listed as endangered or threatened under FESA or CESA, or rare under the California Native Plant Protection Act, or considered to be rare (but not formally listed) by resource agencies and the scientific community. CDFW and local governmental agencies may also recognize special listings developed by focal groups (i.e. Audubon Society Blue List; CNPS Rare and Endangered Plants; U.S. Forest Service regional lists). Table 2 of Appendix C shows 22 special-status plant species that have the potential to occur within the Plan Area, six which have State and federal listing status. These include the Federal Endangered golden larkspur (*Delphinium luteum*), soft salty bird's-beak (*Chloropyron molle* ssp. *molle*), and two-fork clover (*Trifolium amoenum*); Federal and California Endangered white-rayed pentachaeta (*Pentachaeta bellidiflora*); Federal Endangered and California Threatened Marin western flax (*Hesperolinon congestum*); Federal Threatened and California Endangered Santa Cruz tarplant (*Holocarpha macradenia*); and California Threatened North Coast semaphore grass (*Pleuropogon hooverianus*) (CNPS 2018).

## Special-Status Habitats

Special-status habitats are vegetation types, associations, or sub-associations that support concentrations of special-status plant or wildlife species, are of relatively limited distribution, or are of particular value to wildlife. Although special-status habitats are not afforded legal protection unless they support special-status species, potential impacts on them may increase concerns and trigger mitigation suggestions by resources agencies for those habitats considered sensitive by federal, State, and local agencies due to their rarity or value in providing habitat for vegetation, fish, and wildlife.

Sensitive habitats are special-status plant communities considered sensitive by federal, State, and local agencies due to their rarity or value in providing habitat for vegetation, fish, and wildlife. Sensitive habitats present within the Plan Area include: Chaparral, Coastal Salt Marsh, Coastal Scrub, Douglas Fir/Redwood Forest, Oak/Bay Woodland, and Riparian Scrub/Woodland (see Figure 4.3-1)

Because the Plan Area contains some natural or semi-natural drainages (see Impact discussion BIO-3), and other natural, undeveloped areas, the following special-status habitats may be present:

- Drainages, wetlands and associated riparian vegetation under the jurisdiction of CDFW as waters of the State or U.S. Army Corps of Engineers (USACE) as waters of the U.S.
- Wildlife Linkages and Corridors

## c. Wildlife Corridors

Wildlife corridors are generally defined as connections between habitat patches that allow for physical and genetic exchange between otherwise isolated animal populations. Such linkages may serve a local purpose, such as between foraging and denning areas, or they may be regional in nature, allowing movement across the landscape. Some habitat linkages may serve as migration corridors, wherein animals periodically move away from an area and then subsequently return.

Novato supports a diversity of wildlife and creek channels tend to serve as movement corridors for both terrestrial and aquatic species throughout the City. Open space areas within the City, such as the Ignacio Valley Preserve and Deer Island Preserve, provide discontinuous habitat blocks and patches, facilitating wildlife movement. The Sonoma Mountains-Burdell Mountain linkage provides a large continuous corridor that supports wildlife movement from Novato north to Petaluma.

## d. Regulatory Setting

The following is a summary of the regulatory context under which biological resources are managed at the federal, state, and local level. Agencies with responsibility for protection of biological resources within the Plan Area include:

- U.S. Fish and Wildlife Service (federally listed species and migratory birds)
- U.S. Army Corps of Engineers (USACE; wetlands and other waters of the United States)
- California Department Fish and Wildlife (waters of the State, state listed and fully protected species, and other sensitive plants and wildlife)
- San Francisco Bay Regional Water Quality Control Board (RWQCB; waters of the State)
- City of Novato (Municipal Code and 1996 General Plan)

The following discussion provides a summary of those laws that are most relevant to biological resources in the Plan Area vicinity.

### U.S. Fish and Wildlife Service

The USFWS implements the Migratory Bird Treaty Act (MBTA; 16 USC Section 703-711) and the Bald and Golden Eagle Protection Act (16 United States Code (USC) Section 668). USFWS and the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (also called NOAA Fisheries) share responsibility for implementing the FESA (16 USC § 153 *et seq*). USFWS generally implements the FESA for land and freshwater species, while NOAA Fisheries implements the FESA for marine and anadromous species. Projects that would result in take of any federally listed threatened or endangered species are required to obtain permits from the USFWS or NOAA Fisheries through either Section 7 (interagency consultation with a federal nexus) or Section 10 (Habitat Conservation Plan) of FESA, depending on the involvement by the federal government in permitting or funding the project. The permitting process is used to determine if a project would jeopardize the continued existence of a listed species and what mitigation measures would be required to avoid jeopardizing the species.

The FESA also prohibits any activity that kills or injures fish or wildlife, and emphasizes that such activities may include significant habitat modification or degradation that significantly impairs essential behavioral patterns of fish or wildlife. Take under federal definition means to harass, harm (which includes habitat modification), pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. Proposed or candidate species do not have the full protection of FESA; however, the USFWS and NOAA Fisheries advise project applicants that they could be elevated to listed status at any time.

The MBTA, as amended in 1972, protects nesting migratory birds by making it unlawful to "take" (kill, harm, harass, etc.) any migratory bird listed in 50 CFR 10, including their nests, eggs, or products. Migratory birds include geese, ducks, shorebirds, raptors, songbirds, and many other species. It is possible that other state or federal sensitive or special-status avian species may also be adversely affected by development in the Plan Area.

### U.S. Army Corps of Engineers

Under Section 404 of the federal Clean Water Act (CWA) and Section 10 of the Rivers and Harbors Act, the US Army Corps of Engineers (USACE) has authority to regulate activity that could discharge fill or dredge material or otherwise adversely modify wetlands or other waters of the US. Perennial and intermittent creeks and adjacent wetlands are considered waters of the US and fall under USACE's regulatory jurisdiction. USACE implements the federal policy embodied in Executive Order 11990, which when implemented, is intended to result in no net loss of wetland values or acres. In achieving the goals of the CWA, USACE seeks to avoid adverse impacts and to offset unavoidable adverse impacts on existing aquatic resources. Any fill or adverse modification of waters of the U.S. wetlands would require a permit from USACE prior to the start of work. Typically, USACE permits are a condition of a project as mitigation to offset unavoidable impacts on wetlands and other waters of the US in a manner that achieves the goal of no net loss of wetland acres or values.

## California Department of Fish and Wildlife

CDFW derives its authority from the Fish and Game Code of California Species listed under the CESA (Fish and Game Code Section 2050 *et seq*.). The code prohibits the take of listed threatened or endangered species. A "take" is defined under CESA as to hunt, pursue, catch, capture, or kill a protected species, or to make an attempt at these actions.

Fish and Game Code Sections 3503, 3503.5, and 3511 describe unlawful take, possession, or needless destruction of birds, nests, and eggs. Fully protected birds (Section 3511) may not be taken or possessed except under specific permit. Section 3503.5 of the Code protects all birds-of-prey and their eggs and nests against take, possession, or destruction of nests or eggs.

Species of Special Concern (SSC) is a category used by CDFW for those species considered to be indicators of regional habitat changes or considered to be potential future protected species. SSC do not have any special legal status except that afforded by the Fish and Game Code. The SSC category is intended by the CDFW for use as a management tool to include these species into special consideration when decisions are made concerning the development of natural lands.

CDFW also has authority to administer the Native Plant Protection Act (Fish and Game Code Section 1900 et seq). The Act requires CDFW to establish criteria for determining if a species, subspecies, or variety of native plant is endangered or rare. Under Section 1913(c) of the Act, the owner of land where a rare or endangered native plant is growing is required to notify the department at least 10 days in advance of changing the land use to allow for salvage of the plant.

Perennial and intermittent streams also fall under the jurisdiction of CDFW. Sections 1600 *et. seq*. of the Fish and Game Code (Streambed Alteration Agreements) gives CDFW regulatory authority over work within the stream zone (which could extend to the 100-year flood plain) consisting of, but not limited to, the diversion or obstruction of the natural flow or changes in the channel, bed, or bank of any river, stream or lake.

## Regional Water Quality Control Board

The protection of water quality in the watercourses of the City of Novato is under the jurisdiction of the North Coast Regional Water Quality Control Board (RWQCB). The RWQCB is responsible for the development, adoption, and implementation of the Water Quality Control Plan (Basin Plan) for the North Coast Region. The Basin Plan is the master policy document that contains descriptions of the legal, technical, and programmatic bases of water quality regulation in the North Coast Region. The Basin Plan identifies beneficial uses of surface waters and groundwater within its region and specifies water quality objectives to maintain the continued beneficial uses of these waters.

### City of Novato

*Municipal Code*

The Novato Zoning Code contains standards and regulations to protect biological resources. Division 19.08, Agriculture and Resource Zoning Districts, establishes use regulations and development standards to preserve and protect open space, natural resources and agricultural areas in specified zoning districts. Division 19.16.030 establishes the Baylands overlay district with additional standards to protect wildlife and aquatic habitat found in historic Baylands.

The Zoning Code also includes special provisions that apply to important natural resources located throughout the City. These standards include Division 19.26, Hillside and Ridgeline Protection; Division 19.35, Waterway and Riparian Protection; Division 19.36, Wetland Protection and Restoration; and Division 19.39, Woodland and Tree Preservation.

## 4.3.2 Impact Analysis

## *4.3.2.1. Methodology and Significance Thresholds*

### a. Methodology

The impact analysis is based on available literature regarding the existing biological resources within the Plan Area. Impacts on biological resources were assessed using significance criteria from federal, State, and local regulations. Impacts to flora and fauna may be determined to be significant even if they do not directly affect rare, threatened, or endangered species because development projected by the proposed project may result in indirect impacts to species.

CEQA Statute Section 21001 (c) states that it is the policy of the State of California to "prevent the elimination of fish and wildlife species due to man's activities, ensure that fish and wildlife populations do not drop below self-perpetuating levels, and preserve for future generations representations of all plant and animal communities." Impacts on biological resources may be assessed using impact significance criteria encompassing CEQA guidelines and federal, State and local plans, regulations, and ordinances.

### b. Significance Thresholds

Appendix G of the CEQA Guidelines provides the following general statements to determine that significant impacts to biological resources could occur if a project action would:

1. Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service;
2. Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service;
3. Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including but not limited to, marsh vernal pool, coastal, etc.) through direct removal, filling, or hydrological interruption, or other means;

4. Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites;
5. Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance; and
6. Conflict with the provisions of an adopted Habitat Preservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan.

### *4.3.2.2. Project Impacts and Mitigation Measures*

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|---|---|
| **Threshold 1:** | Would the project have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, regulations, or by the California Department of Fish and Game or US Fish and Wildlife Service? |
| **Threshold 2:** | Would the project have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies regulations, or by the California Department of Fish and Game or US Fish and Wildlife Service? |

**Impact BIO-1 WITH IMPLEMENTATION OF THE GOALS AND POLICIES IN GENERAL PLAN 2035, SENSITIVE BIOLOGICAL RESOURCES WOULD BE PRESERVED AND ENHANCED. HOWEVER, GENERAL PLAN 2035 DOES NOT REQUIRE ASSESSMENT OF SENSITIVE BIOLOGICAL RESOURCES FOR DEVELOPMENT IN SENSITIVE BIOLOGICAL AREAS; THEREFORE, THE PROPOSED PROJECT COULD AFFECT SENSITIVE RESOURCES OR AREAS. IMPACTS WOULD BE POTENTIALLY SIGNIFICANT.**

As indicated in Subsection 4.3.1, *Setting*, a variety of wildlife species are present throughout the City, including various bird and mammal species, although areas that may provide habitat for special-status species in the Plan Area are primarily located in the City’s open space areas. As shown in Figure 4.3-1, there are sensitive natural communities in the General Plan Area that support special status species.

Development of the proposed project would occur where existing roads, water, and sewer are in place and in a manner that minimizes impacts on existing infrastructure and services and preserves natural resources. The majority of development from the proposed project would occur in the four focus areas and the Industrial Parks MPA, which do not support a wide diversity of biological resources. The four focus areas and the Industrial Parks MPA are located in already urbanized areas and the proposed project would not develop existing open space that supports special-status species or sensitive habitats. One of the guiding principles of General Plan 2035 is to preserve and enhance open space, hillsides, ridgelines, creeks, wetlands, and other natural features. In addition, development of the proposed project would be subject to the provisions of the various federal and State natural resources regulations (discussed in Subsection 4.3.1, *Setting*) and their respective permitting processes. Because one of the guiding principles is to preserve and enhance hillsides and ridgelines, among other natural features, the General Plan would be consistent with the Hillside and Ridgeline Protection Ordinance. In addition, the proposed project would be subject to Implementing Ordinance 8 that would modify woodland tree removal mitigation requirements to prioritize replacement planting of native species. Therefore, the updated ordinance would benefit sensitive species by requiring replanting with native species that could be used as habitat.

The General Plan 2035 Environmental Stewardship Chapter contains goals, policies and programs related to reducing impacts on special-status species. In particular, Goals ES 1 and 2 would minimize impacts from potential direct effects to special-status species because these goals would protect, preserve, and enhance natural areas, including woodlands, which serve as habitat for special-status species. Policies under these goals, such as ES 7, would result in less development in environmentally sensitive areas, thus protecting sensitive species. Other policies in the Environmental Stewardship Chapter would minimize direct impacts on sensitive species, specifically Policy ES 1 would protect and enhance creeks and streams, and Policy ES 11 would protect biological resources, including migratory birds, anadromous fish, and threatened and endangered species. Policy ES 11a would involve corporation with state and federal agencies to ensure that development does not adversely affect listed special status species. Additionally, Policy ES 4 would encourage the City and future developers to restore damaged portions of riparian areas to their natural state, including removal of wherever feasible. However, goals, policies, and programs in General Plan 2035 only require protection and enhancement of habitat and do not require any biological assessment of special-status species or inventory of sensitive resources for development on underdeveloped parcels. Therefore, the proposed project may impact special-status resources. Special status species in the four focus areas may also be impacted because the species and appropriate avoidance measures would not be identified prior to project construction. The Industrial Parks MPA is located in an urbanized area and is less likely to have direct impacts on special status species. However, buildout of the Industrial Parks MPA may impact sensitive species in the Bel Marin Keys area, which contains habitat for sensitive species. Impacts may include indirect effects of increased lighting, human disturbance, and pollutants for special status species and their habitats. These impacts may occur near Pacheco Pond and the area along the Arroyo de San Jones where it connects to Pacheco Pond. Therefore, direct impacts on special-status resources would be significant and Mitigation Measures BIO-1 through BIO-3 would be required.

While Environmental Stewardship Goals 1 and 2 would account for some potential direct impacts on sensitive special-status species, there remains the potential for development to result in indirect effects, such as lighting or dust, on sensitive habitat and special-status species in areas adjacent to or near proposed development. Programs contained in the Community Character Chapter would ensure that development is sensitive to the surrounding landscape by developing lighting design guidelines for the City. Specifically, Program CC 12b would include standards for exterior lighting in design guidelines the support Dark Sky principles, addressing issues such as security, appearance, intensity and light spillage. Novato Municipal Code Section 19.22.060 (Light and Glare) requires light or glare from exterior lighting to be shielded or modified to prevent emission of light or glare beyond the property line and Implementing Ordinance 13 would modify lighting performance standards to require Dark Sky certified exterior lighting fixtures in new development. The placement of exterior lights is required to eliminate spillover illumination or glare onto adjoining properties to the maximum extent feasible, and not interfere with the normal operation or enjoyment of adjoining properties. In addition, Section 19.22.060 requires that all non-essential internal and exterior lighting be turned off after 11:00 p.m. (except for uses with extended hours). Additionally, Mitigation Measure AQ-1 in Section 4.2, *Air Quality*, would require a new policy added to the Environmental Stewardship Chapter to ensure compliance with the Bay Area Air Quality Management District basic construction measures to reduce fugitive dust. Therefore, indirect impacts on special status species would be less than significant. Similarly, indirect impacts for special status species in the four focus areas and Industrial Parks MPA would be less than significant because these areas would adhere to the policies and requirements listed above.

In addition, because the presence of species and extent of development on specific sites is not known at this time, it is possible that previously unidentified species are present in the City. General Plan 2035 encourages most development in the urbanized four focus areas which are not directly adjacent to undeveloped natural areas, except for the North, North Redwood Corridor. The North, North Redwood Corridor is adjacent to Mount Burdell to the west. However, compliance with General Plan 2035 goals and policies as well as Mitigation Measures BIO-1 through BIO-3 would ensure that impacts to special status species in the North, North Redwood Corridor would be less than significant. The North Redwood Boulevard Corridor, Downtown, Northwest Quadrant do not contain large undeveloped natural areas. Impacts in these areas would be less than significant.

## Mitigation Measures

The following mitigation measures would be required to reduce impacts on special-status resources.

### *BIO-1 Incorporation of Sensitive Species*

Environmental Stewardship Goal 1 shall be updated in General Plan 2035 to read:

> Preserve, enhance and restore natural areas <u>and features</u>, including Novato's scenic hillsides, waterways, riparian corridors, wetlands ~~and~~ baylands<u>, and special status species</u>.

### *BIO-2 Biological Studies for New Development*

Project applicants shall be required to provide a biological assessment for projects on parcels with indicators of sensitive biological features, such as waterways. The purpose of these assessments is to identify appropriate measures to avoid or minimize harm to sensitive biological resources and to incorporate the recommended measures as conditions of approval for the project. Detailed assessments are not necessary in locations where past and existing development have eliminated natural habitat and the potential for the presence of sensitive biological resources.

### *BIO-3 Biological Resources Inventory for New Development*

A detailed inventory of biological resources conducted by an independent, professionally qualified biologist, plant ecologist, arborist, or appropriately qualified specialist shall be required for projects in sensitive and vulnerable habitats. If sensitive resources are identified on the project site, recommendations to protect the sensitive resources shall conform with applicable State and federal regulations regarding their protection and may include avoidance of the resource, providing setbacks, clustering development onto less sensitive areas, preparing restoration plans, off-site mitigation, and/or other similar measures as determined on a project specific basis.

## Significance After Mitigation

Impacts would be less than significant with implementation of Mitigation Measure BIO-1 to update General Plan 2035 Environmental Stewardship Goal 1 and Mitigation Measures BIO-2 and BIO-3 to require a biological assessment and inventory for projects on parcels with indicators of sensitive biological features.

| **Threshold 1:** | Would the project have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, regulations, or by California Department of Fish and Game or US Fish and Wildlife Service? |
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**Impact BIO-2 IMPLEMENTATION OF THE PROPOSED PROJECT WOULD NOT RESULT IN A REDUCTION IN NESTING OPPORTUNITIES FOR RESIDENT AND MIGRATORY AVIAN SPECIES OF SPECIAL CONCERN BECAUSE OF PRESERVATION AND ENHANCEMENT POLICIES IN GENERAL PLAN 2035 AND COMPLIANCE WITH THE MIGRATORY BIRD TREATY ACT. HOWEVER, DEVELOPMENT PROJECTED BY GENERAL PLAN 2035 MAY IMPACT SPECIAL-STATUS NESTING BIRDS; IMPACTS WOULD BE POTENTIALLY SIGNIFICANT.**

As with most urbanized environments, landscape features within the City, such as trees, shrubs, herbaceous plants, and parklands, could serve as temporary habitats or foraging grounds for wildlife. As discussed in Subsection 4.3.1, *Setting*, migratory avian species that may use portions of the City for nesting during the breeding season are protected under the MBTA. Construction-related activities such as building demolition and/or relocation, grading, materials laydown, access and infrastructure improvements, and building construction, could result in the disturbance of nesting migratory species covered under the MBTA. The most likely direct impact on migratory species would be from vegetation removal, particularly trees that may serve as perching or nesting sites for migratory birds. This could occur in the landscape vegetation and natural areas throughout the City.

Potential direct impacts from removing trees would be limited by General Plan 2035 and the City of Novato Municipal Code. General Plan 2035 Goal ES 4 and related policies and programs listed above would help offset the potential impacts on trees by preserving and enhancing natural areas and promoting tree protection and replacement. Novato Municipal Code Division 19.39, Woodland and Tree Preservation, was developed to conserve native trees, forests, and woodlands on public and private lands during development. The Division requires a tree inventory and Woodland Conservation and Management Plan for any project that is subject to the provisions of the code. In addition, the Division 19.39.040 contains standards for tree and forest retention and mitigation.

Compliance with the MBTA, General Plan 2035 policies, and the Novato Municipal Code would prevent take of migratory bird species and ensure protection of trees during implementation of the proposed project. However, compliance with these regulations and policies would not provide protection specific to nesting birds throughout the Plan Area, including the four focus areas, during project construction. Similarly, trees located in the Industrial Parks MPA area may contain nesting birds that would be impacted during project construction. Therefore, impacts would be significant and mitigation measure BIO-4 would be required.

## Mitigation Measure

The following mitigation measure is required to reduce impacts on nesting birds.

### *BIO-4 Nesting Bird Protection*

All discretionary projects shall retain the services of a qualified biologist(s) to conduct a pre-construction nesting bird survey during the nesting season (February 1 through August 31) prior to any and all development that may remove trees or vegetation that may provide suitable nesting habitat for migratory birds or other special-status bird species. If nests are found the qualified biologist(s) shall identify and the project sponsor shall implement appropriate avoidance measures, such as fenced buffer areas or staged tree removal periods.

## Significance After Mitigation

Impacts would be less than significant with implementation of Mitigation Measure BIO-4 to conduct pre-construction nesting bird surveys and implement avoidance measures as appropriate.

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| **Threshold 3:** | Would the project have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including but not limited to, marsh vernal pool, coastal, etc.) through direct removal, filling, or hydrological interruption, or other means? |

**Impact BIO-3 WHILE IMPLEMENTATION OF THE PROPOSED PROJECT WOULD NOT FACILITATE DEVELOPMENT THAT WOULD DIRECTLY IMPACT RIPARIAN AND WETLAND HABITATS, THERE WOULD BE POTENTIAL FOR ADVERSE INDIRECT IMPACTS FROM SUCH DEVELOPMENT ON WETLANDS AND AREAS UNDER THE JURISDICTION OF CDFW AND USACE. HOWEVER, COMPLIANCE WITH EXISTING REGULATIONS, AND IMPLEMENTATION OF GENERAL PLAN 2035 POLICIES WOULD REDUCE POTENTIAL IMPACTS TO A LESS THAN SIGNIFICANT LEVEL.**

The Novato vicinity consists of several lakes, streams, and creeks including the Petaluma River, Stafford Lake, Novato Creek, Rush Creek, and San Pablo Bay which boarders the eastern edge of the City. Petaluma Creek boarders the eastern portion of Novato and Novato Creek originates in the hills to the west of the City then flows east emptying into the San Pablo Bay.

Wetland and waterway areas may be subject to USACE jurisdiction. Compliance with the requirements of the Clean Water Act would be required for the proposed project. In addition goals, policies, and programs from the Environmental Stewardship Chapter of General Plan 2035 would reduce impacts on federally protected wetlands and riparian habitat. Specifically, Goal ES 1, as well as Policies ES 6 and 10, would reduce impacts on federally protected wetlands and riparian habitat through preservation and enhancement. Policies contained within Goal ES 1 would preserve wetland and riparian habitat during development and require restoration of previously degraded riparian areas as a condition of approval. Wetland preservation and enhancement included in these policies would ensure that the proposed project would not adversely impact protected wetlands and that if wetlands are effected nearby wetlands should be enhanced to offset the impacts from wetland degradation. Additionally, the policies would require habitat management of public water courses and coordination with appropriate agencies for environmental protection efforts. Management of public water courses would ensure that there is sufficient water available to maintain existing wetlands following development of the proposed project. Finally, implementing Ordinance 11 would amend the City's Wetland Protection and Restoration Ordinance to include the protection of special status species as a reason to require an expanded wetland buffer area. An expanded wetland buffer area would provide additional protection for wetlands by providing a distance barrier between development and protected wetlands.

There are no wetlands or riparian habitat in the Industrial Parks MPA because the area is already developed, however it is adjacent to Bel Marin Keys area which contains wetland habitat, such as Pacheco Pond. Impacts to the Northwest Quad, North Redwood Boulevard Corridor, , Downtown, and Industrial Parks MPA area would be reduced through General Plan goals and policies as well as existing regulations. Adherence to General Plan 2035 goals and policies as well as existing regulations would reduce impacts to wetlands and riparian habitats. Impacts on riparian and wetland habitats would be less than significant.

## Mitigation Measures

No mitigation measures required.

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| **Threshold 4:** | Would the project interfere substantially (i.e. direct/indirect reduction) with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites? |

**Impact BIO-4 IMPLEMENTATION OF THE PROPOSED PROJECT WOULD LARGELY AVOID IMPACTS ON WILDLIFE MOVEMENT CORRIDORS BY CONSERVING NATURAL AREAS THROUGH POLICIES IN GENERAL PLAN 2035. HOWEVER, THERE ARE NO SPECIFIC POLICIES PRESERVING WILDLIFE MOVEMENT CORRIDORS AND IMPACTS WOULD BE POTENTIALLY SIGNIFICANT.**

Most development projected by the proposed project would be directed to the four focus areas located in urbanized settings, as well as the Industrial Parks MPA. The proposed project would not encourage development of open spaces within the City and would preserve riparian corridors utilized by wildlife. In addition, General Plan 2035 would preserve riparian corridors utilized by wildlife through specific goals and policies. General Plan 2035 Environmental Stewardship goals and policies would help preserve natural habitat within the City, thus protecting wildlife corridors. Specifically, Policies ES 1 and ES 3 would preserve and enhance wildlife habitat, including creeks and streams that are used as wildlife corridors. Although General Plan 2035 policies would preserve open space and protect sensitive habitats resulting in the protection of wildlife movement corridors, wildlife movement corridor protection is not a stated goal in General Plan 2035. Wildlife movement corridors in the Plan Area, including the four focus areas may be impacted by implementation of the proposed project. Pacheco Pond a wildlife movement corridor located near the Industrial Parks MPA area may also be impacted by the proposed project. Therefore, impacts would be significant and Mitigation Measure BIO-5 would be required.

## Mitigation Measures

The following mitigation measure is required.

### *BIO-5 Wildlife Movement Corridors Protection Policy*

The General Plan Environmental Stewardship Policy ES 3 shall be updated to read:

> **Policy ES 3: *Wildlife Habitat*.** Endeavor to preserve and enhance wildlife habitat areas <u>and important wildlife movement corridors</u> in watercourse areas and control human use of these areas as necessary to protect them.

### *BIO-6 Biological Studies for Wildlife Movement Corridors*

All discretionary projects on parcels with indicators of wildlife movement corridors shall retain the services of a qualified biologist(s) to conduct a biological assessment prior to any and all development that may impact wildlife movement. If movement corridors are potentially impacted by the proposed project, the qualified biologist(s) shall identify appropriate mitigation measures to avoid or minimize the impact. Such measures shall be a condition of approval and implemented by the project sponsor.

## Significance After Mitigation

Impacts would be less than significant with implementation of General Plan 2035 policies and Mitigation Measure BIO-5 to specify preservation of wildlife movement corridors in Policy ES 3 and Mitigation Measure BIO-6 to conduct biological studies for projects that may impacts wildlife movement corridors.

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| **Threshold 5:** | Would the project conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance? |

**Impact BIO-5 IMPLEMENTATION OF THE PROPOSED PROJECT WOULD CONFORM WITH APPLICABLE LOCAL POLICIES PROTECTING BIOLOGICAL RESOURCES AND UNDERSCORE THEIR IMPORTANCE WITH STRENGTHENED POLICY STATEMENTS. IMPACTS WOULD BE LESS THAN SIGNIFICANT.**

Implementation of the proposed project would be subject to all applicable federal, state, and regional policies and regulations related to the protection of important biological resources. Specifically, implementation of the proposed project would be required to comply with the policies and regulations described previously and listed below:

- Federal Endangered Species Act
- Federal Migratory Bird Treaty Act
- California Endangered Species Act
- California Fish and Game Code
- California Environmental Quality Act – Treatment of Special Status Plan and Animal Species

In addition, the proposed project would be required to comply with the provisions of the City of Novato Municipal Code Division 19.39, Woodland and Tree Preservation. Division 19.39, Woodland and Tree Preservation of the Municipal Code was developed to conserve native trees, forests, and woodlands on public and private lands during development. The Division requires a tree inventory and Woodland Conservation and Management Plan for any project that is subject to the provisions of the code. In addition, the Division 19.39.040 contains standards for tree and forest retention and mitigation and Implementing Ordinance 8 would modify woodland tree removal mitigation requirements to prioritize replacement planting of native species.

Other biological protection policies in the Novato Municipal Code would apply to the proposed project. Novato Municipal Code Section 19.36.030, General Wetland Preservation and Enhancement Standards, would apply to any project that would impact wetlands and Novato Municipal Code Section 19.35.060, Watercourse Protection Standards and Design Criteria, would apply to any project that would result in use, alteration, or encroachment to a watercourse.

General Plan 2035 includes policies that would help ensure that future development within the Plan Area would protect the City’s trees, wetlands, and watercourses in compliance with the City’s Municipal Code. Specifically, Goal ES 4 would protect trees and woodlands within Novato. Policies under Goal ES 4, such as Policy ES 23 which requires preserving existing trees for new development, would ensure that General Plan 2035 would help protect the City’s trees. Policies ES 6 and 10 would reduce impacts on federally protected wetlands and riparian habitat through preservation and enhancement and Policy ES 1 would preserve and enhance waterways including creeks and streams. Development in the Plan Area, including four focus areas and Industrial Parks MPA area, would also adhere to these policies and regulations and would not conflict with existing policies protecting biological resources. Therefore, the proposed project would comply with applicable local regulations and impacts would be less than significant.

## Mitigation Measures

No mitigation measures are required.

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| **Threshold 6:** | Would the project conflict with the provisions of an adopted Habitat Preservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan? |

**Impact BIO-6** **IMPLEMENTATION OF THE PROPOSED PROJECT WOULD NOT CONFLICT WITH ANY HABITAT CONSERVATION PLAN OR NATURAL COMMUNITY CONSERVATION PLAN BECAUSE THERE ARE NO SUCH PLANS IN NOVATO. THERE WOULD BE NO IMPACT.**

Novato does not currently have a habitat conservation plan, natural community conservation plan, or any other similar approved plan. Therefore, implementation of General Plan 2035 would not conflict with any habitat conservation plan or natural community conservation plan. In addition, the Industrial Parks MPA area and four focus areas are not located in a designated habitat conservation plan area. There would be no impact.

## Mitigation Measures

No mitigation measures are required.

## Cumulative Impacts

Cumulative development in the County of Marin surrounding Novato in combination with the proposed project may contribute to the loss of foraging and breeding habitat for special status species; contribute to the decline of special status species, fragmentation of habitat and isolation of populations, and decrease movement opportunities. Implementation of the proposed project would increase density and intensity of existing land uses. However, goals and policies contained within General Plan 2035 would conserve existing natural resource and limit impacts on special status species. Furthermore, impacts on biological resources associated with the proposed project would be less than significant with mitigation incorporated. Therefore, the proposed project would have incremental contribution to cumulative impacts associated with biological resources and impacts to biological resources would not be cumulatively considerable. Cumulative impacts would be less than significant.

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# 4.4 Cultural Resources

This section addresses potential impacts on cultural and paleontological resources from implementation of the proposed project.

## 4.4.1 Setting

### a. Cultural Setting

#### Regional Prehistory

During the twentieth century, many archaeologists developed chronological sequences to explain prehistoric cultural changes within all or portions of northern California (c.f., Jones and Klar 2007:308-312; Moratto 1984:248-250). The Town of Windsor lies in the North Coast archaeological region (Moratto 1984: Figure 1). Following Milliken et al. (2007:101-103), the prehistoric cultural chronology for the North Coast can be generally divided into five periods: the Early Holocene (8,000-3500 B.C.), Early Period (3500-500 B.C.), Lower Middle Period (500 B.C. to A.D. 430), the Upper Middle Period (A.D. 430-1050), and the Late Period (A.D. 1050-European contact).

It is presumed that early Paleoindian groups lived in the area prior to 8,000 B.C. However, no evidence for that period has been discovered in the North Coast to date (Milliken et al. 2007:114). Because sea level was much lower prior to 8,000 B.C., it is likely that any such sites may now be underwater. For this reason, the terminal Pleistocene to earliest Holocene Period (ca. 11,700-8,000 B.C.) is not discussed here.

##### *Early Holocene (8,000-3,500 B.C.)*

The Early Holocene in the North Coast is characterized by a mobile forager pattern and the presence of millingslabs, handstones, and a variety of leaf-shaped projectile points, though evidence for this period is limited. It is likely that Holocene alluvial deposits buried many prehistoric sites in the area (Ragir 1972).

##### *Early Period (3,500-600 B.C.)*

The Early Period saw increased sedentism from the Early Holocene as indicated by new ground stone technologies (introduction of the mortar and pestle), an increase in regional trade, and the earliest cut-bead horizon. By 1,500 B.C., mortars and pestles had almost completely replaced millingslabs and handstones. A shift to a sedentary or semi-sedentary lifestyle is marked by the prevalence of mortars and pestles, ornamental grave associations, and shell mounds. The earliest cut bead horizon, dating to this period, is represented by rectangular *Haliotis* (abalone) and *Olivella* (snail) beads from several sites (Milliken et al. 2007:114-115). The advent of the mortar and pestle indicate a greater reliance on processing nuts such as acorns. Faunal evidence from various sites indicates a diverse diet based on mussel and other shellfish, marine mammals, terrestrial mammals, and birds (D’Oro 2009).

##### *Lower Middle Period (500 B.C.-A.D. 430)*

The Lower Middle Period saw numerous changes from the previous period. Rectangular shell beads, common during the Early Period, disappear completely and are replaced by split-beveled and saucer *Olivella* beads. In addition to the changes in beads, *Haliotis* ornaments, bone tools and ornaments, and basketry awls indicating coiled basketry manufacture appeared. Mortars and pestles continued to be the dominant grinding tool (Milliken et al. 2007:115).

### *Upper Middle Period (A.D. 430-1050)*

Around A.D. 430, *Olivella* saucer bead trade networks established during earlier periods collapsed and over half of known sites occupied during the Lower Middle Period were abandoned. *Olivella* saucer beads were replaced with *Olivella* saddle beads. New items appear at sites, including elaborate, decorative blades, fishtail charmstones, new *Haliotis* ornament forms, and mica ornaments. Sea otter bones became more frequent from earlier periods (Milliken et al. 2007:116). Subsistence analysis at various sites dating to this period indicate a diverse diet that included various species of fish, mammal species, bird species, shellfish, and plant resources that varied by location (Hylkema 2002).

### *Late Period (A.D. 1050-contact)*

The Late Period saw an increase in social complexity, indicated by differences in burials, and an increased level of sedentism relative to preceding periods. Small, finely worked projectile points associated with bow and arrow technology appear around A.D. 1250. *Olivella* shell beads disappeared and were replaced with clamshell disk beads. The toggle harpoon, hopper mortar, and magnesite tube beads also appeared during this period (Milliken et al. 2007:116-117). This period saw an increase in the intensity of resource exploitation that correlates with an increase in population. Many of the sites occupied in earlier periods were abandoned, possibly due to fluctuating climate and drought that occurred throughout the Late Period (Lightfoot and Luby 2002).

## Ethnographic Setting

The City of Novato lies within an area traditionally occupied by the Coast Miwok. Coast Miwok territory is centered on Marin and Sonoma Counties, extending roughly from Duncan's Point south to Point Bonita, with the inland boundary east of the Sonoma River (Kelly 1978:414; Kroeber 1925:443). The Miwok Language consists of two dialect groups, the southern, or Marin group, and the western, or Bodega group (Kelly 1978:414).

The pre-contact Coast Miwok inhabited villages made up of conical dwellings, semi-subterranean sweathouses, and dance houses (Kelly 1978:417). Each village had a chief to oversee village affairs and social and ceremonial life was organized around moieties, or dichotomous groups, classed as either Land or Water (Kelly 1978:419).

Coast Miwok subsistence was based on hunting, gathering, and fishing (Kelly 1978: 415-417). Dried acorns and kelp were primary food sources during the winter and early spring when food was scarce. Coast Miwok relied heavily on nearshore fish and shellfish and on fish from rivers, marshes, and the bay. Hunting focused on deer, elk, bear, and small game. The material culture of the Coast Miwok included clamshell disk beads as currency, and a variety of stone tools, shell ornaments, ceremonial artifacts, and baskets (Kelly 1978: 417-418).

## Regional History

Post-European contact history for the state of California is generally divided into three periods: the Spanish Period (1769–1822), the Mexican Period (1822–1848), and the American Period (1848–present).

### *Spanish Period (1769-1822)*

For more than 200 years, Cabrillo and other Spanish, Portuguese, British, and Russian explorers sailed the Alta (upper) California coast and made limited inland expeditions, but they did not establish permanent settlements (Bean 1968; Rolle 2003). In 1579, Francis Drake landed in what was most likely San Francisco Bay. In 1595, Sebastian Cermeño landed in Drake's Bay before returning south (Bean 1968).

Gaspar de Portolá and Franciscan Father Junípero Serra established the first Spanish settlement in Alta California at Mission San Diego de Alcalá in 1769. This was the first of 21 missions erected by the Spanish between 1769 and 1823. Portolá continued north, reaching the San Francisco Bay in 1769. Short on food and supplies, the expedition turned back to San Diego. In 1770, Pedro Fages began his expedition, reaching the San Francisco Bay Area and exploring the region in 1772 (Bean 1968).

In 1770, the mission and presidio at Monterey were founded and three years later Juan Bautista de Anza proposed to open a land route from Sonora to Monterey. The viceroy at the time, Antonio de Bucareli, sanctioned Anza's expedition and proposed he extend it to form a settlement at the bay of San Francisco. Anza's first expedition traveled from Mexico City to Monterey. During this time, various sea expeditions from Monterey discovered Nootka Sound, the Columbia River, and the Golden Gate. Anza's second expedition began in 1775 leading to the establishment of the presidio and mission at San Francisco, Mission Dolores, approximately 22 miles south of the City of Novato (Bean 1968). Spanish colonial activity in the Bay Area concentrated on Mission Dolores and the presidio. Mission San Rafael Arcangel, the mission nearest Novato, was founded in 1817 (California Mission Resource Center 2016).

### *Mexican Period (1822-1848)*

The Mexican Period commenced when news of the success of the Mexican Revolution (1810-1821) against the Spanish crown reached California in 1822. This period saw the federalization of mission lands in California with the passage of the Secularization Act of 1833. This Act enabled Mexican governors in California to distribute former mission lands to individuals in the form land grants. Successive Mexican governors made more than 700 land grants between 1822 and 1846, putting most of the state's lands into private ownership for the first time (Shumway 2007). Rancho Novato, which included the location of the City of Novato, was granted to Fernando Feliz in 1839 by Governor Alvarado. Rancho Nicasio, which included what is now the western portion of the City of Novato, was granted by Governor Micheltorena to Pablo dela Guerra and Juan Cooper in 1844.

The Mexican Period saw an increased importance of sea trade and an influx of American settlers which motivated the United States to expand their territory into California. The United States supported a small group of insurgents from Sonoma during the Bear Flag Revolt. The Bear Flaggers captured Sonoma in June of 1846. The next month, Commodore John Drake Sloat landed in Monterey and proceeded to take Yerba Buena, Sutter's Fort, Bodega Bay, and Sonoma. Fighting between American and Mexican forces continued until Mexico surrendered in 1847 (Rolle 2003).

### *American Period (1848-Present)*

The American Period began with the signing of the Treaty of Guadalupe Hidalgo in 1848, in which the United States agreed to pay Mexico $15 million for the conquered territory, including California, Nevada, Utah, and parts of Colorado, Arizona, New Mexico, and Wyoming. Settlement of California continued to increase during the early American Period. Many ranchos were sold or otherwise acquired by Americans, and most were subdivided into agricultural parcels or towns.

Thanks to the discovery of gold in 1848, California's population grew exponentially. San Francisco grew from a population of 812 to 25,000 in only a few years and became California's first true city (Rolle 2003).

### *City of Novato*

Rancho Novato changed hands and was subdivided several times after it was first granted (Coady 2005). Residential lots were first put up for sale in 1888 and by 1918 First through Seventh Streets were laid out and developed. Novato grew steadily throughout the early twentieth century. In the late 1920s, construction began at Hamilton Air Force Base, resulting in major economic growth for the region and an eventual population boom when World War II brought numerous recruits and their families to the base (Coady 2005, 2006; City of Novato 2014a). The Novato Fire District was formed in 1926, and in 1954 Novato became the first community in Marin County to form a unified school district. In 1960, Novato was incorporated as a City and has continued to grow in population.

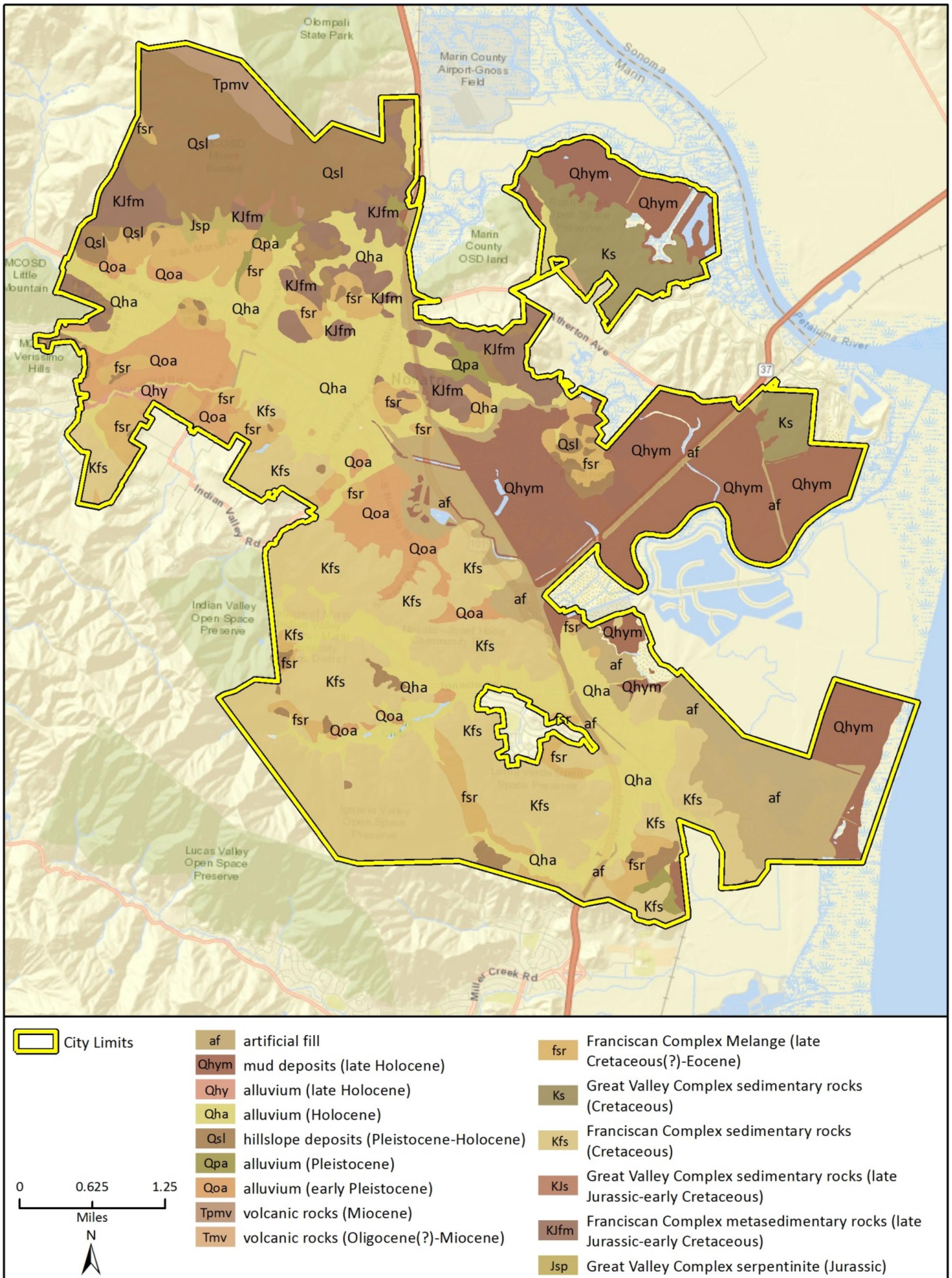
## b. Paleontological Setting

The City of Novato is located in the Novato Creek valley, in the Coast Range geomorphic province. The city is bounded by Olompali State Historic Park to the north, O'Hair Park to the west, Lucas Valley-Marinwood to the south, and the Petaluma River delta and San Pablo Bay to the northeast (Graymer et al. 2006b).

The predominant structural feature in the California Coast Ranges is the San Andreas Fault Zone, which separates two tectonic plates; the Pacific Plate to the southwest of the fault and the North American Plate northeast of the fault. Novato is located in an alluvial valley bound by northwest-southeast trending ridges situated midway between the San Andreas Fault Zone on the west (approximately 13 miles) and the Tolay/Lakeview/Rogers Creek Fault Zone to the east (approximately 7 miles). The Burdell Mountain Fault is within city limits (Graymer et al. 2006a; California Geologic Survey 2002). The Coast Ranges in the Bay Area portion contain Cretaceous to Recent sediments overlying late Cretaceous basement rocks (Graymer et al. 2006b). During the late Cenozoic (Neogene and Quaternary Periods), numerous areas of the Coast Ranges were variably uplifted and downwarped thousands of feet and transposed along lateral faults (Page et al. 1998). All of this relatively late geotectonic dynamism has created a complex series of fault-bounded blocks and depositional basins that have undergone filling and erosion since at least the Miocene. Novato largely falls within one such fault-bounded depositional basin, the Novato Creek valley.

As shown in Figure 4.4-1 and Table 4.4-1, fifteen geologic units, representing hundreds of millions of years, are mapped at the surface within the City of Novato (Graymer et al. 2006b; Rice 1973, 1975; Rice et al. 2002): artificial fill (af), late Holocene mud deposits Qhym), late Holocene alluvium (Qhy), undifferentiated Holocene alluvium (Qha), Pleistocene to Holocene hillslope deposits (Qsl), Pleistocene alluvium (Qpa), early Pleistocene alluvium (Qoa), Miocene volcanic rocks (Tpmv), Oligocene(?) to Miocene volcanic rocks (Tmv), late Cretaceous(?) to Eocene Franciscan Complex Mélange (fsr), Cretaceous Great Valley Complex sedimentary rocks (Ks), Cretaceous Franciscan Complex sedimentary rocks (Kfs), late Jurassic to early Cretaceous Great Valley Complex sedimentary rocks (KJs), late Jurassic Franciscan Complex metasedimentary rocks (KJfm), and Jurassic Great Valley Complex serpentinite (Jsp).

## Figure 4.4-1 Geologic Map of the City of Novato




*Imagery provided by ESRI and its licensors © 2016.*
*Additional data provided by Graymer et al. (2006); Rice et al. (2002); Wagner et al. (2002).*

Fig X Geo Map

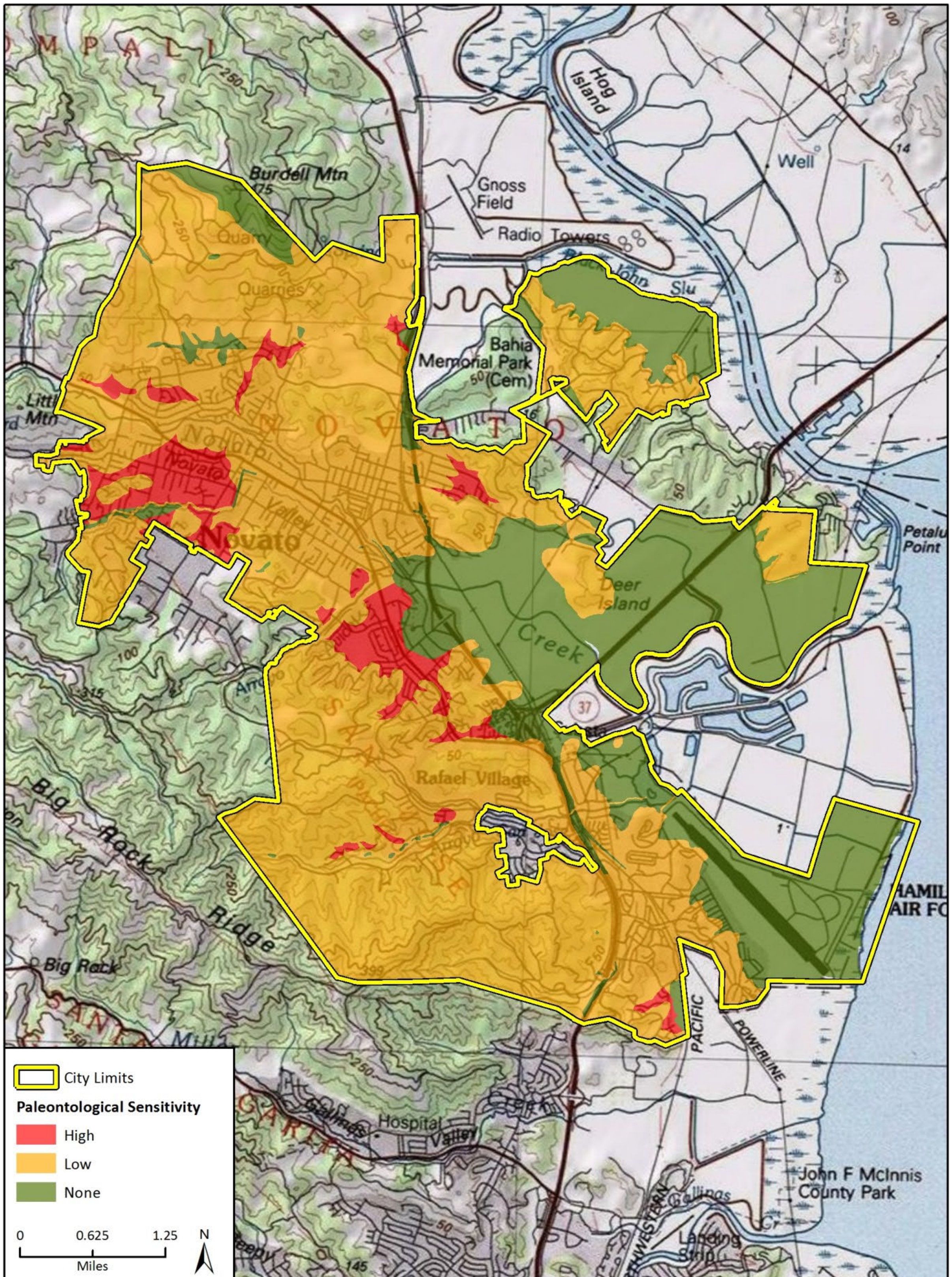
No formal museum searches were conducted for this project, but online fossil collections data from the University of California Museum of Paleontology (UCMP), the Neogene Mammal Mapping Portal (NEOMAP), and the Paleobiology Database (PBDB) was accessed. No fossil localities were discovered in the Plan Area, so paleontological sensitivities of geologic units presented here follow standard conventions as outlined by the Society of Vertebrate Paleontology (2010). Paleontological sensitivities are included in Table 4.4-1 and depicted in Figure 4.4-2.

### Table 4.4-1 Geologic Units within the City of Novato

| Geologic Unit* | Age | Notes | Paleontological Sensitivity (SVP) |
|---|---|---|---|
| Artificial fill (af) | Recent | Human made fill materials | No |
| Late Holocene mud deposits (Qhym) | Late Holocene | No potential to contain significant paleontological resources | No |
| Late Holocene alluvium (Qhy) | Late Holocene | No potential to contain significant paleontological resources | No |
| Holocene alluvium (Qha) | Holocene (undifferentiated) | Potential to contain significant paleontological resources | Low |
| Hillslope deposits (Qsl) | Pleistocene-Holocene | Land slide deposits; Potential to contain significant paleontological resources | Low |
| Pleistocene alluvium (Qpa) | Pleistocene (undifferentiated) | Potential to contain significant paleontological resources | High |
| Pleistocene alluvium (Qoa) | Early Pleistocene | Potential to contain significant paleontological resources | High |
| Volcanic rocks (Tpmv) | Miocene | No potential to contain significant paleontological resources | No |
| Volcanic rocks (Tmv) | Oligocene(?)-Miocene | No potential to contain significant paleontological resources | No |
| Franciscan Complex Mélange (fsr) | Late Cretaceous(?)-Eocene | Potential to contain significant paleontological resources | Low |
| Great Valley Complex sedimentary rocks (Ks) | Cretaceous | Potential to contain significant paleontological resources | Low |
| Franciscan Complex sedimentary rocks (Kfs) | Cretaceous | Potential to contain significant paleontological resources | Low |
| Great Valley Complex sedimentary rocks (KJs) | Late Jurassic-early Cretaceous | Potential to contain significant paleontological resources | Low |
| Franciscan Complex metasedimentary rocks (KJfm) | Late Jurassic-early Cretaceous | Potential to contain significant paleontological resources | Low |
| Great Valley Complex serpentinite (Jsp) | Jurassic | No potential to contain significant paleontological resources | No |

*Source: Graymer et al. 2006b; Rice et al. 2002

**Figure 4.4-2 Paleontological Sensitivity within the City of Novato**




*Imagery provided by ESRI and its licensors © 2016.*

Fig X Paleo Sensitivity

## c. Regulatory Setting

Cultural resources, including built environment and archaeological resources, may be designated as historic by National, State or local authorities. In order for a resource to qualify for listing in the National Register of Historic Places (NRHP), the California Register of Historical Resources (CRHR) or as a locally significant resource, it must meet one or more identified criteria of significance. The resource must also retain sufficient historic integrity, which is defined in National Register Bulletin 15 as the "ability of a property to convey its significance" (National Park Service [NPS] 1990). An explanation of these designations follows.

### Federal

The proposed General Plan does not have a federal nexus and, therefore, compliance with reference to the NHPA and other federal laws is provided here for informational purposes only. Projects that involve federal funding or permitting (i.e., have a federal nexus) must comply with the provisions of the National Historic Preservation Act of 1966 (NHPA), as amended (16 United States Code [U.S.C.] 470f). Cultural resources are considered during federal undertakings chiefly under Section 106 of the National Historic Preservation Act (NHPA) through one of its implementing regulations, 36 Code of Federal Regulations (CFR) 800 (Protection of Historic Properties), as well as the National Environmental Policy Act (NEPA). Properties of traditional religious and cultural importance to Native Americans are considered under Section 101(d)(6)(A) of the NHPA. Other relevant federal laws include the Archaeological Data Preservation Act of 1974, American Indian Religious Freedom Act of 1978, Archaeological Resources Protection Act of 1979, and Native American Graves Protection and Repatriation Act of 1989.

#### *National Historic Preservation Act (NHPA) of 1966 (16 U.S.C. §§ 470 Et Seq.)*

NHPA is a federal law created to avoid unnecessary harm to historic properties. The NHPA includes regulations that apply specifically to federal land-holding agencies, but also includes regulations (Section 106) that pertain to all projects funded, permitted, or approved by any federal agency that have the potential to affect cultural resources. Provisions of NHPA establish a National Register of Historic Places (maintained by the National Park Service), the Advisory Council on Historic Preservation, State Historic Preservation Office (SHPO), and federal grants-in-aid programs.

##### NATIONAL REGISTER OF HISTORIC PLACES

The NRHP was established by the National Historic Preservation Act NHPA of 1966 as "an authoritative guide to be used by Federal, State, and local governments, private groups and citizens to identify the Nation's cultural resources and to indicate what properties should be considered for protection from destruction or impairment" (CFR 36 CFR 60.2). The NRHP recognizes properties that are significant at the national, state, and local levels. To be eligible for listing in the NRHP, a resource must be significant in American history, architecture, archaeology, engineering, or culture. Districts, sites, buildings, structures, and objects of potential significance must also possess integrity of location, design, setting, materials, workmanship, feeling, and association. A property is eligible for the NRHP if it is significant under one or more of the following criteria:

**Criterion A:** It is associated with events that have made a significant contribution to the broad patterns of our history;

**Criterion B:** It is associated with the lives of persons who are significant in our past;

**Criterion C:** It embodies the distinctive characteristics of a type, period, or method of construction, or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components may lack individual distinction; and/or

**Criterion D:** It has yielded, or may be likely to yield, information important in prehistory or history.

### *Secretary of the Interior's Standards*

The Secretary of the Interior is responsible for establishing professional standards and providing guidance related to the preservation and protection of all cultural resources listed in or eligible for listing in the NRHP.

### *American Indian Religious Freedom Act of 1978 (42 U.S.C. §§ 1996 and 1996a)*

The American Indian Religious Freedom Act of 1978 and Native American Graves and Repatriation Act of 1990 (25 U.S.C. §§ 3001 et seq.) establishes that traditional religious practices and beliefs, sacred sites, and the use of sacred objects shall be protected and preserved.

### *Archaeological and Paleontological Salvage (23 USC 305)*

Statute 23 USC 305 amends the Antiquities Act of 1906. Specifically, it states:

> "Funds authorized to be appropriated to carry out this title to the extent approved as necessary, by the highway department of any State, may be used for archaeological and paleontological salvage in that state in compliance with the Act entitled "An Act for the preservation of American Antiquities," approved June 8, 1906 (PL 59-209; 16 USC 431-433), and State laws where applicable."

This statute allows funding for mitigation of paleontological resources recovered pursuant to federal aid highway projects, provided that "excavated objects and information are to be used for public purposes without private gain to any individual or organization" (Federal Register [FR] 46(19):9570).

### *Paleontological Resources Preservation Act of 2009*

The Paleontological Resources Preservation Act (PRPA) is part of the Omnibus Public Land Management Act of 2009 (Public Law 111-011 Subtitle D). This act directs the Secretary of the Interior or the Secretary of Agriculture to manage and protect paleontological resources on federal land, and develop plans for inventorying, monitoring, and deriving the scientific and educational use of such resources. It prohibits the removal of paleontological resources from federal land without a permit issued under this Act, establishes penalties for violation of this act and establishes a program to increase public awareness about such resources. As of May 18, 2015, the U.S. Department of Agriculture has implemented a new rule that "provides for the preservation, management, and protection of paleontological resources on National Forest System Lands (NFS), and insures that these resources are available for current and future generations to enjoy as part of America's national heritage. The rule addresses the management, collection, and curation of paleontological resources from NFS lands including management using scientific principles and expertise, collecting of resources with and without a permit, curation in an approved repository, maintaining confidentiality of specific locality data, and authorizing penalties for illegal collecting, sale, damaging, or otherwise altering or defacing paleontological resources".

## State

### *California Environmental Quality Act*

CEQA requires a lead agency to analyze whether historic and/or archaeological resources may be adversely impacted by a proposed project. Under CEQA, a "project that may cause a substantial adverse change in the significance of a historic resource is a project that may have a significant effect on the environment" (California PRC Section 21084.1). Answering this question is a two-part process: first, the determination must be made as to whether the proposed project involves cultural resources; second, if cultural resources are present, the proposed project must be analyzed for a potential "substantial adverse change in the significance" of the resource.

With regards to paleontological resources, CEQA Guidelines (Article 1, §15002(a)(3)) state that CEQA is intended to prevent significant, avoidable damage to the environment by requiring changes in projects through the use of alternatives or mitigation measures when the governmental agency finds the changes to be feasible. If paleontological resources are identified during the Preliminary Environmental Analysis Report, or other initial project scoping studies (e.g., Preliminary Environmental Study), as being within the proposed project area, the sponsoring must take those resources into consideration when evaluating project effects. The level of consideration may vary with the importance of the resource.

#### CALIFORNIA REGISTER OF HISTORICAL RESOURCES

The California Register of Historical Resources (CRHR) is a guide to cultural resources that must be considered when a government agency undertakes a discretionary action subject to CEQA. The CRHR helps government agencies identify, evaluate, and protect California's historical resources, and indicates which properties are to be protected from substantial adverse change (Pub. Resources Code, Section 5024.1(a)). The CRHR is administered through the State Office of Historic Preservation (SHPO) that is part of the California State Parks system.

A cultural resource is evaluated under four CRHR criteria to determine its historical significance. A resource must be significant at the local, state, or national level in accordance with one or more of the following criteria set forth in the State CEQA Guidelines at Section 15064.5(a)(3):

1) It is associated with events that have made a significant contribution to the broad pattern of California's history and cultural heritage;
2) It is associated with the lives of persons important in our past;
3) It embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of an important creative individual, or possesses high artistic values; or
4) It has yielded, or may be likely to yield, information important in prehistory or history.

In addition to meeting one or more of the above criteria, the California Register requires that sufficient time must have passed to allow a "scholarly perspective on the events or individuals associated with the resource." Fifty years is used as a general estimate of the time needed to understand the historical importance of a resource according to SHPO publications. The California Register also requires a resource to possess integrity, which is defined as "the authenticity of a historical resource's physical identity evidenced by the survival of characteristics that existed during the resource's period of significance. Integrity is evaluated with regard to the retention of location, design, setting, materials, workmanship, feeling, and association." Archaeological resources can sometimes qualify as "historical resources" [State CEQA Guidelines, Section 15064.5(c)(1)].

According to CEQA, all buildings constructed over 50 years ago and that possess architectural or historical significance may be considered potential historic resources. Most resources must meet the 50-year threshold for historic significance; however, resources less than 50 years in age may be eligible for listing on the CRHR if it can be demonstrated that sufficient time has passed to understand their historical importance.

In addition, if a project can be demonstrated to cause damage to a unique archaeological resource, the lead agency may require reasonable efforts to permit any or all of these resources to be preserved in place or left in an undisturbed state. To the extent that resources cannot be left undisturbed, mitigation measures are required (PRC, Section 21083.2[a], [b], and [c]).

PRC, Section 21083.2(g) defines a unique archaeological resource as an artifact, object, or site about which it can be clearly demonstrated that, without merely adding to the current body of knowledge, there is a high probability that it meets any of the following criteria:

1) Contains information needed to answer important scientific research questions and that there is a demonstrable public interest in that information; or
2) Has a special and particular quality such as being the oldest of its type or the best available example of its type; or
3) Is directly associated with a scientifically recognized important prehistoric or historic event or person.

Two other programs are administered by the state: California Historical Landmarks and California "Points of Historical Interest." California Historical Landmarks are buildings, sites, features, or events that are of statewide significance and have anthropological, cultural, military, political, architectural, economic, scientific or technical, religious, experimental, or other historical value. California Points of Historical Interest are buildings, sites, features, or events that are of local (city or county) significance and have anthropological, cultural, military, political, architectural, economic, scientific or technical, religious, experimental, or other historical value.

Impacts to significant cultural resources that affect the characteristics of any resource that qualify it for the NRHP or adversely alter the significance of a resource listed in or eligible for listing in the CRHR are considered a significant effect on the environment. These impacts could result from physical demolition, destruction, relocation, or alteration of the resource or its immediate surroundings such that the significance of an historical resource would be materially impaired (CEQA Guidelines, Section 15064.5 [b][1], 2000). Material impairment is defined as demolition or alteration in an adverse manner [of] those characteristics of an historical resource that convey its historical significance and that justify its inclusion in, or eligibility for inclusion in, the California Register… (CEQA Guidelines, Section 15064.5[b][2][A]).

### *Codes Governing Human Remains*

Section 15064.5 of the CEQA Guidelines also assigns special importance to human remains and specifies procedures to be used when Native American remains are discovered. The disposition of human remains is governed by Health and Safety Code Section 7050.5 and PRC Sections 5097.94 and 5097.98, and falls within the jurisdiction of the NAHC. If human remains are discovered, the County Coroner must be notified within 48 hours and there should be no further disturbance to the site where the remains were found. If the remains are determined by the coroner to be Native

American, the coroner is responsible for contacting the NAHC within 24 hours. The NAHC, pursuant to PRC Section 5097.98, will immediately notify those persons it believes to be most likely descended from the deceased Native Americans so they can inspect the burial site and make recommendations for treatment or disposal.

## Local

### *Novato Zoning Code*

Section 19.16.060 of the Novato Zoning Code establishes standards and regulations for the Historic (H) overlay district. The purpose of the H overlay district is to "protect areas and structures identified by the community as historically significant elements that contribute to Novato's cultural, social, economic, political, aesthetic, architectural heritage, identity, and character." The development of new structures, demolition, or alteration of existing structures and establishment of new uses within the H district require Design Review approval and must be consistent with specified design standards. Any request for demolition approval must include an evaluation of the architectural significance of the structure prepared by a qualified person approved by the City.

### *City of Novato Municipal Code Section 4-7*

Novato Municipal Code Section 4-7, Cultural Resources, establishes procedures for preserving and studying cultural resources, defined as sites, structures, artifacts and physical remains which existed prior to 1860. The code requires approval of an Archaeological Investigation Permit by the City prior to construction activity that would disturb cultural resources. Application for the permit is required to be made in a form acceptable to the community development director and accompanied by a standard fee. The Code also requires that records of cultural resources be kept at San Francisco State University, Sonoma State University, the Marin Miwok Museum, and the City Community Development Department.

## d. Existing Conditions

There is one NRHP-listed cultural resource, the Fashion Shop and Stephen Porcella House, located within the City (OHP 2018). The Stephen Porcella House is located at 1009 Reichert Way, and consists of what was once the home and blacksmith shop constructed, owned, and operated by Porcella, the last Novato blacksmith, beginning in 1894 (NPS 1980). The Sweetser Mansion at 50 Rica Vista is listed on the CRHP and is eligible for listing on the National Register. Now known as Trumball Manor, mansion was built in 1866 and was originally the home of the Sweetser and DeLong families, who planted extensive fruit orchards along Novato Creek.

Novato has a discontiguous historic district, listed on the NRHP and CRHP, that encompasses parts of the Hamilton Army Air Field. The Hamilton Army Airfield Discontiguous Historic District was constructed in Southern Novato on the shore of the San Pablo Bay and utilized during World War II. One Point of Historical Interest, the Pioneer Memorial Cemetery, is located within Pioneer Park on Simmons Lane. Additionally, the city of Novato has 54 locally designated cultural resources, each consisting of built environment resources. These are listed in General Plan 2035 Table B-2 in Appendix B (City of Novato 1996).

## 4.4.2 Impact Analysis

### a. Methodology and Significance Thresholds

Under CEQA, any project that may cause a substantial adverse change in the significance of a historical resource would also have a significant effect on the environment. According to Appendix G of the *CEQA Guidelines*, impacts related to cultural resources from the proposed project would be significant if the project would:

1 Cause a substantial adverse change in the significance of an historical resource as defined in Section 15064.5
2 Cause a substantial adverse change in the significance of an archaeological resource pursuant to Section 15064.5
3 Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature of paleontological or cultural value
4 Disturb any human remains, including those interred outside of dedicated cemeteries

### Cultural Resources

The significance of a cultural resource and subsequently the significance of any impact is determined by among other things, consideration of whether that resource can increase our knowledge of the past. The determining factors are site content and degree of preservation. A finding of archaeological significance follows the criteria established in the *CEQA Guidelines*.

CEQA Guidelines Section 15064.5 (Determining the Significance of Impacts to Archaeological Resources) states:

> (3) […] Generally, a resource shall be considered by the lead agency to be “historically significant” if the resource meets the criteria for listing on the CRHR (Pub. Res. Code, § 5024.1, Title 14 CCR, Section 4852).
>
> (4) The fact that a resource is not listed in, or determined to be eligible for listing in the CRHR, not included in a local register of historical resources (pursuant to section 5020.1(k) of the Public Resources Code), or identified in an historical resources survey (meeting the criteria in section 5024.1(g) of the Public Resources Code) does not preclude a lead agency from determining that the resource may be an historical resource as defined in Public Resources Code sections 5020.1(j) or 5024.1.
>
> (b) A project with an effect that may cause a substantial adverse change in the significance of an historical resource is a project that may have a significant effect on the environment.

Historical resources are “significantly” affected if there is demolition, destruction, relocation, or alteration of the resource or its surroundings. Generally, impacts to historical resources can be mitigated to below a level of significance by following the Secretary of the Interior’s Guidelines for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring, and Reconstructing Historic Buildings or the Secretary of the Interior’s Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings [Guidelines § 15064.6(b)]. In some circumstances, documentation of an historical resource by way of historic narrative photographs or architectural drawings will not mitigate the impact of demolition below the level of significance [Guidelines § 15126.4(b)(2)]. Preservation in place is the preferred form of mitigation for archaeological resources as it retains the relationship between artifact and context, and may avoid conflicts with groups associated with the site [Guidelines § 15126.4 (b)(3)(A)]. If an archaeological resource does not meet either the historic resource or the more specific "unique archaeological resource" definition, impacts do not need to be mitigated [Guidelines § 15064.5(e)]. Where the significance of a site is unknown, it is presumed to be significant for the purpose of the EIR investigation.

## Paleontological Resources

Paleontological sensitivity refers to the potential for a geologic unit to produce scientifically significant fossils. Direct impacts to paleontological resources occur when earthwork activities, such as grading or trenching, cut into the geologic deposits (formations) within which fossils are buried and physically destroy the fossils. Since fossils are the remains of prehistoric animal and plant life, they are considered to be nonrenewable. Such impacts have the potential to be significant and, under the CEQA guidelines may require mitigation. Sensitivity is determined by rock type, past history of the geologic unit in producing significant fossils, and fossil localities recorded from that unit. Paleontological sensitivity is derived from the known fossil data collected from the entire geologic unit, not just from a specific survey.

The discovery of a vertebrate fossil locality is of greater significance than that of an invertebrate fossil locality, especially if it contains a microvertebrate assemblage. The recognition of new vertebrate fossil locations could provide important information on the geographical range of the taxa, their radiometric age, evolutionary characteristics, depositional environment, and other important scientific research questions. Vertebrate fossils are almost always significant because they occur more rarely than invertebrates or plants. Thus, geological units having the potential to contain vertebrate fossils are considered the most sensitive.

The SVP outlines in its Standard Procedures for the Assessment and Mitigation of Adverse Impacts to Paleontological Resources (SVP 2010) guidelines for categorizing paleontological sensitivity of geologic units within a project area. These guidelines describe sedimentary rock units as having a high, low, undetermined, or no potential for containing significant nonrenewable paleontological resources. This criterion is based on rock units within which vertebrates or significant invertebrate fossils have been determined by previous studies to be present or likely to be present. Significant paleontological resources are fossils or assemblages of fossils, which are unique, unusual, rare, uncommon, diagnostically or stratigraphically, taxonomically, or regionally. While these standards were specifically written to protect vertebrate paleontological resources, all fields of paleontology have adopted these guidelines. Rincon has evaluated the paleontological sensitivity of the Plan Area according to the SVP categories; the results are discussed below.

### *High Potential (Sensitivity)*

Rock units from which significant vertebrate or significant invertebrate fossils or significant suites of plant fossils have been recovered are considered to have a high potential for containing significant non-renewable fossiliferous resources. These units include but are not limited to, sedimentary formations and some volcanic formations which contain significant nonrenewable paleontological resources anywhere within their geographical extent, and sedimentary rock units temporally or lithologically suitable for the preservation of fossils. Sensitivity comprises both (a) the potential for yielding abundant or significant vertebrate fossils or for yielding a few significant fossils, large or small, vertebrate, invertebrate, or botanical and (b) the importance of recovered evidence for new and significant taxonomic, phylogenetic, ecologic, or stratigraphic data. Areas which contain potentially datable organic remains older than Recent, including deposits associated with nests or middens, and areas that may contain new vertebrate deposits, traces, or trackways are also classified as significant.

#### *Low Potential (Sensitivity)*

Sedimentary rock units that are potentially fossiliferous, but have not yielded fossils in the past or contain common and/or widespread invertebrate fossils of well documented and understood taphonomic, phylogenetic species and habitat ecology. Reports in the paleontological literature or field surveys by a qualified vertebrate paleontologist may allow determination that some areas or units have low potentials for yielding significant fossils prior to the start of construction. Generally, these units will be poorly represented by specimens in institutional collections and will not require protection or salvage operations. However, as excavation for construction gets underway significant and unanticipated paleontological resources could be encountered and require a change of classification from Low to High Potential and, thus, require monitoring and mitigation if the resources are found to be significant.

#### *Undetermined Potential (Sensitivity)*

Specific areas underlain by sedimentary rock units for which little information is available are considered to have undetermined fossiliferous potentials. Field surveys by a qualified vertebrate paleontologist to specifically determine the potentials of the rock units are required before programs of impact mitigation for such areas may be developed.

#### *No Potential*

Rock units of metamorphic or igneous origin are commonly classified as having no potential for containing significant paleontological resources.

In general terms, for geologic units with high sensitivity, full-time monitoring typically is recommended during any project-related ground disturbance. For geologic units with low sensitivity, protection or salvage efforts typically are not required. For geologic units with undetermined sensitivity, field surveys by a qualified paleontologist are usually recommended to specifically determine the paleontological potential of the rock units present within the study area. For geologic units with no sensitivity, a paleontological monitor is not required.

## b. Project Impacts and Mitigation Measures

| | |
|---|---|
| **Threshold 1:** | Would the project cause a substantial adverse change in the significance of a historical resource as defined in CEQA Guidelines §15064.5? |

**Impact CUL-1 IMPLEMENTATION OF THE PROPOSED PROJECT HAS THE POTENTIAL TO IMPACT HISTORICAL RESOURCES. IMPACTS WOULD BE POTENTIALLY SIGNIFICANT.**

Based on CEQA Guidelines §15064.5, the proposed project – and future development activities facilitated by the proposed project, including development in the four focus areas and the Industrial Parks MPA – would have a significant impact on historical resources if they would cause a substantial adverse change in the significance of a historical resource. Historical resources include properties eligible for listing on the NRHP, the CRHR, and local designation. In addition, as explained in Section 15064.5, "[s]ubstantial adverse change in the significance of an historical resource means physical demolition, destruction, relocation, or alteration of the resource or its immediate surroundings such that the significance of an historical resource would be materially impaired."

Although there are no specific development projects associated with the proposed project, implementation of the proposed project would guide development in the Plan Area though the year 2035, directing development in the four focus areas and the Industrial Parks MPA area. Two NRHP-listed cultural resources, the Fashion Shop and Stephen Porcella House, located in the Downtown focus area, and the Hamilton Airfield Discontiguous Historic District, and one California Point of Historical Interest, the Pioneer Memorial Cemetery, are located within the City. In addition, many buildings are over 50 years in age and are potentially eligible for listening on the NRHP, CRHR, or local designation. Therefore, development under the proposed project could affect known or unknown historical resources.

Similarly, the proposed project promotes reinvestment and revitalization of the Northwest Quadrant Neighborhood through development of carefully designed housing. This neighborhood is predominantly residential in character and consists of single- and multi-family residential properties. Many of these buildings are over 50 years of age and have potential to be historical resources as properties that are eligible for federal, state, or local designation. The neighborhood-specific zoning code would help to ensure that new development is consistent with the existing setting of the neighborhood. However, Municipal Code revisions as part of the proposed project will allow for demolition of single-family residences, which has the potential to result in the demolition of unknown historical resources and result in significant adverse impacts to the environment. The proposed project Community Character Chapter contains goals, policies and programs related to reducing impacts on cultural resources. In particular, Policy CC 1 would require the identification and protection of historic resources. However, impacts on historical resources can only be determined once a specific project has been proposed because the effects are highly dependent on both the individual resource and the characteristics of the proposed activity. Similarly, development in the four focus areas and Industrial Parks MPA would comply with General Plan 2035 Policy CC1, but would remain potentially significant because characteristics of these projects have not yet been determined. Therefore, historical resource impacts would be significant and Mitigation Measure CR-1 would be required. Archaeological resources that may be considered historical resources are addressed under Threshold 2.

## Mitigation Measures

The following Mitigation Measure is required.

### *CUL-1 Historical Resources Study Program*

All discretionary projects shall investigate the potential to impact historical resources. A historical resources evaluation shall be performed to confirm the presence of historical resources within the project site when there is a structure(s) or feature of a type, period, and/or method of construction that could be qualified as having historic status. The study shall, at a minimum, be conducted by a qualified professional meeting the Secretary of the Interior's (SOI) Professional Qualification Standard (PQS) for architectural history (NPS 1983). The study shall include a pedestrian survey of the project site and background research including a records search at the Northwest Information Center (NWIC), building permit research, and/or research with the local historical society(ies). The subject property(ies) and/or structures shall be evaluated for federal, state, and local designation on California Department of Parks and Recreation 523 series forms, included as an appendix to the study. If historical impacts are identified, the study shall include recommendations to avoid or reduce impacts on historical resources and the project sponsor shall implement the recommendations or conduct additional environmental review.

## Significance After Mitigation

The implementation of Mitigation Measure CUL-1 would reduce impacts on historical resources to a less than significant level by requiring historical resource studies for projects within the City and the implementation of further requirements to avoid or reduce impacts on those resources on a project-by-project basis.

| | |
|---|---|
| **Threshold 2:** | Would the project cause a substantial adverse change in the significance of an archaeological resource pursuant to CEQA Guidelines §15064.5? |

### Impact CUL-2 IMPLEMENTATION OF THE PROPOSED PROJECT HAS THE POTENTIAL TO IMPACT ARCHAEOLOGICAL RESOURCES. IMPACTS WOULD BE POTENTIALLY SIGNIFICANT.

Effects on archaeological resources can only be determined once a specific project has been proposed because the effects are highly dependent on both the individual project site conditions and the characteristics of the proposed ground-disturbing activity. Ground-disturbing activities associated with development facilitated by the proposed project, including development in the four focus areas and the Industrial Parks MPA, particularly in areas that have not previously been developed with urban uses, have not been studied through a cultural resources investigation, or when excavation depths exceed those previously attained, have the potential to damage or destroy previously-unknown historic or prehistoric archaeological resources that may be present on or below the ground surface. Consequently, damage to or destruction of previously-unknown sub-surface cultural resources could occur as a result of development under the proposed General Plan.

The Great Places Chapter contains goals, policies and programs related to reducing impacts on cultural resources. Specifically, Policy CC 2 would require the recognition of the importance of archaeological resources and the implementation of measures to preserve such resources. However, impacts on archaeological resources can only be determined once a specific project has been proposed because the effects are highly dependent on both the individual resource and the characteristics of the proposed activity. Similarly, development in the four focus areas and Industrial Parks MPA would comply with General Plan 2035 Policy CC 2, but would remain potentially significant because characteristics of these projects have not yet been determined. Therefore, impacts on archaeological resources, including those that may be considered historical resources, would be potentially significant and Mitigation Measure CUL-2 would be required.

## Mitigation Measures

The following Mitigation Measure is required.

### *CUL-2 Archaeological Resources Study Program*

All discretionary projects shall investigate the potential to disturb archaeological resources. If preliminary reconnaissance suggests that cultural resources may exist, a Phase I cultural resources study shall be performed by a qualified professional meeting the Secretary of the Interior's (SOI) Professional Qualification Standard (PQS) for archaeology (NPS 1983). A Phase I cultural resources study shall include a pedestrian survey of the project site and sufficient background research and, as necessary, field sampling to determine whether archaeological resources may be present. Archival research shall include a records search at the Northwest Information Center (NWIC) and a Sacred Lands File (SLF) search with the Native American Heritage Commission (NAHC). The Phase I technical report documenting the study shall include recommendations to avoid or reduce impacts on archaeological resources. The project sponsor shall implement the recommendations.

## Significance After Mitigation

The implementation of Mitigation Measure CUL-2 would reduce impacts on archaeological resources to a less than significant level by requiring historical resource studies for projects within the City and the implementation of further requirements to avoid or reduce impacts on those resources on a project-by-project basis.

| | |
|---|---|
| **Threshold 3:** | Would the project directly or indirectly destroy a unique paleontological resource or site or unique geologic feature of paleontological or cultural value? |

**Impact CUL-3 DEVELOPMENT PROJECTED BY THE PROPOSED PROJECT HAS THE POTENTIAL TO IMPACT PALEONTOLOGICAL RESOURCES. IMPACTS WOULD BE POTENTIALLY SIGNIFICANT.**

Paleontological resources may be present in fossil-bearing sediments and geologic units either at or below the ground surface. Ground-disturbing activities in geologic units with high paleontological sensitivity, as shown in Figure 4.4-2, have the potential to damage or destroy paleontological resources that may be present. Therefore, ground-disturbing activities resulting from implementation of the proposed project, including development in the four focus areas and the Industrial Parks MPA, could damage or destroy fossils in these geologic units resulting in a potentially significant impact.

Effects on paleontological resources can only be determined once a specific project has been proposed because the effects are highly dependent on both the individual project site conditions (in this case, the geologic setting) and the characteristics of the proposed ground-disturbing activity. Ground-disturbing activities associated with development facilitated by the proposed project, particularly in areas that have not previously been developed with urban uses, have not been studied through a paleontological resources investigation, or when excavation depths exceed those previously attained, have the potential to damage or destroy paleontological resources that may be present on or below the ground surface, especially in areas mapped as high paleontological sensitivity in the Pleistocene alluvial units (Figure 4.4-2). Consequently, damage to or destruction of fossils could occur as a result of development projected by the proposed General Plan. The four focus areas and Industrial Parks MPA area are not included in areas with high geologic sensitivity. As shown in Figure 4.4-2 the four focus areas are identified as having low paleontological sensitivity, while the Industrial Parks MPA area is identified as having no geologic sensitivity.

General Plan 2035 does not include any goals, policies, or implementation plans related to paleontological resources. Therefore, impacts on paleontological resources would be significant and Mitigation Measure CUL-3 would be required.

## Mitigation Measures

The following Mitigation Measure is required.

### *CUL-3 Paleontological Resource Studies*

**A**voidance and/or mitigation for potential impacts to paleontological resources shall be required for any discretionary development proposal in Novato that occurs within high sensitivity geologic units (Pleistocene alluvium [Qpa] and Pleistocene alluvium [Qoa] deposits), whether they are mapped at the surface or occur at the subsurface. When paleontological resources are uncovered during site excavation, grading, or construction activities, work on the site will be suspended until the significance of the fossils can be determined by a qualified paleontologist. If significant resources are determined to exist, the paleontologist shall make recommendations for protection or recovery of the resource.

The City shall require the following specific measures for projects that could disturb geologic units with high paleontological sensitivity:

- **Retain a Qualified Paleontologist to Prepare a PMMP.** Prior to initial ground disturbance, the project applicant shall retain a Qualified Paleontologist, as defined by the SVP (2010), to direct all mitigation measures related to paleontological resources and design a Paleontological Mitigation and Monitoring Program (PMMP) for the project. The PMMP shall include measures for a preconstruction survey, a training program for construction personnel, paleontological monitoring, fossil salvage, curation, and final reporting, as applicable.

## Significance After Mitigation

Implementation of Mitigation Measure CUL-3 would reduce impacts on paleontological resources to a less than significant level by including an implementation program requiring paleontological resource studies for projects in high sensitivity geological units within the City and implementation of a Paleontological Mitigation and Monitoring Program to avoid or reduce impacts to such resources on a project-by-project basis.

| | |
|---|---|
| **Threshold 4:** | Would the project disturb any human remains, including those interred outside of dedicated cemeteries? |

**Impact CUL-4 GROUND-DISTURBING ACTIVITIES ASSOCIATED WITH IMPLEMENTATION OF THE PROPOSED PROJECT COULD RESULT IN DAMAGE TO OR DESTRUCTION OF HUMAN BURIALS. HOWEVER, WITH COMPLIANCE WITH EXISTING REGULATIONS, IMPACTS WOULD BE LESS THAN SIGNIFICANT.**

Human burials outside of formal cemeteries often occur in prehistoric archeological contexts. These resources could be present in areas where development has not yet occurred. Excavation during construction activities in the City could disturb these resources, including Native American burials.

Human burials, in addition to being potential archaeological resources, have specific provisions for treatment in PRC Section 5097. The California Health and Safety Code (Sections 7050.5, 7051, and 7054) has specific provisions for the protection of human burial remains. Existing regulations address the illegality of interfering with human burial remains, and protects them from disturbance, vandalism, or destruction, and established procedures to be implemented if Native American skeletal remains are discovered. PRC Section 5097.98 also addresses the disposition of Native American burials, protects such remains, and established the NAHC to resolve any related disputes.

Development projected by the proposed project, including in the four focus areas and Industrial Parks MPA area, would be required to adhere to existing regulations regarding the treatment of human remains. Thus, impacts would be less than significant.

## Mitigation Measures

No mitigation measures are required.

## Cumulative Impacts

Cumulative development in in County of Marin surrounding Novato in combination with development proposed under the proposed project may contribute to impacts on cultural resources as growth occurs in the region. The increase in growth from cumulative development may impact existing and previously undisturbed and undiscovered historical, archaeological, and paleontological resources. While most cultural resources are typically site-specific, with impacts that are project-specific, others may have regional significance; for example, an historical structure that represents the last known example of its kind. For such a resource, cumulative impacts, and the contribution of the proposed project to them, would be potentially significant. Mitigation measures outlined in this section would reduce impacts associated with the proposed project to a less than significant level.

# 4.5 Geology and Soils

This section addresses the potential physical environmental effects related to seismic hazards, underlying soil characteristics, slope stability, erosion, and existing mineral resources within the City of Novato from implementation of the proposed project.

## 4.5.1 Setting

### a. Regional Geology

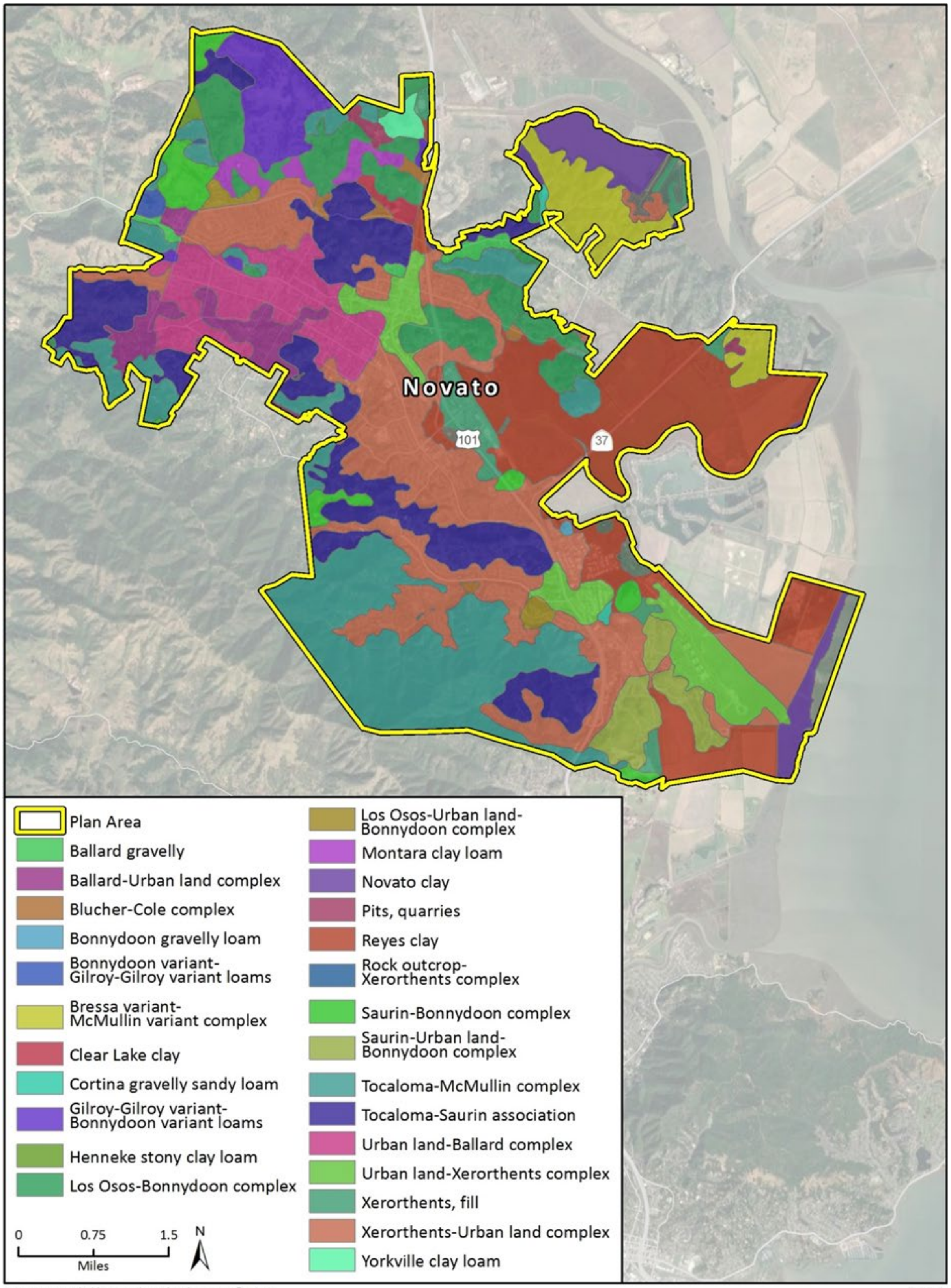
The City of Novato is located in northern Marin County in the San Francisco Bay Area and lies within the Coast Ranges geomorphic province (DOC 2002). This geomorphic province runs nearly parallel to the San Andreas Fault, beginning in the Central Coast and extending north to the State boundary. It is bounded by the Pacific Ocean to the west and includes the Santa Cruz Mountains and the Diablo Range (Elder 2016). The Coast Ranges are composed of thick Mesozoic and Cenozoic sedimentary strata. The northern and western portion of Novato is underlain by Franciscan assemblages consisting of a mixture of metamorphosed sandstone, shale, volcanics, serpentine, and chert. The eastern area is underlain by Great Valley sequence rock, which is mostly shale that has been deposited in a deep-marine setting, with thick bodies of sandstone and minor conglomerate.

The San Francisco Bay Region is situated on a plate boundary marked by the San Andreas Fault system, which forms the tectonic boundary between the Pacific Plate and the North American Plate. The region consists of several northwest trending active and potentially active faults. Movement along this plate boundary is distributed across a complex system of strike-slip, right-lateral, parallel and sub-parallel faults. In the Novato area, these include the San Andreas, Burdell Mountain, Tolay, Rodgers Creek, and Hayward fault zones. The nearest potentially active fault is the Burdell Mountain Fault (City of Novato 2014a).

### b. Local Geologic Setting

Novato is a suburban city bordered by undeveloped hillsides, open space, wetlands, bay plains and the Petaluma River, which leaves much of the surface soils exposed in the City and surrounding areas. The elevation of the City ranges from sea level to 1,558 feet above sea level at the highest point on Burdell Mountain (City of Novato 2014a). Like much of Marin County bordering San Francisco Bay, the Novato area has hills and ridges underlain by ancient rocks that are part of a dissected highland. These rocks have been partly buried within the last 10,000 years by highly compressible, semi-fluid, silty clay alluvium deposits known as bay mud that is unstable (Rice 1973). Areas of engineered fill placed over bay mud are found in the central to southeastern area between Hamilton Air Force Base and Bel Marin Keys, between the Northwest Pacific Railroad and Highway 101 in the vicinity of Novato Creek, and southward to Novato Boulevard and south of Highway 37. Engineered levee fill is found in low lying areas along Novato Creek near the Petaluma River and along roads associated with Hamilton Air Force Base. Engineered fill is also used in scattered areas of low elevation, primarily below Highway 101 and the railroad (City of Novato 2014a). In other areas, surficial soils vary considerably in type with over fifteen types of soil present, as shown on Figure 4.5-1. These soils are predominantly of the mollisols and entisols soil order. Within these soil orders, the most abundant soil series include the Ballard Series, Boonydoon Series, Tocaloma Series, McMullin Series, Saurin Series, and Reyes clay series, in the form of components, or more than one soil type; such as the Urban land-Ballard complex located at the northwest end of the Plan Area, the Tocaloma- Boonydoon complex, and the Tocaloma-Saurin association located intermittently

## Figure 4.5-1 Soil Types

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throughout the Plan Area. The following provides a description of the most abundant soil series found in Novato.

### Ballard Series

The Ballard Series is a fine-loamy soil found on terraces and slopes of 0 to 15 percent. This soil is a deep, well-drained soil with a slow to medium runoff classification.

### Boonydoon Series

The Boonydoon Series is a loamy shallow soil found on uplands with slopes of 5 to 85 percent. This soil is a shallow, somewhat excessively drained soil with a medium to very rapid runoff classification.

### Tocaloma Series

The Tocaloma Series is a fine-loamy soil found on hills with slopes that vary between 2 to 75 percent. This soil is a moderately deep, well-drained soil with a slow to very rapid runoff classification.

### McMullin Series

The McMullin Series is a loamy soil found on ridges and north-facing slopes between 1 to 75 percent. This soil is shallow, well and somewhat excessively drained with a medium to very rapid runoff classification.

### Saurin Series

The Saurin Series is a fine-loamy soil found on hills that vary between 2 to 75 percent. This soil is a moderately deep, well-drained soil with a slow to very rapid runoff classification.

### Reyes Clay Series

The Reyes Clay Series is a fine soil found in reclaimed and protected marsh areas with slopes of 0 to 2 percent. These soils are somewhat poorly drained with a very slow runoff or ponded runoff classification. Reyes Clay is located north and south of Highway 37. (USDA NRCS 2018a)

## c. Seismic Hazards

Northern California is a region of high seismic activity. Similar to most cities in the region, Novato is subject to risks associated with potentially destructive earthquakes. The City of Novato lies in a seismically active region of Northern California with several major active faults, including the San Andreas, Burdell Mountain, Tolay, Rodgers Creek, and Hayward fault zones. Figure 4.5-2 identifies faults in the General Plan Area. The Burdell Mountain Fault is the nearest potentially active fault and is located within Novato’s Plan Area (City of Novato 2014a). The type and magnitude of seismic impacts on the General Plan Area are dependent on the distance to the epicenter of the earthquake, the nature of the fault on which the earthquake is located, and the intensity and magnitude of the seismic event.

## Faults

The California Geological Survey (CGS) establishes criteria for classification of faults as Holocene-active, Pre-Holocene, and Age-undetermined faults. Holocene-active faults are faults that have had surface displacement during the past 11,700 years. Surface displacement can be recognized by the existence of cliffs in alluvium, terraces, offset stream courses, fault troughs and saddles, the alignment of depressions, sag ponds, and the existence of steep mountain fronts. Pre-Holocene faults are faults that have not moved in the past 11,700 years, thus do not meet the criteria of "Holocene-active fault" as defined in the Alquist-Priolo Earthquake Fault Zoning Act (A-P Act) and State Mining and Geology Board (SMGB) regulations [California Code of Regulations, Title 14, Division 2, Section 3601(a)]. This class of fault may still be capable of surface rupture, but is not regulated under the A-P Act. Age-undetermined faults are faults where the recency of fault movement has not been determined. Faults can be "age-undetermined" if the fault in question has simply not been studied in order to determine its recency of movement. Within the framework of the A-P Act, age-undetermined faults within regulatory Earthquake Fault Zones can be considered Holocene-active until proven otherwise (California Geological Survey [CGS] 2018). Numerous faults in the Novato area are categorized as Holocene-active, Pre-Holocene, or Age-undetermined faults.

## Regional Faults

Earthquakes from several Holocene-active and Pre-Holocene faults in the San Francisco Bay region could affect future development that would be facilitated by the proposed project, although no known regional faults directly traverse the City. Figure 4.5-2 shows regional faults around the Plan Area. A summary of the Holocene-active faults nearest to the City of Novato is provided below.

### *San Andreas Fault Zone*

This fault zone runs southeast to northwest and is located approximately 13.7 miles west of the City at the nearest point (City of Novato 2014a). The fault zone extends over 700 miles from the Gulf of California north to the Cape Mendocino area where it continues northward along the ocean floor. The length of the fault and its active seismic history indicates that it has a very high potential for large-scale movement in the near future (7.9 Moment Magnitude [Mw]), and should be considered important in land use planning for most cities in California. The most recent large earthquake on the San Andreas Fault to affect the Bay Area was the Loma Prieta earthquake in 1989, which had a Mw of 6.9.

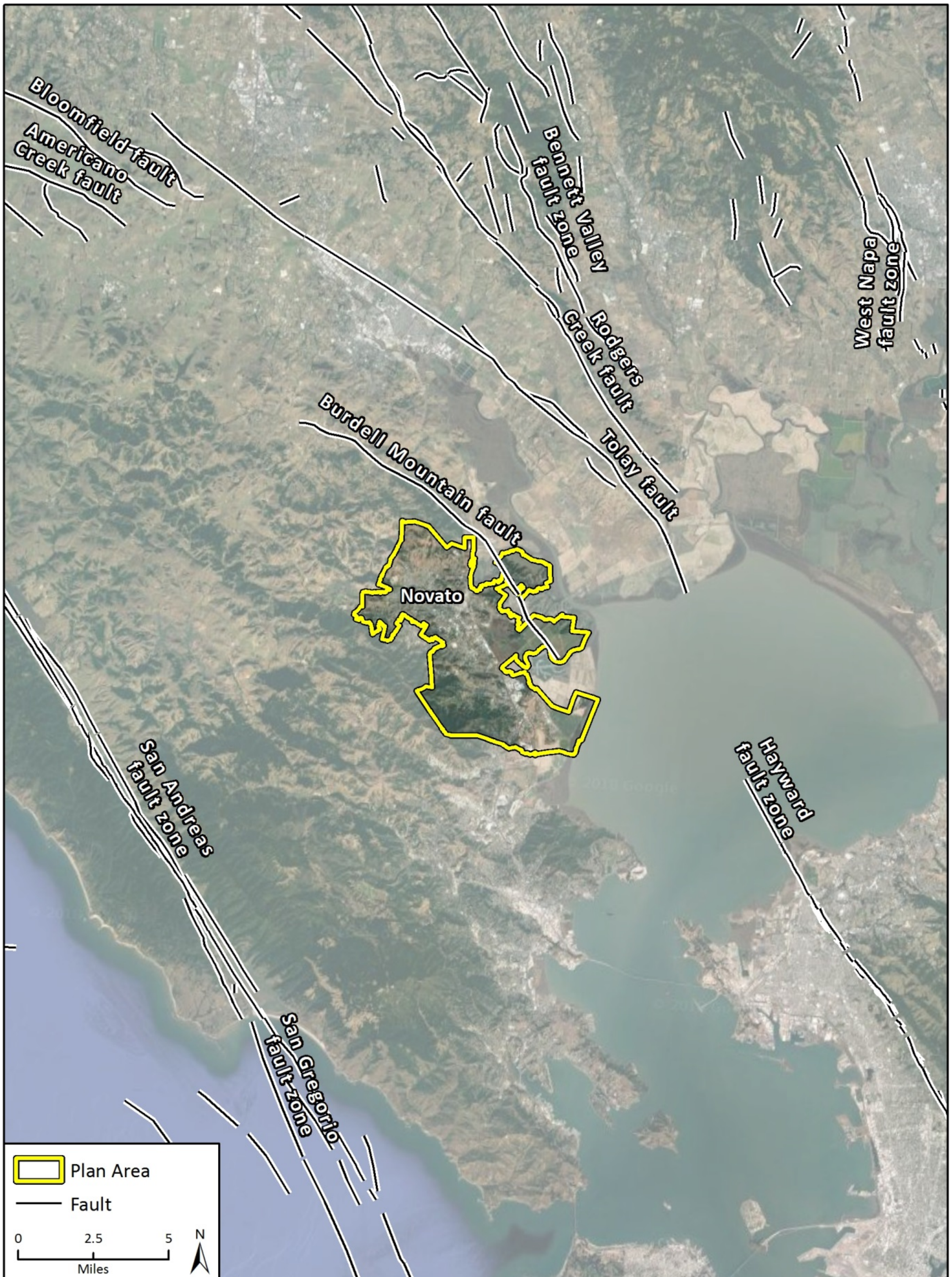
### *Rodgers Creek Fault Zone*

The Rodgers Creek Fault runs through the northern San Francisco Bay Area and links two active creeping faults: the Hayward Fault to the southeast and the Maacama Fault to the northwest. It is located approximately 4.8 miles northeast of Novato and has a maximum potential magnitude of 7.0 Mw. While no major earthquake has historically occurred along the Rodgers Creek Fault (City of Novato 2014a), it is seismically active and two intermediate magnitude (5.6 and 5.7) occurred near Santa Rosa in 1969. There is also evidence that the fault slipped about 2 meters (Mw of about 7) in the 18th century (Funning et al. 2007).

### *Hayward Fault Zone*

The Hayward Fault zone runs northwest for about 74 miles along the east side of the San Francisco Bay and is located approximately 13.7 miles southeast from Novato at its closest point. In 2015, scientists discovered that it is smoothly linked to the Rodgers Creek Fault (Watt 2015). It is predicted

**Figure 4.5-2 Regional Fault Types**

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*Fault data provided by Bryant, W. A. (compiler), 2005, Digital Database of Quaternary and Younger Faults from the Fault Activity Map of California, version 2.0: CGS.*

that the Rodgers-Hayward system together could produce a maximum magnitude 7.2 earthquake and it is possible that a seismic event on either fault would result in movement on the other fault.

## Local Faults

### *Burdell Mountain Fault*

The Burdell Mountain Fault runs to the northwest beginning within Novato's Plan Area. It is considered potentially active (City of Novato 2014a).

### *Tolay Fault*

The Tolay Fault runs for about 600 meters northwest beginning 4.8 miles northeast of Novato. It is considered Pre-Holocene (City of Novato 2014a), though there has been little, if any displacement along the fault zone (Wagner et al. 2007).

## Recent Seismic Activity

Historically, earthquakes have caused substantial groundshaking in the San Francisco Bay Area region, and include the following major (magnitude of 5.0 or greater) quakes: the 1906 Great San Francisco earthquake (magnitude 7.8 on Richter scale) along the San Andreas Fault; the 1911 Morgan Hill earthquake (magnitude 6.5), along the Calaveras Fault; the 1979 Coyote Lake earthquake (magnitude 6.0); the 1980 Livermore earthquake (magnitude 6.0), along the Mt. Diablo-Greenville Fault; the 1984 Morgan Hill earthquake (magnitude 6.3), along the Calaveras Fault; the 1989 Loma Prieta earthquake (magnitude 7.1) along the San Andreas fault; the 2001 Napa earthquake earthquake north of Pomona (magnitude 5.3); the 1991 Sierra Madre earthquake (magnitude 5.8); the 1992 Landers area earthquake (magnitude 7.4); and the 1994 Northridge earthquake (magnitude 5.1), along the West Napa fault; and a 5.6 quake along the Calaveras Fault (EarthquakeSafety 2018).

# d. Surface Rupture and Groundshaking

## Surface Rupture

Surface rupture represents the breakage of ground along the surface trace of a fault, which is caused by the intersection of the fault surface area ruptured in an earthquake with the Earth's surface. Fault displacement occurs when material on one side of a fault moves relative to the material on the other side of the fault. This can have particularly adverse consequences when buildings are located within the rupture zone. It is not feasible, from a structural or economic perspective, to design and build structures that can accommodate rapid displacement involved with surface rupture. Amounts of surface displacement can range from a few inches to tens of feet during a rupture event.

The Alquist-Priolo Earthquake Fault Zoning Act (A-P Act) regulates development near active faults to mitigate the hazard of surface fault rupture. Essentially, this Act contains two requirements: (1) it prohibits the location of most structures for human occupancy across the trace of active faults; and (2) it establishes Earthquake Fault Zones and requires geologic/seismic studies of all proposed developments within 1,000 feet of the zone. The Earthquake Fault Zones are delineated and defined by the State Geologist and identify areas where potential surface rupture along a fault could occur. The City is not located within an Alquist-Priolo Earthquake Fault Zone. The Rodgers Creek Fault

Zone, the nearest Alquist-Priolo Earthquake Fault Zone, is the located 4.6 miles northeast of the Plan Area (California Department of Conservation [CA DOC] 2018a).

### Groundshaking

The major cause of structural damage from earthquakes is groundshaking. The intensity of ground motion expected at a particular site depends upon the magnitude of the earthquake, the distance to the epicenter, and the geology of the area between the epicenter and the property. Greater movement can be expected at sites located on poorly consolidated material, such as alluvium, within close proximity to the causative fault, or in response to a seismic event of great magnitude. Groundshaking could occur in Novato at a magnitude of 6.9 to 7.9 on the Richter scale (City of Novato 2014a).

## e. Secondary Seismic Effects

Potential hazards resulting from the secondary effects of ground-shaking include: liquefaction, subsidence, and earthquake-induced landslides. The potential for tsunami inundation of the City (which may occur as a result of strong seismic events) are discussed in Section 4.8, *Hydrology and Water Quality*, with details on the designated tsunami inundation area discussed in Section 4.8.1.e and shown on Figure 4.8-5. Soil-disturbing activities such as grading, soil compaction, and cut and fill activities can create or exacerbate conditions that increase the chance of such effects during or independent of seismic activity.

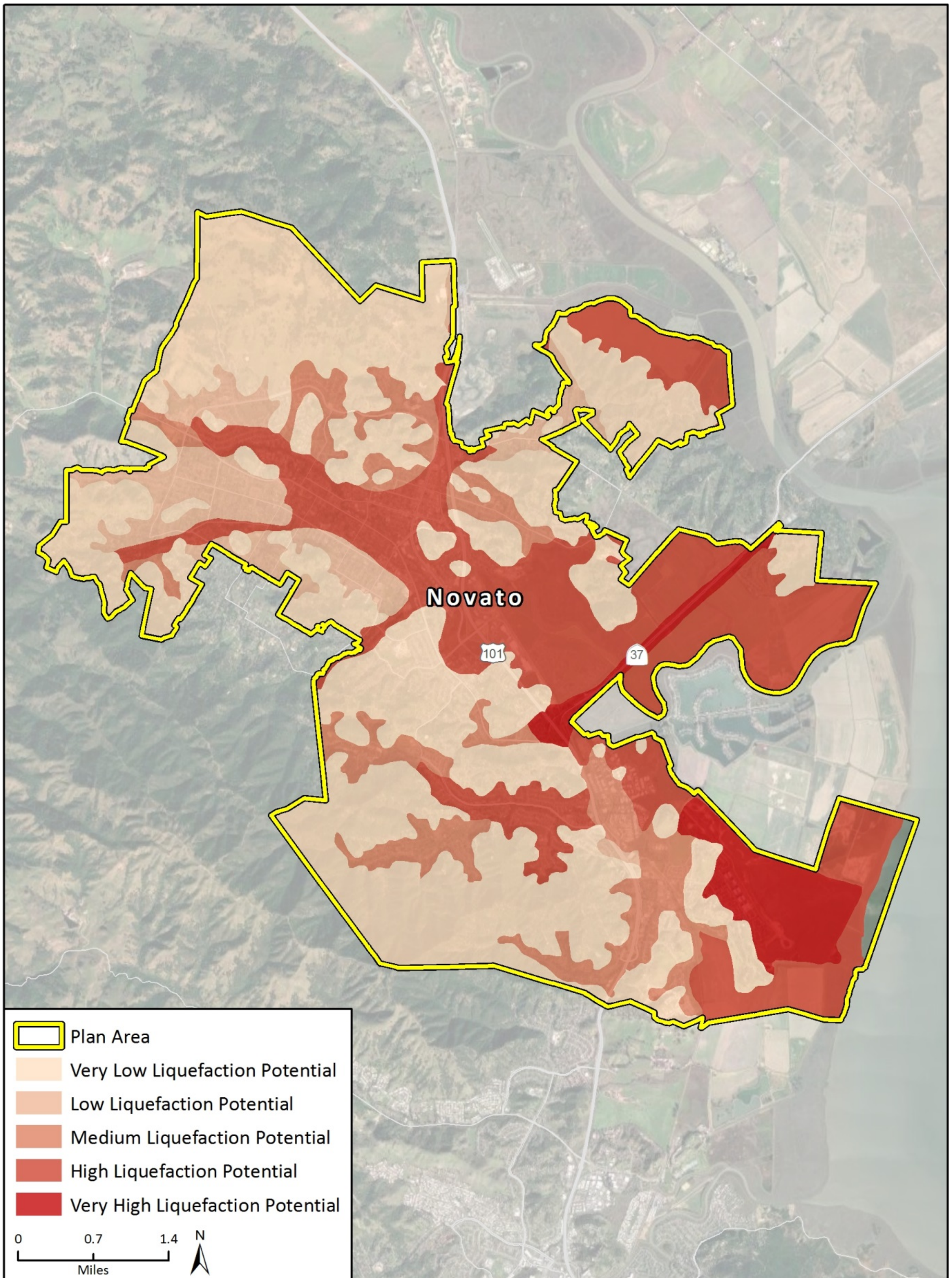
### Liquefaction

Liquefaction is a phenomenon that occurs in soils where granular sediment or fill material either contain, or lie immediately above, high moisture content. Groundshaking or other rapid loading can reduce the strength and stiffness of a soil and transform it momentarily from a solid state to a liquid state. Buildings in areas that experience liquefaction may suddenly sink or suffer major structural damage. Novato includes areas with soils highly susceptible to liquefaction primarily in the low-lying area of fill near San Pablo Bay. Bay mud (Early to Late Pleistocene deposits and Holocene estuarine deposits) is considered to have a medium liquefaction potential and blanket much of the city east of Highway 101. Generally, low-lying areas within the mapped 100- or 500-year floodplain will be more prone to liquefaction, especially where underlain by fill. Upland areas in the city have low potential for liquefaction (City of Novato 2017, United States Geological Survey 2018). Figure 4.5-3 illustrates liquefaction potential throughout the General Plan Area.

### Landslides and Slope Stability

Seismic ground shaking can also result in landslides and other slope instability. Landslides occur when slopes become unstable and masses of earth material move downslope. Landslides are usually rapid events, often triggered during periods of rainfall or by earthquakes. Mudslides and slumps are a more shallow type of slope failure. They typically affect the upper soil horizons rather than bedrock features. Usually mudslides and slumps occur during or soon after periods of rainfall, but they can be triggered by seismic shaking. As shown in Figure 4.5-4**,** the lower elevation areas of the General Plan Area have no or low landslide potential due to relatively flat grades, while landslides do commonly occur in upland areas, or surrounding hillsides of the City. However, the Novato conglomerate in hilly areas is relatively stable with a low risk of landslide. Many of the hills have shallow soil with Franciscan bedrock very close to the surface, resulting in low to moderate landslide potential (City of Novato 2014a).

**Figure 4.5-3 Liquefaction Risk**

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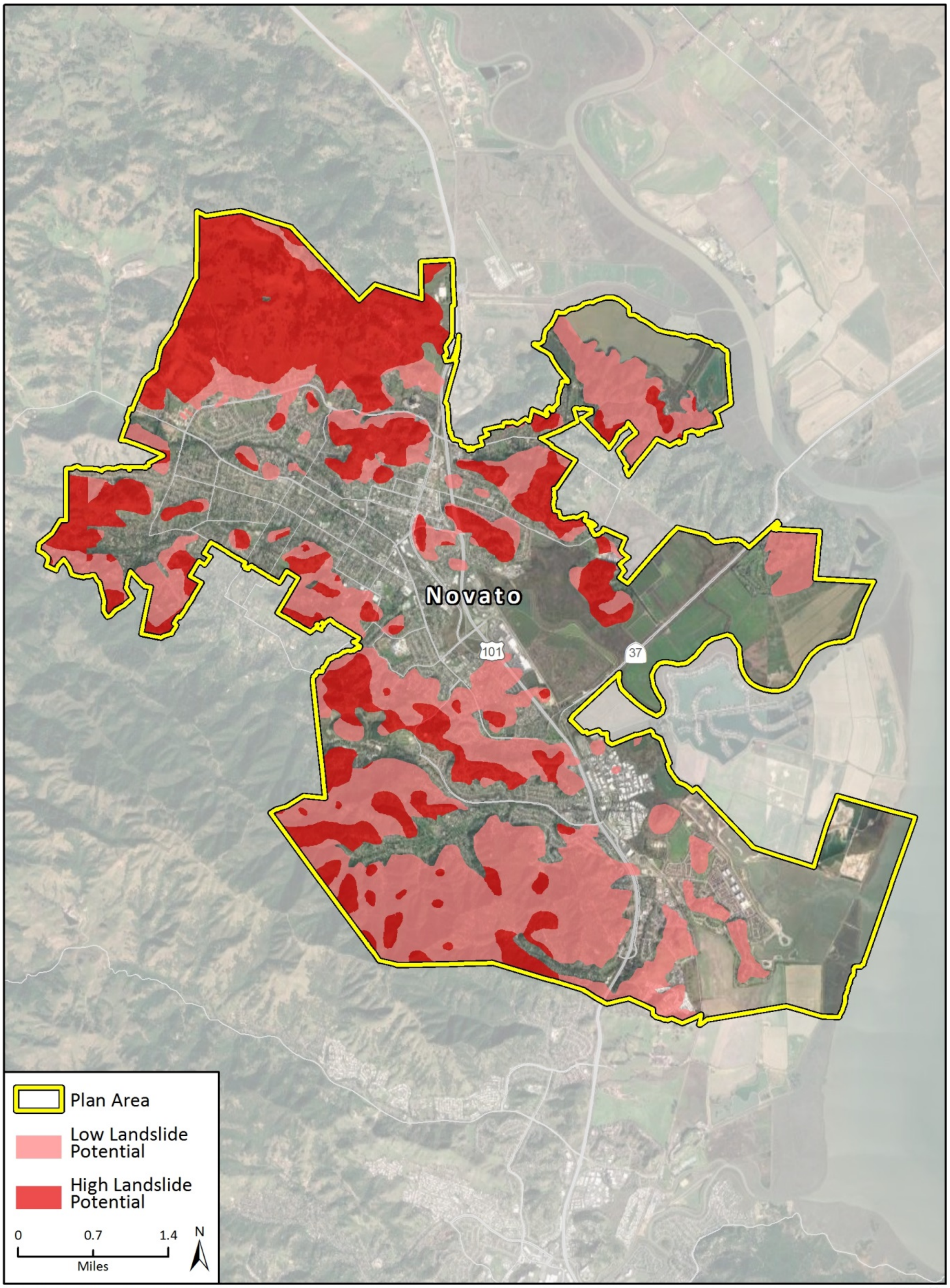
*Additional data provided by NRCS 2018.*

**Figure 4.5-4 Landslides**

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## f. Other Geologic Hazards

Some of the geotechnical hazards discussed above, such as subsidence, landslides and slope instability, can be triggered by or occur independently of seismic events. Others, such as subsidence, expansive soils, and soil erosion occur independently of seismic events, and are discussed here.

### Subsidence

Subsidence refers to the sinking of a large area of ground surface in which material is displaced vertically with little or no horizontal movement. Subsidence originates at great depths below the surface when subsurface pressure is reduced by the natural loss or human withdrawal of fluids (e.g. groundwater, natural gas, or oil), or can occur due to soil compression. Subsidence is common in diked baylands, such as areas of Novato near San Pablo Bay, because of the highly compressible nature of fill. Areas susceptible to earthquake-induced settlement include those areas underlain by thick layers of colluvial material or un-engineered fill. Fill in the Bahia Marsh in Novato has settled approximately 6 to 18 inches in the past 40 years. Land subsidence has occurred within the low lying areas, mainly along the Bay margins. The loss of water within the Bay Mud along the Bay margins has led to subsidence, and many areas, such as the former Hamilton Air Force Base, are now below mean sea level and require pumping to drain (City of Novato 2014a).

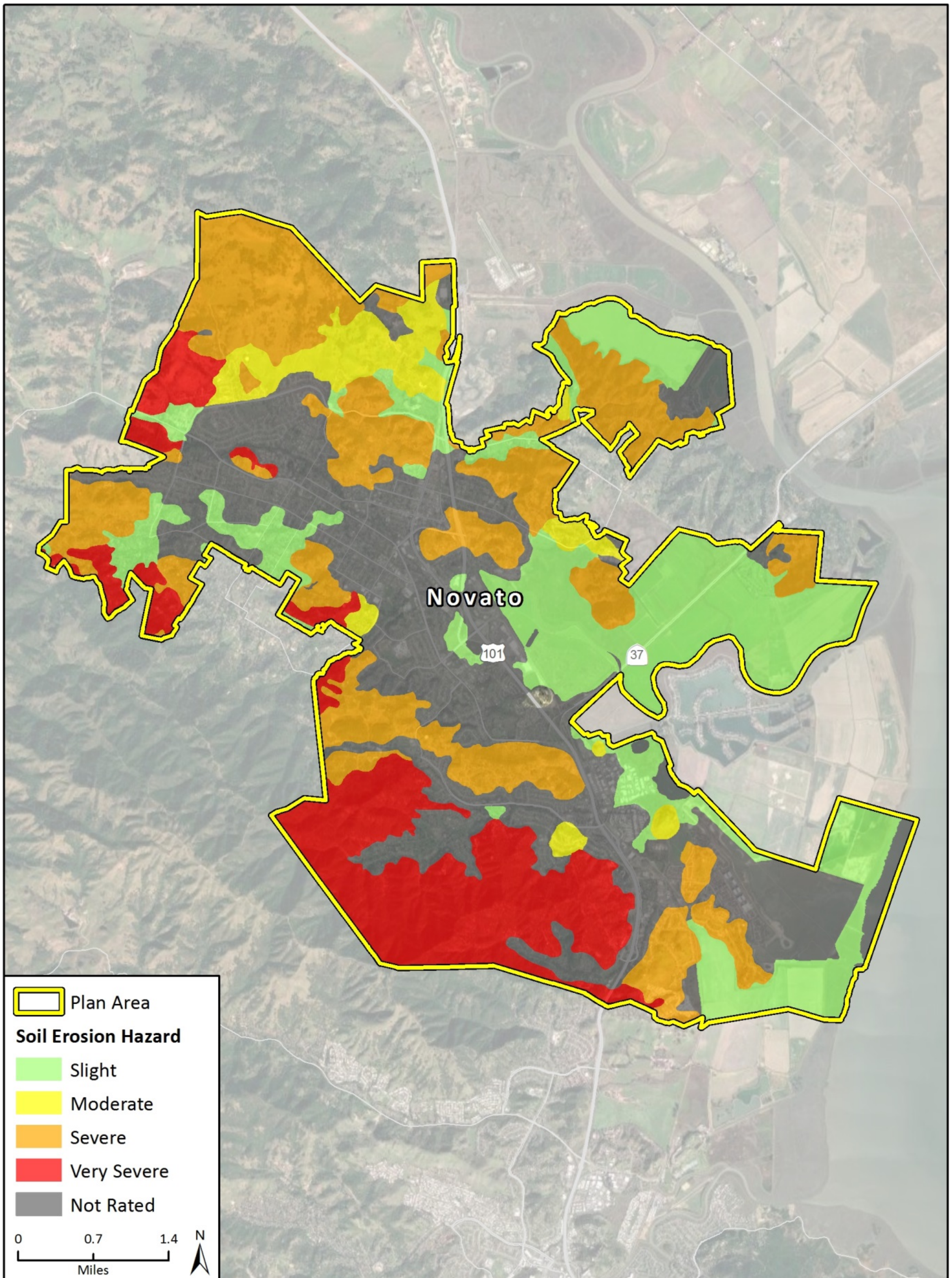
### Expansive Soils

Expansive soils swell with increases in moisture content and shrink with decreases in moisture content. These soils usually contain high clay content. Foundations for structures constructed on expansive soils require special design considerations. Because expansive soils can expand when wet and shrink when dry, they can cause foundations, basement walls and floors to crack, causing substantial structural damage. As such, structural failure due to expansive soils near the ground surface is a potential hazard. Soils with no or low expansion potential occur along stream and river valleys and on steep mountain slopes. Soils of high expansion potential generally occur east of Highway 101 (City of Novato 2014a, USDA NRCS 2018b).

### Soil Erosion

Erosion refers to the removal of soil by water or wind. Factors that influence erosion potential include the amount of rainfall and wind, the length and steepness of the slope, and the amount and type of vegetative cover. Depending on how well protected the soil is from these forces; the erosion process can be very slow or rapid. Removal of natural or manufactured protection can result in substantial soil erosion and excessive sedimentation and pollution problems in streams, lakes, and estuaries. Construction activities represent the greatest potential cause of erosion. In Marin County, continuous soil mass movement causes substantial slope erosion and landslides, particularly debris flows. Throughout the county, debris flows are most prevalent during winter seasons with intense rainfall (Marin County 2007). As shown on Figure 4.5-5, the potential for very severe soil erosion occurs at the southwest end of the Plan Area, and is associated with the Tocaloma-McMullin complex, Boonydoon variant-Gilroy-Gilroy variant loams, the Saurin-Boonydoon complex, and the Tocaloma-Saurin association; all components of the soil series described under *Local Geologic Setting* above. Severe soil erosion occurs throughout the Plan Area, although mostly in the western portion, and is associated with the Bressa variant-McMullin variant complex, the Gilroy-Gilroy variant-Bonnydoon variant loams, the Henneke stony clay loam, the Los Osos-Bonnydoon complex, the Tocaloma-McMullin complex, and the Tocaloma-Saurin association. Moderate soil erosion is limited to small areas in the northern portion of the Plan Area and intermittently

**Figure 4.5-5 Soil Erosion Hazards**

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*Additional data provided by Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Soil Survey Geographic (SSURGO) Database 2017.*

throughout the Plan Area. Otherwise, the majority of the City contains soils that are classified "not rated," which includes urban land that is mostly fill, but also pits, quarries, rock outcrops, or slight erosion hazard areas (USDA NRCS 2018b). Coastal erosion also occurs along the coast, in Novato, in what is known as the Hamilton Wetlands, and is attributed to tide elevations due to sea-level rise, wave patterns, and the coastal geography of San Pablo Bay.

### Corrosive Soils

Corrosive to severely corrosive shallow subsurface soils, referred to as Young Bay Mud, occur in the Bahia area of northern Novato as well as the San Francisco Bay margin along the Petaluma River. Young Bay Mud possesses high sulfate and chloride concentrations and maintains a low pH, which would negatively impact metals and concrete used in construction (City of Novato 2014a).

## 4.5.2 Regulatory Setting

### Federal

#### *Clean Water Act*

Congress enacted the Clean Water Act (CWA), formerly the Federal Water Pollution Control Act of 1972, with the intent of restoring and maintaining the chemical, physical, and biological integrity of the waters of the United States. The CWA requires states to set standards to protect, maintain, and restore water quality through the regulation of point source and non-point source discharges to surface water. Those discharges are regulated by the National Pollutant Discharge Elimination System (NPDES) permit process (CWA Section 402). NPDES permitting authority is administered by the California State Water Resources Control Board (SWRCB) and its nine Regional Water Quality Control Boards (RWQCB). Novato is within a watershed administered by the San Francisco Bay Regional Water Quality Control Board, Region 2 (State Water Resources Control Board 2018).

#### *Disaster Mitigation Act of 2000*

Congress passed the Disaster Mitigation Act of 2000 to amend the Robert T. Stafford Disaster Relief and Emergency Assistance Act by invoking new and revitalized approaches to mitigation planning. Section 322 of the Act emphasized the need for state and local government entities to closely coordinate on mitigation planning activities, and makes the development of a hazard mitigation plan a specific eligibility requirement for any local government applying for federal mitigation grant funds. Communities with an adopted and federally-approved hazard mitigation plan thereby become pre-positioned and more apt to receive available mitigation funds before and after the next declared disaster.

To implement the new Stafford Act provisions, FEMA published requirements and procedures for local hazard mitigation plans in the Code of Federal Regulations (CFR) at Title 44, Chapter 1, Part 201.6. These regulations specify minimum standards for developing, updating, and submitting local hazard mitigation plans for FEMA review and approval at least once every five years.

### State

#### *California Building Code*

The CBC, Title 24, Part 2 provides building codes and standards for the design and construction of structures in California. The 2016 California Building Code is based on the 2015 International

Building Code with the addition of more extensive structural seismic provisions. Chapter 16 of the California Building Code contains definitions of seismic sources and the procedure used to calculate seismic forces on structures. The CBC requires addressing soil-related hazards, such as treating hazardous soil conditions involving removal, proper fill selection, and compaction. In cases where soil remediation is not feasible, the CBC requires structural reinforcement of foundations to resist the forces of expansive soils.

#### *Alquist-Priolo Earthquake Fault Zoning Act*

The Alquist-Priolo Earthquake Fault Zoning Act of 1972 was passed into law following the destructive February 9, 1971 M6.6 San Fernando earthquake. The Act provides a mechanism for reducing losses from surface fault rupture on a statewide basis. The intent of the Act is to ensure public safety by prohibiting the siting of most structures for human occupancy across traces of active faults that constitute a potential hazard to structures from surface faulting or fault creep. This Act groups faults into categories of active, potentially active, and inactive. Historic and Holocene age faults are considered active, Late Quaternary and Quaternary age faults are considered potentially active, and pre-Quaternary age faults are considered inactive.

#### *Seismic Hazards Mapping Act*

The Seismic Hazards Mapping Act (the Act) of 1990 was passed into law following the destructive October 17, 1989 M6.9 Loma Prieta earthquake. The Act directs the CGS to delineate Seismic Hazard Zones. The purpose of the Act is to reduce the threat to public health and safety and to minimize the loss of life and property by identifying and mitigating seismic hazards. Cities, counties, and State agencies are directed to use seismic hazard zone maps developed by CGS in their land-use planning and permitting processes. The Act requires that site-specific geotechnical investigations be performed prior to permitting most urban development projects within seismic hazard zones.

### Local

#### *Novato Municipal Code*

The following NMC regulations provide protection against potential hazards due to soil/geologic conditions, and limit the loss of top soil:

NMC Section 9-15.006, *Corrective Measure Recommendations*, states that if a soil or geologic problem identified in a soil report, which, if not corrected, would pose a hazard to property, improvements or life, recommendations for the correction of those hazardous conditions shall be included in the soil report.

Section 9-15.008, *Approval of Subdivisions with Soil/Geologic Hazard Conditions*, states that the city council or city engineer may approve final maps or parcel maps, respectively involving potential hazards due to soil/geologic conditions only if they find that the recommendations contained in the soil report will reasonably preclude damage, injury or loss of life from the identified hazardous condition.

NMC, Chapter 6, *Excavations and Fills*, establishes minimum requirements for excavating, grading and filling on private properties to provide protection against hazards of such activities, such as erosion and excessively compacting soils.

The intent of the NMC Chapter 7-4, *Urban Runoff Pollution Prevention Ordinance*, is to protect and enhance the water quality of the state’s, and the nation’s watercourses, water bodies, and wetlands in a manner pursuant to and consistent with the CWA. Novato Municipal Code Section 7-4-10, *Reduction of pollutants to urban runoff*, requires any person engaged in activities which will or may result in pollutants entering the city storm drains to undertake all practicable measures to cease and/or eliminate or reduce such pollutants. Novato Municipal Code Section 7-4.10e1, *Stormwater control plan requirements*, requires every applicant to submit a stormwater control plan (SCP) that meets the criteria in the most recent version of the Bay Area Stormwater Management Agencies (BASMAA) Post-Construction Manual, and to implement conditions of approval that reduce stormwater pollutant discharges through the construction, operation and maintenance of source control measures, low impact development design, site design measures, stormwater treatment measures and hydromodification management measures. Novato Municipal Code Section 7-4.10c, *Best management practices for construction activity, new development and redevelopment*, requires any person performing construction activities in the city shall implement appropriate best management practices (BMPs) to prevent the discharge of construction wastes or contaminants from construction materials, tools and equipment from entering the storm drain system or watercourse. Construction-phase BMPs include erosion and sediment controls and pollution prevention practices.

Novato Municipal Code Section 19.26, *Hillside and Ridgeline Protection*, establishes development and design standards for hillside areas to reduce the potential for slope failure and exposure to other soil-related hazards, as well as encourage aesthetic compatibility with hillside terrain. The ordinance requires reduced development intensity in areas with steep slopes and incorporation of specific design elements for buildings proposed in hillside areas.

Novato Municipal Code Section 19.36.070D, *Development Standards and Design Criteria-Erosion and Sediment Control,* requires an erosion control plan prepared by a registered professional engineer to be submitted to the Department for approval, including BMPs to minimize siltation, sedimentation, and erosion (see Municipal Code Section 5-23.008).

Section 5-27-008b, *Standards - Specific Plans,* requires Specific Plans to include a complete final grading and erosion plan of the entire area of construction. The grading and erosion control plan shall show sufficient topographic details outside of the limits of construction so that the impact of the proposed development with respect to adjoining properties may be evaluated.

Novato Municipal Code Section 19.42.060, *Master Plans and Precise Development Plans*, requires Master Plans to be submitted with a written statement describing the development concepts as they apply to soils, flooding, geologic hazards, and seismic hazards. Precise Development Plans shall be submitted with a professional analysis and report on soils, flooding, geologic hazards, and seismic hazards, as identified in the Master Plan or required by the Director.

Novato Municipal Code Section 19.52.020.B.4, *Seismic Retrofitting/Building Code Compliance*, requires repairs or alterations of nonconforming structures to be allowed in the following circumstances: a) Reconstruction required to reinforce unreinforced masonry structures shall be allowed without cost limitations, provided the retrofitting is limited exclusively to compliance with earthquake safety standards; b) Reconstruction required to comply with CBC requirements shall be allowed without cost limitations, provided the retrofitting/Code compliance is limited exclusively to compliance with earthquake safety standards, as identified in Subsection B.3.a, above and other Building Code requirements, including State law (e.g., Title 24, California Code of Regulations, etc.).

*Marin County Multi-Jurisdictional Local Hazard Mitigation Plan*

Marin County updated its Local Hazard Mitigation Plan in the winter of 2018 with the Marin County Multi-Jurisdictional Local Hazard Mitigation Plan (MJLHMP). All of Marin's towns and cities, the North Marin Water District, and Marin County Flood Control and Water Conservation District are participants of the MJLHMP. The City of Novato adopted the MJLHMP in February 2019 to supersede Novato's 2011 Local Hazard Mitigation Plan. The MJLHMP assesses risks posed by natural hazards and provides a mitigation strategy for reducing risks in the County. Both a hazard and vulnerability analysis are included in the MJLHMP. Natural hazards that may impact the City are discussed in the MJLHMP to determine the probability of occurrence and vulnerability of each hazard. A mitigation strategy is included to provide a blueprint for reducing the potential losses identified in the vulnerability analysis (Marin County 2018c).

General Plan 2035 encourages growth management and development within Novato's Urban Growth Boundary. Enacted by the voters of Novato in 1997 and extended to the year 2042 and amended by the voters in November 2017, the Urban Growth Boundary is intended to constrain the expansion of urban-level development into the rural areas surrounding the incorporated City limits and reduce urban sprawl. Further, the Sphere of Influence, a boundary determined by the Marin Local Agency Formation Commission, distinguishes land the City may annex in the future, and for which urban services, if available, could be provided. The City has designated approximately 56 percent of this land for very low and low density residential use and 27 percent for open space and conservation. In general, new development implemented by the proposed project would occur where existing roads, water, and sewer systems are in place and in a manner that minimizes the impact of development on existing infrastructure and services.

## 4.5.3 Impact Analysis

### a. Methodology and Significance Thresholds

### Methodology

This section describes the potential environmental impacts of the proposed project relevant to geology and soils. The impact analysis is based on an assessment of baseline conditions for the Plan Area, including topography, geologic and soil conditions, and seismic hazards, as described above under the Subsection 4.5.1, *Setting*. This analysis identifies potential impacts based on the predicted interaction between the affected environment and construction, operation, and maintenance activities related to the proposed project. This section describes impacts in terms of location, context, duration, and intensity, and recommends mitigation measures, when necessary, to avoid or minimize impacts.

### Significance Thresholds

The following thresholds of significance are based on Appendix G of the *CEQA Guidelines*. For the purposes of this EIR, implementation of the proposed project may have a significant adverse impact if it would do any of the:

1 Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:

- Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault
- Strong seismic ground shaking
- Seismic-related ground failure, including liquefaction
- Landslides

2 Result in substantial soil erosion or the loss of topsoil

3 Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on or off-site landslide, lateral spreading, subsidence, liquefaction or collapse

4 Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property

5 Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water

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|---|---|
| **Threshold 1:** | Would the project expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving rupture of a known earthquake fault, strong seismic ground shaking, seismic-related ground failure, including liquefaction, or landslides? |
| **Threshold 3:** | Would the project be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on or off-site landslide, lateral spreading, subsidence, liquefaction or collapse? |

**Impact GEO-1 IMPLEMENTATION OF THE PROPOSED PROJECT COULD RESULT IN EXPOSURE OF PEOPLE OR STRUCTURES TO A RISK OF LOSS, INJURY, OR DEATH FROM SEISMIC EVENTS. HOWEVER, ADHERENCE TO EXISTING REQUIREMENTS WOULD REDUCE THIS IMPACT TO A LESS THAN SIGNIFICANT LEVEL.**

Implementation of the proposed project would result in additional residential and nonresidential development within the City. As such, additional residents and employees could be potentially exposed to the effects of fault rupture and seismic groundshaking. Because Novato is not located in an Alquist-Priolo Earthquake Fault Zone (DOC 2018a) where fault rupture is more likely, fault rupture is unlikely to affect new or existing structures. However, all buildings located in Novato are vulnerable to earthquake damage. Current building codes address seismic safety mostly to protect occupant lives during an earthquake. However, newly constructed buildings can still be significantly damaged during a major earthquake. Therefore, new structures built in compliance with the proposed project could also experience substantial damage during seismic groundshaking events.

Furthermore, development associated with the proposed project could expose residents and employees to seismic-related ground failure, including liquefaction, or landslides from local and regional earthquakes. Approximately one-third of Novato, primarily low-lying areas fronting San Pablo Bay, is located in an area with a medium, high, or very high liquefaction risk. Although there are no liquefaction zones in Novato mapped by CGS in accordance with the Seismic Hazards Mapping Act, potentially liquefiable soils in the city were identified through a review of NRCS data (USDA NRCS 2018b). Landslides in Novato have the greatest potential to occur in upland areas, with the exception of the Novato conglomerate in hilly areas, which are relatively stable (City of Novato 2014a).

The proposed project encourages infill development, which would in many cases replace older buildings subject to seismic damage with newer structures built to current seismic standards that could better withstand the adverse effects of strong ground shaking. Potential structural damage and the exposure of people to the risk of injury or death from structural failure would be minimized by compliance with CBC engineering design and construction measures. Foundations and other structural support features would be designed to resist or absorb damaging forces from strong ground shaking and liquefaction in accordance with CBC requirements.

The Novato Municipal Code Division 19.26 protects hillsides and ridgelines to reduce the potential for hazards and environmental degradation related to slope failure, increased erosion, sedimentation, storm water run-off, and loss of vegetation. Novato Municipal Code Section 19.26.030 requires a constraint analysis to be prepared and submitted with a Design Review application for undeveloped hillside sites. The constraints analysis is required to be accompanied by a geotechnical report, which identifies and proposes mitigation measures for any soils or geological conditions that may affect site stability or structural integrity.

General Plan 2035 A City That Works Chapter contains goals, policies and programs related to reducing hazards from exposing people and structures to significant loss, injury, or death involving rupture of a known earthquake fault, strong seismic ground shaking, seismic-related ground failure, including liquefaction, or landslides. Safety and Hazard Program under SH 1, Seismic and Geologic Hazards would reduce the risk of loss of life, personal injury and property damage resulting from seismic and geologic hazards including ground shaking, land sliding, liquefaction and slope failure. Specifically, Program SH 1a, Geotechnical Evaluation, would require the preparation of geotechnical evaluations by an engineering geologist or geotechnical engineer for new construction and grading in seismically and geologically hazardous areas and for all crucial (i.e., high occupancy, health, or emergency response) structures. Safety and Hazard Program SH 4, Building Hazards, would reduce the risk of loss of life, personal injury and property damage resulting from structural electrical, and fire damage to structures through code enforcement and public education. Specifically, Program SH 4a, Building Code Enforcement, would require new development, building additions and remodels to be reviewed and inspected to ensure enforcement with the State Uniform Building Code and local amendments. Furthermore, all programs under SH 7 would minimize exposure to all hazards through emergency management, planning and training. These programs would minimize exposure of people and hazards to soil and geologic hazards that could result from seismic events.

Implementation of the General Plan 2035 goals, policies, and programs would result in the avoidance of siting critical facilities or other structures within areas susceptible to seismic hazards. Adherence to these requirements would ensure a detailed review of design and construction plans and incorporation of additional structural safety features, as necessary, for structures that would be located on steep slopes or in areas subject to seismic hazards such as extreme ground shaking, landslides, liquefaction, surficial debris flows, expansive soils, subsidence and settlement, fault displacement, and Bay mud areas. Specifically, Implementation Program SH 1a would require the preparation of a geotechnical evaluation by an engineering geologist or geotechnical engineer for new construction and grading as required by City code on sites in seismically and geologically hazardous areas and for all critical (high occupancy, health or emergency response) structures. Recommendations from these reports would be required to be implemented through the planning, grading, and building permit process. Program SH 1b would require the enforcement of existing regulations and procedures to identify and avoid, or mitigate potential hazards related to slope and soil instability conditions, such as landslides, soil creep or possible debris flow. Policy CC 3 and

Program CC 4a would protect Novato's hillsides and ridgelines from erosion and slope failure by limiting the extent and location of new development and ensuring that new development complies with the requirements of the Hillside and Ridgeline Protection Ordinance in the Zoning Code. Furthermore, Program SH 7c would minimize potential earthquake damage to existing publicly owned buildings and emergency facilities by strengthening building structures, eliminating hazardous features, or relocating facilities to safer buildings where feasible. Development in the Industrial Parks MPA and the four focus areas would be subject to these requirements, which would reduce impacts from geologic hazards. Implementation of the goals, policies and programs, described here and listed above, in addition to compliance with applicable laws and regulations, would minimize the potential for loss, injury, or death following a seismic event and would reduce this potential impact to a less than significant level.

## Mitigation Measures

No mitigation measures are required.

| **Threshold 2:** | Would the project result in a substantial soil erosion or the loss of topsoil? |
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### Impact GEO-2 IMPLEMENTATION OF THE PROPOSED PROJECT WOULD INCLUDE GROUND DISTURBANCE SUCH AS EXCAVATION AND GRADING THAT WOULD RESULT IN LOOSE OR EXPOSED SOIL. HOWEVER, COMPLIANCE WITH EXISTING REGULATIONS AND IMPLEMENTATION OF THE GOALS AND POLICIES OF GENERAL PLAN 2035 WOULD REDUCE IMPACTS TO A LESS THAN SIGNIFICANT LEVEL.

Implementation of the proposed project would involve construction activities such as stockpiling, grading, excavation, paving, and other earth-disturbing activities. Loose and disturbed soils are more prone to erosion and loss of topsoil by wind and water.

Construction activities that disturb one or more acres of land surface are subject to the National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities (Order No. 2012-0006-DWQ) adopted by the State Water Resources Control Board (SWRCB). Compliance with the permit requires each qualifying development project to file a Notice of Intent with the SWRCB. Permit conditions require development of a storm water pollution prevention plan (SWPPP), which must describe the site, the facility, erosion and sediment controls, runoff water quality monitoring, means of waste disposal, implementation of approved local plans, control of construction sediment and erosion control measures, maintenance responsibilities, and non-storm water management controls. Inspection of construction sites before and after storms is also required to identify storm water discharge from the construction activity and to identify and implement erosion controls, where necessary. Compliance with the Construction General Permit (CGP) is reinforced through the City of Novato's Urban Runoff Pollution Prevention Ordinance. For projects subject to the state's CGP, project applicants may submit a SWPPP developed pursuant to the CGP in lieu of submitting an erosion and sediment control plan.

Construction of the Industrial Parks MPA would result in over one acre of disturbed soil. Therefore, development in the Industrial Parks MPA area would be required to develop a SWPPP to reduce construction soil erosion and the loss of topsoil. In addition, the Industrial Parks MPA area and any development in the four focus areas would be required to reduce soil erosion through the Novato Urban Runoff Pollution Prevention Ordinance, descried in more detail below.

NMC Chapter 7-4, Urban Runoff Pollution Prevention Ordinance, requires an erosion and sediment control plan for any project subject to a grading permit under Chapter VI excavations and fills; any project subject to a building permit or other permit that has the potential for significant erosion and/or significant non-stormwater discharges of sediment and/or construction site waste; and any other project as required by the authorized enforcement official considering factors such as whether the project involves hillside soil disturbance, rainy season construction, construction near a creek or an intermittent or ephemeral drainageway, or any other condition or construction site activity that could lead to a non-stormwater discharge to a storm drain if not managed by effective implementation of an Erosion and Sediment Control Plan (ESCP). ESCP's should follow the most recent version of the MCSTOPPP Construction Erosion and Sediment Control Plan Applicant Package (also known as the Marin County SWPPP). The implementation of BMPs are required for construction activity, new development and redevelopment, to prevent the discharge of construction wastes or contaminants from construction materials, tools and equipment from entering the storm drain system or watercourse. Erosion control BMPs may include scheduling and timing of grading activities, timely revegetation of graded areas, the use of hydroseed and hydraulic mulches, and installation of erosion control blankets. Adherence to the requirements of the NMC would reduce the potential for construction implemented as part of the proposed project to cause erosion or the loss of topsoil by ensuring proper management of loose and disturbed soil.

NMC Section 19.26 protects hillsides and ridgelines to reduce the potential for hazards and environmental degradation related to slope failure, increased erosion, sedimentation, storm water run-off, and loss of vegetation. NMC Section 19.26.030 requires a constraints analysis to be prepared and submitted with a Design Review application for undeveloped hillside sites. The constraints analysis is required to be accompanied by a geotechnical report, which identifies and proposes mitigation measures for any soils or geological conditions that may affect site stability or structural integrity.

The General Plan 2035 A City That Works Chapter contains goals, policies and programs related to reducing substantial soil erosion or the loss of topsoil. In particular, Program SH 2g would require measures to minimize soil erosion and velocity of surface runoff during and after construction. Program SH 2h would require projects to maintain unobstructed water flow in the storm drainage system to the maximum extent feasible. In addition, goals, policies, and programs under Goal CC 2 to promote high quality and sustainable development and Goal SH 1 to minimize geologic and seismic hazards would reduce the loss of topsoil associated with implementation of the proposed project, including any new development in the Industrial Parks MPA and four focus areas.

Implementation of these programs would ensure that future development minimizes soil erosion and the loss of topsoil for the proposed project, including the Industrial Parks MPA and four focus areas. Further, the Urban Runoff Pollution and Prevention Ordinance in the NMC would require applicants to prepare a stormwater control plan and/or an erosion and sediment control plan for construction sites, new or redeveloped land, which would reduce the potential for erosion through the implementation of BMPs or Low Impact Development practices. Implementation of these goals and policies, in addition to compliance with applicable laws and regulations, would minimize the potential for erosion and loss of topsoil and would reduce this impact to a less-than-significant level.

## Mitigation Measures

No mitigation measures are required.

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| **Threshold 4:** | Would the project be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property? |

**Impact GEO-3** IMPLEMENTATION OF THE PROPOSED PROJECT MAY RESULT IN THE CONSTRUCTION OF STRUCTURES ON EXPANSIVE SOILS, WHICH COULD CREATE A SUBSTANTIAL RISK TO LIFE OR PROPERTY. HOWEVER, DEVELOPMENT WOULD BE REQUIRED TO COMPLY WITH THE CALIFORNIA BUILDING CODE, WHICH WOULD ENSURE THAT EXPANSIVE SOILS ARE REMEDIATED OR THAT FOUNDATIONS AND STRUCTURES ARE ENGINEERED TO WITHSTAND THE FORCES OF EXPANSIVE SOIL. COMPLIANCE WITH THE REQUIREMENTS OF THE CALIFORNIA BUILDING CODE WOULD REDUCE THIS IMPACT TO A LESS THAN SIGNIFICANT LEVEL.

The Baylands Overlay District (B District), is applied to areas within the historic Baylands, excluding lands that have been legally filled or legally developed. Soils with high expansion potential can be in the B District, which includes portions of the Industrial Parks MPA area. NMC Section Code Section 19.16.030, requires a constraints analysis for any project in the B District. The B District is intended to ensure that potential hazards associated with development on Baylands do not endanger public health and safety. A constraints analysis would ascertain the capability and constraints of land and water areas, including a description and map of soils, geology, and hydrology. Development in the Industrial Parks MPA designated in the B District, would be required to prepare a constraints analysis to determine geology and hydrology constraints associated with development of the Life Sciences Campus. In addition, development in the four focus areas located in the B District would be required to prepare a site-specific constraints analysis.

In addition to compliance with CBC and NMC requirements, implementation of General Plan 2035 goals and policies would further reduce the potential for substantial risks to life or property as a result of expansive soils. In particular, Goal SH 1 and Program SH 1a.

Compliance with the CBC, the NMC, and General Plan 2035 Policy SH 1 and Program SH 1a would reduce impacts related to expansive soils to a less than significant level.

## Mitigation Measures

No mitigation measures are required.

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| **Threshold 5:** | Would the project have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater? |

**Impact GEO-4** IMPLEMENTATION OF THE PROPOSED PROJECT WOULD OCCUR PRIMARILY WHERE EXISTING SEWER SYSTEMS ARE IN PLACE. HOWEVER, SOME NEW DEVELOPMENT MAY REQUIRE THE USE OF SEPTIC SYSTEMS OR ALTERNATIVE WASTEWATER DISPOSAL SYSTEMS. WITH PROPER SITE INVESTIGATION, THESE SYSTEMS WOULD BE CONSTRUCTED ON SOILS CAPABLE OF ADEQUATELY SUPPORTING THEIR USE. IMPACTS WOULD BE POTENTIALLY SIGNIFICANT.

The Novato Sanitary District (NSD) provides wastewater collection, treatment, and disposal services for the Novato community (NSD 2016). The NSD owns and operates a wastewater collection system, a municipal wastewater treatment plant, and an effluent discharge outfall. In 2012, NSD also began operating a Recycled Water Facility that provides up to 1.7 million gallons per day (MGD) of tertiary treated recycled water to the North Marin Water District (the City's water provider). Novato Municipal Code Chapter 5-37.008b. *Standards - Specific* requires projects to include provisions for connection to the public sewage facilities of the Novato sanitary district or other publicly-owned sewage facilities. Where a project involves an existing private sewage disposal system, such system would be discontinued and a connection to publicly-owned facilities would be made. Under certain circumstances, future development could occur in areas not currently served by the City's existing wastewater system. Septic systems or alternative wastewater disposal systems may be allowed on a case-by-case basis, subject to information and review procedures of Novato Municipal Code Section 5-37. Under Section 5-37i, a private sewage disposal system permit would be required to prevent health hazards. Section 5-37.008b.3(a)(b) requires a written statement from an applicant stating the reasons why connection with the publicly-owned facilities should not be required. These reasons shall be corroborated by the public sewage agency. Also, written technical information shall be provided indicating that the private sewage disposal system will function successfully from the standpoint of the future owner/operator and from the standpoint of community health. These required submittals will be reviewed to the City's satisfaction. Development of the Industrial Parks MPA and four focus areas would be connected to existing sewage facilities and would not require alternative wastewater disposal systems because these areas are supplied with existing utilities.

According to the Novato Municipal Code, specific regulations governing engineering requirements, percolation tests, septic tanks, drain fields, and related facilities are required to be adopted by the City Council; however, these regulations have not been adopted yet (City of Novato 2018). If septic tanks or alternative wastewater disposal systems are installed to support development without first performing a soils investigation to determine the adequacy of the underlying soils to support such systems, adverse effects related to improper wastewater disposal could occur. This could result in adverse effects to environmental or human health. Therefore, impacts related to the use of septic tanks would be significant and mitigation would be required.

## Mitigation Measures

The following is required to reduce impacts from septic tanks and alternative wastewater disposal systems.

### *GEO-1 Soil Investigation Report*

New development projects not connected to the municipal sewer system and requiring the use of septic tanks or alternative wastewater disposal systems shall complete a soil investigation report to be submitted to the City of Novato for review and approval prior to issuance of grading and building permits. The study shall demonstrate the capability of the underlying soils to support the use of septic tanks or alternative wastewater disposal systems. Such a report shall be prepared by a registered professional geologist and shall include soil type characteristics, percolation rates, and design recommendations.

## Significance After Mitigation

Impacts would be less than significant with implementation of Mitigation Measure GEO-1 to require a soil investigation report for all projects requiring the installation of septic tanks or alternative wastewater disposal systems.

## b. Cumulative Impacts

Cumulative development in the Plan Area and County of Marin surrounding Novato would gradually increase population and therefore gradually increase the number of people exposed to potential geologic hazards, including effects associated with seismic events such as ground rupture and strong shaking. Potential geologic and seismic hazards are project-level impacts, and are not cumulative in nature. Individual development proposals are reviewed separately by the City and undergo environmental review when it is determined that the potential for significant impacts exist. In the event that future cumulative development would result in impacts related to geologic or seismic impacts, those potential impacts would be addressed on a case-by-case basis in accordance with the requirements of CEQA. However, compliance with the Novato Municipal Code and General Plan 2035 policies and programs, as well as other laws and regulations mentioned above, would ensure that project-specific impacts associated with geology and soils would be less than significant. Construction and grading activities associated with the development of cumulative projects under the 2035 General Plan would increase the potential for soil erosion and sedimentation of surface waters. However, future construction activity on projects that disturb one or more acres of soil would be required to comply with the NPDES program and prepare a SWPPP, which outlines BMPs that would address post-construction runoff. Individual projects would be required to comply with the City's erosion and sediment control regulations and the BASMAA Post-Construction Manual, as discussed above. Potential impacts associated with geology and soils would not be cumulatively considerable, and cumulative impacts related to geologic hazards would be less than significant.

# 4.6 Greenhouse Gas Emissions

This section discusses potential impacts related to greenhouse gas emissions and climate change. The City of Novato's GHG emissions inventory and forecast are based on the Climate Action Plan contained in Appendix E of General Plan 2035, which summarizes the updated emissions inventory, forecast, and GHG reduction measures for General Plan 2035.

## 4.6.1 Setting

### a. Climate Change and Greenhouse Gases

Gases that absorb and re-emit infrared radiation in the atmosphere are called greenhouse gases (GHGs). The gases that are widely seen as the principal contributors to human-induced climate change include carbon dioxide ($CO_2$), methane ($CH_4$), nitrous oxides ($N_2O$), fluorinated gases such as hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs), and sulfur hexafluoride ($SF_6$). Water vapor is excluded from the list of GHGs because it is short-lived in the atmosphere and its atmospheric concentrations are largely determined by natural processes, such as oceanic evaporation.

GHGs are emitted by both natural processes and human activities. Of these gases, $CO_2$ and $CH_4$ are emitted in the greatest quantities from human activities. Emissions of $CO_2$ are largely by-products of fossil fuel combustion, whereas $CH_4$ results from off-gassing associated with agricultural practices and landfills.

Man-made GHGs, many of which have greater heat-absorption potential than $CO_2$, include fluorinated gases and $SF_6$ (California Environmental Protection Agency [CalEPA] 2006). Different types of GHGs have varying global warming potentials (GWPs). The GWP of a GHG is the potential of a gas or aerosol to trap heat in the atmosphere over a specified timescale (generally, 100 years). Because GHGs absorb different amounts of heat, a common reference gas ($CO_2$) is used to relate the amount of heat absorbed to the amount of gas emitted, referred to as "carbon dioxide equivalent" ($CO_2e$). The amount of $CO_2e$ for a specified GHG is the amount of that GHG emitted multiplied by its GWP. Carbon dioxide has a 100-year GWP of one. By contrast, methane $CH_4$ has a GWP of 25, meaning its global warming effect is 25 times greater than $CO_2$ on a molecule per molecule basis (Intergovernmental Panel on Climate Change 2007).

### Greenhouse Gas Emissions Inventories

*Federal Emissions Inventory*

Total United States GHG emissions were 6,511.3 million metric tons (MMT) of $CO_2e$ in 2016 (United States Environmental Protection Agency [U.S. EPA] 2018). Total United States emissions have increased by 2.4 percent since 1990; however, emissions decreased by 1.9 percent from 2015 to 2016 (U.S. EPA 2018). The decrease from 2015 to 2016 was a result of multiple factors, including: (1) substitution from coal to natural gas and other non-fossil energy sources in the electric power sector and (2) warmer winter conditions in 2016 resulting in a decreased demand for heating fuel in the residential and commercial sectors (U.S. EPA 2018). Since 1990, U.S. emissions have increased at an average annual rate of 0.1 percent. In 2015, the industrial and transportation end-use sectors each accounted for 29 percent of $CO_2e$ emissions (with electricity-related emissions distributed). Meanwhile, the residential and commercial end-use sectors accounted for 15 percent and 16 percent of $CO_2e$ emissions, respectively (U.S. EPA 2018).

### *California Emissions Inventory*

Based on the California Air Resource Board's (CARB) California Greenhouse Gas Inventory for 2000-2016, California produced 429.4 MMT of $CO_2e$ in 2016 (CARB 2018b). The major source of GHGs in California is associated with transportation, contributing 41 percent of the state's total GHG emissions. The industrial sector is the second largest source, contributing 23 percent of the state's GHG emissions. Electric power accounted for approximately 16 percent of the total emissions (CARB 2018b). California emissions are due in part to its large size and large population compared to other states. However, a factor that reduces California's per capita fuel use and GHG emissions, as compared to other states, is its relatively mild climate. CARB has projected that statewide unregulated GHG emissions for the year 2020 will be 509 MMT of $CO_2e$ (CARB 2018c). These projections represent the emissions that would be expected to occur in the absence of any GHG reduction actions.

## Potential Effects of Climate Change

Globally, climate change has the potential to affect numerous environmental resources through potential impacts related to future air temperatures and precipitation patterns. Scientific modeling predicts that continued GHG emissions at or above current rates would induce more extreme climate changes during the 21st century than were observed during the 20th century. Long-term trends have found that each of the past three decades has been warmer than all the previous decades in the instrumental record, and the decade from 2000 through 2010 has been the warmest. The global combined land and ocean temperature data show an increase of about 0.89°C (0.69°C–1.08°C) over the period 1901–2012 and about 0.72°C (0.49°C–0.89°C) over the period 1951–2012 when described by a linear trend. Several independently analyzed data records of global and regional Land-Surface Air Temperature (LSAT) obtained from station observations are in agreement that LSAT as well as sea surface temperatures have increased. In addition to these findings, there are identifiable signs that global warming is currently taking place, including substantial ice loss in the Arctic over the past two decades (Intergovernmental Panel on Climate Change 2014).

Potential impacts of climate change in California may include loss in snow pack, sea level rise, more extreme heat days per year, more high ozone days, more large forest fires, and more drought years (CalEPA 2010). Below is a summary of some of the potential effects that could be experienced in California as a result of climate change.

### *Air Quality*

Higher temperatures, which are conducive to air pollution formation, could worsen air quality in California. Climate change may increase the concentration of ground-level ozone, but the magnitude of the effect, and therefore its indirect effects, are uncertain. If higher temperatures are accompanied by drier conditions, the potential for large wildfires could increase, which, in turn, would further worsen air quality. However, if higher temperatures are accompanied by wetter, rather than drier conditions, the rains would tend to temporarily clear the air of particulate pollution and reduce the incidence of large wildfires, thereby ameliorating the pollution associated with wildfires. Additionally, severe heat accompanied by drier conditions and poor air quality could increase the number of heat-related deaths, illnesses, and asthma attacks throughout the state (California Natural Resources Agency 2009).

### *Water Supply*

Analysis of paleoclimatic data (such as tree-ring reconstructions of stream flow and precipitation) indicates a history of naturally widely-varying hydrologic conditions in California and the west, including a pattern of recurring and extended droughts. Uncertainty remains with respect to the overall impact of climate change on future water supplies in California. However, the average early spring snowpack in the Sierra Nevada decreased by about 10 percent during the last century, a loss of 1.5 million acre-feet of snowpack storage. During the same period, sea level rose eight inches along California's coast. California's temperature has risen 1°F, mostly at night and during the winter, with higher elevations experiencing the highest increase. Although projections about future annual precipitation patterns in the Bay Area are highly uncertain, climate change modelling for the Bay Area projects that an increase in the magnitude and frequency of large precipitation events will occur. In addition, the increase in temperature caused by climate change increases the likelihood that future droughts will be larger in magnitude and longer in duration (State of California 2018).

This uncertainty complicates the analysis of future water demand, especially where the relationship between climate change and its potential effect on water demand is not well understood. The Sierra snowpack provides the majority of California's water supply by accumulating snow during the state's wet winters and releasing it slowly during the state's dry springs and summers. Based on historical data and modeling, DWR projects that the Sierra snowpack will experience a 25 to 40 percent reduction from its historic average by 2050. Climate change is also anticipated to bring warmer storms that result in less snowfall at lower elevations, reducing the total snowpack (DWR 2008).

### *Hydrology and Sea Level Rise*

Climate change could potentially affect the amount of snowfall, rainfall, and snow pack; the intensity and frequency of storms; flood hydrographs (flash floods, rain or snow events, coincidental high tide and high runoff events); sea level rise and coastal flooding; coastal erosion; and the potential for salt water intrusion. Climate change also has the potential to induce substantial sea level rise in the coming century (CCCC 2009). The rising sea level increases the likelihood and risk of flooding. The rate of increase of global mean sea levels over the 2001-2010 decade, as observed by satellites, ocean buoys and land gauges, was approximately 3.2 mm per year, which is double the observed 20th century trend of 1.6 mm per year (World Meteorological Organization [WMO] 2013). As a result, sea levels averaged over the last decade were about 8 inches higher than those of 1880 (WMO 2013). Sea levels are rising faster now than in the previous two millennia, and the rise is expected to accelerate, even with robust GHG emission control measures. The 2014 Intergovernmental Panel on Climate Change report predicts a mean sea–level rise of 11 to 38 inches by 2100. This prediction is more than 50 percent higher than earlier projections of 7 to 23 inches, when comparing the same emissions scenarios and time periods. A rise in sea levels could result in coastal flooding and erosion and could jeopardize California's water supply due to salt water intrusion. In addition, increased $CO_2$ emissions can cause oceans to acidify due to the carbonic acid it forms. Increased storm intensity and frequency could affect the ability of flood-control facilities, including levees, to handle storm events.

In the San Francisco Bay, sea levels have risen approximately seven inches over the past century. These rising sea levels increase the upstream extent of tidal flooding, worsen creek flooding due to backwater effects of elevated high tides, and create larger, stronger waves that erode the shoreline and destroy tidal wetlands. Climate change is also likely to increase the magnitude and frequency of winter storms, further worsening flooding problems.

In Novato, water surface elevations in the baylands are expected to increase from one to three feet within the next 50 years. The higher tides will put additional pressure on creek discharge to the bay and are likely to increase flood durations. Floodwaters may need several tide cycles to recede. The BayWAVE assessment of the eastern Marin shoreline from the Golden Gate Bridge to the northern end of Novato found that the following potential impacts of sea level rise in Novato could include[1]:

- Increased daily high tides from 4 to 6 feet today to 8 to 10 feet
- Longer duration of floods in Novato Creek and Warner Creek areas
- Increased sedimentation in the dredge reach and around low-lying channels and outfalls, necessitating elevation of or increased maintenance for low lying outfalls
- Increased need for upstream stormwater storage during high tides
- Reduced movement of sediment through the baylands during both typical and large storm events
- Increased daily tide range and peak flood water surface elevations downstream of Highway 37
- Daily high tides may increase to near or above current Q50 peak flood levels (Marin County Flood Control Water Conservation District 2017)

*Ecosystems and Wildlife*

Climate change and the potential resulting changes in weather patterns could have ecological effects on a global and local scale. Increasing concentrations of GHGs are likely to accelerate the rate of climate change. Scientists project that the average global surface temperature could rise by 1.0 to 4.5°F (0.6 to 2.5°C) in the next 50 years, and by 2.2 to 10°F (1.4 to 5.8°C) in the next century, with substantial regional variation. Soil moisture is likely to decline in many regions, and intense rainstorms are likely to become more frequent. Rising temperatures could have four major impacts on plants and animals: (1) timing of ecological events; (2) geographic range; (3) species' composition within communities; and (4) ecosystem processes, such as carbon cycling and storage (Parmesan 2006).

## b. Regulatory Setting

## Federal Regulations

The U.S. Supreme Court in *Massachusetts et al. v. Environmental Protection Agency et al.* ([2007] 549 U.S. 05-1120) held that the U.S. EPA has the authority to regulate motor-vehicle GHG emissions under the federal Clean Air Act. The U.S. EPA issued a Final Rule for mandatory reporting of GHG emissions in October 2009. This Final Rule applies to fossil fuel suppliers, industrial gas suppliers, direct GHG emitters, and manufacturers of heavy-duty and off-road vehicles and vehicle engines and requires annual reporting of emissions. In 2012, the U.S. EPA issued a Final Rule that establishes the GHG permitting thresholds that determine when Clean Air Act permits under the New Source Review Prevention of Significant Deterioration (PSD) and Title V Operating Permit programs are required for new and existing industrial facilities.

In 2014, the U.S. Supreme Court in *Utility Air Regulatory Group v. EPA* (134 S. Ct. 2427 [2014]) held that the U.S. EPA may not treat GHGs as an air pollutant for purposes of determining whether a

[1] BayWAVE is a focused vulnerability assessment that assesses the sensitivity and adaptability of selected assets in order to help jurisdictions plan implementation of adaptation strategies.

source is a major source required to obtain a PSD or Title V permit. The Court also held that PSD permits that are otherwise required (based on emissions of other pollutants) may continue to require limitations on GHG emissions based on the application of Best Available Control Technology (BACT).

## California Regulations

CARB is responsible for the coordination and oversight of state and local air pollution control programs in California. California has a several regulations aimed at reducing the state's GHG emissions. These initiatives are summarized below.

### *California Advanced Clean Cars Program*

Assembly Bill (AB) 1493 (2002), California's Advanced Clean Cars program (referred to as "Pavley"), requires CARB to develop and adopt regulations to achieve "the maximum feasible and cost-effective reduction of GHG emissions from motor vehicles." On June 30, 2009, the U.S. EPA granted the waiver of Clean Air Act preemption to California for its GHG emission standards for motor vehicles beginning with the 2009 model year. Pavley I regulates model years from 2009 to 2016 and Pavley II, which is now referred to as "LEV (Low Emission Vehicle) III GHG" regulates model years from 2017 to 2025. The Advanced Clean Cars program coordinates the goals of the Low Emissions Vehicles (LEV), Zero Emissions Vehicles (ZEV), and Clean Fuels Outlet programs, and would provide major reductions in GHG emissions. By 2025, when the rules will be fully implemented, new automobiles will emit 34 percent fewer GHGs and 75 percent fewer smog-forming emissions from their model year 2016 levels (CARB 2011).

### *Assembly Bill 32*

California's major initiative for reducing GHG emissions is outlined in Assembly Bill 32 (AB 32), the "California Global Warming Solutions Act of 2006," signed into law in 2006. AB 32 codifies the statewide goal of reducing GHG emissions to 1990 levels by 2020 and requires CARB to prepare a Scoping Plan that outlines the main state strategies for reducing GHGs to meet the 2020 deadline. In addition, AB 32 requires CARB to adopt regulations to require reporting and verification of statewide GHG emissions. Based on this guidance, CARB approved a 1990 statewide GHG level and 2020 limit of 427 MMT $CO_2e$. The Scoping Plan was approved by CARB on December 11, 2008 and included measures to address GHG emission reduction strategies related to energy efficiency, water use, and recycling and solid waste, among other measures. Many of the GHG reduction measures included in the Scoping Plan (e.g., Low Carbon Fuel Standard, Advanced Clean Car standards, and Cap-and-Trade) have been adopted since its approval.

In May 2014, CARB approved the first update to the AB 32 Scoping Plan. The 2013 Scoping Plan update defines CARB's climate change priorities for the next five years and sets the groundwork to reach post-2020 statewide goals. The update highlights California's progress toward meeting the "near-term" 2020 GHG emission reduction goals defined in the original Scoping Plan. It also evaluates how to align the State's longer-term GHG reduction strategies with other State policy priorities, such as for water, waste, natural resources, clean energy and transportation, and land use (CARB 2014).

### *Senate Bill 97*

Senate Bill (SB) 97, signed in August 2007, acknowledges that climate change is an environmental issue that requires analysis in California Environmental Quality Act (CEQA) documents. In March

2010, the California Resources Agency (Resources Agency) adopted amendments to the state CEQA Guidelines for the feasible mitigation of GHG emissions or the effects of GHG emissions. The adopted guidelines give lead agencies the discretion to set quantitative or qualitative thresholds for the assessment and mitigation of GHG and climate change impacts.

### *Senate Bill 375*

SB 375, signed in August 2008, enhances the state's ability to reach AB 32 goals by directing CARB to develop regional GHG emission reduction targets to be achieved from passenger vehicles by 2020 and 2035. In addition, SB 375 directs each of the state's 18 major Metropolitan Planning Organizations (MPOs) to prepare a "sustainable communities strategy" (SCS) that contains a growth strategy to meet these emission targets for inclusion in the Regional Transportation Plan (RTP). On March 22, 2018, CARB adopted updated regional targets for reducing GHG emissions from 2005 levels by 2020 and 2035. The Association of Bay Area Governments (ABAG) and the Metropolitan Transportation Commission (MTC) were assigned joint targets of a 10 percent reduction in GHGs from transportation sources by 2020 and a 19 percent reduction in GHGs from transportation sources by 2035.

The ABAG/MTC *Plan Bay Area 2040* is a long-range land use and transportation plan for the San Francisco Bay Area region that seeks to achieve these mandated GHG emission reductions. Plan Bay Area contains ten goals with performance targets to meet these goals that seek to promote healthy and safe communities by reducing impacts from air pollution, protecting open space and agriculture, and increasing active transportation.

### *Senate Bill 32*

On September 8, 2016, the governor signed Senate Bill 32 (SB 32) into law, extending AB 32 by requiring the State to further reduce GHGs to 40 percent below 1990 levels by 2030 (the other provisions of AB 32 remain unchanged). On December 14, 2017, CARB adopted the 2017 Scoping Plan, which provides a framework for achieving the 2030 target. The 2017 Scoping Plan relies on the continuation and expansion of existing policies and regulations, such as the Cap-and-Trade Program, as well as implementation of recently-adopted policies and policies, such as SB 350 and SB 1383 (see below). The 2017 Scoping Plan also puts an increased emphasis on innovation, adoption of existing technology, and strategic investment to support its strategies. As with the 2013 Scoping Plan Update, the 2017 Scoping Plan does not provide project-level thresholds for land use development. Instead, it recommends that local governments adopt policies and locally-appropriate quantitative thresholds consistent with a statewide per capita goal of 6 metric tons (MT) of $CO_2e$ by 2030 and 2 MT of $CO_2e$ by 2050 (CARB 2017). As stated in the 2017 Scoping Plan, these goals may be appropriate for plan-level analyses (city, county, subregional, or regional level), but not for specific individual projects because they include all emissions sectors in the state.

### *Senate Bill 1383*

Adopted in September 2016, SB 1383 requires CARB to approve and begin implementing a comprehensive strategy to reduce emissions of short-lived climate pollutants. The bill requires the strategy to achieve the following reduction targets by 2030:

- Methane – 40 percent below 2013 levels
- Hydrofluorocarbons – 40 percent below 2013 levels
- Anthropogenic black carbon – 50 percent below 2013 levels

The bill also requires the California Department of Resources Recycling and Recovery, in consultation with the state board, to adopt regulations that achieve specified targets for reducing organic waste in landfills.

### *Senate Bill 100*

Adopted on September 10, 2018, SB 100 supports the reduction of GHG emissions from the electricity sector by accelerating the state's Renewables Portfolio Standard Program, which was last updated by SB X 1-2 in 2011. SB 100 requires electricity providers to increase procurement from eligible renewable energy resources to 33 percent of total retail sales by 2020, 60 percent by 2030, and 100 percent by 2045.

### *Executive Order B-55-18*

On September 10, 2018, the governor issued Executive Order B-55-18, which established a new statewide goal of achieving carbon neutrality by 2045 and maintaining net negative emissions thereafter. This goal is in addition to the existing statewide GHG reduction targets established by SB 375, SB 32, SB 1383, and SB 100.

For more information on the Senate and Assembly Bills, Executive Orders, and reports discussed above, and to view reports and research referenced above, please refer to the following websites: www.climatechange.ca.gov and www.arb.ca.gov/cc/cc.htm.

### *California Environmental Quality Act*

Pursuant to the requirements of SB 97, the Resources Agency has adopted amendments to the *CEQA Guidelines* for the feasible mitigation of GHG emissions or the effects of GHG emissions. The adopted *CEQA Guidelines* provide general regulatory guidance on the analysis and mitigation of GHG emissions in CEQA documents, while giving lead agencies the discretion to set quantitative or qualitative thresholds for the assessment and mitigation of GHGs and climate change impacts. To date, a variety of air districts have adopted quantitative significance thresholds for GHGs.

### *Local Regulations*

The City of Novato is located in the San Francisco Bay Area Air Basin, which is under the jurisdiction of the Bay Area Air Quality Management District (BAAQMD). The BAAQMD is responsible for enforcing standards and regulating stationary sources in their jurisdiction. The BAAQMD regulates GHG emissions through specific rules and regulations as well as project and plan level emissions thresholds for GHGs to ensure that the Bay Area contributes to its fair share of emissions reductions. In 2017, BAAQMD published the 2017 Clean Air Plan, which includes policy approaches, control measures, and technical programs that will help the region make progress toward the 2050 GHG emissions goal of reducing GHG emissions by 2050 to 80 percent below 1990 levels (BAAQMD 2017b).

In January of 2009, the City of Novato prepared the Climate Change Action Plan (CCAP). The 2009 CCAP was updated in 2015 to establish an updated baseline based on the GHG Inventory completed by the Marin Climate & Energy Partnership (MCEP) in 2013 due to refinements in available data, emission factors, and calculation methodologies. The plan outlines strategies to achieve a GHG reduction target of 15 percent below 2005 emission levels by the year 2020, consistent with the state's direction to local governments. The 2009 CCAP suggests a 2035 goal of 40 percent below 2005 levels to achieve the 80 percent statewide reduction by 2050 called for in Executive Order S-3-

05 (City of Novato 2009). The CCAP includes GHG reduction goals, measures, and actions in the areas of energy efficiency and conservation, water and wastewater, green building, waste reduction and recycling, climate-friendly purchasing, renewable energy and low-carbon fuels, efficient transportation, land use and community design, storing and offsetting carbon emission, and promoting community and individual actions. Together, these enable the City to achieve its climate protection goals. As part of development of the CCAP, the City also identified subsequent General Plan amendments to integrate new strategies into the City's planning framework. However, the City Council did not support all of the programs proposed in the CCAP or the development of a qualified plan; therefore, the 2009 CCAP is not considered a qualified GHG reduction plan as defined by CEQA Guidelines Section 15183.5.

## 4.6.2 Impact Analysis

### a. Significance Thresholds for GHG Emissions

Based on Appendix G of the *CEQA Guidelines*, impacts related to GHG emissions from the proposed project would be significant if the project would:

1. Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment; and/or
2. Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases

The vast majority of individual projects do not generate sufficient GHG emissions to create a project-specific impact through a direct influence on climate change. However, physical changes caused by a project can contribute incrementally to cumulative effects that are significant, even if individual changes resulting from a project are limited. The issue of climate change typically involves an analysis of whether a project's contribution towards an impact is cumulatively considerable. "Cumulatively considerable" means that the incremental effects of an individual project are significant when viewed in connection with the effects of past projects, other current projects, and probable future projects (CEQA Guidelines, Section 15064[h][1]). The May 2017 *BAAQMD CEQA Air Quality Guidelines* contain two thresholds for determining significance of GHGs for plans. The two approaches are as follows:

1. Consistency with a qualified GHG reduction plan
2. Meets the efficiency plan threshold of 6.6 MT of $CO_2e$ per service population (SP) per year

According to the BAAQMD *Air Quality Guidelines*, a qualified GHG reduction strategy is one that includes the following elements:

1. Quantify greenhouse gas emissions, both existing and projected over a specified time period, resulting from activities within a defined geographic area
2. Establish a level, based on substantial evidence, below which the contribution to GHG emissions from activities covered by the plan would not be cumulatively considerable
3. Identify and analyze the GHG emissions resulting from specific actions or categories of actions anticipated within the geographic area
4. Specify measures or a group of measures, including performance standards that substantial evidence demonstrates, if implemented on a project-by-project basis, would collectively achieve the specified emissions level

5. Monitor the plan's progress
6. Adopt the GHG Reduction Strategy in a public process following environmental review

Although the City's 2009 CCAP meets several of the elements of a qualified GHG reduction strategy, the City Council did not support all of the programs proposed in the CCAP or the development of a qualified plan. Therefore, the first BAAQMD *CEQA Air Quality Guidelines* significance threshold cannot be applied in this Program EIR when analyzing the General Plan 2035, which serves as the City's Climate Action Plan (CAP).

The second threshold (6.6 MT of $CO_2e$ per SP) is relevant for use, but, given the recent legislative attention and judicial action regarding post-2020 goals and the scientific evidence that additional GHG reductions are needed beyond the year 2020, the Association of Environmental Professionals' (AEP) Climate Change Committee published a white paper in 2016 recommending that CEQA analyses for most land use development projects can continue to rely on current thresholds for the immediate future, but that the significance determination should be based on demonstrating substantial progress along a post-2020 trajectory (Association of Environmental Professionals 2016). The BAAQMD plan-level threshold of 6.6 MT of $CO_2e$ per SP per year is intended to achieve the state's 2020 goal of reducing emissions to 1990 levels. Therefore, the second BAAQMD *CEQA Air Quality Guidelines* significance threshold also cannot be applied to the proposed project.

Accordingly, a year 2035 GHG efficiency threshold can be calculated to represent the rate of emissions reduction necessary for the proposed project to achieve a fair share of statewide GHG reductions necessary to meet post-2020 SB 32 targets.[2] With the release of the 2017 Scoping Plan, CARB recognized the need to balance population growth with emissions reductions and in doing so, provided a new local plan level methodology for target setting that provides consistency with state GHG reduction goals using per capita efficiency targets. These statewide per capita targets account for all emissions sectors in the state, statewide population forecasts, and the statewide reductions necessary to achieve the 2030 and 2050 statewide target under SB 32. The targets are generated by dividing the statewide 2030 GHG emissions targets by the statewide service population (employees plus residents) for that year. The 2017 Scoping Plan recommends that local governments aim to achieve a community-wide goal of no more than 6 MT of $CO_2e$ per SP by 2030 and no more than 2 MT of $CO_2e$ per SP by 2050 (CARB 2017). However, because Novato's 2015 GHG inventory does not include agriculture or industrial emission sources, the 2017 Scoping Plan thresholds must be adjusted in order to provide a local threshold consistent with the 2017 Scoping Plan. To determine whether General Plan 2035 would impede substantial progress toward achieving the project emissions reduction targets established by AB 32, SB 32, and the 2017 Scoping Plan, this EIR establishes a 2035 efficiency threshold based on a 2035 emissions target consistent with the 2017 Scoping Plan. The efficiency threshold represents the rate of emissions reductions necessary for the City of Novato to achieve a fair share of statewide GHG reductions necessary to meet the long-term targets, excluding emissions from the agricultural and industrial sectors.

The following equations detail how the emissions target / efficiency threshold was calculated:

[2] The *Cleveland National Forest Foundation vs. San Diego Association of Governments* (2017) case established that a GHG reduction goal established by executive order does not have to be used as significance threshold for the purposes of CEQA because it is not a binding legal mandate and does not include an adopted plan that demonstrates a discrete pathway to achieving that goal. In light of that case ruling, this analysis does not use the carbon neutrality goal set forth by EO B-55-18 as a significance threshold. Rather, this analysis uses the GHG reduction targets established by SB 32, which is a legal mandate, and the 2017 Scoping Plan, which is an adopted plan that demonstrates a discrete pathway to achieving the GHG reduction targets of SB 32.

## Equation 4.6-1

$$Efficiency\ Threshold = \frac{2035\ Emissions\ Goal}{2035\ Population + 2035\ Employment}$$

**Where:**

Efficiency Threshold = Average emissions efficiency: 2.38 MT $CO_2$e per service population per year

2035 Emissions Goal = 83.3 percent of 2030 Scoping Plan Emissions Goals for Residential/Commercial, Electric Power, High Global Warming Potential (GWP), Recycling and Waste, and Transportation Sectors: 155.5 MMT $CO_2$e per year (linear interpolation of 2017 Scoping Plan goals, see equation 4.6-2)

2035 Population = Statewide in 2035: 45,440,735 (DOF 2018)

2035 Employment = Statewide employment in 2035: 19,924,000 (California Department of Transportation 2017)

## Equation 4.6-2

$$2035\ Emissions\ Goal = 2030\ Goal + (2050\ Goal - 2030\ Goal) * \frac{(2035 - 2030)}{(2050 - 2030)}$$

**Where:**

2035 Emissions Goal = 83.3 percent of Scoping Plan 2030 Emissions Goals for Residential/Commercial, Electric Power, High Global Warming Potential (GWP), Recycling and Waste, and Transportation Sectors: 155.5 MMT $CO_2$e per year

2030 Goal = 2017 Scoping Plan Emissions Goals for Residential/Commercial, Electric Power, High Global Warming Potential (GWP), Recycling and Waste, and Transportation Sectors: 187 MMT CO2e per year (per 2017 Scoping Plan, see Table 4.6-1)

2050 Goal = 80[3] percent below 1990 emissions level, excluding agricultural and industrial emissions: 61 MMT $CO_2$e per year (per 2017 Scoping Plan)

### Table 4.6-1 Scoping Plan 2030 Emissions Goals by Land Use Sector

| Land Use Sector | Emissions (MMT of $CO_2$e)[1] |
|---|---|
| Residential and Commercial | 38 |
| Electric Power | 30 |
| High GWP | 8 |
| Recycling and Waste | 8 |
| Transportation | 103 |
| **Total** | **187** |

[1]CARB 2017

The targets recommended by the 2017 Scoping Plan, adjusted to be specific for Novato, are appropriate for the City of Novato (a local government) to use as the basis for determining an applicable significance threshold for General Plan 2035. Based on the above, General Plan 2035 must meet the target GHG emissions of approximately 2.38 MT $CO_2$e per person per year at full

[3] The 2050 target of 80 percent below baseline 2020 levels is equivalent to a 66% reduction below 2030 target levels.

buildout in the year 2035. Emissions greater than 2.38 MT $CO_2e$ per person per year may conflict with substantial progress toward the long-term reduction targets identified by SB 32 and the 2017 Scoping Plan, and the project's cumulative contribution of long term emissions would be considered significant.

## b. Methodology for GHG Emissions

The focus of this analysis and the estimate of GHG emissions are limited to only those potential emissions that would result from implementation of the proposed project. While emissions generated in the City and the region (such as those emissions generated by businesses or individual operations) may contribute to GHG emissions globally, only those emissions that may change compared to existing conditions as a result of the implementation of the proposed project are included in this EIR as a reasonable approach to estimate GHG impacts of the proposed project. Emissions not directly resulting from implementation of the proposed project are considered outside the scope of this CEQA analysis because it would be speculative to analyze impacts not directly related to the proposed project.

The GHG emissions forecast contained in Appendix E of General Plan 2035 projects 2035 emissions based on buildout and implementation of the proposed project, which includes policies and programs aimed at reducing communitywide GHG emissions. This analysis utilizes the emissions forecast calculated for General Plan 2035 to determine whether the GHG emissions reductions that would be achieved by General Plan 2035 align with state and regional targets. It is important to note that the vehicles miles traveled (VMT) forecast used for the City's GHG inventory is lower than that of the transportation analysis (see Section 4.13, *Transportation and Traffic*) due to differing methodologies. The City's GHG inventory utilizes the Regional Targets Advisory Committee (RTAC) method recommended by SB 375 while the transportation analysis utilizes the SB 743 method recommended by the Office of Planning and Research (OPR). The main difference between these two methods relates to how each method accounts for trips that have either an origin or a destination in the City of Novato (e.g., trips that begin in Novato but end outside the city or vice versa). The RTAC method assigns half the trip length of such trips to the jurisdiction of origin and half the trip length to the jurisdiction of destination, in accordance with standard International Council for Local Environmental Initiatives (ICLEI) methodology for assigning regional VMT. The SB 743 method assigns the entire trip length to both the jurisdiction of origin and the jurisdiction of destination. Therefore, the RTAC method results in a lower estimate of VMT than the SB 743 method. Nevertheless, it is still appropriate to use the VMT forecast calculated via the RTAC method because this method assumes that both jurisdictions have equal responsibility for reducing GHG emissions generated by multi-jurisdictional trips (thus accounting for each jurisdictions' "fair-share" contribution). Furthermore, the RTAC method is widely used for calculating VMT for use in GHG inventories and Climate Action Plans.

## c. Project Impacts and Mitigation Measures

| | |
|---|---|
| **Threshold 1:** | Would the project generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment? |

**Impact GHG-1 IMPLEMENTATION OF GENERAL PLAN 2035, WHICH SERVES AS THE CITY'S CLIMATE ACTION PLAN, WOULD GENERATE ANNUAL GHG EMISSIONS OF APPROXIMATELY 191,003 MT OF $CO_2E$ PER YEAR, OR 2.29 MT OF $CO_2E$ PER SP PER YEAR, WHICH WOULD NOT EXCEED THE 2035 EFFICIENCY THRESHOLD OF 2.38 MT OF $CO_2E$ PER SP PER YEAR. IMPACTS WOULD THEREFORE BE LESS THAN SIGNIFICANT.**

Citywide GHG emissions are based on the City's 2015 emissions inventory and the updated GHG emissions forecast that includes implementation of the proposed project, including Industrial Parks MPA and four focus areas. General Plan 2035 is intended to serve as the City's Climate Action Plan. Policies and programs identified with a leaf include emission reduction measures for the Climate Action Plan. Appendix E of General Plan 2035 contains an updated GHG inventory, forecast, and analysis of anticipated emission reductions based on General Plan policies and implementing actions. The updated GHG forecast assumes that several state and local GHG reduction measures will be implemented by 2035. Specifically, the updated GHG forecast accounts for the following state actions:

- Implementation of the Renewable Portfolio Standard, which requires electricity providers to increase the portion of energy that comes from renewable sources to 60 percent by 2030 and zero-carbon by 2045
- Implementation of Title 24 and subsequent building standards updates that ultimately achieve net zero energy use for new residential and non-residential construction
- Reduction of indoor residential and indoor/outdoor commercial lighting energy usage by at least 50 percent from 2007 levels (AB 1109)
- Incentives for the installation of solar water heating systems (AB 1470)
- Implementation of light and heavy-duty fleet regulations, including Pavley standards, the Advanced Clean Cars program, tractor-trailer GHG regulations, and heavy-duty GHG emissions standards (Phase One)

The updated GHG forecast also accounts for the following local actions, which are included as policies and programs in General Plan 2035:

- Replacement of 3,126 streetlights with LED lamps
- Reduction of municipal building energy use by 30 percent
- Establishment of energy efficiency protocols for municipal facilities
- Implementation of energy efficiency programs
- Implementation of public outreach efforts regarding energy efficiency and GHG emission reductions
- Encouragement of Marin Clean Energy to provide Light Green power that is 95 percent GHG-free and encouragement of homeowners and businesses to purchase Deep Green power that is 100 percent renewable electricity
- Installation of renewable energy systems at municipal buildings
- Removal of barriers to small-scale, distributed renewable energy production

- Expansion of the City's green building program to include Tier 1 requirements for energy efficiency Green building standards
- Requirement of the use of high "albedo" material for future outdoor surfaces
- Increase of tree cover in the City
- Reduction of citywide water use by 20 percent
- Upgrade of municipal plumbing fixtures and irrigation to improve water efficiency by 20 percent
- Implementation of idling limits for commercial and construction vehicles and buses
- Creation of ride-share programs, preferential parking, and shuttle services to public transit and facilitate development of a citywide car-share program
- Improvement of low emission vehicle infrastructure
- Conversion of the City's vehicle fleet to hybrid, electric, and alternative fuels vehicles and installation of clean diesel technology
- Encouragement of mixed use, infill development near transit
- Improvement of the jobs-housing balance by attracting employers to the city
- Support of affordable housing ordinance and programs
- Promotion of walking and construction of pedestrian facilities
- Increase of commercial bicycle parking and facilities requirements
- Increase of multi-family residential bicycle parking and facilities requirements
- Adoption of Complete Streets standards to expand pedestrian and bicycle infrastructure
- Revision of parking standards to allow for reductions in the number of required parking spaces
- Improvement of the transit system
- Employment of traffic calming methods to promote walking as a safe mode of travel to school
- Encouragement of municipal employees to use alternative forms of transportation to travel to and from work
- Achievement of zero waste diversion goals

As shown in Table 4.6-2, under the "business as usual" scenario, estimated citywide GHG emissions would be approximately 318,177 MT of $CO_2e$ per year in 2035. However, state actions are expected to reduce the City's GHG emissions by approximately 78,766 MT of $CO_2e$ per year by 2035, and local actions (included as policies and programs in General Plan 2035) are expected to reduce GHG emissions by approximately 48,408 MT of $CO_2e$ per year by 2035 for a total reduction of 127,174 MT of $CO_2e$ per year. Accounting for state and local GHG emission reduction actions, citywide GHG emissions from buildout of General Plan 2035 would be approximately 191,003 MT of $CO_2e$ per year, or 2.29 MT of $CO_2e$ per SP per year. Therefore, GHG emissions generated by the proposed project would not exceed the 2035 efficiency threshold of 2.38 MT of $CO_2e$ per SP per year.

**Table 4.6-2 Estimated General Plan 2035 Emissions**

| Emission Source | Annual Emissions ($MT\ CO_2e$) |
|---|---|
| Existing (2015) Emissions[1] | 313,128 |
| Business as Usual | 318,177 |
| State Actions | (78,766) |
| Local Actions | (48,408) |
| **Total** | **191,003** |
| Service Population | 83,580 persons[2] |
| **Total per Service Population** | **2.29 MT of $CO_2$e per SP** |
| Threshold | 2.38 MT of $CO_2$e per SP |
| Threshold Exceeded? | No |

( ) denotes a negative number.

[1] Provided for informational purposes only

[2] 55,360 residents + 28,220 jobs. See Section 4.11, *Population and Housing,* for estimated population and employment projections for General Plan 2035.

Source: City of Novato 1998, Appendix E

Goals, policies, and programs contained in General Plan 2035 would implement the GHG emission reduction strategies necessary for the City to achieve reductions in line with the state's 2030 and 2050 targets. For example, Policies LU 2, LU 14, CC 6, CC 7, and MO 11 would encourage mixed-use, infill development near transit thus reducing vehicle trips. In addition, Policy MO 7 would adopt Complete Streets design standards, and policies LU 13, LU 17, LU 19, LU 24, CC 8, LW 5, MO 8, MO 18, MO 19, and MO 20 would support the expansion of bicycle and pedestrian infrastructure. All of these policies would assist in reducing VMT. Policy EV 1 would improve the jobs/housing balance by attracting employers to the city and reducing GHG emissions. Policies LU 17, CC 9, MO 13, MO 14, MO 15, MO 16, and MO 17 would improve the transit system making public transit more accessible to increase ridership and thus reduce dependence on automobiles. Policy ES 26 would support the removal of barriers to on-site, distributed renewable energy production and Policy ES 25 would support the implementation of energy and water conservation features and programs at the City level and communitywide. Finally, Policy ES 27 would support the City in reaching its zero-waste diversion goal. Therefore, GHG emissions from buildout of General Plan 2035, including the Industrial Parks MPA and four focus areas, would be in line with state targets for 2030 and 2050, and impacts from GHG emissions would be less than significant.

## Mitigation Measures

No mitigation measures are required.

| **Threshold 2:** | Would the project conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases? |
|---|---|

### Impact GHG-2 THE PROPOSED PROJECT WOULD BE CONSISTENT WITH GHG REDUCTION GOALS CONTAINED IN THE CITY OF NOVATO 2009 CLIMATE CHANGE ACTION PLAN AND THE ABAG/MTC *PLAN BAY AREA 2040* AND WOULD NOT CONFLICT WITH STATE POLICIES OR REGULATIONS. IMPACTS WOULD BE LESS THAN SIGNIFICANT.

As discussed above, the City adopted a CCAP in 2009. The CCAP outlines strategies to achieve a GHG reduction target of 15 percent below 2005 emission levels by the year 2020 and suggests a 2035 goal of 40 percent below 2005 levels to achieve the 80 percent statewide reduction by 2050 called for in Executive Order S-3-05. The CCAP includes nine global warming reduction goals applicable to the proposed project. As shown in Table 4.6-3, the proposed project would be consistent with the CCAP's GHG reduction goals. Furthermore, as discussed under Impact GHG-1, the GHG reduction strategies outlined in Appendix E of General Plan 2035, which build on the strategies of the 2009 CCAP, are integrated into the goals and policies of General Plan 2035. As discussed under Impact LU-2 in Section 4.9, *Land Use and Planning*, the proposed project, including the Industrial Parks MPA, would be consistent with the goals of *Plan Bay Area 2040*. Therefore, new development associated with General Plan 2035, the focus areas, the Industrial Parks MPA, and implementing ordinances would be consistent with GHG reduction goals and impacts would be less than significant.

### Table 4.6-3 General Plan Consistency with State Regulations and the City of Novato 2009 Climate Change Action Plan

| State Regulations and 2009 CCAP Goals | General Plan Consistency |
|---|---|
| **GHG Emission Reduction Targets**<br>*AB 32*: Reduce GHG emissions to 1990 levels by 2020.<br>*SB 32*: Reduce GHG emissions by 40 percent below 1990 levels by 2030 and 80 percent below 1990 levels by 2050. | **Consistent**<br>As discussed under Impact GHG-1, per capita GHG emissions would fall below the 2035 efficiency threshold, which is designed to ensure that the City of Novato achieves its fair share of emissions reductions necessary to achieve AB 32 and SB 32 targets. |
| **Energy Efficiency and Conservation**<br>*City of Novato 2009 CCAP Goal 1*: Reduce emissions from the energy sector through energy efficiency and conservation efforts within municipal and community operations. | **Consistent.** Part of the sustainability theme of General Plan 2035 is to conserve energy and water and shift to renewable energy sources. Another overarching sustainability strategy to decrease electricity demand includes adopting green building requirements with an ultimate goal of achieving energy-efficient buildings that offset their remaining energy use through renewable energy production. The following Environmental Stewardship Chapter policies would reduce energy in the City:<br>▪ **ES 25 Energy and Water Conservation**. Increase energy and water efficiency and conservation in City buildings, equipment and operations. Promote energy and water conservation and building upgrades to the community.<br>▪ **ES 26 On-site Energy Production.** Support on-site renewable energy facilities that help reduce community energy demand.<br>Under State law, development facilitated by General Plan 2035, including development in the four focus areas and the Industrial Parks MPA, would be required to comply with all energy standards of Title 24 that are in effect at the time of development. The 2016 Title 24 standards are approximately 28% more efficient than the 2013 standards. The 2013 Title 24 standards are approximately 30% more efficient than the 2008 standards, which in turn are |

| State Regulations and 2009 CCAP Goals | General Plan Consistency |
|---|---|
| | approximately 15% more efficient than the 2005 standards. |
| **Renewable Energy**<br>*City of Novato 2009 CCAP Goal 2*: Reduce emissions associated with energy generation through promotion and support of renewable energy generation and use.<br>*SB 100*: Achieve 100 percent renewable electricity by 2045. | **Consistent.** Part of the sustainability theme of General Plan 2035 is to shift to renewable energy sources and adopt green building requirements to achieve energy-efficient buildings that offset their remaining energy use through renewable energy production. The following Environmental Stewardship Chapter programs promote renewable energy in the City.<br>▪ **ES 25a:** *Reduce Resource Use in Buildings*. Require new development to minimize impacts on the environment, including use of energy and water-efficient design features and materials consistent with local building codes and Water District regulations. Strive to achieve sustainable development that, through on-site conservation and renewable energy generation or off-site offsets, has no increased demand on energy and water resources pursuant to the Water District's Urban Water Management Plan.<br>▪ **ES 25c:** *City Facilities and Operations*.<br>▫ 3. Install cost-effective renewable energy systems on City buildings and facilities with a goal of reducing electricity use 800,000 kWh by 2035.<br>▪ **ES 25f:** *Energy Conservation Programs*. Support efforts of Marin Clean Energy and PG&E to increase the proportion of renewable power offered to residents and businesses and to promote energy conservation programs.<br>▪ **ES 25g:** *PACE Financing*. Enable PACE (Property Assessed Clean Energy) financing programs to fund installation of renewable energy systems and other efficiency upgrades in existing buildings. Help promote these opportunities to residents and businesses.<br>New development facilitated by General Plan 2035, including development in the four focus areas and the Industrial Parks MPA, would be required to comply with the provisions of ES 25a, which would increase renewable energy generation in the Novato. |
| **Green Building Design**<br>*City of Novato 2009 CCAP Goal 3*: Reduce emissions from the built environment through "green building" and urban design principles that minimize the urban heat island effect and reduce energy consumption. | **Consistent.** Implementation of policies in the Environmental Stewardship Chapter listed above would promote green building standards. In addition, development facilitated by General Plan 2035, including development in the four focus areas and the Industrial Parks MPA, would be required to comply with all energy standards of Title 24, that are in effect at the time of development. The 2016 Title 24 standards are approximately 28% more efficient than the 2013 standards. The 2013 Title 24 standards are approximately 30% more efficient than the 2008 standards, which in turn are approximately 15% more efficient than the 2005 standards. |
| **Water Conservation**<br>*City of Novato 2009 CCAP Goal 4*: Reduce emissions from water and wastewater sources by increasing water conservation. | **Consistent.** Part of the sustainability theme of General Plan 2035 is to conserve energy and water and shifting renewable energy sources. The following Environmental Stewardship Chapter and A City that Works Chapter policies and programs would support water conservation in the City:<br>▪ **ES 25 Energy and Water Conservation**. Increase energy and water efficiency and conservation in City buildings, equipment and operations. Promote energy and water conservation and building upgrades to the community.<br>▪ **ES 25a:** *Reduce Resource Use in Buildings*. Require new |

| State Regulations and 2009 CCAP Goals | General Plan Consistency |
|---|---|
| | development to minimize impacts on the environment, including use of energy and water-efficient design features and materials consistent with local building codes and Water District regulations. Strive to achieve sustainable development that, through on-site conservation and renewable energy generation or off-site offsets, has no increased demand on energy and water resources pursuant to the Water District's Urban Water Management Plan<br>▪ **PF 3a:** *Water Conservation*. Assist the North Marin Water District in implementing water conservation programs for Novato residents and businesses. Use treated wastewater for irrigation of City facilities and expansion of the recycled water system to the maximum extent practical.<br>New development facilitated by General Plan 2035, including development in the four focus areas and the Industrial Parks MPA, would be required to comply with the provisions of EL 25a, which would increase water conservation. |
| **Vehicle Efficiency and Alternative Fuels**<br>*City of Novato 2009 CCAP Goal 5*: Reduce emissions from transportation sources by promoting use of alternative fuels and efficient use of traditional automobiles. | **Consistent**. The proposed project would reduce transportation emissions by providing a more efficient circulation system that accommodates all users and maintains acceptable levels of services, thus increasing the efficiency of automobiles. The following policies and programs from the City that Works and Environmental Stewardship Chapters promote efficient use of automobiles and the use of alternative fuels.<br>▪ **MO 1: Land Use and Transportation Coordination***.* Manage community growth and infrastructure projects so development can be adequately served by transportation facilities.<br>▪ **MO 1e:** *Traffic Signal Timing*. Optimize traffic signal timing and demand coordination to improve traffic flow and reduce fuel consumption, pollution and greenhouse gas emissions.<br>▪ **MO 2: Level of Service Standards**. Establish traffic Level of Service (LOS) standards as follows for use in evaluating the impacts of proposed development projects so the project can be redesigned or effective mitigation measures can be implemented, making improvements to the roadway system, and determining appropriate traffic impact fees. Continue to consider LOS standards in evaluating the merits of proposed development or traffic infrastructure projects in addition to consideration of standards associated with Vehicle Miles Traveled (VMT) in the required environmental review process. Acceptable LOS standards for intersections in the City are:<br>a. At intersections with signals or four-way stop signs: operation at LOS D,<br>b. At intersections with stop signs on side streets only: operation at LOS E.<br>▪ **ES 24: Emission Reduction Targets.** Establish reduction targets for greenhouse gas emissions and actively implement local strategies to reduce the effects of climate change.<br>▪ **ES 24b**: *Implementation*. Implement the Emission Reduction Measures contained in Appendix E to achieve projected reductions in greenhouse gas emissions as feasible.[1]<br>▪ **ES 25: Energy and Water Conservation**. Increase energy and water efficiency and conservation in City buildings, equipment and operations. Promote energy and water conservation and |

| State Regulations and 2009 CCAP Goals | General Plan Consistency |
|---|---|
| | building upgrades to the community.<br>▪ **ES 25c**: *City Facilities and Operations*. Consider the replacement of existing City fleet vehicles with reduced emission vehicles to assist with achieving the City's greenhouse gas reduction goals. |
| **Citywide Land Use and Design**<br>*City of Novato 2009 CCAP Goal 6*: Reduce emissions by decreasing vehicle miles traveled (VMT) within the City through strategic Land Use and Design.<br>*SB 375/Play Bay Area*: Reduce emissions from transportation sources through land use planning that reduces VMT. | **Consistent**. The land use and design of General Plan 2035 would maintain the character of the City while promoting infill development to decrease VMT. For example, the vision of the Downtown focus area is to allow mixed use development, be close to residential neighborhoods, and be easily navigable by pedestrians and bicycles. Similarly, the vision for the North Redwood Corridor area is to include new commercial development that is pedestrian oriented with convenient pedestrian and bicycle connections to the Downtown and SMART stations, which would reduce VMT within the City. The vision for the Industrial Parks MPA is to allow for expanded development in order to improve the jobs/housing balance in Novato, which would allow more residents to work in the city rather than commuting, thereby reducing VMT. Furthermore, the development standards of the Industrial Parks MPA include creation of a Transportation Demand Management Plan for the life science campus, which would also reduce VMT.<br>The following are policies related to VMT reduction and land use design from the City that Works Chapter of General Plan 2035.<br>▪ **MO 1: Land Use and Transportation Coordination***.* Manage community growth and infrastructure projects so development can be adequately served by transportation facilities.<br>▪ **MO 5: Continuation of Streets**. Facilitate the continuation of streets and bicycle and pedestrian paths through developments, wherever reasonable and feasible, to distribute traffic, improve emergency response options and connect neighborhoods.<br>▪ **MO 7**: **Design for Complete Streets**. Incorporate Complete Streets practices in the planning, design and operation of the City's circulation network, where feasible, consistent with the other objectives, policies and programs of the General Plan.<br>▪ **MO 11: Higher Density/Intensity Land Uses Adjacent to Public Transit.** Encourage higher density/intensity land uses such as offices, mixed use, multiple family residences, public services, and commercial retail centers near transit routes and facilities to reduce vehicle trips. |
| **Alternative Transportation Modes**<br>*City of Novato 2009 CCAP Goal 7*: Reduce emissions from transportation sources through promotion of non-vehicular modes of travel. | **Consistent**. The City that Works Chapter of General Plan 2035 promotes an efficient circulation system for all modes of travel by providing ample connections locally and regionally. The goals and policies of this Chapter address a balanced transportation network that will support and encourage walking, bicycling, and transit ridership. The following City that Works goals and policies promote alternative modes of transportation.<br>▪ **Goal MO 1: Provide a safe and efficient circulation system that accommodates all users and maintains acceptable levels of service.**<br>▪ **MO 5: Continuation of Streets**. Facilitate the continuation of streets and bicycle and pedestrian paths through developments, wherever reasonable and feasible, to distribute traffic, improve emergency response options and connect neighborhoods.<br>▪ **MO 7: Design for Complete Streets**. Incorporate Complete Streets practices in the planning, design and operation of the |

| State Regulations and 2009 CCAP Goals | General Plan Consistency |
|---|---|
| | City's circulation network, where feasible, consistent with the other objectives, policies and programs of the General Plan.<br>▪ **MO 8: Enhance Multimodal Infrastructure**. When developing plans for new or retrofitted roadways, incorporate infrastructure as appropriate that enhances multimodal circulation in addition to auto circulation, such as sidewalks, pedestrian paths, bike lanes, pedestrian refuge islands, accessible curb ramps, transit shelters, and pedestrian-scale lighting.<br>▪ **Goal MO 2: Encourage sustainable mobility systems that reduce dependence on low-occupancy automobiles**.<br>▪ **MO 11: Higher Density/Intensity Land Uses Adjacent to Public Transit**. Encourage higher density/intensity land uses such as offices, mixed use, multiple family residences, public services, and commercial retail centers near transit routes and facilities to reduce vehicle trips.<br>▪ **Goal MO 4: Provide a safe and convenient bicycle and pedestrian network that accommodates all ages and abilities**.<br>▪ **MO 18: Comprehensive Bicycle Network**. Establish and maintain a bicycle network that is consistent with the adopted Bicycle/Pedestrian Plan.<br>▪ **MO 19: Bicycle Parking**. Assure the provision of adequate bicycle parking to encourage bicycle use.<br>▪ **MO 20: Safe and Convenient Pedestrian Facilities**. Promote, provide and maintain a safe and convenient pedestrian system, including consideration of lighting, sidewalk condition, road surface conditions, roadways crossings, access points, signage, shade landscaping, and street furniture.<br>▪ **MO 21: School Traffic and Circulation**. Collaborate with the schools to identify and prioritize transportation improvements that strengthen pedestrian and bicycle safety for students traveling to and from schools.<br>In addition, policies for the Downtown area include improving the multi-model function of Redwood Boulevard through improved bicycle lanes and wider sidewalks, and policies for the North Redwood Corridor include expanding the pedestrian and bicycle network along the SMART corridor and creating wide sidewalks and a bicycle path along the Redwood Boulevard frontage. These policies would support the reduction of GHG emissions from vehicular travel by promoting and facilitating the use of public transit and alternative transportation methods. |
| **Waste**<br>*City of Novato 2009 CCAP Goal 8*: Reduce emissions from waste sources.<br>*SB 1383*: Reduce emissions of short-lived climate pollutants, including methane, hydrofluorocarbons, and anthropogenic black carbon. Reduce the quantity of organic waste in landfills. | **Consistent**. One of the themes of General Plan 2035 is to maintain a sustainable community. Additionally, an overarching strategy of General Plan 2035 is to create a sustainable community by reducing waste and increasing recycling. The Environmental Stewardship Chapter of General Plan 2035 contains the following goals and policies related to waste reduction:<br>▪ **Goal EL 5: Engage in environmental stewardship that balances the needs of the environment, the economy and a diverse society to utilize our natural resources in a sustainable way.**<br>▪ **ES 27: Solid Waste Reduction**. Encourage solid waste reduction methods towards achieving an 80% diversion rate by 2025 and a 90% diversion rate by 2035.<br>Development facilitated by General Plan 2035, including development in the four focus areas and the Industrial Parks MPA, |

| State Regulations and 2009 CCAP Goals | General Plan Consistency |
|---|---|
| | would be encouraged to implement solid waste reduction methods under ES 27. |
| **Climate Change Resiliency**<br>*City of Novato 2009 CCAP Goal 9*: Improve the city's resilience to reduce vulnerability to extreme events resulting from Climate Change. | **Consistent**. General Plan 2035 includes a comprehensive set of goals and policies to achieve a more sustainable future for Novato while contributing to regional and global sustainability initiatives. One of the overarching strategies to create a sustainable community includes planning for the inevitable impacts of climate change, including sea level rise, drought, and increased fire risk. Policies below from the Environmental Stewardship Chapter and City that Moves Chapter would help the City become resilient to climate change.<br>▪ **ES 24: Emissions Reduction Targets.** Establish reduction targets for greenhouse gas emissions and actively implement local strategies to reduce the effects of climate change.<br>▪ **SH 2: Flood Hazards**. Reduce the risk of loss of life, personal injury and property damage resulting from flooding by properly maintaining storm drainage systems, natural flood control channels and waterways and regulating runoff from new construction and development projects. Encourage flood control measures that retain the natural features and conditions of watercourses to the maximum feasible extent.<br>▪ **SH 3: Fire Hazards**. Reduce the risk of loss of life, personal injury and property damage resulting from wildland and urban fire hazards through code enforcement and coordination with the Novato Fire Protection District.<br>Development facilitated by General Plan 2035, including development in the four focus areas and the Industrial Parks MPA, would be required to comply with the provisions of SH 2 and SH 3 as applicable, which would promote climate change resiliency. |

[1] The Emission Reduction Measures contained in Appendix E of General Plan 2035 include measures to improve infrastructure for low emission vehicles and increase the use of alternative fuel vehicles in the City's vehicle fleet.

## Mitigation Measures

No mitigation measures are required.

## Cumulative Impacts

GHG emissions and climate change are by definition cumulative impacts, as they affect the accumulation of greenhouse gases in the atmosphere. As indicated above in Impact GHG-1 emissions associated with the proposed project, including Industrial Parks MPA, would be less than significant, and the project's impacts are therefore also cumulatively less than significant.

# 4.7 Hazards and Hazardous Materials

This section addresses impacts associated with exposure to hazards and hazardous materials from implementation of the proposed project. Specifically, this analysis addresses impacts related to hazardous materials use and transportation, the accidental release of hazardous materials, new development or re-development on contaminated sites, air traffic hazards, interference with emergency response and evacuation plans, and the risk of exposure to wildland fires.

## 4.7.1 Setting

### a. Definition of Hazardous Materials

A material is considered hazardous if it appears on a list of hazardous materials prepared by a federal, state, or local agency, or if it has characteristics defined as hazardous by such an agency. A hazardous material is defined in Title 22 of the California Code of Regulations as follows:

> A substance or combination of substances which, because of its quantity, concentration, or physical, chemical or infectious characteristics, may either (1) cause, or significantly contribute to, an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or (2) pose a substantial present or potential hazard to human health or environment when improperly treated, stored, transported or disposed of or otherwise managed (California Code of Regulations, Title 22, Section 66261.10).

Chemical and physical properties cause a substance to be considered hazardous. Such properties include toxicity, ignitability, corrosiveness, and reactivity. California Code of Regulations, Title 22, Sections 66261.20 through 66261.24 defines the aforementioned properties. The release of hazardous materials into the environment can contaminate soils, surface water, and groundwater supplies.

### b. Land Use Patterns

Small quantities of hazardous materials in Novato are routinely used, stored, and transported in commercial and retail businesses as well as in educational facilities, hospitals, and households. Hazardous materials users and waste generators in the City include businesses, public and private institutions, and households. Federal, State, and local agency databases maintain comprehensive information on the locations of facilities using large quantities of hazardous materials, as well as facilities generating hazardous waste. Some of these facilities use certain classes of hazardous materials that require accidental release scenario modeling and risk management plans to protect surrounding land uses.

Past and present land use patterns are good predictors of the potential for past contamination by hazardous materials and the current use and storage of hazardous materials. Industrial sites and certain commercial land uses, such as dry cleaners, are more likely to use and store large quantities of hazardous materials than residential land uses. Land use patterns are also useful for identifying the location of sensitive receptors, such as schools, day-care facilities, hospitals, and nursing homes. In Novato, industrial and commercial land uses are concentrated along major transportation corridors, such as Highway 101, Ignacio Boulevard, Novato Boulevard, the Downtown area, and the rail corridor. Hazardous materials are also likely to occur on the former Hamilton Field Army Airfield due to its past use as a military facility.

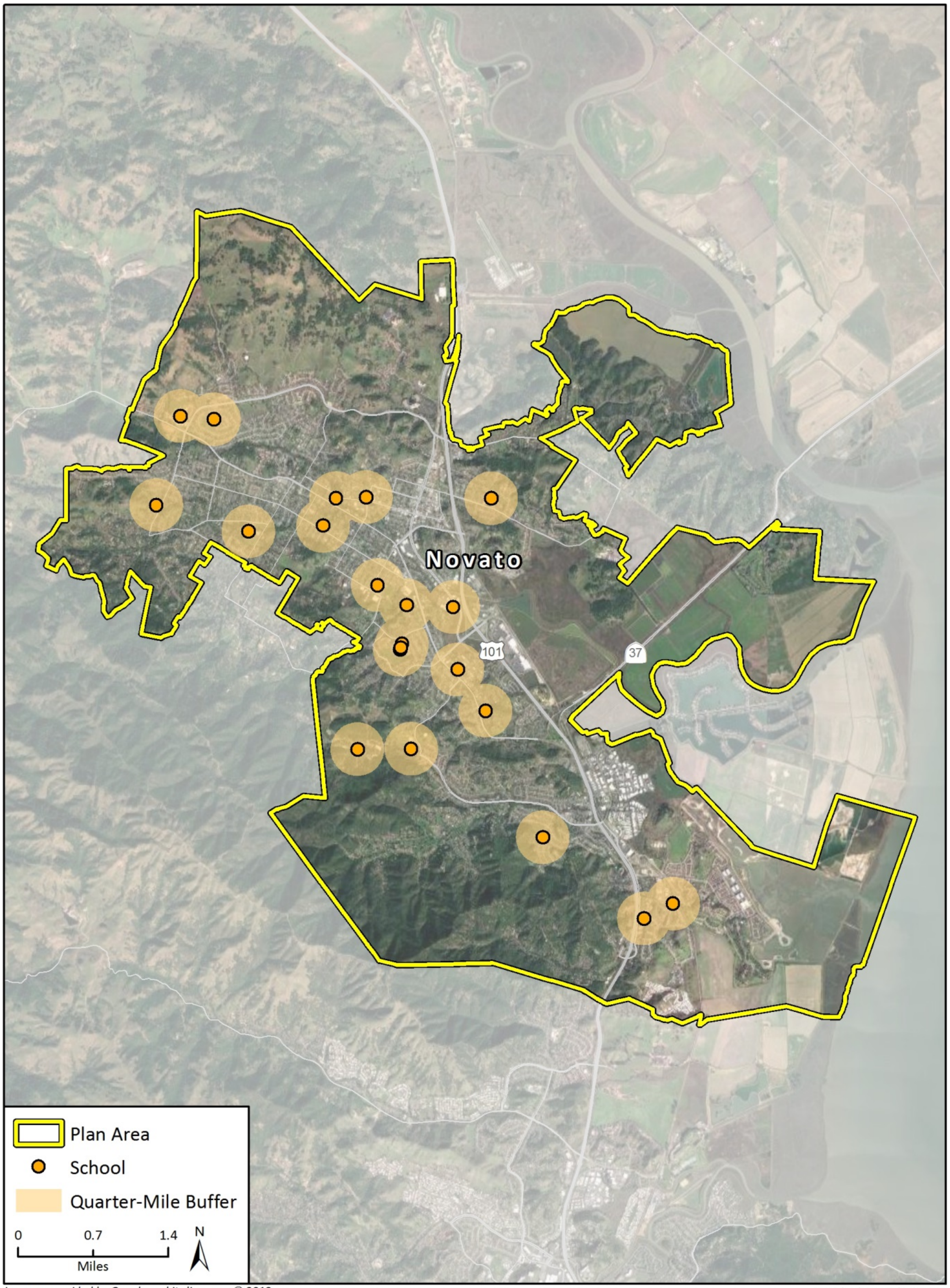
Public educational services within Novato are provided by the Novato Unified School District (NUSD). NUSCD oversees 19 schools and employs over 700 people (NUSD 2018). Figure 4.7-1 shows the locations of school facilities in the City as well as a 0.25-mile radius surrounding each school. Locations of schools throughout the City can also be seen in Figure 2-4 *General Plan Land Use Map,* in Section 2, *Project Description*.

## c. Existing Hazardous Material Contamination

Several existing contaminants, including asbestos, lead (in sources such as lead-based paint in buildings or in soil), and contaminated soil and groundwater, may be present in Novato. Due to the age of some existing buildings in the City that may be redeveloped under the proposed project, asbestos may be present in those structures build prior to 1973 when asbestos was banned and could be mobilized during demolition activities. Similarly, lead may be present in paint that was sold prior to 1978 when it was banned or in soil that was contaminated by leaded gasoline or improperly discarded batteries. Existing soil contamination may also be present at potential redevelopment sites due to contamination from household hazardous wastes. The U.S. EPA describes household hazardous waste as leftover household products that can catch fire, react, explode under certain circumstances, or that are corrosive or toxic. Household hazardous wastes are similar to the operational project-related hazardous materials described above, and include products such as paints, cleaners, oils, batteries, and pesticides (U.S. EPA 2018b).

The State Water Resources Control Board GeoTracker website identifies Leaking Underground Storage Tanks (LUST) cleanup sites, Cleanup Program Sites (formerly known as Spills, Leaks, Investigations, and Cleanups [SLIC] sites), military sites, land disposal sites (landfills), permitted underground storage tank sites, Waste Discharge Requirement sites, Irrigated Lands Regulatory Program sites, and Department of Toxic Substances Control cleanup and hazardous waste permit sites. A search of the GeoTracker database was conducted on April 6, 2018 (SWRCB 2018a). In addition, the Department of Toxic Substances Control's (DTSC) EnviroStor database was searched on April 6, 2018 for cleanup sites in the City (DTSC 2018). According to the database search, there are a total of 25 sites with or potentially containing hazardous materials in the General Plan Area; 18 are open or active hazardous waste sites and seven are active cleanup sites. These include eight LUST sites and ten other hazardous waste sites as shown in Table 4.7-1. In addition, 55 closed hazardous waste sites and 14 closed or inactive cleanup sites are located in the General Plan area.

**Figure 4.7-1 Existing City of Novato Schools with 0.25-Mile Buffer**




*Imagery provided by Google and its licensors © 2018.*
*Additional data provided by Marin County 2018.*

## Table 4.7-1 Hazardous Materials Sites in the General Plan Area

| Site Name | Address | Site ID | Site Type | Status/Pollutant |
|---|---|---|---|---|
| Novato Bus Facility | 801 Golden Gate Pl | T0604100156 | LUST | Site assessment (8/2/1994) |
| Olive Elementary School<br>Novato Unified School District | 819 Olive Street | T0604100097 | LUST | Site assessment (7/19/2001) |
| Unocal | 7455 Redwood Boulevard | T0604100194 | LUST | Open – Remediation (6/26/2007) |
| Shell | 2085 Novato Boulevard | T0604100119 | LUST | Site assessment (9/24/2003) |
| San Marin High School<br>Novato Unified School District | 15 San Marin Drive | T0604100274 | LUST | Site assessment (8/9/2006) |
| Fairfax French Cleaners | 173 San Marin Drive | SL 18266786 | Cleanup Program Site | Verification Monitoring (6/6/2016) |
| Black Point Antenna Field | Stonetree Lane | T10000000624 | Military Cleanup Site | Inactive as of (5/20/2009) |
| Seven to Seven Cleaners | 1432 South Novato Boulevard | SL20248866 | Cleanup Program Site | Open - Remediation (6/3/2016) |
| Mobil | 1400 South Novato Boulevard | T0604100080 | LUST | Open - Remediation (1/15/2014) |
| Indian Valley College | 1800 Ignacio Boulevard | T0604100251 | LUST | Site assessment (9/1/2015) |
| Novato Fire Station #64 | 319 Enfrente Road | T10000005196 | Cleanup Program Site | Eligible for closure (6/7/2017) |
| Chevron | 5810 Nave Drive | T0604100029 | LUST | Site assessment (7/30/1983) |
| Hamilton AAF | 1 Burma Road | T0604120794 | Military Cleanup Site | Verification Monitoring (8/1/2011) |
| Hamilton AAF LF #26 | 1 Burma Road | T0604104011 | Military Cleanup Site | Open - Remediation (12/29/2009) |
| Hamilton AAF HAAF Facility Wide | 1 Burma Road | T10000005291 | Military Cleanup Site | Open - Remediation (11/25/2013) |
| Novato DOD Housing | 957 C Street | T0609592162 | Military Privatized Site | Eligible for Closure (1/1/2011) |
| Novato DOD Housing | 970 C Street | T0609592161 | Military Privatized Site | Verification Monitoring 10/3/2012 |
| Novato DOD Housing | 970 C Street | T10000007672 | Military Privatized Site | Assessment & Interim Remedial Action (9/21/2015) |
| Former 7th Street Cleaners | 936 7th Street | 60002189 | Voluntary Cleanup | Active as of (5/1/2015) |
| NW Pacific RR Depot | Railroad Avenue at Grant Street | 70000099 | Evaluation | In active- needs evaluation as of 2/8/2007) |
| Golden Gate Business Park | Franklin Avenue next to NW Pacific RR | 21490025 | Evaluation | No further action as of (5/3/1990) |
| Black Point Communications Facility Annex | Stonetree Lane | 21970013 | State Response | No further action as of (9/5/2014) |

| Site Name | Address | Site ID | Site Type | Status/Pollutant |
|---|---|---|---|---|
| Bel Marin Keys Unit V | South of Bel Marin Keys Boulevard | 21990001 | Voluntary Cleanup | Refer other agencies (9/28/2000) |
| Omniglow Corporation | 20-C Pimentel Court | 21280005 | Voluntary Cleanup | No further action required as of (7/11/1996) |
| Rafael Village Fam House Annex | Novato, CA | 80000600 | Military Evaluation | No further action required as of (2/11/2013) |
| Pacheco Plaza One Hour Cleaners | 446 Ignacio Boulevard | 60002416 | Voluntary Cleanup | Active as of (8/24/2016) |
| Hamilton AAD AMMO Hill | Novato, CA | 80001047 | Military Evaluation | No further action required as of (4/11/2013) |
| Hamilton Phase II, Contract | Novato, CA | 80000755 | Military Evaluation | Inactive –needs evaluation as of (7/1/2005) |
| Hamilton GSA Phase I | Highway 101 | 21970007 | State Response | Certified as of (6/25/1996) |
| Hamilton AAF | Highway 101 | 21970010 | State Response | Active as of 8/18/1995) |
| Hamilton AAF | Highway 101 | 21970012 | State Response | Active as of (7/20/1999) |
| Hamilton AAF WAF Hill | Novato, CA | 80000756 | Military Evaluation | No further action required as of (4/11/2013) |
| Hamilton AAF | Novato, CA | 80001042 | Military Evaluation | No further action required as of (1/9/2014) |
| Hamilton GSA Lot 7 | Highway 101 | 21970009 | State Response | Certified as of (10/8/2014) |
| Hamilton AAF BRAC | Highway 101 | 21970008 | State Response | Certified as land use restrictions only as of (3/20/2013) |
| Hamilton Elementary School Site | State Access Road/ C Street | 21970014 | School Cleanup | Active as of (5/14/2004) |
| Novato Charter School | C Street/ Main Gate Road | 21890001 | School Investigation | No action required as of (5/15/2001) |
| DOD Housing Facility Hamilton Square | 970 C Street | 800001201 | State Response | Active as of (9/9/2014) |
| Novato DOD Housing | Highway 101 | 21970011 | State Response | Active as of (8/14/1995) |

Source: SWRCB 2018a; DTSC 2018

## d. Airports and Aircraft Hazards

There are no public or private airports in Novato; however, the Gnoss Field Marin County Airport is located approximately two miles north of Novato near the Marin/ Sonoma County border. A portion of Novato between San Marin Drive and Olive Street is inside the area of influence for the airport. The airport currently covers over 91.4 acres in unincorporated Marin County. In accordance with State law, the County of Marin and the City of Novato amended their respective general plans and zoning ordinances to incorporate the compatibility criteria and compatibility zones established by the Marin County Airport Land Use Commission (ALUC) for Gnoss Field Marin County Airport.

## e. Emergency Response Plans

Presidential Directive HSPD 5 identifies steps for improved coordination in response to incidents and requires a National Response Plan (NRP) and a National Incident Management System (NIMS). NIMS is a comprehensive, national approach to incident management developed to improve the coordination of federal, State and local emergency response nationwide. The State of California's NIMS Advisory Committee issued "California Implementation Guidelines for the National Incident Management System" to assist local governments and other entities to incorporate NIMS into already existing programs, plans, training and exercises.

The foundation of California's emergency planning and response is a statewide mutual aid system which is designed to ensure that adequate resources, facilities, and other support is provided to jurisdictions whenever their own resources prove to be inadequate to cope with a given situation.

The California Disaster and Civil Defense Master Mutual Aid Agreement (California Government Code Sections 8555–8561) requires signatories to the agreement to prepare operational plans to use within their jurisdiction, and outside their area. These plans include fire and non-fire emergencies related to natural, technological, and war contingencies. The State of California, all state agencies, all political subdivisions, and all fire districts signed this agreement in 1950.

California Government Code Section 8568, the "California Emergency Services Act," states that "the State Emergency Plan shall be in effect in each political subdivision of the state, and the governing body of each political subdivision shall take such action as may be necessary to carry out the provisions thereof." The Act provides the basic authorities for conducting emergency operations following the proclamations of emergencies by the Governor or appropriate local authority, such as a City Manager. The provisions of the act are further reflected and expanded on by appropriate local emergency ordinances. The Act further describes the function and operations of government at all levels during extraordinary emergencies, including war.

All local emergency plans are extensions of the State of California Emergency Plan. The State Emergency Plan conforms to the requirements of California's Standardized Emergency Management System (SEMS), which is the system required by Government Code 8607(a) for managing emergencies involving multiple jurisdictions and agencies (CalEMA 2009). The SEMS incorporates the functions and principles of the Incident Command System (ICS), the Master Mutual Aid Agreement (MMAA), existing mutual aid systems, the operational area concept, and multi-agency or inter-agency coordination (CalEMA 2009). Local governments must use SEMS to be eligible for funding of their response-related personnel costs under state disaster assistance programs (CalEMA 2009). The SEMS consists of five organizational levels that are activated as necessary, including: field response, local government, operational area, regional, and state. The State of California Governor's Office of Emergency Services divides the state into six mutual aid regions. The City of Novato is located in Mutual Aid Region II, which includes Del Norte, Humboldt, Mendocino, Sonoma, Lake, Napa, Marin, Solano, Contra Costa, San Francisco, San Mateo, Alameda, Santa Clara, Santa Cruz, San Benito, and Monterey Counties (California Governor's Office of Emergency Services Auxiliary Communications Service 2018).

In an emergency, governmental response is an extension of responsibility and action, coupled with normal day-to-day activity. Normal governmental duties will be maintained, with emergency operations carried out by those agencies assigned specific emergency functions.

The City of Novato Local Hazard Mitigation Plan (LHMP) focuses on mitigating hazards to reduce the impacts of disasters by identifying effective and feasible actions to reduce the risks of potential hazards (City of Novato 2007). This plan has been superseded by the 2018 Marin County Multi-

Jurisdictional Local Hazard Mitigation Plan (MCM LHMP) (Marin County 2018c), which was adopted by the Novato City Council in February 2019. The MCM LHMP assesses risks posed by natural hazards and develops a strategy for reducing the County's risks, in accordance with the Disaster Mitigation Act of 2000.

## f. Wildland Fire Hazards

Many factors contribute to an area being at risk of structural fires in terms of local fire departments' capabilities to control them, including the construction size and type, built-in protection, density of construction, and street widths. The City's daytime population levels may also add to the congestion and difficulty of ingress and egress of emergency response vehicles. Older homes that were constructed prior to modern building standards and fire code requirements are more susceptible to urban fires.

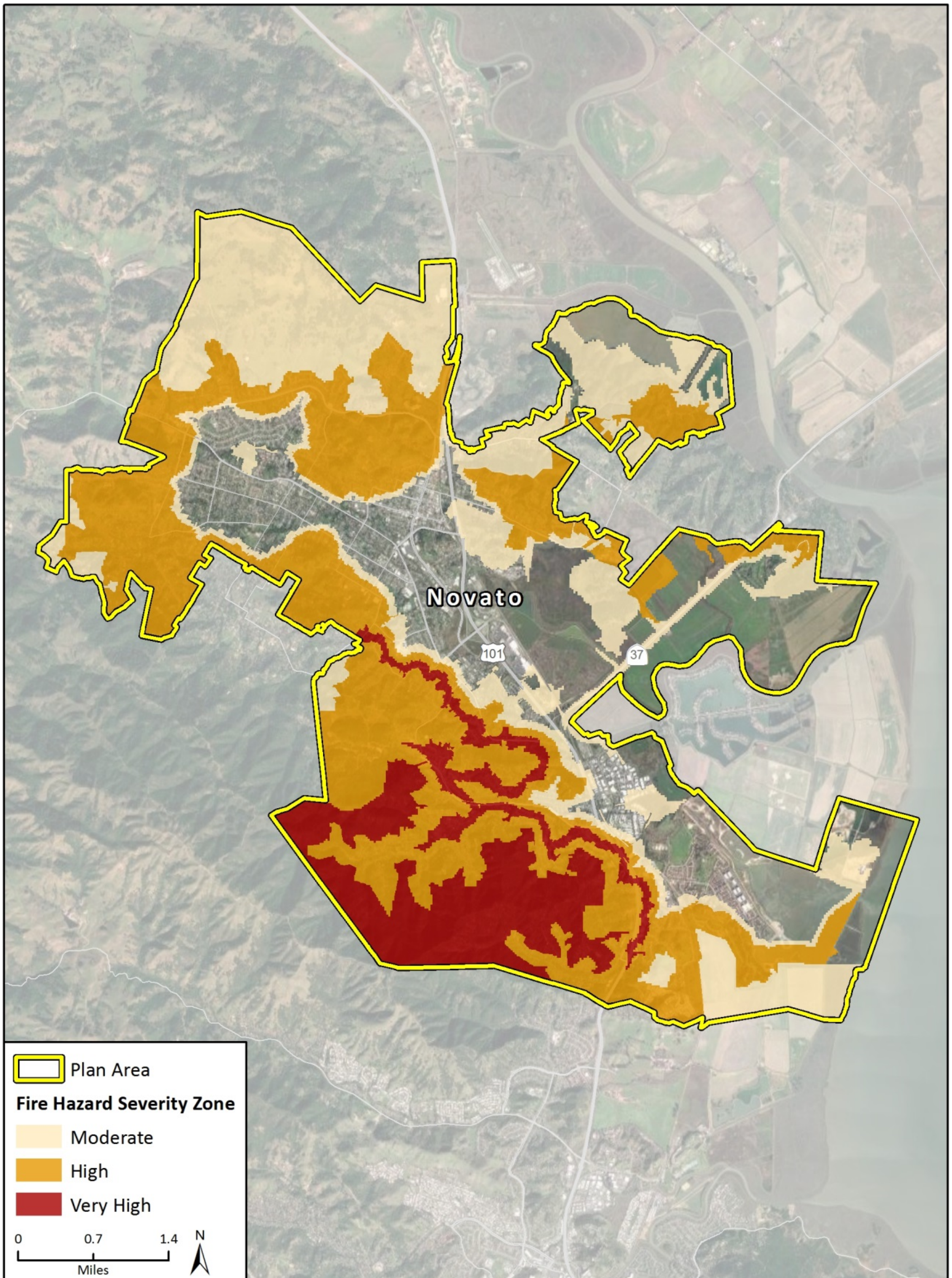
Topography is an important factor in determining the level of wildland fire risk. Flat, urban areas generally present a lower probability risk of wildland fire compared to hilly, less developed areas. Novato is surrounded on three sides by wildland or agriculture, which makes the City vulnerable to fires. The California Department of Forestry and Fire Protection (CAL FIRE) determines a fire hazard severity zone based on the potential fire hazard that is expected to prevail there. Factors that are included in this determination include: fuel (material that can burn), slope, and weather. There are three zones, based on increasing hazard severity: moderate, high, and very high. Moderate hazard zones are typically identified as either wildland areas supporting areas of typically low fire frequency and relatively modest fire behavior, or are developed/urbanized areas with a very high density of nonburnable surfaces including roadways, irrigated lawn/parks, and low total vegetation cover (less than 30 percent) that is highly fragmented and low in flammability (e.g., irrigated, manicured, managed vegetation). CAL FIRE has identified that the southwest and north east edges of the City abut a high wildland fire hazard. A majority of the City abuts productive agricultural lands and open space which have a moderate wildland fire hazard zone associated with them. However, a portion of Novato, along the City's southern border is designated as a very high fire severity zone (CAL FIRE 2007a). Wildland fire hazards within the General Plan Area are shown in Figure 4.7-2 below.

CAL FIRE works in cooperation with the Governor's Office of Emergency Services (OES), as well as neighboring state governments through a network of mutual aid agreements to fight wildland fires. CAL FIRE is also a dedicated firefighting partner to the federal government, with experience contributing to firefighting efforts on the 45 million acres of federal lands in California. CAL FIRE is the largest multipurpose fire protection agency in the United States, responsible for wildland fire protection of over 31 million acres of California's privately owned watershed lands, as well as services in 150 counties, cities, and districts via contracts with local governments. CAL FIRE responds to over 5,400 wildland fires each year. CAL FIRE commands a force of approximately 5,300 full-time fire professionals, 1,800 seasonal personnel, and over 5,000 volunteers (CAL FIRE 2016). In addition to its approximately 350 fire engines, CAL FIRE maintains a significant fleet of aircraft that includes twenty-two air tankers, 17 air tactical planes, and 12 helicopters (CAL FIRE 2016).

## g. Regulatory Setting

The management of hazardous materials and hazardous wastes is regulated at federal, state, and local levels, including through programs administered by the U.S. EPA; agencies within the California Environmental Protection Agency (CalEPA), such as the DTSC; Federal and State occupational safety agencies; and the Marin County Certified Unified Program Agency (CUPA) Hazardous Materials Unit.

## Figure 4.7-2 Fire Hazard Zones in Novato




*Imagery provided by Google and its licensors © 2018.*
*Additional data provided by City of Novato 2018.*

## Federal

### *The Federal Toxic Substances Control Act (1976) and the Resource Conservation and Recovery Act of 1976 (RCRA)*

These acts established a program administered by the U.S. EPA for the regulation of the generation, transportation, treatment, storage, and disposal of hazardous waste. RCRA was amended in 1984 by the Hazardous and Solid Waste Act (HSWA), which affirmed and extended the "cradle to grave" system of regulating hazardous wastes. Among other things, the use of certain techniques for the disposal of some hazardous wastes was specifically prohibited by HSWA.

### *The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) (enacted 1980), amended by the Superfund Amendments and Reauthorization Act (SARA) (1986)*

This law provides broad federal authority to respond directly to releases or threatened releases of hazardous substances that may endanger public health or the environment. Among other things, CERCLA established requirements concerning closed and abandoned hazardous waste sites, provided for liability of persons responsible for releases of hazardous waste at these sites, and established a trust fund to provide for cleanup when no responsible party could be identified. CERCLA also enabled revision of the National Contingency Plan (NCP), which provided the guidelines and procedures needed to respond to releases and threatened releases of hazardous substances, pollutants, or contaminants. The NCP also established the National Priorities List (NPL).

### *The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)*

FIFRA (7 USC 136 et seq.) provides Federal control of pesticide distribution, sale, and use. EPA was given authority under FIFRA not only to study the consequences of pesticide usage, but also to require users (farmers, utility companies, and others) to register when purchasing pesticides. Later amendments to the law required users to take exams for certification as applicators of pesticides. All pesticides used in the United States must be registered (licensed) by EPA. Registration assures that pesticides will be properly labeled and that, if used in accordance with specifications, they will not cause unreasonable harm to the environment.

### *Lead-Based Paint Elimination Final Rule 24 Code of Federal Regulations*

Regulations for Lead-Based Paint (LBP) are contained in the Lead-Based Paint Elimination Final Rule 24 Code of Federal Regulations (CFR) 33, governed by the U.S. Housing and Urban Development (HUD), which requires sellers and lessors to disclose known LBP and LBP hazards to perspective purchasers and lessees. Additionally, all LBP abatement activities must be in compliance with California and Federal OSHA and with the State of California Department of Health Services requirements. Only LBP trained and certified abatement personnel are allowed to perform abatement activities. All lead LBP removed from structures must be hauled and disposed of by a transportation company licensed to transport this type of material at a landfill or receiving facility licensed to accept the waste.

### *U.S. Environmental Protection Agency*

The U.S. EPA is the agency primarily responsible for enforcement and implementation of Federal laws and regulations pertaining to hazardous materials. Applicable Federal regulations pertaining to hazardous materials are contained in the Code of Federal Regulations (CFR) Titles 29, 40, and 49.

Hazardous materials, as defined in the CFR, are listed in 49 CFR 172.101. The management of hazardous materials is governed by the following laws:

- Resource Conservation and Recovery Act of 1976 (RCRA) (42 U.S. Code [USC] 6901 et seq.); Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA, also called the Superfund Act) (42 USC 9601 et seq.)
- Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) (7 USC 136 et. Seq.)
- Superfund Amendments and Reauthorization Act (SARA) of 1986 (Public Law 99 499)

These laws and associated regulations include specific requirements for facilities that generate, use, store, treat, and/or dispose of hazardous materials. U.S. EPA provides oversight and supervision for Federal Superfund investigation/remediation projects, evaluates remediation technologies, and develops hazardous materials disposal restrictions and treatment standards.

## State

### *Department of Toxic Substances Control*

As a department of the California EPA, the Department of Toxic Substances Control (DTSC) is the primary agency in California that regulates hazardous waste, cleans up existing contamination, and looks for ways to reduce the hazardous waste produced in California. DTSC regulates hazardous waste in California primarily under the authority of RCRA and the California Health and Safety Code.

DTSC also administers the California Hazardous Waste Control Law (HWCL) to regulate hazardous wastes. While the HWCL is generally more stringent than RCRA, until the U.S. EPA approves the California program, both state and federal laws apply in California. The HWCL lists 791 chemicals and approximately 300 common materials that may be hazardous; establishes criteria for identifying, packaging, and labeling hazardous wastes; prescribes management controls; establishes permit requirements for treatment, storage, disposal, and transportation; and identifies some wastes that cannot be disposed of in landfills.

Government Code Section 65962.5 requires the DTSC, the State Department of Health Services, the SWRCB, and CalRecycle to compile and annually update lists of hazardous waste sites and land designated as hazardous waste sites throughout the state. The Secretary for Environmental Protection consolidates the information submitted by these agencies and distributes it to each city and county where sites on the lists are located. Before the lead agency accepts an application for any development project as complete, the applicant must consult these lists to determine if the site at issue is included.

If any soil is excavated from a site containing hazardous materials, it would be considered a hazardous waste if it exceeded specific criteria in Title 22 of the California Code of Regulations. Remediation of hazardous wastes found at a site may be required if excavation of these materials is performed, or if certain other soil disturbing activities would occur. Even if soil or groundwater at a contaminated site does not have the characteristics required to be defined as hazardous waste, remediation of the site may be required by regulatory agencies subject to jurisdictional authority. Cleanup requirements are determined on a case-by-case basis by the agency taking jurisdiction.

### *Hazardous Waste Control Act*

The hazardous waste management program enforced by DTSC was created by the Hazardous Waste Control Act (California Health and Safety Code Section 25100 et seq.), which is implemented by regulations described in CCR Title 26. The State program is similar to, but more stringent than, the Federal program under RCRA. The regulations list materials that may be hazardous, and establish criteria for their identification, packaging, and disposal. Environmental health standards for management of hazardous waste are contained in California Code of Regulations (CCR) Title 22, Division 4.5. In addition, as required by California Government Code Section 65962.5, DTSC maintains a Hazardous Waste and Substances Site List for the State called the Cortese List.

#### *California Department of Pesticide Regulation, Department of Food and Agriculture, and the Department of Public Health*

The California Department of Pesticide Regulations (DPR), a division of CalEPA, in coordination with the California Department of Food and Agriculture (CDFA), a division of Measurement Standards and the California Department of Public Health (CDPH) have the primary responsibility to regulate pesticide use, vector control, food, and drinking water safety. CCR Title 3 requires the coordinated response between the County Agricultural Commissioner and SBDEH to address the use of pesticides used in vector control for animal and human health on a local level. DPR registers pesticides, and pesticide use is tracked by the County. Title 22 is used also to regulate both small (less than 200 connections regulation by the SBC Water District) and large CDPH water systems.

#### *California Fire Building Code (2016)*

The 2016 Fire and Building Code establishes the minimum requirements consistent with nationally recognized good practices to safeguard the public health, safety, and general welfare for the hazards of fire, explosion, or dangerous conditions in new and existing buildings, structures and premises, and to provide safety and assistance to firefighters and emergency responders during emergency operations. The provisions of this code apply to the construction, alteration, movement enlargement, replacement, repair, equipment, use and occupancy, location, maintenance, removal, and demolition of every building or structure or any appurtenances connected or attached to such building structures throughout the State of California.

### Local

#### *County of Marin Agricultural Commissioner*

The regulation of pesticide storage, application, and waste disposal is under the jurisdiction of the County Agricultural Commissioner; the Commissioner implements the Cal EPA Department of Pesticide Regulation (DPR) program. Since 1990 the Commissioner’s office has compiled reports required of farmers and other users of agricultural pesticides which provide complete, site specific documentation of every pesticide application. These requirements include pesticides used on crops, parks, golf courses, cemeteries, rangeland and pastures, and along roadside and railroad rights-of-way. The reports are transferred to the DPR and entered into a statewide database.

#### *Marin County Environmental Health and Safety Department*

The Marin County Environmental Health and Safety Department protects health, prevents disease, and promotes health for all persons in Marin County. The department has programs that employ strategies to prevent health hazards.

# 4.7.2 Impact Analysis

## a. Methodology and Thresholds of Significance

### Methodology

This section describes the potential environmental impacts of the proposed project relevant to hazards and hazardous materials. The impact analysis is based on an assessment of baseline conditions for the Plan Area, including locations of hazardous materials use and storage, existing contaminated sites, air traffic hazards, emergency response and evacuation plan requirements, and the risk of exposure to wildland fires, as described in Subsection 4.7.1, *Setting*. This analysis identifies potential impacts based on the predicted interaction between the affected environment and construction, operation, and maintenance activities related to the predicted development that would occur under the proposed project. This section describes impacts in terms of location, context, duration, and intensity.

### Significance Thresholds

The following thresholds of significance are based on Appendix G of the *CEQA Guidelines*. For the purposes of this EIR, implementation of the proposed project may have a significant adverse impact if it would do any of the following:

1 Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials

2 Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment

3 Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school

4 Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would create a significant hazard to the public or the environment

5 For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, result in a safety hazard for people residing or working in the project area

6 For a project within the vicinity of a private airstrip, result in a safety hazard for people residing or working in the project area

7 Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan

8 Expose people or structures to a significant risk of loss, injury, or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands

## Project Impacts and Mitigation Measures

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| **Threshold 1:** | Would the project create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials? |
| **Threshold 2:** | Would the project create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment? |

**Impact HAZ-1 IMPLEMENTATION OF THE PROPOSED PROJECT COULD RESULT IN AN INCREMENTAL INCREASE IN THE OVERALL ROUTINE TRANSPORT, USE, STORAGE, AND DISPOSAL OF HAZARDOUS MATERIALS WITHIN THE CITY AND INCREASE THE RISK OF RELEASE OF HAZARDOUS MATERIALS. HOWEVER, COMPLIANCE WITH APPLICABLE REGULATIONS RELATED TO THE HANDLING AND STORAGE OF HAZARDOUS MATERIALS AND COMPLIANCE WITH GENERAL PLAN 2035 POLICIES WOULD MINIMIZE THE RISK OF SPILLS AND THE PUBLIC'S POTENTIAL EXPOSURE TO THESE SUBSTANCES. IMPACTS WOULD BE LESS THAN SIGNIFICANT.**

Implementation of the proposed project would facilitate development in the City consistent with development forecasts, including conversion of uses in response to market demand, and more intense use of land in several locations throughout the City. The focus would be infill development, in the four focus areas, and development in the Industrial Parks MPA area.

Development associated with the proposed project would be primarily residential, commercial, office space, and industrial land uses. The proposed project would encourage development of 646,353 square feet of office space, 694,797 square feet of commercial space and 332,312 square feet of industrial space including 500,000 square feet of development in the Industrial Parks MPA area. Residential and office land use typically do not use or handle large quantities of hazardous materials. However, industrial developments such as the biotechnology manufacturing uses anticipated in the Industrial Park MPA would involve an increase in transport and storage of potentially hazardous materials normally associated with these land uses. Additionally, new residential development could be introduced in close proximity to existing and/or future industrial and commercial development, such as in the northern and central portions of the City near the railroad tracks in the Downtown and North Redwood Corridor.

Hazardous materials normally associated with biotechnology manufacturing and R&D uses typically include laboratory chemicals (e. g., acids, bases, reagents, flammable materials, compressed gases, and biohazardous and radioactive substances and wastes) and waste generated from the use of these chemicals. The exact types, quantities, and locations of these hazardous materials and wastes would be dependent on the specific uses of the developments.

The precise increase in hazardous materials transported within Novato as a result of implementation of the proposed project cannot be predicted because specific development projects are not yet identified at a level of detail allowing such analysis. This analysis focuses on the potential nature and magnitude of risks associated with the accidental release, storage, transportation, and use of hazardous materials used during operations of typical residential, industrial, and retail-commercial development projects. As described below, compliance with applicable federal and State laws related to the transport, storage and handling of hazardous materials would reduce the likelihood and severity of accidents associated with the use of hazardous materials.

Exposure of persons to hazardous materials could occur in the following ways: improper handling or use of hazardous materials or hazardous wastes during construction or operation of future developments, particularly by untrained personnel; transportation accident; environmentally unsound disposal methods; leaking underground storage tanks; or fire, explosion or other emergencies. The types and amounts of hazardous materials would vary according to the nature of the activity. In some cases, it is the type of material that is potentially hazardous; in others, it is the amount of material that could present a hazard.

Whether a person exposed to a hazardous substance would suffer adverse health effects depends upon a complex interaction of factors that determine the effects of exposure to hazardous materials: the exposure pathway (the route by which a hazardous material enters the body); the amount of material to which the person is exposed; the physical form (e.g., liquid, vapor) and characteristics (e.g., toxicity) of the material; the frequency and duration of exposure; and the individual's unique biological characteristics such as age, weight, and general health. Adverse health effects from exposure to hazardous materials may be short-term (acute) or long-term (chronic). Acute effects can include damage to organs or systems in the body and possibly death. Chronic effects, which may result from long-term exposure to a hazardous material, can also include organ or systemic damage, but chronic effects of particular concern include birth defects, genetic damage, and cancer. Existing hazardous materials regulations were established at the State level to ensure compliance with federal regulations in order to reduce the risk to human health and the environment from the routine use of hazardous substances.

Although the overall quantity of hazardous materials and waste generated in the City could incrementally increase as a result of implementation of the proposed project, all new developments that handle or use hazardous materials would be required to comply with the regulations, standards, and guidelines established by the U.S. EPA, State, Marin County, and City of Novato related to storage, use, and disposal of hazardous materials.

The transport of hazardous materials can result in accidental spills, leaks, toxic releases, fire, or explosion. It is possible that licensed vendors could bring some hazardous materials to and from new residential and retail-commercial sites in the City under the proposed project. However, appropriate documentation for all hazardous waste transported in connection with specific project-site activities would be provided as required for compliance with existing hazardous materials regulations codified in Titles 8, 22, and 26 of the California Code of Regulations, and their enabling legislation set forth in Chapter 6.95 of the California Health and Safety Code. In addition, individual developers would be required to comply with all applicable federal, State, and local laws and regulations pertaining to the transport, use, disposal, handling, and storage of hazardous waste, including but not limited to, Title 49 of the Code of Federal Regulations.

California Building Code requirements prescribe safe accommodations for materials that present a moderate explosion hazard, high fire or physical hazard, or health hazards. Compliance with applicable federal and State laws related to the storage of hazardous materials would maximize containment (through safe handling and storage practices described above) and provide for prompt and effective cleanup if an accidental release occurs.

For those employees that would work with hazardous materials, the amounts of hazardous materials that are handled at any one time are generally relatively small, reducing the potential consequences of an accident during handling. Further, site-specific project activities would be required to comply with federal and State laws to eliminate or reduce the consequence of hazardous materials accidents. For example, employees who would work around hazardous materials would be required to wear appropriate protective equipment, and safety equipment is routinely available in all areas where hazardous materials are used.

The County of Marin WMD personnel respond to hazardous materials incidents in the City of Novato. Major hazardous materials accidents associated with residential, industrial, and retail-commercial uses are fairly infrequent, and additional emergency response capabilities are not anticipated to be necessary to respond to the potential incremental increase in the number of incidents that could result from implementation of the proposed project. Further, adherence to applicable regulations as discussed above would be required to reduce any potential consequences of a hazardous materials operational accident.

Goals and policies in Chapter 6 of the 2035 General Plan under Subsection 6.3, Safety and Hazards would minimize any impacts related to the use, storage, transport, and release of hazardous materials in the City. Policy SH 5a calls for the City to continue to coordinate with appropriate regulatory agencies on land use and transportation decisions as well as other programs involving hazardous materials regulations and consider measures to protect public health from hazards associated with transportation, storage and disposal of hazardous wastes. Continued coordination with appropriate regulatory agencies such as the Department of Toxic Substances Control, on issues and decisions related to hazards and hazardous materials will ensure compliance with applicable regulations and reduce potential impacts related to the transport, storage, use and disposal of hazardous materials.

Compliance with existing applicable regulations and General Plan 2035 policies would ensure that risks from routine use, transport, handling, storage, disposal, and release of hazardous materials would be minimized. Oversight by the appropriate federal, State, and local agencies and compliance by new development with applicable regulations related to the handling and storage of hazardous materials would minimize the risk of the public's potential exposure to these substances, including impacts from the Industrial Parks MPA area. Therefore, impacts from a hazard to the public or the environment through routine transport, use or disposal of hazardous materials would be less than significant.

## Mitigation Measures

No mitigation would be required.

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| **Threshold 3:** | Would the project emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school? |

**Impact HAZ-2 IMPLEMENTATION OF THE PROPOSED PROJECT COULD RESULT IN HAZARDOUS EMISSIONS OR HANDLING OF HAZARDOUS OR ACUTELY HAZARDOUS MATERIALS, SUBSTANCES, OR WASTE WITHIN ¼ MILE OF AN EXISTING OR PROPOSED SCHOOL, BUT COMPLIANCE WITH EXISTING REGULATORY REQUIREMENTS WOULD MINIMIZE RISKS TO SCHOOLS AND STUDENTS, RESULTING IN A LESS THAN SIGNIFICANT IMPACT.**

Development associated with the proposed project could result in hazardous emissions within one-quarter mile of an existing or proposed school. Specifically, commercial and industrial uses in the Downtown, North Redwood Corridor, and North, North Redwood Corridor could handle hazardous or acutely hazardous materials, substances or waste within one-quarter mile of a school. Consequently, hazardous materials sites may impact schools. There are no schools within one-quarter mile of the Industrial Parks MPA area.

Since the proposed project does not include any specific development projects, the quantity of hazardous materials proposed for use by future commercial developments within the City is currently unknown. Accidental release or combustion of hazardous materials at new commercial and industrial developments could endanger residents or students in the surrounding community.

Several schools are located on or within one quarter mile of a facility that has or could emit hazardous air emissions or handle hazardous materials or wastes. It is possible that future development and redevelopment associated with the proposed project may result in an increase in hazardous emissions and handling of hazardous materials and wastes within one-quarter mile of an existing or future proposed school. However, the California Education Code (Section 17210 et seq.) outlines the requirements for siting school facilities near or on known or suspected hazardous materials sites, or near facilities that emit hazardous air emissions, handle hazardous or acutely hazardous materials, substances, or waste. Section 17210 of California Education Code requires school districts to evaluate school sites prior to the acquisition of real property or expansion of an existing school site. Evaluation must include consultation with Department of Toxic Substance Control, commissioning of a Phase I Environmental Site Assessment, and environmental review under the California Environmental Quality Act to identify any potential hazards to public health and safety.

Further, hazardous materials and waste generated from future development would not pose a health risk to nearby schools because businesses that handle or have on-site storage of hazardous materials would be required to comply with the provisions of the California Fire Code adopted by the City (Novato Fire Protection District Ordinance No. 2016.1) and any additional elements as required in the California Health and Safety Code Article 1 Chapter 6.95 for Business Emergency Plan. As described in the Regulatory Setting above, both the federal and State governments require all businesses that handle more than a specified amount of hazardous materials to submit a business plan to a regulating agency. As such, compliance with the provisions of the California Fire Code and existing applicable State and federal regulations would minimize the risks associated with exposure of sensitive receptors to hazardous materials throughout the Plan Area, including the four focus areas. Impacts would be less than significant.

## Mitigation Measures

No mitigation would be required.

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| **Threshold 4:** | Would the project be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would create a significant hazard to the public or the environment? |

**Impact HAZ-3** **IMPLEMENTATION OF THE PROPOSED PROJECT COULD RESULT IN DEVELOPMENT ON SITES CONTAMINATED WITH HAZARDOUS MATERIALS. HOWEVER, COMPLIANCE WITH APPLICABLE REGULATIONS RELATING TO SITE CLEANUP AND GENERAL PLAN 2035 POLICIES WOULD MINIMIZE IMPACTS FROM DEVELOPMENT ON CONTAMINATED SITES. IMPACTS WOULD BE LESS THAN SIGNIFICANT.**

Existing sites that may potentially contain hazardous land uses in the City include large and small-quantity generators of hazardous waste, such as gas stations. As noted previously, 25 active sites containing or potentially containing hazardous materials contamination are located within the Plan Area. One potentially hazardous site, Omniglow Corporation (21280005), is located in the Industrial Parks MPA area. However, this site was cleaned up in 1996 and no further action is required. There is one inactive site, Northwest Pacific Railroad Passenger and Freight Depot (70000099), in Downtown that is in need of evaluation but completed a site screening in 2006 that stated an above ground diesel tank was stored on the site last used in 2002. There are no identified hazardous material sites in the Norwest Quadrant, North Redwood Corridor, or North, North Redwood Corridor (DTSC 2018).

New development occurring on documented hazardous materials sites as listed in Table 4.7-1, including the Northwest Pacific Railroad Passenger and Freight Depot in Downtown, would be preceded by remediation and cleanup under the supervision of the DTSC before construction activities could begin. In addition, General Plan 2035 contains policies related to contaminated sites. Policy SH 5a requires the City to consult with the Regional Water Quality Control Board (RWQCB), DTSC, and other appropriate agencies when considering development proposals for sites contaminated with hazardous materials.

It is also possible that underground storage tanks (USTs) that were in use prior to permitting and record keeping requirements may be present in the City. If an unidentified UST were uncovered or disturbed during construction activities, it would be closed in place or removed pursuant to existing laws and regulations. Removal activities could pose both health and safety risks, such as the exposure of workers, tank handling personnel, and the public to tank contents or vapors. Potential risks, if any, posed by USTs would be minimized by managing the tank according to existing Marin County standards as enforced and monitored by the Department of Public Works – Office of Waste Management. The extent to which groundwater may be affected, if at all, depends on the type of contaminant, the amount released, and depth to groundwater at the time of the release. If groundwater contamination is identified, remediation activities would be required by the RWQCB prior to the commencement of any new construction activities. If contamination exceeds regulatory action levels, the developer would be required to undertake remediation procedures prior to grading and development under the supervision of the County Public Works Department or RWQCB (depending upon the nature of any identified contamination). Compliance with existing state and local regulations as well as implementation of General Plan 2035 policies would reduce impacts to less than significant.

## Mitigation Measures

No mitigation measures are required.

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| **Threshold 5:** | For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area? |
| **Threshold 6:** | For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area? |

**IMPACT HAZ-4 THE NORTHERN PORTION OF NOVATO IS INSIDE THE AREA OF INFLUENCE FOR THE GNOSS FIELD-MARIN COUNTY AIRPORT AND COULD RESULT IN SAFETY HAZARDS FOR PEOPLE WORKING OR RESIDING IN THE AREA OF INFLUENCE. IMPACTS WOULD BE AVOIDED THROUGH IMPLEMENTATION OF GOALS AND POLICIES IN GENERAL PLAN 2035 AND HAZARDOUS IMPACTS ON PEOPLE WORKING AND RESIDING WITHIN THE AIRPORT AREA OF INFLUENCE WOULD BE LESS THAN SIGNIFICANT.**

There are no public or private airports within the Plan Area. The nearest airport is the Gnoss Field-Marin County Airport located in Northern Marin County, approximately one mile north of Novato. The northern and central portions of Novato are inside the area of influence for the airport. The four focus areas and Industrial Parks MPA are not within the airports area of influence. The County has land use jurisdiction over the unincorporated areas surrounding the airport. Additionally, as owner of the airport, the County has control over the operation and development of the facility.

Section 65302.3 of the Government Code requires general plans and applicable specific plans to be consistent with amended CALUPs. In accordance with State law, the County of Marin and the City of

Novato amended their respective general plans and zoning ordinances to incorporate the compatibility criteria and compatibility zones established by the ALUC for Gnoss Field Marin County Airport (City of Novato 1996, County of Marin 2007). General Plan 2035 Policy LU 32, Policy MO 24, and related policies would minimize hazards associated with the daily operations of the airport by monitoring the County's planning efforts to ensure the health and safety of Novato residents and encouraging maintenance at Gnoss Field to support safety improvements. Compliance with the CALUP and applicable 2035 General Plan policies would reduce airport hazards within the City and impacts would be less than significant.

## Mitigation Measures

No mitigation measures are required.

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| **Threshold 7:** | Would the project impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan? |

**Impact HAZ-5 GENERAL PLAN 2035 POLICIES ADDRESS MAINTAINING THE LOCAL HAZARD MITIGATION PLAN AND EMERGENCY ACCESS IMPLEMENTATION. THEREFORE, THE PROPOSED PROJECT WOULD NOT RESULT IN INTERFERENCE WITH THESE TYPES OF ADOPTED PLANS. IMPACTS WOULD BE LESS THAN SIGNIFICANT.**

Implementation of the proposed project would result in the development of new residential, commercial, institutional, and industrial land uses throughout the Plan Area. However, the majority of development would occur in the four focus areas and in the Industrial Parks MPA. The Mobility section of General Plan 2035 directs the City to accommodate safety needs, including those associated with future developments, while increasing the resiliency of the City's residents and businesses to respond to and be prepared for potential emergencies. This would include emergency vehicle assess and location of emergency response facilities. General Plan 2035 Goal SH 7 calls for the City to minimize exposure to hazards through emergency management, planning and training. Specifically, Policy SH 7a requires the City to periodically update its Emergency Operations Plan and LHMP, which has been superseded by the 2018 MCM LHMP, to coordinate with emergency plans of other governmental agencies and respond to changing conditions such as sea level rise and extreme heat and storm events.

In addition, the Novato Fire Protection District reviews and approves projects to ensure that emergency access meets fire safety standards. The Industrial Parks MPA area would have one way in and out. However, project review and approval by the Novato Fire Prevention District would ensure that the project would meet emergency access standards. Implementation of General Plan 2035 policies associated with emergency planning and response, in addition to Fire District Review would ensure that potential impacts from implementation of the proposed project on emergency response and evacuation would be less than significant.

## Mitigation Measures

No mitigation measures are required.

| | |
|---|---|
| **Threshold 8:** | Would the project expose people or structures to a significant risk of loss, injury, or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands? |

**Impact HAZ-6 IMPLEMENTATION OF THE PROPOSED PROJECT COULD RESULT IN DEVELOPMENT IN URBANIZED AREAS ADJACENT TO WILDLANDS. HOWEVER, IMPLEMENTATION OF POLICIES INCLUDED IN GENERAL PLAN 2035 WOULD REDUCE THE EXPOSURE OF PEOPLE OR STRUCTURES TO A SIGNIFICANT RISK OF LOSS, INJURY, OR DEATH INVOLVING WILDLAND FIRES. IMPACTS WOULD BE LESS THAN SIGNIFICANT.**

Implementation of the proposed project could lead to an increase in residential, commercial, or industrial development in areas that are susceptible to wildland fires. Urbanized areas, such as the Downtown, and Northwest Quadrant are less susceptible to wildfire because they are surrounded by development. However, areas such as the North Redwood Corridor, North, North Redwood Corridor and Industrial Parks MPA area are more susceptible to wildfire since they are adjacent to undeveloped lands.

Fire tends to burn and spread uphill, and the southeast area of Novato, where fire hazard is highest, generally slopes uphill toward the west, away from the developed areas of the City. However, winds in Novato are generally from the west during most of the year (Cedar Lake Ventures 2018), which could move wildfire-related smoke and air pollutants in the southeast of the City toward the urbanized, more heavily populated areas of the City.

Most of the growth under the proposed project would occur as infill and redevelopment within the urbanized areas of the City. Because development would occur in urbanized areas of the City, where large tracts of vegetation cover are not present, the proposed project would not increase wildfire risk in Novato.

Severe wildfires can damage the forest or shrub canopy, the plants below, as well as the soil. This can result in increased runoff after intense rainfall, which can put homes and other structures downslope of a burned area at risk of localized floods and landslides. Slopes at risk of wildfire in the City are limited to the outskirts of Novato. If a severe wildfire were to occur in the hillside area of the City, structures downslope would be at risk of flooding or landslides. Other areas of the City are generally flat to gently sloping, and developed with little to no wildfire fuels or vegetation cover prone to ignition. If a structural fire or large urban fire were to occur in the more flat and urbanized areas of the City, the risk of flooding or landslides afterward would be negligible because of the nearly flat topography and because little soil would be exposed due to the developed conditions.

Goals and policies contained with the Mobility section of General Plan 2035 provide guidance for preventative measures and practices to avoid wildfires. Specifically, policies SH 3a through SH 3j call for the City to review all development proposals for fire risk and require mitigation measures to reduce the probability of fire; continue to enforce the Fire Safety Ordinance requirements for sprinkler systems; require new developments within the Wildland-Urban Interface areas to develop and implement a vegetation management plan; ensure that new traffic signals include a system which allows emergency vehicles to change the signal; implement elements of the Novato Fire Protection District All Hazard Mitigation Program; encourage property owners to maintain defensible space; update fire safety ordinance to reflect current standards; ensure new public and critical facilities are located outside of Very High Fire Hazard Severity Zones; and review existing road widths to preserve emergency accessibility. In addition, policies SH 7a through SH 7f reduce potential impacts related to wildland hazards through periodically updating the City’s Emergency Operations Plan and MCM LHMP; identify essential emergency facilities and critical utilities and ensure they will function in the event of a disaster; continue to coordinate with the appropriate federal, state and local agencies to practice and implement effective emergency plans; provide hazard awareness and safety training programs. With implementation the fire hazard policies in General Plan 2035, impacts would be less than significant.

## Mitigation Measures

No mitigation measures are required.

## Cumulative Impacts

Cumulative development in the County of Marin surrounding Novato in combination with development proposed under the proposed project may contribute to an increase in regional hazards related to the use of and exposure to hazardous material and exposure to wildland fire. Implementation of the proposed project would increase density exposing additional residences to hazardous materials and wildland fire. However, implementation of the Plan Safety and Hazards policies contained in General Plan 2035 and compliance with existing laws and regulations would reduce cumulative hazards and hazardous materials. Therefore, the proposed project would have an incremental contribution to cumulative impacts associated with hazards and hazardous materials but would not be cumulatively considerable. Cumulative impacts would be less than significant

# 4.8 Hydrology and Water Quality

This section evaluates the potential environmental effects related to hydrology and water quality associated with implementation of the proposed project. It discusses the regional and local watershed characteristics, including water quality, drainage and infiltration patterns, and flood hazards. The analysis includes a review of surface water, groundwater, flooding, storm water, and water quality. Water supply and wastewater conveyance are discussed in Section 4.15, *Utilities and Service Systems*. Issues regarding wetlands and waters of the U.S. are discussed in Section 4.3, *Biological Resources*.

## 4.8.1 Setting

The City of Novato is located in northern Marin County, approximately 30 miles north of downtown San Francisco and approximately one mile north of the City of San Rafael. Novato is in the Coast Ranges geomorphic province. This province is characterized by parallel northwest-trending mountain ranges and valleys, formed over the past 10 million years or less by active uplift related to complex tectonics of the San Andreas fault/plate boundary system (California Geological Survey [CGS] 2002). Novato generally is bounded by Burdell Mountain to the north, San Pablo Bay to the east, Big Rock Ridge to the south and southwest, and Little Mountain to the west (USGS 2018). Further west, Bolinas Ridge runs southeast to northwest, parallel to the Pacific Ocean (USGS 2018). Approximately 20 miles northeast of the city, Napa Valley runs southeast to northwest, parallel to Highway 29 (USGS 2018).

Novato covers about 28 square miles, of which approximately two percent is water. Hills and steeper terrain lie to the north, south, and west of Novato's urban center, which occupies the relatively flat alluvial valley associated with Novato Creek (USGS 2018). To the east, the land slopes down towards San Pablo Bay (USGS 2018). The elevation of Novato ranges from sea level to 1,558 feet above sea level at the highest point on Burdell Mountain (City of Novato 2014a). Downtown Novato lies at 18 feet above mean sea level. Surface water runoff in the city varies from concentrated, channelized flows in the surrounding hills to sheet flow that is then intercepted by stormwater conveyance systems in the flatter city center. To the east of the city, stormwater enters a tidal marshlands system through canals and ditches. All surface drainage eventually flows into San Pablo Bay by overland flow, tributary swales (shallow, vegetated ditches), or perennial streams, such as Novato Creek (City of Novato 2014a).

Novato is characterized by a typical Mediterranean climate, generally dry in the summer with mild, wet winters. Average summer temperatures in degrees Fahrenheit are in the 60s and average winter temperatures are in the 50s. The warmest month of the year is August with an average maximum temperature of 81, while the coldest month is January, with an average minimum temperature of 41 (Idcide.com 2018). Most rainfall occurs between November and March, with an average annual rainfall of 34.29 inches (City of Novato 2014a). The wettest month of the year is January with an average rainfall of 7.38 inches (Idcide.com 2018).

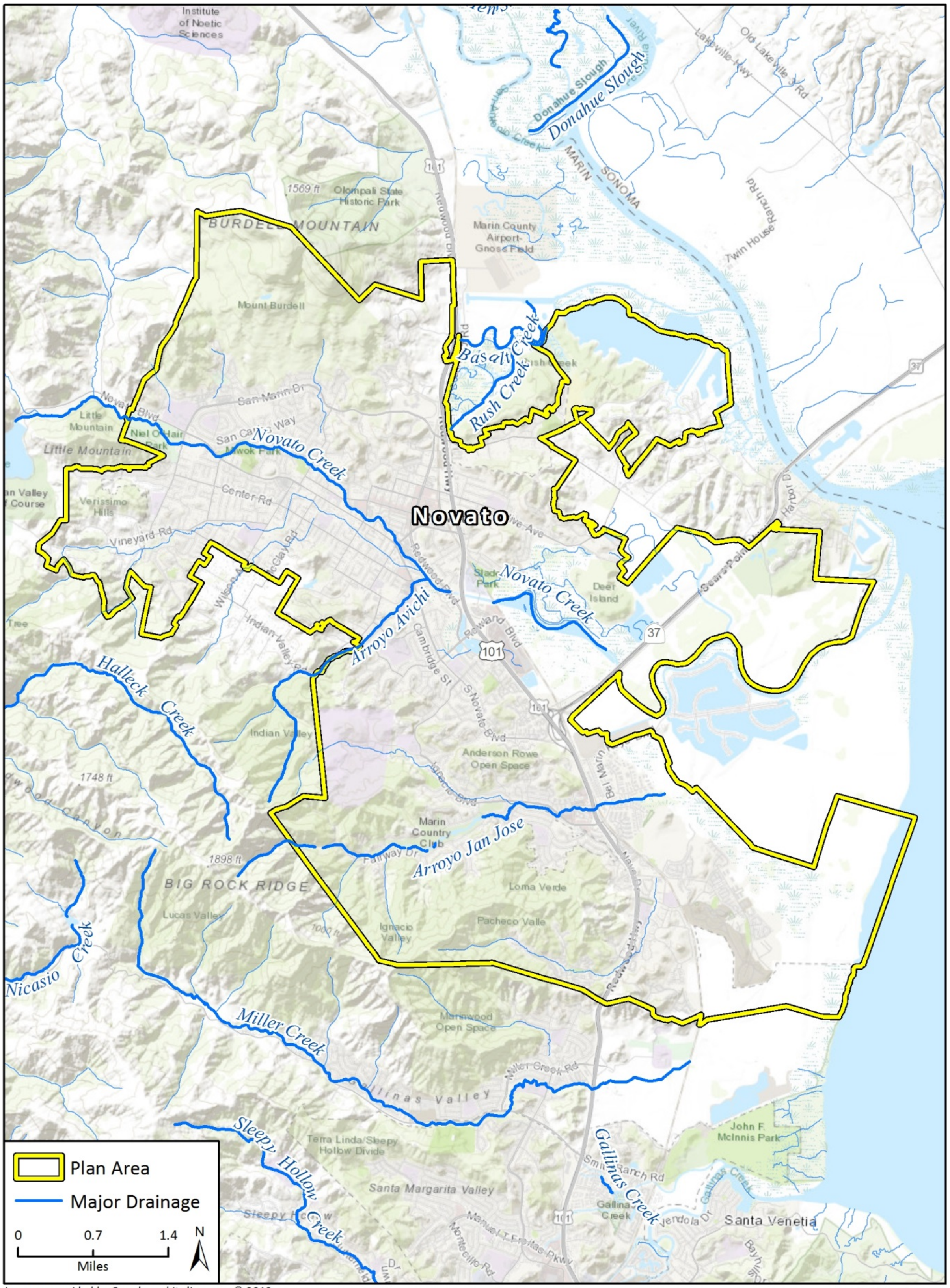
### a. Surface Water

The California Department of Water Resources (DWR) divides surface watersheds in California into 10 hydrologic regions, which are further divided into Hydrologic Units (HU) and even smaller Hydrologic Areas (HA) within each hydrologic unit. Novato lies within the San Francisco Bay Hydrologic Region (HR), which covers approximately 2.88 million acres, or 4,500 square miles, and includes all of San Francisco and portions of Marin, Sonoma, Napa, Solano, San Mateo, Santa Clara, Contra Costa, and Alameda counties. Though it is the smallest HR in terms of size, it contains the second largest population (CA DWR 2003). The San Francisco Bay Regional Water Quality Control Board (RWQCB) governs basin planning and water quality within the San Francisco Bay HR (DWR 2003). Within the San Francisco Bay HR, Novato is located entirely within the San Pablo HU (CAL FIRE 2004). Within the San Pablo HU, most of the City is located in the Novato HA. A small area in the northernmost part of the City is in the Petaluma River HA (CAL FIRE 2004).

In addition to the statewide watershed designations in the city, watersheds in Novato are named locally by the Marin County Flood Control and Water Conservation District (MCFCWD) through the Marin County Watershed Program. Based on those local designations, which generally correspond with major stream channels, Novato lies within two locally-named watersheds: the Novato Creek Watershed and the Rush Creek Watershed (MCFCWD 2018). The Novato Creek Watershed is located west of the northern portion of San Pablo Bay and is the largest watershed in eastern Marin County. The basin is 45 square miles and the main drainage in the watershed is Novato Creek, which bisects the city as it flows generally eastward from its headwaters west of Stafford Lake to San Pablo Bay. Several tributaries, some of which are named locally but are unnamed in the National Hydrography Dataset, join Novato Creek along its 17 mile length: Arroyo Avichi, Arroyo de San Jose, Bowman Canyon Creek, Cheda Creek, Deer Island Channel, Leveroni Ditch, Lynwood Slough, Simmons Slough, and Warner Creek. These tributary creeks generally flow eastward through oak and bay forests, grasslands, and unincorporated Marin County and the City of Novato before joining Novato Creek and discharging into San Pablo Bay just south of the mouth of the Petaluma River. The Rush Creek Watershed is located at the northern edge of Novato and provides critical wetland habitat year-round. It supports coastal saltwater marsh and coastal brackish-water marsh habitats. Northeastern Novato stormwater is directed into either Rush Creek, which then flows into Black John Slough and eventually to the Petaluma River or the Deer Island Basin and Simmons Slough. Simmons Slough is routed to Novato Creek through the use of pumps. Rush Creek wetlands are managed for both wildlife habitat and winter stormwater management through a series of levees and floodgates (MCFCWCD 2018).

Novato has both undeveloped open space with natural drainage features and urban development with highly altered drainage systems, such as underground stormwater systems. The drainage network of Novato consists of a number of rivers, streams, and other water bodies, including the Novato Creek, Petaluma River, Rush Creek, Stafford Lake, and San Pablo Bay. The Petaluma River begins 20 miles north of the City of Petaluma and borders the northeastern edge of Novato. San Pablo Bay, a navigable waterbody that provides access to San Francisco Bay and the Pacific Ocean, borders the eastern edge of the city. The shoreline extends for approximately seven miles. Rush Creek flows north and east from Downtown Novato to the Petaluma River. Stafford Lake is a reservoir and headwater for Novato Creek approximately 11 miles upstream from San Pablo Bay and approximately one mile west of the city’s western boundary. The reservoir has a storage capacity of about 4,450 acre-feet and a water surface area of about 230 acres (City of Novato 2014a; MCFCWD 2017). Figure 4.8-1 depicts major drainages and other surface water features within and near the city. For a description of jurisdictional features in the City, including wetlands, see Section 4.3, *Biological Resources*.

## Figure 4.8-1 Major Drainages

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*Additonal data provided by U.S. Geological Survey, 2013, National Hydrography Geodatabase.*

## b. Groundwater

The Novato Valley Basin, which occupies a structural depression in the Coast Ranges immediately west of San Pablo Bay and north of San Rafael, underlies portions of Novato associated with the alluvial valleys of Novato Creek and Rush Creek. The basin has a surface area of approximately 32 square miles. The Novato Valley Basin is bound by San Antonio Creek and the Petaluma River to the north, by Big Rock Ridge, Little Mountain, and Burdell Mountain to the west, by San Rafael Hill to the south, and by San Pablo Bay to the east. Groundwater in this basin occurs primarily in alluvial deposits composed of unconsolidated clay, silt, and sand with discontinuous lenses of gravel. The thickness of the alluvial deposits ranges from 60 feet near the city center to more than 200 feet near San Pablo Bay. Streams discharging to San Pablo Bay recharge and drain the basin and are tidally influenced in the lower reaches. Natural recharge occurs primarily as infiltration from streambeds that exit the upland areas within the drainage basin and from direct percolation of precipitation that falls on the basin floor (DWR 2004). The Novato Valley Basin is not used for municipal water supply, and neither the storage capacity nor the current amount of groundwater in storage has been reported for this basin.

## c. Water Supply

Novato's potable water supply is provided by the North Marin Water District (NMWD) via the Novato Water System. The Novato water system serves primarily the City of Novato and surrounding areas in Marin encompassing approximately 75 square miles (City of Novato 2014a). The NMWD receives most of its water, approximately 80 percent, from Sonoma County Water Agency (SCWA), which provides water principally from the Russian River to several retail water contractors, primarily in Sonoma County. As described under *Groundwater*, the NMWD does not extract groundwater for municipal water supply. In addition to the water purchased from SCWA, NMWD supplies water to the city from Stafford Lake. Recycled water is an additional source of non-potable water supply for the city. See Section 4.15, *Utilities and Service Systems*, for additional details about water supply and demand for Novato.

## d. Water Quality

### Storm Water and Urban Runoff

Water quality in the City is governed by the San Francisco Bay RWQCB, which sets water quality standards in the Water Quality Control Plan for the San Francisco Bay Basin (Basin Plan). The Basin Plan identifies surface waterbodies and groundwater basins within the region that have beneficial uses. It also establishes water quality objectives and standards to maintain those beneficial uses, such as maximum contaminant levels. The Basin Plan identifies beneficial uses for a number of surface waterbodies in Novato, including Arroyo Avichi, Arroyo San Jose, Bahia Lagoon, Bowman Canyon Creek, Novato Creek, Pacheco Pond, Rush Creek, and Warner Creek. Table 4.8-1 presents the beneficial uses for identified surface waters within the City.

**Table 4.8-1 Basin Plan Beneficial Uses**

| Beneficial Uses | Arroyo Avichi | Arroyo San Jose | Bahia Lagoon | Bowman Canyon Creek | Novato Creek | Pacheco Pond | Rush Creek | Warner Creek |
|---|---|---|---|---|---|---|---|---|
| | Waterbody Name | | | | | | | |
| Cold Freshwater Habitat | X | X | | X | X | X | | X |
| Commercial and Sport Fishing | | | | | X | X | | |
| Estuarine Habitat | | | X | | | | X | |
| Fish Migration | | | | X | X | X[1] | | X |
| Fish Spawning | | | | X | X | X[1] | | |
| Municipal and Domestic Supply | | | | | X | | | |
| Non-Contact Water Recreation | X | X | X | X | X | X | X | X |
| Preservation of Rare and Endangered Species | X | X | | X | X | X | X | X |
| Warm Freshwater Habitat | X | X | | X | X | X | | X |
| Water Contact Recreation | X | X | X | X | X | X | X | X |
| Wildlife Habitat | X | X | X | X | X | X | X | X |

[1] Potential Beneficial Use

Source: SFBRWQCB 2017

The Clean Water Act (CWA) 303(d) list is a register of impaired and threatened waters which states submit for U.S. Environmental Protection Agency (U.S. EPA) approval. The list identifies all waters where pollution control measures have so far been unsuccessful in reaching or maintaining water quality standards. Waters that are listed are known as “impaired.” Novato Creek was included on the 303(d) list in 1998 due to the presence of Diazinon, a popular insecticide for home gardening, potentially transported to the creek via urban runoff/storm sewers. Diazinon was banned from future sale by the U.S. EPA in 2005 (Cone 2005). Diazinon contamination began being addressed in 2006 via a U.S. EPA approved standard (total maximum daily load [TMDL]) for Diazinon. Novato Creek remains on the current 303(d) List/305(b) Report as an impaired waterbody that is being addressed by a U.S. EPA approved TMDL (SWRCB 2018b).

Storm water runoff may play a role in the water quality impairments. Runoff that occurs as overland flow across yards, driveways, and public streets is intercepted by the storm water drainage system and conveyed to local drainages before eventually being routed to the Pacific Ocean via San Pablo Bay. This storm water can carry pollutants that enter the local waterways and result in reduced water quality. Common sources of storm water pollution in the City include litter, trash, pet waste, paint residue, organic material (yard waste), fertilizers, pesticides and herbicides, sediments, construction debris, metals from automobile brake pad dust, air pollutants that settle on the ground or attach to rainwater, cooking grease, illegally dumped motor oil, and other harmful fluids.

### Drinking Water Quality

As described under *Water Supply*, Novato sources its potable drinking water primarily from Russian River water through an agreement with SCWA. Additional local sources of water supply include Stafford Lake and recycled water. The quality of the NMWD's water deliveries is regulated by the State Water Resources Control Board (SWRCB) Division of Drinking Water (DDW), which requires regular collection and testing of water samples to ensure that the quality meets regulatory standards and does not exceed Maximum Contaminant Levels (MCLs). Both NMWD and SCWA perform water quality testing, which has consistently yielded results within acceptable regulatory limits. The NMWD's Water Quality Division monitors water quality and provides supervision for water quality related issues. Surface water supply quality is expected to be adequate with no water quality deficiencies over the next 25 years. As described under *Groundwater*, NMWD does not pump groundwater within the Novato Valley Basin. The groundwater quality is considered poor due to high salinity, and well yields are too low for municipal supply (NMWD 2014).

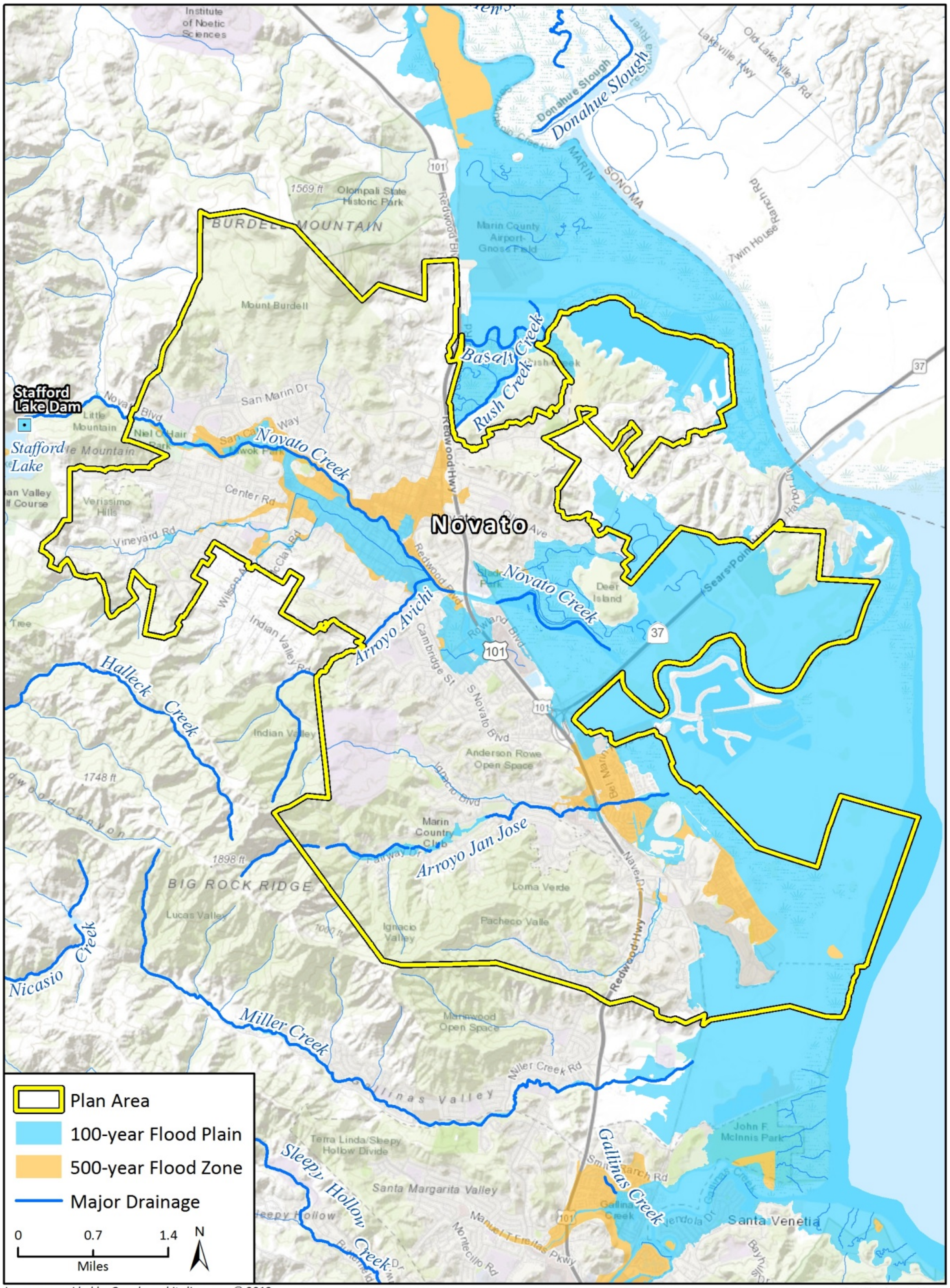
## e. Flood Hazards

Flood hazards can occur when the amount of rainfall exceeds the infiltration capacity of the surrounding landscape or the conveyance capacity of the storm water drainage system. Flood risk is defined as an annual percent-chance of flooding, or the probability that flooding would occur in any given year. Although a 100-year flood will, on average, occur once every 100 years, the probability of a 100-year flood is one percent for any particular year. Two 100-year floods could occur in the same year or even in the same month, but the likelihood that two 100-year flood events would occur consecutively is very small.

Novato has a history of flooding. Winter storms in 2016-2017 closed Highway 37 for 27 days and flooded neighborhood streets. The City now faces new threats of sea level rise and climate change (MCFCWCD 2017).

Areas that are subject to flood risk are identified by the Federal Emergency Management Agency (FEMA) on the National Flood Hazard Layer. As shown in Figure 4.8-2, flood hazard areas are mainly located in the eastern portion of the City. Winter storms can generate heavy wave action along the bay coastal areas of Novato, which either by itself or when combined with high tides and/or high winds, can initiate flooding along the ocean and by coastlines of Novato (MCFCWD 2017). Several small areas of the easternmost portion of the City are located in Zone VE, which represents coastal areas with a one percent or greater chance of flooding and an additional hazard associated with storm waves. Most of the eastern portion of the City and areas along major streams (such as Arroyo San Jose, Novato Creek, and Warner Creek) are in Zone AE, which represents areas with a one percent or greater chance of flooding where base flood elevations have been established. An area upstream of the confluence of Novato Creek and Warner Creek is in Zone AO, which represents river or stream flood hazard areas and areas with a one percent or greater chance of shallow flooding each year, usually in the form of sheet flow with an average depth ranging from one to three feet. Several small areas along Novato Creek and in the southeastern portion of the City are in Zone X (shaded), which represents areas of moderate flood hazard, usually the area between the limits of the 100-year and 500-year floods, as well as areas protected by levees from the 100-year flood (FEMA 2018). The Hamilton levee, described in more detail under *Levee Failure* below, protects an area in the southeast corner of the city from flood risk.

**Figure 4.8-2 Floodplains in the Plan Area**

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*Additonal data provided by FEMA 2016; U.S. Geological Survey, 2013, National Hydrography Geodatabase.*

### Dam Inundation

Novato is subject to potential flooding resulting from the structural failure of the Novato Creek Dam (also known as the Stafford Dam) at Stafford Lake. According to the Department of Water Resources, the dam is certified and may safely impound water. It is also in satisfactory condition, with no existing or potential dam safety deficiencies. The Stafford Dam is designed to withstand an earthquake of a magnitude up to 8.25 on the San Andreas Fault. Major flooding would occur in the event of a dam failure. The dam failure evacuation area extends approximately 4.5 miles, passing through downtown Novato and ending at Highway 37. The most critical zone is the San Marin residential area in the vicinity of Miwok Park, which would be flooded very shortly after dam failure. The flood waters would reach the first residential area at San Marin Drive and Sutro Avenue approximately 11 minutes after dam failure. Approximately 32 minutes after dam failure, the flood waters would begin to inundate the business district and city government buildings in downtown Novato, and would reach U.S. Highway 101 approximately 50 minutes after dam failure. Figure 4.8-3 shows the area that would be inundated following the failure of Stafford Dam (MCFCWD 2017).

### Levee Failure

The Hamilton Levee, a FEMA-accredited levee in the southwestern portion of Novato, protects low-lying residential and commercial areas from coastal flooding during a 100-year flood event. The levee is located at the eastern edge of development, including residential housing, commercial space, a community center, an amphitheater and park facilities, from the waters of San Pablo Bay. Stormwater is pumped to the bay side of the levee via two pump stations. In the event of a levee failure during flooding conditions or a severe storm combined with a high tide, developed parcels could be threatened with immediate flooding. An imminent threat of levee failure could require a rapid evacuation of affected residents, with little to no advanced warning. Figure 4.8-4 shows the area that would be inundated following the failure of the Hamilton Levee.

### Tsunami

As shown in Figure 4.8-5, the easternmost edges of Novato and areas along Novato Creek just north of the Bel Marin Keys are in a tsunami inundation zone ([CGS 2009). The tsunami inundation area is composed primarily of tidal wetlands and does not contain residential or commercial development.

## f. Regulatory Setting

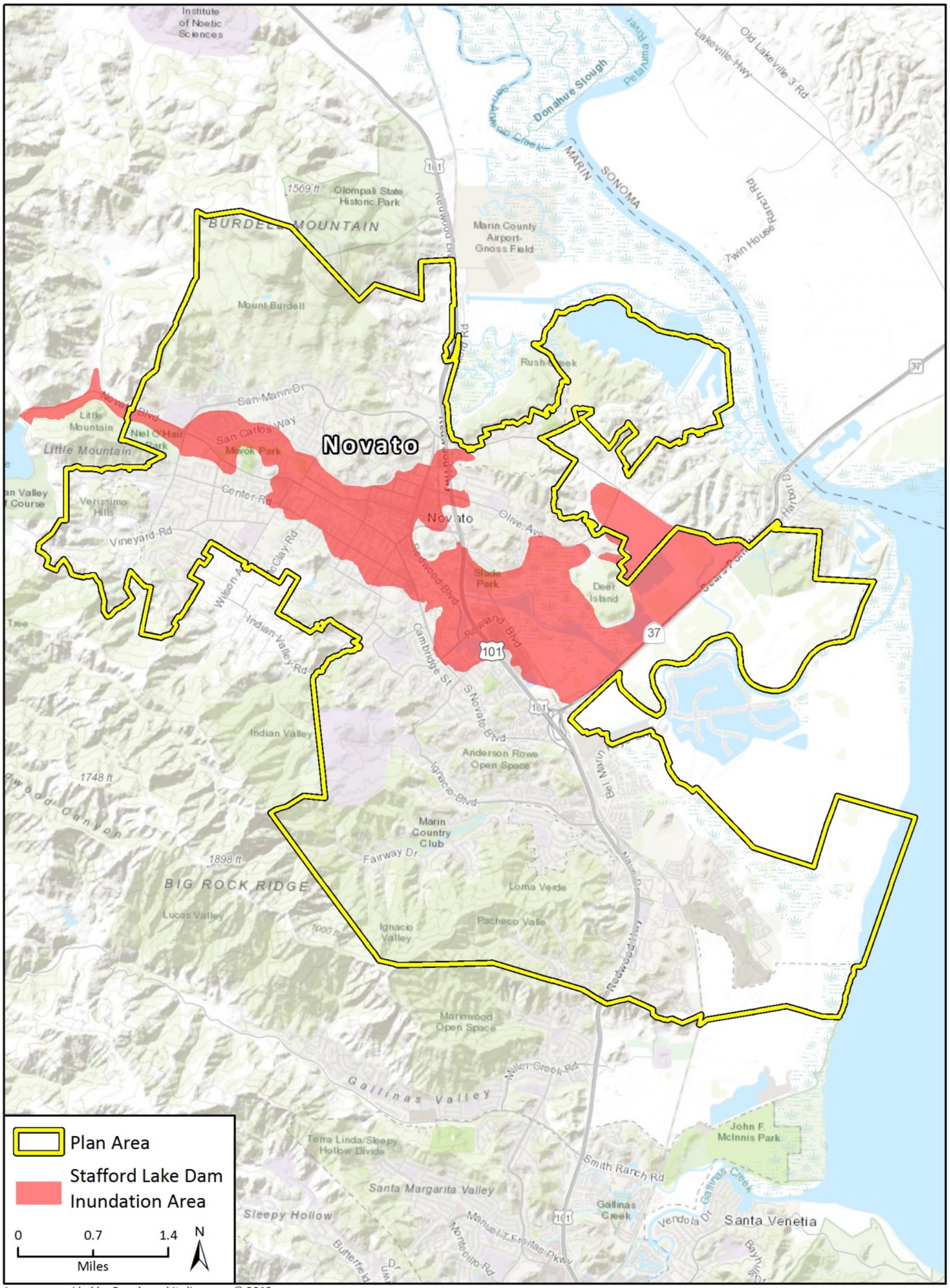
### Federal

#### *Clean Water Act*

Congress enacted the Clean Water Act (CWA) with the intent of restoring and maintaining the chemical, physical, and biological integrity of the waters of the United States. The CWA requires states to set standards to protect, maintain, and restore water quality through the regulation of point source and non-point source discharges to surface water. Those discharges are regulated by the National Pollution Discharge Elimination System (NPDES) permit process (CWA Section 402). NPDES permitting authority is administered by SWRCB and its nine Regional Water Quality Control Boards (RWQCB). Novato is in a watershed administered by the San Francisco Bay RWQCB.

As part of Section 402 of the CWA, the U.S. EPA has established regulations under the NPDES program to control both construction and operation (occupancy) stormwater discharges. Individual projects in the City that would disturb at least one acre of land must provide stormwater treatment

## Figure 4.8-3 Dam Inundation Area

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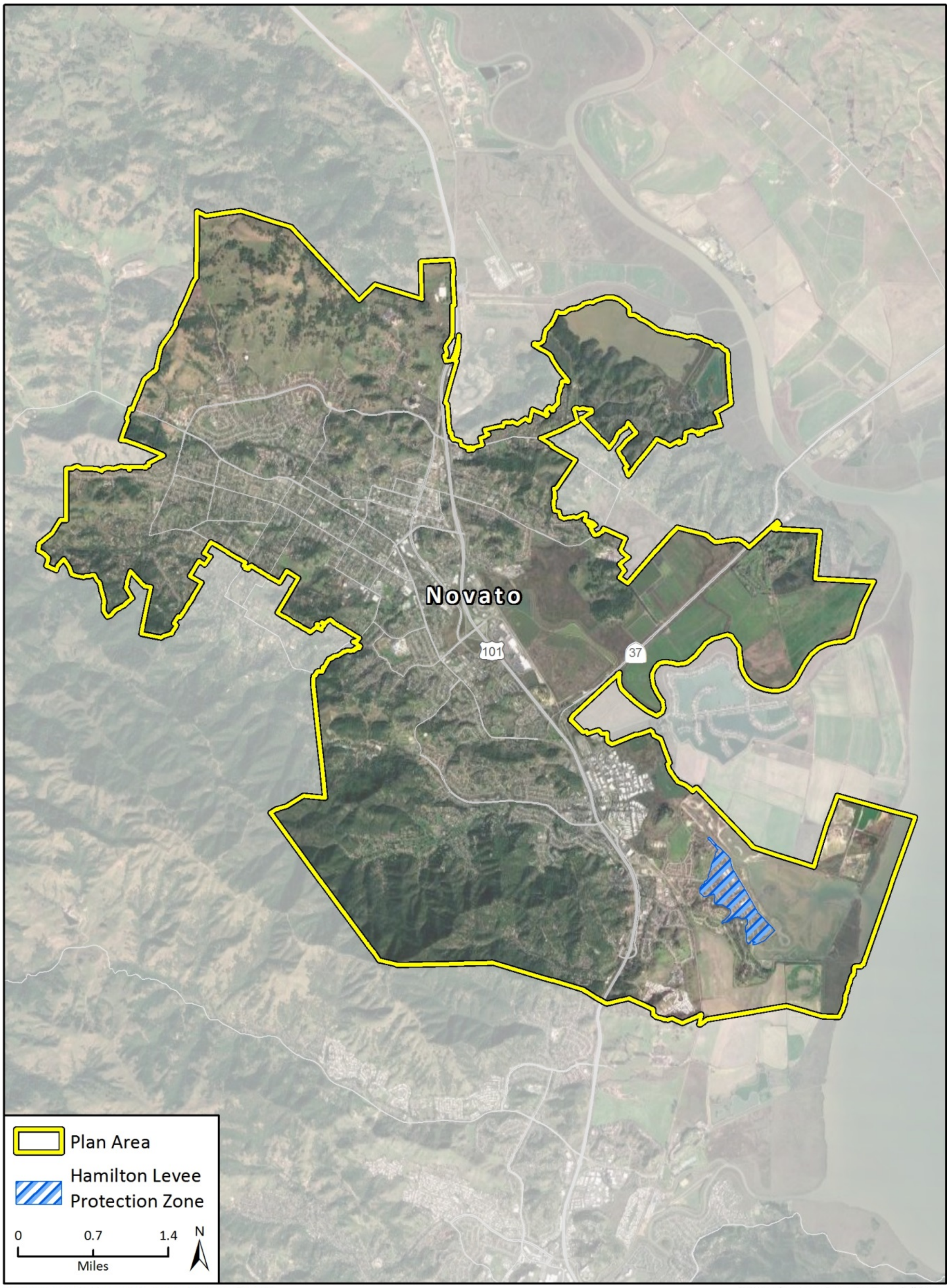
*Additional data provided by Marin County 2018.*

## Figure 4.8-4 Hamilton Levee Protection Zone

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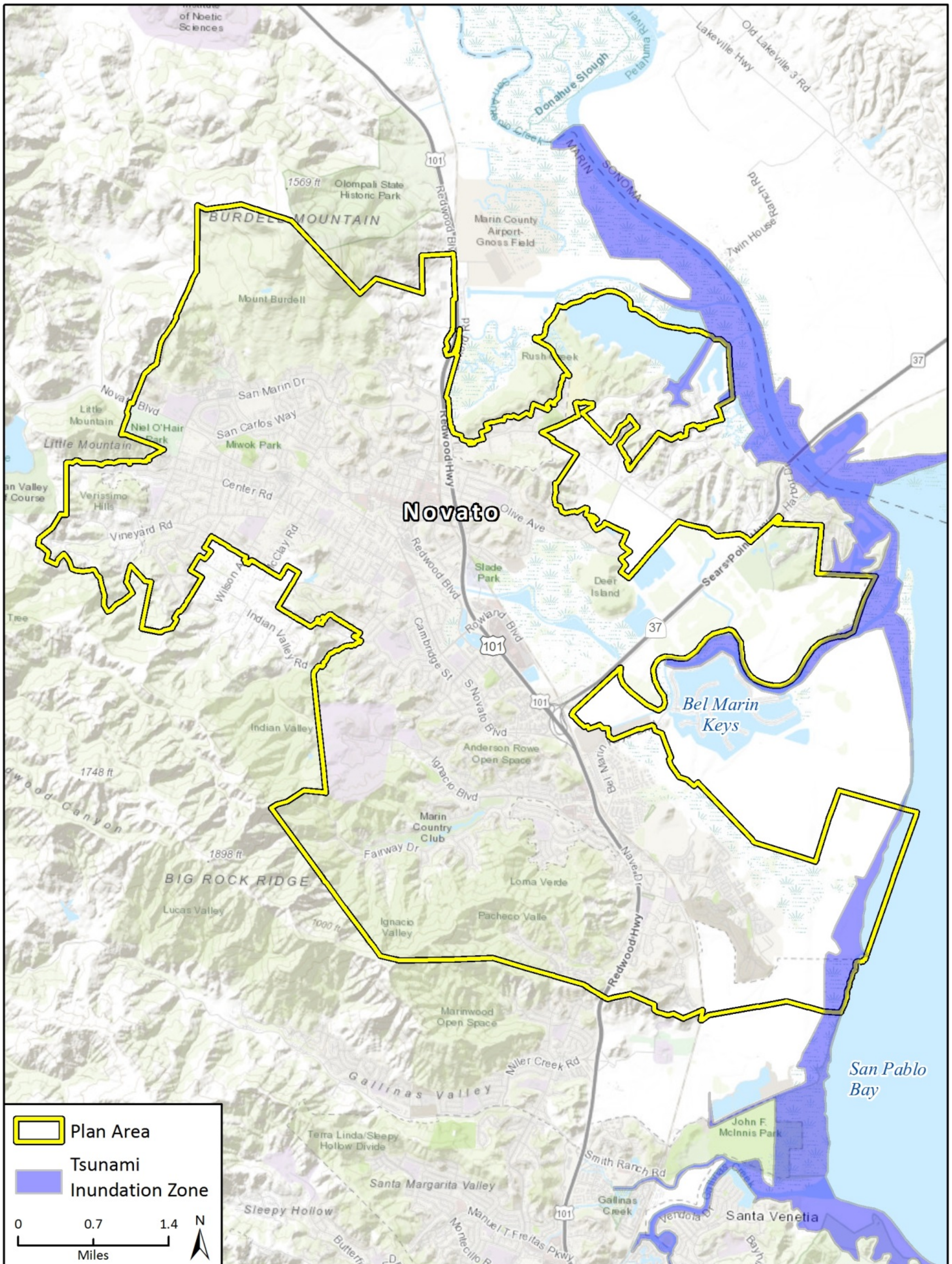
## Figure 4.8-5 Tsunami Inundation Zone




*Imagery provided by Google and its licensors © 2018. Additional data provided by State of California, 2009, Tsunami Inundation Map for Emergency Planning, Novato/Petaluma Point Quadrangle, Marin County; produced by California Emergency Management Agency, California Geological Survey, and University of Southern California – Tsunami Research Center; dated July 1, 2009, mapped at 1:24,000 scale.*

during construction and would be required to obtain coverage under the General Permit for Discharges of Storm Water Associated with Construction Activity (Construction General Permit Order 2009-0009-DWQ or 2009-0009-DWQ General Permit). The Stormwater Pollution Prevention Plan (SWPPP) must contain stormwater and erosion control Best Management Practices (BMP), a visual monitoring program; a chemical monitoring program for “non-visible” pollutants to be implemented if there is a failure of BMPs; and a sediment monitoring plan if the site discharges directly to a waterbody listed on the 303(d) list for sediment. Future projects projected by General Plan 2035 would be subject to the SWRCB Water Quality Order No. 2013-0001-DWQ, NPDES General Permit No. CAS000004, Waste Discharge Requirements (WDRs) for Storm Water Discharges from Small Municipal Separate Storm Sewer Systems (MS4s), and the provisions set forth in Section E.12, *Post Construction Stormwater Management Program*. Provision E.12 of the NPDES MS4 permit addresses post-construction stormwater requirements for new development and redevelopment projects that add and/or replace 5,000 square feet or more of impervious area, including 1) incorporate site design, source control, and stormwater treatment measures into the project design; 2) minimize the discharge of pollutants in stormwater runoff and non-stormwater discharge; and 3) minimize increases in runoff flows as compared to pre-development conditions. In addition, Low Impact Development (LID) requirements apply. Projects that create and/or replace between 2,500 and 5,000 square feet of impervious surface must implement site design measures, including stream setbacks and buffers, soil quality improvement and maintenance, tree planting and preservation, rooftop and impervious area disconnection, porous pavement, green roofs, vegetated swales, and rain barrels and cisterns (SWRCB 2013).

Section 401 of the CWA requires that any activity that would result in a discharge into waters of the U.S. be certified by the RWQCB. This certification ensures that the proposed activity does not violate State and/or federal water quality standards. Section 404 of the CWA authorizes the U.S. Army Corps of Engineers to regulate the discharge of dredged or fill material to the waters of the U.S. and adjacent wetlands. Discharges to waters of the U.S. must be avoided where possible, and minimized and mitigated where avoidance is not possible. Section 303(d) of the CWA requires states to establish TMDL programs for streams, lakes and coastal waters that do not meet certain water quality standards.

### *National Flood Insurance Act/Flood Disaster Protection Act*

The National Flood Insurance Act of 1968 made flood insurance available for the first time. The Flood Disaster Protection Act of 1973 made the purchase of flood insurance mandatory for the protection of property located in Special Flood Hazard Areas. These laws are relevant because they led to mapping of regulatory floodplains and to local management of floodplain areas according to guidelines that include prohibiting or restricting development in flood hazard zones.

## State

### *California Porter Cologne Water Quality Control Act*

The Porter Cologne Water Quality Control Act of 1967 requires the SWRCB and the nine RWQCBs to adopt water quality criteria to protect State waters. These criteria include the identification of beneficial uses, narrative and numerical water quality standards, and implementation procedures. The criteria for State waters within the City are contained in the Water Quality Control Plan for the San Francisco Bay Basin (SFBRWQCB 2017). The Water Quality Control Plan, or Basin Plan, protects designated beneficial uses of State waters through the issuance of Waste Discharge Requirements (WDRs) and through the development of TMDLs. Anyone proposing to discharge waste that could affect the quality of the waters of the State must make a report of the waste discharge to the RWQCB or SWRCB as appropriate, in compliance with Porter-Cologne.

### *California Streambed Alteration Agreement*

Sections 1600–1616 of the California Fish and Game Code require that any entity that proposes an activity that would substantially divert or obstruct the natural flow of any river, stream or lake; substantially change or use any material from the bed, channel, or bank of, any river, stream, or lake; or, deposit or dispose of debris, waste, or other material containing crumbled, flaked, or ground pavement where it may pass into any river, stream, or lake, must notify the California Department of Fish and Wildlife (CDFW). The CDFW would require a Lake or Streambed Alteration Agreement if the Department determines that the alteration may adversely affect fish and wildlife resources. The Agreement includes conditions necessary to protect those resources. The Agreement applies to any stream, including ephemeral streams and desert washes.

### *Assembly Bill 70*

Assembly Bill 70 requires cities and counties that have "unreasonably approved" development in an area with known flood risks to share liability for flood control damage with State entities.

### *Assembly Bill 162*

Assembly Bill 162 requires cities and counties to address flood-related matters in the land use, conservation, safety, and housing elements of their General Plans (DWR 2007). The General Plan must contain a statement of development policies and shall include a diagram or diagrams and text setting forth objectives, principles, standards, and plan proposals. The land use element shall identify and annually review those areas covered by the plan that are subject to flooding identified by flood plain mapping prepared by FEMA or DWR. The conservation element shall identify rivers, creeks, streams, flood corridors, riparian habitats, and land that may accommodate floodwater for the purposes of groundwater recharge and stormwater management. The safety element shall identify information regarding:

- Flood hazards, including flood hazard zones
- National Flood Insurance Program maps published by FEMA
- Information about flood hazards that is available from the United States Army Corps of Engineers
- Dam failure inundation maps
- Awareness Floodplain Mapping Program maps
- Levee protection zone maps
- Historical data on flooding
- Existing and planned development in flood hazard zones, including structures, roads, utilities, and essential public facilities
- Local, state, and federal agencies with responsibility for flood protection.

The safety element must establish a set of comprehensive goals, policies, objectives, and feasible implementation measures based on the information identified above for the protection of the community from unreasonable risks of flooding, including but not limited to:

- Avoiding or minimizing the risks of flooding to new development
- Evaluating whether new development should be located in flood hazard zones, and identifying construction methods or other methods to minimize damage if new development is located in a flood hazard zone
- Maintaining the structural and operational integrity of essential public facilities during flooding
- Locating, when feasible, new essential public facilities outside of flood hazard zones
- Establishing cooperative working relationships among public agencies with responsibility for flood protection.

## Local

### *Marin County Flood Control and Water Conservation District*

All of Marin County, including Novato, is under the jurisdiction of MCFCWCD, which is responsible for managing stormwater and flooding problems in the County.

MCFCWCD is staffed by the Marin County Department of Public Works and is responsible for administering the Marin County Stormwater Pollution Prevention Program (MCSTOPPP) and FEMA Flood Insurance Programs. The goal of MCSTOPPP is to prevent stormwater pollution, protect and enhance water quality in creeks and wetlands, preserve beneficial uses in waterways and comply with State and federal regulations. MCSTOPPP submitted a county-wide Stormwater Management Plan (SWMP) to the RWQCB and coordinates consistency between individual SWMPs.

MCFCWD identifies eight “zones” within the County to focus on issues in specific watersheds. The City of Novato and a sizeable area of unincorporated Marin County are within MCFCWCD’s Zone 1. The boundary of Zone 1 is formed by the entire watershed tributary to Rush Creek and Novato Creek.

### *Action Plan 2010*

*Action Plan 2010* is the five-year SWMP for the member agencies of MCSTOPPP. The County of Marin and each of the cities and towns in the County, including the City of Novato, are member agencies of MCSTOPPP. MCSTOPPP coordinates consistency between individual SMPs. *Action Plan 2010* was submitted to and approved by SWRCB in May 2005.

### *Storm Drainage Master Plan*

To accommodate 25-year flood flows, the City has implemented a Local Drainage Master Plan for improving storm drains. A detention pond has been constructed at Deer Island (located on the northern portion of Deer Creek in eastern Novato), and improvements have also been made to the channels of Novato Creek, Warner Creek, and Arroyo Avichi Creek (City of Novato 2014a). In July of 2014 the City began developing a City-wide Storm Drain Master Plan. The work included an inventory and mapping of existing storm water infrastructure as well as the creation of a computer model. The final product includes a detailed report that will guide the City in planning, financing, improving, and maintaining the current storm water infrastructure. The City is currently in the process of updating the Local Drainage Master Plan (City of Novato 2016).

### *Novato Municipal Code*

Novato Municipal Code Section 5-15, Drainage, establishes standards for drainage that are necessary to ensure that underground and surface waters are conducted through and away from developments in such a manner as to not detrimentally affect other properties, to ensure that underground and surface water is not a problem within the completed development, and to correct or improve existing underground or surface water problems within the boundaries of the development and within the immediately affected surrounding area. This section of the Municipal Code requires that existing drainage patterns be maintained or improved and that stormwater is prevented from intruding in new structures.

The Novato Municipal Code Section 5-31, Flood Damage Prevention Requirements, establishes regulations for "special flood hazard areas" in Novato. Special flood hazard areas are defined by the flood hazard zones delineated in FEMA's Flood Insurance Rate Maps. Development, designation and subdivision of land within a special flood hazard area require the review and approval of the City Engineer, who must find the land use proposal consistent with specific use regulations and development standards intended to reduce flooding hazards. Standards include elevating the structure's lowest level above the base flood elevation and anchoring structures to prevent lateral movement in case of flooding. These rules apply to new structures and to improvements or repairs totaling 50 percent of more of the value of an existing building.

Novato Municipal Code Section 7-4, Urban Runoff Pollution Prevention, requires minimizing discharges other than storm runoff to storm drains or watercourses, responding to the discharge of spills, preventing and controlling the discharge of spills or disposal of materials other than stormwater to storm drains or watercourses, reducing pollutants in stormwater discharges, requiring developers to install and maintain appropriate best management practices (BMP), and requiring development projects to maintain or reduce the volume, velocity, peak flow rate, and duration of runoff as compared to pre-development stormwater runoff and to prevent stormwater pollution through stormwater management controls. This section of the Municipal Code requires an erosion and sediment control plan (ESCP) for any project subject to a grading permit and for any project subject to a building permit or other City permit that has the potential for significant erosion and/or significant non-stormwater discharges of sediment and/or construction site waste. The City may also require as a condition of project approval a stormwater control plan that details the implementation and maintenance requirements for post-construction permanent stormwater control measures.

Novato Zoning Code Section 19.16.050 establishes the Flood Hazard (F) Overlay District in Novato. The purpose of this district is to "protect people and property from flood hazard risks by appropriately regulating development and land uses within an F overlay district." The (F) Overlay District limits land uses permitted in primary and secondary floodways and requires studies and mitigation for development proposed within a 100-year flood plain.

Novato Municipal Code Section 19.26.050, Hillside Project Development Standards, requires that structures are not placed on average slopes exceeding 25 percent for residential development and 20 percent for non-residential development. Encroachment of building envelopes on slopes exceeding these percentages may be permitted by the review authority only where findings in Section 19.26.050 H. can be made. Design review for hillside development may be approved by the review authority only when the required findings have been made. One of the findings, Finding C, states that "site grading has been designed to be as minimal as possible to achieve hillside design, minimize tree removal, and provide safe site access and required parking." However, Implementing Ordinance 2 would modify the Hillside Project Development Standards to reduce restrictions and allow for increased development on lots with existing homes.

Novato Municipal Code Section 19.35, Waterway and Riparian Protection, establishes buffer areas along watercourses to protect water quality, minimize flood hazards and maintain or expand storage capacity for flood waters. Section 19.35 establishes a "stream protection zone" that includes the stream bed, the stream banks, all riparian vegetation and a buffer zone at least 50 feet wide, measured from the top of the channel bank. The stream protection zone may be expanded or reduced based on specific sit conditions. Any proposed development, grading, fill, planting, or vegetation removal requires a use permit. In order to obtain a use permit, an applicant must submit a Stream Management Plan and incorporate annual maintenance requirements into the project.

## 4.8.2 Impact Analysis

### *4.8.1.2 Methodology and Thresholds of Significance*

#### a. Methodology

This section describes the potential environmental impacts of the proposed project relevant to hydrology and water quality. The impact analysis is based on an assessment of baseline conditions for the Plan Area, including climate, topography, watersheds and surface waters, groundwater, and floodplains, as described above under Subsection 4.8.1, *Setting*. This analysis identifies potential impacts based on the predicated interaction between the affected environment and construction, operation, and maintenance activities related to the development that would occur under General Plan 2035, and recommends mitigation measures, when necessary, to avoid or minimize impacts.

#### b. Significance Thresholds

The following thresholds of significance are based on CEQA Guidelines Appendix G. For the purposes of this EIR, implementation of the proposed project may have a significant adverse impact if it would:

1. Violate any water quality standards or waste discharge requirements
2. Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g. the production rate of pre-existing nearby wells would drop to a level that would not support existing land uses or planned uses for which permits have been granted)
3. Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion or siltation on- or off-site
4. Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in flooding on- or off-site
5. Create or contribute runoff water that would exceed the capacity of existing or planned storm water drainage systems or provide substantial additional sources of polluted runoff
6. Otherwise substantially degrade water quality
7. Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map
8. Place within a 100-year flood hazard area structures which would impede or redirect flood flows

9. Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam
10. Expose people or structures to significant risk or loss, injury or death involving inundation by seiche, tsunami, or mudflow

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| **Threshold 1:** | Would the project violate any water quality standards or waste discharge requirements? |
| **Threshold 6:** | Would the project otherwise substantially degrade water quality? |

**Impact HWQ-1 IMPLEMENTATION OF THE PROPOSED PROJECT COULD RESULT IN A DISCHARGE OF POLLUTANTS TO SURFACE WATERS OR CONTAMINATION OF SHALLOW GROUNDWATER THROUGH INCREASED SOIL DISTURBANCE AND EROSION, DISCHARGE OF CONTAMINATED WASTEWATER OR STORM WATER, OR ACCIDENTAL SPILLS OR LEAKS OF HAZARDOUS MATERIALS. COMPLIANCE WITH APPLICABLE LAWS AND REGULATIONS AND IMPLEMENTATION OF THE GOALS AND POLICIES OF GENERAL PLAN 2035 WOULD MINIMIZE THE POTENTIAL FOR WATER QUALITY DEGRADATION. IMPACTS WOULD BE LESS THAN SIGNIFICANT.**

Construction activities associated with the proposed project could include road improvements and realignments, installation and realignment of utilities, demolition of existing structures, new development, and the potential replacement and/or improvement of drainage facilities. Water quality degradation from construction would be specific to each construction site. The topography of the site, the amount of soil disturbance, the duration that disturbed soil would be exposed, the amount of rainfall and wind that would occur during construction, and the proximity of the nearest waterbody all affect the potential for water quality degradation during construction. Implementation of the proposed project would be limited to the Plan Area and infill development would be focused primarily in the four focus areas and Industrial Parks MPA, which would minimize the amount of new infrastructure that would be required.

Project construction could result in soil erosion due to earth-moving activities such as excavation and trenching for foundations and utilities, soil compaction and moving, cut and fill activities, and grading. If not managed properly, disturbed soils would be susceptible to high rates of erosion from wind and rain, resulting in sediment transport via stormwater runoff from the construction sites. The types of pollutants contained in runoff from construction sites would be typical of urban areas, and may include sediments and contaminants such as oils, fuels, paints, and solvents. Additionally, other pollutants, such as nutrients, trace metals, and hydrocarbons, can attach to sediment and be transported to downstream drainages and ultimately into collecting waterways, contributing to degradation of water quality.

Per compliance with NPDES general permit, the County's SWPPP, and other state and local regulations, the proposed project, including development in the focus areas and Industrial Parks MPA area, would be required to implement erosion control BMPs that may include scheduling and timing of grading activities, timely revegetation of graded areas, the use of hydroseed and hydraulic mulches, and installation of erosion control blankets. Pollution prevention practices may include designated washout areas or facilities, control of trash and recycled materials, tarping of stockpiled materials on site, and proper location of and maintenance of temporary sanitary facilities. The combination of BMPs used must be customized to the site using up-to-date standards and practices.

Prior to and/or during construction, the city may establish controls on the volume and rate of stormwater runoff from new developments and redevelopment as may be appropriate to minimize peak flows or total runoff volume, and to mimic the pre-development site hydrology. These controls may include limits on impervious areas or provisions for detention and retention of runoff on site. Implementation of an approved ESCP would be a condition of the issuance of a building permit, a grading permit, or other permit issued by the city for a project subject to Section 7-4, Urban Runoff Pollution Prevention, of the Novato Municipal Code. When any work is being done contrary to the provisions of the Urban Runoff Pollution Prevention Ordinance, an authorized Novato enforcement official may order the work stopped by notice in writing served on any persons engaged in doing or causing the work to be done. Such work would stop until the enforcement official authorizes the work to proceed. This remedy is in addition to and does not supersede or limit any and all other remedies, both civil and criminal provided in the Novato Municipal Code.

Adherence to the requirements of the Novato Municipal Code would reduce the potential for the proposed project to cause erosion and the subsequent sedimentation of local streams by ensuring proper management of loose and disturbed soil.

Construction activities, including excavation and trenching, may encounter shallow groundwater. In the event that shallow groundwater is encountered, dewatering of the excavation or trenching site may be required. If improperly managed, these dewatering activities could result in discharge of contaminated groundwater. In accordance with the San Francisco Bay RWQCB Groundwater General Permit (Order No. R2-2012-0060; NPDES No. CAG912004), contaminated groundwater would be treated prior to discharge or disposed of at an appropriate disposal facility or wastewater treatment plant. The Urban Runoff Pollution Prevention Ordinance, Novato Municipal Code Section 7-4.9, prohibits the establishment, use, maintenance or continuance of illicit discharges to the city storm drains or watercourses.

Compliance with applicable regulations and policies would reduce the risk of water degradation in Novato from soil erosion and other pollutants related to construction activities. Because violations of water quality standards would be minimized, impacts on water quality from the proposed project would be less than significant.

Operation of the proposed project could potentially add contaminants into both the storm water runoff entering the City's storm water drainage system and the wastewater stream entering the local wastewater collection and treatment system. If storm water controls are not designed or managed properly, runoff from urban development could contain contaminants such as oil, grease, metals, and landscaping chemicals (pesticides, herbicides, fertilizers, etc.) that could enter the City's storm water drainage system and ultimately degrade surface water and groundwater quality. The City of Novato's NPDES Storm Water Program and Novato Municipal Code prevents illicit discharges into drains, waterways and wetlands. Any entity found responsible for engaging in illicit discharges may be held liable for the cost of clean-up and remediation. The City may also require, as a condition of project approval, permanent structural controls designed for the removal of sediment and other pollutants and for control of the volume and rate of stormwater runoff from the project's added or replaced impervious surfaces. Post-construction measures may include source control measures, low impact development design, site design measures, stormwater treatment measures, and hydromodification management measures. MCSTOPPP's Stormwater Program details requirements and BMPs to control runoff and stormwater pollution during both construction and operation of projects in Marin County and is designed to achieve compliance with the SWRCB's Phase II General Permit (Water Quality Order No. 2003-0005-DWQ) for stormwater discharges from small MS4s.

In addition to compliance with mandatory CWA and Novato Municipal Code requirements, implementation of General Plan 2035 goals and policies would further reduce the potential for water quality degradation. For example, Policies CC 3, CC 4, CC 5, and CC 6 would protect Novato's hillsides and ridgelines from erosion and soil instability while minimizing impacts on sites with environmental constraints; Policies ES 1a, ES 1c, and ES 1d would preserve and enhance the ecology of creeks and streams to ensure further degradation does not take place; Policy ES 2 would retain and restore watersheds to minimize effects of pollution in stormwater runoff; Policies ES 4, ES 5, ES 6, ES 7, ES 8 would preserve, enhance, and restore habitat; Policy ES 10 would protect water resources from pollution and sedimentation; and Policy SH 5 would minimize risks associated with hazardous waste transportation, storage, and disposal. Although implementation of implementing Ordinance 2 would revise Novato Municipal Code Section 19.26.050 to allow for appurtenant structures and taller residential structures on hillsides, those developments would still be subject to Novato Municipal Code Section 7-4, which requires development of an ESCP for any project subject to a building permit or other permit that has the potential for significant erosion and/or significant non-stormwater discharges of sediment and/or construction site waste. Compliance with NPDES permit requirements, the Novato Municipal Code, and General Plan 2035 goals and policies would reduce the risk of water contamination within the City from project construction and operation to the maximum extent practicable. These regulations and policies would also apply to the four focus areas and Industrial Parks MPA to reduce the risk of water contamination. Therefore, this impact would be less than significant.

## Mitigation Measures

No mitigation measures are required.

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| **Threshold 2:** | Would the project substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g. the production rate of pre-existing nearly wells would drop to a level that would not support existing land uses or planned uses for which permits have been granted)? |

**Impact HWQ-2** **IMPLEMENTATION OF THE PROPOSED PROJECT WOULD RESULT IN NEW IMPERVIOUS SURFACES THAT COULD INTERFERE WITH GROUNDWATER RECHARGE, RESULTING IN A LOWERING OF THE LOCAL GROUNDWATER TABLE LEVEL. HOWEVER, COMPLIANCE WITH APPLICABLE LAWS AND REGULATIONS AND IMPLEMENTATION OF THE GOALS AND POLICIES CONTAINED IN GENERAL PLAN 2035 WOULD MINIMIZE RUNOFF AND MAXIMIZE INFILTRATION OF STORMWATER. IMPACTS WOULD BE LESS THAN SIGNIFICANT.**

Implementation of the proposed project is anticipated to result in a net increase of approximately 4.7 million square feet of commercial, industrial, and office uses. In addition, approximately 930 new residential units would be constructed through 2035, which represents an approximately 4.3 percent increase in residential units. The total amount of impervious surface area associated with the proposed project is estimated to be less than one percent of the total recharge area for the Novato Valley Basin, the groundwater basin that underlies the City. Infill development, including in the four focus areas and Industrial Parks MPA area, would be prioritized as part of the proposed project, which would minimize the conversion of open space and permeable surfaces to impervious surfaces. Individual projects that would create or replace 2,500 square feet or more of impervious surface would be required to implement site design measures identified in the SWRCB Phase II General Permit to reduce project site runoff. These measures include stream setbacks and buffers, soil quality improvement and maintenance, tree planting and preservation, rooftop and impervious area disconnection, porous pavement, green roofs, vegetated swales, and rain barrels and cisterns. Individual projects that create or replace 5,000 square feet or more of impervious surface area would be required to implement Low Impact Development (LID) design standards, hydromodification management measures, and post-construction storm water management measures to reduce runoff and maximize infiltration. Compliance with General Plan Policy SH 2a would maintain post-development peak runoff rates and average volumes similar to the predevelopment conditions to the maximum extent practicable. Due to the small amount of new impervious surfaces associated with the proposed project, and with adherence to SWRCB Phase II General Permit requirements to minimize runoff and maximize infiltration, implementation of the proposed project would not substantially interfere with groundwater recharge such that a lowering of the local groundwater table level would result.

Although Novato is underlain by the Novato Valley groundwater basin, the City does not use groundwater as a source for municipal water supply. Therefore, implementation of the proposed project would not result in extraction of groundwater resources or the direct lowering of local groundwater levels.

Compliance with the SWRCB Phase II General Permit requirements and adherence with General Plan 2035 policies would minimize runoff from project sites and maximize groundwater infiltration. In addition, new impervious surfaces associated with implementation of the proposed project would occupy less than one percent of the total recharge area for the underlying aquifer. Similarly, development in the four focus areas and Industrial Parks MPA area would adhere to the regulations and policies listed above and would not deplete ground water supplies. The Industrial Parks MPA is already covered in impervious surfaces and would not result in reduced water infiltration. Therefore, this impact would be less than significant.

## Mitigation Measures

No mitigation measures are required.

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| **Threshold 3:** | Would the project substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion or siltation on- or off-site? |

**Impact HWQ-3 THE PROPOSED PROJECT COULD ALTER THE EXISTING DRAINAGE PATTERNS IN THE CITY AND POTENTIALLY RESULT IN EROSION AND SILTATION. HOWEVER, COMPLIANCE WITH APPLICABLE REGULATIONS, INCLUDING THE CLEAN WATER ACT, AND IMPLEMENTATION OF THE GOALS AND POLICIES CONTAINED IN GENERAL PLAN 2035 WOULD MINIMIZE THE POTENTIAL FOR EROSION AND SILTATION. IMPACTS WOULD BE LESS THAN SIGNIFICANT.**

Implementation of the proposed project would involve construction activities such as stockpiling, grading, excavation, paving, and other earth-disturbing activities. Development would also result in alterations to drainage patterns through structural changes to ground surface permeability and changes in topography from grading and excavation. Although Implementing Ordinance 2 would revise Novato Municipal Code Section 19.26.050 to allow for additional hillside development that could alter existing drainage patterns, that new development would still be subject to Novato Municipal Code Section 7-4, which requires development of an ESCP for any project subject to a building permit or other permit that has the potential for significant erosion and/or significant non-stormwater discharges of sediment. As described under Impact HWQ-1, construction of future projects could result in soil erosion due to earth-moving activities such as excavation and trenching for foundations and utilities, soil compaction and moving, cut and fill activities, and grading. If not managed properly, disturbed soils would be susceptible to high rates of erosion from wind and rain, resulting in sediment transport and siltation of local streams via storm water runoff from the construction sites.

Construction activities that disturb one or more acres of land surface such as implementation of the Industrial Parks MPA, are subject to the NPDES Construction General Permit (CGP) that requires a SWPPP, which must describe the site, the facility, erosion and sediment controls, runoff water quality monitoring, means of waste disposal, implementation of approved local plans, control of construction sediment and erosion control measures, maintenance responsibilities, and non-storm water management controls. Compliance with the CGP is reinforced through the City of Novato, which requires projects with a potential for significant erosion to develop an ESCP that is equivalent to the required SWPPP and that includes the requirements listed in Section 7-4.10 7(b).

ESCP's should follow the most recent version of the MCSTOPPP Construction Erosion and Sediment Control Plan Applicant Package (also known as the Marin County SWPPP). The implementation of BMPs are required for construction activity to prevent the discharge of construction wastes or contaminants from construction materials, tools and equipment from entering the storm drain system or water course. Adherence to the requirements of the Novato Municipal Code would reduce the potential for new construction under General Plan 2035 to cause erosion or siltation by ensuring proper management of loose and disturbed soil.

Changes to drainage patterns that may result from new development associated with the proposed project, including additional hillside development with Implementing Ordinance 2, could result in the alteration of existing drainage patterns and/or an operational increase in the rate and amount of surface runoff, which in turn could result in increased soil erosion. Compliance with the SWRCB Phase II General Permit and the City's Urban Runoff Pollution Prevention Ordinance would minimize post-construction runoff and maximize infiltration of stormwater, thus minimizing the potential impact of drainage pattern alteration from new development. In addition to compliance with mandatory NPDES and Novato Municipal Code requirements, implementation of General Plan 2035 Program SH 2a would further reduce the potential for erosion and off-site siltation from construction-related soil disturbance through the minimization of post-construction runoff. General Plan 2035 Program SH 2a requires new development to maintain post-development peak runoff rates and average volumes similar to pre-development conditions, requires runoff rate/volume analysis of projects at the discretion of City staff, and requires new development to cover the cost of necessary drainage facilities.

Implementation of General Plan Program SH 2a, in addition to compliance with applicable laws and regulations, would minimize the potential for erosion and siltation and would reduce this potential impact to a less-than-significant level. Similarly, development in the four focus areas and Industrial Parks MPA would comply with General Plan Program SH 2a and applicable laws and regulations. Impacts would be less than significant.

## Mitigation Measures

No mitigation measures are required.

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| **Threshold 4:** | Would the project substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in flooding on- or off-site? |
| **Threshold 5:** | Would the project create or contribute runoff water that would exceed the capacity of existing or planned storm water drainage systems or provide substantial additional sources of polluted runoff? |

**Impact HWQ-4** **IMPLEMENTATION OF THE PROPOSED PROJECT COULD ALTER THE EXISTING DRAINAGE PATTERNS AND INCREASE THE AMOUNT OF RUNOFF THROUGHOUT THE CITY, WHICH COULD RESULT IN FLOODING ON- OR OFF-SITE, EXCEEDING THE CAPACITY OF EXISTING OR PLANNED STORM WATER DRAINAGE SYSTEMS, OR CREATE SUBSTANTIAL ADDITIONAL SOURCES OF POLLUTED RUNOFF. COMPLIANCE WITH APPLICABLE REGULATIONS AND IMPLEMENTATION OF THE GOALS AND POLICIES INCLUDED IN GENERAL PLAN 2035 WOULD MINIMIZE THE POTENTIAL FOR INCREASED RUNOFF AND FLOODING AND CONSTRUCTION OF NEW STORM WATER DRAINAGE FACILITIES WOULD NOT BE REQUIRED. IMPACTS WOULD BE LESS THAN SIGNIFICANT.**

Implementation of the proposed project would encourage infill development through General Plan 2035 policies in appropriate areas on sites with environmental constraints, and would keep urban development from extending into rural and natural areas. Specifically, Community Character Policy CC 6 focuses new residential and commercial growth at appropriate infill sites near transit and retail services. Implementation of the proposed project could incrementally increase the total impervious area within Novato and increase storm water runoff. However, as described above, implementation of General Plan 2035 Program SH 2a and adherence to the requirements of the SWRCB Phase II General Permit and the Novato Municipal Code would maximize the on-site infiltration capacity for projects and would minimize the off-site runoff that would leave those project sites.

Storm water drainage facilities in the City discharge storm water to the local streams, which then drain eventually to the San Pablo Bay and the Pacific Ocean. The existing storm water drainage system is sufficient to drain runoff within the City under all but the most severe flooding conditions. Please see Section 4.15, *Utilities and Service Systems*, for further discussion of the City's stormwater conveyance capacity. Implementation of General Plan 2035 goals and policies would ensure that the City's storm water drainage facilities remain adequate following anticipated future development. Specifically, Policy ES 2, Watershed Management, would minimize storm water runoff by prioritizing storm drain maintenance and street sweeping programs to reduce urban runoff. Adherence to General Plan Policy SH 2, Flood Hazards, and its associated programs, would require proper maintenance of storm drainage systems and natural flood control channels and waterways, would minimize runoff from projects, and would encourage flood control measures that retain the natural features and conditions of watercourses to the maximum extent feasible. Because goals and policies in General Plan 2035 are related to maintaining existing facilities construction of new storm water drainage facilities or expansion of existing facilities would not occur during implementation of the proposed project.

Implementation of these goals and policies would ensure that the City maintains and implements an effective storm water management plan and that the storm water drainage system provides adequate storm water drainage for both existing and new development. Development in the four focus areas and Industrial Parks MPA area would also comply with these goals and policies that would ensure adequate storm water management. Implementation of these goals and policies, in addition to compliance with applicable laws and regulations, would minimize the potential for increased runoff and flooding and would reduce this potential impact to a less-than-significant level.

## Mitigation Measures

No mitigation measures are required.

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| **Threshold 7:** | Would the project place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map? |
| **Threshold 8:** | Would the project place within a 100-year flood hazard area structures which would impede or redirect flood flows? |

**Impact HWQ-5 IMPLEMENTATION OF THE PROPOSED PROJECT COULD PLACE HOUSING OR STRUCTURES IN A FLOOD HAZARD AREA OR EXPOSE PEOPLE OR STRUCTURES TO A SIGNIFICANT RISK OF LOSS, INJURY, OR DEATH INVOLVING FLOODING. COMPLIANCE WITH APPLICABLE REGULATIONS AND IMPLEMENTATION OF THE GOALS AND POLICIES OF GENERAL PLAN 2035 WOULD PROTECT STRUCTURES FROM ADVERSE EFFECTS RELATED TO FLOODING. IMPACTS WOULD BE LESS THAN SIGNIFICANT.**

Relatively small areas associated with the main streams that cross Novato, including Novato Creek and Arroyo Jan Jose, are subject to flooding from a 100-year storm and are designated as Special Flood Hazard Areas (FEMA 2018).These Special Flood Hazard Areas run northwest to southeast through the northern portion of the Plan Area and west to east through the southern portion of the Plan Area (FEMA 2018). As shown in Figure 4.8-2, most of the eastern portion of the City is subject to flooding during a 100-year storm. In the event of a severe storm combined with a high tide, developed parcels in the southeastern portion of the City could be threatened with immediate flooding.

As described above under Impact HWQ-4, the City's storm water conveyance system is currently adequate to drain runoff away from structures and improvements to the storm water drainage system would occur concurrently with new development under General Plan 2035 such that the drainage system remains adequate, in compliance with General Plan 2035 Program SH 2a and 2i. Pursuant to Novato Municipal Code Section 7-5, owners of real property in the City are required to pay an annual fee to the City for clean stormwater activities, which include capital improvements to the City's storm drainage system. New development under General Plan 2035 would be subject to the clean stormwater activity fee.

Although 100-year flood hazard areas exist within the City, future development within these areas would be subject to the requirement of the Novato Municipal Code. Chapter V of the Municipal Code, Development Standards, contains several requirements and restrictions related to floodplain development, including siting restrictions for new structures and engineering design requirements for new development in floodplains. Encroachments, including fill, new construction, substantial improvements, and other development would be prohibited in floodways unless certification by a registered professional engineer or architect is provided demonstrating that encroachments would not result in any increase in flood levels during the occurrence of the base flood discharge.

In addition to compliance with the mandatory California Building Code and the Novato Municipal Code requirements, implementation of General Plan 2035 goals and policies would further reduce the risk of loss, injury, or death from flooding. General Plan Policy SH 2, Flood Hazards, and its associated implementation actions would help to ensure proper flood zone protection and management, and would minimize the risk of loss, injury, or death from flooding. Development in the four focus areas and Industrial Parks MPA would also adhere to relevant regulations and policies that would reduce the risk of flooding. Implementation of this goal and related policies, in addition to compliance with Chapter V of the Novato Municipal Code, would reduce this potential impact to a less than significant level.

## Mitigation Measures

No mitigation measures are required.

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| **Threshold 9:** | Would the project expose people or structures to a significant risk of loss, injury or death involving flooding, including as a result of the failure of a levee or dam? |

**Impact HWQ-6 IMPLEMENTATION OF THE PROPOSED PROJECT COULD PLACE HOUSING OR STRUCTURES IN AN AREA THAT COULD BE FLOODED DURING THE FAILURE OF A LEVEE OR DAM. COMPLIANCE WITH APPLICABLE REGULATIONS AND IMPLEMENTATION OF THE GOALS AND POLICIES OF GENERAL PLAN 2035 WOULD PROTECT STRUCTURES FROM ADVERSE EFFECTS RELATED TO FLOODING. IMPACTS WOULD BE LESS THAN SIGNIFICANT.**

As described in Section 4.8.1 *Dam Inundation*, the City of Novato is within the dam inundation area for the Novato Creek Dam, also known as the Stafford Dam. As shown on Figure 4.8-3, failure of this dam would result in flooding in the City of Novato from Stafford Lake to just west of Highway 37 and the Bel Marin Keys (MCFCWD 2017). Therefore, flooding from dam failure would occur in the Downtown, Northwest Quadrant Neighborhood, North Redwood Boulevard, and Industrial Parks MPA area. The North, North Redwood Boulevard corridor is not at risk from flooding as a result of dam failure. In addition, in the event of a failure of the Hamilton Levee developed parcels in the southeastern portion of the City could be threatened with immediate flooding from levee failure. Implementation of the proposed project would not increase the risk of inundation following dam failure compared to existing conditions. Compliance with the California Building Code would ensure that projects would incorporate adequate flood protection measures, such as drainage facilities, protective walls, suitable fills, or elevated floors.

In addition to compliance with the mandatory California Building Code, implementation of General Plan 2035 goals and policies would further reduce the risk of loss, injury, or death from flooding as a result of dam or levee failure. General Plan Program SH 2m, Dam and Levee Safety, would ensure that design and location of dams and levees is in accordance with all applicable design standards. In addition, as part of the program the city would review complete an inventory of levees and shorelines. This policy would help ensure proper flood protection and management, and would minimize the risk of loss, injury, or death from flooding throughout the Plan Area, including the Industrial Parks MPA area. Implementation of this goal and related policies, in addition to compliance with the California Building Code to incorporate flood protection measures, would reduce this potential impact to a less than significant level.

## Mitigation Measures

No mitigation measures are required.

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| **Threshold 10:** | Would the project expose people or structures to significant risk or loss, injury or death involving inundation by seiche, tsunami, or mudflow? |

**Impact HWQ-7 IMPLEMENTATION OF THE PROPOSED PROJECT COULD EXPOSE PEOPLE OR STRUCTURES TO A SIGNIFICANT RISK OF LOSS, INJURY, OR DEATH INVOLVING A MUDFLOW. COMPLIANCE WITH APPLICABLE REGULATIONS AND IMPLEMENTATION OF THE GOALS AND POLICIES INCLUDED IN GENERAL PLAN 2035 WOULD MINIMIZE THE POTENTIAL FOR ADVERSE EFFECTS RELATED TO MUDFLOW AND WOULD REDUCE THIS POTENTIAL IMPACT TO A LESS-THAN-SIGNIFICANT LEVEL.**

Tsunamis and seiches have the potential to occur but according to Novato's Hazard Mitigation Plan are an insignificant risk in Novato (Novato 2011). The City of Novato is within a tsunami inundation area along the easternmost edges of Novato and along Novato Creek just north of the Bel Marin Keys, as shown in Figure 4.8-5 (CGS 2009). The four focus area and Industrial Parks MPA area are not within an area that is at risk from tsunami inundation as shown in Figure 4.8-5. Although an earthquake on the Hayward and Rodgers Creek fault complex, which runs beneath San Pablo Bay, could create a tsunami, there is a low potential for a tsunami to affect Novato because the San Pablo Bay is a relatively small body of water compared to the Pacific Ocean and the amount of water that would be displaced by earth movement along the Hayward and Rogers Creek fault complex likely would not affect developed areas of the City. The Plan Area is located approximately one mile east of Stafford Lake. Although a seiche could form on Stafford Lake during a seismic event, there would be no risk of inundation from seiche in the City due to the relatively small size of Stafford Lake and the distance between the lake and the Plan Area. Although a seismic event could result in both a seiche on the lake and the failure of Stafford Dam, those two potential impacts are considered separately. Seiche is not a typical cause of dam failure in and of itself. The potential impacts of dam failure are discussed above under Impact HWQ-6.

Mudflows are not considered a significant threat, given the relative lack of steep grades in developed portions of the City and the requirements of the California Building Code and the City's Hillside and Ridgeline Protection Ordinance (Division 19.26). Compliance with existing laws and regulations including the California Building Code would reduce any potential for loss, injury, or death from mudflow by requiring that foundations and structures are built to withstand geotechnical hazards such as landslide and mudflow. Novato Municipal Code Section 19.26.030 requires a constraints analysis be prepared and submitted with a Design Review application for undeveloped hillsides in compliance with Section 19.40.040 B, and must be accompanied by a geotechnical report, which would identify and propose mitigation measures for any soils or geological conditions that may affect site stability or structural integrity. Therefore, projects proposed on any undeveloped hillside site would be required to prepare a geotechnical report, and would include project-level mitigation for potential adverse effects related to mudflows. The four focus areas and Industrial Parks MPA area are not near hillside and therefore are not at risk from mudflows.

In addition to compliance with mandatory California Building Code requirements and implementation of the Novato Municipal Code, implementation of General Plan 2035 goals and policies further reduced the risk of loss, injury, or death from mudflow, tsunami, or seiche. Implementation of General Plan 2035 Policy CC 3, Hillsides, would protect Novato's hillsides and ridgelines from erosion and slope failure. Implementation of General Plan Policy ES 7, Bayland Area Protection, and Policy ES 8, Tidal Areas, would discourage development in coastal areas and reduce the potential impact of inundation by tsunami in the City. Adherence with these goals and policies and compliance with applicable laws and regulations would reduce the potential impact from tsunami, seiche, or mudflow to a less-than-significant level.

## Mitigation Measures

No mitigation measures are required.

## c. Cumulative Impacts

Cumulative development in the County of Marin surrounding Novato in combination with the proposed project would gradually increase population and therefore gradually increase the potential for impacts to hydrology and water quality, including increased stormwater runoff, erosion, pollutant discharge to waterbodies, and flooding, and decreased groundwater infiltration capacity.

Cumulative development would increase erosion and sedimentation resulting from grading and construction, as well as changes in drainage patterns which could degrade surface and ground water quality. In addition, new development would increase the generation of urban pollutants that may adversely affect water quality in the long term. As with the proposed project, individual construction projects within the cumulative impact area would be required to comply with applicable water quality regulations, as discussed above. Compliance with these existing requirements would reduce project-level impacts throughout the cumulative impact area; as such, cumulative impacts related to water quality would be less than significant, and the proposed project's contribution to this impact would not be cumulatively considerable. The total amount of impervious surface area associated with the proposed project is estimated to be less than one percent of the total recharge area for the Novato Valley Basin, the groundwater basin that underlies the City. Implementation of the proposed project would not substantially interfere with groundwater recharge. Cumulative development in the Novato Valley Basin could increase the amount of impervious surface, but much of that development would be subject to review under CEQA and would be required to comply with existing policies and regulations to minimize runoff and maximize infiltration. Future cumulative development in the area is not expected to result in an increase in impervious surfaces such that there would be a lowering of local groundwater table levels, and regardless the proposed project's contribution to any potential groundwater impacts would be less than cumulatively considerable.

Compliance with the SWRCB Phase II General Permit, the Novato Municipal Code, and General Plan 2035 policies, as well as other laws and regulations mentioned above, would ensure that project-specific impacts associated with hydrology and water quality would be less than significant. Potential impacts associated with hydrology and water quality would not be cumulatively considerable, and cumulative impacts related to hydrology and water quality would be less than significant.

# 4.9 Land Use and Planning

This section addresses the City's land use characteristics, including the overall land use pattern as well as a more detailed analysis by major land use type, and analyzes existing plans and focus areas with development potential in order to determine the land use and planning effects of the proposed project. The area of analysis is the Plan Area as described in Section 2, *Project Description*.

## 4.9.1 Setting

### a. Current Land Use Pattern

Existing land uses that make up the built environment of Novato are shown on Figure 2-1 in the *Existing Conditions Report* (2014a) and are summarized in Table 4.9-1 below. Existing land uses in Novato are predominantly residential in the valley areas west of Highway 101 and in neighborhoods east of the freeway. Most residential units are single-family, detached homes on lots under one acre in size, and are located throughout the City with the exception of the open space areas along the City boundaries. In the last decade, the re-use of the Hamilton Army Airfield added over 2,100 new homes to Novato. Multi-family homes are largely clustered along South Novato Boulevard, Atherton Avenue, Canyon Road, and along Vallejo Avenue near downtown.

Mixed use parcels combine more than one type of land use, usually in the same building. Novato has a limited amount of mixed uses within the incorporated city, primarily located Downtown.

General commercial uses are service establishments such as medical facilities, banks and parking facilities. The significant areas of General Commercial in Novato are primarily located along Olive Avenue in the North Redwood Corridor and Atherton Avenue, along Redwood Boulevard Downtown and Ignacio Boulevard near Highway 101. The Vintage Oaks Shopping Center, located east of the freeway and south of the Rowland Boulevard interchange, has been serving the region since 1991.

Retail uses in Novato include stores, restaurants, and personal services. Theses retail uses are concentrated Downtown and along the Highway 101 corridor, particularly south of Rowland Boulevard where the Rowland and Vintage Oaks shopping centers are located.

Offices are located along the freeway, in and around Downtown, near the Novato Community Hospital, along Novato, South Novato and Redwood Boulevards, and within the Industrial Parks MPA Area. There is a concentration of offices in the northern portion of the city, where the Buck Center for Aging and the Fireman's Fund Insurance Company headquarters are located, Downtown and along the Highway 101 corridor.

Industrial uses are manufacturing and productive uses, as well as warehouses. Industrial uses in Novato are primarily concentrated along Redwood Boulevard where the Birkenstock manufacturing plant is located, along the Highway 101 corridor. Industrial uses are also concentrated along Vallejo Avenue east of Redwood Boulevard. Industrial parks are located in the Industrial Parks MPA east of US 101 in the Bel Marin Keys area of southern Novato.

Public/Quasi-Public uses include city parks, public schools, civic services, such as the library and wastewater treatment facilities, and other uses such as an electrical sub-station. In Novato, the electric facility at the southeast corner of Highway 101 and Highway 37 is one of the largest Public/Quasi-Public uses in Novato, as well as the Valley Memorial Park cemetery in the northeast portion of the city. Other major parcels of Public/Quasi-Public land are located in the southwest along Ignacio Boulevard, where the College of Marin Indian Valley Campus is located.

A network of open space surrounds the City. The majority of open space is owned and operated by the Marin County Open Space District. The majority of open space is located in the northern part of the city, surrounding Mount Burdell and the area north of Atherton Avenue, as well as the Loma Verde Open Space Preserve located west of Highway 101 in southern Novato. City parks are located throughout the City. Agricultural activities, primarily crop production or grazing, continue primarily outside the City limits.

**Table 4.9-1 Existing Land Use**

| Land Use | Acres | Percent of Total |
|---|---|---|
| Single-Family Residential | 5,693 | 24.9% |
| Multi-Family Residential | 394 | 1.7% |
| Mixed Use | 30 | 0.1% |
| General Commercial | 436 | 1.9% |
| Retail | 155 | 0.7% |
| Office | 284 | 1.2% |
| Industrial | 252 | 1.1% |
| Agriculture | 2,162 | 9.5% |
| Open Space and Parks | 5,694 | 25% |
| Vacant | 2,282 | 10% |
| Public/Quasi-Public | 5,418 | 23.7% |
| Unknown | 22 | 0.1% |
| **Total** | **22,823** | **100.0%** |

Source: City of Novato 2014a

## b. Existing Plans and Studies

### 1996 City of Novato General Plan

The current City of Novato General Plan, shown on Figure 2-5 of Section 2, *Project Description*, was adopted by the Novato City Council on March 8, 1996 by Resolution No. 21-96. Several amendments have been approved since the General Plan was originally adopted. These changes have been incorporated into the maps and text of the General Plan. Some of the key goals and objectives related to land use are summarized below.

The following 13 goals form the foundation of what is intended to be achieved by the 1996 Novato General Plan.

1. Preserve and improve the quality of life in Novato. Conserve and where appropriate restore the natural environment and strive for high quality in the built environment that complements the natural environment.
2. Retain and promote the small town character of Novato including preservation of the historic features and landmarks.

3. Keep Novato relatively compact in physical size by establishing firm urban limit lines. Provide areas where land uses, densities and intensities create a gradual transition from the developed suburban area to the surrounding rural area. Coordinate with the County to maintain rural land uses within the Novato Sphere of Influence.
4. Maintain and revitalize downtown Novato as the heart of the community.
5. Preserve, protect and enhance the natural setting throughout the community, including creeks, hillsides, ridgelines, woodlands, wildlife, native plants, wetlands and open space.
6. Preserve bayfront lands and diked wetlands for agriculture, resource restoration, conservation and recreation.
7. Increase job opportunities and income of residents by encouraging a diversified local economy. Foster the economic vitality of Novato businesses, the City of Novato and other local governmental agencies by encouraging a healthy economy which provides for diversity of economic enterprises.
8. Provide for a variety of housing opportunities through new construction and maintenance of existing housing for an economically and socially diverse population, while preserving the character of the community. Low and moderate income housing of all types (including mobile homes, mobile home and recreational vehicle parks) will be given special consideration.
9. Coordinate transportation, economic and land use planning to help provide effective transit services which reduce dependence on the single-occupant automobile.
10. Encourage local job opportunities to avoid the need to commute out of Novato for employment.
11. Manage growth by requiring the coordination of development with adequate infrastructure, public facilities, public services and promoting conservation, reuse, and recycling strategies while meeting the needs of the community with the limited land available for development.
12. Provide and maintain greater recreational, educational, including the Indian Valley Campus of Marin Community College, and cultural opportunities for all segments of the community. Pursue all efforts with community and neighborhood organizations, nonprofit organizations, for profit organizations, and public agencies to provide care and services, including medical, counseling, recreational, educational, cultural, shelter, and housing opportunities to meet the needs of Novato's citizens.
13. Protect the integrity of residential neighborhoods from conversion and/or intrusion of incompatible land uses. Create transition buffers separating incompatible land uses.

## 1998 Novato Downtown Specific Plan

The Novato Downtown Specific Plan was adopted in July 1998 by the Novato City Council as part of the Novato General Plan to guide redevelopment and infrastructure upgrades in the downtown area. The Downtown Novato Specific Plan has been amended four times since 1998 (i.e., August 1999, March 2001, November 2013, and October 2017) (City of Novato 2015). The Downtown Specific Plan contains objectives, strategies, and guidelines to make Downtown more exciting and convenient for residents and visitors, to support existing and potential new businesses, and to strengthen Novato's cultural and community life. The specific plan area is bordered by the Northwestern Pacific Railroad on the east, DeLong Avenue on the south including vacant parcels that wrap along the eastside of Redwood Boulevard, parks, school district building and Downtown Novato Center on the west, at Seventh Street; and mostly vacant land beyond Olive Avenue to the north.

### *Land Use Goals*

- Maintain City Hall Downtown
- Establish a Downtown branch post office
- Locate appropriate recreational and park facilities Downtown
- Locate a museum in Downtown
- Locate a small hotel in Downtown
- Maintain a diversity of businesses, services, and multi-ethnic restaurants in Downtown
- Improve and maintain retail at street level, with potential offices and/or residences above the street

## 2005 Downtown Novato Design Guidelines

The Downtown Novato Design Guidelines were not formally adopted by the City Council, largely due to the cost of preparing an environmental analysis, pursuant to CEQA; however, staff continues to use the Guidelines to help applicants understand the design approach and philosophy contemplated in the Specific Plan area (City of Novato 2015). The Guidelines are intended to guide site and architecture design for new buildings, additions and renovations of existing buildings to optimize the look and function of each building and its aesthetic and functional contribution to the greater Downtown area. The application of these Guidelines is intended to clarify the City's design objectives and expectations for development and redevelopment within the Downtown. The goal is to optimize the look and function of each building and its aesthetic and functional contribution to the greater Downtown area.

### *General Design Objectives*

1. Provide the business and/or development community with a clear and comprehensive set of architectural design criteria applicable to the Downtown.
2. Create a very attractive and vibrant downtown through the physical design of structures and space, and maximize pedestrian access to and use of commercial uses and public spaces.
3. Facilitate pedestrian friendly spaces through appropriate site and architectural design including measures to mitigate negative impacts associated with automobile circulation, loading/unloading and parking.
4. Preserve and invigorate structures that are distinctive due to their age, historical or cultural importance or architectural character.
5. Ensure that all new buildings, additions and renovations incorporate outstanding architectural design and detailing that includes high quality finish materials.

## 1980 Novato Industrial Park Precise Development and Master Plan, Amended 1981, 1983, and 2013

The purpose of the Novato Industrial Park Precise Development and Master Plan is to set forth a common set of development objectives and parameters for the future improvements of the property included in and encompassed by: 1) Ignacio Industrial Park Units 1, 2, &3; Bel Marin Commerce Park Units I & II; and the portion of Hamilton Industrial Park within the City of Novato. It designates the affected areas for industrial park development and use. The Precise Development Plan includes land use regulations, including permitted and non-permitted uses, property development standards, performance standards, and an approved plant list.

The City has adopted Master Plans for two parks within the Novato Industrial Park Master Plan Area, including:

- **Hamilton Master Plan.** This plan, adopted in June 22, 1993, envisions a planned mixed-use community of approximately 414 acres of office, mixed-use retail/office, residential and park development, linked with automobile, pedestrian and bicycle corridors, and sensitive to the preservation of prime natural resources and open space areas. The Hamilton Master Plan report is intended to be the initial step in the continuing process which will lead to specific criteria and agreements to guide and control development of Hamilton through all phases of design and construction (City of Novato 1993).
- **Bel Marin Keys Industrial Parks Master Plan.** This plan was approved by the City in 1978 to plan development of 2.7million square feet of office, service commercial, industrial and manufacturing uses. Since 1997, biotech firms such as BioMarin, Ultragenyx, Sutter Instruments and Karuna Corporation, have occupied the park (City of Novato 1978).

## Proposed City of Novato General Plan 2035

General Plan 2035, would update and supersede the 1996 General Plan. It contains a description of twenty different land use designations proposed for the City of Novato. The descriptions include building density and intensity standards to regulate development within each land use designation. Two themes emerge as guiding principles for General Plan 2035: Healthy Eating and Active Living; and Sustainability. These themes provide a foundation for the goals, policies, and programs of the General Plan update.

## Proposed General Plan 2035, Great Places Chapter Goals

The Great Places Chapter presents a framework for governing future decisions about appropriate land use and desirable development patterns to maintain and enhance the character of Novato. This framework aims to effectively manage growth and provide needed housing, jobs and services while encouraging the use of quality design and infill strategies for new development. This Chapter includes the following sections: Community Character, Demographics and Growth Projections, Land Use, Growth Management and Development Projections, and Housing. Section 2.7, Great Places Chapter, identifies goals, policies, and programs applicable to each section. The following Chapter goals are applicable to land use and planning:

- **Land Use Goal 1:** Manage Growth and Maintain Community Character.
- **Community Character Goal 1:** Retain our Connections to our Past
- **Community Character Goal 2:** Promote High-Quality and Sustainable Development

### *Focus Areas*

General Plan 2035 includes four focus areas as shown in Figure 2-1 in Section 2, *Project Description*: the Downtown; the North Redwood Boulevard Corridor; the North, North Redwood Corridor; and the Northwest Quadrant Neighborhood. The General Plan describes the vision for each of these focus areas:

- **Downtown.** Downtown Novato is the commercial core of the community. The area is maintained as a pedestrian-oriented shopping and dining destination. General Plan 2035 vision for the Downtown is to maintain the area as the civic and economic center of the community, blending historic buildings and new construction, and adding housing in mixed-use developments.

- **North Redwood Boulevard Corridor.** The North Redwood Boulevard Corridor provides an opportunity for the City to address an identified retail sales leakage pattern and address community shopping needs by creating a vibrant retail area with a unique sense of place. General Plan 2035 envisions the North Redwood Corridor as a place that would also feature inviting gathering places, restaurants, and entertainment uses.
- **North, North Redwood Boulevard Corridor.** The North, North Redwood Boulevard Corridor area contains predominately non-residential development set back from the street with landscaped buffers. Under General Plan 2035 the corridor would be developed with high-quality office and research and development uses, as well as supporting uses such as local-serving retail and recreational uses.
- **Northwest Quadrant Neighborhood.** In the Northwest Quadrant Neighborhood lots are usually small, and homes are in close proximity to one another. The General Plan 2035 promotes reinvestment and revitalization of this district through development of carefully designed housing through adoption of a neighborhood-specific form-based zoning code that would ensure compatibility with the scale and diversity of residences.

In addition to the four focus areas, expanded development could occur in the Novato Industrial Park area, specifically Hamilton Industrial and Ignacio Industrial Parks, through the proposed Industrial Parks MPA. The Industrial Parks MPA is proposed to be modified to allow an increased floor area ratio and building height limit for designated "Life Science Campus" development for the biotechnology industry, subject to a cap of 500,000 square feet.

### *Urban Growth Boundary*

The City's UGB was adopted by the voters in 1997 to limit urban sprawl by curtailing development outside the City boundaries and focusing new residential, commercial and industrial growth in areas already served by urban services. Development outside the UGB is limited to nonurban uses such as agricultural, conservation, parkland, and open spaces. In the November 2017 election, Novato citizens voted to amend and extend the term of the UGB to the end of 2042.

### *Sphere of Influence*

The SOI is a boundary defining the probable future physical boundaries and service areas of the City as determined by Marin Local Agency Formation Commission (LAFCO). Marin LAFCO and the County of Marin refer potential development outside of the UGB, but within the City's SOI. There are 1,188 acres of unincorporated land within Novato's SOI. The County has designated approximately 56 percent of this land for very low and low density residential use and 27 percent for open space and conservation. As described in Section 2, *Project Description*, and shown on Figure 2-3, the City's SOI, and thus Plan Area, extends a few areas past the UGB boundaries into nearby unincorporated areas.

## Implementing Ordinances

It is the City's intent to adopt a number of the implementing zoning provisions and modify Novato's zoning map to be consistent with the policies and programs contemplated in General Plan 2035 as part of the proposed project. There are 15 General Plan implementing ordinances as shown in Table 2-1 in Section 2, *Project Description*.

## c. Regulatory Setting

### State

#### *General Plan Law (California Government Code Section 65300)*

California Government Code Section 65300 regulates the substantive and topical requirements of general plans. State law requires each city and county to adopt a general plan "for the physical development of the county or city, and any land outside its boundaries which bears relation to its planning." The California Supreme Court has called the general plan the "constitution for future development." The general plan expresses the community's development goals and embodies public policy relative to the distribution of future land uses, both public and private.

#### *California Government Code Section 65301*

Section 65301 of the California Government Code requires a general plan to address the geographic territory of the local jurisdiction and any other territory outside its boundaries that bears relation to the planning of the jurisdiction. The jurisdiction may exercise their own judgment in determining what areas outside of its boundaries to include in the Planning Area. The State of California General Plan Guidelines state that the Planning Area for a city should include (at minimum) all land within the city limits and all land within the city's SOI.

#### *California Government Code Section 65860*

In counties, general law cities, and charter cities with a population of more than two million, zoning provisions must be consistent with the general plan. Charter cities with a population of under two million are exempt from the zoning consistency requirement unless their charters provide otherwise. The City of Novato is a general law city and is, therefore, required to have zoning consistency with its General Plan.

#### *Cortese Knox Hertzberg Local Government Reorganization Act of 2000 (CKH Act)*

The CKH Act established procedures for local agency changes of organization, including city incorporation, annexation to a city or special district, and consolidation of cities or special districts (Section 56000, et seq.). Under the CKH Act, LAFCOs are granted power to act on local agency boundary changes and to adopt SOIs for local agencies. The law also states that in order to update a SOI, LAFCOs are required to first conduct a review of the municipal services provided by the local agency. The CKH Act also requires LAFCOs to update the SOI for every city and special district every five years. Every SOI update must be accompanied by an update of the municipal services review. Marin County LAFCO completed a municipal service review for Novato in September 2007. Government Code Section 56425(f) requires the Commission to review and update, as necessary, the adopted SOI not less than once every five years. The Marin County LAFCO's adopted policies, procedures, and guidelines include provisions for compliance with Government Code Section 56425 (Marin LAFCO 2018).

### Regional

#### *Plan Bay Area 2040*

*Plan Bay Area 2040*, adopted in July 2017, is a long-range, integrated transportation and land-use plan for the nine-county San Francisco Bay Area. The Plan's combined Sustainable Communities

Strategy and Regional Transportation Plan (also referred to as the RTP/SCS) was jointly adopted by the Association of Bay Area Governments (ABAG) and Metropolitan Transportation Commission (MTC) in July 2017. The Plan describes where and how the region can accommodate the projected 820,000 new households and 1.3 million new jobs between 2017 and 2040 and details the regional transportation investment strategy over the next 24 years. Growth in the plan area is promoted in Planned Development Areas (PDAs) and limited in Priority Conservation Areas (PCAs) to promote preservation of key resources. The Plan contains seven goals to address major challenges in the region and has established 13 performance targets to assess the Plan’s effectiveness in meeting its goals. ABAG and MTC developed land use and transportation scenarios in the Plan that distribute the total amount of anticipated growth across the region and measure how well each scenario measures against the Plan goals. Based upon performance, the preferred scenario provides a regional pattern of household and employment growth and a corresponding transportation investment strategy (ABAG 2017).

### *Marin County Airport, Gnoss Field Airport Land Use Plan*

The California State Aeronautics Act requires Marin County to protect the development and operation of Gnoss Field through compatible zoning and land use around the airport. The Board of Supervisors, through the Airport Land Use Commission, adopted the Airport Land Use Plan in 1991. The policies adopted protect the airspace around the airport, improve aviation safety, address aviation noise compatibility, and ensure compatibility of airport environs land use. The document sets forth policies which the Marin county Airport Land Use Commission will use to evaluate land use plans and proposed development in the vicinity of Gnoss Field. The Airport Land Use Commission review is required to assure that future actions involving land use decisions in the Airport environs take into account compatibility with the Airport and aviation activities (Marin County 1991; 2018).

## Local

### *Novato Zoning Ordinance*

Zoning is the instrument that implements the land use designations of the General Plan. In addition to establishing permitted uses, zoning may also establish development standards relating to issues such as intensity, setbacks, height, and parking. Projects submitted to the City for review and approval are generally evaluated for consistency with the zoning designations.

The City of Novato’s Zoning Ordinance carries out the policies of the Novato General Plan by classifying and regulating the uses of land and structures within the City, consistent with the General Plan. The Zoning Code describes various types of zoning districts and land use classifications, land use regulations, development standards, and environmental performance standards. The Zoning Ordinance applies to all land uses, subdivisions, and development within the City of Novato. The purpose of the Zoning Ordinance is to protect and to promote the public health, safety, and general welfare of residents, and preserve and enhance the aesthetic quality of the City. To fulfill these purposes, it is the intent of the Zoning Ordinance to:

A. Provide standards for the orderly growth and development of the City, and guide and control the use of land to provide a safe, harmonious, attractive, and sustainable community;
B. Implement the uses of land designated by the Novato General Plan and avoid conflicts between land uses;
C. Maintain and protect the value of property;

D. Conserve and protect the open space, scenic beauty, and other natural resources of the City;

E. Protect the character, and social and economic stability of residential, commercial, and industrial areas;

F. Assist in maintaining a high quality of life without causing unduly high public or private costs for development or unduly restricting private enterprise, initiative, or innovation in design; and

G. Provide for appropriate citizen participation in the decisions made in compliance with the Zoning Ordinance (Novato 2012).

The City is divided into 28 zoning districts that fall under five general categories, as follows:

- Agricultural and Resource Districts
  - A – Agricultural
  - OS – Open Space
  - ROS – Restricted Open Space
  - C – Conservation
- Residential Districts
  - RR – Rural Residential
  - RVL– Very Low Density Residential
  - R1 – Low Density Residential
  - R4 – Medium Density Detached Residential
  - R5 – Medium Density Residential
  - R10 – Medium Density Multi-Family Residential
  - R20 – High Density Multi-Family Residential
- Commercial and Industrial Districts
  - BPO – Business and Professional Office
  - CN – Neighborhood Commercial
  - CG – General Commercial
  - CDR – Downtown Core Retail
  - CDB – Downtown Core Business
  - CI – Commercial/Industrial
  - LIO – Light Industrial/Office
- Special Purpose Districts
  - MU –Mixed Use
  - PD – Planned District
  - CF – Community Facilities
  - PL – Parkland
  - REI – Research/Education-Institutional

- Overlay Districts
  - B – Baylands
  - D – Downtown Novato Specific Plan
  - F – Flood Hazard
  - H – Historic
  - AHO – Affordable Housing Opportunity

## 4.9.2 Impact Analysis

### Methodology and Significance Thresholds

The analysis in this section focuses on the compatibility of land uses identified in the proposed project with existing and planned land uses within the Plan Area, as well as consistency with any applicable land use plans, policies, or regulations. The following thresholds of significance are based on Appendix G of the CEQA Guidelines. For purposes of this EIR, implementation of the proposed project may have a significant adverse impact if it would do any of the following:

1 Physically divide an established community
2 Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, and local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect
3 Conflict with any applicable habitat conservation plan or natural community conservation plan

### Project Impacts and Mitigation Measures

| | |
|---|---|
| **Threshold 1:** | Would the project physically divide an established community? |

**Impact LU-1** **IMPLEMENTATION OF THE PROPOSED PROJECT WOULD PROVIDE FOR ORDERLY DEVELOPMENT IN THE CITY OF NOVATO AND WOULD NOT PHYSICALLY DIVIDE AN ESTABLISHED COMMUNITY. IMPACTS WOULD BE LESS THAN SIGNIFICANT.**

The proposed project does not include substantial land use or circulation changes that would physically divide an established community, residential, or otherwise (for example, no major roads or other facilities would be constructed that would physically divide an established community). The goals and policies of the Mobility Chapter would encourage the enhancement of the City's multimodal circulation and incorporate complete streets practices that would enhance connectivity of City's circulation network. Policy MO 7 would require the City to incorporate Complete Streets practices in the planning, design and operation of the City's circulation network, where feasible. Policy MO 8 would require the City, when developing plans for new or retrofitted roadways, to incorporate infrastructure as appropriate that enhances multimodal circulation in addition to auto circulation, such as sidewalks, pedestrian paths, bike lanes, pedestrian refuge islands, accessible curb ramps, transit shelters, and pedestrian-scale lighting. Program MO 8a would require the City to revise the development standards of the Municipal Code to include complete streets principles to aid in the design and assessment of new or retrofitted roadways. Revised design standards shall be drafted in a manner providing flexibility to address a wide range of street and neighborhood contexts. Policy MO 18 would establish and maintain a bicycle network. Policy MO 20a would require all new development to include a sidewalk, path or shoulder on all property street frontages as deemed appropriate by City staff and routinely include projects to close gaps in the pedestrian system on existing streets through the City's Capital Improvement Program.

One of the guiding principles of General Plan 2035 is to encourage and promote sustainable development. Two of the identified strategies to create a sustainable community are focusing new residential and commercial development on infill sites, close to transit and within walking and biking distance of shopping, recreation, and jobs; and protecting open space and wildlife habitat and expanding Novato's tree canopy. This approach helps create more efficient and cost-effective infrastructure, maximizes the use of underutilized parcels within the City, and minimizes the loss of open space and agricultural lands. General Plan 2035 would promote infill strategies for new development, and encourage clustering of development to achieve environmental goals and attain densities within the range of land use designations. General Plan 2035 would direct new growth with the designation of four focus areas that would direct the built environment over time to help Novato achieve its General Plan vision. In addition, General Plan 2035 includes a specific vision and policies for each of the four focus areas: North Redwood Boulevard Corridor; North, North Redwood Boulevard Corridor; Northwest Quadrant Neighborhood; and Downtown. The vision and policies of these focus areas encourage pedestrian-oriented development with active street frontages, convenient pedestrian bicycle connections to the Downtown and the SMART stations, use of the new SMART railway station with site design, on and off-site bicycle and pedestrian access, median improvements with wider sidewalks and improved bicycle lanes, and circulation improvements to address the City's level-of-service standards concurrently with new development. These improvements serve to connect, rather than divide, the Downtown with the other three focus areas and with the community of Novato. Finally, by developing gateways, the City would establish a clear entryway and exit to the community and exhibit design concepts that convey an image consistent with the City's identity.

The Great Places Chapter and the A City That Works Chapter include policies that encourage managed growth in focused areas of the city, promote infill development near transit, and provide for a connected transportation network for vehicles and pedestrians. Policy CC 5 would encourage clustering of development on sites with environmental constraints and ensure that clustered development is compatible with surrounding neighborhoods. Policy CC 6 would focus new residential and commercial growth at appropriate infill sites near transit and retail services. Policy MO 11 would encourage higher density/intensity land uses such as offices, mixed use, multiple family residences, public services and commercial retail centers near transit routes and facilities. All of the policies described above would provide for orderly development in the City, and would not physically divide the City of Novato.

General Plan 2035 policies would maintain existing communities within the City of Novato and would ensure that with implementation of the proposed project, established communities would not be divided. Specifically, LU Goal 1 would manage growth and maintain community character by implementing the land use map and growth management objectives to ensure orderly growth within the City that would not divide communities. Additionally, the Community Character policies within the Great Places Chapter encourage clustering development sites and focus new development at infill sites.

Implementation of the proposed project would require revisions to the Zoning Ordinance and Zoning Map to ensure consistency with General Plan 2035. Specifically, revisions to the Zoning Map would need to be consistent with General Plan 2035, incorporating revisions to the land use categories and other recommended design and development standards. General Plan 2035 would apply the same land use designations as the City's 1996 General Plan, however the description and standards for various land use designations would be updated to reflect the vision of General Plan 2035. For example, in addition to allowable densities, maximum Floor Area Ratios (FARs) have been established for residential uses to be consistent with the General Plan's updated goals and policies.

While the City of Novato controls land use decisions within the Plan Area, Marin County makes the land use and development decisions for areas outside of the UGB. Marin County and Marin LAFCO refer potential development outside the UGB, but within the City's SOI to the City for review and comment. General Plan 2035 goals and policies related to maintaining the UGB, promote orderly, managed growth in the City. In order to achieve the growth management policies established in General Plan 2035, the City plans to coordinate closely with other agencies, particularly Marin County and Marin LAFCO per Policy LU 29. Policy LU 29 includes measures that the City should consider amendments to policies of the UGB to better define permissible health and safety based exceptions and to encourage better coordination between the City, Marin LAFCO and the Novato Sanitary District to support the implementation of the UGB. Policy LU 30 states that annexations should be consistent with guidelines that require proposed annexations to be served by existing City facilities and by facilities provided by other agencies, or by environmentally and economically feasible extensions to these facilities; be contiguous to existing developed areas (i.e., leapfrog development will not be supported); and should be consistent with the proper land use designation and meet all other requirements of the General Plan.

General Plan 2035 includes many growth management strategies that would: 1) direct new growth within the City's established UGB; 2) direct new growth to Focus Areas to ensure growth is orderly and consistent with the availability of community services and facilities; 3) encourage new development at infill sites to minimize the need for expansion of the UGB; and 4) support intergovernmental cooperation to achieve the City's growth management goals and policies. In addition, General Plan 2035 supports an UGB. Policy LU 29 establishes the UGB to improve the City's ability to provide municipal services and discourage urban sprawl and the provision of urban services to property outside the City limits. Additionally, the Community Character policies within the Great Places Chapter encourage clustering development sites and focus new development at infill sites. Policy CC 5 would encourage clustering of development on sites with environmental constraints to achieve environmental goals and attain densities within the range of the land use designation. Policy CC 6 would focus new residential and commercial growth at appropriate infill sites near transit and retail services to minimize the need for expansion of the UGB.

Overall, the proposed project would promote orderly development in the Plan Area and UGB by encouraging growth in designated focused areas and at infill sites near transit and other amenities, and promote the enhancement of the City's multimodal circulation by incorporating Complete Streets practices in planning, design and operation of the City's circulation network (Policy MO 7). Therefore, the proposed project would not physically divide the City of Novato. Impacts would be less than significant.

## Mitigation Measure

No mitigation measures are required.

| **Threshold 2:** | Would the project conflict with any applicable land use plan, policy, or regulation of any agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect? |
|---|---|

**Impact LU-2 IMPLEMENTATION OF THE PROPOSED PROJECT WOULD BE GENERALLY CONSISTENT WITH APPLICABLE REGIONAL LAND USE PLANS, POLICIES, OR REGULATIONS SUCH AS ABAG/MTC'S *PLAN BAY AREA 2040*. IMPACTS WOULD BE LESS THAN SIGNIFICANT.**

Several regionally and locally adopted land use plans, policies, and regulations apply to the proposed project. These include *Plan Bay Area 2040* (ABAG 2017) and BAAQMD's 2017 Clean Air Plan (BAAQMD 2017). Consistency of the proposed project with the 2017 Clean Air Plan is discussed under Impact AQ-2 of Section 4.2, *Air Quality*.

*Plan Bay Area 2040* is a long-range land use and transportation plan for the San Francisco Bay Area region. The plan contains ten goals with performance targets to meet these goals that seek to promote healthy and safe communities by reducing impacts from air pollution, protecting open space and agriculture, and increasing active transportation. Table 4.9-2 includes the seven Plan Bay Area goals and their related performance targets as well as whether General Plan 2035 would be consistent with the goal.

### Table 4.9-2 Project Consistency with Plan Bay Area 2040 Goals

| Plan Bay Area Goals | General Plan 2035 Consistency |
|---|---|
| **Goal 1: Climate Protection** | |
| **Target.** Reduce per-capita $CO_2$ emissions from cars and light-duty trucks by 15 percent. | **Consistent.** The *Environmental Stewardship* and *A City That Works* Chapter includes goals and policies within General Plan 2035 support climate protection. The *Environmental Stewardship* Chapter, Goal ES 5, is to engage in environmental stewardship that balances the needs of the environment, the economy and a diverse society to utilize our natural resources in a sustainable way. Under Goal ES 5, Policy ES 24 would require the City to establish reduction targets for GHG emissions and actively implement local strategies to reduce the effects of climate change. Implementation Programs within this Chapter set specific targets to reduce GHG emissions by 2020 and again in 2035. Implementation Programs ES 24a through ES 24c would require the implementation of cost-effective strategies to achieve GHG emissions consistent with the City's goal of a 15% reduction below 2005 emission levels by 2020, and a 40% reduction in 2005 emissions by 2035; implementation of the Emission Reduction Measures contained in Appendix E of General Plan 2035 to achieve projected reductions in GHG emissions as feasible; and periodically update the GHG emission inventory for both community and City emissions and quantify success in meeting reduction measures to monitor achievement of emission reduction targets, respectively. Policy ES 25c would require the City to consider the replacement of existing City fleet vehicles with reduced emission vehicles to assist with achieving the City's GHG reduction goals. *A City That Works* Chapter, Goal MO 1, is to provide a safe and efficient circulation system that accommodates all users and maintains an acceptable level of service. Policy MO 1e would optimize traffic signal timing and demand coordination to improve traffic flow and reduce fuel consumption, pollution and GHG emissions. Therefore the City's General Plan 2035 would be consistent with this goal. |
| **Goal 2: Adequate Housing** | |
| **Target.** House 100 percent of the region's projected growth by income level without | **Consistent.** As described in the *Great Places* Chapter, Section 2.6, Housing, housing element law requires local governments to plan adequately to meet their existing and projected housing needs, including their fair share of the "regional housing need." |

| Plan Bay Area Goals | General Plan 2035 Consistency |
|---|---|
| displacing current low-income residents and with no increase in commuters over the Plan baseline year. | ABAG develops a Regional Housing Needs Plan, allocating the region's share of the statewide need to the cities and counties within the region. That regional share is then classified according to four income levels; very low income, low income, moderate income, and above moderate income. Local governments are not required to build or finance housing, but they are required to ensure there are adequate vacant and underutilized sites, appropriately zoned, to meet the projected housing need. The City adopted its most recent Housing Element on November 18, 2014, pursuant to the state-mandated timeline for housing element adoption for the 2015-2023 planning period. The State Department of Housing and Community Development (HCD) certified the Housing Element on January 22, 2015 (refer to the Housing Element, Appendix C of the 2035 General Plan). Furthermore, the *Great Places Chapter, Housing Section 2.6,* of General Plan 2035 includes provisions for providing adequate housing. Land Use Policy LU 6 would promote the development of housing to meet the needs of an aging population, including group homes and residential care facilities. Therefore General Plan 2035 would be consistent with this goal. |
| **Goal 3: Healthy and Safe Communities** | |
| **Target.** Reduce adverse health impacts associated with air quality, road safety, and physical inactivity by 10%. | **Consistent.** The *Environmental Stewardship* Chapter includes goals and policies to support air quality, road safety, and promote physical activity. The *Environmental Stewardship* Chapter, Goal ES 2, is to maintain clean, healthful air. *Environmental Stewardship* goals and policies within General Plan 2035 promote the maintenance of clean, healthful air. Policy ES 17a under Goal ES 2 would require the City to cooperate with the BAAQMD in implementing the regional Clean Air Plan. Policy MO 4 under Mobility Goal, Goal MO 1, seeks to reduce impacts of new transportation improvements on open space lands, recreational facilities and neighborhood integrity. When transportation improvements are expected to have negative impacts, seek to reduce them through design changes or mitigation. Review proposed transportation improvements to ensure that adequate measures will be implemented to reduce to the maximum extent feasible any anticipated air quality, noise, visual, or other impacts. Therefore the City's 2035 General Plan would be consistent with the regional goal to reduce health impacts associated with air quality impacts.<br><br>The *Environmental Stewardship* Chapter, Section 6.6, Mobility, Transportation and Mobility Chapter of General Plan 2035 contains policies that address safety and promote active transportation. Goal MO 1 is to provide a safe and efficient circulation system that accommodates all users and maintains acceptable levels of service. Policy MO 1b would result in a list of improvements (Table CW-2) that accommodates future growth consistent with the General Plan, enabling the roadway system to operate safely and efficiently. Prioritize construction of roadway improvements based on consideration of relevant factors including, but not limited to, funding availability, periodic analysis of traffic service levels, the location of new development, and safety considerations. Policy MO 9, Traffic Safety, would improve the safety of the roadway system. Implementation Programs MO 9a and MO 9b would periodically analyze the locations of accidents and set priorities for improvements as part of the City's Capital Improvement Program, and continue to use and update as appropriate the City's Crosswalk Prioritization Criterial to evaluate requests for new crosswalks and related improvements, respectively. Furthermore, Implementation Program Under Policy MO 18, Implementation Program MO 18c would ensure that the bicycle safety programs are continued by the Police Department and the Safe Routes to School Program. Policy MO 20 would promote, provide, and maintain a safe and convenient pedestrian system, including consideration of lighting, sidewalk condition, road surface conditions, roadway crossings, access points, shade landscaping, and roadway crossings. Implementation Program MO 20b would provide pedestrian safety enhancements where appropriate and feasible, such as bulb-outs, separated pedestrian paths, high-visibility signs and markings, pedestrian warning signals, and other amenities in areas with high volumes |

| Plan Bay Area Goals | General Plan 2035 Consistency |
|---|---|
| | of pedestrian traffic or other safety concerns. Policy MO 21 would ensure that the City is collaborating with the school district to identify and prioritize transportation improvements that strengthen pedestrian and bicycle safety for students traveling to and from schools. Implementation Program MO 21a would require the City to assist with the preparation and updating of Safe Routes to school (SR2S) plans for schools that serve the Novato population. Policy MO 22 would create an accessible circulation system that is consistent with guidelines established by the Americans with Disabilities Act (ADA), allowing mobility-impaired users such as the disabled and elderly to safety and effectively travel within and beyond the City. Therefore, General Plan 2035 would be consistent with the regional goal of reducing adverse health impacts associated with road safety.<br>The *Living Well* Chapter supports Healthy Eating/Active Living. Goal LW 2 supports a healthy, active community. Policy LW 9 supports policies, projects, programs, and regulations that improve community health, wellbeing, and physical activity. Implementation Program LW 9a would consider the creation of design recommendations to share with developers to incorporate active living objectives in site planning and building layout. Therefore, General Plan 2035 would be consistent with the regional goal of reducing adverse health impacts associated with physical inactivity. |
| **Goal 4: Open Space and Agricultural Preservation** | |
| **Target.** Direct all non-agricultural development within the urban footprint (existing urban development and UGBs). | **Consistent.** The framework of General Plan 2035 aims to effectively manage growth and provide housing, jobs and services while encouraging the use of quality design and infill strategies for new development; and to contain development and preserve natural lands and agricultural use adjacent to the City through the UGB. Policy LU 29 establishes the Urban Growth Boundary for long term planning purposes. Implementation Program LU 29a states the UGB can only be amended by a vote of the people until December 31, 2042, to improve the City's ability to provide municipal services and discourage urban sprawl and the provision of urban services to property outside the City limits. Policy CC 6: Infill Development would minimize the need for expansion of the UGB, focus new residential and commercial growth at appropriate infill sites near transit and retail services. Furthermore, *Environmental Stewardship* Chapter Policy ES 13 would protect designated open space of Countywide and local significance in the Novato area. Implementation Programs ES 13a and ES 13b would require the City to work with the county, regional, state, and federal agencies and non-profits to fund acquisition and maintenance of open space, and identify open space of local importance and prioritize for acquisition while actively seeking grant opportunities for acquisition. Policy ES 9 would allow agricultural uses in Bayland Areas that do not adversely affect wetlands or sensitive wildlife habitats and do not damage fish habitat. Policy ES 18 encourages the preservation of agriculture. Implementation Program ES 18a would ensure that the City assist public agencies or a non-profit land trust in the acquisition of conservation easements on agricultural lands in the Novato area. Therefore, the City's 2035 General Plan would be consistent with this goal. |
| **Goal 5: Equitable Access** | |
| **Target**. Increase the share of affordable housing in PDAs, Transit Priority Areas (TPA), or high-opportunity areas by 15%.<br>**Target**. Decrease the share of low-income residents' household income consumed by transportation and housing by 10% | **Consistent.** The *Environmental Stewardship* Chapter, Section 6.6, Mobility, Transportation and Mobility Chapter of General Plan 2035 contains policies that would address increasing public transit near existing affordable housing, and focusing new affordable housing at appropriate infill sites near transit services to help decrease transportation costs for low-income residents. Goal MO 1 is to provide a safe and efficient circulation system that accommodates all users and maintains acceptable levels of service. Policy MO 8 requires the enhancement of multimodal infrastructure when developing plans for new or retrofitted roadways; incorporate infrastructure as appropriate that enhances multimodal circulation in addition to auto circulation, such as sidewalks, bike lanes, pedestrian refuge islands, accessible |

| Plan Bay Area Goals | General Plan 2035 Consistency |
|---|---|
| **Target**. Do not increase the share of low- and moderate-income renter households in PDAs, TPAs, or high-opportunity areas that are at risk of displacement. | curb ramps, transit shelters, and pedestrian-scale lighting. Goal 2 is to encourage sustainable mobility systems that reduce dependence on low-occupancy automobiles. Policy MO 11 encourages higher density/intensity land uses such as offices, mixed use, multiple family residences, public services and commercial retail centers near transit routes and facilities to reduce vehicle trips. Goal MO 3 is to support local and regional transit that is efficient, convenient and safe. Policy MO 13 would require the City to provide improved headways, longer service hours, expanded service areas, safe, convenient, and comfortable facilities throughout the City. Implementation Programs MO 13a, MO 13b, and MO 13c would require the City to work with the Marin Transit District to implement and periodically update local transit assessments and improvement plans, request route and schedule changes to regional transit services, and encourage the development of ride sharing services and other new services in Novato by private providers. Within the Great Places Chapter, Community Character Policy CC 6 would minimize the need for expansion of the Urban Growth Boundary, focus new residential and commercial growth at appropriate infill sites near transit and retail services. Policy CC 11 would promote local retail services within comfortable walking and bicycling distance of all residents and employees. Encourage neighborhood retail centers to create comfortable community gathering places. Therefore the City's General Plan 2035 would be consistent with this goal. |
| **Goal 6: Economic Vitality** | |
| **Target.** Increase by 38% the number of jobs in predominantly middle-wage industries.<br>**Target.** Reduce per-capita delay on the Regional Freight Network by 20%.<br>**Target.** Increase by 20% the share of jobs available within 30 minutes by auto or within 45 minutes by transit in congested conditions. | The goals and policies in the *Economic Vitality Chapter* of General Plan 2035 support the development of a thriving business environment with high-paying industries, a vibrant downtown, and a healthy economy. Goal EV 1 is to maintain a vital, diverse, and forward-looking citywide economy. Policy EV1 would encourage seeking, retaining, and promoting businesses that enhance Novato's economic vitality. Implementation Program EV 1a would require the City to continue a business retention and visitation program in partnership with the Chamber of Commerce to help existing businesses thrive in Novato. Implementation Program EV 1b would require the City to identify economic sectors, such as life sciences, "high tech" and others in which the City has competitive advantages and capitalize on these strengths to encourage diversification of the local economy and allow residents to work in the community they live in. Policies within the focus areas would promote innovative employee trip reduction measures. North, North Redwood Corridor Policy LU 33 would promote access by office employees to the SMART station as East Campus Drive is connected to the Rush Creek Landing Road/Redwood Boulevard intersection in conjunction with the redevelopment of Site 7. This policy would also require an employee trip reduction plan as new development is implemented. Policy EV 2 would encourage development of commercial lands primarily for economic activities that contribute to local employment, income, and convenience. The goals and policies of the *Mobility* Chapter of General Plan 2035 support ride sharing, linkages to transit stations, park and rides, and increasing transit linkages to places of employment. Policy MO 12 promotes measures to reduce travel demand. Implementation Program MO 12a and MO 12c would require the City to review and amend as necessary the existing Travel Demand Reduction Ordinance applicable to businesses in new or remodeled commercial development, and facilitate ride sharing programs for employment centers, including City staff, and a citywide car-sharing program, respectively. Implementation Program MO 16b would require the City to coordinate with Marin Transit to ensure that effective transit linkages are in place between SMART stations and the City's primary activity and employment centers. Therefore the City's General Plan 2035 would be consistent with this goal. |

| Plan Bay Area Goals | General Plan 2035 Consistency |
|---|---|
| **Goal 7: Transportation System Effectiveness** | |
| **Target.** Increase non-auto mode share by 10%.<br>**Target.** Reduce per-rider transit delay due to aged infrastructure by 100%.<br>**Target.** Reduce vehicle operating and maintenance costs due to pavement conditions by 100%. | The *Mobility* Chapter of General Plan 2035 promotes an efficient circulation system that encompasses roadways, transit routes, pedestrian paths and sidewalks, and bicycle paths, lanes and routes. The goals and policies of this Element address a safe and efficient circulation system that accommodates all users, encourages a sustainable mobility system that reduces dependence on low-occupancy automobiles, and supports local and regional transit that is efficient, convenient and safe. Policy MO 7 would incorporate Complete Streets practices in the planning, design and operation of the City's circulation network, where feasible, consistent with the other objectives, policies and programs of the General Plan. Policy MO 8 would enhance multimodal infrastructure when developing plans for new or retrofitted roadways, incorporate infrastructure as appropriate that enhances multimodal circulation in addition to auto circulation, such as sidewalks, pedestrian paths, bike lanes, pedestrian refuge islands, accessible curb ramps, transit shelters, and pedestrian-scale lighting. Policy MO 11 would encourage higher density/intensity land use such as offices, mixed uses, multiple family residences, public services, and commercial retail centers near transit routes and facilities to reduce vehicle trips. Policy MO 13 would require the City to work with the Marin Transit District to provide improved headways, longer service hours, expanded service areas, and safe, convenient, and comfortable facilities throughout the City. Policy MO 14 would encourage the use of public transit through improvements to support facilities at transit stops and park and ride lots. Policy MO 15 would encourage and where possible require the provision of bus stops, bus shelters, benches, turnouts, and related facilities in major new commercial, industrial, residential, and institutional developments that might be service by transit when supported by transit agencies. Policy MO 16 would require the City to work with transportation agencies to create safe, convenient and integrated transit services to maximize use of the rail service, where feasible, and improve connectivity to the SMART stations and bicycle/pedestrian paths. Therefore, proposed project would be consistent with this goal. |

Source: ABAG 2017

As shown in Table 4.9-2, the proposed project would be generally consistent with the goals contained in the *Plan Bay Area 2040*. In addition to the four focus areas, expanded development could occur in the Industrial Parks MPA area, specifically through the proposed Industrial Parks MPA. This Amendment would provide common development objectives and parameters for future improvements in the industrial parks. An objective of this Amendment is to strengthen and expand the biotech and life science industries in Novato. These objectives and parameters would be required to be consistent with *General Plan 2035*. As concluded within this impact discussion, implementation of the proposed project would be generally consistent with applicable adopted plans, regulations, or policies.

## Mitigation Measure

No mitigation measures are required.

| **Threshold 2:** | Would the project conflict with any applicable land use plan, policy, or regulation of any agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect? |
|---|---|

**Impact LU-3 IMPLEMENTATION OF THE PROPOSED PROJECT WOULD NOT CONFLICT WITH THE MARIN COUNTY, GNOSS FIELD AIRPORT LAND USE PLAN. IMPACTS WOULD BE LESS THAN SIGNIFICANT.**

The Marin County, Gnoss Field Airport is not located within the Plan Area; however, the northern one-fourth of the City of Novato, including all of the North, North Redwood Boulevard Corridor and the North Redwood Boulevard Corridor, and portions of the North Redwood Boulevard Corridor and the Northwest Quadrant Neighborhood is located within the Gnoss Field "Referral Area" established in the *Airport Land Use Plan - Marin County Airport Gnoss Field* (1991) by the Marin County Airport Land Use Commission (ALUC). The Referral Area extends two miles from the future airport boundary of Gnoss Field, as shown on Figure 4.9-1, Safety Zones, Gnoss Field, in the *Airport Land Use Plan - Marin County Airport Gnoss Field*. Policy SZ-7.2 in the Gnoss Field Airport Land Use Plan requires all proposed development projects, including subdivisions, City and County General and Specific Plans, General Plan Amendments, and zoning changes in the Referral Area to be directed to the ALUC for review and comment before they can be approved. The exceptions to this requirement and ALUC review include minor development projects and zoning changes that are unlikely to create airport environs compatibility problems (County of Marin 1991, 2018).

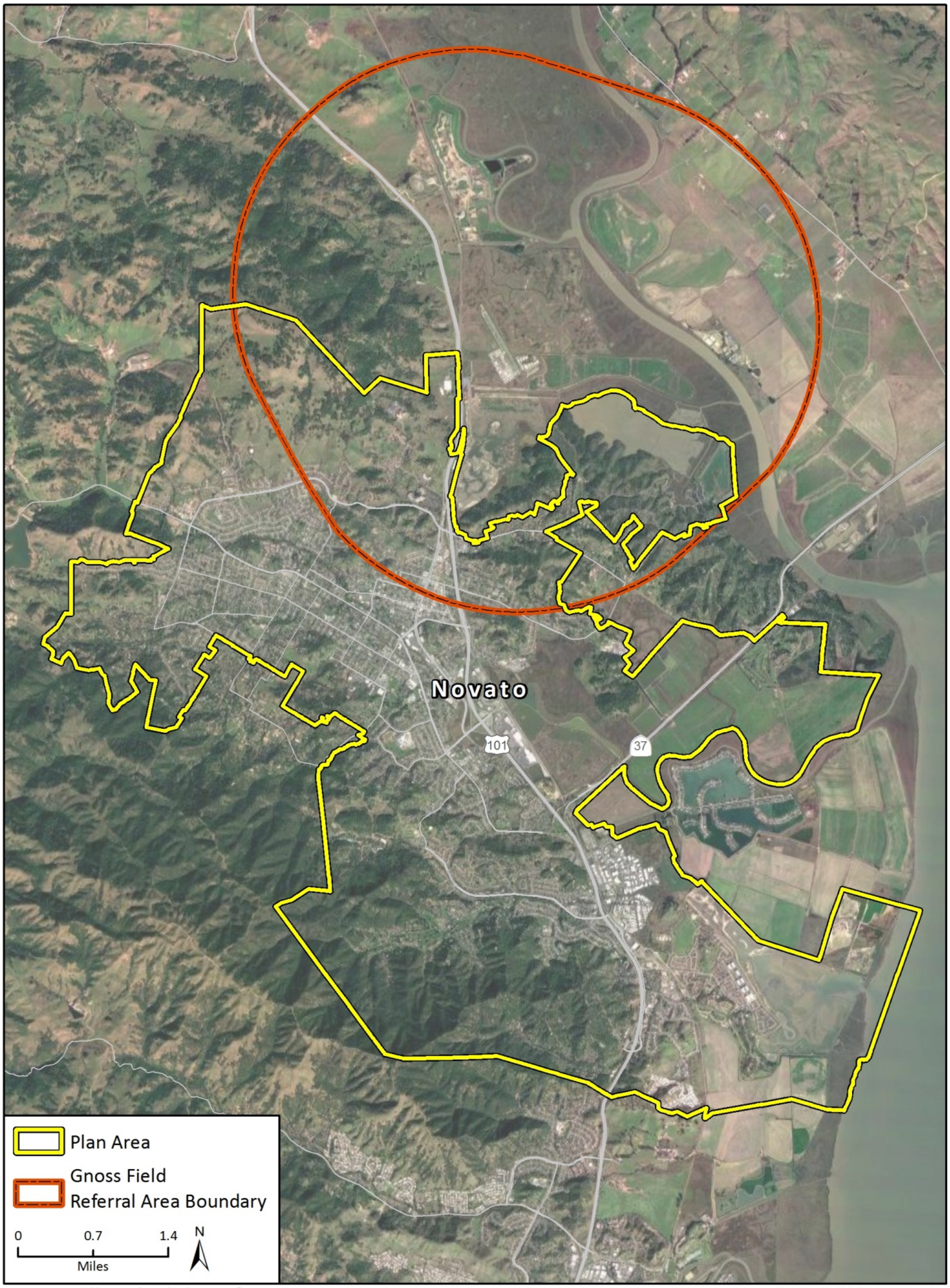
General Plan 2035 includes Policy LU 32, County Airport Planning that would require the City to continue to monitor the County's planning efforts for Gnoss Field Airport to ensure that the health and safety of Novato residents are protected. Implementation Program LU 32a, Development within the Referral Area, would require the City to refer all General Plan Amendments, Zoning Ordinance amendments and specific plans within the Gross Field Referral Area to the Marin County ALUC. Policy LU 32 and Program LU 32a would ensure that development projects located within the Gnoss Field Referral Area would be monitored by the City and referred to the Marin County ALUC. Implementation of Policy LU 32 and Program LU 32a would ensure projects are consistent with the Gnoss Field Airport Land Use Plan.

The Industrial Parks MPA area is not within an airport land use plan area, including the Gnoss Field Airport referral area. Therefore, the proposed project would not conflict with the Marin County, Gnoss Field Airport Land Use Plan.

## Mitigation Measure

No mitigation measures are required.

**Figure 4.9-1 Marin County Airport Gnoss Field, Referral Area**




*Imagery provided by Google and its licensors © 2018.*
*Additional data provided by Marin County 1991.*

| | |
|---|---|
| **Threshold 3:** | Would the proposed project conflict with any applicable habitat conservation plan or natural community conservation plan? |

**Impact LU-4 IMPLEMENTATION OF THE PROPOSED PROJECT WOULD NOT CONFLICT WITH ANY APPLICABLE HABITAT CONSERVATION PLAN OR NATURAL COMMUNITY CONSERVATION PLAN. THERE WOULD BE NO IMPACT.**

Novato does not currently have a habitat conservation or natural community conservation plan. Therefore, implementation of the proposed project would not conflict with any habitat conservation plan or natural community conservation plan, including in the Industrial Parks MPA area and the four focus areas. There would be no impact.

## d. Cumulative

Planned growth in the County of Marin surrounding Novato in combination with development proposed under General Plan 2035 may have significant cumulative land use impacts related to either physical division of communities or conflicts with land use goals, polices, and plans adopted for the purpose of avoiding or mitigating environment effects. To achieve the growth management policies established in General Plan 2035, the City would coordinate closely with other agencies, particularly Marin County and Marin LAFCO. Therefore, General Plan 2035 would not contribute to a significant cumulative impact relative to the physical division of communities or conflicts with County land use goals and policies. The policies contained in General Plan 2035, and plans consistency with related plans and policies, would reduce cumulative land use impacts to a less than significant level.

# 4.10 Noise

This section addresses impacts associated with exposure to noise related to implementation of the proposed project including noise from construction, building operations, traffic, and flight operations are addressed.

## 4.10.1 Setting

### a. Overview of Noise and Vibration Measurement

#### Noise

Noise level (or volume) is generally measured in decibels (dB) using the A-weighted sound pressure level (dBA). The A-weighting scale is an adjustment to the actual sound power levels to be consistent with that of human hearing response, which is most sensitive to frequencies around 4,000 Hertz (similar to the highest note on a piano) and less sensitive to frequencies below 100 Hertz (similar to a transformer hum).

Sound pressure level is measured on a logarithmic scale with the 0 dB level based on the lowest detectable sound pressure level that people can perceive (an audible sound that is not zero sound pressure level). Based on the logarithmic scale, a doubling of sound energy is equivalent to an increase of 3 dB, and a sound that is 10 dB less than the ambient sound level has no effect on ambient noise. Because of the nature of the human ear, a sound must be about 10 dB greater than the reference sound to be judged as twice as loud. In general, a 3 dBA change in community noise levels is noticeable, while 1-2 dBA changes generally are not perceived. Quiet suburban areas typically have noise levels in the range of 40-50 dBA, while those along arterial streets are in the 50-60+ dBA range. Normal conversational levels are in the 60-65 dBA range, and ambient noise levels greater than 65 dBA can interrupt conversations.

Noise levels typically attenuate (drop off) at a rate of 6 dB per doubling of distance from point sources such as industrial machinery. Noise from lightly traveled roads typically attenuates at a rate of about 4.5 dB per doubling of distance. Noise from heavily traveled roads typically attenuates at about 3 dB per doubling of distance.

In addition to the instantaneous measurement of sound levels, the duration of sound is important since sounds that occur over a long period of time are more likely to be an annoyance or cause direct physical damage or environmental stress. One of the most frequently used noise metrics that considers both duration and sound power level is the equivalent noise level (Leq). The Leq is defined as the single steady A-weighted level that is equivalent to the same amount of energy as that contained in the actual fluctuating levels over a period of time (essentially, the average noise level). Typically, Leq is summed over a one-hour period.

The time period in which noise occurs is also important since noise that occurs at night tends to be more disturbing than that which occurs during the daytime. Two commonly used noise metrics – the Day-Night average level (Ldn) and the Community Noise Equivalent Level (CNEL) - recognize this fact by weighting hourly Leqs over a 24-hour period. The Ldn is a 24-hour average noise level that adds 10 dB to actual nighttime (10:00 p.m. to 7:00 a.m.) noise levels to account for the greater sensitivity to noise during that time period. The CNEL is identical to the Ldn, except it also adds a 5 dB penalty for noise occurring during the evening (7:00 p.m. to 10:00 p.m.). Noise levels described by Ldn and

CNEL typically do not differ by more than 1 dBA. In practice, CNEL and Ldn are often used interchangeably.

## Vibration

Vibration is sound radiated through the ground. The rumbling sound caused by the vibration of room surfaces is called groundborne noise. Groundborne vibration is almost exclusively a concern inside buildings and is rarely perceived as a problem outdoors. Groundborne vibration related to human annoyance is generally related to root mean square (RMS) velocity levels expressed in vibration decibels (VdB). However, construction-related groundborne vibration in relation to its potential for building damage can also be measured in inches per second (in/sec) peak particle velocity (PPV) (Federal Transit Administration [FTA], 2018). Based on the FTA's *Transit Noise and Vibration Impact Assessment* and the California Department of Transportation's (Caltrans) *1992 Transportation-Related Earthborne Vibration, Technical Advisory*, vibration levels decrease by 6 VdB with every doubling of distance.

The background vibration velocity level in residential and educational areas is usually around 50 VdB (FTA 2018). The vibration velocity level threshold of perception for humans is approximately 65 VdB. A vibration velocity level of 75 VdB is the approximate dividing line between barely perceptible and distinctly perceptible levels for many people. Most perceptible indoor vibration is caused by sources within buildings, such as operation of mechanical equipment, movement of people, or the slamming of doors. Typical outdoor sources of perceptible groundborne vibration are construction equipment, steel-wheeled trains, and traffic on rough roads. If a roadway is smooth, the groundborne vibration from traffic is rarely perceptible. The range of interest is from approximately 50 VdB, which is the typical background vibration velocity level, to 100 VdB, which is the general threshold where minor damage can occur in buildings.

## b. Sensitive Receptors

Noise exposure goals for various types of land uses reflect the varying noise sensitivities associated with those uses. The existing 1996 General Plan defines noise sensitive receptors as hospitals, schools and libraries. Sensitive land uses generally should not be subjected to noise levels that would be considered intrusive in character. Noise sensitive residential areas are located throughout Novato, specifically in quiet areas lacking major noise sources. However, residences and hotels located in Downtown or near Highway 101, and other arterials may experience elevated noise levels.

## c. Regulatory Setting

## Federal Noise Policies

There are no federal noise requirements or regulations that apply directly to the implementation of General Plan 2035. However, there are federal regulations that influence the audible landscape, especially for projects where federal funding is involved. For example, the Federal Highway Administration (FHWA) requires abatement of highway traffic noise for highway projects through rules in the Code of Federal Regulations (23 CFR Part 772), the FTA, and Federal Railroad Administration (FRA). Each agency recommends thorough noise and vibration assessments through comprehensive guidelines for any highway, mass transit, or high-speed railroad projects that would pass by residential areas.

In addition, the Federal Aviation Administration (FAA) has prepared guidelines for acceptable noise exposure in its Federal Aviation Regulations Part 150 Noise Compatibility Planning program for airports. The program is aimed at balancing an airport's operational needs and its impact on the surrounding community. Its purpose is to reduce noise impacts on existing incompatible land use and to prevent the introduction of new incompatible land uses in the areas impacted by aircraft noise. It establishes standard noise methodologies and noise metrics, identifies land uses normally compatible with various levels of airport noise, and provides for voluntary development and submission of noise exposure maps and noise compatibility programs by airport operators. See discussion below regarding the Gnoss Airport Land Use Plan.

## State Noise and Vibration Policies

Title 24 of the California Code of Regulations codifies Sound Transmission Control requirements establishing uniform minimum noise insulation performance standards for new hotels, motels, dormitories, apartment houses, and dwellings other than single-family dwellings. Specifically, Section 1207.4 in Title 24 states that interior noise levels attributable to exterior noise sources shall not exceed 45 dBA CNEL/Ldn in any habitable room of a new building.

While there are no State standards for vibration, Caltrans establishes vibration risk for structures. For continuous, frequent, and intermittent vibration, Caltrans considers the architectural damage risk level to be somewhere between 0.08 and 0.5 inches per second (in/sec) PPV depending on the type of building that is affected.

## Local

### *City of Novato 1996 General Plan*

In the current City of Novato General Plan (1996), adopted March 8, 1996, Safety and Noise Chapter established noise and land use compatibility standards adapted from the State Office of Planning and Research. The City’s Noise Element defines noise as unwanted sound. The purpose of the Noise Element is to protect the welfare of the community by encouraging noise compatible development, based on established noise standards. Standards included in the Noise Element are shown in Table 4.10-1 and are used to determine whether a proposed development or land use is located in an area requiring special noise mitigation measures. Residential land use and schools are considered “normally acceptable” when exposed to a CNEL of 60 dBA or less.

The City’s Noise Element includes policies and programs which aim to reduce the community’s exposure to excess noise. SF Policy 37, Noise and Compatibility Standards, encourages development to abide by the “normally acceptable” outdoor noise standards outlined in Table 4.10-1. SF Policy 37 specifically prohibits new residential development within the 60 dBA CNEL contour for Gnoss Field Airport. If there is development within the 60 dBA CNEL contour, all residents should be informed of the noise information and would be required to indicate, on record, that they are aware of and accept the noise level (SF Program 37.60). SF Policy 38, Noise Reduction and Mitigation, requires mitigation for noise exceeding applicable standards in order to reduce excess noise to the maximum degree feasible.

### Table 4.10-1 City of Novato General Plan – Noise and Land Use Compatibility Standards

| Land Use Category | Exterior Noise Exposure – $L_{dN}$ or CNEL, dB | | |
|---|---|---|---|
| | Normally Acceptable | Conditionally Acceptable | Unacceptable |
| Residential, Hotels, and Motels | <60 | 60-75 | 75-85 |
| Outdoor Sports and Recreation, and Neighborhood Parks and Playgrounds | <65 | 65-80 | >80 |
| Schools, Libraries, Museums, Hospitals, Personal Care Facilities, Meeting Halls, and Churches | <60 | 60-75 | 75-85 |
| Office Buildings, Business Commercial, and Professional | <70 | 70-80 | 80-85 |
| Auditoriums, Concert Halls, and Amphitheaters | <70 | 70-85 | 70-85 |
| Industrial, Manufacturing, Utilities, and Agriculture | <70 | >70 | – |

Note: A "normally acceptable" designation indicates that standard construction can occur with no special noise reduction requirements. Conventional construction, with closed windows and fresh air supply systems (e.g., air conditioning) normally suffices for the "conditionally acceptable" condition.

Source: Novato General Plan, Safety and Noise Element, 1996.

### *City of Novato Noise Ordinance*

The City of Novato Municipal Code Zoning Ordinance (Section 19.22.070) includes performance standards for allowable exterior noise levels. According to this section uses, activities, and processes shall not generate or emit any noise in excess of the levels provided in Table 4.10-2 beyond the property line of the parcel on which they are located. In addition, Section 19.22.070(7) exempts construction activities between 7:00 a.m. and 6:00 p.m. on weekdays and between 10:00 a.m. and 5:00 p.m. on Saturday are exempted from these standards. Routine maintenance activities are also exempted.

### Table 4.10-2 City of Novato Municipal Code Allowable Exterior Noise Levels

| Type of Land Use | Allowable Exterior Noise Levels[1] | |
|---|---|---|
| | Time Interval | Maximum Noise Level (dBA Leq)[2] |
| Residential[3] | 10:00 p.m. – 6:00 a.m. | 45 |
| | 6:00 a.m.– 10:00 p.m. | 60 |
| Commercial[4] | 10:00 p.m.– 6:00 a.m. | 60 |
| | 6:00 a.m.– 10:00 p.m. | 70 |
| Industrial or Manufacturing[4] | Anytime | 70 |

Novato Municipal Code Table 3-5

[1] Each of the noise limits specified above shall be reduced by 5 dBA for impulse or simple tone noises. If the ambient noise exceeds the resulting standard, the ambient shall be the standard.

[2] Maximum noise levels shall not be exceeded for an aggregate period of more than three minutes within a one-hour time period or by more than 20 dBA at any time.

[3] Residential standards apply to sensitive receptors such as schools, hospitals, libraries, group care facilities, and convalescent homes. These uses may require special mitigation.

[4] Commercial standards apply to Mixed Use Districts.

### *Gnoss Airport Land Use Plan*

The Airport Land Use Plan for the Marin County Gnoss Field Airport (Cortright and Seibold 1991) Section 3.3.1, Noise Standards, states that residential uses and schools are considered compatible with airport/aircraft noise exposures of a Community Noise Equivalent Level (CNEL) value of 65 dBA or less. In order to protect future residential developments from exposure to excess noise generated by the Gnoss Airport, Section 3.3.3, Planning Considerations, prohibits residential development within the 60 dBA CNEL noise contour. Additionally, noise easements are required for development within the 55 dBA CNEL noise contour.

### *Existing Noise Conditions and Sources*

The predominant source of noise in Novato, as in most communities, is motor vehicles on roadways within the City. Motor vehicle noise is of concern because it is characterized by a high number of individual events, which often create a sustained noise level, and because of its proximity to noise-sensitive uses. Roadways with the highest traffic volumes and the highest speeds produce the highest noise levels. The Sonoma Marin Area Rail Transit (SMART)/Northwest Pacific Railroad corridor and the Gnoss Field Airport are also significant sources of noise in Novato. While there are no industrial plants or factories that significantly affect noise levels in the City, construction, heating and cooling equipment, truck loading, and recreational activities contribute to Novato's overall noise environment. The roadways with the highest traffic volumes (such as the Highway 101, SR 37 and major arterial roadways such as Novato Boulevard, Ignacio Boulevard, Redwood Boulevard, and San Marin Drive) produce the highest noise levels.

The SMART system runs parallel to Highway 101 throughout the City of Novato. While the SMART railway line contributes to the overall noise within the City, it is not a major noise source in the community when compared to noise generated by roadways, as mentioned above. The Gnoss Field Airport is located north of Basalt Creek to the east of Highway 101 just outside of the City limits. Gnoss Field Airport is located approximately half a mile from the closest City border. Novato does not have major "point sources" of noise, such as large factories.

Figure 4.10-1 maps average ambient noise levels from highways, arterial roadways, and rail traffic, expressed as noise contours (See Appendix D for noise measurements in the Plan Area). Roadway noise levels were calculated based on existing traffic volumes, average traffic speeds, and the percentage of truck traffic on roadways. As shown in the figure, average ambient noise levels in Novato exceed 75 dBA Ldn along all major roadways. These noise levels are conservative because they do not account for local factors that reduce exposure to ambient noise: intervening structures and topography between noise sources and receptors. For example, sound walls protect some residential neighborhoods from traffic noise generated on Highway 101.

# 4.10.2 Impact Analysis

## Methodology and Significance Thresholds

Appendix G of the CEQA Guidelines provides the following significance criteria to determine that significant impacts from noise could occur if a project action would:

1. Expose persons to or generate noise levels in excess of standards established in the local general plan, noise ordinance, or applicable standards of other agencies
2. Expose persons to or generate excessive groundborne vibration or groundborne noise levels

3. A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project
4. A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project
5. Expose people residing or working in the project area to excessive noise levels within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport
6. Expose people residing or working in the project area to excessive noise levels within the vicinity of a private airstrip

### Construction Noise

This section estimates construction noise associated with the proposed project based on reference noise levels reported by the FTA's *Noise and Vibration Impact Assessment* (2018) for various pieces of construction equipment. It is conservatively assumed that construction equipment typically operates as close as 50 feet from the nearest noise-sensitive receptors. Construction noise level estimates do not account for the presence of intervening structures or topography, which could reduce noise levels at receptor locations. New development implemented by the proposed project would have a significant impact if temporary construction noise during permitted daytime hours could expose noise-sensitive receptors to adverse noise levels.

### Groundborne Vibration

Section 19.22090 of the Novato Municipal Code contains the City's vibration standards. The vibration standard in Novato for operational noise is when uses, activities, or processes generate vibration that is perceptible by the average person at the property line of the parcel containing the activities. Most people perceive vibrations at levels of 65 VdB and greater (FTA 2018). Therefore, operational vibration that exceeds 65 VdB would be considered significant. Vibration from temporary construction, demolition, and vehicles is exempt from the City's vibration standard.

### On-site Operational Noise

On-site activities at new development from the proposed project would have a significant impact if it would expose neighboring noise-sensitive land uses to noise levels exceeding the City's standards shown in Table 4.10-2.

### Increase in Traffic Noise

This analysis involves noise contour modeling to estimate noise levels associated with existing and future (year 2035) traffic on area roadways and railways. Projected traffic volumes in the year 2035, provided by W-Trans, were used to predict future noise contours. Existing and future noise contours were compared to assess the increase in noise-sensitive receptors' exposure to traffic noise from implementation of the proposed project. Proposed policies were then evaluated for the ability to protect noise-sensitive receptors from excessive increases in ambient noise.

### Exposure of New Noise-Sensitive Land Uses to Noise

This section analyzes noise exposure to new noise-sensitive land uses. Projected noise contours for the year 2035 were evaluated to estimate future exposure to ambient traffic noise. Estimated noise levels were compared to the City's proposed exterior noise compatibility standards shown in Table 4.10-1.

## 4.10.3 Project Impacts and Mitigation Measures

| | |
|---|---|
| **Threshold 1:** | Would the project expose persons to or generate noise levels in excess of standards established in the local general plan, noise ordinance, or applicable standards of other agencies? |

**IMPACT N-1 IMPLEMENTATION OF THE PROPOSED PROJECT COULD EXPOSE NEW DEVELOPMENT TO AMBIENT NOISE LEVELS THAT EXCEED THE CITY'S NOISE COMPATIBILITY STANDARDS. HOWEVER, IMPLEMENTATION OF GENERAL PLAN 2035 GOALS AND POLICIES WOULD REDUCE IMPACTS TO A LESS-THAN-SIGNIFICANT LEVEL.**

Implementation of the proposed project could expose new development to noise levels that exceed the City's noise compatibility standards shown in Table 4.10-1. Noise compatibility standards included in the Noise Element are used to determine whether a proposed development or land use is located in an area requiring special noise mitigation measures.

Goals, policies, and programs included in General Plan 2035 would ensure that proposed development is not exposed to excessive noise levels. Specifically, Goal NS 1 Compatibility of New Development would protect people in new development from excessive noise by applying the City's Land Use Compatibility Standards in locating and designing new development. Program NS 1a requires acoustical studies for all new residential projects with a future exterior exposure of 60 dBA Ldn or more to ensure consistency with the City's noise compatibility standards. In addition, the Program requires the consideration of several mitigation measures to lower noise exposure to applicable levels. Program NS 1b sets of the maximum acceptable interior noise level for all new residential development, including hotels and motels, as 45 dBA Ldn, consistent with California interior noise level standards required by Title 24. Development proposed as part of the project would be required to be consistent with the City's noise standards and to implement noise reduction measures if necessary to ensure compliance with the City's Land Use Compatibility Standards. Impacts would be less than significant.

### Mitigation Measures

No mitigation measures are required.

| | |
|---|---|
| **Threshold 1:** | Would the project expose persons to or generate noise levels in excess of standards established in the local general plan, noise ordinance, or applicable standards of other agencies? |
| **Threshold 3:** | Would the project result in a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project? |

**IMPACT N-2 IMPLEMENTATION OF THE PROPOSED PROJECT COULD INCREMENTALLY INCREASE TRAFFIC AND ASSOCIATED NOISE LEVELS ALONG CITY ROADWAYS AND RAILROADS, THUS EXPOSING EXISTING AND FUTURE NOISE-SENSITIVE LAND USES TO INCREMENTALLY GREATER NOISE LEVELS. HOWEVER, IMPLEMENTATION OF GENERAL PLAN 2035 POLICIES WOULD REDUCE IMPACTS TO A LESS THAN SIGNIFICANT LEVEL.**

Implementation of the proposed project would add up to an estimated 930 new housing units, 694,797 sf of commercial space, 332,312 sf of industrial space, and 646,353 sf of office space by the year 2035. Anticipated development would increase traffic on area roadways, particularly in the Downtown, North Redwood Corridor and Northwest Quadrant Neighborhood, and the Industrial Parks MPA area where most development is anticipated (see Figure 2-1).

SMART includes two existing stations in Novato at Atherton Avenue and in the Hamilton Area. A new Novato Downtown SMART station, located near Railroad Avenue at the eastern end of Grand Avenue, is expected to be completed in 2019. Increased ridership of passenger trains or movement of goods associated with implementation of the proposed project and the addition of the Novato Downtown station could result in increased railroad traffic volumes on SMART and freight rail lines throughout the City, which would potentially increase ambient noise levels for sensitive receptors in the general vicinity of existing rail lines.

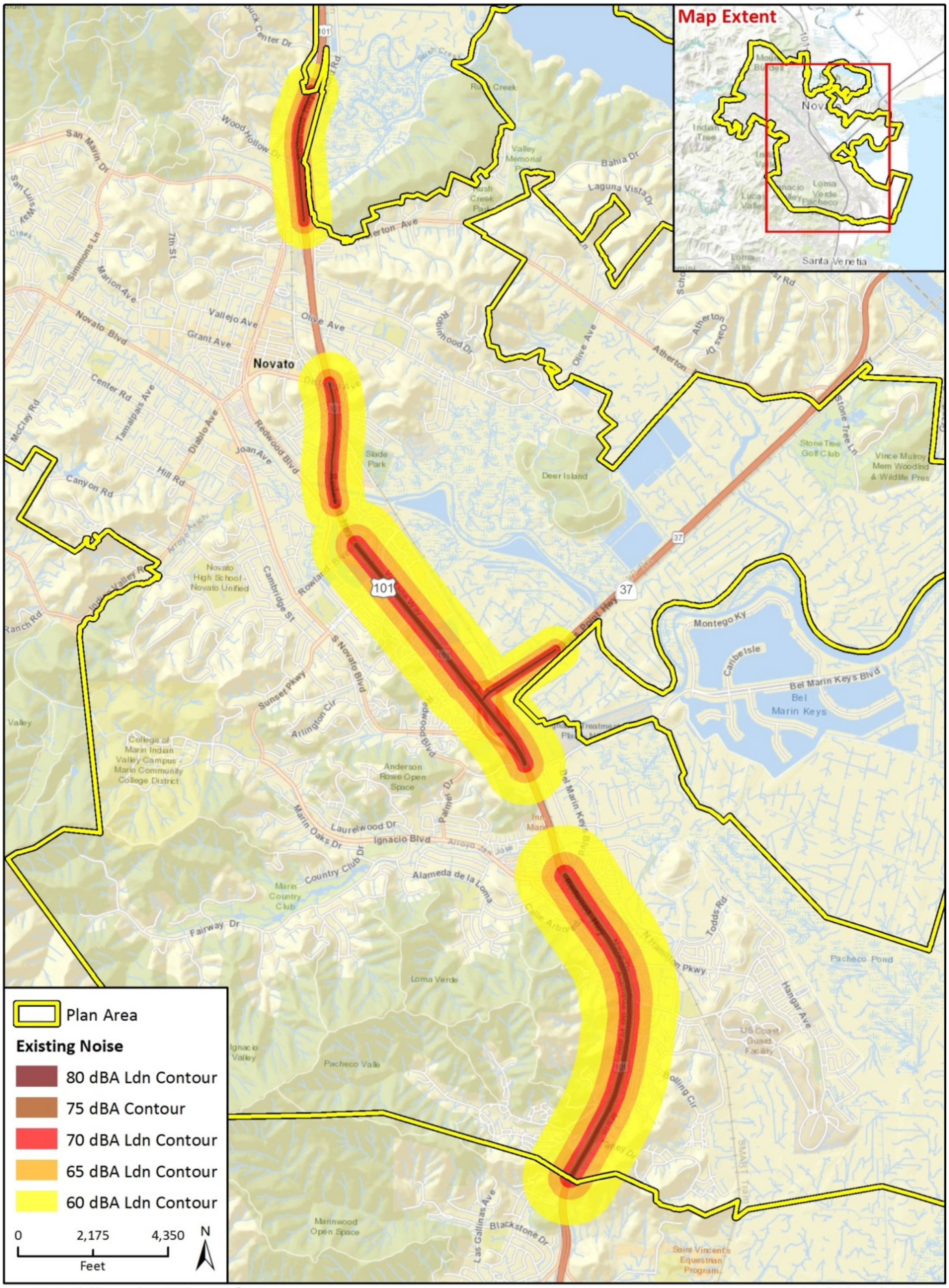
Roadway and rail traffic from implementation of the proposed project would lead to a slight expansion of the noise contours shown in Figure 4.10-1 outward from major roadways and rail lines. See Figure 4.10-2 for anticipated 2035 noise contours. Noise would generally remain the same along the Highway 101 and State Route 37. These noise levels are conservative because they do not account for local factors that reduce exposure to ambient noise: intervening structures and topography between noise sources and receptors. Increased traffic noise would have the greatest impact on noise-sensitive uses, such as residences, schools, and hospitals. In addition, railway noise would be reduced at locations throughout Novato that are classified as “Quiet Zones” and prohibit routine sounding of train horns.

Future noise-sensitive development would be protected from excessive traffic noise by 2035 General Plan Program NS 1c that states that mitigation measures should be considered if a new project would cause an increase above 60 dBA Ldn or cause an increase of 5 dBA Ldn or more if the noise ambient noise levels in nearby residential areas affected by traffic generated by new development.

General Plan 2035 includes Program NS 4a that encourages the City to work with Caltrans to ensure that proper noise studies would be prepared and alternative noise mitigation measures are considered in State projects. The Program also calls for Caltrans to obtain City concurrence before starting any noise mitigation project in Novato. Program NS 4b requires excessively loud vehicles operated on city streets to be compliant with the California Vehicle Code. In addition, Policy NS 3 would require noise mitigation for projects such as increasing setbacks and strategic building placement to reduce noise at receptors.

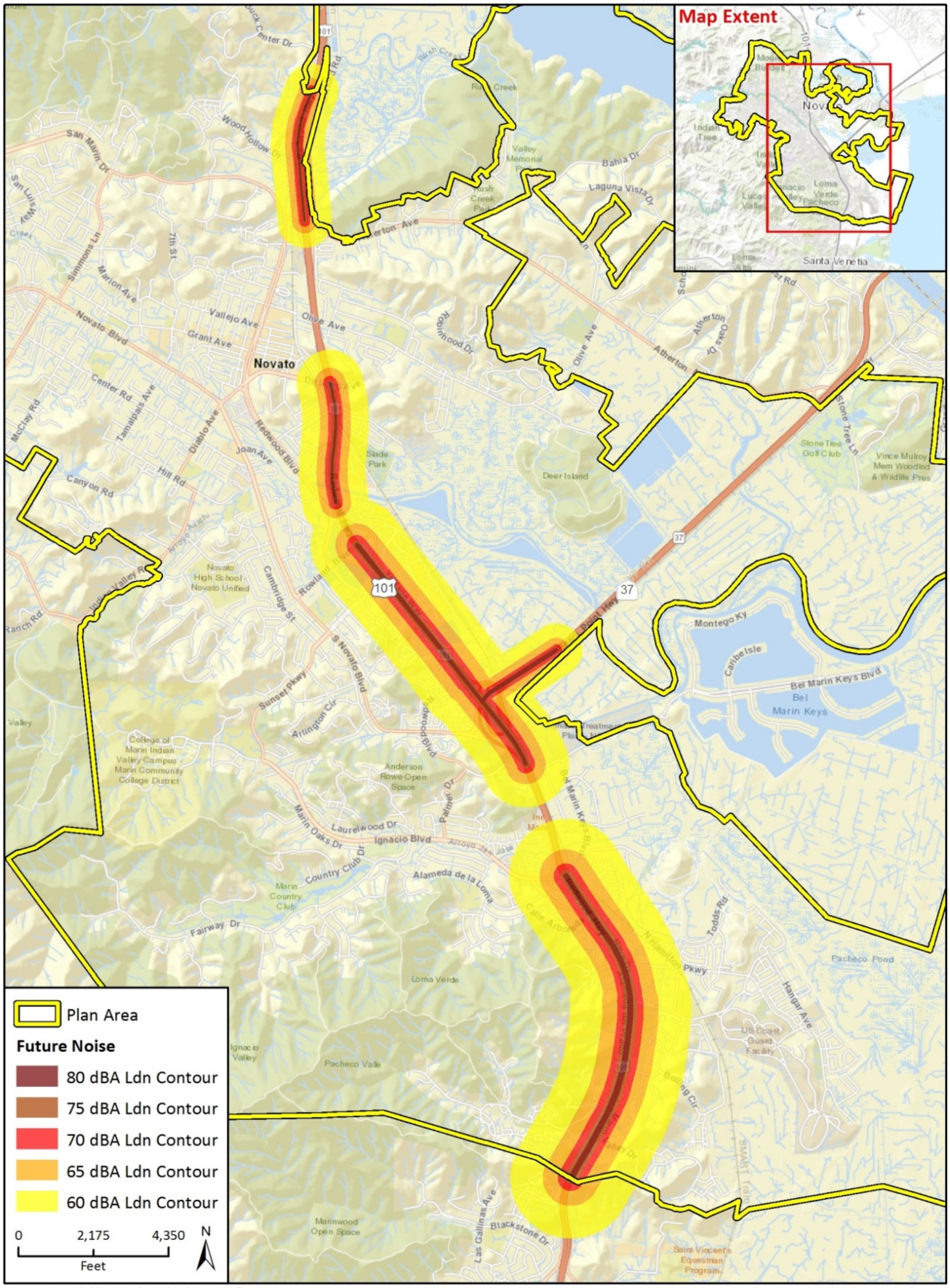
As shown by Figure 4.10-1 and Figure 4.10-2, the Plan Area would be exposed to incremental increases in traffic noise along major roadways and rail noise along the SMART route. The 2035 General Plan requires proper protection of new sensitive land uses from excessive noise, and aims to reduce traffic noise through proper mitigation and compliance with State codes. In addition, rail noise would be required to adhere to federal standards that require electronic bells mounted at intersections to not exceed 61 to 91 dBA at 50 feet. In addition, the City of Novato has several classified “Quiet Zones”, which prohibit routine sounding of train horns, which would reduce noise impacts on sensitive receptors near at-grade crossings. Implementation of the above policies and regulations would ensure that noise impacts are considered as individual development is proposed and that various noise reduction techniques are considered for noise abatement. With implementation of General Plan 2035 policies, increases in roadway and rail noise in the Plan Area, including the Industrial Parks MPA area and four focus areas, would be reduced to a less than significant level.

## Figure 4.10-1 Existing Noise Contours




*Imagery provided by Google and its licensors © 2018.*

**Figure 4.10-2 Future 2035 Noise Contours**




*Imagery provided by Google and its licensors © 2018.*

## Mitigation Measures

No mitigation measures are required.

| | |
|---|---|
| **Threshold 1:** | Would the project expose persons to or generate noise levels in excess of standards established in the local general plan, noise ordinance, or applicable standards of other agencies? |

**IMPACT N-3 IMPLEMENTATION OF THE PROPOSED PROJECT WOULD INTRODUCE NEW ON-SITE NOISE SOURCES ASSOCIATED WITH RESIDENTIAL, COMMERCIAL AND INDUSTRIAL LAND USES. THE CONTINUED REGULATION OF ON-SITE NOISE, CONSISTENT WITH THE NOVATO MUNICIPAL CODE, AND IMPLEMENTATION OF GOALS AND POLICIES IN GENERAL PLAN 2035 WOULD MINIMIZE DISTURBANCE TO ADJACENT LAND USES. IMPACTS WOULD BE LESS THAN SIGNIFICANT.**

Implementation of the proposed project would facilitate the development of new noise generating land uses, including approximately 930 additional residential units, 694,797 sf of commercial development, 322,312 sf of industrial development, and 646,353 sf of office space. Most development associated with the proposed project would occur in the four focus areas: North, North Redwood Boulevard Corridor, North Redwood Boulevard Corridor, Northwest Quadrant Neighborhood, and Downtown. Therefore, sensitive receptors in these areas, such as single and multi-family residences could be impacted by operational noise from new development. In addition to the four focus areas, expanded development could occur in the Industrial Parks MPA area. The Industrial Parks MPA addresses future improvements to Ignacio Industrial Park Units 1, 2 and 3, Bel Marin Commerce Park Units I and II, and the portion of Hamilton Industrial Park within the City of Novato, all of which are located to the east of Highway 101 along Bel Marin Keys Boulevard in the southern section of the City. The closest noise-sensitive receptors are multi-family residences located on Entrada Drive, west of Highway 101 and the Los Robles mobile home park located south of the Industrial Parks MPA area.

Proposed development would introduce new on-site activities that generate noise. Typical noise sources at new residential and mixed-use development would include rooftop ventilation and heating (HVAC) systems, and delivery and hauling services. New development in industrial areas, such as the Industrial Parks MPA area, could introduce noise associated with loading activity and industrial equipment.

Existing sensitive receptors in the four focus areas and surrounding Industrial Parks MPA area could be affected by operational noise from the proposed project. HVAC equipment can range from 60 to 70 dBA Leq at 15 feet from the source (Illingworth & Rodkin 2009). Noise from HVAC equipment at residential, mixed-use, and industrial sites would be significant if noise exceeded the City's maximum allowable exterior noise levels at receiving land uses, as shown in Table 4.10-2. Delivery trucks are assumed to generate a noise level of 68 dBA Lmax at 30 feet from the source (Charles M. Salter Associates, Inc. 2017). However, noise from delivery and loading trucks would be temporary and intermittent noise and would be limited to five minutes per the California Code of Regulations Section 2485.

Noise from industrial equipment at newly proposed industrial development sites, such as the Industrial Parks MPA area, would depend on the type of equipment being used and the location of such equipment. Single-family residences located to the west across the Highway 101 would not be affected by proposed industrial uses because noise generated by Highway 101 is expected to drown out the industry-related noise. However, sensitive receptors south of the Industrial Park MPA area could be exposed to noise in excess of applicable standards.

General Plan 2035 includes goals and policies that seek to reduce excess noise generated by new development. Goal NS 1 is to maintain a quiet community through ensuring that new development does not result in excessive noise. Program NS 2a would require an Acoustical Impact Study and mitigation measures for new development that affects noise sensitive receptors. Policy NS 3 seeks to reduce noise impacts through various site planning options, including increasing distance between noise source and receptor, strategic building placement, and sound walls when necessary. Implementation of these policies and actions would ensure that operational noise from new development would not exceed applicable standards and that appropriate noise reduction features would be implemented on a case-by-case basis as necessary. Depending on the specific development project proposed and the location and source of noise, some examples of noise reduction features that could be required include site placement and design to shield noise-sensitive uses from operational noise, special building standards to reduce interior noise or increase noise attenuation from the building, or the use of barriers to reduce exterior noise. Implementation of General Plan 2035 goals and policies, as well as existing regulatory requirements including state noise regulations, would reduce potential impacts to a less than significant level.

Noise sensitive projects proposed in noisy environments, and potential noise generating projects that potentially exceed acceptable standards, would be evaluated, and that appropriate sound attenuation measures would be implemented on a case-by-case basis. General Plan 2035 goals and policies seek to reduce noise impacts of future development. The policies would require noise reduction features as applicable to reduce noise to applicable standards. With implementation of these policies, impacts would be less than significant. Therefore, no mitigation measures are required.

## Mitigation Measures

No mitigation measures are required.

| | |
|---|---|
| **Threshold 1:** | Would the project expose persons to or generate noise levels in excess of standards established in the local general plan, noise ordinance, or applicable standards of other agencies? |
| **Threshold 4:** | Would the project result in a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project? |

**IMPACT N-4 IMPLEMENTATION OF THE PROPOSED PROJECT WOULD TEMPORARILY PRODUCE NOISE LEVELS POTENTIALLY AFFECTING ADJACENT NOISE-SENSITIVE LAND USES. ALTHOUGH THE NOVATO MUNICIPAL CODE'S TIMING RESTRICTIONS ON CONSTRUCTION ACTIVITY WOULD LIMIT NOISE DISTURBANCE, HIGH NOISE LEVELS DURING WORKING CONSTRUCTION HOURS COULD POTENTIALLY DISTURB NEARBY RECEPTORS. IMPACTS WOULD BE POTENTIALLY SIGNIFICANT.**

Noise from construction of the proposed project would create temporary noise level increases on and adjacent to individual construction sites, including noise from construction traffic. Since there are no specific plans or time scales for the proposed project, it is not possible to determine exact noise levels, locations, or time periods for construction of such projects. However, sites adjacent to areas where most future development is anticipated to occur would be exposed to the highest levels of construction noise for the longest duration. The focus areas, Downtown, North Redwood Corridor, North, North Redwood Corridor, and Northwest Quadrant Neighborhood, as well as the Industrial Parks MPA area would undergo considerable construction activity under implementation of the proposed project, potentially including construction of 930 units of residential development, 694,797 sf of commercial development, 332,312 sf of industrial development, and 619,855 sf of office development. These activities, including construction traffic, demolition and reconstruction, would generate construction noise. Table 4.10-3 illustrates typical noise levels associated with construction equipment. At a distance of 50 feet from the construction site, noise levels similar to those shown in Table 4.10-3 would be expected to occur during individual development projects, depending on the types of constructing equipment used. Noise would typically drop off at a rate of about 6 dBA per doubling of distance for stationary equipment. Therefore, noise levels would be about 6 dBA lower than shown in the table at 100 feet from the noise source and 12 dBA lower at a distance of 200 feet from the noise source.

**Table 4.10-3 Typical Noise Levels from Equipment at Construction Sites**

| | Typical Noise Level (dBA) | | |
|---|---|---|---|
| Equipment | 50 feet from Source | 100 feet from Source | 200 feet from Source |
| Air Compressor | 80 | 74 | 68 |
| Backhoe | 80 | 74 | 68 |
| Concrete Mixer | 85 | 79 | 73 |
| Dozer | 85 | 79 | 73 |
| Grader | 83 | 77 | 71 |
| Paver | 85 | 79 | 73 |
| Pile-driver (impact) | 101 | 95 | 89 |
| Saw | 76 | 70 | 64 |
| Scraper | 85 | 79 | 73 |
| Truck | 84 | 78 | 72 |

Source: FTA 2018

As shown in Table 4.10-3, noise levels from construction activity could approach 101 dBA Leq at adjacent land uses located approximatley 50 feet away. Construction noise would exceed ambient noise levels and may temporarily disturb people at neighboring properties.

Section 19.22.070(4) of the City's Noise Ordinance prohibits construction activities between the hours of 6:00 p.m. and 7:00 a.m. on weekdays and 5:00 p.m. and 10:00 a.m. on Saturdays, and anytime on Sundays and federal holidays. These requirements would limit noise disturbance from construction equipment. Construction occurring within the allowable hours is exempt from exterior noise level standards which are also included in Section 19.22.070 of the City's Municipal Code. However, construction noise would exceed ambient noise levels surrounding construction sites. Construction of the Industrial Parks MPA may impact the mobile home park to the south of the Hamilton and Ignacio Industrial Parks. In addition, construction noise in the four focus areas may impact nearby noise sensitive receptors. Impacts would be less than significant with mitigation incorporated.

## Mitigation Measures

### *N-1 Construction Noise Reduction Measures*

The following measures to minimize exposure to construction noise shall be included as standard conditions of approval for applicable projects involving construction:

1 *Mufflers*. During excavation and grading construction phases, all construction equipment, fixed or mobile, shall be operated with closed engine doors and shall be equipped with properly operating and maintained mufflers consistent with manufacturers' standards.

2 *Stationary Equipment*. All stationary construction equipment shall be placed so that emitted noise is directed away from the nearest sensitive receptors.

3 *Equipment Staging Areas*. Equipment staging shall be located in areas that will create the greatest distance feasible between construction-related noise sources and noise-sensitive receptors.

4 *Smart Back-up Alarms*. Mobile construction equipment shall have smart back-up alarms that automatically adjust the sound level of the alarm in response to ambient noise levels. Alternatively, back-up alarms shall be disabled and replaced with human spotters to ensure safety when mobile construction equipment is moving in the reverse direction.

## Significance After Mitigation

Impacts would be less than significant with implementation of Mitigation Measure N-1 to require noise reduction measures during construction to reduce noise levels at nearby noise receptors.

| **Threshold 2:** | Would the project expose persons to or generate excessive groundborne vibration or groundborne noise levels? |
|---|---|

**IMPACT N-5 CONSTRUCTION OF THE PROPOSED PROJECT COULD TEMPORARILY GENERATE GROUNDBORNE VIBRATION THAT MAY IMPACTS NEARBY RECEIVERS. IMPACTS WOULD BE POTENTIALLY SIGNIFICANT.**

Construction activity associated with General Plan 2035 buildout would likely create groundborne vibration. Buildings in the vicinity of a construction site respond to vibration to varying degrees ranging from imperceptible effects at the lowest levels, to low rumbling sounds and perceptible vibrations at minor levels, and up to minor damage at the highest vibration levels. Table 4.10-4 lists groundborne vibration levels from various types of construction equipment at various distances.

### Table 4.10-4 Vibration Source Levels for Construction Equipment

| | Approximate Vibration Level (VdB) | | | |
|---|---|---|---|---|
| Equipment | 25 feet from Source | 50 feet from Source | 100 feet from Source | 200 feet from Source |
| Caisson Drilling | 87 | 80 | 74 | 67 |
| Jackhammer | 79 | 72 | 66 | 59 |
| Large Bulldozer | 87 | 78 | 69 | 60 |
| Loaded Truck | 86 | 77 | 68 | 58 |
| Small Bulldozer | 58 | 51 | 45 | 38 |
| Vibratory Roller | 94 | 85 | 76 | 67 |

Source: FTA 2018

As shown in Table 4.10-4, noise-sensitive receptors could experience the strongest vibration during the use of vibratory rollers, caisson drills, and large bulldozers on neighboring construction sites. Vibration levels from vibratory rollers could approach 94 VdB at a distance of 25 feet from the source and 87 VdB at 50 feet.

Construction of individual projects facilitated by General Plan 2035 could temporarily create groundborne vibration that could affect nearby sensitive receptors. Section 19.22.070 of the City's

Municipal Code prohibits construction activities between the hours of 6:00 p.m. and 7:00 a.m. on weekdays, 5:00 p.m. and 10:00 on Saturdays, and on any Sunday or federal holiday. The Municipal Code requirements reduce exposure to construction vibration by limiting construction activities to the less noise-sensitive daytime hours. However, 94 VdB is appropriate for assessing vibration impacts on human annoyance from transient sources, as it focuses on effects of vibrations that are temporary in nature and will cease in a known time period (Caltrans 2013). In addition, vibration generated by construction activity has the potential to damage structures depending on the type of structure.[1] This damage could be structural damage, such as cracking of floor slabs, foundations, columns, beams, or wells, or cosmetic architectural damage, such as cracked plaster, stucco, or tile. As shown in Table 4.10-4 construction vibration would reach the threshold of human annoyance and result in potential building damage. Impacts would be potentially significant.

Operational vibration can occur from activities that use large pieces of equipment on a routine basis. The proposed project includes development of the Industrial Parks MPA area with a Life Sciences campus. Operations on such campuses would include office, laboratory, and manufacturing uses. These types of life science operations do not involve the use of large pieces of equipment emitting vibrations that would be strong enough to be perceptible at the property lines of the various parcels comprising the Industrial Parks MPA area. Therefore, operational vibration impacts would be less than significant.

## Mitigation Measures

### *N-2 Construction Vibration Reduction Measures*

The following measures to minimize exposure to construction vibration shall be included as standard conditions of approval for applicable projects involving construction:

1 *Building Examination*. The pre-existing condition of any buildings within 25 feet of any construction activities shall be recorded in order to evaluate damage from project-related construction. Fixtures and finishes within a 25-foot radius of construction activities susceptible to damage will be documented (photographically and in writing) prior to construction. All damage will be repaired back to its pre-existing condition.

2 *Stationary Equipment*. All vibratory stationary construction equipment shall be placed as far as possible from the nearest sensitive receptors.

3 *Equipment Staging Areas*. Equipment staging shall be located in areas that will create the greatest distance feasible between construction-related vibration sources and noise-sensitive receptors.

## Significance After Mitigation

Impacts would be less than significant with implementation of Mitigation Measure N-2 to require vibration reduction measures during construction to reduce noise levels at nearby receivers.

[1] Historic structures are more perceptible to vibration impacts while engineered structures can withstand higher vibration levels.

| | |
|---|---|
| **Threshold 5:** | Would the project expose people residing or working in the project area to excessive noise levels within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport? |
| **Threshold 6:** | Would the project expose people residing or working in the project area to excessive noise levels within the vicinity of a private airstrip? |

**IMPACT N-6 IMPLEMENTATION OF THE PROPOSED PROJECT COULD BE AFFECTED BY NOISE GENERATED BY THE GNOSS FIELD AIRPORT. HOWEVER, GOALS AND POLICIES CONTAINED IN GENERAL PLAN 2035 AND GNOSS FIELD AIRPORT LAND USE PLAN AND COMPLIANCE WITH THE NOVATO MUNICIPAL CODE WOULD ENSURE THAT FUTURE DEVELOPMENT IS COMPATIBLE WITH EXISTING NOISE CONDITIONS AND THAT NOISE-SENSITIVE USES WOULD NOT BE EXPOSED TO EXCESS AIRPORT NOISE. IMPACTS WOULD BE LESS THAN SIGNIFICANT.**

The Gnoss Field Airport is located outside the Plan Area approximately 0.2 miles north of the nearest City border. Gnoss Field is a County-owned, general aviation airport that has no scheduled commercial flights. However, the airport has numerous private aircraft operations and an air taxi service.

The General Plan 2035 includes policy NS 1c which requires consideration of an acoustical study and noise mitigation for residential development within the 55 dBA CNEL contour. NS 1c also requires disclosure of noise levels to residents who may live in an area where outdoor noise exceeds or is anticipated to exceed 60 dBA $L_{dn}$. Section 3.3.3 of the Gnoss Field Airport Land Use Plan, Planning Considerations, also prohibits residential development within the 60 dBA CNEL noise contour, and requires noise easements for development within the 55 dBA CNEL noise contour.

According to the General Plan 2035 and Gnoss Field Airport Land Use Plan, residential development included in the proposed project should not be located within the 60 dBA CNEL contour included in the Airport Land Use Plan. As discussed previously, approvals for future development in the 2035 General Plan should be analyzed on a case by case basis to determine whether or not proposed land uses are compatible (see Table 4.10-1). If development is proposed in an area where noise levels exceed 60 dBA CNEL, deed disclosure to residents of the noise levels anticipated would be required. Because residential development that would be exposed to excess airport noise is discouraged, and proper acoustical studies are required for development in the direct vicinity of the Gnoss Field Airport, impacts would be less than significant.

## Mitigation Measures

No mitigation measures are required.

## Cumulative Impacts

Noise and vibration impacts are based on factors related to site-specific and project-specific characteristics and conditions, such as distance to noise and vibration sources and barriers between land uses and noise/vibration sources. Therefore, cumulative impacts related to construction would be similar to impacts discussed above and construction noise and vibration impacts would be less than significant with mitigation. Cumulative development in the County of Marin surrounding Novato in combination with the proposed project may result in increased noise from operation of proposed development. However, the proposed project is not anticipated to substantially increase inter-regional travel. Therefore, traffic noise impacts would remain less than significant. Implementation of the proposed project would increase density and intensity of existing land uses potentially resulting in increased noise levels in combination with nearby regional development. However, compliance with noise related policies and programs of General Plan 2035, standards of the Novato Municipal Code, and the mitigation measures prescribed above would reduce cumulative noise impacts to a less than significant level so the proposed project would have only an incremental contribution to cumulative impacts associated with noise. Noise impacts would not be cumulatively considerable and cumulative impacts would be less than significant.

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# 4.11 Population and Housing

This section addresses the potential population growth and housing displacement impacts associated with implementation of the proposed project. Data used to prepare this section were taken from the United States Bureau of the Census (US Census), the California Department of Finance (CA DOF), and the Association of Bay Area Governments (ABAG).

## 4.11.1 Setting

Population, housing, and employment data from the agencies listed above are used in the sections below to provide an analysis of potential population and housing impacts for the City of Novato, California.

### a. Population

Incorporated in 1960, the City of Novato experienced a rapid rise in population during its first two decades, increasing from 17,900 to 43,900 residents by 1980. Following 1980 the City experienced a slower growth rate, adding approximately 3,700 residents by 2000. Between 2000 and 2010 the City grew by approximately 4,300 residents, primarily as a result of the Hamilton Air Force Base, which added over 2,000 new homes to Novato as well as new commercial buildings (City of Novato 2014a). According to the Association of Bay Area Governments (ABAG) the city is expected to add about 3,340 residents between 2015 and 2035 (ABAG 2017).

Table 4.11-1 shows population growth in the City from 2010 to 2015. Based on this data, the City's population growth increased from 51,900 in 2010 to 52,290 in 2015, an approximately 1 percent increase during this timeframe. In 2015, the City's population of 52,290 represented approximately 20 percent of Marin County's total population of 262,274 persons (DOF 2016). Novato is the second most populated city of the ten cities in Marin County, second only to San Rafael.

### b. Households

A household is defined by the DOF and the U.S. Census as a group of people who occupy a housing unit. A household differs from a dwelling unit because the number of dwelling units includes both occupied and vacant dwelling units. Not all of the population lives in households. A portion lives in group quarters, such as board and care facilities; others are homeless.

### Households

Small households (1 to 2 persons per household [pph]) traditionally reside in units with 0 to 2 bedrooms; family households (3 to 4 pph) normally reside in units with 3 to 4 bedrooms. Large households (5 or more pph) typically reside in units with 4 or more bedrooms. However, the size of units in relation to the household size may also reflect preference and economics; many small households obtain larger units, and some large families live in small units for economic reasons.

Table 4.11-2 compares the number and size of households in Novato and Marin County as a whole for every five or six years from the period 2000-2016. As shown, the total number of households in the City has increased every five years. There has also been an overall increase in the number of households in the county over the past 16 years. The average household size in the City increased slightly from 2.52 pph in 2000 to 2.64 pph in 2016. The average household size in the county as a whole also increased slightly from 2.34 pph in 2000 to 2.47 pph in 2016.

### Table 4.11-1 Population Growth in Novato (2010-2015)

| 2010 | 2015 | Percent Change |
|---|---|---|
| 51,900 | 52,290 | 1 |

Source: U.S. Census and ABAG 2017

### Table 4.11-2 Households in Novato and Marin County

| Area | 2000 | 2010 | 2016 |
|---|---|---|---|
| **Total Households** | | | |
| Novato | 18,524 | 20,270 | 20,290* |
| Marin County | 100,650 | 103,210 | 102,727 |
| **Average Household Size** | | | |
| Novato | 2.52 | 2.53 | 2.64 |
| Marin County | 2.34 | 2.36 | 2.47 |

Source: US Census Bureau, American Fact Finder, Census 2000 Demographic Profile Highlights (US Census 2000a and 2000b). CA Department of Finance, E-5 Population and Housing Estimates, for Cities, Counties, and the State, 2011-2016, with 2010 Benchmark.
*2015 households projection (ABAG 2017)

## c. Jobs-Housing Ratio

Information on the jobs-housing ratio is provided for informational purposes only. The jobs-household ratio in a jurisdiction is an overall indicator of jobs availability within the area. A balance of jobs and housing can give residents an opportunity to work locally and avoid employment commutes to other places in the region. As shown in Table 4.11-3, employment in Novato was estimated at 26,380 in 2010 (ABAG 2017). Based on this employment estimate and the City's estimated 2010 population of 51,900, the City's jobs-household ratio in 2010 was 1.03 jobs per household**.**

### Table 4.11-3 Novato Population, Households, and Employment

| City of Novato | 2010 | 2015 | 2020 | 2025 | 2030 | 2035 | Change 2015-2035 | % Change 2015-2035 |
|---|---|---|---|---|---|---|---|---|
| Population | 51,900 | 52,290 | 53,310 | 53,910 | 54,890 | 55,360 | 3,340 | 6% |
| Households | 20,270 | 20,290 | 20,690 | 20,910 | 21,170 | 21,220 | 930 | 5% |
| Jobs | 26,380 | 26,820 | 26,910 | 27,290 | 27,910 | 28,220 | 1,400 | 5% |
| Jobs/Housing Ratio | 1.03 | 1.32 | 1.3 | 1.3 | 1.31 | 1.32 | 0.29 | 1.28% |

Source: U.S. Census and ABAG 2017

## d. Projections

Table 4.11-3 presents population, households, and employment projections through 2035 for Novato. The projections suggest that the City's population will grow approximately 6 percent over the next 25 years. This translates into an estimated 3,340 new residents by 2035. New households are expected to increase 5 percent over the next 25 years for a total increase of 935 units from 2015 levels. Employment is projected to increase approximately 5 percent from 2015 levels, for a total of approximately 1,400 new jobs by 2035. This would hold steady the City's jobs-housing ratio from 1.32 jobs per household in 2015 to 1.32 jobs per household in 2035.

## e. Regulatory Setting

### Regional Housing Needs Assessment

California's Housing Element law requires that each county and city develop local housing programs to meet their "fair share" of future housing growth needs for all income groups, as determined by the DOF. The regional councils of government (COGs), including ABAG, are then tasked with distributing the State-projected housing growth need for their region among their city and county jurisdictions by income category. This fair share allocation is referred to as the Regional Housing Needs Assessment (RHNA) process. The RHNA represents the minimum number of housing units each community is required to plan for through a combination of: 1) zoning "adequate sites" at suitable densities to provide affordability; and 2) housing programs to support production of below-market rate units. Table 4.11-4 shows Novato's allocation from the 2014-2022 RHNA distributed among the four income categories.

**Table 4.11-4 Regional Housing Needs Assessment 2014-2022**

| Income Group | RHNA Allocation (units) |
|---|---|
| Very Low: up to 50 percent of area median income | 111 |
| Low: between 51 and 80 percent of area median income | 65 |
| Moderate: between 81 and 120 percent of area median income | 72 |
| Above Moderate | 167 |
| **Total** | **415** |

Source: City of Novato Housing Element Update 2015-2023; 2014b

### Association of Bay Area Governments

As discussed in Section 4.8, *Land Use and Planning*, Novato is located within the ABAG planning area. ABAG functions as the Metropolitan Planning Organization (MPO) for Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara and Solano Counties, and is responsible for implementing the Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS) (Plan Bay Area) which is a long-range integrated transportation and land-use/housing strategy for the San Francisco Bay Area through 2040.

### State Housing Element Statutes

State housing element statutes (Government Code Sections 65580-65589.9) mandate that local governments adequately plan to meet the existing and projected housing needs of all economic segments of the community. The law recognizes that in order for the private market to adequately address housing needs and demand, local governments must adopt land use plans and regulatory systems that provide opportunities for, and do not unduly constrain, housing development. As a result, State housing policy rests largely upon the effective implementation of local general plans and in particular, housing elements. Additionally, Government Code Section 65588 dictates that housing elements must be updated at least once every eight years. Novato's most recent housing element, (Novato Housing Element 2015 – 2023, 2014b) was adopted in November 2014.

## 4.11.2 Impact Analysis

### a. Methodology and Thresholds of Significance

### Methodology

Population and housing trends in the City were evaluated by reviewing the most current data available from the U.S. Census Bureau, the California DOF, the current Novato General Plan, ABAG, and the 2014 RHNA. Impacts related to population are generally social or economic in nature. Under CEQA, a social or economic change generally is not considered a significant effect on the environment unless the changes are directly linked to a physical change.

### Significance Thresholds

The following thresholds of significance are based on Appendix G to the CEQA Guidelines. For purposes of this EIR, implementation of the proposed project may have a significant adverse impact if it would do any of the following:

1. Induce substantial population growth either directly or indirectly
2. Displace substantial number of existing housing, necessitating the construction of replacement housing elsewhere
3. Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere

### b. Project Impacts and Mitigation Measures

| | |
|---|---|
| **Threshold 1:** | Would the General Plan induce substantial population growth either directly or indirectly? |

**Impact PH-1** **IMPLEMENTATION OF THE PROPOSED PROJECT WOULD NOT INCLUDE SUBSTANTIAL POPULATION GROWTH DIRECTLY OR INDIRECTLY. THEREFORE, POPULATION AND GROWTH INDUCING IMPACTS WOULD BE LESS THAN SIGNIFICANT.**

The proposed project, which includes future residential development in the four focus areas is expected to result in approximately 935 additional residential units in the City by the year 2035 (see Section 2.6, General Plan Buildout, of this EIR). Based on Novato's estimated average household size of 2.64 persons (DOF 2016), this would lead to an increase of approximately 3,340 residents in the City from 2015 to 2035. The Industrial Parks MPA includes commercial and industrial development and would not directly result in an increase in Novato's population. Development of the Industrial Parks MPA would bring new employment to Novato. However, given the City's proximity to other bay area communities and accessible transportation the Industrial Parks MPA would not result in indirect population growth because employees would likely live throughout the bay area.

Residential development would be concentrated in two of the four focus areas (Downtown and the Northwest Quadrant Neighborhood), which are areas identified in the proposed project as having the greatest potential for change. Future residential growth facilitated by the proposed project is predicted to increase the City's total population to 55,630, which is below ABAG's 2035 population forecast of 55,700 from the 2013 RTP/SCS (ABAG 2013). The addition of approximately 3,340 residents would lead to an approximately six percent increase in population over the 20-year horizon of the proposed project.

As discussed in Chapter 2, *Project Description*, the General Plan's focus on development in the four focus areas, and state and regional demographic trends are anticipated to limit citywide growth to within the forecast amounts. Because no exceedance of the population forecast is anticipated, the proposed project would not induce substantial population growth.

One of the fundamental purposes of the proposed project is to direct future development in such a way as to minimize the impacts of growth by emphasizing the intensification and reuse of already developed areas, thus minimizing pressure to develop on the remaining open space in the City and directing growth to the five focus areas. Specifically Great Places Chapter Policies LU 7 through LU 28 includes guidance for development in each of the four focus areas. Additionally, Community Character Policy CC 5 calls for the City to "minimize the need for expansion of Urban Growth Boundary, focus new residential and commercial growth at appropriate infill sites near transit and retail services" and Policy LU 3 would plan the City's infrastructure and service levels to provide capacity for the total amount of development expected by 2035. In addition, development in accordance with the proposed project would not indirectly induce growth in the City by building roads or other infrastructure in new areas that would facilitate development. Therefore, impacts would be less than significant.

## Mitigation Measures

No mitigation measures are required.

| | |
|---|---|
| **Threshold 2:** | Would the project displace a substantial number of existing housing, necessitating the construction of replacement housing elsewhere? |
| **Threshold 3:** | Would the project displace substantial numbers of people, necessitating the construction of replacement housing elsewhere? |

**Impact PH-2** **IMPLEMENTATION OF THE PROPOSED PROJECT WOULD NOT RESULT IN THE DISPLACEMENT OF SUBSTANTIAL NUMBERS OF HOUSING OR PEOPLE. TO THE CONTRARY, THE PROPOSED PROJECT WOULD FACILITATE THE DEVELOPMENT OF NEW HOUSING IN ACCORDANCE WITH STATE AND LOCAL HOUSING REQUIREMENTS, WHILE PRESERVING EXISTING RESIDENTIAL NEIGHBORHOODS. IMPACTS WOULD BE LESS THAN SIGNIFICANT.**

The proposed project directs new growth to the four focus areas, where development pressures are the greatest and change is anticipated, while protecting stable residential areas and targeting housing growth in strategic areas such as Downtown and the Northwest Quadrant Neighborhood. The Great Places Element Policy LU 3 would plan the City's infrastructure and service levels to provide capacity for the buildout expected in 2035 with the following programs: review of growth assessment; infrastructure and service level planning; and analyzing projects impacts on infrastructure capacity and services.

Focusing development in the four focus areas over the life of the proposed project would not result in significant displacement of existing residences in order to accommodate the planned increase in development intensity. The proposed removal of the single family residential retention requirement in the Northwest Quadrant has the potential to displace residents. However, the retention requirement would result in either incremental replacement of demolished residences with new single family residences on the same lot or, in some cases, new multi-family development. Therefore, there would be new housing available in the Northwest Quadrant. In addition, Community Character Chapter, implementation of the proposed project would facilitate the development of new housing. Specifically, Goal 2 would promote high quality sustainable development and Policy CC 10 would promote new development in residential neighborhoods providing housing for any displaced residents.

The proposed project forecasts that 935 residential units would be developed over the next 20 years. Similarly, ABAG projections (2017) show an increase of 935 residential units to the City within the same time period, with most of this growth directed to the four focus areas. Although no projects have been identified that would displace existing units, as stated above if displacement did occur new residential units would be constructed to replace any existing displaced residences. Therefore, impacts related to displacement of existing residences would be less than significant.

## Mitigation Measures

No mitigation measures are required.

## Cumulative Impacts

Cumulative development in the County of Marin surrounding Novato in combination with development proposed under the proposed project may result in increased population, job, and housing projections. Implementation of the proposed project would increase density and intensity of existing land uses potentially resulting in increased growth. However, the proposed project would be consistent with ABAG forecasts, which include regional development throughout the Bay Area. Therefore, the proposed project would have incremental contribution to cumulative impacts associated with population and housing. Cumulative impacts would be less than significant.

# 4.12 Public Services

This section addresses potential impacts on public services, including fire and police protection, public schools, and libraries from implementation of the proposed project. Impacts related to water and wastewater infrastructure and solid waste collection and disposal are discussed in Section 4.15, *Utilities and Service Systems*.

## 4.12.1 Setting

### a. Fire Protection

Fire protection services in the Plan Area are provided by the Novato Fire Protection District (NFPD). The NFPD serves a population of 65,000 residents, employees and visitors in the City of Novato and surrounding unincorporated lands (71 square miles). It was formed in 1926 and currently maintains five fire stations.

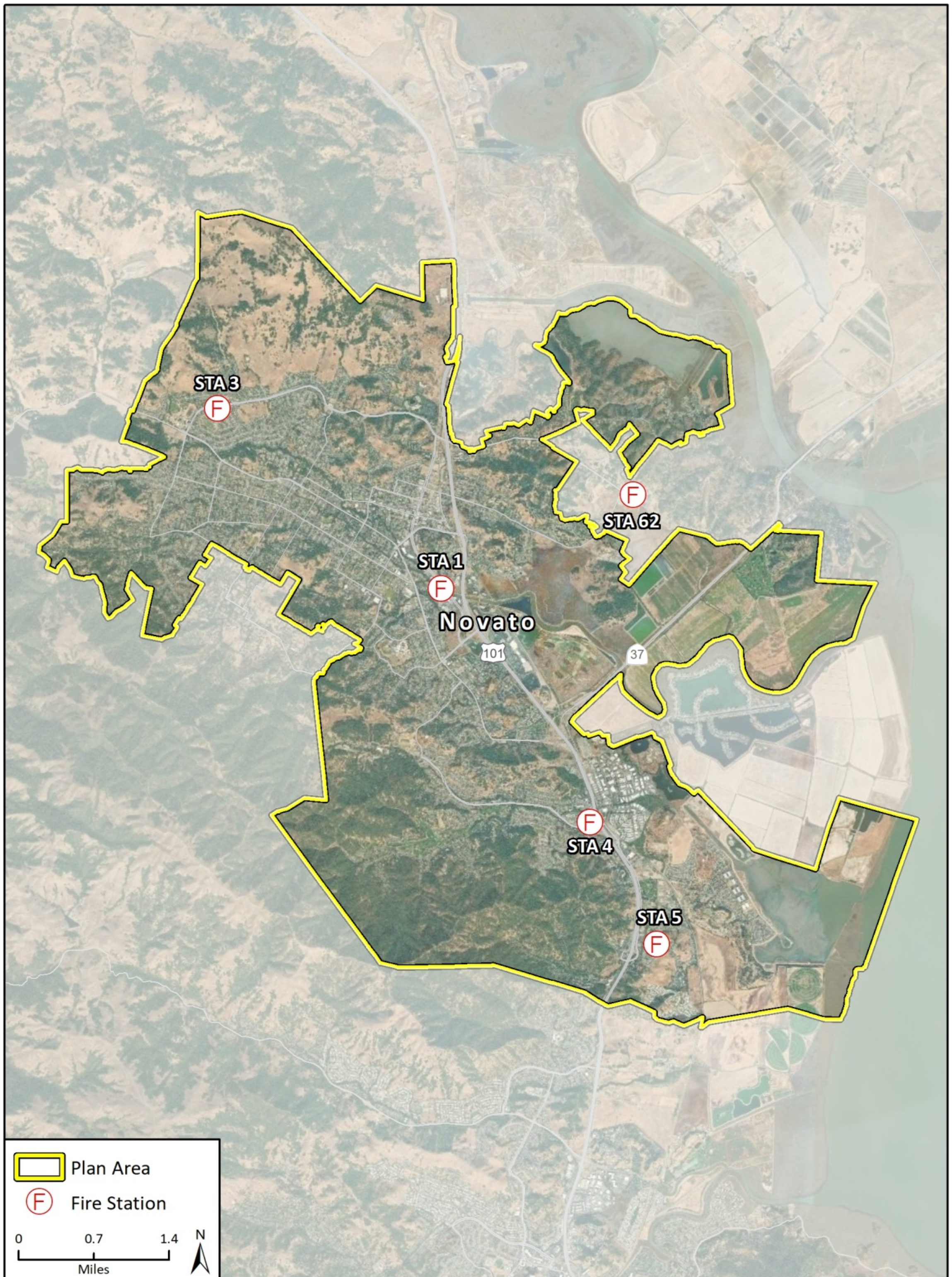
The NFPD provides full service emergency service delivery for fire protection, emergency medical response, and hazardous spills in addition to fire prevention and public education services within the incorporated and unincorporated service areas of the City of Novato.

### Personnel, Facilities and Equipment

The NFPD employs one fire chief and 66 fire fighters, 9 command staff, and 13 administrative staff in the its five fire stations (Novato Fire Prevention District 2009).

Figure 4.12.1 shows the location of the City's five fire stations. Fire Station No. 61 is located at 7025 Redwood Boulevard and houses six firefighting personnel, and a Battalion Chief. This is the largest station in the district and also houses two paramedic staff and an advanced life support ambulance. Fire Station No. 62 is located at 450 Atherton Avenue houses three firefighting personnel, one firefighter/ paramedic and an Advanced Life Support Paramedic Ambulance. Fire Station 63 is located at 65 Ramon Way boasts a Paramedic Engine company staffed by one Captain, one Engineer, and one Firefighter/ Paramedic. In addition, this fire station also houses one Type III engine and an Advanced Life Support Paramedic Ambulance. Fire Station 64 is located at 319 Enfrente Road and houses one paramedic truck company staffed by one captain, one Engineer, and one Firefighter/paramedic. In addition, this station houses two Firefighters/ Paramedics staff and an Advanced Life Support Paramedic Ambulance. Fire Station 65 is the newest fire station in the District, located at 5 Bolling Drive. It has a three-person Fire District Paramedic Engine Company, type 3 engine, superintendent truck, and crew hauler. During wildfire season, Station 65 is also home to the 15-person Tam Fire Crew (part of Marin County Fire Department) which responds to wildfires in the region (NFPD 2018).

## Figure 4.12.1 Novato Fire Protection District Fire Stations[1]




*Imagery provided by Microsoft Bing and its licensors © 2019.*
*Additional data provided by Marin County 2019.*

[1] Station 62 is located outside of the Novato City limits but services the City

## Fire Protection Regulatory Setting

### *Federal Policies*

#### DISASTER MITIGATION ACT (2000-PRESENT)

Section 104 of the Disaster Mitigation Act of 2000 (Public Law 106-390) requires a state mitigation plan as a condition of disaster assistance. There are two different levels of state disaster plans: "Standard" and "Enhanced." States that develop an approved Enhanced State Plan can increase the amount of funding available through the Hazard Mitigation Grant Program. The Act has also established new requirements for local mitigation plans

#### NATIONAL FIRE PLAN (NFP) 2000

The National Fire Plan was developed under Executive Order 11246 in August 2000, following a landmark wildland fire season. Its intent is to actively respond to severe wildland fires and their impacts to communities while ensuring sufficient firefighting capacity for the future. The plan addresses firefighting, rehabilitation, hazardous fuels reduction, community assistance, and accountability.

### *State Policies*

#### CALIFORNIA FIRE PLAN

The Strategic California Fire Plan is the State's road map for reducing the risk of wildfire. The plan was updated in 2012, and directs each CAL FIRE Unit to prepare a locally specific Fire Management Plan. In compliance with the California Fire Plan, individual CAL FIRE units are required to develop Fire Management Plans for their areas of responsibility. These documents assess the fire situation within each of CAL FIRE's 21 units and six contract counties. The plans include stakeholder contributions and priorities, and identify strategic areas for pre-fire planning and fuel treatment as defined by the people who live and work with the local fire problem. The plans are required to be updated annually.

#### CALIFORNIA STATE MULTI-HAZARD MITIGATION PLAN, DRAFT (UPDATED 2013)

The purpose of the State Multi-Hazard Mitigation Plan (SHMP) is to significantly reduce deaths, injuries, and other losses attributed to natural and human-caused hazards in California. The SHMP provides guidance for hazard mitigation activities emphasizing partnerships among local, state, and federal agencies as well as the private sector. The California Office of Emergency Services (OES) prepares the State of California Multi-Hazard Mitigation Plan (SHMP). The SHMP identifies hazard risks, and includes a vulnerability analysis and a hazard mitigation strategy. The SHMP is Federally required under the Disaster Mitigation Act of 2000 in order for the State to receive federal funding. The Disaster Mitigation Act of 2000 requires a State mitigation plan as a condition of disaster assistance.

#### WILDLAND-URBAN INTERFACE BUILDING STANDARDS

On September 20, 2007 the Building Standards Commission approved the Office of the State Fire Marshal's emergency regulations amending the California Code of Regulations, Title 24, Part 2, known as the 2007 California Building Code (CBC). These codes include provisions for ignition-resistant construction standards in the wildland urban interface.

#### CALIFORNIA FIRE AND BUILDING CODE (2016)

The 2016 Fire and Building Code establishes the minimum requirements consistent with nationally recognized good practices to safeguard the public health, safety, and general welfare for the hazards of fire, explosion or dangerous conditions in new and existing buildings, structures and premises, and to provide safety and assistance to firefighters and emergency responders during emergency operations. The provisions of this code apply to the construction, alteration, movement enlargement, replacement, repair, equipment, use and occupancy, location, maintenance, removal and demolition of every building or structure or any appurtenances connected or attached to such building structures throughout the State of California.

### *Regional and Local Policies*

#### ASSOCIATION OF BAY AREA GOVERNMENTS (ABAG) MULTI-JURISDICTIONAL LOCAL HAZARD MITIGATION PLAN

The Plan covers mitigation measures that should be adopted by participating municipalities across the San Francisco Bay Area. The mitigation measures focus on hazards such as earthquake, fire, flood, and tsunami.

#### MARIN COUNTY MULTI-JURISDICTIONAL LOCAL HAZARD MITIGATION PLAN

Marin County updated its Local Hazard Mitigation Plan in the winter of 2018 with the Marin County Multi-Jurisdictional Local Hazard Mitigation Plan (MJLHMP). All of Marin’s towns and cities, the North Marin Water District, and Marin County Flood Control and Water Conservation District are participants of the MJLHMP. The City of Novato adopted the MJLHMP in February 2019 to supersede Novato’s 2011 Local Hazard Mitigation Plan. The MJLHMP assesses risks posed by natural hazards and provides a mitigation strategy for reducing risks in the County. Both a hazard and vulnerability analysis are included in the MJLHMP with a mitigation strategy to provide a blueprint for reducing the potential losses identified in the vulnerability analysis (Marin County 2018c).

#### MARIN COUNTY COMMUNITY WILDFIRE PROTECTION PLAN 2016

The Marin County Community Wildfire Protection Plan reflects the wildfire situation in the CAL FIRE Unit by identifying high-risk and high-value areas where potential exists for costly and damaging wildfires. The four basic components of the fire plan assessment are assets at risk; vegetation fuel hazards; fire history and frequency of severe fire weather; ignition workload assessment; and management prioritization. The plan also includes strategies for reducing the fire risk in priority areas. Wildland fire hazards within the General Plan area are shown in Figure 4.7-2 of the Hazards section of this report.

## b. Police Protection Services

The Novato Police Department (NPD) provides professional and proactive street patrol, investigations, traffic enforcement, narcotics enforcement, a 911 dispatch center, and emergency services and preparedness to the 28-square-mile Plan Area. NPD operates under a Mutual Aid Agreement with the Marin County Sheriff’s Office (MCSO) and will provide service to unincorporated areas when requested by MCSO. Unincorporated acres in or near Novato include Loma Verde, part of Bel Marin Keys, Indian Valley, Wild Horse Valley and Atherton Avenue. Additional law enforcement in Novato is provided by the California Highway Patrol (CHP), primarily along Highway 101, on unincorporated roadways and at Park and Ride areas.

NPD operates out of one main police station located at 909 Machin with a satellite office within Fire Station 5 located at 5 Bolling Drive. The satellite office is primarily used by officers to write reports and to conduct follow-up investigations while working patrol shifts in the south end of the City.

There are approximately 78 department staff and 60 sworn officers in NPD. Additionally, the NPD has three part-time interns and 17 volunteers of which four are Chaplains. The current ratio of officers per 1,000 residents is 1.13. This is below the Federal Bureau of Investigations recommended standard of 2 officers per 1,000 residents below staffing levels of all law enforcement agencies in Marin County and the City of Petaluma.

The Department's policing and services programs are divided into two divisions, the Administrative Services Division and the Operations Division. The Operations Division is the most visible and larger of the two divisions within the Department and includes patrol, investigations, and traffic. Additionally, specialty units such as the Crisis Response Unit (a Special Response and Crisis Negotiation Team), bicycle and off-road motorcycle patrol, and the Novato Response Team are also housed within this division of the Novato Police Department. The Services Division is responsible for the support elements of the Police Department which include Records and Communications, Personnel and Training, Evidence, Crime Prevention Bureau and facilities management.

### California Highway Patrol

The California Highway Patrol (CHP) provides traffic safety and enforcement services on unincorporated roadways and State highways. The City of Novato is located in the CHP Golden Gate Division that operates one of twelve area offices in Corte Madera, approximately 11.2 miles south of Novato. The Golden Gate Division also includes three commercial inspection facilities, one Communications Center, and an Air Operations unit and employs 1,250 peace officers and 200 civilians.

### Police Protection Regulatory Setting

#### *California Commission on Peace Officer Standards and Training (POST)*

The California Commission on Peace Officer Standards and Training (POST) advocates for, exchanges information with sets selection and training standards for, and works with law enforcement and other public and private entities. POST was established by the Legislature in 1959 to identify common needs that are shared by representatives of law enforcement.

## c. Schools

### Novato Unified School District

The City is served by the Novato Unified School District (NUSD) that oversees 19 schools including eight elementary schools, three middle schools, two high schools and five alternative schools. There are also three private schools located in the City. The NUSD employs over 700 staff members with student/teacher ratios in district elementary schools at 22:1. The District's student population demographics reflect the overall demographics of Marin County as a whole with 35.2 percent of the District's students being Latino and 49.6 percent being white. English learners comprise 15.8 percent of the total district population (California Department of Education 2017).

The District also sponsors one charter school. The Novato Charter School is a small K-8 school focused on nature-based education. There are also three private schools located within Plan Area, Our Lady of Loretto School, Good Shepherd Lutheran School, and North Bay Christian Academy.

Table 4.12-1 describes public and private schools within the Plan Area, their corresponding grades, capacity and student enrollment as of the 2016-2017 school years (July 2016).

**Table 4.12-1 Plan Area School Enrollment and Capacity**

| School | Grades | 2016-2017 Enrollment | School Capacity | Remaining Capacity |
|---|---|---|---|---|
| Novato High School | 9-12 | 1,350 | 2,077 | 727 |
| San Marin High School | 9-12 | 1,106 | 1,183 | 77 |
| San Jose Middle School | 6-8 | 775 | 765 | -10 |
| Sinaloa Middle School | 6-8 | 822 | 808 | -12 |
| Hamilton School | K-8 | 653 | 865 | 212 |
| Loma Verde Elementary School | K-5 | 376 | 473 | 97 |
| Lu Sutton Elementary School | K-5 | 371 | 460 | 89 |
| Lynwood Elementary School | K-5 | 311 | 460 | 149 |
| Olive Elementary School | K-5 | 360 | 400 | 40 |
| Pleasant Valley Elementary School | K-5 | 477 | 440 | -37 |
| Rancho Elementary School | K-5 | 403 | 505 | 102 |
| San Ramon Elementary School | K-5 | 479 | 490 | 11 |
| Marin Oaks High School | 9-12 | 46 | 150 | 104 |
| NOVA Independent Study | 6-12 | 31 | 150 | 119 |
| Novato Charter School | K-8 | 249 | 250 | 1 |
| Nexus Academy | 6-8 | 4 | 150 | 146 |
| Good Shepherd Lutheran School | K-8 | NA | NA | NA |
| North Bay Christian Academy | 9-12 | NA | NA | NA |
| Our Lady of Loretto School | K-8 | 220* | NA | NA |

Note: NA is used on this table to indicate data that was not available on the following sources.

*Data collected from: Privateschoolreview.com

Source: Novato Unified School District Facilities Master Plan 2016, July, 2016; City of Novato, Existing Conditions Report Table 14-1 Novato Unified School District Schools Enrollment and Capacity.

## Local Ballot Measure G

During the November 2016 election, a bond issue measure was on the ballot for the Novato Unified School District. Measure G issues $222 million in bonds to Novato Unified School District to upgrade classrooms, science labs, libraries and facilities to meet current academic and safety standards. The Measure passed with 57.98 percent approval.

### Schools Regulatory Setting

#### *California Code of Regulations*

The California Code of Regulations, Title 5 Education Code, governs all aspects of education within the state.

California State Assembly Bill 2926 (AB 2926)—School Facilities Act of 1986. In 1986, AB 2926, entitled the School Facilities Act of 1986, was enacted by the state of California and added to the California Government Code (Section 65995). It authorizes school districts to collect development fees, based on demonstrated need, and generate revenue for school districts for capital acquisitions and improvements. It also established that the maximum fees (adjustable for inflation) which may be collected under this and any other school fee authorization are $1.50 per square foot ($1.50/sf) of residential development and $0.25/sf of commercial and industrial space.

AB 2926 was expanded and revised in 1987 through the passage of AB 1600, which added Section 66000 et seq. of the Government Code. Under this statute, payment of statutory fees by developers serve as total mitigation under CEQA to satisfy the impact of development on school facilities. However, subsequent legislative actions have alternatively expanded and contracted the limits placed on school fees by AB 2926.

#### *California Senate Bill 50 (SB 50)*

As part of the further refinement of the legislation enacted under AB 2926, the passage of SB 50 in 1998 defined the Needs Analysis process in Government Code Sections 65995.5–65998. Under the provisions of SB 50, school districts may collect fees to offset the costs associated with increasing school capacity as a result of development. The fees (referred to as Level One fees) are assessed based upon the proposed square footage of residential, commercial/industrial, and/or parking structure uses. Level Two fees require the developer to provide one-half of the costs of accommodating students in new schools, while the state would provide the other half. Level Three fees require the developer to pay the full cost of accommodating the students in new schools and would be implemented at the time the funds available from Proposition 1A (approved by the voters in 1998) are expended. School districts must demonstrate to the state their long-term facilities needs and costs based on long-term population growth in order to qualify for this source of funding. However, voter approval of Proposition 55 on March 2, 2004, precludes the imposition of the Level Three fees for the foreseeable future. Therefore, once qualified, districts may impose only Level Two fees, as calculated according to SB 50.

## d. Public Libraries

The Novato Library (1720 Novato Boulevard) and the South Novato Library (931 C Street) are two of 11 branches within the Marin County Free Library system and provides education activities, reading, and writing programs for children and adults. The mission of the Marin County Free Library system is to provide welcoming, equitable and inclusive opportunities for all to connect, learn and explore. During the June 2014 election, 78.53 percent of the voters in Marin County voted to support Marin County Free Library by passing Measures A to renew a parcel tax of $49 per year for 9 years to maintain, restore, and enhance library services throughout the District.

The *2007 Marin County Free Library Services and Facilities Vision Plan* identifies Novato as a key area of growth within its current service area and projects future needs to meet this anticipated growth and associated service demand. The *Vision Plan* identifies the Library's six main goals: to provide library service for all; plan for future flexibility; build upon current strengths; maximize coordination with other agencies; look at the way we do business; and to create a library system that is sustainable

### e. Parks and Recreational Facilities

The City of Novato manages and operates 29 parks totaling approximately 439 acres, or approximately 8.5 acres per 1,000 residents. Parks in Novato feature, among other amenities, hiking trails, playgrounds, playing fields, outdoor courts, amphitheater, a skate park, a dog park, a community swimming pool, and picnic areas. In addition to facilities formally recognized as parks, Novato residents have access to a variety of open space and recreational facilities owned and managed by other partner agencies including the Novato Unified School District school playgrounds and playing fields and open space recreation areas owned by the Marin County Parks and Open Space District.

## 4.12.2 Impact Analysis

### a. Methodology and Significance Thresholds

According to Appendix G of the adopted *CEQA Guidelines*, impacts related to public services and recreation from implementation of the proposed project would be significant if it would:

1 Result in substantial adverse physical impacts associated with the provision of new or physically altered government facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other objectives for any of the public services:

   a) Fire protection
   b) Police protection
   c) Schools
   d) Parks
   e) Other public facilities

Fire, police, and schools are addressed under Threshold 1(a), 1(b), 1(c) below. In terms of Threshold 1(e) regarding impacts on "other public facilities," such facilities include libraries and other public utility infrastructure. Impacts related to libraries are discussed in this section, impacts related to public stormwater facilities are addressed in Section 4.8, *Hydrology and Water Quality,* and impacts related to public wastewater, water, and solid waste facilities are discussed in Section 4.15, *Utilities and Service Systems.* In terms of Threshold 1(d), impacts to parks are discussed in Section 4.13, *Recreation*.

## b. Impacts and Mitigation Measures

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| **Threshold 1a:** | Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered government facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other objectives relating to fire services? |

**Impact PS-1 IMPLEMENTATION OF THE PROPOSED PROJECT WOULD INCREASE POPULATION, GENERATING ADDITIONAL NEED FOR GOVERNMENT FACILITIES INCLUDING NOVATO FIRE PROTECTION DISTRICT SERVICES. HOWEVER, ADHERENCE TO GENERAL PLAN 2035 POLICIES WOULD REDUCE IMPACTS ASSOCIATED WITH THE PROVISION OF FIRE PROTECTION SERVICES TO A LESS-THAN-SIGNIFICANT LEVEL.**

With implementation of the proposed project, an estimated 3,340 new residents would be added to the Plan Area, mainly in the four focus areas and in the Industrial Parks MPA. When added to the current 2015 population, the proposed project would increase the City of Novato's total population to an estimated 55,640 residents by 2035, an increase of six percent. This increase in development and population generated by the proposed land uses would increase demand for fire protection services and may require provision of new or physically altered fire protection facilities. NFPD completed major renovations of Fire Station 64 in 2015. In the NFPD's most recent Strategic Plan, the NFPD identifies one of its major goals as being to "develop a facilities maintenance and review program to address physical resources needs." While facilities maintenance needs are a concern for the NFPD, no future plans for expansion or renovation of NFPD facilities exist. Thus, the specific environmental impact of constructing a new fire protection facility in the planning area cannot be determined at this programmatic level of analysis because no specific projects are proposed. However, development and operation of public facilities, such as a new fire protection facility, may result in potentially significant impacts that can be addressed by various General Plan 2035 goals and policies.

General Plan 2035 goals and policies aimed at reducing impacts related to the provision of fire service in the Plan Area include: Goals LU 3, SH 3 and Policies LU 3a, LU 3b, LU 3c and SH 3a. Goal LU 3 calls for the City to plan infrastructure and service levels to provide capacity for the total amount of development expected by 2035. This would be achieved through implementing policies LU 3a through LU 3c which require the city to review growth associated with the proposed project and adjust service levels, infrastructure capacity and impact fees to meet the needs of the community; coordinate growth projections and planning of infrastructure and public services with the water, sanitary, fire protection and school districts; and continue to analyze the impacts of development on infrastructure capacity and services as a part of CEQA review. Additionally, Goal SH 3 calls for the City to continue to enforce fire code through review of all development proposals for fire risk and through coordination with the Novato Fire Protection District.

Implementation of these goals and policies would ensure that all new development is adequately served by fire protection and emergency services, reducing the need for additional facilities through proper maintenance and improvement of existing facilities.

While current facilities planning documents for the City of Novato and NFPD do not include plans for the construction of new or physical alteration of an existing fire protection facilities, if such a need arises, adherence to General Plan 2035 policies described above would reduce potential impacts to a less than significant level. Similarly, impacts to new or physical alteration of existing fire protection facilities from growth the in four focus areas and Industrial Park MPA would be less than significant with implementation of General Plan goals and polices discussed above.

## Mitigation Measures

No mitigation measures are required.

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| **Threshold 1b:** | Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered government facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other objectives relating to police protection services? |

**Impact PS-2** **IMPLEMENTATION OF THE PROPOSED PROJECT WOULD INCREASE POPULATION, GENERATING ADDITIONAL NEED FOR GOVERNMENT FACILITIES INCLUDING NOVATO POLICE DEPARTMENT PROTECTION SERVICES. HOWEVER, ADHERENCE TO GENERAL PLAN 2035 POLICIES WOULD REDUCE IMPACTS ASSOCIATED WITH THE PROVISION OF POLICE PROTECTION SERVICES TO A LESS-THAN-SIGNIFICANT LEVEL.**

Police service in Novato is provided by the Novato Police Department (NPD). There are currently 78 department staff and 60 sworn officers in NPD. The City of Novato currently maintains a ratio of 1.13 sworn police officers to every 1,000 residents.

Implementation of the proposed project would result in an increase in development and population in the Plan Area, including the four focus areas and Industrial Parks MPA area. This increase in development and population may require additional police protection services. To serve the additional 3,340 residents added to the Plan Area with development associated with the proposed project and maintain existing service ratios, NPD may need to add additional officers. Thus, implementation of the proposed project could result in the need for an increase in police staff, specifically to serve the four focus areas and in the Industrial Parks MPA where the majority of development is anticipated to occur. However, it is not anticipated that the number of new officers would require construction of new police facilities.

An assessment of the Novato Police Station facilities conducted by Faithful and Gould in March 2013 found no need for construction of new facilities, recommending only maintenance of existing facilities (Faithful and Gould 2013). Based on these recommendations, there are no current plans to expand or relocate the existing police station. Furthermore, General Plan 2035 goals and policies would reduce impacts related to the provision of police protection in the Plan Area. Specifically, Policy SH 6 which calls for the City to provide a high level of service to the community by working to reduce crime and improve safety of the community. This would be achieved through implementing Programs SH 6a through SH 6d which require the city to enhance current community-oriented policing programs; maintain sufficient civilian employees, equipment and support sworn staff; review development proposals for potential safety concerns that may affect demand for police services as a part of CEQA review; and provide services to those with substance or mental illness who are in crisis. Implementation of these goals and policies would ensure that all new development is adequately served by police protection services. Therefore, implementation of the proposed project would not result in the need for new or physically altered police facilities which could cause significant environmental impacts. Similarly, impacts to new or physical alteration of existing police protection facilities from growth the in four focus areas and Industrial Park MPA would be less than significant with implementation of General Plan goals and polices discussed above. This impact would be less than significant.

## Mitigation Measures

No mitigation measures are required.

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|---|---|
| **Threshold 1c:** | Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered government facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other objectives relating to school facilities? |

**Impact PS-3 DEVELOPMENT ASSOCIATED WITH THE PROPOSED PROJECT WOULD ADD SCHOOL AGED CHILDREN. HOWEVER, FACILITIES HAVE ADEQUATE CAPACITY AND NEW DEVELOPMENT WOULD BE REQUIRED TO PAY IMPACT FEES WHICH WOULD RESULT IN LESS THAN SIGNIFICANT IMPACTS WITH REGARD TO THE PROVISION OF SCHOOL FACILITIES.**

As discussed in Section 2.3 *Demographics and Growth Projections* of General Plan 2035, the City is expected to see a population increase of 3,340 additional residents 2035, mostly in the Downtown and Northwest Quadrant Neighborhood (City of Novato 2018). These changes in population and demographics would result in increased demand for public services such as schools. The City maintains a high level of communication and cooperation with education provider agencies such as NUSD. However, each of these provider agencies retains independent decision-making authority and General Plan 2035 does not include specific goals or policies that pertain to public services and facilities they provide. NUSD maintains their own planning documents which anticipate future growth and include policies to meet future service and facilities demands.

According to the NUSD *2016 Facilities Master Plan,* 16 of the District's schools are operating below capacity, while San Jose Middle School, Sinaloa Middle School and Pleasant Valley Elementary school are currently operating above capacity. As mentioned above, the proposed project would result in an increase of 3,340 new residents or 935 new households. NUSD utilizes the student generation rate of 0.7 per single family residence set by the State of California Office of Public School Construction to estimate future facilities needs. Assuming each single-family residence houses one household, 655 new students will be added to the Plan Area by 2035 (Schreder 2014). Despite capacity overages in the three schools listed above, total existing NUSD facilities can accommodate 1,815 additional students. Therefore, the 655 new students would be adequately served by existing NUSD facilities and no new or physically altered school facilities would be required.

Furthermore, all future development associated with the proposed project would be required to pay school impact fees which, pursuant to Section 65995 (3) (h) of the California Government Code (Senate Bill 50, chaptered August 27, 1998), are "deemed to be full and complete mitigation of the impacts of any legislative or adjudicative act, or both, involving, but not limited to, the planning, use, or development of real property, or any change in governmental organization or reorganization." With payment of mandatory school impact fees by developers in the city, impacts would be less than significant.

## Mitigation Measures

No mitigation measures are required.

| **Threshold 1e:** | Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered government facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other objectives relating to library services facilities? |
|---|---|

**Impact PS-4** **DEVELOPMENT ASSOCIATED WITH THE PROPOSED PROJECT WOULD RESULT IN AN INCREASE IN THE CITY'S POPULATION AND INCREASED DEMAND FOR LIBRARY SERVICES, WHICH COULD RESULT IN THE PROVISION OF NEW OR PHYSICALLY ALTERED LIBRARY FACILITIES. IMPACTS WOULD BE LESS THAN SIGNIFICANT.**

The population in the Plan Area is anticipated to increase by 3,340 new residents by 2035. This increase in population would result in increased demand for public services such as libraries. As discussed in section 4.12 *Setting* above, library service in Novato is provided by Marin County Free Library (MCFL). MCFL retains independent decision-making authority and proposed project does not include specific goals or policies that pertain to public services and facilities they provide. MCFL maintains its own planning documents which anticipate future growth and include policies to meet future service and facilities demands.

To achieve goals outlined in the *2007 Marin County Free Library Services and Facilities Vision Plan*, the *2007 Vision Plan* recommends maintaining the existing service areas and branches and identifying revenue sources to improve all present libraries by 2020. Facilities needs assessments are based on the size of the service population however, MCFL does not have a specific population-to-facilities square foot ratio.

According to the *2007 Vision Plan*, maintenance and improvement of existing level of service is achieved through a number of measures including expansion of collections and the expansion of the library's service area through the use of the book mobile and increased digital collections. Depending on the size of each branch, physical alterations of branch facilities may be required to accommodate increases in collections. Physical facilities needs are determined based on projected service population estimates derived from ABAG population projection (MCFL 2007).

Facilities needs identified in the *2007 Vision Plan* include between 16,975 and 20,020 square feet of additional space in the Novato Library and between 4,026 and 4,836 square feet of additional space in the South Novato Library. Additional space needed to meet the demands of the service population in the South Novato branch can be accommodated in the existing building while relocation or major renovation would be required to accommodate the facilities needs of the Novato Library (MCFL 2007). There are no specific projects, policies, or implementation actions in General Plan 2035 to develop a new library within the Plan Area. However, library service and facilities policies 1 and 2 of the *2007 Vision Plan* emphasize the use of technology and alternative facilities such as the bookmobile and kiosks for pick-up of materials which would allow the library to accommodate existing and expanded demand for library services (MCFL 2007).

The specific impact of constructing a new library in the planning area cannot be determined at a programmatic level of analysis because no specific projects are proposed. However, impacts from development and operation of public facilities, such as a new library, would be addressed by existing City policies and mitigation measures included in this EIR. Specifically, Goals LU 2, LU 3 and LU 4 and their associated implementation policies call for the City to manage growth to maintain service levels for public facilities, analyze the impact of development on level of service, and require new development to pay its fair share of infrastructure and public service costs. Furthermore, mitigation measures required throughout other sections of this document would reduce potential impacts associated with development allowed under the proposed project. For example, Mitigation Measures AQ-1, BIO-4, and CR-1a would add new policies to reduce air pollutant emissions from construction activities, increase protections for nesting birds, and require all discretionary projects to investigate potential to disturb archeological and historic resources prior to project approval. Implementation of and adherence to these mitigation measures would reduce potential impacts associated with future development projects, such as a new library. Accordingly, overall impacts on the MCFL library system would be less than significant.

## Mitigation Measures

No mitigation measures are required.

## Cumulative Impacts

Cumulative development in the County of Marin surrounding Novato in combination with development proposed under General Plan 2035 may contribute to the need for additional public services including police, fire, school, and library services. Implementation of General Plan 2035 would increase density and intensity of existing land uses, which could regionally impact public services. However, local planning to accommodate future growth, such as planning required in Novato by Goals LU 2 and LU 3 of the 2035 General Plan, would reduce the potential cumulative impacts associated with the provision of public services to a less than significant level. Policies in the 2035 General Plan such as Policies ES 11a, ES 13a, SH 2k, and SH 7d support cooperation with other regional agencies which would further reduce impacts associated with potentially new public facilities. Furthermore, growth anticipated under General Plan 2035 would be within ABAG projections. Therefore, General Plan 2035 would have incremental contribution to cumulative impacts associated with public services and would not be cumulatively considerable. Cumulative impacts would be less than significant.

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# 4.13 Recreation

This section addresses recreation impacts, including impacts to parks.

## 4.13.1 Setting

### a. Regulatory Setting

The Quimby Act was established by the California legislature in 1965 to provide parks for growing communities in California. The Act authorizes cities to adopt ordinances addressing the dedication of park land and/or the payment of fees for residential subdivisions for the purpose of providing and preserving open space and recreational facilities and improvements. The Act requires the provision of three acres of park area per 1,000 persons residing within a subdivision, unless the amount of existing neighborhood and community park area exceeds that limit, in which case the City may adopt a higher standard not to exceed five acres per 1,000 residents. The Act also specifies acceptable uses and expenditures of such funds.

Section 9-20 of the Novato Code of Ordinances, Park Dedications and In-Lieu Fees, contains a general standard requiring 4.5 acres of neighborhood and community park and recreational purposes per 1,000 residents and requires either new development either dedicate land or pay a fee to meet this standard.

The City of Novato manages and operates 29 parks totaling approximately 439 acres, or approximately 8.5 acres per 1,000 residents. Parks in Novato feature, among other amenities, hiking trails, playgrounds, playing fields, outdoor courts, amphitheater, a skate park, a dog park, a community swimming pool, and picnic areas. In addition to facilities formally recognized as parks, Novato residents have access to a variety of open space and recreational facilities owned and managed by other partner agencies including the Novato Unified School District school playgrounds and playing fields and open space recreation areas owned by the Marin County Parks and Open Space District.

## 4.13.2 Impact Analysis

### a. Methodology and Significance Thresholds

According to Appendix G of the adopted *CEQA Guidelines*, impacts related to public services and recreation from implementation of the proposed project would be significant if it would:

1 Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated; or

2 Include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment.

## b. Impacts and Mitigation Measures

| | |
|---|---|
| **Threshold 1:** | Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated? |
| **Threshold 2:** | Would the project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment? |

**Impact REC-1 DEVELOPMENT PROJECTED BY THE PROPOSED PROJECT WOULD ALLOW FOR AN INCREASE IN THE CITY'S POPULATION. THIS WOULD INCREASE DEMAND FOR PARKS AND RECREATION FACILITIES AND POTENTIALLY CREATE THE NEED FOR NEW PARK AND RECREATION FACILITIES. HOWEVER, COMPLIANCE WITH THE POLICIES IN GENERAL PLAN 2035 AND PAYMENT OF MANDATORY PARKLAND DEDICATION FEES WOULD REDUCE IMPACTS RELATED TO PARKS AND RECREATION TO LESS THAN SIGNIFICANT.**

Part of the vision and guiding principles of the proposed project is to manage growth and to preserve open space adjacent to the City. The City has a goal for a park ratio of 4.5 acres of parkland per 1,000 residents. Implementation of the proposed project would add an estimated 3,340 new residents to the Plan Area, which would increase demand for parks and recreational facilities in the City of Novato, primarily located in the four focus areas where new development would be concentrated.

To maintain the service ratio with the population growth anticipated as part of the proposed project, approximately 15 additional acres of parkland would need to be added to the Plan Area by 2035 (3,340 residents/ 1,000 residents x 4.5 acres = 15 additional acres). Thus, physical alteration of existing parks or provision of new park facilities would be necessary to accommodate projected growth. Such developments would be required to adhere to the goals and policies included in General Plan 2035.

The purpose of several goals and policies included in the Living Well Chapter of General Plan 2035 is to ensure responsible growth in the City of Novato and adequate planning for the development of new or improved parks and recreational facilities. Specifically, Policy LW 2 is aimed at maintaining adequate parks-to-resident ratio to ensure that all residents and neighborhoods are adequately served with open space and recreational opportunities. To achieve this level of service, Policy LW 4 calls for the city to update its Parkland Dedication Ordinance to assure new development contributes to addressing community park needs. Programs LW 2a, LW 2b, LW 2c, and LW 2e identify specific locations for new and expanded existing parks within the general plan area such as development of a linear park along North Redwood Boulevard, redevelopment of the American Assets site, and in the Northwest Quadrant Neighborhood. Policies LW 1 and LW 3 call for the City to examine opportunities for acquisition of new recreational facilities and expand community access to indoor and outdoor recreational facilities through joint use agreements with the school district and other community partners. Adherence to these General Plan 2035 goals and policies would reduce potential impacts on parks and other recreational facilities to a less than significant level.

Furthermore, per the City's Parkland Dedication Ordinance, all future developments under the proposed project would be required to pay parkland dedication fees which, pursuant to Section 65995 (3) (h) of the California Government Code (Senate Bill 50, chaptered August 27, 1998), are "deemed to be full and complete mitigation of the impacts of any legislative or adjudicative act, or both, involving, but not limited to, the planning, use, or development of real property, or any change in governmental organization or reorganization." With payment of mandatory parkland dedication fees by developers in the City as well as implementation of General Plan 2035 goals and policies, impacts would be less than significant.

## Mitigation Measures

No mitigation measures are required.

## Cumulative Impacts

Cumulative development in the County of Marin surrounding Novato in combination with development proposed as part of the project may contribute to the need for additional recreational facilities, which could result in additional impacts to recreational facilities. However, goals and policies contained within General Plan 2035 would ensure adequate park and recreational facilities in Novato. Specifically, Policy LW 2 is aimed at maintaining adequate parks-to-resident ratio to ensure that all residents and neighborhoods are adequately served with open space and recreational opportunities. Therefore, the proposed project would have incremental contribution to cumulative impacts associated with parks and recreation and would not be cumulatively considerable. Cumulative impacts would be less than significant.

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# 4.14 Transportation and Traffic

This section evaluates the potential impacts to the transportation system associated with adoption and implementation of the proposed project. This includes an analysis of the potential for General Plan 2035 and its related actions to increase local and regional traffic volumes, increase hazards due to design features, interfere with emergency access, or conflict with applicable alternative transportation systems. See Appendix E for traffic data and calculations.

## 4.14.1 Setting

### a. Street Classifications

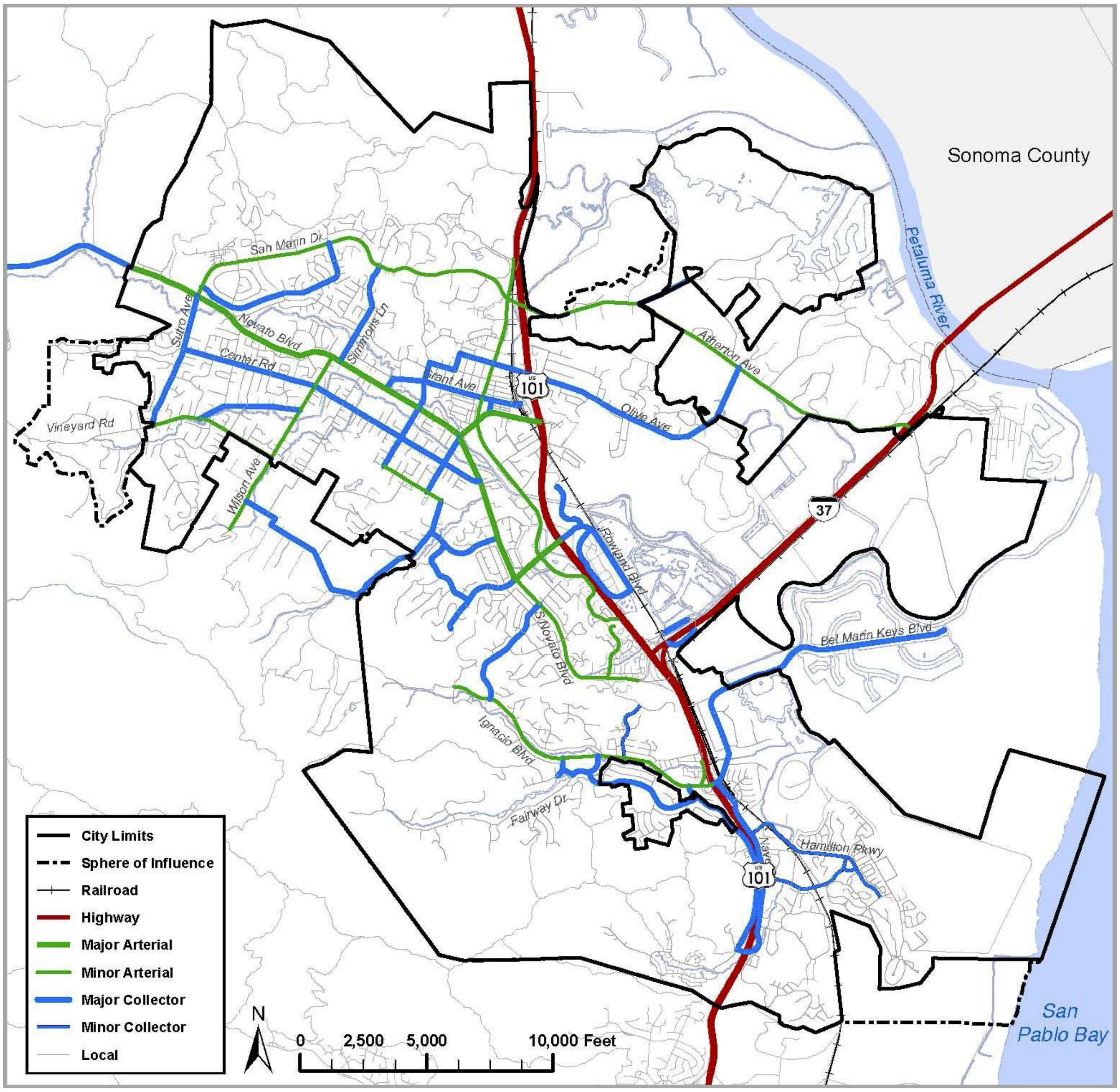
The City of Novato applies three functional classifications to the streets under its jurisdiction. The roadway classification system reflects each roadway's volume, access (number and type of curb cuts and driveway access), posted speed limits, parking, median type, traffic control and other characteristics. The three functional street classifications in Novato, listed in order of highest to lowest volume, are as follows:

- **Arterial.** Novato designates both major and minor arterial streets. A major arterial is commonly defined as a roadway, generally with four through lanes, which may be separated by a median and may have bicycle lanes. Parking is generally prohibited on major arterial roadways. Major arterials typically serve volumes of 10,000 to 35,000 vehicles per day and direct access to fronting parcels is usually limited. Speeds on major arterials typically range from 30 to 45 miles per hour (mph). Examples of major arterial streets include Redwood Boulevard, Novato Boulevard, and San Marin Drive. Minor arterials have generally similar characteristics but typically have two through lanes instead of four, and carry 10,000 to 20,000 vehicles per day. Typical speed limits on minor arterials range from 30 to 40 mph. Examples of minor arterials include Atherton Avenue and Wilson Avenue.
- **Collector.** A collector is generally a two-lane undivided roadway with the primary function of collecting and distributing local traffic. A collector is a relatively low-speed, relatively low-volume street that typically carries 5,000 to 10,000 vehicle trips per day and provides access within and between neighborhoods. Typical speed limits range from 25 to 35 mph. Examples of collector streets include Olive Avenue, Grant Avenue, and Indian Valley Road.
- **Local.** Remaining streets are considered local streets as they serve local traffic, feeding into the collector and arterial streets. Local streets typically have two lanes and usually include parking on both sides, with paved widths of 20 to 40 feet and 25 mph speed limits. The City Council can choose to designate local roads as rural streets to maintain the rural character of certain neighborhoods, allowing reduced pavement width and exclusion of curbs, gutters and/or sidewalks.

The City of Novato is also served by two freeways, defined as access-controlled, divided highways having two or more lanes in each direction. US 101 has five to six mixed-flow lanes through the City. Additionally, a continuous northbound high-occupancy vehicle (HOV) lane exists on US 101 within Novato, and a southbound HOV lane exists between just south of De Long Avenue and the southern City limits. SR 37 has four mixed-flow lanes (two in each direction). US 101 has interchanges at San Marin Drive-Atherton Avenue, DeLong Avenue, Rowland Avenue, Novato Boulevard-SR 37, Ignacio Boulevard-Bel Marin Keys Boulevard, and Alameda del Prado. SR 37 has interchanges at US 101 and Atherton Avenue.

The Novato street network consists of approximately 160 miles of roadways that serve motor vehicle, bicycle, pedestrian and transit circulation. Figure 4.14-1 provides a map of the existing roadway network serving the City.

**Figure 4.14-1 Novato Roadway Network & Street Classification Map**




Source: City of Novato General Plan 2035 Draft

## b. Bicycle and Pedestrian Facilities

Novato residents and visitors walk and bicycle throughout the City for leisure, recreation, and for access to schools, employment sites, transit resources, shopping and other utilitarian purposes. The City's Mediterranean climate and mostly flat topography are conducive to walking and bicycling. Moreover, the City has a well-developed network of bicycle and pedestrian facilities and amenities that provide dedicated access for pedestrians and bicyclists along many of its primary transportation routes. Although the planned pedestrian and bicycle network may not be built out for many more years, and barriers such as US 101 limit access to major destinations, the overall quality of the City's non-motorized transportation system is high.

## Bicycle Facilities

Bicycle facilities in Novato consist of Class I pathways, Class II bike lanes, and Class III bike routes along with support facilities such as bicycle parking, multi-modal transit access and amenities such as showers, changing areas, and storage facilities. The majority of Novato's bikeway system is comprised of Class II Bicycle Lanes. The primary north-south bikeway corridor is along Novato Boulevard between San Marin Drive to just east of Redwood Boulevard. This bikeway is a major regional connector frequently used by recreational cyclists traveling to and from west Marin County. Bike lanes along Redwood Boulevard continue north to east-west bike lanes on Atherton Avenue. Primary east-west bikeways are provided along San Marin Drive, Atherton Avenue, Olive Avenue, Rowland Boulevard, Ignacio Boulevard, Bel Marin Keys Boulevard, and Hamilton Parkway.

### *Bicycle Paths*

Novato has several existing bicycle paths, which are off-street Class I facilities that are also often used by pedestrians. Key bicycle paths include:

- Enfrente Road Connector – Enfrente Road to Redwood Boulevard
- Novato Boulevard Path – Sutro Avenue to Eucalyptus Avenue
- South Novato Boulevard Path – Rowland Boulevard to Gateway Court
- Pacheco Hill Path – Nave Drive/Alameda del Prado intersection to the southern City limits
- SMART Path – completed segments include those from the Atherton SMART Station to Rush Creek Place, Grant Avenue to Novato Creek, Hanna Ranch Road to the Bel Marin Keys area (Hamilton Drive), and the Hamilton SMART Station to State Access Road

There are also several bicycle paths of less than a half-mile in length that link neighborhoods and establish connections to the City's primary bicycle network.

### *Bicycle Lanes*

The majority of Novato's existing bikeway system is comprised of Class II bicycle lanes. The primary north-south bikeway corridor is along Novato and South Novato Boulevards between San Marin Drive to just east of Redwood Boulevard. This bikeway is a major regional connector frequently used by recreational cyclists traveling to and from west Marin County. Bike lanes along Redwood Boulevard continue north to existing and proposed east-west bike lanes on Atherton Avenue. Primary east-west bikeways are provided along San Marin Drive, Atherton Avenue, Olive Avenue, Rowland Boulevard, Ignacio Boulevard, Bel Marin Keys Boulevard and Hamilton Parkway.

### *Bicycle Routes*

Bike routes are on-street, signed Class III bikeways where bicyclists share the roadway with automobiles. Bicycle routes currently exist on several streets throughout the City.

### *Bicycle Parking*

Bicycle racks can be found at various businesses, employment centers, schools, transit stops and parks throughout Novato. Bicycle lockers for long-term bicycle parking can be leased from Caltrans at the Alameda del Prado park-and-ride lot. The park-and-ride lot at Rowland Boulevard has bike lockers available to bicyclists on a first-come, first-served basis to riders who bring their own locks.

Bicycle parking was included as a part of the Grant Avenue Improvement Project. Racks were placed at various locations for access to retail destinations. Space created by reconfiguring curb lines and constructing bulbouts was used to install racks outside the pedestrian travel zone. The City of Novato has adopted official design standards for sidewalk bicycle parking and an ordinance requiring showers, lockers and changing facilities in newly-developed employment centers.

### *Planned Bicycle Facilities*

The 2015 *City of Novato Bicycle/Pedestrian Plan* (City of Novato 2015) includes the plan and vision for the City's future bicycle network. The bike facilities depicted in this document have been carried forth into General Plan 2035. Approximately seven miles of new bike paths, eight miles of new bike lanes, and seven miles of new bike routes are identified within the City. Major bike facilities include completing the remaining segments of the SMART path through the City, a new path along Novato Boulevard from San Marin Drive to the western City limits, and a new path along SR 37 between the SMART path and Atherton Avenue.

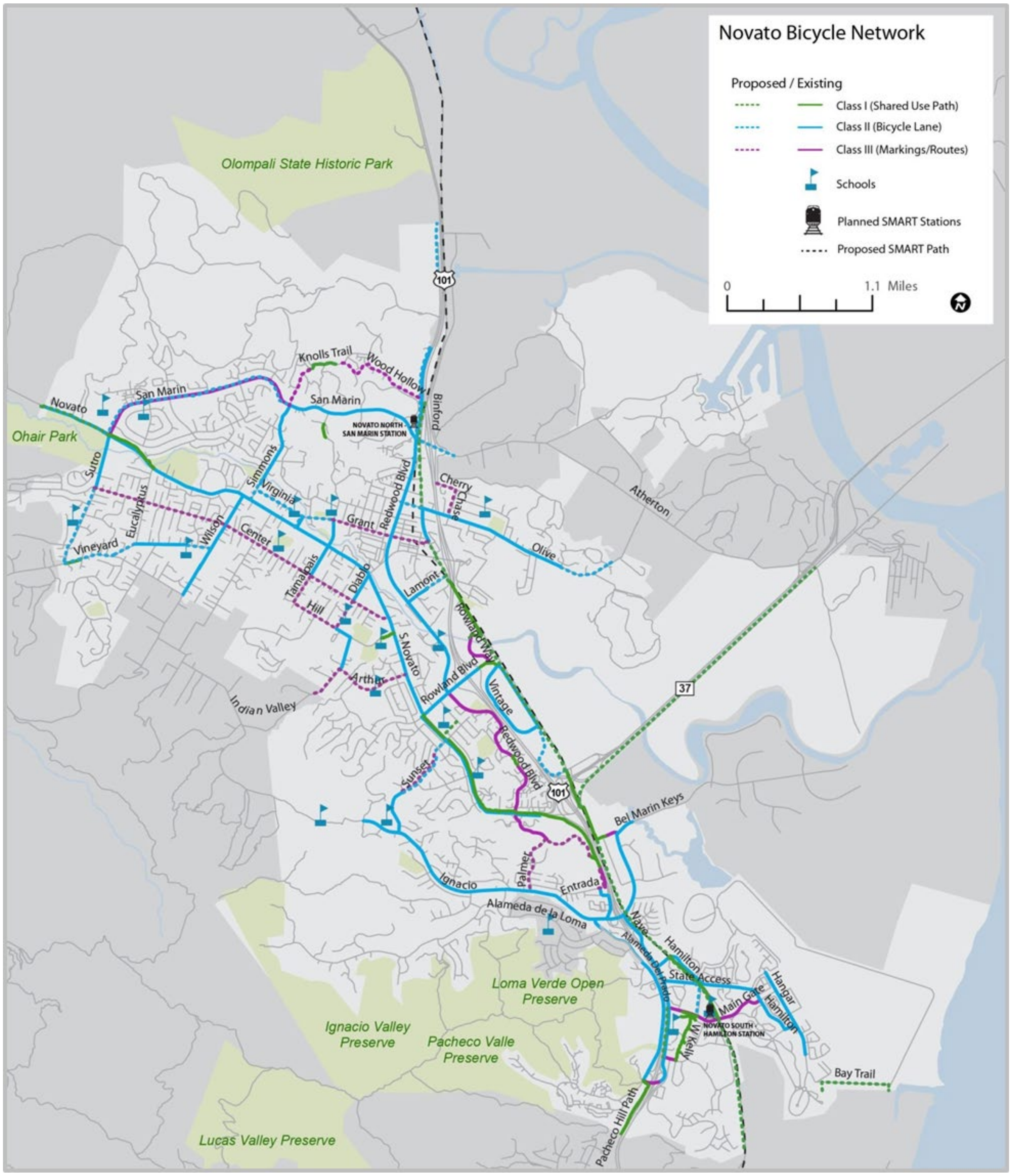
The existing and planned bikeway facilities in the City of Novato are shown on Figure 4.14-2.

## Pedestrian Facilities

The City of Novato has a well-developed network of pedestrian facilities that includes sidewalks, pathways, curb ramps, crosswalks and amenities such as bulbouts, pedestrian scale lighting, benches, transit shelters, street trees, landscape plantings, and decorative paving treatments. Sidewalks are provided on the majority of streets in Novato, with continuous sidewalks and/or multi-use pathways in place along most major arterials, minor arterials, and collector streets. Downtown Novato and surrounding neighborhoods have nearly complete sidewalk coverage, while outlying residential areas have some streets with varying coverage.

In general, sidewalks are constructed of concrete, are at least four to five feet wide, and include either a landscape buffer or parking lane between the sidewalk and vehicle travel lanes. Curb ramps are provided at most intersections and sidewalk transitions. In recent years the City has installed or upgraded curb ramps throughout the community to meet current accessibility standards. Upgraded ramps, which include accessible grades, landings, and tactile inlays, have been installed throughout the downtown area, at intersections along major arterials, in school zones and at select 'high activity' crossings. Bulbouts, pedestrian refuge islands, decorative treatments, landscaping and amenities are provided in downtown and other locations throughout the city. High visibility markings and advanced warning signs are also provided at mid-block crossings on arterials, in school zones and at transit hubs.

**Figure 4.14-2 Existing and Planned Bicycle Facilities**




Source: City of Novato Bicycle/Pedestrian Plan, 2015

## c. Public Transit

### Bus Service

Marin Transit is responsible for providing local transit service within Marin County, including the City of Novato. Although Marin Transit has responsibility for local services, it contracts with other providers including Golden Gate Transit and Whistlestop Wheels to provide local transit services in Novato. Timed bus transfers in Novato currently take place at the transit facility on Redwood Boulevard at Grant Avenue. Most Golden Gate Transit bus stops within the City of Novato have bicycle racks provided. Up to two bicycles can be accommodated on buses.

Golden Gate Transit and Marin Transit serve Novato with local and express bus service linking to Marin and Sonoma County cities, as well as to San Francisco. Transit service in Novato is provided via Routes 35, 49, 54, 56, 58, 70, 71x, 101, and 251. Route descriptions are provided below.

- Routes 49 and 35 provide service within Novato and connect to the Marin Civic Center and downtown San Rafael Transit Center. The routes operate on weekdays at typically one-hour headways, with half-hour headways during peak commute periods in each direction. Route 35 operates with half-hour headways during the weekend in both directions, with Route 49 operating with one-hour headways.
- Route 54 provides service during peak periods in Novato and Marin County with approximately half-hour headways in each direction. It serves San Francisco Civic Center, San Pedro, Terra Linda, Ignacio, San Marin, and downtown Novato.
- Route 56 provides commuter service between Novato and San Francisco, with five southbound morning buses and six northbound evening buses. The route serves the San Marin area and the Rowland Boulevard park and ride lots. Route 58 also provides commuter service between Novato and San Francisco, with four southbound buses during the morning commute and three northbound buses during the return evening commute. The route also serves the downtown Novato transit hub and Hamilton areas.
- Route 70 provides 19 to 20 trips per day in each direction between Novato and San Francisco, with intermediate stops in other Marin County communities and headways of approximately one hour.
- Route 71X connects Novato to Sausalito on weekdays, with 15 buses per day in each direction at approximately one-hour headways.
- Route 101 operates along the US 101 corridor between Sonoma County and San Francisco, with stops in Downtown Novato. Twenty-two buses per weekday serve the northbound and southbound directions with headways of approximately one hour. The route also operates on weekends with twenty-three buses per day in each direction at approximately 30-minute headways.
- Route 251 provides service local service between Novato and Hamilton areas, with approximately one-hour headways.

### SMART Commuter Rail

The Sonoma-Marin Area Rail Transit (SMART) commuter rail system currently operates between San Rafael and the Sonoma County Airport. SMART includes stations at the major population and job centers of the North Bay, including two existing stations in Novato at Atherton Avenue and in the Hamilton area. Commuter rail service is provided by 17 round-trip trains on weekdays and five round-trip trains on weekends. Typical headways during the weekday morning and evening commute periods are 30 minutes, with longer headways during midday, late evening, and weekend periods.

The Novato Downtown SMART Station was completed in December 2019 and is now operational. The station is located near Railroad Avenue at the eastern end of Grant Avenue.

The Transportation Authority of Marin (TAM) also has a partnership with Lyft that provides a discount of up to $5 off rides to and from a SMART station and destinations within Marin through a mobile ridesharing app.

### Paratransit

The transportation needs of the elderly and persons with disabilities in Novato are addressed by demand responsive or 'Dial-A-Ride' paratransit services. EZ Rider partners with the Novato Human Needs Center to provide transportation services for all Novato area residents seven days a week. Novato's Dial-A-Ride service operates from 7:00 AM to 11:00 AM and 3:00 PM to 6:00 PM Monday through Friday and 8:30 AM to 5:00 PM on Saturdays and Sundays. For Tuesdays only the Novato Human Needs Food Pantry Shuttle runs from 1:00 PM to 3:00 PM, and again from 11:00 AM to 2:00 PM on Wednesdays through the Margaret Todd Midday Service. Rides are arranged in advance, up to seven days prior to the trip, with same day reservations allowed if space is available.

Figure 4.14-3 provides a map of existing transit service.

## d. Goods Movement

### Truck Routes

The City of Novato has designated the following truck routes:

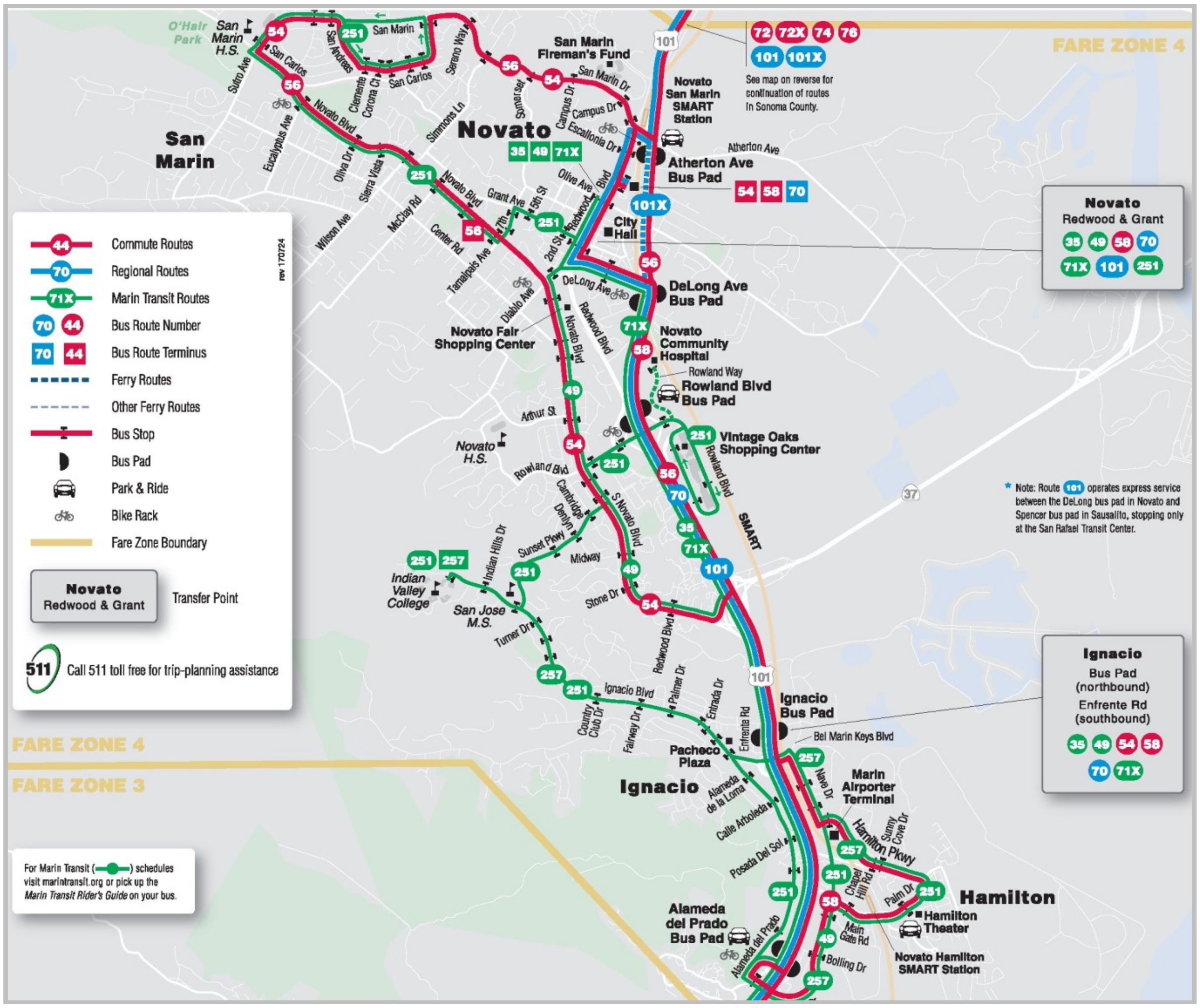
- Redwood Boulevard (from Rowland Boulevard to San Marin Drive)
- Atherton Avenue
- DeLong Avenue (from Redwood Boulevard to US 101)
- Diablo Avenue (easterly of Novato Boulevard)
- Novato Boulevard (northwesterly of Diablo Avenue)
- Rowland Boulevard (from Redwood Boulevard to US 101)
- San Marin Drive

Novato's Municipal Code prohibits any vehicle exceeding the maximum gross weight limit of five tons from traveling or parking on any City street except on streets designated as truck routes except for trips associated with destinations that cannot be reached without using other streets.

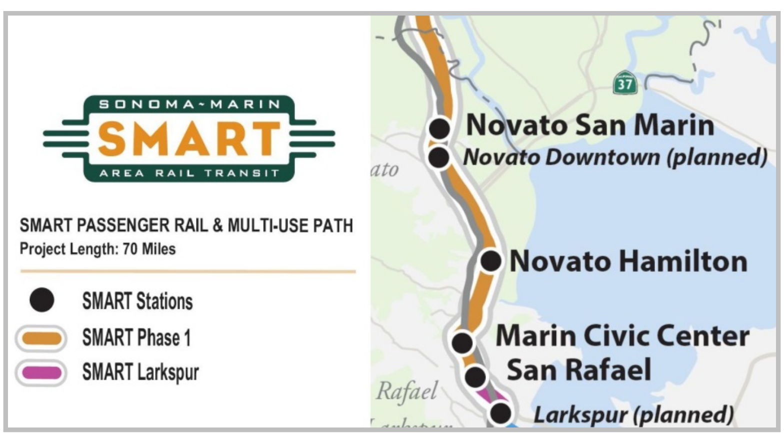
### Rail Freight

The Northwestern Pacific Railroad Company (NWP) is currently operating freight service between Napa and Windsor along tracks owned by SMART. These freight trains typically operate two to four times per week (round trip) during overnight periods when SMART is not running, and pass through the northern portion of Novato between the Ignacio Wye and the northern City limits. There are currently no rail freight users or customers within Novato.

## Figure 4.14-3 Existing Transit Service Maps




Source: Golden Gate Transit, April 2018




Source: SMART, April 2018

## e. Travel Characteristics

### Travel Modes & Commute Times

U.S. Census Bureau data for mode travel to and from places of employment provides general travel characteristics and patterns for the City. As shown in Table 4.14-1, Novato residents have a higher rate of driving alone than the Marin countywide average. However, a higher percentage of people carpool in Novato as compared to the County average. Transit, walk, and bike to work mode shares are also slightly lower in Novato compared to the countywide average. The mean travel time of Novato residents to work is approximately 32 minutes, which is very close to the Marin County average of 31 minutes.

**Table 4.14-1 Travel Mode Comparison for Work Trips**

| Jurisdiction | Drive Alone | Carpool | Transit | Walk | Bicycle | Work at Home | Other |
|---|---|---|---|---|---|---|---|
| Novato | 73% | 11% | 7% | 2% | 1% | 6% | 0% |
| Marin County | 66% | 8% | 10% | 3% | 2% | 10% | 1% |

Source: American Community Survey, 2012-2016 5 Year Estimates

## f. Existing Traffic Operation

### Study Area

*Study Intersections*

The capacity of a street system is typically dependent upon the operation of intersections rather than the segments connecting them since conflicting vehicle movements are concentrated at intersections. Traffic analyses therefore usually focus on the points where two non-local (arterial or collector) streets intersect. The study area for the proposed project’s transportation analysis was selected to include the locations most likely to be impacted by future traffic growth. The study area chosen consists of the following 41 intersections, listed below and shown on Figure 4.14-4.

1. San Marin Drive/Simmons Land
2. San Marin Drive/W Campus Drive
3. San Marin Drive/E Campus Drive
4. Redwood Boulevard/San Marin Drive
5. US 101 S/San Marin Drive
6. US 101 N/Atherton Avenue
7. Redwood Boulevard/Olive Avenue
8. Redwood Boulevard/Grant Avenue
9. Novato Boulevard/San Marin Dr-Sutro Avenue
10. Wilson Avenue/Novato Boulevard
11. Simmons Land/Novato Boulevard
12. Grant Avenue Novato Boulevard
13. 7th St-Tamalpais Avenue/Novato Boulevard
14. Diablo Avenue/Novato Boulevard
15. Redwood Boulevard/Diablo Ave-DeLong Avenue
16. DeLong Avenue/Reichert Avenue
17. US 101 S/DeLong Avenue
18. US 101 N/DeLong Avenue
19. Redwood Boulevard/Lamont Avenue
20. Redwood Boulevard/Landing Court
21. S Novato Boulevard/Center Street
22. S Novato Boulevard/Arthur Street
23. S Novato Boulevard/Rowland Boulevard
24. Redwood Boulevard/Rowland Boulevard
25. US 101 S/Rowland Boulevard
26. US 101 N/Rowland Boulevard
27. Rowland Boulevard/Rowland Way
28. Rowland Boulevard/Vintage Way
29. S Novato Boulevard/Sunset Parkway

30. S Novato Boulevard/Redwood Boulevard
31. Ignacio Boulevard/Alameda del Prado
32. US 101 S/Ignacio Boulevard -Enfrente Road
33. US 101 N/Bel Marin Keys Blvd-Nave Drive
34. Bel Marin Keys Boulevard/Commercial Boulevard
35. Bel Marin Keys Boulevard/Digital Drive
36. US 101 N/Nave Drive
37. Nave Drive/Hamilton Center
38. Nave Drive/N Hamilton Parkway
39. Nave Drive/Main Gate Drive
40. Nave Drive/Bolling Drive
41. Alameda del Prado/Nave Drive (Overpass)

Operation during the weekday AM and PM peak hours was evaluated. These peak hours represent the highest volume hour for each intersection during the peak periods of 7:00 to 9:00 AM and 4:00 to 6:00 PM. Traffic volumes were obtained at most of the study intersections in November 2016. Traffic count data for several intersections on Novato Boulevard (intersections 12 through 14) were obtained in May 2017.

### *Study Corridors*

Several roadway and freeway segments in Novato are part of the Marin County Congestion Management Program (CMP) network, and were included in this project's transportation impact analysis. The Transportation Authority of Marin (TAM), which serves as the region's congestion management agency, has established PM peak hour level of service (LOS) standards for designated roadways in Marin County including the following in Novato:

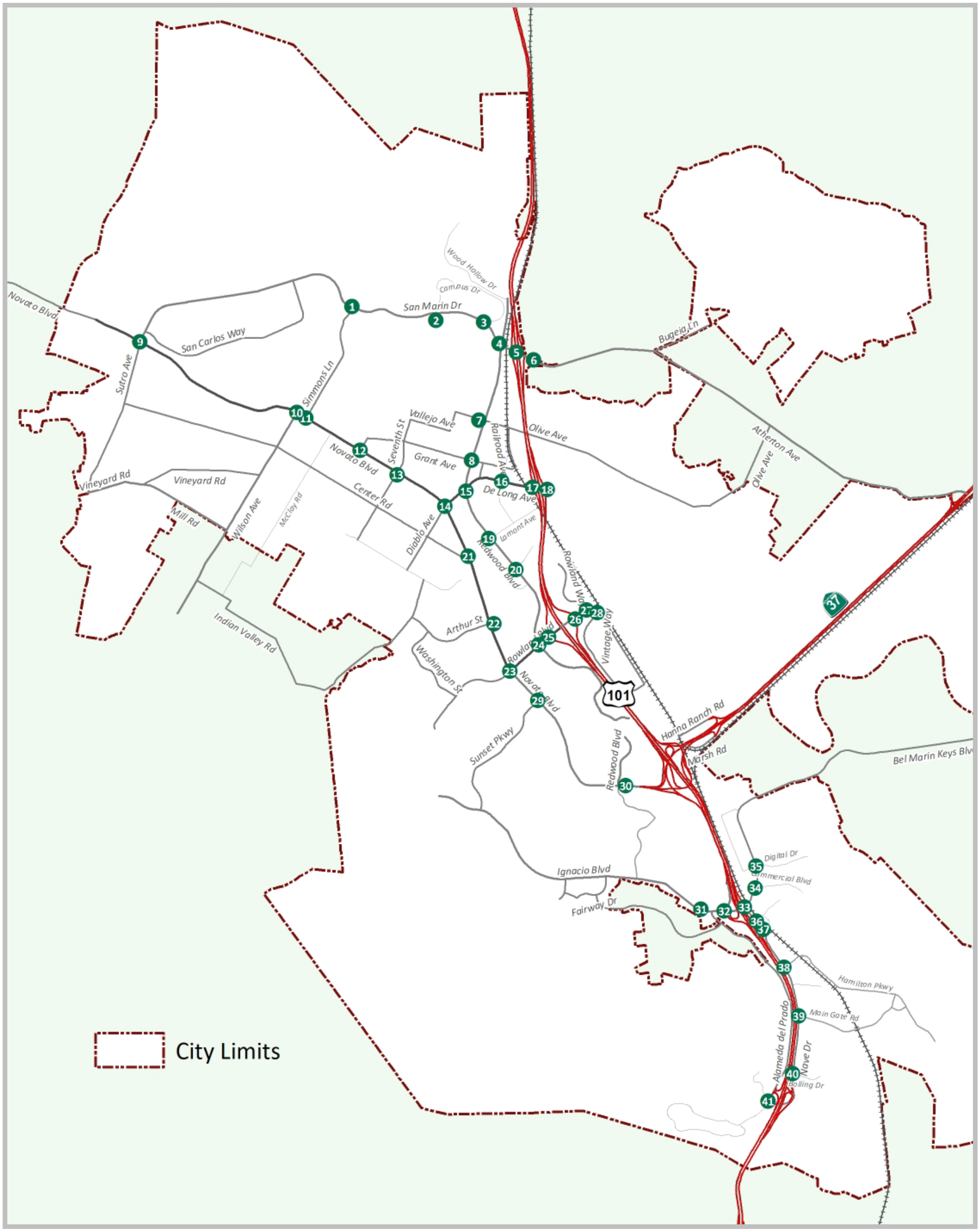
- US 101
- Novato Boulevard
- South Novato Boulevard
- Bel Marin Keys Boulevard

## Level of Service Definitions

Traffic engineers use "level of service" to rank intersection operations using a series of letter designations ranging from LOS A to F based on traffic volumes during peak periods and capacity. Generally, LOS A represents free flow conditions and LOS F represents forced flow or breakdown conditions.

LOS is analyzed using methodologies published in the *Highway Capacity Manual* (HCM) (Transportation Research Board 2000). HCM 2000 was used for intersection analysis because the signal phasing used at several of the study intersections is incompatible with newer methodologies, and in order to maintain consistency with past traffic analyses in the City. This source contains methodologies for various types of intersection control, all of which are related to a measurement of delay in average number of seconds per vehicle. The LOS designation is accompanied by a measure that indicates a level of delay. The ranges of delay associated with each LOS are indicated in Table 4.14-2.

**Figure 4.14-4 Study Intersection Locations**




Source: W-Trans 2018

**Table 4.14-2 Intersection Level of Service Criteria**

| LOS | Signalized Intersections | All-Way Stop-Controlled Intersections |
|---|---|---|
| A | Delay of 0 to 10 seconds. Most vehicles arrive during the green phase, so do not stop at all. | Delay of 0 to 10 seconds. Upon stopping, drivers are immediately able to proceed. |
| B | Delay of 10 to 20 seconds. More vehicles stop than with LOS A, but many drivers still do not have to stop. | Delay of 10 to 15 seconds. Drivers may wait for one or two vehicles to clear the intersection before proceeding from a stop. |
| C | Delay of 20 to 35 seconds. The number of vehicles stopping is significant, although many still pass through without stopping. | Delay of 15 to 25 seconds. Drivers will enter a queue of one or two vehicles on the same approach, and wait for vehicle to clear from one or more approaches prior to entering the intersection. |
| D | Delay of 35 to 55 seconds. The influence of congestion is noticeable, and most vehicles have to stop. | Delay of 25 to 35 seconds. Queues of more than two vehicles are encountered on one or more approaches. |
| E | Delay of 55 to 80 seconds. Most, if not all, vehicles must stop and drivers consider the delay excessive. | Delay of 35 to 50 seconds. Longer queues are encountered on more than one approach to the intersection. |
| F | Delay of more than 80 seconds. Drivers may wait through more than one cycle to clear the intersection. | Delay of more than 50 seconds. Drivers enter long queues on all approaches. |

Source: Highway Capacity Manual (HCM) (Transportation Research Board 2000)

### *Signalized Intersections*

The study intersections that are currently controlled by a traffic signal were evaluated using the signalized methodology from the HCM. This methodology is based on factors including traffic volumes, green time for each movement, phasing, whether or not the signals are coordinated, truck traffic, and pedestrian activity. Average stopped delay per vehicle in seconds is used as the basis for evaluation in this LOS methodology.

### *Unsignalized Intersections*

The study intersections with stop signs on all approaches were analyzed using the “All-Way Stop-Controlled” Intersection methodology from the HCM. This methodology evaluates delay for each approach based on turning movements, opposing and conflicting traffic volumes, and the number of lanes. Average vehicle delay is computed for the intersection overall, which is then related to a Level of Service.

### *Roadway Segments*

The roadway segment Level of Service methodology found in Chapter 17, "Urban Street Segments," of the *Highway Capacity Manual* is the basis of the automobile LOS analysis. This method does not address the capacity of a facility, but rather determines a Level of Service based the calculated percentage of the street’s base free-flow speed. In essence, congestion occurs as traffic volumes increase, and the overall travel speed is reduced due to increased delay. Therefore, the slower the speed, the lower that speed is as a percentage of free-flow speed, and the lower the Level of Service.

The relationship between Level of Service and percentages of free-flow speed is shown in Table 4.14-3.

**Table 4.14-3 Roadway Segment Level of Service Criteria**

| LOS | Travel Speed as a Percentage of Base Free-Flow Speed (%) |
|---|---|
| A | > 85 |
| B | > 67 - 85 |
| C | > 50 - 67 |
| D | > 40 - 50 |
| E | > 30 - 40 |
| F | ≤ 30 |
| Source: Highway Capacity Manual (HCM) 2010 | |

Average speeds on the study roadway segments were determined through use of the Simtraffic software application, which is an extension of the Synchro application used to determine intersection levels of service. The average of ten randomly-seeded Simtraffic runs was taken to obtain average segment speeds, using the same traffic volume, signal operation, and roadway geometry factors used in Synchro.

### *Freeway Segments*

The freeway analysis methodology contained in Chapter 10 of the HCM, “Freeway Facilities,” was used to determine levels of service on US 101. The method analyzes extended lengths of freeway composed of continuously connected basic freeway as well as weaving, merge, and diverge segments, which are collectively referred to as a freeway facility. For each individual segment, the analysis methodologies from the relevant chapters of the HCM, including Chapter 11 “Basic Freeway Segments,” Chapter 12 “Freeway Weaving Segments,” and Chapter 13 “Freeway Merge and Diverge Segments,” were used. The methods use variables such as traffic volumes, geometric configuration of the freeway (i.e., number of lanes, presence of auxiliary lanes, distance between merges and diverges, widths of lanes and shoulders), topography, the percentage of heavy vehicles, and free-flow speeds. These data are used to determine the density of the segment, which is the criterion used for determining freeway LOS. Density is indicative of the travel speed service flow rates and travel demand on a freeway facility, and is measured in the number of passenger cars per mile per lane. The ranges of vehicle density associated with each Level of Service are shown in Table 4.14-4.

**Table 4.14-4 Freeway Segment Level of Service Criteria**

| LOS | Density (Passenger Cars/Mile/Lane) |
|---|---|
| A | ≤ 11 |
| B | >11 - 18 |
| C | > 18 - 26 |
| D | > 26 – 35 |
| E | > 35 – 45 |
| F | > 45 or v/c ratio > 1.00 |
| Source: Highway Capacity Manual (HCM) 2010 | |

Operation of the freeway segments was evaluated based on October 2016 traffic volume data obtained from the Caltrans Performance Measurement System (PeMS). The freeway LOS analysis focuses on the operation of mixed flow lanes (and not carpool lanes).

## Existing Level of Service

### *Existing Intersection Operation*

Existing intersection LOS reflecting year 2016 conditions is summarized in Table 4.14-5. The table summarizes the analyzed weekday AM peak-hour and PM peak-hour conditions. As shown, most intersections meet the City's current LOS standard of LOS D, with the exception of the following three study intersections:

- San Marin Drive/Simmons Lane operates unacceptably at LOS F during the PM peak hour.
- Novato Boulevard/San Marin Drive-Sutro Avenue operates unacceptably at LOS F during the PM peak hour.
- South Novato Boulevard/Redwood Boulevard operates unacceptably at LOS F during the AM peak hour.

**Table 4.14-5 Existing Intersection Levels of Service**

| | | | AM Peak Hour | | PM Peak Hour | |
|---|---|---|---|---|---|---|
| ID | Intersection Name | Control | Delay | LOS | Delay | LOS |
| 1 | San Marin Dr/Simmons Ln | AWSC | 29.9 | D | **74.6** | **F** |
| 2 | San Marin Dr/W Campus Dr | Signal | 4.8 | A | 4.7 | A |
| 3 | San Marin Dr/E Campus Dr | Signal | 1.0 | A | 2.2 | A |
| 4 | Redwood Blvd/San Marin Dr | Signal | 29.5 | C | 38.2 | D |
| 5 | US 101 S/San Marin Dr | Signal | 12.2 | B | 10.1 | B |
| 6 | US 101 N/Atherton Ave | Signal | 13.6 | B | 19.7 | B |
| 7 | Redwood Blvd/Olive Ave | Signal | 25.8 | C | 28.2 | C |
| 8 | Redwood Blvd/Grant Ave | Signal | 14.6 | B | 16.7 | B |
| 9 | Novato Blvd/San Marin Dr-Sutro Ave | AWSC | 23.8 | C | **59.9** | **F** |
| 10 | Wilson Ave/Novato Blvd | Signal | 21.7 | C | 18.2 | B |
| 11 | Simmons Ln/Novato Blvd | Signal | 47.5 | D | 14.1 | B |
| 12 | Grant Ave/Novato Blvd | Signal | 16.6 | B | 13.2 | B |
| 13 | 7th St-Tamalpais Ave/Novato Blvd | Signal | 19.8 | B | 28.8 | C |
| 14 | Diablo Ave/Novato Blvd | Signal | 29.9 | C | 45.3 | D |
| 15 | Redwood Blvd/Diablo Ave-DeLong Ave | Signal | 37.9 | D | 31.5 | C |
| 16 | DeLong Ave/Reichert Ave | Signal | 21.0 | C | 25.1 | C |
| 17 | US 101 S/DeLong Ave | Signal | 10.6 | B | 20.2 | C |
| 18 | US 101 N/DeLong Ave | Signal | 11.5 | B | 29.5 | C |
| 19 | Redwood Blvd/Lamont Ave | Signal | 10.5 | B | 10.8 | B |
| 20 | Redwood Blvd/Landing Ct | Signal | 3.4 | A | 3.4 | A |
| 21 | S Novato Blvd/Center St | Signal | 15.8 | B | 19.9 | B |
| 22 | S Novato Blvd/Arthur St | Signal | 18.2 | B | 13.1 | B |
| 23 | S Novato Blvd/Rowland Blvd | Signal | 49.3 | D | 35.6 | D |

| ID | Intersection Name | Control | AM Peak Hour Delay | AM Peak Hour LOS | PM Peak Hour Delay | PM Peak Hour LOS |
|---|---|---|---|---|---|---|
| 24 | Redwood Blvd/Rowland Blvd | Signal | 20.9 | C | 29.3 | C |
| 25 | US 101 S/Rowland Blvd | Signal | 9.0 | A | 13.0 | B |
| 26 | US 101 N/Rowland Blvd/Park and Ride | Signal | 16.7 | B | 30.4 | C |
| 27 | Rowland Blvd/Rowland Way | Signal | 8.2 | A | 15.2 | B |
| 28 | Rowland Blvd/Vintage Way | Signal | 5.9 | A | 17.6 | B |
| 29 | S Novato Blvd/Sunset Pkwy | Signal | 29.2 | C | 21.5 | C |
| 30 | S Novato Blvd/Redwood Blvd | AWSC | ** | **F** | 33.7 | D |
| 31 | Ignacio Blvd/Alameda del Prado | Signal | 19.1 | B | 16.5 | B |
| 32 | US 101 S/Ignacio Blvd-Enfrente Rd | Signal | 29.8 | C | 23.0 | C |
| 33 | US 101 N/Bel Marin Keys Blvd-Nave Dr | Signal | 20.1 | C | 20.9 | C |
| 34 | Bel Marin Keys Blvd/Commercial Blvd | Signal | 7.3 | A | 16.9 | B |
| 35 | Bel Marin Keys Blvd/Digital Dr | Signal | 12.4 | B | 24.8 | C |
| 36 | US 101 N/Nave Dr | Signal | 13.6 | B | 13.1 | B |
| 37 | Nave Dr/Hamilton Center | Signal | 7.0 | A | 11.7 | B |
| 38 | Nave Dr/N Hamilton Pkwy | Signal | 16.0 | B | 17.0 | B |
| 39 | Nave Dr/Main Gate Dr | Signal | 9.9 | A | 9.7 | A |
| 40 | Nave Dr/Bolling Dr | Signal | 12.7 | B | 16.2 | B |
| 41 | Alameda del Prado/Nave Dr (Overpass) | AWSC | 21.2 | C | 14.8 | B |

Delay is measured in average seconds per vehicle; LOS = Level of Service; AWSC = All Way Stop Controlled ** = delay greater than 120 seconds; **Bold** text = deficient operation

Source: W-Trans

### *Existing Roadway Segment Operation*

Existing roadway segment LOS during the PM peak hour is summarized in Table 4.14-6. As shown, all four corridor segments evaluated are currently operating acceptably.

**Table 4.14-6 Existing PM Peak Hour Roadway Segment Levels of Service**

| Study Corridor | Average Speed | %FFS | LOS |
|---|---|---|---|
| **Novato Boulevard – San Marin Drive to Eucalyptus Avenue** | | | |
| Eastbound | 28 | 80% | B |
| Westbound | 29 | 83% | B |
| **Novato Boulevard –Eucalyptus Avenue to Diablo Avenue** | | | |
| Eastbound | 23 | 66% | C |
| Westbound | 26 | 74% | B |
| **South Novato Boulevard – Diablo Avenue to US 101** | | | |
| Northbound | 25 | 71% | B |
| Southbound | 30 | 86% | A |
| **Bel Marin Keys Drive – US 101 to Digital Drive** | | | |
| Eastbound | 18 | 51% | C |
| Westbound | 19 | 54% | C |

Speed is measured in miles per hour; LOS = Level of Service; %FFS=percent free-flow speed; free-flow speed on all four corridors is 35 mph

Source: W-Trans

*Existing Freeway Operation*

Within the City of Novato, US 101 currently operates at LOS E in the southbound direction during the AM peak hour, and at LOS D in the northbound direction during the PM peak hour. This operation falls within the LOS E standard set forth in the Marin County Congestion Management Program. The freeway operates at LOS C or better in the reverse-commute directions. The freeway segment of SR 37 within Novato currently operates at LOS C or better. The freeway levels of service are summarized in Table 4.14-7.

**Table 4.14-7 Existing PM Peak Hour Freeway Levels of Service**

| Freeway | AM Peak Hour | PM Peak Hour |
|---|---|---|
| **US 101 Northbound** | | |
| Density | 12.0 | 28.2 |
| LOS | LOS B | LOS D[1] |
| **US 101 Southbound** | | |
| Density | 39.1 | 17.7 |
| LOS | LOS E[1] | LOS B |
| **SR 37 Eastbound** | | |
| Density | 7.9 | 18.2 |
| LOS | LOS A | LOS C |
| **SR 37 Westbound** | | |
| Density | 17.4 | 9.8 |
| LOS | LOS B | LOS A |

Density is measured in passenger cars per mile per lane; LOS = Level of Service

[1] Reflects average LOS for US 101 within Novato; some individual components operate at a lower LOS, such as in the northern portion of the City approaching the Marin-Sonoma Narrows during the PM peak hour

Source: W-Trans

The existing conditions level of service calculations, existing lane configuration figures, and traffic volume figures are contained in Appendix E.

## 4.14.2 Regulatory Setting

This section summarizes the Federal, State, Regional, and Local regulations and policies that are relevant to circulation in Novato. This information provides a context for the impact discussion related to consistency of the proposed project with applicable policies, plans, laws and regulations.

### Federal

The US Department of Transportation (USDOT) provides a number of grant programs, primarily for the construction and upgrading of major highways and transit facilities. Many of these grants are administered by the state and regional governments. Use of federal grant funding also invokes the National Environmental Protection Act (NEPA) in some cases. The Federal Highway Administration (FHWA) sets design standards (such as interchange spacing) for interstate highways. The Federal Railroad Administration (FRA) within the USDOT establishes safety rules regarding the operation of railroads (e.g., maximum train speeds, maximum allowed highway crossing blockage time).

The Americans with Disabilities Act (ADA) provides comprehensive rights and protections to individuals with disabilities. The goal of the ADA is to assure equality of opportunity, full participation, independent living and economic self-sufficiency. To implement this goal, the US Access Board has created accessibility guidelines for public rights-of-way. The guidelines address various issues, including roadway design practices, slope and terrain, pedestrian access to streets, sidewalks, curb ramps, street furnishings, pedestrian signals, parking and other components of public rights-of-way.

## State

The California Department of Transportation (Caltrans) has jurisdiction over state highways. Caltrans constructs and maintains all state highways, and sets design standards that are often copied by local governments.

### *Caltrans*

Caltrans is responsible for planning, design, construction and maintenance of all interstate freeways and state routes. Within the study area, US 101 and SR 37 are under the jurisdiction of Caltrans.

In 2001, Caltrans adopted Deputy Directive 64 (Complete Streets – Integrating the Transportation System); a policy directive related to non-motorized travel throughout the state. In October 2008, Deputy Directive 64 was strengthened to reflect changing priorities and challenges. DD 64-R1 states:

> “The Department views all transportation improvements as opportunities to improve safety, access, and mobility for all travelers in California and recognizes bicycle, pedestrian, and transit modes as integral elements of the transportation system. Providing safe mobility for all users, including motorists, bicyclists, pedestrians and transit riders, contributes to the Department's mission/vision: "Improving Mobility Across California.”

### *SB 743*

SB 743, which was signed into law by Governor Brown in 2013, tasked the State Office of Planning and Research (OPR) with establishing new criteria for determining the significance of transportation impacts under CEQA. SB 743 requires the new criteria to “promote the reduction of greenhouse gas emissions, the development of multimodal transportation networks, and a diversity of land uses.” It also states that alternative measures of transportation impacts may include “vehicle miles traveled, vehicle miles traveled per capita, automobile trip generation rates, or automobile trips generated.” SB 743 changes the way that public agencies evaluate the transportation impacts of projects under CEQA, recognizing that roadway congestion, while an inconvenience to drivers, is not itself an environmental impact (see Pub. Resource Code, § 21099, subd. (b)(2)). In addition to new exemptions for projects that are consistent with specific plans, the draft SB 743 guidelines replace congestion-based metrics, such as auto delay and level of service, with Vehicle Miles Traveled as the basis for determining significant impacts, unless the guidelines provide specific exceptions.

### *California’s Complete Streets Act*

The California Complete Streets Act (AB 1358) was signed into law in 2008. AB 1358 requires any substantive revision of the circulation element of a city or county’s general plan to identify how the jurisdiction will safely accommodate the circulation of all users of the roadway including pedestrians, bicyclists, children, seniors, individuals with disabilities, and transit riders, as well as motorists. The current Novato General Plan was adopted prior to the Complete Streets Act. The

Proposed General Plan 2035 places a greater emphasis on bicycle, pedestrian and transit circulation and planned improvements.

## Regional

### *Plan Bay Area 2040*

The current Regional Transportation Plan (RTP) produced by the Metropolitan Planning Commission (MTC) and the Association of Bay Area Governments (AGAG), *Plan Bay Area 2040*, was adopted in July 2017. The Plan sets forth regional transportation and land use policy, and provides capital program planning for all regional, state and federally funded projects. In addition, the Plan provides strategic investment recommendations to improve regional transportation system performance through the year 2040, including investments in regional highway, transit, local roadway, bicycle, and pedestrian projects. Plan Bay Area transportation infrastructure projects in and surrounding Novato include:

- Maintenance of local streets and roads
- Widen Novato Boulevard between Diablo Avenue and Grant Avenue
- Study improvements to SR 37 to accommodate future sea level rise and address congestion
- Bicycle and pedestrian projects including Safe Routes to School elements and closure of bicycle and pedestrian gaps throughout Marin County
- Implement Marin Sonoma Narrows widening of US 101 including HOV lanes
- Improve access to bus and SMART rail stations
- Transit operating and capital improvement program for Marin Transit and Golden Gate Transit
- Improve local transit frequencies and service spans in Marin County

### *Marin County Congestion Management Plan*

The Transportation Authority of Marin (TAM) is designated as both the congestion management agency and the transportation sales tax authority for Marin County. TAM is responsible for managing a variety of transportation projects and programs in Marin County, receiving federal, State, regional, and local funds, working closely with all eleven cities and towns as well as the County. The Marin County Transportation Sales Tax Expenditure Plan was approved by voters as Measure A in November 2004, authorizing a quarter-percent sales tax to generate revenues for transportation needs in Marin County over a twenty-year period.

The 2017 Congestion Management Program (CMP) adopted by TAM has specified PM peak hour level of service criteria for a number of facilities in the County and its member cities, including Novato. Following are the roadways within Novato that are on the CMP roadway network, plus the LOS standard set by the CMP for that facility.

- US 101 (LOS E)
- SR 37 (LOS E)
- Bel Marin Keys Boulevard from US 101 to Commercial Boulevard (LOS D)
- Novato Boulevard from San Marin Drive to Diablo Avenue (LOS D)
- South Novato Boulevard from Diablo Avenue to US 101 (LOS D)

## Local

### *1996 Novato General Plan*

Novato's current adopted General Plan contains circulation-related goals and policies within the Transportation chapter. The chapter is organized around nine objectives that address all modes of transportation and call for the City to provide a balanced, efficient and accessible circulation system. Traffic operation is addressed in TR Policy 4 and TR Program 4.1 as follows.

**TR Policy 4: Level of Service Standards**

- Establish traffic Level of Service (LOS) standards for use in (1) evaluating the impacts of proposed development projects so the project can be redesigned or effective mitigation measures can be implemented, (2) making improvements to the roadway system, and (3) determining appropriate traffic impact fees.

**TR Program 4.1: Establish Traffic Level of Service Standards as follows:**

- At intersections with signals or four-way stop signs: operation at LOS D
- At intersections with stop signs on side streets only: operation at LOS E
- Mitigation measures which reduce side street delay, such as traffic signals, all-way stops and/or center two-way left turn lanes will be considered when LOS F conditions are projected for side street traffic. The volume of traffic should also be considered when evaluating the severity of side street traffic operations.

The proposed project analyzed in this EIR is the 2017 update to the Novato General Plan, referred to as General Plan 2035, as well as the Plan's related actions including development in four focus areas and the Industrial Parks MPA. Following is a summary of the transportation-related policies related to the focus areas and MPA.

**Downtown Focus Area**

- *LU 11: Automobile-Intensive Uses* discourages new auto-intensive uses
- *LU 17: SMART Corridor* encourages installation of the multi-use pathway along the SMART corridor between downtown and the North Novato and Downtown SMART stations
- *LU 18: Shuttle Connection* encourages the establishment of a shuttle between employment centers and the North Novato SMART station
- *LU 19: Redwood Boulevard* supports improvement of multi-modal circulation along Redwood Boulevard
- *LU 24: Pedestrian Alleys* encourages new midblock pedestrian connections

**North Redwood Corridor Focus Area**

- *LU 26: North Redwood Corridor* suggests design guidelines to provide pedestrian and bicycle connections between Sites 4, 5, and 6 and the SMART path, as well as sidewalks and a bicycle path along Redwood Boulevard

**North, North Redwood Corridor Focus Area**

- *LU 27: North, North Redwood Corridor* calls for evaluation and implementation of several circulation improvements including:
    - *Identified improvements to the San Marin Drive/Redwood Boulevard intersection, freeway ramps and Atherton Avenue/Binford Road intersection to assure continued traffic operations which meet the City's level-of-service standards*
    - *The need for an additional southbound lane on Redwood Boulevard between Wood Hollow Drive and San Marin Drive*
    - *In conjunction with redevelopment of Site 7, connection of East Campus Drive to the Rush Creek Landing Road/Redwood Boulevard intersection, including pedestrian and bicycle facilities to promote access by office employees to the SMART station*
    - *Improvements to bicycle, pedestrian and transit facilities along the corridor through City investments or in conjunction with private development*
    - *Preparation and implementation by new development of an employee trip reduction plan*
    - *A funding plan for required roadway improvements in the area, including a determination if an additional area impact fee is necessary for full funding*

**Northwest Quadrant Focus Area**

- *LU 28: Northwest Quadrant Neighborhood* identifies several neighborhood objectives including evaluation of physical modifications and signage to decrease vehicular speeds on Vallejo and Olive Avenues, and evaluation of intersection crossing treatments to improve pedestrian safety and walkability

**Industrial Parks MPA**

- *Section III.E.7 Transportation Demand Management Program* requires Life Sciences Campus development projects to have an approved Transportation Demand Management (TDM) program to achieve no less than a 10 percent reduction in employee vehicular trip generation

Relevant goals, policies, and actions from General Plan 2035 are also discussed in the Impacts and Mitigation Measures section of this EIR.

### *City of Novato Bicycle/Pedestrian Plan*

The *City of Novato Bicycle/Pedestrian Plan*, adopted in 2015, provides for a citywide network of bicycle paths, lanes and routes, along with bicycle-related programs and support facilities. A key goal of the Plan is to make bicycling and walking viable transportation options for people who live, work and recreate in Novato. The Plan contains a number of goals and policies, a needs analysis, a proposed system of bicycle and pedestrian facilities, and guidance on plan implementation.

# 4.14.3 Impact Analysis

## a. Methodology and Significance Thresholds

### Methodology

Following is a description of the methodology applied to the analysis of transportation and circulation impacts. The year 2035 was chosen as the year for the future conditions analysis, matching the planning horizon year of the General Plan.

#### *Study Scenarios*

Weekday AM and PM peak-hour traffic operations were evaluated at the study intersections for the following traffic scenarios:

- Existing Conditions
- Existing plus Project Conditions
- Cumulative (Year 2035) Conditions

The Existing plus Project scenario reflects buildout of General Plan 2035 and related actions including development in the four focus areas and Industrial Parks MPA, and when compared to the Existing Conditions scenario, allows the environmental effects of the project to be discerned. The Cumulative (Year 2035) Conditions scenario includes buildout of the proposed project and also accounts for traffic associated with development potential outside of the Plan Area, and traffic associated with major building vacancies in Novato that are likely to be re-occupied in the future.

In addition to intersection operation, PM peak hour corridor operation was determined on four roadway segments that are on the CMP designated roadway network, and subject to CMP requirements. Traffic operation was also analyzed for US 101 and SR 37 within the City.

This analysis is a program-level analysis of the General Plan 2035 as represented by the Plan's land use map and related actions including potential development in four focus areas and the Industrial Parks MPA. The land use authorized by adoption of the proposed land use plan would be implemented through new private development and revitalization of existing uses. Plan impacts were analyzed based on the incremental traffic increases associated with all General Plan 2035 land use intensity and use changes, including those proposed in the related actions.

#### *Traffic Forecasts*

The added traffic volumes associated with buildout of the proposed project in the City of Novato were obtained from the City of Novato's TRAFFIX-based travel demand model maintained by W-Trans. The model incorporates parcel-specific land use development projections that are reflective of the proposed General Plan 2035 land uses and other adopted regulations such as the City's Hillside and Ridgeline Protection Ordinance. The land use data was supplied to W-Trans by City Staff in April 2017 and verified in October 2019. The traffic associated with buildout of these parcels within Novato in accordance with the proposed General Plan and its related actions was added to existing volumes in order to obtain the applied "Existing plus Project" traffic volumes.

A Cumulative Conditions analysis was also performed to identify potential impacts with buildout of the proposed project, development in the County of Marin surrounding Novato in a manner consistent with the County's General Plan, and re-occupation of several large buildings identified by

City Staff that were vacant at the time that existing traffic volumes were collected. While smaller office and retail vacancies are a typical condition in most cities, these large vacancies were included in the analysis because of their potential to generate substantial traffic volumes upon being re-occupied, potentially affecting the types of circulation improvements needed under cumulative conditions. City Staff collaborated with County of Marin staff to update the land use projections in the County's jurisdiction near the City. Traffic projections from the Marin County travel demand model were also obtained from TAM in order to determine the additional increment of regional traffic growth that could occur on the Novato Boulevard and Atherton Avenue corridors, both of which serve non-local regional traffic passing through the City of Novato. With respect to the applied vacancy adjustments, traffic associated with the following major developments are included in the Cumulative scenario.

- 100 Wood Hollow Drive – 66,180 square feet of office
- Former Fireman's Fund Campus (773, 775, and 777 San Marin Drive) – 607,660 square feet of office
- Sports Authority Vintage Oaks (212 Vintage Way) – 39,000 square feet of retail

The estimated vehicle trip generation associated with the additional development allowed by the proposed General Plan 2035 (including the 500,000 square foot Industrial Parks MPA area), with development in the County of Marin adjacent to the City, and with re-occupation of major vacant sites in the City of Novato is indicated in Table 4.14-8.[1] Trips associated with the proposed project represent the "project" trips applied in the Existing plus Project analysis scenario, with 2,916 added trips during the AM peak hour and 3,896 added trips during the PM peak hour. The combination of these trips with those occurring in the County of Marin adjacent to the City, as well as that associated with re-occupation of major vacant sites in the City of Novato, represent the total added trips applied in the Cumulative scenario. A total of 4,134 added AM peak hour trips and 5,544 additional PM peak hour trips are included in the Cumulative analysis scenario.

### Table 4.14-8 Trip Generation Summary

| | Added Vehicle Trips | |
|---|---|---|
| **Traffic Source** | **AM Peak Hour** | **PM Peak Hour** |
| **City of Novato** | | |
| Proposed Project Added Trips | 2,916 | 3,896 |
| **County of Marin** | | |
| Added Trips from Areas Adjacent to Novato | 511 | 684 |
| **Major Vacancies in City of Novato** | | |
| Added Trips from Re-Occupation of Major Vacant Sites | 707 | 964 |
| **Total Added Cumulative Trips** | **4,134** | **5,544** |

Source: W-Trans

[1] It should be noted that the critical variable in determining significance is the number of peak hour trips added to the surrounding network, rather than the amount of new development. The EIR analysis conservatively-developed trip generation rates that capture a wide range of potential health science tenants ranging from small-scale operations to large campus expansions, as is appropriate for a programmatic general plan EIR. Individual health science applicants may ultimately be able to generate fewer trips per square foot than analyzed. Larger campus-type facilities in particular have the potential to internalize some trips (e.g., by providing onsite dining, services, and/or child care) and can also implement robust TDM measures more easily than smaller tenants. For example, if a specific project were able to provide evidence of a lower per-square-foot trip generation rate, be required by the City to monitor TDM effectiveness and auto trips generated over time, and comply with other development and zoning requirements, it may be possible to allow a larger building size without generating unanticipated trips.

High occupancy vehicle (HOV) lane utilization data was obtained from the *2015 Bay Area Managed Lanes Report* (Caltrans 2015). HOV lane enforcement is in effect in the southbound direction during the AM peak hour and in the northbound direction during the PM peak hour. Traffic volume forecasts for US 101 were determined based on data contained in the *Marin Sonoma Narrows Project Report* (Caltrans 2009). These projections were established using baseline conditions in 2010 and had a horizon of 2030. The year 2030 projections were extrapolated to the year 2035 for the purposes of this EIR using linear growth rates. Future traffic projections for SR 37 were obtained from the *Transportation Concept Report: State Route 37*, Caltrans, 2014. The projected future volumes in this document are for the year 2040, which is beyond the 2035 horizon year assumed for the cumulative conditions analysis, so should be considered somewhat conservative.

General Plan 2035 does not include any major extensions of the City's current arterial and collector street network, though local streets would be added within some of the development projects to be constructed over the course of General Plan buildout. The proposed General Plan 2035 Roadway Network Map, which is the same as the existing roadway network map, is shown on Figure 4.14-1.

### *Significant Impact Criteria*

The following criteria are based on Appendix G of the State CEQA Guidelines. Impacts would be significant if the proposed project would:

1 Conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including, but not limited to intersections, streets, highways, and freeways, pedestrian and bicycle paths, and mass transit

2 Conflict with an applicable congestion management program, including but not limited to level of service standards and travel demand measures, or other standards established by the County congestion management agency for designated roads and highways

3 Result in a change in traffic patterns, including either an increase in traffic levels or a change in location that result in substantial safety risks

4 Substantially increase traffic hazards due to a design feature (e.g. sharp curves or dangerous intersections) or incompatible uses (e.g. farm equipment)

5 Result in inadequate emergency access

6 Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities

## Significance Thresholds

As discussed in Section 1, *Introduction*, VMT was reviewed as part of the General Plan EIR analysis and a VMT Analysis for Novato General Plan Update EIR was completed by Fehr & Peers in April 2018 to provide VMT forecasts for the City as well as describe options for adopting VMT thresholds for future development and transportation projects in Novato (Appendix E). However, the City has elected to apply the level of service criteria for determining an environmental impact in this EIR and wait to implement VMT standards until 2020 once further VMT guidance is available. In addition, in accordance with General Plan 2035 Policy MO 2 the City will consider LOS standards in evaluating the merits of proposed development or traffic infrastructure projects in addition to standards associated with VMT. The following thresholds were used to determine the severity of impacts at analyzed intersections, roadway segments, and freeway segments for this EIR.

- **Intersections.** The City's current General Plan has established LOS as a measure of effectiveness for performance of intersections. Policy MO 2 of the General Plan 2035 carries forward the same LOS standard as the City's current General Plan. Intersections controlled by traffic signals or four-way stop signs have a standard of LOS D, and intersections with stop signs on the side street only have a standard of LOS E. A significant traffic-related impact would occur if implementation of the project would cause intersections to operate below these standards. For the purposes of the proposed project's environmental analysis, at intersections that are already projected to operate below these standards without the project, a significant traffic-related impact is considered to result if the project would cause the intersection's overall delay to increase by 5.0 seconds or more.
- **Roadway Segments.** While the City of Novato's LOS standard is applied to intersections, the LOS standard established by the Transportation Authority of Marin's 2017 Congestion Management Plan applies to roadway corridor segments. A significant traffic-related impact would occur if the project would cause any arterial road segment that is part of the Marin County CMP network to degrade from an acceptable level (LOS D or better) to an unacceptable level (LOS E or F).
- **Freeway Segments.** A significant traffic-related impact would occur if the project would cause freeway operations to degrade from an acceptable level to an unacceptable level. In accordance with the Transportation Authority of Marin's Congestion Management Plan, the applicable threshold for US 101 and SR 37 is LOS E.

## b. Project Impacts and Mitigation Measures

| | |
|---|---|
| **Threshold 1:** | Would the project conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including, but not limited to intersections, streets, highways, and freeways, pedestrian and bicycle paths, and mass transit? |

**Impact T-1 NEW DEVELOPMENT FACILITATED BY THE PROPOSED PROJECT IS EXPECTED TO INCREASE TRAFFIC VOLUMES IN NOVATO, WHICH MAY CONFLICT WITH MEASURES OF EFFECTIVENESS PERTAINING TO MOTOR VEHICLE DELAY AT INTERSECTIONS. INCREASED DELAY TO MOTOR VEHICLE TRAFFIC AT SOME INTERSECTIONS DURING THE AM AND PM PEAK TRAVEL HOURS WOULD CONFLICT WITH TRAFFIC LEVEL OF SERVICE (LOS) STANDARDS. IMPACTS WOULD BE POTENTIALLY SIGNIFICANT.**

The City of Novato has established LOS as a measure of effectiveness for performance of the vehicle circulation system. While the City has not adopted specific performance measures for non-auto modes, an impact assessment of pedestrian, bicycle, and transit travel is included under Impact T-6.

### Impacts to Study Intersections

The transportation analysis includes an assessment of potential peak-hour traffic impacts at 41 study intersections to determine whether increased delay to motor vehicle traffic would conflict with the applicable LOS standards. Table 4.14-9 provides a comparison of LOS at each study intersection under each scenario during both the AM and PM peak hours. LOS calculations and traffic volume figures are contained in Appendix E.

Traffic impacts would be related to growth associated with General Plan 2035, including growth within the four focus areas, and growth within the Industrial Parks MPA area. Given the regional distribution of traffic generated by new development, each of the identified intersection impacts would generally be attributable to multiple sources (i.e., new traffic associated with General Plan 2035 growth as well as growth in the four focus areas and the Industrial Parks MPA). As shown in Table 4.14-9, seven intersections are projected to operate unacceptably under Existing plus Project conditions. Nine intersections are projected to operate unacceptably and/or require mitigation under Cumulative conditions. The net change in delay would exceed the impact threshold when comparing Existing plus Project Conditions with Existing Conditions at all nine intersections. Therefore, potentially significant traffic impacts would occur at the following locations:

- San Marin Drive/Simmons Lane (Intersection #1) would continue to operate unacceptably at LOS F during the PM peak hour, dropping from LOS D to LOS E during the AM peak hour under Existing Plus Project conditions, and further dropping to LOS F during the AM peak hour under Cumulative Conditions. Therefore, this intersection would operate unacceptably as defined in the City's current General Plan and General Plan 2035. The traffic impact would be attributable to General Plan 2035 growth throughout the northern part of the City.
- Redwood Boulevard/San Marin Drive (Intersection #4) would drop from its current acceptable operation of LOS D or better to unacceptable LOS F operation during the PM peak hour under Existing plus Project conditions. This drop in operation would be inconsistent with the City's LOS standard. The traffic impact would be attributable to growth in all four of the focus areas (North, North Redwood Boulevard; North Redwood Boulevard; Northwest Quadrant; and Downtown) as well as General Plan 2035 growth throughout the northern part of the City.
- US 101 South Ramps/San Marin Drive (Intersection #5) would require modifications in order to result in acceptable operation at the adjacent Redwood Boulevard/San Marin Drive intersection.
- US 101 North Ramps/Atherton Avenue (Intersection #6) would have acceptable operation of LOS C or better under Existing and Existing plus Project conditions, but would drop to an unacceptable LOS E during the PM peak hour under cumulative conditions. The project is anticipated to increase average delays by more than five seconds when comparing Existing to Existing plus Project results. This increase in delay would be inconsistent with the City's LOS standard and is cumulatively considerable. The traffic impact would be attributable to growth in all four of the focus areas (North-North Redwood, North Redwood, Northwest Quadrant, and Downtown) as well as General Plan 2035 growth throughout the northern part of the City.
- Novato Boulevard/San Marin Drive-Sutro Avenue (Intersection #9) would continue to operate unacceptably at LOS F during the PM peak hour, and would drop from LOS C to LOS E during the AM peak hour. This drop in operation would be inconsistent with the City's LOS standard. The traffic impact would be attributable to General Plan 2035 growth in the western part of the City.
- Diablo Avenue/Novato Boulevard (Intersection #14) would drop from its current acceptable operation of LOS D or better to unacceptable LOS E operation during the PM peak hour under Existing plus Project conditions. This drop in operation would be inconsistent with the City's LOS standard. The traffic impact would be attributable to growth in the Downtown focus area as well as General Plan 2035 growth throughout the central and western areas of the City.

## Table 4.14-9 Intersection Levels of Service with the Proposed Project

| | | | AM Peak Hour | | | | | | PM Peak Hour | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Existing Conditions | | Existing plus Project | | Cumulative Conditions | | Existing Conditions | | Existing plus Project | | Cumulative Conditions | |
| ID | Intersection Name | Control | Delay | LOS | Delay | LOS | Delay | LOS | Delay | LOS | Delay | LOS | Delay | LOS |
| 1 | San Marin Dr/Simmons Ln | AWSC | 29.9 | D | **46.9** | **E** | **64.6** | **F** | **74.6** | **F** | **101.8** | **F** | ** | **F** |
| 2 | San Marin Dr/W Campus Dr | Signal | 4.8 | A | 4.8 | A | 5.6 | A | 4.7 | A | 6.5 | A | 9.2 | A |
| 3 | San Marin Dr/E Campus Dr | Signal | 1.0 | A | 1.6 | A | 6.4 | A | 2.2 | A | 4.4 | A | 11.9 | B |
| 4 | Redwood Blvd/San Marin Dr | Signal | 29.5 | C | 35.9 | D | 36.4 | D | 38.2 | D | ** | **F** | ** | F |
| 5 | US 101 S/San Marin Dr[1] | Signal | 12.2 | B | 14.8 | B | 26.0 | C | 10.1 | B | 11.7 | B | 21.0 | C |
| 6 | US 101 N/Atherton Ave[1] | Signal | 13.6 | B | 17.9 | B | 25.9 | C | 19.7 | B | 27.6 | C | **66.8** | **E** |
| 7 | Redwood Blvd/Olive Ave | Signal | 25.8 | C | 30.0 | C | 31.4 | C | 28.2 | C | 36.1 | D | 38.8 | D |
| 8 | Redwood Blvd/Grant Ave | Signal | 14.6 | B | 16.8 | B | 17.4 | B | 16.7 | B | 23.4 | C | 25.2 | C |
| 9 | Novato Blvd/San Marin Dr-Sutro Ave | AWSC | 23.8 | C | **41.3** | **E** | **39.9** | **E** | **59.9** | **F** | **92.2** | **F** | ** | **F** |
| 10 | Wilson Ave/Novato Blvd | Signal | 21.7 | C | 24.7 | C | 25.6 | C | 18.2 | B | 20.8 | C | 22.1 | C |
| 11 | Simmons Ln/Novato Blvd | Signal | 47.5 | D | 47.8 | D | 22.3 | C | 14.1 | B | 14.5 | B | 14.8 | B |
| 12 | Grant Ave/Novato Blvd | Signal | 16.6 | B | 17.4 | B | 17.8 | B | 13.2 | B | 13.9 | B | 13.5 | B |
| 13 | 7th St-Tamalpais Ave/Novato Blvd | Signal | 19.8 | B | 20.0 | C | 20.5 | C | 28.8 | C | 30.9 | C | 32.8 | C |
| 14 | Diablo Ave/Novato Blvd | Signal | 29.9 | C | 33.3 | C | 34.9 | D | 45.3 | D | **62.6** | **E** | **71.9** | **E** |
| 15 | Redwood Blvd/Diablo Ave-DeLong Ave | Signal | 37.9 | D | 42.3 | D | 43.2 | D | 31.5 | C | 42.2 | D | 47.2 | D |
| 16 | DeLong Ave/Reichert Ave | Signal | 21.0 | C | 22.0 | C | 22.3 | C | 25.1 | C | 25.0 | C | 26.2 | C |
| 17 | US 101 S/DeLong Ave[1] | Signal | 10.6 | B | 22.6 | C | 24.8 | C | 20.2 | C | 26.9 | C | 23.7 | C |
| 18 | US 101 N/DeLong Ave[1] | Signal | 11.5 | B | 12.3 | B | 12.1 | B | 29.5 | C | 23.9 | C | 25.4 | C |
| 19 | Redwood Blvd/Lamont Ave | Signal | 10.5 | B | 10.6 | B | 10.6 | B | 10.8 | B | 11.1 | B | 11.2 | B |
| 20 | Redwood Blvd/Landing Ct | Signal | 3.4 | A | 6.2 | A | 6.9 | A | 3.4 | A | 5.4 | A | 5.4 | A |
| 21 | S Novato Blvd/Center St | Signal | 15.8 | B | 15.9 | B | 15.9 | B | 19.9 | B | 20.1 | B | 20.1 | C |
| 22 | S Novato Blvd/Arthur St | Signal | 18.2 | B | 17.8 | B | 18.3 | B | 13.1 | B | 13.3 | B | 14.0 | B |
| 23 | S Novato Blvd/Rowland Blvd | Signal | 49.3 | D | 51.4 | D | 51.8 | D | 35.6 | D | 36.7 | D | 41.9 | D |
| 24 | Redwood Blvd/Rowland Blvd | Signal | 20.9 | C | 22.4 | C | 22.3 | C | 29.3 | C | 36.8 | D | 44.7 | D |

| | | | AM Peak Hour | | | | | | PM Peak Hour | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Existing Conditions | | Existing plus Project | | Cumulative Conditions | | Existing Conditions | | Existing plus Project | | Cumulative Conditions | |
| ID | Intersection Name | Control | Delay | LOS | Delay | LOS | Delay | LOS | Delay | LOS | Delay | LOS | Delay | LOS |
| 25 | US 101 S/Rowland Blvd[1] | Signal | 9.0 | A | 11.2 | B | 11.6 | B | 13.0 | B | 17.4 | B | 20.5 | C |
| 26 | US 101 N/Rowland Blvd/Park and Ride[1] | Signal | 16.7 | B | 18.5 | B | 20.0 | B | 30.4 | C | 34.2 | C | 35.3 | D |
| 27 | Rowland Blvd/Rowland Way | Signal | 8.2 | A | 8.3 | A | 8.4 | A | 15.2 | B | 14.8 | B | 15.1 | B |
| 28 | Rowland Blvd/Vintage Way | Signal | 5.9 | A | 9.3 | A | 9.4 | A | 17.6 | B | 20.6 | C | 21.2 | C |
| 29 | S Novato Blvd/Sunset Pkwy | Signal | 29.2 | C | 39.6 | D | 39.9 | D | 21.5 | C | 24.3 | C | 24.3 | C |
| 30 | S Novato Blvd/Redwood Blvd | AWSC | ** | **F** | ** | **F** | ** | **F** | 33.7 | D | **41.1** | **E** | **49.6** | **E** |
| 31 | Ignacio Blvd/Alameda del Prado | Signal | 19.1 | B | 18.9 | B | 19.3 | B | 16.5 | B | 16.5 | B | 16.9 | B |
| 32 | US 101 S/Ignacio Blvd-Enfrente Rd[1] | Signal | 29.8 | C | **57.3** | **E** | **64.0** | **E** | 23.0 | C | 32.1 | C | 33.5 | C |
| 33 | US 101 N/Bel Marin Keys Blvd-Nave Dr[1] | Signal | 20.1 | C | 33.7 | C | 36.9 | D | 20.9 | C | 27.0 | C | 29.0 | C |
| 34 | Bel Marin Keys Blvd/Commercial Blvd | Signal | 7.3 | A | 7.9 | A | 7.9 | A | 16.9 | B | 18.5 | B | 22.5 | C |
| 35 | Bel Marin Keys Blvd/Digital Dr | Signal | 12.4 | B | 12.5 | B | 13.4 | B | 24.8 | C | 50.6 | D | **56.4** | **E** |
| 36 | US 101 N/Nave Dr[1] | Signal | 13.6 | B | 15.9 | B | 16.2 | B | 13.1 | B | 14.7 | B | 15.1 | B |
| 37 | Nave Dr/Hamilton Center | Signal | 7.0 | A | 8.9 | A | 9.0 | A | 11.7 | B | 15.1 | B | 16.9 | B |
| 38 | Nave Dr/N Hamilton Pkwy | Signal | 16.0 | B | 18.3 | B | 18.3 | B | 17.0 | B | 18.6 | B | 19.2 | B |
| 39 | Nave Dr/Main Gate Dr | Signal | 9.9 | A | 13.1 | B | 13.2 | B | 9.7 | A | 15.3 | B | 15.5 | B |
| 40 | Nave Dr/Bolling Dr | Signal | 12.7 | B | 17.5 | B | 17.5 | B | 16.2 | B | 21.7 | C | 22.1 | C |
| 41 | Alameda del Prado/Nave Dr (Overpass) | AWSC | 21.2 | C | 32.1 | D | 33.9 | D | 14.8 | B | 19.3 | C | 19.9 | C |

Delay is measured in average seconds per vehicle; LOS = Level of Service; AWSC = all way stop controlled; ** = delay greater than 120 seconds; **Bold** text = deficient operation; a project is considered to result in a significant impact if it causes LOS to drop below the City's LOS standard, or for intersections already operating below the LOS standard, the project would cause an increase in average vehicle delay of 5.0 seconds or more

[1] Intersection on State Highways under the jurisdiction of Caltrans

Source: W-Trans

- South Novato Boulevard/Redwood Boulevard (Intersection #30) would continue to operate unacceptably at LOS F during the AM peak hour, and would drop from LOS D to LOS E during the PM peak hour. The traffic impact would be attributable to growth in the Downtown focus area as well as growth throughout the central, western, and midwest areas of the City.
- US 101 South Ramps/Ignacio Boulevard-Enfrente Road (Intersection #32) would drop from its current acceptable operation of LOS C to an unacceptable LOS E during the AM peak hour under Existing plus Project conditions. The traffic impact would be attributable to growth in the Industrial Parks MPA area and southwest areas of the City.
- Bel Marin Keys Boulevard/Digital Drive (Intersection #35) would have acceptable operation of LOS D or better under Existing and Existing plus Project conditions, but would drop to an unacceptable LOS E during the PM peak hour under cumulative conditions. The project is anticipated to increase average delays by greater than five seconds when comparing Existing to Existing plus Project results, which is cumulatively considerable. The traffic impact would be attributable to growth in the Industrial Parks MPA area.

Although potentially significant impacts would occur with implementation of the proposed project, General Plan 2035 contains a number of goals and policies that would assist in reducing the negative effects of motor vehicle traffic on Novato's environment. These include:

**Mobility Goal MO 1: Provide a safe and efficient circulation system that accommodates all users and maintains acceptable levels of service.**

*Policies*

- **MO 1: Land Use and Transportation Coordination.** Manage community growth and infrastructure projects so development can be adequately served by transportation facilities.
- **MO 1b: Roadway Improvements.** Adopt a list of improvements (Table CW-2) that accommodate future growth consistent with the General Plan, enabling the roadway system to operate safely and efficiently. Prioritize construction of roadway improvements based on consideration of relevant factors including, but not limited to, funding availability, periodic analysis of traffic service levels, the location of new development, and safety considerations. Explore opportunities for innovative traffic management techniques where appropriate when considering intersection upgrades, such as roundabouts.
- **MO 1e: Traffic Signal Timing.** Optimize traffic signal timing and demand coordination to improve traffic flow and reduce fuel consumption, pollution and greenhouse gas emissions.
- **MO 8: Enhance Multimodal Infrastructure.** When developing plans for new or retrofitted roadways, incorporate infrastructure as appropriate that enhances multimodal circulation in addition to auto circulation, such as sidewalks, pedestrian paths, bike lanes, pedestrian refuge islands, accessible curb ramps, transit shelters, and pedestrian-scale lighting.

**Mobility Goal MO 2: Encourage sustainable mobility systems that reduce dependence on low-occupancy automobiles.**

*Policies*

- **MO 12: Transportation Demand Management.** Promote measures to reduce travel demand. Larger projects with substantial trip generation should implement Transportation Demand Management to reduce traffic impacts.

- **MO 12a: Trip Reduction Program.** Review and amend as necessary the existing Travel Demand Reduction Ordinance applicable to businesses in new or remodeled commercial development.
- **MO 12c: Ride Sharing and Car Sharing Programs.** Facilitate ride sharing programs for employment centers, including City staff, and citywide car-sharing programs.

Nonetheless, even with implementation of these General Plan 2035 goals and policies, impacts are potentially significant and mitigation is required.

## Mitigation Measures

The following mitigation measures would be required to reduce impacts at the nine study intersections to a less than significant level.

### *T-1 Intersection Delay Mitigations*

The following additional intersection improvements are necessary to maintain acceptable operation under Existing plus Project and Cumulative conditions with the proposed project.

- San Marin Drive/Simmons Lane (Intersection #1)
  - Signalize the intersection; restripe both San Marin Drive approaches to include separate left-turn, through, and right-turn lanes.
  - Alternative Mitigation: install a roundabout; the westbound approach would have two lanes, one serving through/right movements and one serving left-turn movements, and the remaining three approaches would have single lanes.
  - The alternative roundabout mitigation may require minor right-of-way acquisitions on one or more intersection corners. Minor right-of-way acquisitions would be subject to project specific environmental review prior to implementation.
- Redwood Boulevard/San Marin Drive (Intersection #4)
  - Widen the SMART railroad overpass to provide space on the westbound approach for two left-turn lanes, two through lanes, and one right-turn lane, as well as bike lanes and a widened sidewalk on the south side of the overpass.
  - Widen the southbound Redwood Boulevard approach to include a left-turn lane, shared left-turn/through lane, and right-turn lane.
  - Restripe the northbound Redwood Boulevard to include a left-turn lane, left-turn/through lane, and two right-turn lanes.
  - Add right-turn overlap signal phasing on the northbound and westbound approaches.
  - This mitigation would entail roadway and overpass widening that could require right-of-way acquisition. Roadway and overpass widening would be subject to project specific environmental review prior to implementation.
  - To make this intersection function acceptably, additional improvements would be needed at the US 101 South Ramps/San Marin Drive intersection, as described in the next bullet.
- US 101 South Ramps/San Marin Drive (Intersection #5)
  - Modify the eastbound San Marin Drive approach (the SMART railroad overpass) to include a through lane, a shared through/right-turn lane, and a right-turn lane.
  - Provide an enhanced bicycle-pedestrian crossing at the on-ramp entrance, including modified signal phasing to include protected pedestrian and bicyclist movements across the ramp.

- This mitigation would entail roadway and overpass widening that could require right-of-way acquisition, and potentially affect areas that appear to be wetlands between the SMART rail corridor and the off-ramp. Roadway and overpass widening and right-of-way acquisition would be subject to project specific environmental review prior to implementation.

- US 101 North Ramps/Atherton Avenue (Intersection #6)
  - Widen the northbound off-ramp to include two left-turn lanes and a shared through/right-turn lane.

- Novato Boulevard/San Marin Drive-Sutro Avenue (Intersection #9)
  - Signalize the intersection.
  - Alternative Mitigation: install a single-lane roundabout with a southbound right-turn "slip" lane.
  - The alternative roundabout mitigation may require minor right-of-way acquisition on one or more intersection corners. Minor right-of-way acquisitions would be subject to project specific environmental review prior to implementation.

- Diablo Avenue/Novato Boulevard (Intersection #14)
  - Restripe the eastbound and westbound Diablo Avenue approaches to include separate left-turn, through, and right-turn lanes.
  - Restripe the northbound Novato Boulevard Approach to include a left-turn lane, through lane, and through/right-turn lane.
  - Widen and modify southbound Novato Boulevard to include dual left-turn lanes and a shared through/right-turn lane.
  - Modify the signal phasing to protected left-turns on all approaches plus a westbound right-turn overlap phase.
  - The mitigation may require minor right-of-way acquisition on Novato Boulevard to the northwest of the intersection. Minor right-of-way acquisitions would be subject to project specific environmental review prior to implementation.

- South Novato Boulevard/Redwood Boulevard (Intersection #30)
  - Signalize the intersection.
  - Alternative Mitigation: install a single-lane roundabout with an eastbound right-turn "slip" lane.
  - The alternative roundabout mitigation may require minor right-of-way acquisition on one or more intersection corners. Minor right-of-way acquisitions would be subject to project specific environmental review prior to implementation.

- US 101 South Ramps/Ignacio Boulevard-Enfrente Road (Intersection #32)
  - On the southbound US 101 "loop" off-ramp, extend the length of the dual right-turn pockets to 500 feet.
  - Optimize signal timing on the coordinated Ignacio Boulevard-Bel Marin Keys Boulevard corridor.

- Bel Marin Keys Boulevard/Digital Drive (Intersection #35)
  - Restripe the westbound approach to include a left-turn lane and a left-turn/through/right-turn lane, and modify the signal to operate with split phasing in the eastbound and westbound directions.

## Significance After Mitigation

Table 4.14-10 summarizes mitigation options at each impacted intersection and shows the level of significance after mitigation. Impacts to peak-hour traffic delays under Existing plus Project and Cumulative 2035 conditions with the proposed project could be mitigated at all nine of the study intersections that are projected to operate at unacceptable levels. However, because several of the mitigations require improvements in areas that are beyond the control or jurisdiction of the City of Novato and the City cannot guarantee their implementation, and mitigation options would be subject to funding and/or site-specific physical constraints potentially including right-of-way acquisition and wetlands as indicated, impacts to three Caltrans intersections and one City intersection that is dependent on improvements at the adjacent Caltrans intersection would be considered significant and unavoidable.

In addition to the impacts at Novato intersections discussed above there may be secondary impacts associated with implementation of Mitigation Measure T-1. Intersection improvements that may have potential secondary impacts are identified in Table 4.14-10. Specific intersections that may have secondary impacts include San Marin Drive/Simmons Lane (Intersection #1), Redwood Boulevard/San Marin Drive (Intersection #4), US 101 South Ramps/San Marin Drive (Intersection #5), Novato Boulevard/San Marin Drive-Sutro Avenue (Intersection #9), Diablo Avenue/Novato Boulevard (Intersection #14), and South Novato Boulevard/Redwood Boulevard (Intersection #30). Secondary impacts at these intersections would result from right-of-way acquisition for roundabout improvements, roadway and overpass widening. Right-of-way acquisition in Novato may impact biological resources, such as potential wetlands between the SMART corridor and off ramp at US 101 South Ramps/San Marin Drive (Intersection # 5). Secondary impacts to biological resources, including wetlands, would be reduced with implementation of Mitigation Measures BIO-1 through BIO-5 would ensure that impacts from acquisition of right-of-way would incorporate protection of sensitive species, prepare biological studies for acquisition areas that are undeveloped, prepare a biological resources inventory, protect nesting birds, and protect wildlife movement corridors. Secondary noise impacts from construction of mitigation measures listed above may impact nearby noise sensitive receptors. However, implementation of Mitigation Measure N-1 to implement noise reduction techniques would ensure that construction would not affect nearby noise sensitive receptors.

## Table 4.14-10 Intersection Level of Service with Mitigation

| Intersection | Peak Hour | Peak Hour LOS: Existing Conditions LOS Delay | Existing + Project LOS Delay | Ex + Project Mitigated LOS Delay | Cumulative Conditions LOS Delay | Cumulative Mitigated LOS Delay | Impact Findings: Mitigation | Level of Significance with Mitigation |
|---|---|---|---|---|---|---|---|---|
| 1. San Marin Drive/Simmons Lane | AM | 29.9<br>D | **46.9**<br>**E** | 17.7<br>B | **64.6**<br>**F** | 19.4<br>B | Signalize intersection; restripe both San Marin Drive approaches to include separate left-turn, through, and right-turn lanes.<br>Alternative Mitigation: install a roundabout; the westbound approach would have two lanes, one serving through/right movements and one serving left-turn movements, and the remaining three approaches would have single lanes. One quadrant of the roundabout would have dual circulating lanes.[2] | Less than Significant with Mitigation |
| | PM | **74.6**<br>**F** | **101.8**<br>**F** | 20.3<br>C | **<br>**F** | 22.3<br>C | | |
| 4. Redwood Boulevard/San Marin Drive | AM | 29.5<br>C | 35.9<br>D | 28.5<br>C | 36.4<br>D | 30.5<br>C | Widen the SMART railroad overpass to provide space on the westbound approach for two left-turn lanes, two through lanes, and one right-turn lane, as well as bike lanes and a widened sidewalk on the south side of the overpass.[2]<br>Widen the southbound Redwood Boulevard approach to include a left-turn lane, shared left-turn/through lane, and right-turn lane.<br>Restripe the northbound Redwood Boulevard to include a left-turn lane, left-turn/through lane, and two right-turn lanes.<br>Add right-turn overlap signal phasing on the northbound and westbound approaches.<br>To make this intersection function acceptably, additional improvements would be needed at the US 101 South Ramps/San Marin Drive intersection (described below).<br>The City cannot guarantee provision of a feasible mitigation, as this mitigation is complex, requiring the widening of an overpass, and requires the approval of improvements at an adjacent intersection which is under the jurisdiction of Caltrans. | Significant and Unavoidable[1] |
| | PM | 38.2<br>D | **<br>**F** | 42.3<br>D | **<br>**F** | 48.0<br>D | | |

| Intersection | Peak Hour | Peak Hour LOS: Existing Conditions LOS Delay | Existing + Project LOS Delay | Ex + Project Mitigated LOS Delay | Cumulative Conditions LOS Delay | Cumulative Mitigated LOS Delay | Impact Findings: Mitigation | Level of Significance with Mitigation |
|---|---|---|---|---|---|---|---|---|
| 5. US 101 South Ramps/San Marin Drive | AM | 12.2<br>B | 14.8<br>B | 22.9<br>C | 26.0<br>C | 26.5<br>C | Modify the eastbound San Marin Drive approach (the SMART railroad overpass) to include a through lane, a shared through/right-turn lane, and a right-turn lane.<br>Provide an enhanced bicycle-pedestrian crossing at the on-ramp entrance, including modified signal phasing to include protected pedestrian and bicyclist movements across the ramp.<br>This mitigation is needed in order to result in acceptable operation at the adjacent Redwood Boulevard/San Marin Drive intersection, and the interchange overall.<br>The City cannot guarantee provision of a feasible mitigation, as this Intersection is under Caltrans jurisdiction and improvement options are complex, requiring the widening of an overpass. | Significant and Unavoidable[1] |
| | PM | 10.1<br>B | 11.7<br>B | 18.9<br>B | 21.0<br>C | 22.4<br>C | | |
| 6. US 101 North Ramps/Atherton Avenue | AM | 13.6<br>B | 17.9<br>B | 31.3<br>C | 25.9<br>B | 32.0<br>C | Widen the northbound off-ramp to include two left-turn lanes and a shared through/right-turn lane.<br>While there appears to be sufficient space to widen the off-ramp, the City cannot guarantee provision of a feasible mitigation, as this ramp and Intersection are under the jurisdiction of Caltrans. | Significant and Unavoidable[1] |
| | PM | 19.7<br>B | 27.6<br>C | 32.9<br>C | **66.8**<br>**E** | 36.4<br>D | | |
| 9. Novato Boulevard/San Marin Drive-Sutro Avenue | AM | 23.8<br>C | **41.3**<br>**E** | 23.9<br>C | **39.9**<br>**E** | 26.4<br>C | Signalize the intersection.<br>Alternative Mitigation: install a single-lane roundabout with a southbound right-turn "slip" lane. [2] | Less than Significant with Mitigation |
| | PM | **59.9**<br>**F** | **92.2**<br>**F** | 25.9<br>C | ******<br>**F** | 28.7<br>C | | |

| Intersection | Peak Hour | Existing Conditions LOS Delay | Existing + Project LOS Delay | Ex + Project Mitigated LOS Delay | Cumulative Conditions LOS Delay | Cumulative Mitigated LOS Delay | Mitigation | Level of Significance with Mitigation |
|---|---|---|---|---|---|---|---|---|
| 14. Diablo Avenue/Novato Boulevard | AM | 29.9 C | 33.3 C | 27.2 C | 34.9 C | 28.6 C | Restripe the eastbound and westbound Diablo Avenue approaches to include separate left-turn, through, and right-turn lanes.<br>Restripe the northbound Novato Boulevard Approach to include a left-turn lane, through lane, and through/right-turn lane.<br>Widen and modify southbound Novato Boulevard to include dual left-turn lanes and a shared through/right-turn lane.[2]<br>Modify the signal phasing to provide protected left turns on all approaches plus a westbound right-turn overlap phase. | Less than Significant with Mitigation |
| | PM | 45.3 D | **62.6 E** | 36.4 D | **71.9 E** | 38.6 D | | |
| 30. South Novato Boulevard/ Redwood Boulevard | AM | ** **F** | ** **F** | 45.0 D | ** **F** | 47.6 D | Signalize the intersection.<br>Alternative Mitigation: install a single-lane roundabout with an eastbound right-turn "slip" lane. [2] | Less than Significant with Mitigation |
| | PM | 33.7 D | **41.1 E** | 17.4 B | **49.6 E** | 17.6 B | | |
| 32. US 101 South Ramps/Ignacio Boulevard-Enfrente Road | AM | 29.8 C | **57.3 E** | 48.6 D | **64.0 E** | 52.3 D | On the southbound US 101 "loop" off-ramp, extend the length of the dual right-turn pockets to 500 feet, and optimize signal timing on the coordinated Ignacio Boulevard-Bel Marin Keys Boulevard corridor.<br>While there appears to be sufficient space to lengthen the off-ramp turn pockets, the City cannot guarantee provision of a feasible mitigation, as this ramp and Intersection are under the jurisdiction of Caltrans. | Significant and Unavoidable[1] |
| | PM | 23.0 C | 32.1 C | 31.9 C | 33.5 C | 33.3 C | | |
| 35. Bel Marin Keys Boulevard/Digital Drive | AM | 12.4 B | 15.5 B | 13.0 B | 13.4 B | 11.6 B | Restripe the westbound approach to include a left-turn lane and a left-turn/through/right-turn lane, and modify the signal to operate with split phasing in the eastbound and westbound directions. | Less than Significant with Mitigation |
| | PM | 24.8 C | 50.6 D | 27.4 C | **56.4 E** | 27.4 C | | |

Delay is measured in average seconds per vehicle; LOS = Level of Service; ** = delay greater than 120 seconds; **Bold** text = deficient operation

[1] Indicates significant and unavoidable impacts since prescribed mitigations require improvements on Caltrans facilities that are outside of the City's jurisdiction and may not be permitted.

[2] Indicates a potential secondary impact from implementation of the mitigation measure.

Source: W-Trans

## Overall Impacts

In summary, impacts to intersection LOS would be reduced to a less than significant level at the following five intersections.

- San Marin Drive/Simmons Lane (Intersection #1)
- Novato Boulevard/San Marin Drive-Sutro Avenue (Intersection #9)
- Diablo Avenue/Novato Boulevard (Intersection #14)
- South Novato Boulevard/Redwood Boulevard (Intersection #30)
- Bel Marin Keys Boulevard/Digital Drive (Intersection #35)

While impacts at the following four remaining intersections could be mitigated to achieve acceptable LOS, because the mitigations require improvements to be constructed in areas that are under the jurisdiction of Caltrans and outside of the City of Novato's control, the ability to implement them is uncertain and the impacts are considered significant and unavoidable. While the impacts are significant and unavoidable, the proposed General Plan does identify the mitigation measures needed to alleviate the impacts, and the City will continue to collaborate with Caltrans in pursuing their completion. The four intersections are:

- Redwood Boulevard/San Marin Drive (Intersection #4)
- US 101 South Ramps/San Marin Drive (Intersection #5, requires accompanying mitigation at the adjacent Caltrans-controlled intersection)
- US 101 North Ramps/Atherton Avenue (Intersection #6)
- US 101 South Ramps/Ignacio Boulevard-Enfrente Road (Intersection #32)

It should be noted that intersections #5, #6, and #32 may be reduced to a less than significant level with Caltrans approval for intersection improvements. However, to make a less than significant determination in this Program EIR at these intersections, Caltrans approval would be necessary since these intersections are beyond the control or jurisdiction of the City of Novato. Because of the programmatic nature of this EIR, coordination with Caltrans has not yet been initiated and approval of the intersection improvements is not feasible at the time of EIR preparation. Therefore, impacts are conservatively assumed to be significant and unavoidable.

| | |
|---|---|
| **Threshold 2:** | Would the project conflict with an applicable congestion management program, including but not limited to level of service standards and travel demand measures, or other standards established by the County congestion management agency for designated roads and highways? |

**Impact T-2 NEW DEVELOPMENT FACILITATED BY THE PROPOSED PROJECT IS EXPECTED TO INCREASE TRAFFIC VOLUMES IN NOVATO, POTENTIALLY LEADING TO NON-COMPLIANCE WITH THE STANDARDS SET FORTH IN THE COUNTY OF MARIN CONGESTION MANAGEMENT PROGRAM. REDUCED VEHICLE SPEEDS BY 2035 WOULD CONFLICT WITH THE ROADWAY SEGMENT LOS STANDARD ON BEL MARIN KEYS BOULEVARD. IMPACTS WOULD BE POTENTIALLY SIGNIFICANT.**

The following roadway and freeway segments in Novato are part of the Marin County CMP network, and subject to the PM peak hour LOS standards set forth in the CMP.

- Novato Boulevard – San Marin Drive to Eucalyptus Avenue
- Novato Boulevard – Eucalyptus Avenue to Diablo Avenue
- South Novato Boulevard – Diablo Avenue to US 101
- Bel Marin Keys Boulevard – US 101 to Digital Drive
- US 101 – within City limits
- SR 37 – within City limits

### Impacts to CMP Designated Arterial Corridors

The transportation analysis includes an assessment of potential PM peak hour traffic impacts on the four CMP-designated arterial roadway segments in the City of Novato to determine whether implementation of the proposed project would reduce average travel speeds such that the applicable LOS D standard would be exceeded.

Three of the four corridors are projected to operate acceptably under both Existing plus Project and Cumulative conditions. The Bel Marin Keys Boulevard segment is projected to operate unacceptably in the westbound direction under Existing plus Project and Cumulative conditions, with a projected drop in average vehicle speeds of five miles per hour compared to Existing conditions, and a drop in operation from LOS C to LOS E. The traffic growth on Bel Marin Keys that contributes to this impact is predominantly associated with the Industrial Parks MPA component of the proposed project. This would be a potentially significant impact.

Table 4.14-11 provides a comparison of LOS on each corridor under each scenario during the PM peak hour.

**Table 4.14-11 PM Peak Hour Roadway Segment Levels of Service with the Proposed Project**

| Roadway Segment | Existing Conditions | | | Existing plus Project | | | Cumulative Conditions | | |
|---|---|---|---|---|---|---|---|---|---|
| Direction of Travel | Speed | % FFS | LOS | Speed | % FFS | LOS | Speed | % FFS | LOS |
| **Novato Blvd – San Marin Dr to Eucalyptus Ave** | | | | | | | | | |
| Eastbound | 28 | 80% | B | 28 | 80% | B | 27 | 77% | B |
| Westbound | 29 | 83% | B | 25 | 71% | B | 22 | 63% | C |
| **Novato Blvd – Eucalyptus Ave to Diablo Ave** | | | | | | | | | |
| Eastbound | 23 | 66% | C | 20 | 57% | C | 20 | 57% | C |
| Westbound | 26 | 74% | B | 26 | 74% | B | 25 | 71% | B |
| **South Novato Blvd – Diablo Ave to US 101** | | | | | | | | | |
| Eastbound | 25 | 71% | B | 21 | 60% | C | 20 | 57% | C |
| Westbound | 30 | 86% | A | 29 | 83% | B | 29 | 83% | B |
| **Bel Marin Keys Blvd – US 101 to Digital Dr** | | | | | | | | | |
| Eastbound | 18 | 51% | C | 17 | 49% | D | 15 | 43% | D |
| Westbound | 19 | 54% | C | **14** | **40%** | **E** | **14** | **40%** | **E** |
| **With Mitigation T-1** | | | | | | | | | |
| Eastbound | – | – | – | 17 | 49% | D | 17 | 49% | D |
| Westbound | – | – | – | 15 | 43% | D | 15 | 43% | D |

Speed is measured in miles per hour; LOS = Level of Service; % FFS=percent free-flow speed; free-flow speed on all four corridors is 35 mph; **Bold** text = deficient operation; shaded rows reflect conditions with intersection mitigations

Source: W-Trans

## Impacts to CMP Freeway Segments

The analysis includes an assessment of PM peak hour traffic impacts on the US 101 and SR 37 freeway segments within the City of Novato to determine whether implementation of the General Plan and its related actions would cause operation to drop below the PM peak hour thresholds established in the CMP. The CMP identifies an LOS E threshold for US 101 and an LOS D threshold for SR 37.

Both US 101 and SR 37 are projected to operate within the level of service parameters established by the County of Marin CMP under both Existing plus Project and Cumulative conditions. The project's impact would therefore be less than significant.

Table 4.14-12 provides a comparison of freeway LOS under each scenario.

### Table 4.14-12 PM Peak Hour Freeway Levels of Service with the Proposed Project

| Roadway Segment | Existing Conditions | | | Existing plus Project | | | Cumulative Conditions | | |
|---|---|---|---|---|---|---|---|---|---|
| Direction of Travel | Speed | Density | LOS | Speed | Density | LOS | Speed | Density | LOS |
| **US 101 Northbound** | | | | | | | | | |
| Northbound | 55.6 | 28.2 | D | 52.3 | 29.8 | D | 46.5 | 33.3 | D |
| Southbound | ≥65.0 | 17.7 | B | ≥65.0 | 19.7 | C | ≥65.0 | 21.8 | C |
| **SR 37** | | | | | | | | | |
| Eastbound | ≥65.0 | 18.2 | C | ≥65.0 | 19.6 | C | ≥65.0 | 21.7 | C |
| Westbound | ≥65.0 | 9.8 | A | ≥65.0 | 10.5 | A | ≥65.0 | 11.3 | B |

Density is measured in passenger cars per mile per lane; LOS = Level of Service

Results reflect average conditions for the length of US 101 within Novato; some individual segments operate at a lower LOS, such as in the northern portion of the City approaching the Marin-Sonoma Narrows

Source: W-Trans

The City of Novato General Plan 2035 contains a number of goals and policies that would assist in reducing the negative effects of motor vehicle traffic on the CMP roadway network. These include:

**Mobility Goal MO 1: Provide a safe and efficient circulation system that accommodates all users and maintains acceptable levels of service.**

*Policies*

- **MO 1: Land Use and Transportation Coordination.** Manage community growth and infrastructure projects so development can be adequately served by transportation facilities.
- **MO 1b: Roadway Improvements.** Adopt a list of improvements (Table CW-2) that accommodates future growth consistent with the General Plan, enabling the roadway system to operate safely and efficiently. Prioritize construction of roadway improvements based on consideration of relevant factors including, but not limited to, funding availability, periodic analysis of traffic service levels, the location of new development, and safety considerations. Explore opportunities for innovative traffic management techniques where appropriate when considering intersection upgrades, such as roundabouts.
- **MO 1e: Traffic Signal Timing.** Optimize traffic signal timing and demand coordination to improve traffic flow and reduce fuel consumption, pollution and greenhouse gas emissions.

**Mobility Goal MO 2: Encourage sustainable mobility systems that reduce dependence on low-occupancy automobiles.**

*Policies*

- **MO 12: Transportation Demand Management.** Promote measures to reduce travel demand. Larger projects with substantial trip generation should implement Transportation Demand Management to reduce traffic impacts.
- **MO 12a: Trip Reduction Program.** Review and amend as necessary the existing Travel Demand Reduction Ordinance applicable to businesses in new or remodeled commercial development.
- **MO 12c: Ride-Sharing and Car-Sharing Programs.** Facilitate ride sharing programs for employment centers,  including City staff, and citywide car-sharing programs.

**Mobility Goal MO 3: Support local and regional transit that is efficient, convenient and safe.**

*Policies*

**MO 13: Improved Transit.** Work with the Marin Transit District to provide improved headways, longer service hours, expanded service areas, and safe, convenient, and comfortable facilities throughout the City.

**MO 16: SMART Rail.** Work with transportation agencies to create safe, convenient and integrated transit services to maximize use of the rail service, when feasible. Improve connectivity to the SMART stations and bicycle/pedestrian path.

**MO 17: Park and Ride.** Support construction of park and ride facilities to increase transit ridership and carpooling.

**Mobility Goal MO 5: Take an influential role in shaping and implementing regional transportation decisions.**

*Policy*

**MO 23: Regional Transportation Planning.** Participate in regional transportation planning efforts to further Novato's transportation objectives.

Even with implementation of these General Plan 2035 goals and policies, impacts are potentially significant and mitigation is required.

## Mitigation Measures

Impacts to the Bel Marin Keys Boulevard corridor under Cumulative 2035 conditions with the project could be alleviated with implementation of the intersection modifications that have already been identified in Mitigation Measure T-1. This would improve corridor operation by making two of the critical intersections along the corridor operate more efficiently (US 101 South Ramps/Ignacio Boulevard-Enfrente Road and Bel Marin Keys Boulevard/Digital Drive). With these intersection modifications, the Bel Marin Keys Boulevard corridor is projected to operate acceptably at LOS D under Existing plus Project and Cumulative conditions.

Implementation of the General Plan 2035 policies cited above would also help to maintain acceptable operation on the CMP network by shifting more travel to non-auto modes including bus and SMART commuter rail, facilitating ride-sharing and car-sharing programs, and promoting transportation demand management and trip reduction programs.

## Significance After Mitigation

Implementation of Mitigation Measure T-1 would be required to mitigate impacts to the Bel Marin Keys Boulevard corridor. However, as described above under Impact T-1, mitigation, including that at the US 101 South Ramps/Ignacio Boulevard-Enfrente Road intersection, requires improvements in areas under the jurisdiction of Caltrans and beyond control of the City of Novato, and the City cannot guarantee their implementation. Therefore, while the projected traffic operation associated with the proposed project would remain compliant with standards on most of the designated CMP roadways within Novato, mitigation to achieve compliance on the Bel Marin Keys Boulevard corridor cannot be assured, and the resulting impact is considered significant and unavoidable.

| **Threshold 3:** | Would the project result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that result in substantial safety risks? |
|---|---|

### Impact T-3 THE PROPOSED PROJECT WOULD NOT RESULT IN A CHANGE IN AIR TRAFFIC PATTERNS OR SAFETY RISKS PERTAINING TO AIR TRAFFIC. IMPACTS TO AIR TRAFFIC WOULD BE LESS THAN SIGNIFICANT.

Gnoss Field is located in the County of Marin near the northeast corner of the City of Novato. The runway approach zones are oriented in a roughly northwest/southeast alignment that minimizes takeoff and landing activity over properties within the City's boundaries. The general aviation airport is primarily surrounded by open space and wetland areas. Gnoss Field Airport has a Referral Area two miles from the airport property line, which includes portions of northern Novato. However, General Plan 2035 contains Land Use Policy 32a which states that development in the Referral Area will be referred to the County Airport Land Use Commission. The City of Novato General Plan 2035 and its related actions do not propose any land uses that could disrupt air traffic patterns. Therefore, impacts would be *less than significant* and no mitigation measures are required.

General Plan 2035 also includes the following goal and policies that help to reinforce the relationship between the City and Gnoss Field.

**Land Use Goal LU 2: Establish clear limits to urban development outside the Novato City Limits**

*Policies*

**LU 32: County Airport Planning.** Continue to monitor the County's planning efforts for Gnoss Field Airport to ensure that the health and safety of Novato residents are protected.

**Mobility Goal MO 6: A local airport with minimal off-site impacts.**

*Policies*

**MO 24: Gnoss Field.** Encourage the maintenance of Gnoss Field as a general aviation airport, consistent with the Gnoss Field Airport Land Use Plan. Support safety improvements and oppose improvements that could increase noise impacts to Novato residents and businesses.

**MO 24a: Review Planning Documents.** Continue to monitor the environmental effects of Gnoss Field by reviewing and responding, as appropriate, to all EIRs and related planning documents.

## Mitigation Measures

Impacts would be less than significant; therefore, mitigation is not required.

| **Threshold 4:** | Would the project substantially increase traffic hazards due to a design feature (e.g. sharp curves or dangerous intersections) or incompatible uses (e.g. farm equipment)? |
|---|---|

**Impact T-4 THE PROPOSED PROJECT IS A PROGRAM-LEVEL PLAN THAT DOES NOT DIRECTLY ADDRESS PROJECT-LEVEL DESIGN FEATURES. ROADWAY IMPROVEMENTS AND SITE ACCESS MEASURES WOULD BE DESIGNED AND REVIEWED IN ACCORDANCE WITH CITY STANDARDS. IMPACTS WOULD BE LESS THAN SIGNIFICANT.**

General Plan 2035 and its related implementing actions consist of a program-level plan that does not directly address project-level design features or building specifications. The City of Novato maintains improvement standards that guide the construction of new transportation facilities to minimize design hazards for all users of the system. Through the environmental and entitlement review process, land use proposals that would add traffic to streets not designed to current standards are evaluated. If needed, mitigation measures are identified and the project is conditioned to construct or provide funding for an improvement that would minimize or eliminate the hazard. Typical improvements include shoulder widening, adding turn pockets, adding sidewalks or crosswalks, realigning sharp curves, prohibiting certain turning movements, and signalizing intersections, among other measures. New and upgraded roadways needed to accommodate new development will be designed according to applicable Federal, State, and local design standards. Development and infrastructure projects in Novato would be required to comply with the General Plan 2035, Municipal Code, and applicable State and local regulations. As a result, and in consideration of the proposed General Plan's policies regarding infrastructure safety, the project's impacts are considered to be *less than significant* and no mitigation measures would be required.

The General Plan 2035 establishes the following goals and policies that are intended to result in roadway designs that safely accommodate all users:

**Mobility Goal MO 1: Provide a safe and efficient circulation system that accommodates all users and maintains acceptable levels of service.**

*Policies*

**MO 8: Enhance Multimodal Infrastructure.** When developing plans for new or retrofitted roadways, incorporate infrastructure as appropriate that enhances multimodal circulation in addition to auto circulation, such as sidewalks, pedestrian paths, bike lanes, pedestrian refuge islands, accessible curb ramps, transit shelters, and pedestrian-scale lighting.

**MO 8a: Design Standards.** Revise the development standards of the Municipal Code to include complete streets design principles to aid in the design and assessment of new or retrofitted roadways. Revised design standards shall be drafted in a manner providing flexibility to address a wide range of street and neighborhood contexts.

**MO 9: Traffic Safety.** Improve the safety of the roadway system.

**MO 9a: Accident Analysis.** Periodically analyze the locations of traffic accidents to identify problems and use this information to set priorities for improvements as a part of the City's Capital Improvement Program.

**Goal MO 4: Provide a safe and convenient bicycle and pedestrian network that accommodates all ages and abilities.**

**MO 20: Safe and Convenient Pedestrian Facilities.** Promote, provide and maintain a safe and convenient pedestrian system, including consideration of lighting, sidewalk condition, road surface conditions, roadway crossings, access points, signage, shade landscaping and street furniture.

**MO 20a: New Development and City Projects.** Require new development projects to include a sidewalk, path or shoulder on all property street frontages as deemed appropriate by City staff, and routinely include projects to close gaps in the pedestrian system on existing streets through the City's Capital Improvement Program.

**MO 20b: Safety Enhancements.** Provide pedestrian safety enhancements where appropriate and feasible, such as bulb-outs, separated pedestrian paths, high-visibility signs and markings, pedestrian warning signals, and other amenities in areas with high volumes of pedestrian traffic or safety concerns.

## Mitigation Measures

Impacts would be less than significant; therefore, no mitigation is required.

| **Threshold 5:** | Would the project result in inadequate emergency access? |
|---|---|

### Impact T-5 THE PROPOSED PROJECT IDENTIFIES CIRCULATION IMPROVEMENTS AND POLICIES THAT WILL SUPPORT EMERGENCY ACCESS. IMPACTS WOULD BE LESS SIGNIFICANT.

Implementation of the proposed project would result in increased development, would result in new roadways, and would increase the number of users on the city's transportation system. As shown in Tables 4.14-9, 4.14-10, and 4.14-11, implementation of the proposed project is projected to result in LOS D or better operation at all study intersections and CMP-designated arterial corridors with implementation of the identified mitigations, which is an indicator that the roadway network is functioning sufficiently to allow drivers to react to emergency response vehicles (i.e., pull over), and for emergency responders to be able to maneuver effectively. One potential area of concern is the Bel Marin Keys Boulevard corridor, which would require mitigation in order to maintain LOS D operation, but the ability to implement the mitigation (namely, improvements to the US 101 South Ramps/Ignacio Boulevard-Enfrente Road intersection) is uncertain as discussed under Impact T-1. Consideration was given to whether the LOS E operation on Bel Marin Keys Boulevard under unmitigated cumulative conditions could adversely affect emergency response. This particular corridor is characterized as a five-lane arterial street including center turn lanes. Such a configuration allows emergency responders to use the center turn lane for travel during responses (with lights and siren), even if the street's through traffic lanes are congested. Emergency responders would also be able to briefly maneuver into the opposing direction of traffic if needed, as is commonly done at busy intersections where auto drivers have no space to pull over. Therefore, given the configuration of the Bel Marin Keys corridor, emergency access would be adequately maintained even without implementation of Mitigation Measure T-1.

In addition to maintaining traffic flows that facilitate emergency response, General Plan Policy MO 1e calls for advanced signal technologies that would also include signal preemption to assist emergency responders. Policy MO 4 calls for street continuity and additional roadway connections that will help to create multiple routes for emergency response. Safety and Hazards policy SH 7b calls for the City to identify the essential facilities needed to respond to a disaster.

General Plan 2035 and its related actions are program-level documents that do not directly address project-level components that will be required to maintain adequate emergency access. City of Novato staff, including emergency responders, review all development applications to ensure that applicable safety codes are met, including provisions for adequate access for emergency responders and response vehicles. Given the anticipated traffic operation upon implementation of the proposed project, configuration of key arterial streets such as Bel Marin Keys Boulevard, established procedures for reviewing project-level emergency access needs, and in consideration of General Plan 2035 policies affecting emergency response, the proposed project's impacts are considered to be *less than significant* and no mitigation measures would be required.

General Plan 2035 establishes the following goals and policies that will help promote effective emergency response on the City's circulation system:

**Mobility Goal MO 1: Provide a safe and efficient circulation system that accommodates all users and maintains acceptable levels of service.**

*Policies*

- **MO 1b: Roadway Improvements.** Adopt a list of improvements (Table CW-2) that accommodates future growth consistent with the General Plan, enabling the roadway system to operate safely and efficiently. Prioritize construction of roadway improvements based on consideration of relevant factors including, but not limited to, funding availability, periodic analysis of traffic service levels, the location of new development, and safety considerations. Explore opportunities for innovative traffic management techniques where appropriate when considering intersection upgrades, such as roundabouts.
- **MO 1e: Traffic Signal Timing.** Optimize traffic signal timing and demand coordination to improve traffic flow and reduce fuel consumption, pollution and greenhouse gas emissions.
- **MO 5: Continuation of Streets.** Facilitate the continuation of streets and bicycle and pedestrian paths through developments, wherever reasonable and feasible, to distribute traffic, improve emergency response options and connect neighborhoods.

**Safety and Hazards Goal SH 1: Maintain high levels of public safety and emergency preparation.**

*Policy*

- **SH 7b: Emergency Facilities.** Identify essential emergency facilities and critical utilities and ensure that they will function in the event of a disaster, eliminate hazardous features and identify alternative facilities if needed. Work with utilities, health providers and school districts to ensure their continued operations and coordination in the event of a disaster.

## Mitigation Measures

Impacts would be less than significant; therefore, no mitigation is required.

| **Threshold 6:** | Would the project conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities? |
|---|---|

**Impact T-6 THE PROPOSED PROJECT SUPPORTS THE GOALS AND POLICIES IDENTIFIED IN APPLICABLE PLANS REGARDING COMPLETE STREETS, PUBLIC TRANSIT, BICYCLE FACILITIES, AND PEDESTRIAN FACILITIES. THIS IMPACT WOULD BE LESS THAN SIGNIFICANT.**

The new development potential under the proposed project would generate new transit riders, bicyclists, and pedestrians. General Plan 2035 emphasizes multimodal circulation needs, ensuring that the City's mobility needs are considered regardless of travel mode. General Plan 2035 includes goals and policies that provide for an integrated network of bicycle and pedestrian facilities, as well as facilities that support and encourage transit use through collaboration with transit operators including Marin Transit and SMART, for all users, including the mobility-impaired. The four focus areas (North-North Redwood, North Redwood, Northwest Quadrant, and Downtown) also include policies aimed at improving pedestrian and bicycle connectivity and safety.

In addition to ensuring that new development occurs in a manner that supports all travel modes, General Plan 2035 includes goals and policies that support enhancement of the City's existing circulation infrastructure to better accommodate non-auto travel modes. General Plan 2035 includes policies regarding complete streets in compliance with State requirements, and supports both the implementation of the current Bicycle & Pedestrian Master Plan as well as completing updates to the Bicycle & Pedestrian Master Plan over time. The proposed bikeway network included in General Plan 2035 is consistent with the City's current Bicycle & Pedestrian Master Plan, and is shown in Figure 4.14-5.

While the City currently has no adopted standards for measuring the performance of transit, bicycle, and pedestrian systems, Policy MO 7a calls for the City to establish these types of standards and monitor performance over time.

Given the substantial level of guidance contained in the goals and policies General Plan 2035 Mobility chapter regarding complete streets, public transit, bicycle facilities, and pedestrian facilities, including emphasis on ensuring that new development and infrastructure identified in General Plan 2035 as well as the four focus areas and Industrial Parks MPA be designed with a multimodal focus, impacts to non-auto modes would be *less than significant*. General Plan 2035 would support adopted policies, plans, and programs regarding public transit, bicycle, and pedestrian facilities and would not decrease the performance or safety of such facilities.

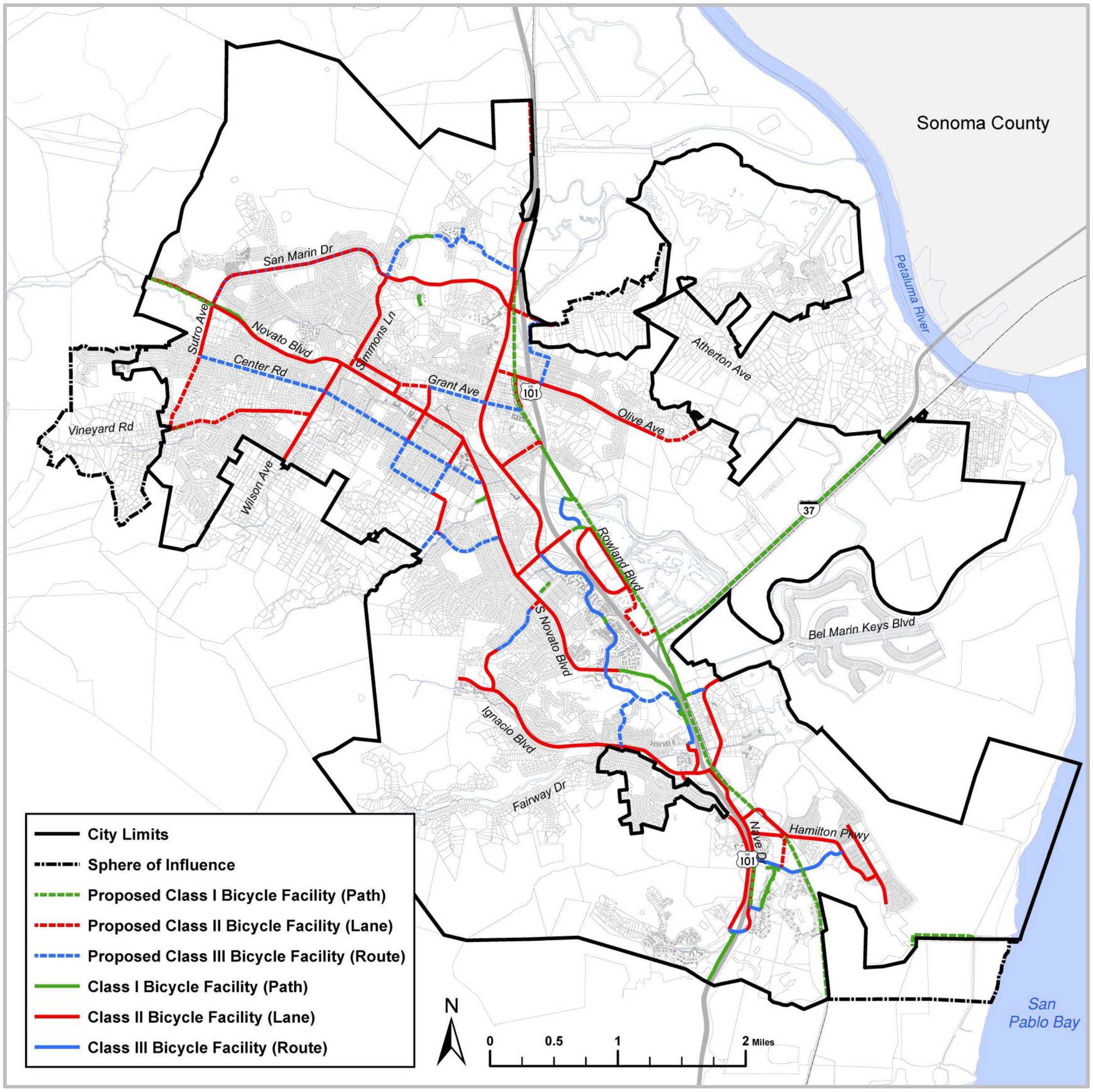
The proposed project includes goals and policies aimed at facilitating travel by public transit, walking and bicycling including the following:

**Mobility Goal MO 1: Provide a safe and efficient circulation system that accommodates all users and maintains acceptable levels of service.**

*Policies*

- **MO 7: Design for Complete Streets.** Incorporate Complete Streets practices in the planning, design and operation of the City's circulation network, where feasible, consistent with the other objectives, policies and programs of the General Plan.

## Figure 4.14-5 General Plan 2035 Proposed Bikeways




Source: City of Novato General Plan 2035 Draft

- **MO 7a: Performance Standards.** Establish a set of performance standards for multimodal circulation, monitoring performance over time and through the development review process. Such performance standards may include multimodal level of service “grades” such as the 2010 *Highway Capacity Manual* or through establishment of a checklist set of criteria.
- **MO 8: Enhance Multimodal Infrastructure.** When developing plans for new or retrofitted roadways, incorporate infrastructure as appropriate that enhances multimodal circulation in addition to auto circulation, such as sidewalks, bike lanes, pedestrian refuge islands, accessible curb ramps, transit shelters, and pedestrian-scale lighting.
- **MO 8b: Pedestrian and Bicycle Facilities.** Incorporate pedestrian and bicycle facilities into the design and construction of roadway improvements where practicable, in accordance with the adopted *Bicycle and Pedestrian Master Plan*. Construct bike facilities according to the standards established by Caltrans and/or other nationally recognized design standards consistent with good engineering practices, adjusting as necessary to minimize impacts to environmentally sensitive areas.

**Mobility Goal MO 3: Support local and regional transit that is efficient, convenient and safe.**

- **MO 13: Improved Transit.** Work with the Marin Transit District to provide improved headways, longer service hours, expanded service areas, and safe, convenient, and comfortable facilities throughout the City.
- **MO 13a: Implement Plans.** Work with the Marin Transit District to implement and periodically update local transit assessments and improvement plans such as the Novato Transit Needs Assessment (2011) and the Novato Community-Based Transportation Plan (2015).
- **MO 14: Transit Facilities.** Encourage use of public transit through improvements to supporting facilities at transit stops and park and ride lots, including but not limited to new or improved shelters, lighting, “next bus” rider information technology, bicycle parking, and enhanced pedestrian facilities surrounding transit stops.
- **MO 14a: Bus Shelters and Benches.** Encourage attractive, well-lighted and comfortable bus shelters or benches placed in convenient locations that are compatible with surrounding neighborhoods.
- **MO 14b: City Projects.** Identify appropriate locations for bus stops, benches and shelters whenever possible and practical in City Capital Improvement Projects. Consider enhanced facilities in key areas serving a large ridership.
- **MO 15: Transit Improvements in New Development.** Encourage and where possible require the provision of bus stops, bus shelters, benches, turnouts, and related facilities in major new commercial, industrial, residential, and institutional developments that might be served by transit when supported by transit agencies.
- **MO 16: SMART Rail.** Work with transportation agencies to create safe, convenient and integrated transit services to maximize use of the rail service, when feasible. Improve connectivity to the SMART stations and bicycle/pedestrian path.
- **MO 16a: Expand Access.** Coordinate with and support efforts of SMART and TAM in seeking opportunities to fund and construct improvements that expand multimodal access to Novato’s rail stations.
- **MO 16b: Linkages from Stations.** Coordinate with Marin Transit to ensure that effective transit linkages are in place between SMART stations and the City’s primary activity and employment centers.

- **MO 16c: Multi-Use Path.** Coordinate closely with SMART to ensure that the planned on- and off-street segments of the SMART multi-use path safely and conveniently tie into the City's existing and planned bicycle and pedestrian network.

**Mobility Goal MO 4: Provide a safe and convenient bicycle and pedestrian network that accommodates all ages and abilities.**

- **MO 18: Comprehensive Bicycle Network.** Establish and maintain a bicycle network that is consistent with the adopted Bicycle/Pedestrian Plan.
- **MO 18a: Bicycle/Pedestrian Plan.** Periodically update the City's Bicycle/Pedestrian Plan.
- **MO 18b: Route Maps.** Post information depicting Novato's bicycle routes on the City's website. To the extent practical, also provide copies of route maps and/or links to cell phone applications identifying local bicycle routes.
- **MO 18c: Safety Programs.** Continue the bicycle safety programs offered by the Police Department and the Safe Routes to School Program. Work with schools and community organizations to expand both youth and adult cyclist training and orientation programs.
- **MO 18d: Traffic Signal Detection.** As intersections are improved on adopted bicycle routes, ensure that traffic signals include bicycle detectors that function for both steel and non-steel framed bicycles as practicable.
- **MO 18f: Marin Bicycle Advisory Committee.** Continue to participate in the Transportation Authority of Marin's Bicycle and Pedestrian Advisory Committee.
- **MO 18g: Funding.** Utilize grant funding and other means, as appropriate, to acquire rights-of-way needed for a comprehensive bike route system and to provide bike racks and other bicycle-related facilities.
- **MO 20: Safe and Convenient Pedestrian Facilities.** Promote, provide and maintain a safe and convenient pedestrian system, including consideration of lighting, sidewalk condition, road surface conditions, roadway crossings, access points, signage, shade landscaping, and street furniture.
- **MO 20a: New Development and City Projects.** Require new development projects to include a sidewalk, path or shoulder on all property street frontages as deemed appropriate by City staff, and routinely include projects to close gaps in the pedestrian system on existing streets through the City's Capital Improvement Program.
- **MO 20b: Safety Enhancements.** Provide pedestrian safety enhancements where appropriate and feasible such as bulb-outs, separated pedestrian paths, high-visibility signs and markings, pedestrian warning signals, and other amenities in areas with high volumes of pedestrian traffic or safety concerns.
- **MO 20c: Traffic Signal Timing for Pedestrians.** Continue as appropriate to review traffic signal timing to ensure adequate crossing times for all users at signalized intersections.
- **MO 21: School Traffic and Circulation.** Collaborate with the schools to identify and prioritize transportation improvements that strengthen pedestrian and bicycle safety for students traveling to and from schools.
- **MO 21a: Safe Routes to School Plan.** Assist with the preparation and updating of Safe Routes to School (SR2S) plans for schools that serve the Novato population.
- **MO 21b: New and Existing Development.** As part of the development review process, ensure, as legally permissible, that new and existing development projects that are substantially

renovated provide bicycle and pedestrian improvements to facilitate the implementation of adopted Safe Routes to School plans.

- **MO 21c: Funding.** Actively pursue grants and other funding sources to complete improvements identified in Safe Routes to School plans.
- **MO 22: Accessibility Improvements.** Create an accessible circulation system that is consistent with guidelines established by the Americans with Disabilities Act (ADA), allowing mobility-impaired users such as the disabled and seniors to safety and effectively travel within and beyond the City.
- **MO 22a: Identify Access Barriers.** As staffing resources are available, review transportation corridors to identify barriers encountered by persons with disabilities, including locations where there are not ADA-compliant curb cuts and ramps, and address such obstacles in the Capital Improvement Program to the extent that funding is available.
- **MO 22c: Eliminate Access Barriers.** Continue to make accessibility improvements that eliminate barriers created by utility infrastructure (such as poles that obstruct accessibility).

## Mitigation Measures

Impacts would be less than significant; therefore, no mitigation is required.

# 4.15 Tribal Cultural Resources

This section evaluates potential effects on tribal cultural resources related to implementation of the proposed project.

## 4.15.1 Setting

The project lies within an area traditionally occupied by the Coast Miwok. A full discussion of the prehistoric and ethnographic setting of the region is presented in Section 4.4, *Cultural Resources*.

### a. Regulatory Setting

#### Federal

No existing federal regulations pertain to tribal cultural resources within the Plan Area.

#### State

##### *Assembly Bill 52*

As of July 1, 2015, California Assembly Bill 52 of 2014 (AB 52) was enacted and expands CEQA by defining a new resource category, "tribal cultural resources." Assembly Bill 52 establishes that "A project with an effect that may cause a substantial adverse change in the significance of a tribal cultural resource is a project that may have a significant effect on the environment" (PRC Section 21084.2). It further states that the lead agency shall establish measures to avoid impacts that would alter the significant characteristics of a tribal cultural resource, when feasible (PRC Section 21084.3). PRC Section 21074 (a)(1)(A) and (B) defines tribal cultural resources as "sites, features, places, cultural landscapes, sacred places, and objects with cultural value to a California Native American tribe" and meets either of the following criteria:

a) Listed or eligible for listing in the California Register of Historical Resources or in a local register of historical resources as defined in Public Resources Code section 5020.1(k), or
b) A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Public Resources Code Section 5024.1. In applying the criteria set forth in subdivision (c) of Public Resource Code Section 5024.1, the lead agency shall consider the significance of the resource to a California Native American tribe.

AB 52 also establishes a formal consultation process for California tribes regarding those resources. The consultation process must be completed before a CEQA document can be certified. AB 52 requires that lead agencies "begin consultation with a California Native American tribe that is traditionally and culturally affiliated with the geographic area of the proposed project." Native American tribes to be included in the process are those that have requested notice of projects proposed within the jurisdiction of the lead agency.

##### *Senate Bill 18*

California Government Code Section 65352.3 (adopted pursuant to the requirements of SB 18) requires local governments to contact, refer plans to, and consult with tribal organizations prior to making a decision to adopt or amend a general or specific plan. The tribal organizations eligible to consult have traditional lands in a local government's jurisdiction, and are identified, upon request, by the Native American Heritage Commission (NAHC). As noted in the California Office of Planning and Research's Tribal Consultation Guidelines (2005), "The intent of SB 18 is to provide California Native American tribes an opportunity to participate in local land use decisions at an early planning stage, for the purpose of protecting, or mitigating impacts to, cultural places."

## b. Existing Conditions

As part of the process of identifying tribal cultural resources issues within or near the project site, the NAHC conducted a search of the Sacred Lands File (SLF). The SLF search stated that the SLF search was completed with negative results.

### AB 52 and SB 18 Consultation

In accordance with AB 52 and SB 18, the City of Novato notified the Federated Indians of Graton Rancheria (FIGR) of proposed project and invited them to participate in consultation. The City prepared and mailed letters and a draft copy of General Plan 2035 in accordance with SB 18 on February 26, 2015. FIGR representative Nick Tipon attended a meeting with City staff to discuss FIGR interest in the proposed project and the pending implementation of AB 52. On August 22, 2016 the City provided a copy of the public review draft General Plan to FIGR for comment. FIGR responded on November 22, 2016 stating that they did not have comments on the draft General Plan.

On March 23, 2017, the City prepared and mailed a letter inviting the FIGR to consult under AB 52. FIGR responded to consultation request on April 13, 2017 indicating that they wished to engage in formal consultation. The City responded to FIGR's request via email on May 2, 2017 to set up a consultation meeting but was unable to confirm a meeting time and date. The City mailed a follow-up letter on May 22, 2017 indicating that they had not received a response to the meeting invitation and suggesting a meeting on May 30, 2017. On June 9, 2017, FIGR responded to the May 2, 2017 email request requesting that they set up an in-person meeting with the Tribal Council Members on June 28 or 30. After FIGR missed the suggested meeting date of May 30, 2017, the City made the decision to continue preparation of the proposed project and this Draft EIR and to provide both to FIGR for comment. Copies of correspondence are provided in Appendix F.

# 4.15.2 Impact Analysis

## a. Methodology and Thresholds of Significance

According to Appendix G of the *CEQA Guidelines*, an impact on Tribal Cultural Resources would be significant if the project:

1) Would the project cause a substantial adverse change in the significance of a tribal cultural resource, defined in Public Resources Code section 21074 as either a site, feature, place, cultural landscape that is geographically defined in terms of the size and scope of the landscape, sacred place, or object with cultural value to a California Native American tribe, and that is:
    a) Listed or eligible for listing in the California Register of Historical Resources, or in a local register of historical resources as defined in Public Resources Code section 5020.1(k), or
    b)A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Public Resources Code section 5024.1. In applying the criteria set forth in subdivision (c) of

Public Resource Code section 5024.1, the lead agency shall consider the significance of the resource to a California Native American tribe.

| **Threshold 1:** | Would the project cause a substantial adverse change in the significance of a tribal cultural resource? |
|---|---|

**Impact TCR-1 IMPLEMENTATION OF THE PROPOSED PROJECT MAY INVOLVE EXCAVATION, WHICH HAS THE POTENTIAL TO IMPACT PREVIOUSLY UNIDENTIFIED TRIBAL CULTURAL RESOURCES. IMPACTS ON TRIBAL CULTURAL RESOURCES WOULD BE POTENTIALLY SIGNIFICANT.**

The majority of development projected by proposed project would occur in the four focus areas and the Industrial Parks MPA area. However, effects on tribal cultural resources can only be known once a specific project has been proposed because the effects are highly dependent on both the individual project site conditions and the characteristics of the proposed activity. There are existing TCRs within the City and new TCRs may be identified or established during implementation of the proposed project which is expected to occur over many years. Therefore, as specific projects are proposed, consultation with tribes under AB 52 would occur to determine if any TCRs may be impacted by specific projects. If TCRs are identified during AB 52 consultation, impacts to any such TCRs would be potentially significant unless mitigation is incorporated. General Plan 2035 as currently written does not contain any goals or policies that pertain specifically to the protection of tribal cultural resources.

Mitigation Measure TCR-1 is required to reduce impacts to less than significant.

## Mitigation Measures

The following mitigation measure is required.

### *TCR-1 Tribal Cultural Resources*

The following policy shall be added to Community Character Goal 1 in General Plan 2035:

> **Tribal Cultural Resources Protection**. The City shall comply with AB 52, which may require formal tribal consultation on a project-by-project basis.

## Significance After Mitigation

The implementation of Mitigation Measure TCR-1 would reduce impacts on tribal cultural resources to a less than significant level by ensuring compliance with AB 52 on a project-by-project basis.

## Cumulative Impacts

Development in the City of Novato would be facilitated by proposed project. The increase in growth contributes to regional impacts on TCRs. While most TCRs are typically site-specific, with impacts that are project-specific, others may have regional significance, such as an important viewshed or resource gathering area. For such a resource, cumulative impacts, and the contribution of General Plan 2035 to them, would be potentially significant. Mitigation measures outlined in this section would reduce impacts associated with the proposed project to a less than significant level.

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# 4.16 Utilities and Services Systems

This section evaluates potential effects associated with implementation of the proposed project on utilities by identifying anticipated demands and existing and planned service availability. Utility systems analyzed in this section consist of: (1) water supply, (2) wastewater, and (3) solid waste. Storm drain facilities are analyzed in Section 4.8, *Hydrology and Water Quality*.

## 4.16.1 Setting

### a. Water Supply

This section presents information about Novato's water supply system. Information for this section comes primarily from the 2015 Urban Water Management Plan (UWMP) for the North Marin Water District (NMWD).

The NMWD provides water to approximately 61,381 people in the City of Novato and surrounding unincorporated areas, as well as portions of West Marin. NMWD receives most of its water (about 80 percent) from the Sonoma County Water Agency (Agency). Most of the remaining supplies come from Stafford Lake, which is located four miles west of downtown Novato. The NMWD also delivers a modest amount of recycled water developed in cooperation with Novato and Las Gallinas Valley Sanitary Districts. The NMWD has no developed groundwater sources (NMWD 2016a).

#### Distribution and Storage

Imported water is conveyed to the NMWD via the Petaluma Aqueduct, which is run by the Agency, and the North Marin Aqueduct, which is run by the NMWD. Water conveyance within the NMWD is managed through four separate pressure zones with 31 storage tanks, 26 booster pump stations, and seven hydropneumatic systems that have combined storage and pump stations. The water system's 29 storage facilities have a total capacity of 37 million gallons. Water is distributed via pipelines constructed primarily of asbestos cement or polyvinyl chloride that range from 6 to 12 inches in diameter and are up to 65 years old (NMWD 2016a).

#### Imported Water

The NMWD purchases most of its water supply from the Agency, which obtains its water from the Russian River Project. The Russian River Project includes the Coyote Valley Dam, which creates Lake Mendocino, and Warm Springs Dam, which creates Lake Sonoma. The Agency manages releases from both reservoirs (NMWD 2016a).

#### Surface Water

The NMWD's remaining water supplies come primarily from Stafford Lake, which captures runoff from an approximately 8.3-square mile area of land near the upper reaches of Novato Creek. The lake has a capacity of 4,450 acre-feet (AF) at a water surface elevation of 196 feet above mean sea level. The NMWD holds two water right permits for diversion from Novato Creek. In combination, the two permits allow for annual diversion of 8,400 AF from Novato Creek for storage in Lake Stafford. The permits also grant the NMWD the right to directly divert up to 2.9 cubic feet per second (cfs) during a water year (i.e., October 1 thru September 30), and 9.75 cfs between October 1 and April 30 (NMWD 2016a).

## Recycled Water

The NMWD currently utilizes recycled water for agriculture and landscape irrigation and intends to expand recycled water service to industrial and commercial uses. Most of the NMWD's recycled water is produced by the Novato Treatment Plant (1,655 AF in 2015) and the Las Gallinas Valley Sanitary District (LGVSD) Treatment Plant (140 AF in 2015). The Novato Treatment Plant is owned by the Napa Sanitary District (NSD) and provides both secondary and tertiary treatment level. The LGVSD Treatment Plant provides tertiary treated water (NMWD 2016a).

## Conservation

In 2001, the NMWD pledged to make a good faith effort to implement best management practices (BMP) for urban water management as a member of the California Urban Water Conservation Council (CUWCC). The NMWD implements all CUWCC recommended BMPs, which are listed in Table 9-1 of the NMWD's 2015 UWMP, and include: metering all connections, billing residential customers using a three-tier rate system and billing non-residential customers using a seasonal rate system, providing free outdoor landscape irrigation surveys for residential customers, and offering rebates for high efficiency washing machines and toilets. The NMWD is also an active member of the Sonoma-Marin Saving Water Partnership, composed of nine other local retail water utilities and the Agency. The Partnership establishes minimum water conservation funding requirements for members. Participants are committed to remain members of the CUWCC, implement CUWCC BMPs, and implement water conservation programs that exceed CUWCC BMP requirement.

## Water Supply and Demand

The NMWD expects future water supplies to come from a mix of sources similar to its current portfolio. Table 4.16-1 summarizes the actual water supply portfolio, by source, from 2015 and the projected supplies from 2020 to 2040. As shown, the NMWD expects to continue to meet the majority of its water demand via imported and surface water supplies. The NMWD will continue to purchase imported water from Sonoma County Water Agency and acquire surface water from Lake Stafford. Additionally, recycled water supplies will increase to 650 acre-feet per year (AFY) starting in 2020.

**Table 4.16-1 Actual (2015) and Projected (2020-2040) Water Supplies**

| Water Source | 2015 | 2020 | 2025 | 2030 | 2035 | 2040 |
|---|---|---|---|---|---|---|
| Imported | 6,034 | 8,699 | 8,835 | 8,913 | 9,028 | 9,178 |
| Surface | 1,795 | 2,500 | 2,125 | 1,750 | 1,375 | 1,000 |
| Recycled | 178 | 650 | 650 | 650 | 650 | 650 |
| Other (raw water) | 454 | 218 | 218 | 218 | 218 | 218 |
| **Total** | **8,461** | **12,067** | **11,828** | **11,531** | **11,271** | **11,046** |

Units are in acre-feet per year.
Source: NMWD 2016a

According to the NMWD UWMP, there is no predicted reduction in water supply for multiple dry years (NMWD 2016a). The NMWD projects that future supplies would be sufficient to meet forecasted demand under normal year and multiple-dry year scenarios. However, existing supplies may be insufficient to meet forecasted demand under a single-dry year scenario from 2025 through

2040. As shown in Table 4.16-2, forecasted demand would exceed supply in a single-dry year by 249 AF, 679 SF, 1,158 AF, and 1,591 AF in 2025, 2025, 2030, 2035, and 2040, respectively.

**Table 4.16-2 Forecasted Water Supply and Demand for Normal Year, Multiple-Dry Year, and Single-Dry Year Conditions**

| Water Source | 2020 | 2025 | 2030 | 2035 | 2040 |
|---|---|---|---|---|---|
| **Normal-Year** | | | | | |
| Supply | 12,067 | 11,828 | 11,531 | 11,271 | 11,046 |
| Demand | 10,662 | 10,708 | 10,731 | 10,805 | 10,930 |
| Difference | 1,405 | 1,120 | 818 | 466 | 116 |
| **Multiple-Dry Year: 1st, 2nd and 3rd Year** | | | | | |
| Supply | 12,067 | 11,828 | 11,531 | 11,271 | 11,046 |
| Demand | 10,662 | 10,708 | 10,731 | 10,805 | 10,930 |
| Difference | 1,405 | 1,120 | 818 | 466 | 116 |
| **Single-Dry Year** | | | | | |
| Supply | 12,067 | 10,459 | 10,034 | 9,647 | 9,339 |
| Demand | 10,662 | 10,708 | 10,713 | 10,805 | 10,930 |
| Difference | 1,405 | (249) | (679) | (1,158) | (1,591) |

Units are in acre-feet per year.
( ) indicate that demand exceeds supply
Source: NMWD 2016a

The NMWD has prepared a contingency plan it can implement if faced with water shortages, as required by Water Code Section 10332(a). The plan details three stages of increasingly critical water supply conditions, the reduction in water use that can be achieved at each level, and the means to achieve it (NMWD 2016a). In the first-dry year of a severe drought, the NMWD would be able to reduce the level of water supplied by up to 50 percent (Stage 3), if needed.

## Drinking Water Quality

Surface water from Stafford Lake is treated to meet drinking water quality standards at the Stafford Lake Water Treatment Plant. Imported Agency water originates from naturally filtered sources and does not require additional treatment, though the Agency adds small amounts of chlorine and sodium hydroxide to the water to ensure purity and adjust the pH to 8.3. According to the NMWD's 2015 *Annual Water Quality Report-Novato Edition* (NMWD 2016b), drinking water provided by NWMD met or surpassed every federal and state drinking standard in 2015. Nonetheless, drinking water may contain at least small amounts of contaminants. This occurs because water traveling over the land surface or through the layers of the ground may dissolve naturally occurring minerals and, in some cases, radioactive material, and could pick up substances resulting from the presence of human or animal activity. Potential contaminants include:

- **Microbial contaminants**, such as viruses and bacteria that may come from sewage treatment plants, septic systems, agricultural livestock operations, and wildlife
- **Inorganic contaminants**, such as salts and metals that can be naturally-occurring or result from urban storm water runoff, industrial or domestic wastewater discharges, oil and gas production, mining, or farming

- **Pesticides and herbicides**, which may come from a variety of sources such as agriculture, urban storm water runoff, and residential uses
- **Organic chemical contaminants**, including synthetic and volatile organic chemicals that are byproducts of industrial processes and petroleum production and can also come from gas stations, urban storm water runoff, agricultural application, and septic systems
- **Radioactive contaminants,** that can be naturally-occurring or be the result of oil and gas production and mining activities
- **Lead**, if present in elevated levels, can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing.

## b. Water Supply Regulatory Setting

### Federal

#### *Clean Water Act*

The primary goals of the Federal Clean Water Act (CWA), 33 USC Sections 1251, *et seq*. are to restore and maintain the chemical, physical, and biological integrity of the nation's waters and to make all surface waters fishable and swimmable. The CWA forms the basic national framework for the management of water quality and the control of pollutant discharges. The CWA sets forth a number of objectives in order to achieve the above- mentioned goals. The CWA objectives include regulating pollutant and toxic pollutant discharges; providing for water quality which protects and fosters the propagation of fish, shellfish and wildlife; developing waste treatment management plans; and developing and implementing programs for the control of non-point sources pollution.

#### *Safe Drinking Water Act*

The federal Safe Drinking Water Act (SDWA) establishes standards for contaminants in drinking water supplies. Contaminants regulated by the SDWA include metals, nitrates, asbestos, total dissolved solids, and microbes.

### State

#### *California Water Code*

The California Water Code, a section of the California Code of Regulations, is the governing law for all aspects of water management in California. NMWD is a County water district operating under the provisions of Division 12 of the California Water Code, which establishes rules for their formation, internal organization, powers and purposes, and financial provisions.

#### *Safe Drinking Water Act (1976)*

California enacted its own Safe Drinking Water Act in 1976. The California Department of Public Health (CDPH) [formerly the California Department of Health Services (CDHS)] has been granted primary enforcement responsibility for the SDWA. Title 22 of the California Administrative Code establishes CDPH authority and stipulates drinking water quality and monitoring standards. These standards are equal to or more stringent than the federal standards.

### *Senate Bill 610*

Senate Bill (SB) 610 (2002) amended California Water Code to require detailed analysis of water supply availability for certain types of development projects. The primary purpose of SB 610 is to improve the linkage between water and land use planning by ensuring greater communication between water providers and local planning agencies, and ensuring that land use decisions for certain types of development projects are fully informed as to whether sufficient water supplies are available to meet project demands. SB 610 requires the preparation of a Water Supply Assessment (WSA) for a project that is subject to CEQA and meets certain requirements, including residential developments of more than 500 dwelling units.

### *Porter-Cologne Water Quality Control Act (California Water Code)*

The State of California is authorized to administer Federal or State laws regulating water pollution within the State. The Porter-Cologne Water Quality Control Act (Water Code Sections 13000, et seq.) includes provisions to address requirements of the CWA. These provisions include NPDES permitting, dredge and fill programs, and civil and administrative penalties. The Porter-Cologne Act is broad in scope and addresses issues relating to the conservation, control, and utilization of the water resources of the State. Additionally, the Porter-Cologne Act states that the quality of all the waters of the State (including groundwater and surface water) must be protected for the use and enjoyment by the people of the State.

### *Recycled Water Regulations*

Within California, recycled water is regulated by the U.S. Environmental Protection Agency (U.S. EPA), the State Water Resources Control Board (SWRCB), Regional Water Quality Control Boards (RWQCB), and CDPH. The SWRCB has adopted Resolution No. 77-1, “Policy with Respect to Water Reclamation in California.” This policy states that the SWRCB and RWQCBs will encourage and consider or recommend for funding water reclamation projects that do not impair water rights or beneficial in-stream uses. The CDPH establishes the recycled water uses allowed in California and designates the level of treatment (i.e., un-disinfected secondary, disinfected secondary, or disinfected tertiary) required for each of these designated uses (Title 22, California Code of Regulations).

The Regional Water Quality Control Boards (RWQCBs) implement the SWRCB Guidelines for Regulation of Water Reclamation and issue waste discharge permits that serve to regulate the quality of recycled water based on stringent water quality requirements. The CDPH develops policies protecting human health and comments and advises on RWQCB permits. The RWQCB Region 2 office in Oakland regulates water quality for all waters that flow into the San Francisco Bay, which includes all rivers, streams, and tributaries within the nine-county San Francisco Bay region.

### *Title 22*

The California Water Code requires the CDPH to establish water reclamation criteria. In 1975, the former CDHS prepared Title 22 to fulfill this requirement. Title 22 regulates production and use of reclaimed water in California by establishing three categories of reclaimed water: primary effluent, which typically includes grit removal and initial sedimentation or settling tanks; adequately disinfected, oxidized effluent (secondary effluent) which typically involves aeration and additional settling basins; and adequately disinfected, oxidized, coagulated, clarified, filtered effluent (tertiary effluent) which typically involves filtration and chlorination. In addition to defining reclaimed water uses, Title 22 defines requirements for sampling and analysis of effluent and requires specific design requirements for facilities.

### *Urban Water Management Planning Act of 1983*

The California Urban Water Management Planning Act requires all publicly or privately owned utilities that provide water service to more than 3,000 service connections or over 3,000 acre-feet per year to prepare an Urban Water Management Plan (UWMP). The UWMP is intended to support long-term resource planning and ensure suppliers have adequate supplies for existing and future demand. SB X7-7, passed in 2009, requires a reduction in 20 percent per capita water use by the year 2020. These water savings targets must be quantified in updated UWMPs.

## Local

### *Water Quality Control Plan for the San Francisco Bay Basin*

The RWQCB Region 2 office regulates water quality in the San Francisco Bay Basin in accordance with the Water Quality Control Plan or "Basin Plan." The Basin Plan presents the beneficial uses which the Regional Board has designated for surface water, groundwater, marshes and mudflats, as well as the water-quality objectives and criteria that must be met to protect these uses. A number of existing beneficial uses have been designated for Novato Creek and Stafford Lake, and are considered reasonably applicable to their tributaries. The existing beneficial uses for Novato Creek include agricultural, municipal and domestic water supply, recreation, wildlife habitat and preservation of rare and endangered species. The existing beneficial uses for Stafford Lake include municipal and domestic water supply, cold and warm freshwater habitat, fish spawning, wildlife habitat, and non-contact aquatic recreation.

### *Novato Municipal Code*

The City's Municipal Code contains policies to support the provision of water and conservation of water supplies, including the following:

- 5-55, Water. Requires permitting and approval processes associated with development to include provisions for adequate water supply.
- *19.28.040*, *Landscape Design Standards.* Requires landscape and irrigation plans to comply with NMWD requirements and guidelines for water efficient landscaping.

### *Novato Water System Master Plan*

The Novato Water System Master Plan, developed by NMWD in 2002, updated in 2007, and most recently updated in 2012, is a long-range strategic plan that consolidates planning efforts directly related to the water system and develops procedures to regulate and monitor this system. The average annual demand in the Novato water system is expected to increase by approximately 43 percent by year 2035 (buildout projection). Currently, new development in Novato is expected to occur within existing pressure zones and service areas, and therefore will not require new pressure zones or an extension of facilities beyond current boundaries.

The Master Plan also identifies and guides necessary Capital Improvement Plan (CIP) projects for the Novato water system. CIP projects are identified in Section 9 of the Master Plan and organized into four categories: Pipeline Replacement and Additions, System Improvements, Storage Tanks and Pump Stations, and Preliminary Project Engineering and Studies. Section 10 of the Master Plan discusses project timelines and completion dates, as well as individual project costs through FY 2035.

### *Water Conservation Master Plan*

Water conservation is a top priority for NMWD. The 2008 Water Conservation Master Plan tiers off the NMWD's 1999, 2002, and 2004 Draft Water Conservation Plans and the 2005 Urban Water Management Plan. The updated 2008 Water Conservation Master Plan examines the NMWD's existing Tier One Measures, Tier Two Measures and New Development Standards, and recommends potential water conservation programs to be implemented.

In 2010 NMWD entered into a Memorandum of Understanding with the Agency, the seven other retail water providers signatory to the Restructured Agreement for Water Supply, and Marin Municipal Water District, to form the Sonoma Marin Saving Water Partnership (SMSWP). The SMSWP's purpose is to identify, recommend, and implement water conservation projects, and regionally to maximize cost effectiveness and the saving of more water than can be done individually. Each of the SMSWP partners has water conservation programs that can assist community members to reduce water use, and each partner has committed to necessary funding for water conservation programs.

## c. Wastewater

This section describes the City's existing wastewater system. Information for this section is mostly based on the Novato Sanitary District's (NSD) *Sewage System Master Plan* (NSD 2016) and the *2015 Annual Operations and Maintenance Report* for the Novato Treatment Plant (NTP), prepared by Veolia Water Operating Services (Veolia; Veolia 2016).

## Collection and Treatment

The NSD provides wastewater collection, treatment, and disposal services for the Novato Community (NSD 2016). The NSD owns and operates a wastewater collection system, a municipal wastewater treatment plant, and an effluent discharge outfall. In 2013, the NSD also began operating a Recycled Water Facility that provides up to 1.7 million gallons per day (MGD) of tertiary treated recycled water to the NMWD. The Las Gallinas Valley Sanitary District serves the Marin Valley Mobile County Club. Implementation of the proposed project would not result in a change in services for the Las Gallinas Valley Sanitary District and no land use changes would impact the Las Gallinas Valley Sanitary District. Therefore, the Las Gallinas Valley Sanitary District is not discussed further.

The NSD wastewater system collects and transports wastewater through a series of gravity sewers and interceptors, pump stations, and force mains (NSD 2016). The system consists of about 225 miles of sewers with about 200 miles of gravity sewer lines ranging from four inches to 54 inches in diameter,25 miles of force mains, five pump stations, and 33 lift stations. Much of the existing local mains are deteriorating, resulting in high inflows of stormwater into the system (NSD 2018a). The NSD expects that the expanded public sewers and treatment plant will accommodate inflows from damaged local mains until about 2025 (NSD 2018a). The NSD is responsible for construction, repair, and maintenance of sewer lines with exception of those located in the Marin Valley Mobile Country Club, which are privately maintained by the City as the owner of the mobile home park.

Wastewater is transported to the Novato Treatment Plant (NTP) where most of the water undergoes primary and secondary treatment and is either discharged to San Pablo Bay or used for pasture irrigation. In the months of May, September, and October, effluent is discharged to San Pablo Bay (Veolia 2016). During the non-discharge season, most effluent is stored for future use (e.g. pasture irrigation) and some undergoes tertiary treatment and is diverted to golf course irrigation.

The NTP underwent significant upgrades and returned to service in 2010. Since then, operation of the NTP has been contracted to Veolia Water. The upgraded NTP is designed for an average dry weather flow of 7.05 MGD and peak wet weather flow of 30.7 MGD. In 2015, the NTP experienced an average dry weather flow of 3.25 MGD and peak wet weather flow of 14.22. Thus, the NTP has a remaining processing capacity of approximately 3.8 MGD for dry weather flow and 16.5 MGD for peak wet weather flow

## Wastewater Regulatory Setting

### *Federal and State*

#### NATIONAL POLLUTION DISCHARGE ELIMINATION SYSTEM (NPDES) PERMITS

The NPDES permit program was established in the CWA to regulate municipal and industrial discharges to surface waters of the United States. Federal NPDES permit regulations have been established for broad categories of discharges, including point-source municipal waste discharges and nonpoint-source stormwater runoff. NPDES permits generally identify effluent and receiving water limits on allowable concentrations and/or mass emissions of pollutants contained in the discharge; prohibitions on discharges not specifically allowed under the permit; and provisions that describe required actions by the discharger, including industrial pretreatment, pollution prevention, self-monitoring, and other activities.

Wastewater discharge is regulated under the NPDES permit program for direct discharges into receiving waters and by the National Pretreatment Program for indirect discharges to a sewage treatment plant. In California, the federal requirements are administered by the SWRCB, and individual NPDES permits are issued by the RWQCBs.

#### DISPOSAL OF BIOSOLIDS

Title 40 of the Code of Federal Regulations (CFR) Part 503, Title 23 California Code of Regulations, and standards established by the RWQCB regulate the disposal of biosolids.

#### TITLE 22 OF CALIFORNIA CODE OF REGULATIONS

Title 22 regulates the use of reclaimed wastewater. In most cases only disinfected tertiary water may be used on food crops where the recycled water would come into contact with the edible portion of the crop. Disinfected secondary treatment may be used for food crops where the edible portion is produced below ground and will not come into contact with the secondary effluent. Lesser levels of treatment are required for other types of crops, such as orchards, vineyards, and fiber crops.

### *Local*

#### NOVATO SANITARY DISTRICT (NSD) SEWER SYSTEM MANAGEMENT PLAN (SSMP)

The San Francisco Bay RWQCB requires each wastewater collection agency in its jurisdiction to develop goals to properly manage the wastewater collection system, provide adequate capacity to convey peak flows, minimize the frequency of SSOs, and mitigate the impact of SSOs. The NSD SSMP was initially adopted on August 11, 2008 to meet the requirements of the San Francisco Bay RWQCB and the SWRCB. At the time of publication of this EIR, the SSMP was most recently revised in March 2016. The goals of the NSD SSMP are to:

- Properly manage, operate, and maintain all parts of the wastewater collection system the NSD owns and controls in a safe, sound, and cost-effective manner
- Provide adequate capacity to convey base and peak wastewater flows in its system
- Minimize the frequency of occurrence of SSOs in its system
- Evaluate and analyze both current and potential maintenance practices and performance in an on-going effort to operate efficiently and to effectively reduce SSOs.

The SSMP provides a summary of the NSD's objectives, plans, practices, and procedures to meet its goals.

## d. Solid Waste

The NSD is responsible for waste disposal, recycling, and green-waste collection in Novato through its franchise collection entity, currently Recology Sonoma Marin (Recology). As of December 2017, Recology is responsible for the collection, disposal, and processing of solid waste, recyclables, and compostable materials (green and food waste) in Novato (NSD 2017). Prior to 2017, Novato Disposal was the responsible entity. Collected waste is delivered to the Redwood Landfill and Recycling Center (Redwood Landfill) located north of the Novato City limit at 8950 Redwood Highway (City of Novato 2014a). Redwood Landfill has composting and recycling facilities, as well as 222.5 acres of landfill disposal area (City of Novato 2014a). The landfill is permitted to process up to 2,300 tons of waste per day and has a maximum permitted capacity of 19.1 million cubic yards (CalRecycle 2017a). The composting facility is permitted to process 170 tons per day with a permitted capacity of 60,000 cubic yards per year.

In 2013, approximately 45,000 tons of solid waste (an average of 123 tons per day) was collected by Novato Disposal and transferred to Redwood Landfill. Regular waste comprised about 54 percent of waste collected, green waste comprised 37 percent, and construction and demolition waste comprised 9 percent. Approximately 58 percent of the construction and demolition waste was recycled and all the green waste was either recycled or composted (City of Novato 2014a). In addition, a total of 31,330 tons of recyclables, including aluminum, cardboard, glass, paper, plastic, and tin cans, were collected by Novato Disposal in 2013.

In 2016, Redwood Landfill received 111,751 tons of solid waste. Averaging approximately 306 tons per day, Redwood Landfill is therefore receiving about 13 percent of its daily capacity. As of January 1, 2017, it was estimated that Redwood Landfill had a remaining capacity of approximately 6.4 million tons (Novato Sanitary District 2018c).

In 2011, the NSD established performance goals to set the City on track to meet its zero waste goals. The contract requires Recology to divert 70 percent of trash collected through recycling, reuse or composting by 2020 and 80 percent by 2025 (NSD 2018b).

## Solid Waste Regulatory Setting

*State*

### CALIFORNIA INTEGRATED WASTE MANAGEMENT ACT

The California Integrated Waste Management Act of 1989 (AB 939), set a requirement for cities and counties to divert 50 percent of all solid waste from landfills by January 1, 2000 through source reduction, recycling, and composting. To help achieve this, the Act required that each city and county prepare and submit a Source Reduction and Recycling Element. AB 939 also established the goal for all California counties to provide at least 15 years of on-going landfill capacity.

In 2007, SB 1016 subsequently amended AB 939, now requiring 50 percent diversion requirement to be calculated in a per capita disposal rate equivalent. CalRecycle sets a target per capita disposal rate for each jurisdiction. Each jurisdiction must submit an annual report to CalRecycle with its progress in implementing diversion programs and its current per capita disposal rate (CalRecycle 2017).

In 2011, AB 341 was passed setting a State policy goal of not less than 75 percent of solid waste that is generated to be source reduced, recycled, or composted by the year 2020.

### MANDATORY COMMERCIAL ORGANICS RECYCLING

In 2014, AB 1826 required businesses to recycle their organic waste on and after April 1, 2016, depending on the amount of waste they generate per week. This law also requires that on and after January 1, 2016, local jurisdictions implement an organic waste recycling program to divert organic waste generated by business, including multi-family residential dwellings that consist of five or more units. Organic waste means food waste, green waste, landscape and pruning waste, nonhazardous wood waste, and food-soiled paper waste that is mixed in with food waste.

### GLOBAL WARMING SOLUTIONS ACT OF 2006

In 2006, the Global Warming Solutions Act or AB 32, adopted by the Air Resources Board, included a Mandatory Commercial Recycling Measure. The Mandatory Commercial Recycling Measure focuses on diverting commercial waste as a means to reduce greenhouse gas (GHG) emissions, with a goal of reducing GHG emissions by five metric tons of carbon dioxide equivalents (MT of $CO_2e$), consistent with the 2020 targets set by AB 32. CalRecycle adopted this Measure on January 17, 2012.

In 2012, SB 1018, required both businesses that generate 4 cubic yards or more of commercial solid waste per week and multi-family residences with five or more units to arrange for recycling services.

### CALGREEN BUILDING CODE

In 2008, the California Building Standards Commission adopted the nation’s first green building standards. The California Green Building Standards Code (Part 11, Title 24, known as “CALGreen”) was adopted as part of the California Building Standards Code. Section 4.408, Construction Waste Reduction Disposal and Recycling, mandates that in the absence of a more stringent local ordinance, a minimum of 50 percent of non-hazardous construction and demolition debris must be recycled or salvaged. The Code requires the applicant to have a waste management plan for on-site sorting or construction debris.

*Local*

#### CITY OF NOVATO CONSTRUCTION & DEMOLITION WASTE RECOVERY ORDINANCE

The City's Construction & Demolition Waste Recovery Ordinance requires applicants to submit a Waste Management Plan (WMP) for Construction Demolition Recycling and Reuse before a construction or demolition permit will be issued. Applicants are required to recycle or reuse at least 50 percent of their materials, and may be fined for a failure to comply with this condition.

## 4.16.2 Impact Analysis

### a. Methodology and Significance Thresholds

Assessment of impacts is based on review of site information and conditions, analysis provided in the 2015 NMWD UWMP and City information regarding utility-related issues, including water supply and facilities, wastewater facilities, and solid waste. According to Appendix G of the *CEQA Guidelines*, a significant impact would occur if implementation of the proposed project would result in one or more of the following circumstances:

1. Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board;
2. Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects;
3. Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects;
4. Have insufficient water supplies available to serve the project from existing entitlements and resources, or if new or expanded entitlements are needed;
5. Result in a determination by the wastewater treatment provider which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments;
6. Be served by a landfill with insufficient permitted capacity to accommodate the project's solid waste disposal needs; or
7. Not comply with federal, state, and local statutes and regulations related to solid waste.

Impacts regarding stormwater drainage facilities (Threshold question 3) are discussed under Thresholds 4 and 5 in Section 4.9, *Hydrology and Water Quality*.

## b. Project Impacts and Mitigation Measures

| | |
|---|---|
| **Threshold 1:** | Would the project exceed the wastewater treatment requirements of the applicable Regional Water Quality Control Board? |
| **Threshold 2:** | Would the project require or result in the construction of new wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects? |
| **Threshold 5:** | Would the project result in a determination that the wastewater treatment provider does not have adequate capacity to serve projected demand in addition to existing commitments? |

**IMPACT UTL-1 DEVELOPMENT PROJECTED BY THE PROPOSED PROJECT WOULD INCREASE DEMAND FOR WASTEWATER COLLECTION AND TREATMENT BUT GOALS AND POLICIES IN THE GENERAL PLAN 2035 WOULD ENSURE SUFFICIENT WASTEWATER TREATMENT CAPACITY IS AVAILABLE. IMPACTS WOULD BE LESS THAN SIGNIFICANT.**

In 2015, the NTP experienced an average dry weather flow of 3.25 MGD and peak wet weather flow of 14.22 MGD. Thus, the NTP has a remaining processing capacity of approximately 3.8 MGD for dry weather flow and 16.5 MGD for peak wet weather flow (NSD 2016). Implementation of the proposed project, including the four focus areas and Industrial Parks MPA, is expected to involve the following new development:

- 930 residential units
- 694,797 square feet of commercial area
- 323,123 square feet of industrial area
- 646,353 square feet of office area

The water demand calculations in this analysis use sewage generation factors developed by the City of Los Angeles (City of Los Angeles 2006). These factors are conservatively applied for the proposed project in Novato, where the climate is generally wetter than the climate in southern California. Each customer account type (development type) has its own associated sewage generation factor by unit, which were used to calculate projected sewage generation volumes for each type of new development.

Table 4.16-3 shows the total projected sewage generation by customer account type under full buildout of the proposed project.

As shown in Table 4.16-3, the projected wastewater generation of buildout associated with the proposed project would be approximately 320,000 gpd. Specifically, 500,000 square feet of development as part of the Industrial Parks MPA would result in 40,000 gpd of wastewater generation. The wastewater generation increase associated with the proposed project would represent approximately 8.4 percent of the remaining capacity for dry weather flow and approximately 1.9 percent of the remaining capacity for peak wet weather flow. The NTP has capacity to meet the wastewater treatment demands that would be generated from the proposed project. Expansion or construction of a new wastewater treatment facility to meet the demands of the proposed project would not be required.

**Table 4.16-3 Projected Total Wastewater Generation by Customer Account Type**

| Account Type | Proposed Project Growth Forecast | Sewage Generation Factor | Projected Wastewater Generation (gpd) |
|---|---|---|---|
| Single Family Residential | 465 units[a] | 180 gpd/unit | 83,700 |
| Multi-Family Residential | 465 units[a] | 120 gpd/unit | 55,800 |
| Commercial | 694,797 sq. ft | 80 gpd/1,000 sq. ft | 55,584 |
| Industrial | 332,312 sq. ft | 80 gpd/1,000 sq. ft | 26,585 |
| Office | 646,353 sq. ft | 150 gpd/1,000 sq. ft | 96,953 |
| **Total** | | | **318,622** |

gpd = gallons per day; AFY = acre-feet per year; sq. ft = square feet

[a]For calculation purposes, it was assumed that residential buildout would consist of 50% single family and 50% multi-family residential units. “Single Family Residential” usage was assumed to be equivalent to a two-bedroom SFD (single family development) and “Multi-Family Residential” was assumed to be equivalent to a two-bedroom apartment or condo.

Source for water demand factors used in calculations: City of Los Angeles 2006

Additionally, NSD has prepared and is implementing a Capital Improvement Program (CIP) that will provide hydraulic capacity of key sanitary sewer system elements for dry weather peak flow conditions, as well as the appropriate design storm or wet weather event. The planned improvements in the CIP would increase capacity through projects including increases in pipe size, infiltration/inflow reduction programs, increases and redundancy in pumping capacity, and storage facilities (NSD 2016).

Development in the Industrial Parks MPA may result in the creation of hazardous waste and/or biotics. However, development would not result discharge of hazardous materials and/or biotics into the sewer system as appropriate documentation for all hazardous waste transported in connection with specific project-site activities would be provided as required for compliance with existing hazardous materials regulations codified in Titles 8, 22, and 26 of the California Code of Regulations, and their enabling legislation set forth in Chapter 6.95 of the California Health and Safety Code. In addition, individual developers would be required to comply with all applicable federal, State, and local laws and regulations pertaining to the transport, use, disposal, handling, and storage of hazardous waste, including but not limited to, Title 49 of the Code of Federal Regulations. See Section 4.7, *Hazards and Hazardous Materials*, for additional information.

The policies in the General Plan 2035 require coordination between planning agencies and the NSD. Policy LU 3b requires coordination between infrastructure planning and public services with the water, sanitary, fire protection, and school districts. With adherence to these General Plan 2035 policies, impacts would be less than significant.

## Mitigation Measure

No mitigation measures are required.

| **Threshold 2:** | Would the project require or result in the construction of new water facilities or expansion of existing facilities, the construction of which could cause significant environmental effects? |
|---|---|

**IMPACT UTL-2 DEVELOPMENT PROJECTED BY THE PROPOSED PROJECT WOULD INCREASE DEMAND FOR WATER SUPPLY. HOWEVER, WITH ADHERENCE TO GENERAL PLAN 2035 POLICIES, THE PROPOSED PROJECT WOULD NOT RESULT IN THE CONSTRUCTION OF NEW WATER FACILITIES OR THE EXPANSION OF EXISTING FACILITIES. IMPACTS WOULD BE LESS THAN SIGNIFICANT.**

Per the 2015 NMWD UWMP, the NMWD has enough water supply to meet current demands. The UWMP projects water supplies and demand out to 2040, five years past the proposed projects horizon year. However, the 2015 NMWD UWMP does not take into account projected buildout from the proposed project. The NMWD projects that future supplies would be sufficient to meet forecasted demand under normal year and multiple-dry year scenarios across its planning horizon. NMWD projects water use in a normal year in 2035 to be 10,805 AFY, yielding an excess 466 AFY in supplies. The supply totals include imported water from the Agency, surface water from Lake Stafford, and recycled water supplies.

The water demand calculations in this analysis use sewage generation factors developed by the City of Los Angeles (City of Los Angeles 2006). Sewage generation projections were multiplied by a water demand factor of 1.1 to calculate the original water demand. This is a commonly used approach to estimate water supply demands.

Table 4.16-4 shows the total projected water demand by customer account type under implementation of the proposed project.

### Table 4.16-4 Projected Total Water Demand by Customer Account Type

| Account Type | Proposed Project Growth Forecast | Sewage Generation Factor | Projected Water Demand (gpd) | Projected Water Demand (AFY) |
|---|---|---|---|---|
| Single Family Residential | 465 units[a] | 180 gpd/unit | 92,070 | 103 |
| Multi-Family Residential | 465 units[a] | 120 gpd/unit | 61,380 | 69 |
| Commercial | 694,797 sq. ft | 80 gpd/1,000 sq. ft | 61,142 | 68 |
| Industrial | 332,312 sq. ft | 80 gpd/1,000 sq. ft | 29,243 | 33 |
| Office | 646,353 sq. ft | 150 gpd/1,000 sq. ft | 106,648 | 119 |
| **Total** | | | **350,484** | **393** |

gpd = gallons per day; AFY = acre-feet per year; sq. ft = square feet

[a]For calculation purposes, it was assumed that residential buildout would consist of 50% single family and 50% multi-family residential units. "Single Family Residential" usage was assumed to be equivalent to a two-bedroom SFD (single family development) and "Multi-Family Residential" was assumed to be equivalent to a two-bedroom apartment or condo.

Note: Sewage generation projections were all multiplied by a water demand factor of 1.1 to calculate the original water demand.

Source for water demand factors used in calculations: City of Los Angeles 2006

According to NMWD's 2015 UWMP, supply would exceed demand in a normal year by approximately 466 AFY in 2035. As shown in Table 4.16-4, the projected water demand of buildout associated with the proposed project would be 393 AFY. The Industrial Parks MPA would demand approximately 49 AFY. Therefore, NMWD anticipates that there will be sufficient excess supply to meet the demands of the proposed project in a normal year.

Existing supplies may be insufficient to meet forecasted demand under a single-dry year scenario from 2025 through 2040. However, the NMWD has prepared a contingency plan it can implement if faced with water shortages, which would allow it to reduce the level of water supplied by up to 50 percent, if needed (NMWD 2014). There is no predicted reduction in water supply for multiple dry years, so available supply would be sufficient to meet the needs of the proposed project (NMWD 2016).

New development offsets new water demand through the water connection rate structure, which funds the reclaimed water infrastructure. In accordance with SB 610 any new development project subject to CEQA that meets specific requirements, such as residential development with over 500 dwelling units, would need to complete Water Supply Assessment (WSA). In addition, General Plan 2035 goals and policies further minimize the water demands of new developments. Policy ES 25a requires new developments to incorporate water-efficient design features and comply with NMWD regulations. Policy PF 3a involves water conservation programs and expansion of the recycled water system. With adherence to these General Plan 2035 policies, impacts would be less than significant.

## Mitigation Measure

No mitigation measures are required.

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|---|---|
| **Threshold 4:** | Would the project have insufficient water supplies available to serve the project from existing entitlements and resources, or require new or expanded entitlements? |

**IMPACT UTL-3 IMPLEMENTATION OF THE PROPOSED PROJECT WOULD INCREASE DEMAND FOR WATER SUPPLY. HOWEVER, WITH ADHERENCE TO GENERAL PLAN 2035 POLICIES, THE CITY WOULD HAVE SUFFICIENT WATER SUPPLIES TO SUPPORT NEW DEVELOPMENT FROM EXISTING ENTITLEMENTS AND RESOURCES. IMPACTS WOULD BE LESS THAN SIGNIFICANT.**

As discussed under Impact UTL-2, the proposed project would increase demand for water supply by approximately 393 AFY. According to the NMWD UWMP, there will be sufficient water supplies available to serve the water demands of the proposed project. In 2035, supply would exceed demand in a normal year and in multiple dry years by approximately 466 AFY. Although existing demands may exceed supplies in single-dry year scenarios from 2025 through 2040, the NMWD has prepared a contingency level plan which would allow it to reduce the level of water supplied by up to 50 percent, if needed. Therefore, the City would have sufficient supplies from its existing entitlements and resources to meet the demands of the proposed project. In addition, General Plan 2035 goals and policies discussed under Impact UTL-2 would further minimize the water demands of new developments. Impacts related to sufficiency of water supplies would be less than significant.

## Mitigation Measure

No mitigation measures are required.

| | |
|---|---|
| **Threshold 6:** | Would the project be served by a landfill with insufficient permitted capacity to accommodate the project's solid waste disposal needs? |
| **Threshold 7:** | Would the proposed project fail to comply with federal, state, and local statutes and regulations related to solid waste? |

**IMPACT UTL-3 IMPLEMENTATION OF THE PROPOSED PROJECT WOULD INCREASE DEMAND FOR SOLID WASTE SENT TO AREA LANDFILLS. HOWEVER, LANDFILLS SERVING THE CITY OF NOVATO HAVE ADEQUATE CAPACITY TO ACCEPT THE ADDITIONAL WASTE. FURTHER, THE GENERAL PLAN 2035 CONTAINS POLICIES TO INCREASE RECYCLING. IMPACTS WOULD BE LESS THAN SIGNIFICANT.**

The proposed project, including General Plan 2035, the implementing ordinances, four focus areas, and Industrial Parks MPA, would increase solid waste generation in the City. However, the policies in General Plan 2035 would promote waste diversion and ensure sufficient landfill capacity is available to accommodate the estimated increase in solid waste generation. The *Environmental Stewardship* policies addressing solid waste would support the reduction of waste through prevention, reuse, recycling, and composting. Goal ES 27 guides the City to achieve a diversion rate of 80 percent by 2025 and 90 percent by 2035. Policies include waste reduction marketing efforts, recycling programs, and a more stringent Construction and Demolition Ordinance.

In March 2018, R3 Consulting Group (R3) prepared a memorandum for Zero Waste Marin assessing the long-term disposal capacity at Redwood Landfill (R3 2018). Using historical disposal rates, current remaining solid waste disposal capacity, and projections for future population growth and various disposal rate scenarios, R3 created a model to estimate the capacity depletion date of Redwood Landfill. Under a "Business As Usual" scenario, in which existing material flow continues with no diversion increase, the estimated landfill capacity depletion date is 2040. Under a "SB 1383 Achievement" scenario, in which Marin County achieves 50 percent diversion by 2020 and 75 percent reduction by 2025, the estimated depletion date is 2044. Under "Worst Case Scenarios," in which the landfill receives its maximum annual disposal each year (among other factors), the depletion date could be between 2024 and 2034. However, data from 1995 onward shows that Redwood Landfill has yet to hit its annual maximum permitted disposal capacity in one year. Furthermore, adherence to the *Environmental Stewardship* policies outlined above would ensure that Novato's diversion rates continue to increase throughout the planning horizon.

As detailed in Section 4.11*, Population and Housing*, the growth associated with the General Plan is consistent with the Association of Bay Area Governments (ABAG) population growth projections. Since the landfill capacity model relied on ABAG's population growth projections, the model incorporates the growth associated with the General Plan. If the "Business As Usual" scenario is used to conservatively assume that no diversion increases occur, the landfill will not reach its capacity until 2040. Therefore, impacts would be less than significant.

## Mitigation Measure

No mitigation measures are required.

## c. Cumulative Impacts

### Wastewater

Cumulative buildout associated with the proposed project and other regional development would increase demands on the existing wastewater treatment and conveyance facilities. The analysis provided under Impact UTL-1 is cumulative in nature and considers wastewater generation associated with the cumulative buildout. In addition, the policies in the General Plan 2035 require coordination between planning agencies and the NSD. Such coordination will ensure that development would not outpace wastewater infrastructure. Implementation of the proposed project would not result in a change in services for the Las Gallinas Valley Sanitary District and would thus have no effect on cumulative wastewater impacts. With implementation of General Plan 2035 policies, as described under Impact UTL-1, the proposed project would not result in cumulatively considerable impacts related to wastewater infrastructure.

### Water

The analysis provided under Impact UTL-2 is cumulative in nature and considers water demand imposed by the buildout associated with the proposed project and other projected regional growth. General Plan 2035 includes policies to minimize increased water demand associated with new developments. The policies promote water conservation, direct the expansion of recycled water infrastructure, and require new developments to incorporate water-efficient design features. With adherence to these General Plan 2035 policies, associated buildout would not result in cumulatively considerable water supply impacts.

### Solid Waste

Cumulative buildout associated with the proposed project and other regional development would increase solid waste generation. The policies in General Plan 2035 would promote waste diversion and ensure sufficient landfill capacity is available to accommodate the estimated increase in solid waste generation.

As discussed under Impact UTL-3, area landfills have capacity to accommodate additional solid waste and potential impacts of buildout of the proposed project would be less than significant. Cumulatively, other areas which utilize the same landfills would also continue to experience growth and associated increases in solid waste generation. Compliance with applicable regulations and with General Plan goals, policies, and actions would maintain or improve upon existing solid waste diversion rates in the City. In addition, state-mandated solid waste diversion rates (for recycling) would continue to minimize the quantity of waste directed to area landfills. Thus, cumulative impacts on solid waste facilities would be not cumulatively considerable.

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# 4.17 Effects Found Not to Be Significant

During evaluation of the proposed project, certain impact areas included in the California Environmental Quality Act (CEQA) Appendix G checklist were found to have a less than significant impact or no impact. As allowed under CEQA Guidelines Section 15128, this section discusses why impacts to these environmental topics were determined to have a less than significant impact or no impact and therefore are not discussed in detail in the Draft Environmental Impact Report (EIR) as individual sections.

## 4.17.1 Agricultural Resources

*a. Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?*

*b. Conflict with existing zoning for agricultural use, or a Williamson Act contract?*

*c. Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220(g)), timberland (as defined by Public Resources Code section 4526), or timberland zoned Timberland Production (as defined by Government Code section 51104(g))?*

*d. Result in the loss of forest land or conversion of forest land to non-forest use?*

*e. Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use or conversion of forest land to non-forest use?*

According to the Department of Conservation, there is one Williamson Act contract within Novato (California Department of Conservation 2016a). However, the parcel with a Williamson Act contract would have an Agricultural land use designation under General Plan 2035. Therefore, agriculture production could continue on the parcel and the proposed project would not conflict with agriculture or the Williamson Act contract.

There are also no areas of Prime Farmland, Unique Farmland, or Farmland of Statewide Importance within Novato (California Department of Conservation 2016b). While no areas of Prime Farmland, Unique Farmland, or Farmland of Statewide Importance occur within the City, the current General Plan designates agricultural land uses to the west of Highway 101. General Plan 2035 maintains this agriculture land use designation, consistent with the current General Plan. Therefore, the proposed project would not result in the conversion of agriculture use to no non-agriculture uses and there would be no impact on agricultural uses or Farmland.

As described in Section 4.3, *Biological Resources*, there are a variety of vegetation communities in Novato, including oak woodland, redwood forest, and chaparral. The vegetation communities containing stands of trees, such as oak woodland, are located in less developed areas along the outskirts of the City. Division 19.39 of the Novato Municipal Code, Woodland and Tree Preservation, was developed to conserve native trees, forests, and woodlands on public and private lands during development. In addition, General Plan 2035 Goal ES 4 and related policies and programs would preserve and enhancing natural areas and promote tree protection and replacement. Therefore, impacts to forest and timberland would be less than significant.

## 4.17.2 Mineral Resources

*a. Would the project result in a loss of availability of a known mineral resource that would be of value to the region and residents of the state?*

*b. Would the project result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan?*

The primary extractive resources located within the Plan Area include sand and gravel. However, there are no active quarry operations in the City. The California Geological Survey has designated four Resource Sectors in the Novato area (MRZ-2 zones) in the Rush Creek Open Space preserve, the Black Point area, Burdell Mountain, and Bowman Canyon. Approximately 126 acres of the Resources Sectors located within the Plan Area have been urbanized. The remaining approximately 360 acres of Resources Sectors in the Plan Area contain construction aggregate for concrete. General Plan 2035 Policy ES 19 recognizes designated mineral resources and mineral resources sites to continue their conservation. Therefore, impacts would be less than significant.

# 5 Other CEQA Required Discussions

This section discusses growth-inducing impacts, irreversible environmental impacts, and energy impacts that could be caused by the proposed project.

## 5.1 Growth Inducement

Section 15126(d) of the CEQA Guidelines requires a discussion of a proposed project's potential to foster economic or population growth, including ways in which a project could remove an obstacle to growth. Growth does not necessarily create significant physical changes to the environment. However, depending upon the type, magnitude, and location of growth, it can result in significant adverse environmental effects. The proposed project's growth inducing potential is therefore considered significant if project-induced growth could result in significant physical effects in one or more environmental issue areas. Analysis of project related growth is analyzed through this EIR for individual environmental issue areas in Sections 4.1 through 4.17.

### 5.1.1 Population and Employment Growth

As described in detail in Section 4.11, *Population and Housing,* development associated with the General Plan could accommodate an estimated 3,340 new residents and 935 new dwelling units in the City. With the estimated growth as part of the proposed project the City of Novato would have a 2035 population of 56,630 and 22,339 dwelling units. This would not exceed ABAG growth projections or the anticipated growth rate of 33 percent projected in the Metropolitan Transportation Commission's Plan Bay Area 2040. As discussed in Section 4.11, *Population and Housing*, employment in the City is projected to increase by approximately five percent by 2035. Therefore, the project would not directly or indirectly induce significant population growth in the City beyond that already anticipated.

### 5.1.2 Removal of Obstacles to Growth

The proposed project encourages development in Downtown, the North Redwood Boulevard Corridor, the North, North Redwood Boulevard Corridor, and the Northwest Quadrant Neighborhood as well as the Industrial Parks MPA area. In November 2017, the City of Novato voters amended and extended the term of the existing Urban Growth Boundary (UGB) to 2042. Furthermore, Goal LU 2: Establish clear limits to urban development outside the Novato City Limits proposes to coordinate with the County of Marin in order to maintain rural land uses outside of the UGB. Therefore, although development of vacant lands would require new connections, new development would occur primarily where existing roads, water, and sewer are in place and in a manner that minimizes the impact of development on existing infrastructure and services. The proposed project also includes the City's Sphere of Influence (SOI), which extends in a few areas past the UGB into nearby unincorporated areas. However, major infrastructure extensions generally are not envisioned, and improvements would be primarily limited to the replacement and upgrade of aging facilities and enhancement of existing infrastructure in key locations. In addition, the goals, policies, and programs of the Land Use Chapter would limit development in Novato, thereby controlling, rather than removing, obstacles to growth. Specifically, Policy LU 2 would support growth management in order to protect and/or enhance whenever feasible the environment, maintain the high level of services and infrastructure in the City, and retain Novato's small town character. Policy LU 30 would support annexations that are contiguous to Novato and discourage development that "leapfrogs" over vacant and unused land. Policy LU 6 would also require that annexations are adequately supported by existing infrastructure and services or by environmentally and economically feasible extensions to these facilities. Furthermore, Policies LU 29 through LU 32 would support coordination between the City of Novato, the Marin Local Agency Formation Commission, and the County of Marin so that development with the Sphere of Influence and Area of Interest does not conflict with effective implementation of the UGB.

## 5.2 Irreversible Environmental Effects

The *CEQA Guidelines* require that EIRs evaluating projects involving amendments to public plans, ordinances, or policies contain a discussion of significant irreversible environmental changes. CEQA also requires decision-makers to balance the benefits of a proposed project against its unavoidable environmental risks in determining whether to approve a project. This section addresses non-renewable resources, the commitment of future generations to the proposed uses, and irreversible impacts associated with the development that would be facilitated by implementation of the proposed project.

Construction activity associated with the proposed project would involve the use of building materials and energy, some of which are non-renewable resources. Consumption of these resources would occur with any development in the region and are not unique to Novato or the proposed project. The addition of new residential and non-residential development in the City through 2035 would irreversibly increase local demand for non-renewable energy resources such as petroleum and natural gas. Increasingly efficient building fixtures and automobile engines, as well as implementation of policies included in General Plan 2035, are expected to offset the demand to some degree. Specifically, Policy ES 25 promotes energy conservation both at the municipal level and communitywide through the following measures:

- Require new development to minimize environmental impacts through energy-efficient design features and on-site renewable energy generation
- Adopt green building regulations that exceed minimum code requirements
- Upgrade City facilities and operations to reduce energy use
- Promote energy conservation service providers, including Marin Energy Watch Partnership
- Conduct public outreach to promote the use of renewable power
- Enable Property Assessed Clean Energy (PACE) financing to fund renewable energy installations and energy efficiency upgrades in existing buildings

Furthermore, Policy ES 26 promotes on-site renewable energy facilities that would reduce community energy demand. As a result, it is not anticipated that growth associated with the proposed project would significantly affect local or regional energy supplies.

Growth facilitated by the proposed project would require an irreversible commitment of law enforcement, fire protection, water supply, and wastewater treatment. As discussed in Section 4.12, *Public Services*, and Section 4.16 *Utilities and Service Systems*, impacts to public services and utilities would be reduced to a less than significant level with implementation of policies included in General Plan 2035.

The additional vehicle trips associated with growth through 2035 would incrementally increase local traffic, noise levels, and regional air pollutant emissions. As discussed in Section 4.2, *Air Quality*, and Section 4.6, *Greenhouse Gas Emissions*, implementation of General Plan 2035 policies, regional air pollution programs, and mitigation measures would reduce the air pollutant and GHG emissions associated with individual future development projects to below significance thresholds. As discussed in Section 4.10, *Noise*, implementation of proposed policies and mitigation measures would reduce the noise impacts associated with future growth to a less than significant level. As discussed in Section 4.13, *Transportation/Traffic*, General Plan 2035 policies and mitigation measures would reduce the majority of traffic impacts to a less than significant level. However, traffic impacts to Caltrans-controlled intersections would remain significant and unavoidable because the City does not have jurisdiction over these intersections.

# 5.3 Energy Effects

Public Resources Code Section 21100(b)(2) and Appendix F of the *CEQA Guidelines* require that EIRs include a discussion of the potential energy consumption and/or conservation impacts of proposed projects when relevant, with particular emphasis on avoiding or reducing inefficient, wasteful, or unnecessary consumption of energy.

California is one of the lowest per capita energy users in the United States, ranked 48th in the nation, due to its energy efficiency programs and mild climate (U.S. Energy Information Administration 2016). California consumed 285,701 gigawatt-hours (GWh) of electricity in 2016 and 1,273,910 billion British thermal units (BTU) of natural gas in 2016 (California Energy Commission [CEC] 2016). Californians presently consume over 19 billion gallons of motor vehicle fuels per year (CEC 2018).

Electricity and natural gas service in the City of Novato is provided by Pacific Gas & Electric (PG&E). PG&E provides natural gas and electric service to approximately 16 million people throughout a 70,000-square mile service area in northern and central California (PG&E 2018). In 2016, PG&E provided 28,625 GWh of electricity to its residential users and 54,783 GWh of electricity to all other user types (CEC 2016). PG&E's power mix consists of approximately 13 percent renewable solar energy (CEC 2017). In 2015, PG&E provided 1,746 million therms of natural gas to its residential users and 2,814 million therms of natural gas to all other user types (CEC 2016). Residents and businesses in Novato are able choose how much renewable energy is in their electric service through Marin Clean Energy. Marin Clean Energy has contacts with power suppliers for renewable energy and replaces the electric generation services with 60 to 100 percent renewable energy. By providing the option for residents to choose renewable energy Marin Clean Energy is helping Novato reach greenhouse gas reduction goals.

## Appendix F Requirements and Energy Conservation Standards

Appendix F of the *CEQA Guidelines* requires inclusion in an EIR of relevant information that addresses "potential energy impacts of proposed projects, with particular emphasis on avoiding or reducing inefficient, wasteful and unnecessary consumption of energy" (Public Resources Code Section 21100[b][3]). Although the 2018 *CEQA Guidelines* do not include formal thresholds for evaluating the significance of potential energy-related impacts, the following discussion addresses direct energy impacts of the project as framed in Appendix F of the *CEQA Guidelines* by evaluating whether the project would result in the wasteful or inefficient consumption of energy or the potential need for new energy-related infrastructure, the construction or operation of which would have significant impacts. In addition, the discussion below analyzes if the proposed project would conflict with state or local renewable energy consistent to the *CEQA Guidelines* adopted in January 2019.

| | |
|---|---|
| **Threshold 1:** | Would the project result in the wasteful and inefficient use of non-renewable resources during construction and operation of the project? |

**Impact E-1** **IMPLEMENTATION OF THE PROPOSED PROJECT WOULD RESULT IN OVERALL CONSUMPTION OF ENERGY BEYOND EXISTING CONDITIONS. THE PROPOSED PROJECT WOULD IMPLEMENT A LAND USE STRATEGY THAT PROMOTES GREATER OVERALL ENERGY CONSERVATION AND EFFICIENCY IN COMMUNITY AND MUNICIPAL OPERATIONS. GENERAL PLAN 2035 POLICIES AND PROGRAMS WOULD ENSURE THAT PROJECT DEVELOPMENT WOULD COMPLY WITH EXISTING ENERGY EFFICIENCY REGULATIONS AND WOULD ENCOURAGE NEW AND EXISTING DEVELOPMENT TO TAKE ADVANTAGE OF VOLUNTARY ENERGY EFFICIENCY PROGRAMS. IMPACTS WOULD BE LESS THAN SIGNIFICANT.**

The proposed project would involve the use of energy during construction and operation. Energy use during construction would be primarily in the form of fuel consumption to operate heavy equipment, light-duty vehicles, machinery, and generators for lighting. Temporary grid power may also be provided to construction trailers or electric construction equipment. CalGreen and Title 24 of the California Energy Code include specific requirements related to recycling, construction materials, and energy efficiency standards that would apply to construction of implementation of the proposed project and would help minimize wasteful, inefficient, and unnecessary energy consumption.

Operation of the proposed project would consume natural gas and electricity for building heating and power, lighting, and water conveyance, among other operational requirements. However, as discussed in Section 5.2, *Irreversible Environmental Effects*, Policies ES 25 and ES 26 of the Environmental Stewardship Chapter of General Plan 2035 would promote environmental stewardship through policies that support energy and water conservation, energy efficiency, renewable power, and green building design, which would help minimize the occurrence of inefficient, wasteful, and unnecessary energy consumption during operation of development facilitated by the General Plan. In addition, development would be required to comply with the water efficient landscaping requirements of Novato Municipal Code Section 19.28.040, which would further reduce energy consumption.

Daily operation of the regional and local transportation system would use energy in the form of fuel consumed by propulsion of passenger vehicles, including automobiles, vans, trucks, and transit vehicles, such as buses and trains. However, several goals, policies, and programs of the City that Works Chapter of General Plan 2035 would reduce fuel consumption by promoting public transit, alternative transportation, and trip reduction through land use design. Policy MO 8 would enhance pedestrian and bicycle facilities as part of roadway improvement projects, which would encourage residents to use non-vehicular modes of transportation. Policy MO 10 would support development patterns that encourage the use of public transit, and Policy MO 12 would promote the use of transportation demand management programs by the City and private employers. Furthermore, Goal MO 3 and its corresponding policies and programs would improve public transit systems and facilities, facilitate use of the SMART rail system, and promote the construction and use of park and ride facilities. Goal MO 4 and its corresponding policies and programs would improve the bicycle network by establishing and maintaining a comprehensive bicycle path system and expanding bicycle parking throughout the city. As a result of General Plan 2035 goals and policies in combination with regional and local trends, vehicle miles travelled (VMT) in Novato are forecast to decrease by 12.6 percent from 2015 to 2040, thereby reducing overall demand for transportation fuels (Fehr & Peers 2018).

Implementation of the General Plan 2035 goals and policies listed above would promote greater energy efficiency in municipal and community operations and development. In addition, other policies and programs contained in the General Plan 2035 would result in indirect energy conservation, such as the promotion of water conservation in Policy ES 25 and waste reduction in Policy ES 27. Furthermore, General Plan 2035 contains a land use strategy that actively promotes infill development within the Downtown, North Redwood Boulevard Corridor, and the North, North Redwood Boulevard Corridor focus areas as well as mixed use development in the Downtown focus area. This land use strategy would result greater energy efficiency overall for City residents, businesses, and City operations by reducing vehicle miles travelled and fuel consumption. In addition, the City has purchased renewable energy through Marin Clean Energy. The use of renewable energy in Novato would reduce overall energy use in the City.

Expanded development of the Industrial Parks MPA, which would include up to 500,000 square feet of office, manufacturing, and lab uses, would increase energy consumption as compared to existing uses. However, similar to other development under the proposed project, the goals and policies of General Plan 2035 discussed above would ensure that energy usage by future development in the Industrial Parks MPA is not wasteful or inefficient. Therefore, General Plan 2035 would not result in potentially significant environmental effects from wasteful, inefficient, or unnecessary consumption of energy. Impacts would be less than significant.

| | |
|---|---|
| **Threshold 2:** | Would the project conflict with or obstruct a state or local plan for renewable energy or energy efficiency? |

**Impact E-2 THE PROPOSED PROJECT WOULD BE CONSISTENT WITH ENERGY EFFICIENCY GOALS CONTAINED IN THE 2009 CCAP. IN ADDITION, GENERAL PLAN 2035, WHICH IS INTENDED TO SERVE AS THE CITY'S CAP, CONTAINS SEVERAL GHG REDUCTION STRATEGIES THAT TARGET ENERGY EFFICIENCY AND RENEWABLE ENERGY. IMPACTS WOULD BE LESS THAN SIGNIFICANT.**

As discussed in Section 4.6, *Greenhouse Gas Emissions*, the City of Novato prepared a CCAP in 2009 that included GHG emission reduction measures and actions intended to achieve a 2020 target of 15 percent below 2005 emission levels. Goals 1 through 8 of the 2009 CCAP focus on measures and actions that target energy efficiency and conservation, renewable energy, green building design, water conservation, vehicle efficiency and alternative fuels, citywide land use and design, alternative transportation modes, waste reduction. As shown in Table 4.6-2 in Section 4.6, *Greenhouse Gas Emissions*, the proposed project would be consistent with the CCAP's GHG reduction strategies that specifically address energy efficiency and renewable energy.

In addition, General Plan 2035 is intended to serve as the City's CAP and contains several GHG reduction strategies that target energy efficiency and renewable energy as a means of achieving GHG reduction goals. These strategies, which are included as policies and programs in General Plan 2035, include the following:

- Replacement of 3,126 streetlights with LED lamps
- Reduction of municipal building energy use by 30 percent
- Establishment of energy efficiency protocols for municipal facilities
- Implementation of energy efficiency programs

- Implementation of public outreach efforts regarding energy efficiency and GHG emission reductions
- Installation of renewable energy systems at municipal buildings
- Removal of barriers to small-scale, distributed renewable energy production
- Expansion of the City's green building program to include Tier 1 requirements for energy efficiency Green building standards
- Encouragement of mixed use, infill development near transit
- Promotion of walking and construction of pedestrian facilities
- Increase of commercial bicycle parking and facilities requirements
- Increase of multi-family residential bicycle parking and facilities requirements
- Adoption of Complete Streets standards to expand pedestrian and bicycle infrastructure
- Improvement of the transit system

In addition, Policy ES 25f of General Plan 2035 would support Marin Clean Energy and PG&E in their efforts to increase the proportion of renewable power offered to residents, which would support the statewide target of achieving 100 percent renewable electricity by 2045 as established by SB 100. Furthermore, as discussed in Section 4.6, *Greenhouse Gas Emissions*, the proposed project would generate annual GHG emissions that would not conflict with the GHG reduction targets established by the 2017 Scoping Plan and would therefore be consistent with the energy efficiency and renewable energy provisions of this plan. As a result, the proposed project would not conflict with a State or local plan for renewable energy or energy efficiency, and impacts would be less than significant. Development in the four focus areas and Industrial Parks MPA are would adhere to goals and policies of General Plan 2035 related to energy reduction, as well as the City's CAP. Therefore, impacts would be less than significant.

# 6 Alternatives

As required by Section 15126.6 of the *CEQA Guidelines*, this EIR examines a range of reasonable alternatives to the proposed project that could feasibility achieve similar objectives. General Plan 2035 vision and thus the objectives for the future are as follows:

General Plan 2035 sets the following guiding principles:

We wish to <u>preserve and enhance</u>:

- The open space, hillsides, ridgelines, creeks, wetlands and other natural features that give our City its scenic beauty, quality of life and define our borders;
- Our small town character and historical heritage;
- The safe, quiet and individual character of our distinct neighborhoods, where our residents can raise their families and send their children to excellent schools;
- The many small businesses throughout our City that provide our residents with essential goods, services and jobs; and
- The financial integrity of our City government so that it may continue to serve the civic needs of all of our residents.

As we look to the future, we wish to <u>encourage and promote</u>:

- Sustainable development that is in harmony with its natural and built environment;
- A variety of housing types dispersed throughout the community, portions of which are affordable, for our commercial workforce, public employees, seniors, and those with special needs;
- Creation of public gathering places, parks, recreational facilities and community gardens that provide a sense of community, and allow enjoyment of our natural amenities;
- Creation of venues to enrich the visual and performing arts;
- Development that meets the needs of our residents and supports quality public services;
- Encouragement of interconnected modes of local transportation, including bicycle and pedestrian paths and trails, shuttles, buses, and paratransit.

The following are objectives of the Industrial Parks MPA:

- Strengthen and expand the biotech and life sciences industries in Novato
- Economic development in Novato
- Promote job orientation in Novato with higher paying jobs

The analysis of alternatives focuses on the various land use scenarios that incorporate different assumptions regarding the combinations of future land uses and associated infrastructure improvements. Alternatives provided are intended to reduce or avoid significant and unavoidable impacts. As discussed in Section 4.0, *Environmental Impact Analysis*, the proposed project would have significant and unavoidable impacts related to traffic (Impact T-1). An alternative location for the project as a whole is not possible. However, within Novato, the alternatives below consider different patterns of land use and infrastructure to accommodate forecasted future growth and regional housing needs.

The following alternatives are evaluated in this EIR:

- **Alternative 1:** No Project (1996 General Plan)
- **Alternative 2**: Proposed General Plan 2035 Without Industrial Parks MPA
- **Alternative 3:** Proposed General Plan 2035 with 300,000 square foot maximum development cap in the Industrial Parks MPA
- **Alternative 4:** Proposed General Plan 2035 but same land use as 1996 General Plan for the North Redwood Boulevard Corridor and North, North Redwood Boulevard Corridor

# 6.1 Alternative 1: No Project Alternative

## 6.1.1 Description

The No Project Alternative involves continued implementation of the 1996 General Plan. This alternative is comprised of a land use pattern that reflects the land use identified in the existing Novato General Plan. Under this alternative, the proposed General Plan 2035 would not be adopted, Ignacio and Hamilton Industrial Parks would not be amended to increase the development potential for Life Sciences, the implementing ordinances would not be adopted, and the existing 1996 General Plan, including the land use map and all of the General Plan goals and policies, would remain in place through the horizon year of 2035. Thus, any new development in Novato would occur consistent with the existing land use designations and the allowed uses within each designation. Similarly, any new infrastructure would occur as envisioned in the 1996 General Plan. Development under this alternative is anticipated to be spread out throughout the Plan Area instead of concentrated in the four focus areas and Industrial Parks MPA. As shown in Table 2-1 in Section 2.0, *Project Description*, development projections under the 1996 General Plan exceed development projections in General Plan 2035. Specifically, buildout of the 1996 General Plan projects 4,110 additional residential units, approximately 5.1 million additional square feet of commercial development, and approximately 800,000 additional square feet of industrial development. Therefore, overall development and anticipated growth under this alternative would be increased compared to the proposed project.

## 6.1.2 Impact Analysis

### a. Aesthetics

Development under the City's 1996 General Plan would continue the currently planned land use pattern in the City focused on retaining the small town character of Novato and maintaining the downtown as the center of the community. Implementation of Alternative 1 would involve greater overall development and growth than would occur under General Plan 2035. General Plan 2035 focuses on infill development in the four focus areas and buildout associated with the Industrial Parks MPA, while this alternative would continue currently planned development with increased residential, commercial, and industrial development throughout the City. This would result in more urban development at the edges of the Plan Area because development would not be concentrated in the four focus areas and Ignacio and Hamilton Industrial Parks. Therefore, scenic views from the City could be degraded from undeveloped areas on the outskirts of the city. Because development under Alternative 1 would not be as area-focused as General Plan 2035 there would be more impacts to aesthetic resources, such as the potential change in visual character or blocking scenic views. Additionally, more development than anticipated under the proposed project may result in increased light and glare impacts. However, the hillside development implementing ordinance would not occur under this alternative and impacts to scenic views in the hillsides would be reduced as compared to the proposed project. Alternative 1 would not involve implementation of the Industrial Parks MPA. Therefore, aesthetic impacts in the area of the Industrial Parks MPA would be reduced as compared to the proposed project because the Life Sciences Campus would not be constructed.

Overall, aesthetic impacts for Alternative 1 would be less than the proposed project, and would remain less than significant with implementation of existing lighting design guidelines.

### b. Air Quality

Implementation of Alternative 1 would involve increased overall development and associated growth than would occur under the proposed project. Therefore, construction emissions would be greater than the proposed project. Increased growth would be spread throughout Novato, instead of concentrated in the four focus areas and Industrial Parks MPA area. Infill development in the four focus areas would incrementally increase density in specified arterial corridors, and would therefore result in higher toxic air contaminant's (TAC) for sensitive receptors near arterial corridors compared to Alternative 1. However, while the proposed project focuses on infill development in the four focus areas and Industrial Parks MPA, Alternative 1 would continue the currently planned development pattern throughout the City with more urban development occurring at the edges of the City than General Plan 2035. As a result, projected vehicle miles traveled (VMT) at buildout under Alternative 1 would increase as compared to the proposed project. An increase in VMT correlates to an increase in mobile air quality emissions. Under Alternative 1 development under the Industrial Parks MPA would not occur. Therefore, the emissions associated with the construction and operation of the Life Sciences industrial development would be avoided under this alternative. However, Alternative 1 would result in more development overall, and consequently more construction and operation emissions. Overall, Alternative 1 would result in higher associated air contaminant emissions in the City as compared to the proposed project. Because of increased development and VMT, overall air quality impacts would be greater under this alternative than under the proposed project. Impacts would remain significant but mitigable, similar to the proposed project.

### c. Biological Resources

Implementation of Alternative 1 would involve increased overall development and associated growth compared to the proposed project. Increased growth would be spread throughout Novato, instead of concentrated in the four focus areas and Industrial Parks MPA area. Alternative 1 would continue the existing land use pattern which would result in increased urban development occurring throughout the City as compared to the proposed project. Therefore, Alternative 1 would result in more conversion of vacant or underdeveloped areas and more development near sensitive habitats including oak woodlands and wetlands. Thus, there would be more impacts on sensitive status species and habitats under this alternative as compared to the proposed project. In addition, Implementing Ordinance 8 to replant with native tree species and Implementing Ordinance 11 to require the protection of special status species as a reason to require an expanded wetland buffer would not occur as part of Alternative 1 potentially increasing impacts to sensitive status species. Compared to the development pattern in Alternative 1, the proposed project prioritizes infill development in the four focus areas and Industrial Parks MPA, which are already urbanized areas in the City, minimizing development impacts on special status species and habitats. Overall long-term biological impacts under Alternative 1 would be greater than impacts under the proposed project, but impacts would remain significant and mitigable, similar to the proposed project.

## d. Cultural Resources

Implementation of Alternative 1 would involve increased overall development and associated growth than would occur as part of the proposed project. Thus, increased development would result in additional impacts to cultural resources as compared to the proposed project. Alternative 1 would not allow demolition of single-family residences in the Northwest Quadrant Neighborhood. Single family residences in the Northwest Quadrant Neighborhood are over 50 years of age and may be considered historic structures. Therefore, Alternative 1 would reduce impacts to historic structures as compared to the proposed project. Nevertheless, overall long-term cultural resources impacts under Alternative 1 would be greater than impacts under the proposed project because Alternative 1 would result in increased development that may impact cultural resources. Impacts would remain significant but mitigable, similar to the proposed project.

## e. Geology and Soils

Implementation of Alternative 1 would involve increased overall development and associated growth than would occur as part of the proposed project. Because the proposed project focuses on development in the four focus areas and the Industrial Parks MPA, and involves less overall development, it would result in less ground disturbance than Alternative 1. Since ground disturbance for this alternative would be greater than for the proposed project, impacts related to geology and soils would be slightly higher. However, compliance with existing regulatory requirements and policies would reduce impacts from adverse effects such as ground shaking, liquefaction, and seismic ground failure. Overall long-term geology and soils impacts under Alternative 1 would be greater than impacts from the proposed project; however impacts would remain significant but mitigable.

## f. Greenhouse Gas Emissions

Implementation of Alternative 1 would involve increased overall development and associated growth than would occur under the proposed project. Therefore, construction emissions would be greater than the proposed project. While the proposed project focuses on infill development in the four focus areas and Industrial Parks MPA, Alternative 1 would continue the currently planned development pattern throughout the City with more urban development occurring at the edges of the City than the proposed project. As a result, projected vehicle miles traveled (VMT) at buildout under Alternative 1 would increase as compared to the proposed project, which would result in an increase in mobile GHG emissions. Thus, operational emissions would be greater under this alternative. However, under Alternative 1 development under the Industrial Parks MPA would not occur. Therefore, both construction and operational GHG impacts associated with the Life Sciences industrial development would be avoided. In addition, Alternative 1 would not include the proposed Climate Action Plan that is built into General Plan 2035 to ensure Novato's GHG emissions are on the trajectory to meet state GHG reduction goals. Therefore, Alternative 1 would not be consistent with state regulations and policies. Overall, impacts would be greater than impacts from the proposed project, and impacts would be less than significant with mitigation implemented.

## g. Hazards and Hazardous Materials

Implementation of Alternative 1 would involve increased overall development and associated growth than would occur as part of the proposed project. The proposed project would result in less ground disturbance than would occur under this alternative. In addition, increased development under Alternative 1 would result in additional transport and use of hazardous materials. Specifically, the anticipated approximately 800,000 additional square feet of industrial land uses under Alternative 1 would result in greater use of hazardous materials as compared to the proposed project because industrial land include manufacturing and laboratory uses that transport, use, and dispose of hazardous materials. Therefore, even though development would not occur as part of the Industrial Parks MPA under this alternative there would be increased use and transport of hazardous material associated with overall increased industrial development allowed under the 1996 General Plan. Since ground disturbance and use of hazardous materials under this alternative would be greater than for the proposed project, impacts related to hazards and hazardous material would be slightly higher. However, compliance with existing regulatory requirements would address potential impacts related to hazards and hazardous materials, and impacts under Alternative 1 would be less than significant, similar to the proposed project.

## h. Hydrology and Water Quality

Implementation of Alternative 1 would involve increased overall development and associated growth than would occur as part of the proposed project. Increased growth would be spread throughout Novato, instead of concentrated in the four focus areas and Industrial Parks MPA area. However, because the proposed project focuses on higher density development in the four focus areas and Industrial Parks MPA, and less overall development, it would involve less ground disturbance than Alternative 1. Because ground disturbance under this alternative would be greater than for the proposed project, impacts related to hydrology and water quality would be slightly increased as compared to the proposed project due to increased potential for soil erosion. More urban development, as compared to infill development, would result in an increase in impervious surfaces and related runoff, while decreasing infiltration. However, impacts under Alternative 1 would be subject to the same regulatory requirements (such as NPDES permit requirements) governing runoff and protecting water quality and supply as the proposed project. Although impacts would be slightly higher under this alternative, they would remain less than significant, similar the proposed project.

## i. Land Use and Planning

Implementation of Alternative 1 would involve increased overall development and associated growth than would occur as part of the proposed project. Both the proposed project and Alternative 1 would provide for the orderly development of Novato, although under different scenarios. Neither would physically divide an established community or conflict with an applicable habitat conservation plan or natural community conservation plan. As discussed in Section 4.9, *Land Use and Planning*, General Plan 2035 would be consistent with all 2040 Plan Bay Area goals and policies. Alternative 1 would retain the City's 1996 General Plan and thus would not include policies and programs that ensure consistency with Plan Bay Area, such as programs ES 24a through ES 24c that require the implementation of cost-effective strategies to achieve greenhouse gas emissions consistent with the City's greenhouse gas reduction goals of 15 percent and 40 percent below 2005 emissions levels by 2020 and 2035, respectively. Therefore, Alternative 1 would have greater impacts related to land use and planning compared to the proposed project; however, impacts would remain less than significant.

## j. Noise

Implementation of Alternative 1 would involve increased overall development and associated growth than would occur as part of the proposed project. More overall development under Alternative 1 would result in increased noise throughout the City from both construction and operation of individual projects. Because Alternative 1 would involve greater development than the proposed project, additional traffic would be added to area roadways increasing traffic related noise. However, noise impacts to receptors surrounding the Industrial Parks MPA area would be reduced under Alternative 1. Sensitive receptors under this alternative in the vicinity of the Industrial Parks MPA would not be exposed to noise from the Life Sciences campus, including construction and traffic related noise. Overall, Alternative 1 would have greater noise impacts as compared to the proposed project.

## k. Population and Housing

Implementation of Alternative 1 would involve increased overall development and associated growth than would occur as part of the proposed project. Projected growth as part of the proposed project would be below 1996 General Plan growth projections in 2035 by 4,110 housing units, approximately 5.1 million square feet of commercial development, and approximately 800,000 square feet of industrial development. Therefore, Alternative 1 would have greater impacts from development as compared to the proposed project. Neither Alternative 1 nor the proposed project would displace substantial numbers of people or housing. Impacts related to population and housing would be greater than the proposed project, but would remain less than significant, similar to the proposed project.

## l. Public Services

Implementation of Alternative 1 would involve increased overall development and associated growth than would occur as part of the proposed project. Projected growth under the proposed project would be below 1996 General Plan growth projections in 2035 by 4,110 housing units, approximately 5.1 million square feet of commercial development. Therefore, the proposed project would demand fewer public services than Alternative 1. In addition, the proposed project would direct growth in the Plan Area focusing on infill development in the four focus areas and Industrial Parks MPA. Focusing development in these areas would concentrate the areas where increased fire and police services are required, as opposed to development throughout the City. Both Alternative 1 and the proposed project would ensure that public services continue to be provided to the City commensurate with population growth and need. Overall, impacts related to public services would be increased compared to the proposed project, but would remain less than significant, similar to the proposed project.

## m. Traffic and Transportation

Implementation of Alternative 1 would involve increased overall development and associated growth as compared to the proposed project. Projected growth under the proposed project would be below the 1996 General Plan growth projections, and therefore would result in fewer vehicles added to area roadways as compared to Alterative 1. However, the proposed project would concentrate development in the four focus areas, while Alternative 1 would involve development throughout the City. Therefore, the proposed project could result in additional traffic at intersections in the four focus areas. Implementation of Alternative 1 would not involve construction of the Life Sciences campus in the Industrial Parks MPA. Therefore, traffic impacts at intersections serving circulation to and from the Life Sciences campus could be reduced under this alternative as compared to the proposed project. Similar to the proposed project, this alternative would ensure that impacts related to air traffic, emergency access, and alternative transportation would be less than significant. Therefore, while Alternative 1 could have reduced impacts at some specific intersections, it would have similar overall traffic impacts as the proposed project due to increased growth under this alternative. Impacts would remain significant and unavoidable, similar to the proposed project.

#### n. Tribal Cultural Resources

Implementation of Alternative 1 would involve increased overall development and associated growth as compared to the proposed project. The proposed project would involve infill development in the already urbanized four focus areas and Industrial Parks MPA, while Alternative 1 would result in greater development and development occurring throughout the City. Increased development throughout the City would potentially impact more tribal cultural resources because more tribal cultural resources could be unearthed from construction in otherwise undisturbed or undeveloped areas. Overall long-term tribal cultural resources impacts under Alternative 1 would be greater than impacts under the proposed project, but would remain significant but mitigable, similar to the proposed project.

#### o. Utilities and Service Systems

Implementation of Alternative 1 would involve increased overall development and associated growth than would occur as part of the proposed project. As discussed under Section 4.15, *Utilities and Service Systems*, the proposed project's potential impacts related to the provision of utilities and service systems would be less than significant. Alternative 1 would result in increased development and associated growth, which would require additional water demand, wastewater generation, and result in more solid waste. Therefore, Alternative 1 would require additional utilities and service systems including water, wastewater treatment, and landfill space. For example, Alternative 1 would result in an additional 4,110 housing units in the City compared to the proposed project, and each housing unit would generate demand for water and wastewater treatment, and would generate solid waste. Because development under Alternative 1 would be less dense than the proposed project there may be additional impacts from expanded services including expansion of utility lines and wastewater treatment plants. Impacts would be greater than the proposed project and significant but mitigable.

## 6.2 Alternative 2: Proposed General Plan 2035 without Industrial Parks MPA

### 6.2.1 Description

Under this alternative the proposed project would be adopted, but this alternative assumes that an amendment to the Industrial Parks MPA would not occur and therefore there would be no expanded development in the Industrial Parks MPA area. The 500,000 square foot biotechnology industry campus would not be constructed under this alternative. Under Alternative 2 the Industrial

Parks MPA area would remain as it is under existing conditions and would not include the mix of office, laboratory, and manufacturing uses. Thus, overall development and growth would be similar to the proposed project, except that the Industrial Parks MPA area would not be developed with the 500,000 square foot Life Sciences campus as assumed in the proposed project. Therefore, overall development and growth would be reduced as compared to the proposed project.

## 6.2.2 Impact Analysis

### a. Aesthetics

Alternative 2 would exclude development of the 500,000 square foot biotech industry campus in the Industrial Parks MPA area. Development within the rest of the Plan Area would have the same impacts to aesthetics as the proposed project since development under this alternative would be the same as envisioned by the proposed project, except for in the Industrial Parks MPA area. Aesthetic impacts would be reduced under Alternative 2 because there would be fewer impacts to scenic vistas in the Bel Marin Keys area. Buildings shown in the photosimulations on Figure 4.1-8 through Figure 4.1-11 would not be constructed because Alternative 2 would not include the Life Sciences campus. Impacts related to visual character and lighting would remain the same as under the proposed project because goals and policies in the proposed project and the City's municipal code would continue to improve visual quality in the City, while limiting light and glare. Overall, aesthetic impacts under Alternative 2 would be less than under the proposed project and impacts would remain less than significant, similar to the proposed project.

### b. Air Quality

Alternative 2 would exclude development of the 500,000 square foot Life Sciences campus in the Industrial Parks MPA area. Development within the rest of the Plan Area would have the same impacts to air quality as the proposed project since development in the City under this alternative would be the same as envisioned by the proposed project, except for in the Industrial Parks MPA area. Reduced development in the Industrial Parks MPA area under this alternative would result in fewer overall construction and operational air contaminant emissions. Without the 500,000 square feet of biotech development, VMT would be reduced as compared to the proposed project further reducing operational emissions. Similar to the proposed project, Alternative 2 would be consistent with the Clean Air Plan because it would be consistent with CAP control measures and goals. Because Alternative 2 would not develop the 500,000 square foot Life Sciences campus this alternative would not expose sensitive receptors around the Industrial Parks MPA area to new sources of TACs that would be used as part of the campus. For these reasons, overall air quality impacts for Alternative 2 would be reduced as compared to the proposed project. However impacts would remain less than significant with mitigation, similar to the proposed project because Mitigation Measure AQ-1 to add a policy requiring construction best management practices and Mitigation Measure AQ-2 to add a policy for health risk assessment screening would still apply to Alternative 2.

### c. Biological Resources

Alternative 2 would exclude development of the 500,000 square foot Life Sciences campus in the Industrial Parks MPA area. Development within the rest of the Plan Area would have the same impacts to biological resources as the proposed project since development in the City under this alternative would be the same as envisioned by the proposed project, except for in the Industrial

Parks MPA area. Reduced development in the Industrial Parks MPA area under this alternative would reduce impacts to sensitive biological resources as compared to the proposed project because nearby sensitive resources, such as the estuary, would not be affected by development. Impacts to nesting birds would also be reduced under this alternative because there would be reduced development in the Industrial Parks MPA area. In addition, goals and policies in General Plan 2035 would continue to protect valuable habitat and sensitive resources throughout the Plan Area. Overall, biological impacts under Alternative 2 would be less than under the proposed project. However, impacts would remain less than significant with mitigation because Mitigation Measure BIO-1 to protect sensitive species, Mitigation Measure BIO-2 to prepare biological resource assessments for undeveloped areas, Mitigation Measure BIO-3 to require sensitive resource inventories for new development, Mitigation Measure BIO-4 to protect nesting birds, and Mitigation Measure BIO-5 to protect wildlife movement corridors would still apply to Alternative 2.

## d. Cultural Resources

Alternative 2 would exclude development of the 500,000 square foot Life Sciences campus in the Industrial Parks MPA area. Development within the rest of the Plan Area would have the same impacts to cultural resources as the proposed project since development in the City under this alternative would be the same as envisioned by the proposed project, except for in the Industrial Parks MPA area. Reduced development in the Industrial Parks MPA area under this alternative would reduce impacts to cultural and paleontological resources as compared to the proposed project because potential impacts to cultural and paleontological resources from the 500,000 square feet of development in the Industrial Parks MPA area would not occur. Therefore, fewer resources would be disturbed. In addition, goals and policies in General Plan 2035 would continue to protect valuable cultural resources. Overall, cultural and paleontological impacts under Alternative 2 would be less than the proposed project. However, impacts would remain less than significant with mitigation because Mitigation Measure CR-1 to require a cultural resources study implementation program and Mitigation Measure CR-2 to require paleontological resource studies would still apply to Alternative 2.

## e. Geology and Soils

Alternative 2 would exclude development of the 500,000 square foot Life Sciences campus in the Industrial Parks MPA area. Development within the rest of the Plan Area would have the same impacts to geology and soils as the proposed project since development in the City under this alternative would be the same as envisioned by the proposed project, except for in the Industrial Parks MPA area. Reduced development in the Industrial Parks MPA area under this alternative would reduce geology and soils impacts as compared to the proposed project because there would not be impacts from subsidence liquefaction, collapse, and other geologic hazards in the Industrial Parks MPA area. Compliance with existing regulatory requirements and polices would reduce impacts from adverse effects such as ground shaking, liquefaction, and seismic ground failure in the rest of the Plan Area. Overall, geology and soils impacts under Alternative 2 would be less than under the proposed project because there would be less development. However, impacts would remain less than significant with mitigation because Mitigation Measure GEO-1 to require soil investigation of septic systems would still apply to Alternative 2.

### f. Greenhouse Gas Emissions

Alternative 2 would exclude development of the 500,000 square foot Life Sciences campus in the Industrial Parks MPA area. Development within the rest of the Plan Area would have the same GHG impacts as the proposed project since development in the City under this alternative would be the same as envisioned by the proposed project, except for in the Industrial Parks MPA area. Reduced development in the Industrial Parks MPA area would result in fewer GHG emissions than the proposed project from both construction and operation. Specifically, operational emissions such as energy and mobile emissions would be reduced under this alternative. Overall, impacts would be reduced as compared to the proposed project and would remain less than significant.

### g. Hazards and Hazardous Materials

Alternative 2 would exclude development of the 500,000 square foot Life Sciences campus in the Industrial Parks MPA reducing overall growth in the Plan Area. Development within the rest of the Plan Area would have the same impacts to hazards and hazardous materials as the proposed project since development in the City under this alternative would be the same as the proposed project, except for in the Industrial Parks MPA area. Less development under this alternative would reduce hazardous impacts as compared to the proposed project because there would be reduced use and transport of hazardous materials without development of the Life Sciences campus. Specifically, fewer hazards such as acids, bases, radioactive substances, and flammable materials would be used in the Industrial Parks MPA area under this alternative. There is one identified potentially hazardous site in the Industrial Parks MPA area. However, the site at 20 Pimentel Court was cleaned up in 1996 and DTSC determined that no further action is required on the site. Impacts from cleanup sites would thus be similar to the proposed project. Compliance with existing regulatory requirements and polices contained in General Plan 2035 would reduce impacts from adverse effects such as hazardous spills and exposure to wildfires in the Plan Area. Overall, hazard and hazardous material impacts under Alternative 2 would be similar to the proposed project and impacts would remain less than significant, similar to the proposed project.

### h. Hydrology and Water Quality

Alternative 2 would exclude development of the 500,000 square foot Life Sciences campus in the Industrial Parks MPA reducing overall growth in the Plan Area. Development within the rest of the Plan Area would have the same impacts to hydrology and water quality as the proposed project since development in the City under this alternative would be the same as the proposed project, except for in the Industrial Parks MPA area. Less development in the Industrial Parks MPA would reduce the amount of ground disturbance required for construction, thereby decreasing the potential for soil erosion and sedimentation of surface water. Although the Life Sciences campus would not be constructed as part of Alternative 2, the Industrial Parks MPA is already built out. Therefore, the exclusion of the 500,000 square foot Life Sciences campus would not substantially reduce the total impervious surface area. The volume of and velocity of stormwater runoff, and the potential for runoff to carry urban contaminants, such as residual oil and gasoline from parking lots, into surface waters and storm drains would be similar to existing conditions. This alternative would have similar hydrology and water quality impacts as compared to the proposed project because although there would be reduced development, these areas are already developed with impervious surfaces resulting in similar runoff. In addition, compliance with existing regulatory requirements and General Plan 2035 polices would reduce impacts from adverse effects to water quality and drainage, as well as flooding, in the Plan Area. Overall, hydrology and water quality impacts under

Alternative 2 would be less than under the proposed project and impacts would remain less than significant, similar to the proposed project.

### i. Land Use and Planning

Similar to General Plan 2035, Alternative 2 would provide for orderly development in Novato without development of the 500,000 square foot Life Sciences campus in the Industrial Parks MPA area. Alternative 2 would result in less development in the Industrial Park MPA area and thus would not divide an established community or conflict with an applicable habitation conservation plan. As discussed in Section 4.9, *Land Use and Planning*, the proposed project would be consistent with all 2040 Plan Bay Area goals and policies. Alternative 2 would retain General Plan 2035 policies and would thus be consistent with all 2040 Plan Bay Area goals and policies. Overall, land use impacts for this alternative would be similar to the proposed project and impacts would remain less than significant.

### j. Noise

Alternative 2 would exclude development of the 500,000 square foot Life Sciences campus in the Industrial Parks MPA area. Development within the rest of the Plan Area would have the same impacts to noise as the proposed project since development in the City under this alternative would be the same as envisioned by the proposed project, except for in the Industrial Parks MPA area. Reduced development in the Industrial Parks MPA area under this alternative would reduce noise impacts from construction, traffic, and land use operations of the Life Sciences campus for noise receptors in the vicinity of the Industrial Parks MPA area. The mobile home park south of the Industrial Parks MPA area would no longer be exposed to construction noise of the Life Sciences campus and noise from operation of the office, laboratory, or manufacturing uses. Overall, noise impacts under Alternative 2 would be less than under the proposed project. However, impacts would remain less than significant with mitigation because Mitigation Measures N-1 to require construction noise control measures would still apply to Alternative 2.

### k. Population and Housing

Alternative 2 would exclude development of the 500,000 square foot Life Sciences campus in the Industrial Parks MPA area. Development within the rest of the Plan Area would have the same impacts to population and housing as the proposed project since development in the City under this alternative would be the same as the proposed project, except for in the Industrial Parks MPA area. Job and employment numbers in the City would be reduced under Alternative 2 since the 500,000 square foot Life Sciences campus would not be developed. However, sufficient growth throughout the rest of the City is still included in the proposed project to meet the population and employment targets of Plan Bay Area (ABAG 2017). Therefore, Alternative 2 would be consistent with 2040 ABAG growth projections. In addition, Alternative 2 would not displace a substantial number of people or housing because it would result in reduced overall development. Overall, population and housing impacts would be similar to the proposed project. The growth projections for Alternative 2 would be similar to the targets of Plan Bay Area and impacts would remain less than significant, similar to the proposed project.

### l. Public Services

Alternative 2 would not include development of the 500,000 square foot Life Sciences campus in the Industrial Parks MPA area. Development within the rest of the Plan Area would have the same impacts to public services as the proposed project since development in the City under this alternative would be the same as envisioned by the proposed project, except for in the Industrial Parks MPA area. A reduction in growth in the Industrial Parks MPA would require less demand for public services in the City as compared to the proposed project. Therefore, police and fire response times and service ratios would be improved under this alternative as compared to the proposed project. Overall, because of the reduction in development under this alternative, public services impacts would be less than the proposed project, and impacts would remain less than significant similar to the proposed project.

### m. Traffic and Transportation

Implementation of Alternative 2 would involve less overall development than would occur under the proposed project, specifically in the Industrial Parks MPA area. Traffic analysis was completed for Alternative 2 to determine traffic impacts in the City without development of the 500,000 square foot Life Sciences campus.

### Methodology

Weekday AM and PM peak-hour traffic operations were evaluated at the study intersections for the following additional traffic scenarios:

- Existing plus Alternative 2 Conditions
- Cumulative (Year 2035) with Alternative 2 Conditions

In addition to intersection operation, PM peak hour corridor operation was determined for four roadway segments as well as Highway 101 and SR 37 freeway segments within the City, as required by the CMP.

### Traffic Forecasts

The added volumes associated with buildout of Alternative 2 were obtained by deducting the projected traffic associated with 500,000 square feet Life Sciences campus in the Industrial Parks MPA area from the proposed project. The 500,000 square feet Life Sciences campus development in the Industrial Parks MPA would consist of a mix of office, laboratory, and manufacturing uses, and is projected to generate approximately 378 trips during both the AM and PM peak hours. After removing these trips from those projected for the proposed project, it is estimated that Alternative 2 would result in approximately 2,916 AM peak hour and 3,896 PM peak hour trips to the local and regional roadway network compared to existing conditions. This represents a reduction in peak hour trips of 13 percent and 10 percent during the AM and PM peak hours, respectively, compared to the proposed project. A comparison of the trips generated by Alternative 2 versus the proposed project is shown in Table 6-1.

**Table 6-1 Trip Generation Comparison – General Plan 2035 versus Alternative 2**

| | Added Vehicle Trips | |
|---|---|---|
| **Analysis Scenario** | **AM Peak Hour** | **PM Peak Hour** |
| General Plan 2035 | 2,916 | 3,896 |
| Alternative 2 | 2,538 | 3,518 |
| **Net Difference** | **-378 (-13%)** | **-378 (-10%)** |

Source: W-Trans

A summary of the total trips resulting from all development included in the Cumulative with Alternative 2 scenario is shown in Table 6-2.

**Table 6-2 Alternative 2 Trip Generation Summary**

| Traffic Source | Added Vehicle Trips | |
|---|---|---|
| | AM Peak Hour | PM Peak Hour |
| **City of Novato** | | |
| Alternative 2 Added Trips | 2,538 | 3,518 |
| **County of Marin** | | |
| Added Trips from Areas Adjacent to Novato | 511 | 684 |
| **Major Vacancies in City of Novato** | | |
| Added Trips from Re-Occupation of Major Vacant Sites | 707 | 964 |
| **Total Cumulative with Alternative 2 Added Trips** | **3,756** | **5,166** |

Source: W-Trans

## Alternative 2 Traffic Operations Analysis

As compared to the proposed project, Alternative 2 would differ only in the potential traffic impacts that could result from buildout of the 500,000 square foot Life Sciences campus in the Industrial Parks MPA area. Traffic operation was evaluated for the AM and PM peak hours under the "Existing plus Alternative 2" and "Cumulative with Alternative 2" scenarios. Following is a quantitative evaluation of the potential traffic impacts of Alternative 2 at the study intersections, roadway segments, and freeway segments.

### *Impacts to Study Intersections*

Projected traffic operation at the 41 study intersections was evaluated for Alternative 2. Table 6-3 shows a summary of the results. Level of service calculations and traffic volume figures are contained in Appendix F.

Alternative 2 is anticipated to result in intersection traffic impacts that are similar to those projected to occur under the proposed project, with two exceptions. Under Alternative 2, significant impacts would no longer be expected to occur at the intersections of Highway 101 South Ramps/Ignacio Boulevard-Enfrente Road (Intersection #32) or Bel Marin Keys Boulevard/Digital Drive (Intersection #9). The reduction of traffic impacts at these two intersections is attributable to the fact that Alternative 2 excludes the potential addition of 500,000 square foot Life Sciences campus in the Industrial Parks MPA area, thereby reducing the amount of traffic added to the street network in this area of Novato (in comparison to the proposed project, which is projected to cause intersection impacts in this area). Therefore, because of the reduction in trips under this alternative, LOS impacts at study intersections would be less than the proposed project and fewer intersections would experience significant and unavoidable effects. However, overall impacts would remain significant and unavoidable similar to the proposed project because other intersections in the Plan Area would continue to operate an unacceptable LOS including Redwood Boulevard/San Marin Drive, US 101 South Ramps/San Marin Drive, and US 101 North Ramps/Atherton Avenue.

At the remaining 39 study intersections throughout the City, average vehicle delays with Alternative 2 are projected to decrease slightly or remain similar to those projected for the proposed project, with LOS remaining the same. With implementation of Alternative 2, significant impacts are projected to occur at the following seven intersections. These impacts would also occur under the proposed project.

1. San Marin Drive/Simmons Lane (Intersection #1) would continue to operate unacceptably at LOS F during the PM peak hour, and would drop from LOS D to LOS E during the AM peak hour.
2. Redwood Boulevard/San Marin Drive (Intersection #4) would drop from its current acceptable operation of LOS D or better to unacceptable LOS F operation during the PM peak hour under Existing plus Alternative 2 conditions.
3. Highway 101 South Ramps/San Marin Drive (Intersection #5) would require modifications in order to achieve acceptable operation at the adjacent Redwood Boulevard/San Marin Drive intersection.
4. Highway 101 North Ramps/Atherton Avenue (Intersection #6) would have acceptable operation of LOS C or better under Existing and Existing plus Alternative 2 conditions, but would drop to an unacceptable LOS E during the PM peak hour under cumulative conditions with Alternative 2. Alternative 2 is anticipated to increase average delays by more than five seconds when comparing Existing to Existing plus Alternative 2 results, which is cumulatively considerable.
5. Novato Boulevard/San Marin Drive-Sutro Avenue (Intersection #9) would continue to operate unacceptably at LOS F during the PM peak hour, and would drop from LOS C to LOS E during the AM peak hour.
6. Diablo Avenue/Novato Boulevard (Intersection #14) would drop from its current acceptable operation of LOS D or better to unacceptable LOS E operation during the PM peak hour under Existing plus Alternative 2 conditions.
7. South Novato Boulevard/Redwood Boulevard (Intersection #30) would continue to operate unacceptably at LOS F during the AM peak hour, and would drop from LOS D to LOS E during the PM peak hour.

Table 6-4 shows the projected intersection operations, including mitigated cumulative conditions, for all intersections that are projected to have impacts under Alternative 2 scenarios. Results for the proposed project are also provided for comparison. As shown, impacts to intersection LOS at San Marin Drive/Simmons Lane, Novato Boulevard/San Marin Drive-Sutro Avenue, and Diablo Avenue/Novato Boulevard would be less than significant with mitigation, which is the same determination that was reached for the proposed project. Therefore, because of the reduction in trips under this alternative, LOS impacts at study intersections would be less than the proposed project. However, similar to General Plan 2035, Mitigation Measure T-1 to reduce intersection delay would still be required under Alternative 2.

The impacts to three Caltrans intersections and one City intersection that is dependent on improvements at the adjacent Caltrans intersection would be considered significant and unavoidable under Alternative 2, since the City of Novato does not have jurisdiction over these locations, and mitigation options would be subject to funding and/or site-specific physical constraints. The significant and unavoidable impacts would occur at Redwood Boulevard/San Marin Drive, US 101 South Ramps/San Marin Drive, and US 101 North Ramps/Atherton Avenue. Therefore, similar to the proposed project traffic impacts under Alternative 2 would remain significant and unavoidable because of impacts at these three intersections. However, Alternative 2 would avoid significant and unavoidable impacts associated with the Industrial Parks MPA.

## Table 6-3 Intersection Levels of Service with Alternative 2

| | | | AM Peak Hour | | | | | | PM Peak Hour | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Existing Conditions | | Existing plus Project Alternative 2 | | Cumulative with Project Alternative 2 | | Existing Conditions | | Existing plus Project Alternative 2 | | Cumulative with Project Alternative 2 | |
| ID | Intersection Name | Control | Delay | LOS | Delay | LOS | Delay | LOS | Delay | LOS | Delay | LOS | Delay | LOS |
| 1 | San Marin Dr/Simmons Ln | AWSC | 29.9 | D | **45.9** | **E** | **63.9** | **F** | **74.6** | **F** | **100.8** | **F** | ** | **F** |
| 2 | San Marin Dr/W Campus Dr | Signal | 4.8 | A | 4.8 | A | 5.5 | A | 4.7 | A | 6.5 | A | 9.2 | A |
| 3 | San Marin Dr/E Campus Dr | Signal | 1.0 | A | 1.6 | A | 6.4 | A | 2.2 | A | 4.4 | A | 11.9 | B |
| 4 | Redwood Blvd/San Marin Dr | Signal | 29.5 | C | 35.8 | D | 36.2 | D | 38.2 | D | ** | **F** | ** | **F** |
| 5 | US 101 S/San Marin Dr[1] | Signal | 12.2 | B | 14.4 | B | 25.5 | C | 10.1 | B | 11.6 | B | 20.8 | C |
| 6 | US 101 N/Atherton Ave[1] | Signal | 13.6 | B | 17.8 | B | 25.8 | C | 19.7 | B | 27.1 | C | **65.3** | **E** |
| 7 | Redwood Blvd/Olive Ave | Signal | 25.8 | C | 29.6 | C | 31.2 | C | 28.2 | C | 36.0 | D | 36.8 | D |
| 8 | Redwood Blvd/Grant Ave | Signal | 14.6 | B | 16.7 | B | 17.3 | B | 16.7 | B | 23.3 | C | 25.1 | C |
| 9 | Novato Blvd/San Marin Dr-Sutro Ave | AWSC | 23.8 | C | **39.8** | **E** | **39.0** | **E** | **59.9** | **F** | **89.6** | **F** | ** | **F** |
| 10 | Wilson Ave/Novato Blvd | Signal | 21.7 | C | 24.6 | C | 25.6 | C | 18.2 | B | 21.3 | C | 22.2 | C |
| 11 | Simmons Ln/Novato Blvd | Signal | 47.5 | D | 47.9 | D | 22.3 | C | 14.1 | B | 14.4 | B | 14.8 | B |
| 12 | Grant Ave/Novato Blvd | Signal | 16.6 | B | 17.4 | B | 17.7 | B | 13.2 | B | 14.0 | B | 13.6 | B |
| 13 | 7th St-Tamalpais Ave/Novato Blvd | Signal | 19.8 | B | 20.1 | C | 20.5 | C | 28.8 | C | 30.7 | C | 32.5 | C |
| 14 | Diablo Ave/Novato Blvd | Signal | 29.9 | C | 33.2 | C | 34.8 | C | 45.3 | D | **61.7** | **E** | **70.5** | **E** |
| 15 | Redwood Blvd/Diablo Ave-DeLong Ave | Signal | 37.9 | D | 41.5 | D | 42.2 | D | 31.5 | C | 41.6 | D | 46.2 | D |
| 16 | DeLong Ave/Reichert Ave | Signal | 21.0 | C | 21.9 | C | 22.2 | C | 25.1 | C | 24.8 | C | 25.8 | C |
| 17 | US 101 S/DeLong Ave[1] | Signal | 10.6 | B | 20.5 | C | 22.6 | C | 20.2 | C | 27.1 | C | 23.8 | C |
| 18 | US 101 N/DeLong Ave[1] | Signal | 11.5 | B | 12.2 | B | 12.1 | B | 29.5 | C | 23.7 | C | 25.1 | C |
| 19 | Redwood Blvd/Lamont Ave | Signal | 10.5 | B | 10.6 | B | 10.6 | B | 10.8 | B | 11.1 | B | 11.2 | B |
| 20 | Redwood Blvd/Landing Ct | Signal | 3.4 | A | 6.2 | A | 6.9 | A | 3.4 | A | 5.4 | A | 5.4 | A |
| 21 | S Novato Blvd/Center St | Signal | 15.8 | B | 15.9 | B | 15.9 | B | 19.9 | B | 20.0 | B | 20.0 | C |
| 22 | S Novato Blvd/Arthur St | Signal | 18.2 | B | 17.8 | B | 18.3 | B | 13.1 | B | 13.9 | B | 14.0 | B |
| 23 | S Novato Blvd/Rowland Blvd | Signal | 49.3 | D | 51.4 | D | 51.5 | D | 35.6 | D | 36.5 | D | 40.2 | D |
| 24 | Redwood Blvd/Rowland Blvd | Signal | 20.9 | C | 22.3 | C | 22.3 | C | 29.3 | C | 36.4 | D | 43.9 | D |

| ID | Intersection Name | Control | AM Peak Hour: Existing Conditions Delay | LOS | AM: Existing plus Project Alternative 2 Delay | LOS | AM: Cumulative with Project Alternative 2 Delay | LOS | PM Peak Hour: Existing Conditions Delay | LOS | PM: Existing plus Project Alternative 2 Delay | LOS | PM: Cumulative with Project Alternative 2 Delay | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 25 | US 101 S/Rowland Blvd[1] | Signal | 9.0 | A | 11.2 | B | 11.6 | B | 13.0 | B | 17.4 | B | 20.4 | C |
| 26 | US 101 N/Rowland Blvd/Park and Ride[1] | Signal | 16.7 | B | 18.5 | B | 20.0 | B | 30.4 | C | 34.1 | C | 35.1 | D |
| 27 | Rowland Blvd/Rowland Way | Signal | 8.2 | A | 8.3 | A | 8.4 | A | 15.2 | B | 14.8 | B | 15.1 | B |
| 28 | Rowland Blvd/Vintage Way | Signal | 5.9 | A | 9.3 | A | 9.4 | A | 17.6 | B | 20.5 | C | 21.2 | C |
| 29 | S Novato Blvd/Sunset Pkwy | Signal | 29.2 | C | 38.9 | D | 39.1 | D | 21.5 | C | 24.3 | C | 24.3 | C |
| 30 | S Novato Blvd/Redwood Blvd | AWSC | ** | **F** | ** | **F** | ** | **F** | 33.7 | D | **40.2** | **E** | **48.8** | **E** |
| 31 | Ignacio Blvd/Alameda del Prado | Signal | 19.1 | B | 18.8 | B | 19.1 | B | 16.5 | B | 16.5 | B | 17.2 | B |
| 32 | US 101 S/Ignacio Blvd-Enfrente Rd[1] | Signal | 29.8 | C | 34.2 | C | 33.7 | C | 23.0 | C | 25.0 | C | 24.3 | C |
| 33 | US 101 N/Bel Marin Keys Blvd-Nave Dr[1] | Signal | 20.1 | C | 31.5 | C | 33.3 | C | 20.9 | C | 24.1 | C | 24.6 | C |
| 34 | Bel Marin Keys Blvd/Commercial Blvd | Signal | 7.3 | A | 7.4 | A | 7.6 | A | 16.9 | B | 16.3 | B | 16.8 | B |
| 35 | Bel Marin Keys Blvd/Digital Dr | Signal | 12.4 | B | 12.2 | B | 12.3 | B | 24.8 | C | 23.2 | C | 25.1 | C |
| 36 | US 101 N/Nave Dr[1] | Signal | 13.6 | B | 15.5 | B | 15.8 | B | 13.1 | B | 14.6 | B | 15.0 | B |
| 37 | Nave Dr/Hamilton Center | Signal | 7.0 | A | 8.8 | A | 8.9 | A | 11.7 | B | 14.9 | B | 16.8 | B |
| 38 | Nave Dr/N Hamilton Pkwy | Signal | 16.0 | B | 18.0 | B | 18.0 | B | 17.0 | B | 18.5 | B | 19.1 | B |
| 39 | Nave Dr/Main Gate Dr | Signal | 9.9 | A | 13.1 | B | 13.2 | B | 9.7 | A | 15.3 | B | 15.4 | B |
| 40 | Nave Dr/Bolling Dr | Signal | 12.7 | B | 17.5 | B | 17.4 | B | 16.2 | B | 21.7 | C | 22.0 | C |
| 41 | Alameda del Prado/Nave Dr (Overpass) | AWSC | 21.2 | C | 32.1 | D | 33.6 | D | 14.8 | B | 19.2 | C | 19.6 | C |

Delay is measured in average seconds per vehicle; LOS = Level of Service; ** = delay greater than 120 seconds; **Bold** text = deficient operation

[1] Intersection on State Highways under the jurisdiction of Caltrans

Source: W-Trans

## Table 6-4 Alternative 2 Intersection Level of Service Findings and Comparison to General Plan 2035

| Intersection | Peak Hour | Existing Conditions LOS Delay | Existing plus General Plan 2035 LOS Delay | Existing plus Project Alternative 2 LOS Delay | Cumulative with General Plan 2035 LOS Delay | Cumulative with Project Alternative 2 LOS Delay | Cumulative with Project Alternative 2 Mitigated LOS Delay | Impact Discussion and Mitigation | Level of Significance with Mitigation |
|---|---|---|---|---|---|---|---|---|---|
| 1. San Marin Drive/Simmons Lane | AM | 29.9 D | **46.9 E** | **45.9 E** | **64.6 F** | **63.9 F** | 19.4 B | Alternative 2 would result in slightly lower delays than General Plan 2035. Mitigation would be identical to that identified in Mitigation T-1. | Less than Significant with Mitigation |
| | PM | **74.6 F** | **101.8 F** | **100.8 F** | ** **F** | ** **F** | 22.2 C | | |
| 4. Redwood Boulevard/San Marin Drive | AM | 29.5 C | 35.9 D | 35.8 D | 36.4 D | 36.2 D | 30.4 C | Alternative 2 would result in slightly lower delays than General Plan 2035. Mitigation would be identical to that identified in Mitigation T-1. | Significant and Unavoidable[1] |
| | PM | 38.2 D | ** **F** | ** **F** | ** **F** | ** **F** | 48.0 D | | |
| 5. US 101 South Ramps/San Marin Drive | AM | 12.2 B | 14.8 B | 14.4 B | 26.0 C | 25.5 C | 26.4 C | Alternative 2 would result in slightly lower delays than General Plan 2035. Mitigation would be identical to that identified in Mitigation T-1. | Significant and Unavoidable[1] |
| | PM | 10.1 B | 11.7 B | 11.6 B | 21.0 C | 20.8 C | 22.3 C | | |
| 6. US 101 North Ramps/Atherton Avenue | AM | 13.6 B | 17.9 B | 17.8 B | 25.9 B | 25.8 C | 31.9 C | Alternative 2 would result in slightly lower delays than General Plan 2035. Mitigation would be identical to that identified in Mitigation T-1. | Significant and Unavoidable[1] |
| | PM | 19.7 B | 27.6 C | 27.1 C | **66.8 E** | **65.3 E** | 36.4 D | | |
| 9. Novato Boulevard/San Marin Drive-Sutro Avenue | AM | 23.8 C | **41.3 E** | **39.8 E** | **39.9 E** | **39.0 E** | 26.4 C | Alternative 2 would result in slightly lower delays than General Plan 2035. Mitigation would be identical to that identified in Mitigation T-1. | Less than Significant with Mitigation |
| | PM | **59.9 F** | **92.2 F** | **89.6 F** | ** **F** | ** **F** | 28.5 C | | |
| 14. Diablo Avenue/Novato Boulevard | AM | 29.9 C | 33.3 C | 33.2 C | 34.9 C | 34.8 C | 28.4 C | Alternative 2 would result in slightly lower delays than General Plan 2035. Mitigation would be identical to that identified in Mitigation T-1. | Less than Significant with Mitigation |
| | PM | 45.3 D | **62.6 E** | **61.7 E** | **71.9 E** | **70.5 E** | 38.4 D | | |

| Intersection | Peak Hour | Peak Hour LOS: Existing Conditions LOS Delay | Existing plus General Plan 2035 LOS Delay | Existing plus Project Alternative 2 LOS Delay | Cumulative with General Plan 2035 LOS Delay | Cumulative with Project Alternative 2 LOS Delay | Cumulative with Project Alternative 2 Mitigated LOS Delay | Impact Findings: Impact Discussion and Mitigation | Level of Significance with Mitigation |
|---|---|---|---|---|---|---|---|---|---|
| 30. South Novato Boulevard/ Redwood Boulevard | AM | ** **F** | ** **F** | ** **F** | ** **F** | ** **F** | 46.8 D | Alternative 2 would result in slightly lower delays than General Plan 2035. Mitigation would be identical to that identified in Mitigation T-1. | Less than Significant with Mitigation |
| | PM | 33.7 D | **41.1 E** | **40.2 E** | **49.6 E** | **48.8 E** | 17.5 B | | |
| 32. US 101 South Ramps/Ignacio Boulevard-Enfrente Road | AM | 29.8 C | **57.3 E** | 34.2 C | **64.0 E** | 33.7 C | n/a | Alternative 2 would reduce impact to less than significant. Mitigation would no longer be required. | Less than Significant |
| | PM | 23.0 C | 32.1 C | 25.0 C | 33.5 C | 24.3 C | n/a | | |
| 35. Bel Marin Keys Boulevard/Digital Drive | AM | 12.4 B | 15.5 B | 12.2 B | 13.4 B | 12.3 B | n/a | Alternative 2 would reduce impact to less than significant. Mitigation would no longer be required. | Less than Significant |
| | PM | 24.8 C | 50.6 D | 23.2 C | **56.4 E** | 25.1 C | n/a | | |

Delay is measured in average seconds per vehicle; LOS = Level of Service; ** = delay greater than 120 seconds; **Bold** text = deficient operation

[1] Indicates significant and unavoidable impacts requiring improvements on Caltrans facilities that are outside of the City's jurisdiction.

Source: W-Trans

### *Impacts to Study Corridors*

The projected PM peak hour traffic impacts on the four CMP-designated arterial roadway segments in the City of Novato were evaluated for Alternative 2. A summary of the results is shown in Table 6-5.

All four corridors are projected to operate acceptably under both Existing plus Alternative 2 and Cumulative with Alternative 2 conditions. This represents an improvement in roadway operation as compared to the proposed project, which resulted in unacceptable corridor operation on Bel Marin Keys Boulevard. Under Alternative 2, Bel Marin Keys Boulevard would operate acceptably without mitigation. The remaining corridors would operate similarly with either Alternative 2 or the proposed project. Therefore, impacts of Alternative 2 to the CMP arterial roadway network would be less than the proposed project and would not require mitigation at Bel Marin Keys Boulevard, as included in Mitigation Measure T-1.

**Table 6-5 PM Peak Hour Roadway Segment Levels of Service with the Alternative 2**

| Roadway Segment | Existing Conditions | | | Existing plus Alternative 2 | | | Cumulative with Alternative 2 | | |
|---|---|---|---|---|---|---|---|---|---|
| Direction of Travel | Speed | % FFS | LOS | Speed | % FFS | LOS | Speed | % FFS | LOS |
| **Novato Blvd – San Marin Dr to Eucalyptus Ave** | | | | | | | | | |
| Eastbound | 28 | 80% | B | 27 | 77% | B | 27 | 77% | B |
| Westbound | 29 | 83% | B | 26 | 74% | B | 22 | 63% | C |
| **Novato Blvd – Eucalyptus Ave to Diablo Ave** | | | | | | | | | |
| Eastbound | 23 | 66% | C | 21 | 60% | C | 20 | 57% | C |
| Westbound | 26 | 74% | B | 25 | 71% | B | 25 | 71% | B |
| **South Novato Blvd – Diablo Ave to Highway 101** | | | | | | | | | |
| Eastbound | 25 | 71% | B | 21 | 60% | C | 20 | 57% | C |
| Westbound | 30 | 86% | A | 30 | 86% | A | 29 | 83% | B |
| **Bel Marin Keys Blvd – US 101 to Digital Dr** | | | | | | | | | |
| Eastbound | 18 | 51% | C | 18 | 51% | C | 18 | 45% | D |
| Westbound | 19 | 54% | C | 19 | 54% | C | 18 | 45% | D |

Speed is measured in miles per hour; LOS = Level of Service; % FFS=percent free-flow speed; free-flow speed on all four corridors is 35 mph; **Bold** text = deficient operation

Source: W-Trans

### *Impacts to CMP Freeway Segments*

The analysis of Alternative 2 includes an assessment of PM peak hour traffic impacts on the Highway 101 and SR 37 freeway segments within the City of Novato. A summary of the results is shown in Table 6-6.

With implementation of Alternative 2, both Highway 101 and SR 37 are projected to operate within the LOS parameters established by the County of Marin Congestion Management Program under both Existing plus Alternative 2 and Cumulative with Alternative 2 conditions. Freeway impacts would therefore similar to the proposed project.

**Table 6-6 PM Peak Hour Freeway Levels of Service with the Alternative 2**

| Roadway Segment | Existing Conditions | | | Existing plus Alternative 2 | | | Cumulative with Alternative 2 | | |
|---|---|---|---|---|---|---|---|---|---|
| Direction of Travel | Speed | Density | LOS | Speed | Density | LOS | Speed | Density | LOS |
| **US 101 Northbound** | | | | | | | | | |
| Northbound | 55.6 | 28.2 | D | 50.9 | 30.8 | D | 46.9 | 32.8 | D |
| Southbound | ≥65.0 | 17.7 | B | ≥65.0 | 19.6 | C | ≥65.0 | 21.6 | C |
| **SR 37** | | | | | | | | | |
| Eastbound | ≥65.0 | 18.2 | C | ≥65.0 | 18.9 | C | ≥65.0 | 21.1 | C |
| Westbound | ≥65.0 | 9.8 | A | ≥65.0 | 10.4 | A | ≥65.0 | 11.2 | B |

Density is measured in passenger cars per mile per lane; LOS = Level of Service

Results reflect average conditions for the length of US 101 within Novato; some individual segments operate at a lower LOS, such as in the northern portion of the City approaching the Marin-Sonoma Narrows

Source: W-Trans

## Transportation/Traffic Project Alternative Summary Comparison

A comparison of the transportation and traffic impacts associated with Alternative 2 versus the proposed project is shown in Table 6-7. Overall, traffic under Alternative 2 would improve compared to the proposed project. Specifically, improvements would occur at Highway 101 South Ramps/Ignacio Boulevard-Enfrente Road and Bel Marin Keys Boulevard/Digital Drive intersections and along the Bel Marin Keys Boulevard corridor; however, impacts would remain significant and unavoidable because significant impacts would still occur at Redwood Boulevard/San Marin Drive, Highway 101 South Ramps/San Marin Drive, and Highway 101 North Ramps/Atherton Avenue, although fewer total intersections would experience an unacceptable LOS under this alternative.

**Table 6-7 Significance Threshold Comparison – Alternative 2 versus General Plan 2035**

| | Comparison of Alternative 2 to General Plan 2035 | |
|---|---|---|
| **Significance Threshold** | **Relative Impact** | **Impact Comparison** |
| Threshold 1: Conflict with adopted circulation measures of effectiveness | Less than GP 2035 | Reduces intersection-related impacts to less than significant at US 101 South Ramps/Ignacio Boulevard-Enfrente Road and Bel Marin Keys Boulevard/Digital Drive.<br>As with implementation of GP 2035, significant and unavoidable intersection impacts would still occur at Redwood Boulevard/San Marin Drive, US 101 South Ramps/San Marin Drive, and US 101 North Ramps/Atherton Avenue. |
| Threshold 2: Conflict with Congestion Management Program | Less than GP 2035 | Reduces impacts on the Bel Marin Keys Boulevard corridor to less than significant without mitigation. This is an improvement compared to GP 2035, which had an impact of less than significant with mitigation.<br>Implementation of either the Project Alternative or GP 2035 would result in less than significant impacts to US 101 and SR 37 within Novato. |
| Threshold 3: Result in substantial air traffic safety risks | Same as GP 2035 | Alternative 2 would have the same effects as GP 2035, resulting in less than significant impacts. |
| Threshold 4: Increase hazards due to a design feature | Same as GP 2035 | Alternative 2 would have the same effects as GP 2035, resulting in less than significant impacts. |
| Threshold 5: Result in inadequate emergency access | Same as GP 2035 | Alternative 2 would have the same effects as GP 2035, resulting in less than significant impacts. |
| Threshold 6: Conflict with or decrease performance of transit, bicycle, and/or pedestrian facilities | Same as GP 2035 | Alternative 2 would have the same effects as GP 2035, resulting in less than significant impacts. |

GP 2035 = Proposed General Plan 2035 Project

Source: W-Trans

## n. Tribal Cultural Resources

Alternative 2 would exclude development of the 500,000 square foot Life Sciences campus in the Industrial Parks MPA reducing overall growth in the Plan Area. Development within the rest of the Plan Area would have the same impacts to tribal cultural resources as the proposed project since development in the City under this alternative would be the same as the proposed project, except for in the Industrial Parks MPA area. Overall, tribal cultural resources impacts under Alternative 2 would be less than under the proposed project because reduced development in the Industrial Parks MPA area would have less potential to unearth tribal cultural resources. However, implementation of Mitigation Measure TCR-1 to provide tribal cultural resources protection would still would still apply to Alternative 2 and impacts would remain less than significant with mitigation incorporated under this alternative.

## o. Utilities and Service Systems

Alternative 2 would exclude development of the 500,000 square foot Life Sciences campus in the Industrial Parks MPA reducing overall growth in the Plan Area. As discussed in Section 4.15, *Utilities and Service Systems*, the proposed project's potential impacts related to the provision of utilities and service systems would be less than significant. Alternative 2 would lead to less development, thus requiring fewer utilities and services. Wastewater generation would be reduced by approximately 40,000 gpd and water demand would be reduced by approximately 44,000 gpd under this alternative. In addition, compliance with existing regulatory requirements and polices would reduce impacts related to water supply and demand and existing infrastructure services in the Plan Area. Overall, utilities and service system impacts under Alternative 2 would be less than under the proposed project and impacts would remain less than significant, similar to the proposed project.

# 6.3 Alternative 3: Proposed General Plan 2035 with 300,000 square foot maximum development cap in the Industrial Parks MPA

## 6.3.1 Description

Similar to Alternative 2, under this alternative the proposed project would be adopted, but Alternative 3 assumes that the maximum development pursuant to the Industrial Park MPA would be only 300,000 square feet of new development. The 500,000 square foot Life Sciences campus proposed by the project would be reduced to 300,000 square feet of office use, laboratory, and manufacturing uses under this alternative. Therefore, overall buildout and growth would be reduced by approximately 200,000 square feet as compared to the proposed project.

## 6.3.2 Impact Analysis

### a. Aesthetics

Alternative 3 would reduce maximum potential new development of the Life Sciences campus in the Industrial Parks MPA area from 500,000 to 300,000 square feet. Aesthetic impacts would be reduced under Alternative 3 because there would be less development and thus fewer impacts to scenic vistas in the Industrial Parks MPA area. Buildings shown in the photosimulations on Figure 4.1-8 through Figure 4.1-11 would be smaller with a reduced amount of development. Therefore, impacts to scenic vistas in the vicinity of the Industrial Parks MPA area would be reduced incrementally. Although lighting in the Industrial Parks MPA would be reduced due to a reduction in overall development, impacts related to visual character and lighting would remain the same as the proposed project because goals and policies in General Plan 2035 and the City's municipal code would continue to improve visual quality in the City, while limiting light and glare. Overall, aesthetic impacts under Alternative 3 would be less than the proposed project and impacts would remain less than significant, similar to the proposed project.

### b. Air Quality

Alternative 3 would reduce maximum potential new development in the Industrial Parks MPA area to 300,000 square feet of Life Sciences campus. Reduced development in the Industrial Parks MPA area under this alternative would result in fewer construction and operational air contaminant emissions. Specifically, a reduction in 200,000 square feet of biotech development would reduce vehicle trips. Therefore, VMT would be reduced as compared to the proposed project further reducing operational emissions. Additionally, similar to the proposed project, Alternative 3 would be consistent with the Clean Air Plan because it would be consistent with CAP control measures and goals. For these reasons, overall air quality impacts for Alternative 3 would be reduced as compared to the proposed project. Impacts would remain less than significant with mitigation, similar to the proposed project because Mitigation Measure AQ-1 to require construction best management practices and Mitigation Measure AQ-2 for health risk assessment screening would still apply to Alternative 3.

### c. Biological Resources

Alternative 3 would reduce maximum potential new development of the Life Sciences campus in the Industrial Parks MPA area from 500,000 to 300,000 square feet. Reduced development in the Industrial Parks MPA area under this alternative as compared to the proposed project would reduce impacts to sensitive biological resources in the Bel Marin Keys. In addition, goals and policies in General Plan 2035 would continue to protect valuable habitat and sensitive resources throughout the Plan Area. Overall, biological impacts under Alternative 3 would be less than the proposed project because there would be less development in the Industrial Parks MPA area. However, impacts would remain less than significant with mitigation because Mitigation Measure BIO-1 to update Environmental Stewardship Goal 1 to include sensitive species, Mitigation Measure BIO-2 to prepare biological resource assessments for undeveloped areas, Mitigation Measure BIO-3 for sensitive resource inventories for new development, Mitigation Measure BIO-4 requiring nesting bird protection, and Mitigation Measure BIO-5 to protect wildlife movement corridors would still apply to Alternative 3.

### d. Cultural Resources

Alternative 3 would reduce maximum potential new development of the Life Sciences campus in the Industrial Parks MPA area from 500,000 to 300,000 square feet. Reduced development in the Industrial Parks MPA area under this alternative would reduce the area of ground disturbance associated with construction. Therefore, there would be less potential to uncover cultural and paleontological resources, and impacts to these resources would be reduced as compared to the proposed project. Goals and policies in General Plan 2035 would continue to protect valuable cultural resources in the Industrial Parks MPA. Overall, cultural and paleontological impacts under Alternative 3 would be less than the proposed project because there would be reduced development in the Industrial Parks MPA area. However, impacts would remain less than significant with mitigation because Mitigation Measure CR-1 to add a policy for a cultural resources study implementation program and Mitigation Measure CR-2 to add a policy for paleontological resource studies would still apply to Alternative 3.

### e. Geology and Soils

Alternative 3 would reduce maximum potential new development of the Life Sciences campus in the Industrial Parks MPA area from 500,000 to 300,000 square feet. Reduced development in the Industrial Parks MPA area under this alternative would reduce geology and soils impacts as compared to the proposed project. Reduced development and compliance with existing regulatory requirements and polices would reduce impacts from adverse effects such as ground shaking, liquefaction, and seismic ground failure. Overall, geology and soils impacts under Alternative 3 would be less than the proposed project. However, impacts would remain less than significant with mitigation because Mitigation Measure GEO-1 for soil investigation of septic systems would still apply to Alternative 3.

### f. Greenhouse Gas Emissions

Alternative 3 would reduce maximum potential new development of the Life Sciences campus in the Industrial Parks MPA area from 500,000 to 300,000 square feet. Development within the rest of the

Plan Area would have the same GHG impacts as the proposed project since development in the City under this alternative would be the same as envisioned by the proposed project, except for in the Industrial Parks MPA area. Reduced development in the Industrial Parks MPA area would result in fewer GHG emissions than the proposed project from both construction and operation. Specifically, operational emissions such as energy and mobile emissions would be reduced under this alternative resulting from less industrial development. Overall, impacts would be reduced as compared to the proposed project and would remain less than significant.

### g. Hazards and Hazardous Materials

Alternative 3 would reduce maximum potential new development of the Life Sciences campus in the Industrial Parks MPA area from 500,000 to 300,000 square feet. Less development under this alternative would reduce hazardous impacts as compared to the proposed project because there would be reduced use and transport of hazardous materials from the Life Sciences campus. In addition, compliance with existing regulatory requirements and polices would continue to reduce impacts from adverse effects such as hazardous spills, hazardous emissions near schools, and exposure to wildfires. Overall, hazard and hazardous material impacts under Alternative 3 would be less than the proposed project and impacts would remain less than significant, similar to the proposed project.

### h. Hydrology and Water Quality

Alternative 3 would reduce maximum potential new development of the Life Sciences campus in the Industrial Parks MPA area from 500,000 to 300,000 square feet. Less development under this alternative would reduce the amount of ground disturbance required for construction, thereby decreasing the potential for soil erosion and sedimentation of surface water. Additionally, without the addition of the Life Sciences campus, there would be less impervious surface area created within the Industrial Parks MPA under this alternative. This would decrease the volume of and velocity of stormwater runoff, and it would also reduce the potential for runoff to carry urban contaminants, such as residual oil and gasoline from parking lots, into surface waters and storm drains. Therefore, Alternative 3 would reduce hydrology and water quality impacts as compared to the proposed project because reduced development resulting in less potential runoff, erosion, and transport of pollutants. In addition, compliance with existing regulatory requirements and polices would reduce impacts from adverse effects to water quality and drainage, as well as flooding. Overall, hydrology and water quality impacts under Alternative 3 would be less than the proposed project and impacts would remain less than significant, similar to the proposed project.

### i. Land Use and Planning

Similar to the proposed project, Alternative 3 would provide for orderly development in Novato with development in the Industrial Parks MPA area reduced to 300,000 square feet. Alternative 3 would have reduced development in the Industrial Park MPA area as compared to the proposed project and thus would not divide an established community or conflict with an applicable habitation conservation plan. As discussed in Section 4.9, *Land Use and Planning*, the proposed project would be consistent with all 2040 Plan Bay Area goals and policies. Alternative 3 would retain General Plan 2035 policies and would thus be consistent with all 2040 Plan Bay Area goals and policies. Overall, land use impacts for this alternative would be similar to the proposed project and impacts would remain less than significant.

### j. Noise

Alternative 3 would reduce maximum potential new development of the Life Sciences campus in the Industrial Parks MPA area from 500,000 to 300,000 square feet. Reduced development in the Industrial Parks MPA area under this alternative would reduce noise impacts from construction, traffic, and land use operations in the Industrial Parks MPA area. The mobile home park south of the Industrial Parks MPA area would be exposed to reduced construction noise of the Life Sciences campus and reduced noise from operation of the office, laboratory, or manufacturing uses. Overall, noise impacts under Alternative 3 would be less than under General Plan 2035. However, impacts would remain less than significant with mitigation because Mitigation Measures N-1 to require construction noise control would still apply to Alternative 3.

### k. Population and Housing

Alternative 3 would reduce maximum potential new development of the Life Sciences campus in the Industrial Parks MPA area from 500,000 to 300,000 square feet. Therefore, job and employment numbers in the City would be reduced under Alternative 3. However, sufficient growth throughout the rest of the City is still included in Alternative 3 to meet the population and employment targets of Plan Bay Area (ABAG 2017). Therefore, Alternative 3 would be consistent with 2040 ABAG and MTC growth projections. In addition, Alternative 3 would not displace a substantial number of people or housing because it would result in reduced overall development. Overall, population and housing impacts would be similar to the proposed project with reduced development in the Industrial Parks MPA area. Impacts would remain less than significant, similar to the proposed project.

### l. Public Services

Alternative 3 would reduce maximum potential new development of the Life Sciences campus in the Industrial Parks MPA area from 500,000 to 300,000 square feet. A reduction in growth would require less demand for public services in the City as compared to the proposed project. Overall, because of the reduction in development under this alternative, public services impacts would be less than the proposed project and impacts would remain less than significant similar to the proposed project.

### m. Traffic and Transportation

Alternative 3 would reduce maximum potential new development of the Life Sciences campus in the Industrial Parks MPA area from 500,000 to 300,000 square feet. Alternative 3 is anticipated to result in intersection traffic impacts that are similar to those projected to occur under the proposed project for intersections that not near the Industrial Parks MPA area. The following intersections would be impacted under this alternative:

- Ignacio Boulevard/Alameda del Prado
- US 101 South/Ignacio Boulevard-Enfrente Road
- US 101 North/Bel Marin Keys Boulevard-Nave Drive
- Bel Marin Keys Boulevard/Commercial Boulevard
- Bel Marin Keys Boulevard/Digital Drive
- US 101 North/Nave Drive

Following is a quantitative evaluation of the potential traffic impacts of Alternative 3 at the study intersections, roadway segments, and freeways. Table 6-8 shows a summary of the intersection LOS results. Methodology and calculations are contained in Appendix E.

As shown in Table 6-8, with 300,000 square feet of added health science uses for Alternative 3, allsix analyzed study intersections would operate at an acceptable LOS D or better during both the AM and PM peak hour under all scenarios. Therefore, the significant impacts at US 101 South Ramps/Ignacio Boulevard-Enfrente Road and Bel Marin Keys Boulevard/Digital Drive would not occur under this alternative. Additionally, the Bel Marin Keys Boulevard roadway segment would operate at an acceptable LOS for all scenarios under this alternative and impacts would be reduced as compared to the proposed project where the roadway segment would operate at an unacceptable LOS E under cumulative conditions as shown in Appendix E. Both US 101 and SR 37 would also operate acceptably for Alternative 3.

With the reduction in trips and associated delays with a 300,000 square foot maximum increase in the Life Sciences campus under this alternative, LOS impacts at the six intersections listed above would be reduced to a less-than-significant level. However, impacts would remain significant and unavoidable similar to the proposed project at other intersections in the Plan Area including Redwood Boulevard/San Marin Drive, US 101 South Ramps/San Marin Drive, and US 101 North Ramps/Atherton Avenue.

### n. Tribal Cultural Resources

Alternative 3 would reduce maximum potential new development of the Life Sciences campus in the Industrial Parks MPA area from 500,000 to 300,000 square feet. As a result, ground disturbance and excavation required for construction and development in the Industrial Parks MPA would be reduced. Therefore, there would be less potential to encounter unknown or undiscovered tribal cultural resources as compared to the proposed project. Consequently, tribal cultural resources impacts under Alternative 3 would be less than under the proposed project. However, implementation of Mitigation Measure TCR-1 to provide tribal cultural resources protection would still would still apply to Alternative 3 and impacts would remain less than significant with mitigation incorporated under this alternative.

### o. Utilities and Service Systems

Alternative 3 would reduce maximum potential new development of the Life Sciences campus in the Industrial Parks MPA area from 500,000 to 300,000 square feet. As discussed in Section 4.15, *Utilities and Service Systems*, the proposed project's potential impacts related to the provision of utilities and service systems would be less than significant. Alternative 3 would lead to less development, thus requiring fewer utilities and services. Wastewater generation would be reduced by approximately 24,000 gpd and water demand would be by approximately 26,400 gdp under this alternative. In addition, compliance with existing regulatory requirements and polices would reduce impacts related to water supply and demand and existing infrastructure services in the Plan Area. Overall, utilities and service system impacts under Alternative 3 would be less than the proposed project and impacts would remain less than significant, similar to the proposed project.

**Table 6-8 Intersection Levels of Service with Alternative 3**

| | | | AM Peak Hour | | | | | | PM Peak Hour | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Existing Conditions | | Existing plus Project Alternative 3 | | Cumulative with Project Alternative 3 | | Existing Conditions | | Existing plus Project Alternative 3 | | Cumulative with Project Alternative 3 | |
| ID | Intersection Name | Control | Delay | LOS | Delay | LOS | Delay | LOS | Delay | LOS | Delay | LOS | Delay | LOS |
| 31 | Ignacio Blvd/Alameda del Prado | Signal | 19.1 | B | 18.9 | B | 19.3 | B | 16.5 | B | 16.4 | B | 16.9 | B |
| 32 | US 101 S/Ignacio Blvd-Enfrente Rd[1] | Signal | 29.8 | C | 44.1 | D | 49.4 | D | 23.0 | C | 28.6 | C | 30.0 | C |
| 33 | US 101 N/Bel Marin Keys Blvd-Nave Dr[1] | Signal | 20.1 | C | 31.8 | C | 33.6 | C | 20.9 | C | 25.3 | C | 26.4 | C |
| 34 | Bel Marin Keys Blvd/Commercial Blvd | Signal | 7.3 | A | 7.6 | A | 7.6 | A | 16.9 | B | 19.3 | B | 20.7 | C |
| 35 | Bel Marin Keys Blvd/Digital Dr | Signal | 12.4 | B | 12.2 | B | 12.5 | B | 24.8 | C | 39.2 | D | 44.3 | D |
| 36 | US 101 N/Nave Dr[1] | Signal | 13.6 | B | 15.7 | B | 16.0 | B | 13.1 | B | 14.7 | B | 15.1 | B |

Delay is measured in average seconds per vehicle; LOS = Level of Service; ** = delay greater than 120 seconds; **Bold** text = deficient operation

[1] Intersection on State Highways under the jurisdiction of Caltrans

Source: W-Trans, Appendix E

# 6.4 Alternative 4: Proposed General Plan 2035 but same land use as 1996 General Plan for the North Redwood Boulevard Corridor and North, North Redwood Boulevard Corridor

## 6.4.1 Description

Alternative 4 involves continued implementation of the 1996 General Plan in the North Redwood Boulevard Corridor and North, North Redwood Boulevard Corridor. Development in the rest of the Plan Area, including the Downtown and Northwest Quadrant Neighborhood, would occur according to General Plan 2035. Alternative 4 would result in increased development in the North Redwood Boulevard Corridor and North, North Redwood Boulevard Corridor, consistent with the floor area ratio in 1996 General Plan of 1.0 as compared to the floor area ratio of 0.4 in General Plan 2035. Development in the North Redwood Boulevard Corridor would maintain existing zoning of General Commercial (CG), Commercial/Industrial (CI), Light Industrial/Office (LIO), and Planned District (PD) mixed-use. Development in the North, North Redwood Boulevard Corridor would maintain the existing zoning of Business and Professional Office (BPO) and LIO. Therefore, development in these two focus areas would not be developed as high-quality office and research, retail, and entertainment uses. Although overall development in the North Redwood Boulevard Corridor and North, North Redwood Boulevard Corridor would be higher under this alternative vehicle trips would be reduced as compared to the proposed project because the land uses in these areas have lower trip generation rates than office, retail, and entertainment land uses.

## 6.4.2 Impact Analysis

### a. Aesthetics

Alternative 4 would include development in the North Redwood Boulevard Corridor and North, North Redwood Boulevard Corridor consistent with the 1996 General Plan. This would result in increased development in these two focus areas as compared to the proposed project. Because development under Alternative 4 would be increased in the North Redwood Boulevard Corridor and North, North Redwood Boulevard Corridor there would be increased impacts to aesthetic resources, including potential changes in visual character, blocking scenic views, and light and glare. However, implementation of goals and policies in General Plan 2035 and the City's municipal code would continue to improve visual quality in the City, while limiting light and glare. Therefore, aesthetic impacts for Alternative 4 would be greater than General Plan 2035, but would remain less than significant with implementation of existing lighting design guidelines.

### b. Air Quality

Alternative 4 would include development in the North Redwood Boulevard Corridor and North, North Redwood Boulevard Corridor consistent with the 1996 General Plan. This would result in increased development in these two focus areas as compared to the proposed project. Because development under Alternative 4 would be increased in the North Redwood Boulevard Corridor and North, North Redwood Boulevard Corridor there would be increased impacts to air quality contaminants from construction and operation of development. However, vehicle trips would be reduced under this alternative resulting in lower mobile emissions. Overall, Alternative 4 would have similar impacts as the proposed project, with increased construction and operational emissions impacts but fewer traffic emissions as compared to the proposed project. Impacts would remain less than significant similar to the proposed project.

### c. Biological Resources

Alternative 4 would include development in the North Redwood Boulevard Corridor and North, North Redwood Boulevard Corridor consistent with the 1996 General Plan. This would result in increased development in these two focus areas as compared to the proposed project, including on parcels that are vacant and potential habitat for special-status species and other wildlife. Therefore, impacts to special status biological resources would be increased in the North Redwood Boulevard Corridor and North, North Redwood Boulevard Corridor as compared to the proposed project. However, goals and policies in General Plan 2035 would be implemented under this alternative and would continue to protect valuable habitat and sensitive resources throughout the Plan Area. Impacts would remain less than significant with mitigation because Mitigation Measure BIO-1 to update Environmental Stewardship Goal 1 to include sensitive species, Mitigation Measure BIO-2 to prepare biological resource assessments for undeveloped areas, Mitigation Measure BIO-3 for sensitive resource inventories for new development, Mitigation Measure BIO-4 requiring nesting bird protection, and Mitigation Measure BIO-5 to protect wildlife movement corridors would still apply to Alternative 4.

### d. Cultural Resources

Alternative 4 would include development in the North Redwood Boulevard Corridor and North, North Redwood Boulevard Corridor consistent with the 1996 General Plan. This would result in increased development and thus ground disturbance in these two focus areas as compared to the proposed project. Thus, increased development may result in additional impacts to cultural resources in the North Redwood Boulevard Corridor and North, North Redwood Boulevard Corridor as compared to the proposed project because increased development has the potential to unearth additional cultural resources. Overall, cultural resources impacts under Alternative 4 would be greater than impacts under the proposed project, but impacts would remain significant but mitigable, similar to the proposed project.

### e. Geology and Soils

Alternative 4 would include development in the North Redwood Boulevard Corridor and North, North Redwood Boulevard Corridor consistent with the 1996 General Plan. This would result in increased development in these two focus areas as compared to the proposed project. There would be more ground disturbance in these two focus areas as compared to the proposed project. Thus, increased development may result in additional impacts to geology and soils in the North Redwood Boulevard Corridor and North, North Redwood Boulevard Corridor as compared to the proposed project. However, compliance with existing regulatory requirements and policies in General Plan 2035 would reduce impacts from adverse effects such as ground shaking, liquefaction, and seismic ground failure. Overall long-term geology and soils impacts under Alternative 4 would be greater than impacts under the proposed project; however impacts would remain significant but mitigable.

### f. Greenhouse Gas Emissions

Alternative 4 would include development in the North Redwood Boulevard Corridor and North, North Redwood Boulevard Corridor consistent with the 1996 General Plan. This would result in increased development in the two focus areas. Therefore, compared with the proposed project, there would be additional construction and operational GHG emissions. However, vehicle trips would be reduced under this alternative in the North Redwood Boulevard Corridor and North, North Redwood Boulevard Corridor resulting in fewer emissions from vehicle trips. Overall, GHG emissions would be similar to the proposed project, with increased construction and operational emissions but reduced mobile-source emissions. Impacts would remain less than significant.

### g. Hazards and Hazardous Materials

Alternative 4 would include development in the North Redwood Boulevard Corridor and North, North Redwood Boulevard Corridor consistent with the 1996 General Plan. This would result in increased development in these two focus areas as compared to the proposed project. This would result in increased development and thus more ground disturbance in these two focus areas as compared to the proposed project. The additional ground disturbance would result increased potential for disturbing contaminated soils or work within hazardous sites. In addition, increased development under Alternative 4 would result in additional transport and use of hazardous materials in the North Redwood Boulevard Corridor and North, North Redwood Boulevard Corridor, specifically associated with industrial uses that use, transport, and store hazardous materials. Since ground disturbance and use of hazardous materials under this alternative would be greater than for the proposed project, impacts related to hazards and hazardous materials would be slightly higher. However, compliance with existing regulatory requirements would address potential impacts related to hazards and hazardous materials, and impacts under Alternative 4 would be less than significant, similar to the proposed project.

### h. Hydrology and Water Quality

Alternative 4 would include development in the North Redwood Boulevard Corridor and North, North Redwood Boulevard Corridor consistent with the 1996 General Plan. This would result in increased development in these two focus areas as compared to the proposed project. Because ground disturbance under this alternative would be greater than for the proposed project there would be increased impacts to water quality associated with the potential for soil erosion. With more development there would be more impervious surfaces, which would increase the volume and velocity of stormwater runoff, while groundwater infiltration would be reduced. Therefore, impacts related to hydrology and water quality would be slightly increased as compared to the proposed project. However, impacts under Alternative 4 would be subject to the same regulatory requirements (such as NPDES permit requirements) governing runoff and protecting water quality and supply as the proposed project. Although impacts would be slightly higher under this alternative, they would remain less than significant, similar the proposed project.

### i. Land Use and Planning

Implementation of Alternative 4 would involve increased overall development in the North Redwood Boulevard Corridor and North, North Redwood Boulevard Corridor than would occur as part of the proposed project. Both the proposed project and Alternative 4 would provide for the orderly development of Novato, although under different scenarios. Neither would physically divide an established community or conflict with an applicable habitat conservation plan or natural community conservation plan. As discussed in Section 4.9, *Land Use and Planning*, the proposed project would be consistent with all 2040 Plan Bay Area goals and policies. Alternative 4 would retain the City's 1996 General Plan designations in the North Redwood Boulevard Corridor and

North, North Redwood Boulevard Corridor, but overall the proposed project would remain consistent with Plan Bay Area. Therefore, goals and policies from General Plan 2035, such as programs ES 24a through ES 24c that require the implementation of cost-effective strategies to achieve greenhouse gas emissions consistent with the City's greenhouse gas reduction goals of 15 percent, would still apply under this alternative. Therefore, Alternative 4 would have similar impacts related to land use and planning compared to the proposed project and impacts would be less than significant.

### j. Noise

Implementation of Alternative 4 would involve increased overall development in the North Redwood Boulevard Corridor and North, North Redwood Boulevard Corridor than would occur as part of the proposed project. More development in these two focus areas would result in increased noise in the North Redwood Boulevard Corridor and North, North Redwood Boulevard Corridor from both construction and operation of individual projects. However, the 1996 General Plan land uses in these two focus areas would result in reduced vehicle traffic on area roadways as compared to the proposed project. Roadways noise would be reduced under this alternative. Overall, Alternative 4 would have similar impacts as the proposed project, with increased construction noise impacts but reduced traffic noise impacts as compared to the proposed project. Impacts would remain less than significant with mitigation for construction noise, similar to the proposed project.

### k. Population and Housing

Implementation of Alternative 4 would involve increased overall development in the North Redwood Boulevard Corridor and North, North Redwood Boulevard Corridor than would occur as part of the proposed project. Increased growth would result in additional job and employment in the North Redwood Boulevard Corridor and North, North Redwood Boulevard Corridor. Both the proposed project and Alternative 4 would have limited residential development in these two focus areas and population growth would be similar under both scenarios. Neither Alternative 4 nor the proposed project would displace substantial numbers of people or housing. Impacts related to jobs and employment would be greater than the proposed project, but would remain less than significant, similar to the proposed project.

### l. Public Services

Implementation of Alternative 4 would involve increased overall development in the North Redwood Boulevard Corridor and North, North Redwood Boulevard Corridor than would occur as part of the proposed project. Therefore, the Alternative 4 would demand increased public services for these two focus areas as compared to the proposed project. Both Alternative 4 and the proposed project would ensure that public services continue to be provided to the City commensurate with population growth and need consistent with goals and policies in General Plan 2035. Overall, impacts related to public services would be increased compared to the proposed project, but would remain less than significant, similar to the proposed project.

### m. Traffic and Transportation

Implementation of Alternative 4 would involve increased overall development in the North Redwood Boulevard Corridor and North, North Redwood Boulevard Corridor than would occur as part of the proposed project. Projected growth under this alternative would be consistent with the 1996 General Plan development projections in the North Redwood Boulevard Corridor and North,

North Redwood Boulevard Corridor. However, traffic associated with Alternative 4 would be reduced as compared to the proposed project because the land uses under Alternative 4 would result in fewer vehicle trips. Because land uses under this alternative generate fewer vehicle trips, there would be less traffic delays at intersections in the two corridors during peak hours, including Redwood Boulevard/San Marin Drive (Intersection #5) and US 101 South Ramps/San Marin Drive. Therefore, the impacts related to LOS at these intersections would be reduced compared to the proposed project. Similar to the proposed project, this alternative would ensure that impacts related to air traffic, emergency access, and alternative transportation would be less than significant. Alternative 4 would have similar overall traffic impacts as the proposed project because significant and unavoidable traffic impacts at US 101 South Ramps/Ignacio Boulevard-Enfrente Road (Intersection #32) and US 101 North Ramps/Atherton Avenue (Intersection #6) would still occur under this alternative, similar to the proposed project.

### n. Tribal Cultural Resources

Implementation of Alternative 4 would involve increased overall development in the North Redwood Boulevard Corridor and North, North Redwood Boulevard Corridor than would occur as part of the proposed project. Increased development would potentially impact more tribal cultural resources in these two focuses areas resulting from more ground disturbance required for construction and the likelihood to discover additional tribal cultural resources during construction activities. Overall, tribal cultural resources impacts under Alternative 4 would be greater than impacts under the proposed project, but would remain significant but mitigable, similar to the proposed project.

### o. Utilities and Service Systems

Implementation of Alternative 4 would involve increased overall development in the North Redwood Boulevard Corridor and North, North Redwood Boulevard Corridor than would occur as part of the proposed project. As discussed under Section 4.15, *Utilities and Service Systems*, the proposed project's potential impacts related to the provision of utilities and service systems would be less than significant. Alternative 4 would result in increased development and associated growth in the North Redwood Boulevard Corridor and North, North Redwood Boulevard Corridor, thus requiring additional utilities and service systems, and increasing demand at existing facilities, such as landfills and the water treatment plant. Impacts would be greater than the proposed project, but would remain significant but mitigable, similar to the proposed project.

## 6.5 Environmentally Superior Alternative

This section compares the impacts of the four alternatives to those of the proposed project. Table 6-9 shows whether each alternative would have impacts that are less than, similar to or greater than proposed project for each of the issue areas studied.

The No Project Alternative (Alternative 1) would not be considered environmentally superior overall because development and anticipated growth would be increased, and it would result in more ground disturbance than the proposed project. Further, this alternative does not have an emphasis on infill development in the four focus areas and Industrial Parks MPA area. Growth under this alternative would occur throughout the City without being concentrated in any core areas. Although Alternative 1 would entail continued growth as dictated by the existing 1996 General Plan, new policies included in General Plan 2035, such as those related to aesthetics and biological resources, would not be adopted. Additionally, under Alternative 1, transportation improvements as part of the proposed project would not be implemented and development would be spread throughout Novato. Thus, daily VMT is anticipated to be greater under this alternative. As a consequence, air quality and GHG emissions impacts would be greater than for the proposed project.

Alternative 2, Proposed General Plan 2035 without Industrial Parks MPA, performs similar or better to the proposed project for all of the environmental resource impact areas and would be considered the environmentally superior alternative. This alternative would result in less development in the Industrial Parks MPA area. Therefore, Alternative 2 would result in fewer impacts in a majority of the CEQA impact categories including biological resources, cultural resources, noise, and utilities. Because development in the Industrial Parks MPA area would not occur, significant and unavoidable impacts at Highway 101 South Ramps/Ignacio Boulevard-Enfrente Road and Bel Marin Keys Boulevard/Digital Drive intersections and along the Bel Marin Keys Boulevard corridor would be avoided under this alternative. However, although impacts to traffic would be reduced under this alternative, Alternative 2 would not eliminate all significant and unavoidable traffic impacts. Three Caltrans intersections and one City intersection, that is dependent on improvements at the adjacent Caltrans intersection, would remain at an unacceptable LOS because the City of Novato does not have jurisdiction over these locations. Options available to mitigate these impacts would be subject to funding and/or site-specific physical constraints. These significant and unavoidable impacts would occur at Redwood Boulevard/San Marin Drive, US 101 South Ramps/San Marin Drive, and US 101 North Ramps/Atherton Avenue.

Alternative 3, Proposed General Plan 2035 with 300,000 square foot Industrial Parks MPA, performs similar or better to the proposed project for all of the environmental resource impact areas. This alternative would result in reduced development in the Industrial Parks MPA area. Therefore, Alternative 3 would result in fewer impacts to the majority of CEQA issue areas including biological resources, cultural resources, noise, and utilities. Significant and unavoidable traffic impacts at US 101 South Ramps/Ignacio Boulevard-Enfrente Road would not occur under this alternative with reduced life sciences square footage. However, Alternative 3 would have significant and unavoidable traffic impacts at Redwood Boulevard/San Marin Drive, US 101 South Ramps/San Marin Drive, and US 101 North Ramps/Atherton Avenue, although fewer total intersections would experience an unacceptable LOS as a result of this alternative. Three Caltrans intersections and one City intersection, that is dependent on improvements at the adjacent Caltrans intersection, would remain at an unacceptable LOS because the City of Novato does not have jurisdiction over these locations. Options available to mitigate these impacts would be subject to funding and/or site-specific physical constraints. The significant and unavoidable impacts would occur at Redwood Boulevard/San Marin Drive, US 101 South Ramps/San Marin Drive, and US 101 North Ramps/Atherton Avenue

Under Alternative 4, Proposed General Plan 2035 but same land use as 1996 General Plan for the North Redwood Boulevard Corridor and North, North Redwood Boulevard Corridor, development and anticipated growth would be increased in these two focus areas. Although Alternative 4 would entail continued growth as dictated by the land use designations in the existing 1996 General Plan, new policies included in General Plan 2035, such as those related to aesthetics and biological resources, would be adopted. As a result of increased development in the North Redwood Boulevard Corridor and North, North Redwood Boulevard Corridor, impacts would be slightly greater than the proposed project. However, the land uses under this alternative would generate less traffic than the proposed project. Therefore, traffic delays at the intersections in the North Redwood Boulevard Corridor and North, North Redwood Boulevard Corridor would be reduced.

However, significant and unavoidable traffic impacts to US 101 South Ramps/Ignacio Boulevard-Enfrente Road (Intersection #32) and US 101 North Ramps/Atherton Avenue (Intersection #6) would still occur under Alternative 4, similar to the proposed project.

### Table 6-9 Impact Comparison of Alternatives

| Issue | Alternative 1 | Alternative 2 | Alternative 3 | Alternative 4 |
|---|---|---|---|---|
| Aesthetics | = / + | = / + | = / + | = / - |
| Air Quality | = / - | = / + | = / + | = |
| Biological Resources | = / - | = / + | = / + | = / - |
| Cultural Resources | = / - | = / + | = / + | = / - |
| Geology and Soils | = / - | = / + | = / + | = / - |
| Greenhouse Gas Emissions | - | = / + | = / + | = |
| Hazards and Hazardous Materials | = / - | = | = / + | = / - |
| Hydrology and Water Quality | = / - | = / + | = / + | = / - |
| Land Use and Planning | - | = | = | = |
| Noise | = / - | = / + | = / + | = |
| Population and Housing | = / - | = | = | = / - |
| Public Services | = / - | = / + | = / + | = / - |
| Transportation and Circulation | = / + | = / + | = / + | = / + |
| Tribal Cultural Resources | = / - | = / + | = / + | = / - |
| Utilities and Services Systems | = / - | = / + | = / + | = / - |

+ Superior to the proposed project (reduced level of impact)
- Inferior to the proposed project (increased level of impact)
= / + slightly superior to the proposed project in one or more aspects, but not significantly superior
= / - slightly inferior to the proposed project in one or more aspects, but not significantly inferior
+/- Some areas inferior to the proposed project, and some areas superior, but not significantly inferior or superior
= Similar level of impact to the proposed project

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## 7.2 List of Preparers

This EIR was prepared by the City of Novato, with the assistance of Rincon Consultants, Inc. Consultant staff involved in the preparation of the EIR are listed below.

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# Appendix A

NOP of Preparation (NOP) and NOP Responses

Rincon Consultants, Inc.
Environmental Scientists Planners Engineers

# MEMORANDUM

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**Date:** January 23, 2017
**To:** Steve Marshall, Planning & Environmental Services Manager
**Organization:** City of Novato
**From:** Jonathan Berlin, Environmental Planner
**Email:** smarshall@novato.org
**Re:** Summary of Environmental Issues Raised at the January 12th Scoping Meeting

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Please find below a brief summary of the environmental issues raised by the Planning Commission and members of the public during the General Plan 2035 EIR Scoping Meeting that was held on January 12th, 2017 at the Novato City Hall.

## Aesthetics

One commissioner raised a concern about impacts to visual quality from increased building heights in the Bel Marin Keys Master Plan area. This aesthetic concern will be analyzed in the Draft EIR.

## Growth-inducing Impacts

Greenbelt Alliance staff expressed concern that a renewed urban growth boundary would result in growth-inducing impacts if adopted by the city council instead of by a public vote. However, considering the potential environmental effects of the manner of adoption would be speculative and is not a CEQA issue.

## Hazards and Hazardous Materials

A member of the public expressed concern that the Ignacio Boulevard interchange at Highway 101 could be damaged during an earthquake, preventing evacuation from Bel Marin Keys. The commenter did not present any evidence that the interchange is seismically unsafe, and this concern is speculative.

However, the Draft EIR will generally consider potential impacts from interfering with an adopted emergency response plan or emergency evacuation plan.

## Recreation

A member of the public expressed concern about the supply of open space for business park employees in Bel Marin Keys. Demand of open space or recreational facilities is typically assessed for residents, not for employees. The Draft EIR will analyze overall demand for parks and recreational facilities based on projected population growth and City estimates of per capita park demand.

## Transportation

A member of the public expressed concern that the General Plan 2035 would worsen traffic congestion in Bel Marin Keys by adding trips to an area with one main access route. The Draft EIR will evaluate level of service (LOS) impacts for 32 intersections, three roadway segments, and Highway 101, based on a traffic analysis from W-Trans.

A related public request is for a second connector route to Bel Marin Keys, built from State Route 37. Annexing land from outside city limits for this route would be infeasible. Therefore, the Draft EIR will not consider this request as a potential mitigation measure for traffic impacts.

A member of the public raised a concern that the diminished parking requirement for laboratory space in Bel Marin Keys would result in an inadequate parking supply in the future (if different companies with higher parking demand come in and occupy building space). The Draft EIR will not consider this concern because it is speculative.

Greenbelt Alliance staff also expressed support for the goal of reducing vehicle miles traveled (VMT).

## Alternatives

- Consider different development intensities in Bel Marin Keys
- Consider preserving open space in the North, North Redwood Corridor instead of commercial zoning. this alternative will not be considered because Novato already preserves an abundant amount of open space within city limits (42%)

Please feel free to contact us with any questions that you may have.

Sincerely,

Jonathan Berlin

**DEPARTMENT OF TRANSPORTATION**
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*Serious Drought.*
*Help save water!*

January 17, 2017

04-MRN-2016-00030
SCH # 2016122043

Mr. Steve Marshall
City of Novato
Community Development Department
922 Machin Avenue
Novato, CA 94945

**Novato General Plan 2035 Update – Notice of Preparation (NOP)**

Dear Mr. Marshall:

Thank you for including the California Department of Transportation (Caltrans) in the environmental review process for the above-referenced Plan. In tandem with the Metropolitan Transportation Commission's (MTC) Sustainable Communities Strategy (SCS), Caltrans mission signals a modernization of our approach to evaluating and mitigating impacts to the State Transportation Network (STN). Caltrans *Strategic Management Plan 2015-2020* targets aim to reduce Vehicle Miles Travelled (VMT) by tripling bicycle and doubling both pedestrian and transit travel by 2020. Our comments are based on the NOP.

***Project Understanding***
The proposed General Plan update (Plan) will provide an update to the City of Novato's General Plan previously adopted in 1996. The Plan will provide the context to effectively plan and manage Novato, pursuant to goals and policies that reflect present-day values held by the community. Additionally, the update will equip Novato with a policy framework to responsibly manage future projects and have the capacity to accommodate the growth and development anticipated to occur in the City of Novato for the next 20 years. Regional access to and from the City is provided by US 101.

***Lead Agency***
As the Lead Agency, the City of Novato is responsible for all mitigation measures, including any needed improvements to the STN or reduction in VMT in association with the Plan. Any fair share contribution, financing, scheduling, implementation responsibilities and Lead Agency monitoring associated with the Plan should be fully discussed for all proposed mitigation measures.

***Cultural Resources***

- Cultural resource information is confidential and report distribution should be restricted from public access per California Government Code sections 6254.10 and 6254(r); California Code of Regulations Section 15120(d); and Section 304 of the National Historic Preservation Act of 1966. We recommend that the locational and other sensitive information regarding cultural resources in Appendix B be removed from public documents.
- The City of Novato should consult with the appropriate Native American tribes, groups or individuals regarding the implementation of the General Plan, in accordance with Senate Bill 18. Native Americans should also be consulted regarding Tribal Cultural Resources prior to future project approval by the City of Novato, in accordance with Assembly Bill 52. In the Cultural Resource Section on page 2-12, the phrase "State historic landmark status" should be replaced with "California Historical Landmark."
- We recommend in Section CC 1 (page 2-44), that the City of Novato include resources that also have the potential to contribute to California's and the United States' heritage. We also recommend revising the language of Section CC 2 (page 2-44) include information about mitigation and regulatory requirements: "Identify, recognize, and protect significant archaeological resources, and implement measures to preserve such resources prior to the implementation of projects in accordance with the California Environmental Quality Act (California Public Resources Code §21083.2 and 21084.1). Mitigate potential effects of projects on archaeological resources."
- We recommend adding two additional CCs. The first should address the treatment of Native American cultural resources per Assembly Bill 52, and the second should require a records search at the Northwest Information Center of the California Historical Resources Information System (CHRIS) at Sonoma State University before approval of a project.

***Travel Demand Analysis***

With the enactment of Senate Bill (SB) 743, Caltrans is focusing on transportation infrastructure that supports smart growth and efficient development. Recently approved guidance for incorporating SB 743 (*Local Development-Intergovernmental Review Program Interim Guidance, September 2016*) intends to ensure that development projects align with State policies through the use of efficient development patterns, innovative travel demand reduction strategies, and necessary multimodal roadway improvements. In Caltrans' *Smart Mobility 2010: A Call to Action for the New Decade*, this Plan falls under **Place Type 5 Rural Towns**, which includes areas with a mix of housing, services and public institutions in compact form that serve surrounding rural areas. Given this Place Type and future development planned throughout the City of Novato, please submit a travel demand analysis that provides VMT analysis resulting from the proposed Plan including:

- A vicinity map, regional location map, and site plan clearly showing the Plan's location in relation to nearby State roadways. Clearly identify State Right-of-Way (ROW), bicycle paths, and transit facilities.
- A VMT analysis pursuant to the Office of Planning and Research's Draft Guidelines. Mitigation for increasing VMT should be identified. Mitigation should support the use of

transit and active transportation modes. Potential mitigation measures that include the requirements of other agencies such as Caltrans are fully enforceable through permit conditions, agreements, or other legally-binding instruments under the control of the City of Novato.

- Evaluation of potential safety issues for all road users should be identified and fully mitigated.
- The Plan's primary and secondary effects on pedestrians, bicycles, disabled travelers and transit performance should be evaluated, including countermeasures and trade-offs resulting from mitigating VMT increases. Access to pedestrians, bicycle, and transit facilities must be maintained.

***Multimodal Planning***

The Plan should be conditioned to ensure connections to existing bike lanes and multi-use trails to facilitate walking and biking to nearby jobs, neighborhood services, and transit nodes such as the planned Novato San Marin Sonoma-Marin Area Rail Transit (SMART) Station. Specifically, the proposed Plan should include connections to existing and proposed bike lanes throughout the City of Novato as shown in the *2008 Marin County Unincorporated Area Bicycle and Pedestrian Master Plan*. Providing these connections with streets configured for alternative transportation modes will reduce VMT by creating multi-modal links to increase ridership of nearby Sonoma County Bus Routes and the upcoming SMART rail line.

***Vehicle Trip Reduction***

As the Rural Towns Place Type typically leads to high levels of VMT and corresponding low levels of active transportation, we encourage the establishment of Transportation Management Associations (TMA) in partnership with other developments in the area to pursue aggressive trip reduction targets with Lead Agency monitoring and enforcement. In addition, the TMA's should consider the following Transportation Demand Management (TDM) elements when designing projects within the City of Novato to promote smart mobility and reduce regional VMT and traffic impacts to the STN:

- Project design to encourage walking, bicycling, and convenient transit access;
- Lower parking ratios;
- Transit fare and carpool incentives for patrons, visitors, employees, and residents such as subsidized transit passes on a continuing basis;
- Enhanced bus stops including bus shelters;
- Designated bicycle parking;
- On-site showers and lockers at job centers for active transportation users;
- Designated parking spaces for carpooling;
- Charging stations and designated parking spaces for electric vehicles; and
- Reducing headway times of nearby Sonoma County Bus Routes and the upcoming SMART rail line.

For additional TDM options, please refer to Chapter 8 of FHWA's *Integrating Demand Management into the Transportation Planning Process: A Desk Reference*, regarding TDM at the local planning level. The reference is available online at: http://www.ops.fhwa.dot.gov/publications/fhwahop12035/fhwahop12035.pdf. For information about parking ratios, please see MTC's report, Reforming Parking Policies to Support Smart Growth, or visit the MTC parking webpage: http://www.mtc.ca.gov/planning/smart_growth/parking.

***Traffic Impact Fees***
Based on project-generated travel demand, please estimate the costs of public transportation improvements necessitated by the proposed Plan; viable funding sources such as development and/or transportation impact fees should also be identified. We encourage a sufficient allocation of fair share contributions toward multi-modal and regional transit improvements to fully mitigate cumulative impacts to regional transportation. We also strongly support measures to increase sustainable mode shares, thereby reducing VMT.

***Encroachment Permit***
Please be advised that any work or traffic control that encroaches onto the State ROW requires an encroachment permit that is issued by Caltrans. To apply, a completed encroachment permit application, environmental documentation, and five (5) sets of plans clearly indicating State ROW must be submitted to the following address: David Salladay, District Office Chief, Office of Permits, California Department of Transportation, District 4, P.O. Box 23660, Oakland, CA 94623-0660. Traffic-related mitigation measures should be incorporated into the construction plans prior to the encroachment permit process. See the website linked below for more information: http://www.dot.ca.gov/hq/traffops/developserv/permits.

Should you have any questions regarding this letter, please call Erik Bird at 510-286-5521 or Erik.Bird@dot.ca.gov.

Sincerely,

PATRICIA MAURICE
District Branch Chief
Local Development - Intergovernmental Review

c: State Clearinghouse

Dear Novato Planning Commission,

Greenbelt Alliance is interested in supporting a voter approved renewal of the Novato's  Urban Growth Boundary before it expires in 2017 and would like to touch base with Planning Commissioners individually, if possible, before the Jan. 12 Planning Commission meeting.

We are also reaching out to Novato City Council members.

Greenbelt Alliance realizes that that City Council previously decided to renew the city's UGB with a Council vote only instead of putting it on the ballot. However, we hope that the city might reconsider given the importance and success of maintaining voter approval for UGBs in the city of Novato and around the Bay Area.

Doing so needs to be included as part of the scoping for the General Plan EIR and the election planned and budgeted for 2017.

Thanks for your consideration.

Teri Shore

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Teri Shore
Regional Director, North Bay

Greenbelt Alliance
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GREENBELT ALLIANCE

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Jan. 12, 2017

Planning Commission
City of Novato
922 Machin Ave.
Novato, CA 94945

Re: Item 2 Receive and consider public agency and community input on the scope and content of the EIR to be prepared for the General Plan 2035

Dear Planning Commission,

Greenbelt Alliance appreciates the opportunity to provide public comment on the scoping of the environmental review of the draft General Plan 2035 for the City of Novato. We appreciate the comprehensive public process that the city has undertaken over the past several years to develop and update the General Plan. It is a strong document that is also user friendly and provides a strong vision for city-centered growth for the next 20 years. Greenbelt Alliance is happy to support it overall.

Additionally, Greenbelt Alliance is interested in providing specific input on analysis of the renewal of the city's Urban Growth Boundary as part of the environmental review. We'd also like to provide comment on analyzing the vision and zoning for the North, North Redwood Corridor. We may provide additional comments during the environmental review and General Plan before the public process is concluded.

1. Urban Growth Boundary

In the Great Places section, Chapter 2.5, Growth Management and Development Projections, the draft General Plan states that: *Program LU 5a calls for the amendment and extension of the effective date of the Urban Growth Boundary for another 20 years.*

While we understand that the City of Novato is committed in principle to renewing the UGB for at least 20 years as stated, Program LU 5a does not in fact *call* for the extension *nor for how long*: but that: *the City Council will consider extending the term of the Urban Growth Boundary to improve the City's ability to provide municipal services and discourage urban sprawl and the provision of urban services to property outside the City limits.*

In addition, the draft General Plan does not mention that the way that the UGB is implemented or renewed change from baseline conditions and incur different environmental impacts.

If the UGB is not renewed, or if its renewal is weakened from the current voter-approved ordinance to a simple City Council approved policy, the potential environmental impacts will be different than the baseline conditions.

The environmental impacts associated with the renewal of the Urban Growth Boundary and the General Plan 2035 on the City of Novato will be vary depending on:

A. whether the UGB is renewed or not,
B. whether it is renewed by the City Council with a majority vote, (weakening existing protections),
C. whether it is renewed by the voters, (providing equivalent to existing protections),
D. whether or not the policies are changed and how, and
E. whether or not the actual boundary is changed or not.

The approach to renewing the UGB and the length of time will produce varying environmental impacts related to sprawl, city-centered growth, GHG emissions, water quality, air quality and other areas covered by the California Environmental Quality Act. Therefore we urge that the following alternatives and the associated environmental impacts be considered in the environmental review:

1. The potential, if unlikely, that the city does not renew the Urban Growth Boundary.
2. Renewal of the Urban Growth Boundary by a City Council majority vote only, thereby potentially degrading existing baseline conditions.
3. Renewal of the Urban Growth Boundary by the voters, preserving existing baseline conditions.
4. The length of the renewal of the UGB for 20 years, 30 years, 50 years or in perpetuity (with and without voter approval).
5. Proposed changes in the UGB policies and associated impacts.
6. Proposed changes in the actual boundary.
7. Impacts from the annexations that occurred since the first UGB was enacted.

Greenbelt Alliance is urging the City of Novato to consider renewing its existing Urban Growth Boundary (UGB) for 20, 30, or more years, or perhaps in perpetuity, through a vote of the people with a city-sponsored ballot measure in November 2017. By including the above options in the environmental review, the Planning Commission and the City Council will be given more flexibility in how it would like to proceed with the UGB in 2017 and beyond. Please see attached letter that was submitted to the City Council on Jan. 10, 2017.

2. North, North Redwood Corridor

The North, North Redwood Corridor contains some of the last undeveloped lands within the city of Novato and within Marin County. Greenbelt Alliance has identified these lands as among the most high-risk of development in Marin County and in the San Francisco Bay Area. We can provide more details on our analysis once our updated At Risk report is released on Jan. 31, 2017.

As stated in the draft General Plan, the corridor extends north of San Marin Drive to the City's northerly boundary with Olompali State Park and west to the slopes of Mt. Burdell. While we realize that these lands are within the City of Novato's Urban Growth Boundary and described as "vacant commercially-zoned land," we urge the Planning Commission to consider prioritizing these lands for their open space, habitat, wetlands, oak woodlands and other natural values in the environmental review of the General Plan.

We recognize that the General Plan is currently prioritizing these lands for other uses including economic development, redevelopment for office and research uses, and for retail and recreation. The Northern Novato SMART train station is also in this corridor, providing opportunities for transit-oriented development and recreation.

Given that these greenfields are adjacent to the state park and other open lands, please consider an alternative of preserving these lands for natural resource values and recreation instead of commercial development. Consider an option for this focus area that does not include additional freeway or street access, but is primarily bicycle, pedestrian, and train access only. Doing so could provide significant environmental and economic benefits for the long term beyond the boom and bust cycles of commercial and retail development. Preserving the remaining greenbelts in the City of Novato as well as around the Bay Area and concentrating growth and development of all kinds in the city center and existing developed areas will benefit people and the environment for generations to come.

Including such an option in the environmental review is likely to help the Planning Commission, the City Council and the public in making final decisions about the future zoning and use of the North, North Redwood Corridor.

Thank you so much for your time and consideration.

Sincerely,

Teri Shore

Teri Shore
Regional Director, North Bay
707 575 3661

January 12, 2017

**<u>Delivered By Electronic Mail</u>**
Steve Marshall
Planning & Environmental Services Manager
City of Novato
922 Machin Avenue
Novato, California 94945
smarshall@cityofnovato.org

**SUBJECT: Comments | Notice of Preparation of a Draft Environmental Impact Report for the Novato General Plan 2035 Update**

Steve:

Thank you for providing the Marin Local Agency Formation Commission (LAFCO) the opportunity to review and comment on the Notice of Preparation (NOP) of a Draft Environmental Impact Report (DEIR) for the Novato General Plan 2035 Update. It is expected that Marin LAFCO will serve as a responsible agency under the California Environmental Quality Act (CEQA) with respect to carrying out certain aspects of the General Plan's implementation. Most notably, this includes the potential of enacting future boundary changes involving Novato as well as other public agencies' whose service areas – such as the Novato Sanitation District – overlap the project area. Accordingly, and in step with the referenced role, Marin LAFCO offers the following comments.

- **Listing of Responsible Agencies in Project Description**
  The DEIR's project description should list all responsible agency approvals needed in implementing the document. This includes listing Marin LAFCO should the DEIR contemplate any specific sphere of influence or boundary changes directly involving Novato or other governmental agencies overlapping the project area.

- **Incorporate and Reference as Appropriate Marin LAFCO Factors**
  Should the DEIR contemplate changes to either Novato's sphere of influence or another governmental agency the document should incorporate – as appropriate – the mandatory factors required therein for review by Marin LAFCO under Government Code Section 56425. Similarly, should the DEIR contemplate changes to either Novato's jurisdictional boundary or another governmental agency the document should incorporate – as appropriate – the mandatory factors required therein for review by Marin LAFCO under Government Code Section 56668.

- **Defining Agricultural Land**
  Please note LAFCO law provides a distinct definition for "agricultural land" under Government Code Section 56016. This definition may be broader in application than the criteria to be used in the DEIR. To this end, please incorporate – as appropriate – into the DEIR the referenced definition under Section 56016 in step with any changes requiring approval by Marin LAFCO.

Thank you for this opportunity to comment on the NOP. Should you have any questions for Marin LAFCO please contact me by telephone at (415) 448-5877 or by e-mail at ksimonds@marinlafco.org.

Sincerely,

Keene Simonds

Keene Simonds
Executive Officer

STATE OF CALIFORNIA Edmund G. Brown Jr., Governor

NATIVE AMERICAN HERITAGE COMMISSION
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December 30, 2016

Steve Marshall
City of Novato

Sent by Email: smarshall@novato.org

RE: SCH#2016122043, Novato General Plan 2035 Update, Marin County

Dear Mr. Marshall:

The Native American Heritage Commission has received the Notice of Preparation (NOP) for the project referenced above. The California Environmental Quality Act (CEQA) (Pub. Resources Code § 21000 et seq.), specifically Public Resources Code section 21084.1, states that a project that may cause a substantial adverse change in the significance of an historical resource is a project that may have a significant effect on the environment. (Pub. Resources Code § 21084.1; Cal. Code Regs., tit.14, § 15064.5 (b) (CEQA Guidelines Section 15064.5 (b)). If there is substantial evidence, in light of the whole record before a lead agency, that a project may have a significant effect on the environment, an environmental impact report (EIR) shall be prepared. (Pub. Resources Code § 21080 (d); Cal. Code Regs., tit. 14, § 15064 subd.(a)(1) (CEQA Guidelines § 15064 (a)(1)). In order to determine whether a project will cause a substantial adverse change in the significance of a historical resource, a lead agency will need to determine whether there are historical resources with the area of project effect (APE).

**CEQA was amended significantly in 2014**. Assembly Bill 52 (Gatto, Chapter 532, Statutes of 2014) (AB 52) amended CEQA to create a separate category of cultural resources, "tribal cultural resources" (Pub. Resources Code § 21074) and provides that a project with an effect that may cause a substantial adverse change in the significance of a tribal cultural resource is a project that may have a significant effect on the environment. (Pub. Resources Code § 21084.2). Public agencies shall, when feasible, avoid damaging effects to any tribal cultural resource. (Pub. Resources Code § 21084.3 (a)). **AB 52 applies to any project for which a notice of preparation or a notice of negative declaration or mitigated negative declaration is filed on or after July 1, 2015.** If your project involves the adoption of or amendment to a general plan or a specific plan, or the designation or proposed designation of open space, on or after March 1, 2005, it may also be subject to Senate Bill 18 (Burton, Chapter 905, Statutes of 2004) (SB 18). **Both SB 18 and AB 52 have tribal consultation requirements**. If your project is also subject to the federal National Environmental Policy Act (42 U.S.C. § 4321 et seq.) (NEPA), the tribal consultation requirements of Section 106 of the National Historic Preservation Act of 1966 (154 U.S.C. 300101, 36 C.F.R. § 800 et seq.) may also apply.

The NAHC recommends consultation with California Native American tribes that are traditionally and culturally affiliated with the geographic area of your proposed project as early as possible in order to avoid inadvertent discoveries of Native American human remains and best protect tribal cultural resources. Below is a brief summary of portions of AB 52 and SB 18 as well as the NAHC's recommendations for conducting cultural resources assessments. **Consult your legal counsel about compliance with AB 52 and SB 18 as well as compliance with any other applicable laws**.

AB 52

AB 52 has added to CEQA the additional requirements listed below, along with many other requirements:

1. Fourteen Day Period to Provide Notice of Completion of an Application/Decision to Undertake a Project: Within fourteen (14) days of determining that an application for a project is complete or of a decision by a public

agency to undertake a project, a lead agency shall provide formal notification to a designated contact of, or tribal representative of, traditionally and culturally affiliated California Native American tribes that have requested notice, to be accomplished by at least one written notice that includes:

a. A brief description of the project.
b. The lead agency contact information.
c. Notification that the California Native American tribe has 30 days to request consultation. (Pub. Resources Code § 21080.3.1 (d)).
d. A "California Native American tribe" is defined as a Native American tribe located in California that is on the contact list maintained by the NAHC for the purposes of Chapter 905 of Statutes of 2004 (SB 18). (Pub. Resources Code § 21073).

2. Begin Consultation Within 30 Days of Receiving a Tribe's Request for Consultation and Before Releasing a Negative Declaration, Mitigated Negative Declaration, or Environmental Impact Report: A lead agency shall begin the consultation process within 30 days of receiving a request for consultation from a California Native American tribe that is traditionally and culturally affiliated with the geographic area of the proposed project. (Pub. Resources Code § 21080.3.1, subds. (d) and (e)) and prior to the release of a negative declaration, mitigated negative declaration or environmental impact report. (Pub. Resources Code § 21080.3.1(b)).
    a. For purposes of AB 52, "consultation shall have the same meaning as provided in Gov. Code § 65352.4 (SB 18). (Pub. Resources Code § 21080.3.1 (b)).

3. Mandatory Topics of Consultation If Requested by a Tribe: The following topics of consultation, if a tribe requests to discuss them, are mandatory topics of consultation:
    a. Alternatives to the project.
    b. Recommended mitigation measures.
    c. Significant effects. (Pub. Resources Code § 21080.3.2 (a)).

4. Discretionary Topics of Consultation: The following topics are discretionary topics of consultation:
    a. Type of environmental review necessary.
    b. Significance of the tribal cultural resources.
    c. Significance of the project's impacts on tribal cultural resources.
    d. If necessary, project alternatives or appropriate measures for preservation or mitigation that the tribe may recommend to the lead agency. (Pub. Resources Code § 21080.3.2 (a)).

5. Confidentiality of Information Submitted by a Tribe During the Environmental Review Process: With some exceptions, any information, including but not limited to, the location, description, and use of tribal cultural resources submitted by a California Native American tribe during the environmental review process shall not be included in the environmental document or otherwise disclosed by the lead agency or any other public agency to the public, consistent with Government Code sections 6254 (r) and 6254.10. Any information submitted by a California Native American tribe during the consultation or environmental review process shall be published in a confidential appendix to the environmental document unless the tribe that provided the information consents, in writing, to the disclosure of some or all of the information to the public. (Pub. Resources Code § 21082.3 (c)(1)).

6. Discussion of Impacts to Tribal Cultural Resources in the Environmental Document: If a project may have a significant impact on a tribal cultural resource, the lead agency's environmental document shall discuss both of the following:
    a. Whether the proposed project has a significant impact on an identified tribal cultural resource.
    b. Whether feasible alternatives or mitigation measures, including those measures that may be agreed to pursuant to Public Resources Code section 21082.3, subdivision (a), avoid or substantially lessen the impact on the identified tribal cultural resource. (Pub. Resources Code § 21082.3 (b)).

7. Conclusion of Consultation: Consultation with a tribe shall be considered concluded when either of the following occurs:
    a. The parties agree to measures to mitigate or avoid a significant effect, if a significant effect exists, on a tribal cultural resource; or
    b. A party, acting in good faith and after reasonable effort, concludes that mutual agreement cannot be reached. (Pub. Resources Code § 21080.3.2 (b)).

8. Recommending Mitigation Measures Agreed Upon in Consultation in the Environmental Document: Any mitigation measures agreed upon in the consultation conducted pursuant to Public Resources Code section 21080.3.2 shall be recommended for inclusion in the environmental document and in an adopted mitigation monitoring and reporting program, if determined to avoid or lessen the impact pursuant to Public Resources Code section 21082.3, subdivision (b), paragraph 2, and shall be fully enforceable. (Pub. Resources Code § 21082.3 (a)).

9. Required Consideration of Feasible Mitigation: If mitigation measures recommended by the staff of the lead agency as a result of the consultation process are not included in the environmental document or if there are no agreed upon mitigation measures at the conclusion of consultation, or if consultation does not occur, and if substantial evidence demonstrates that a project will cause a significant effect to a tribal cultural resource, the lead agency shall consider feasible mitigation pursuant to Public Resources Code section 21084.3 (b). (Pub. Resources Code § 21082.3 (e)).

10. Examples of Mitigation Measures That, If Feasible, May Be Considered to Avoid or Minimize Significant Adverse Impacts to Tribal Cultural Resources:
    a. Avoidance and preservation of the resources in place, including, but not limited to:
        i. Planning and construction to avoid the resources and protect the cultural and natural context.
        ii. Planning greenspace, parks, or other open space, to incorporate the resources with culturally appropriate protection and management criteria.
    b. Treating the resource with culturally appropriate dignity, taking into account the tribal cultural values and meaning of the resource, including, but not limited to, the following:
        i. Protecting the cultural character and integrity of the resource.
        ii. Protecting the traditional use of the resource.
        iii. Protecting the confidentiality of the resource.
    c. Permanent conservation easements or other interests in real property, with culturally appropriate management criteria for the purposes of preserving or utilizing the resources or places.
    d. Protecting the resource. (Pub. Resource Code § 21084.3 (b)).
    e. Please note that a federally recognized California Native American tribe or a nonfederally recognized California Native American tribe that is on the contact list maintained by the NAHC to protect a California prehistoric, archaeological, cultural, spiritual, or ceremonial place may acquire and hold conservation easements if the conservation easement is voluntarily conveyed. (Civ. Code § 815.3 (c)).
    f. Please note that it is the policy of the state that Native American remains and associated grave artifacts shall be repatriated. (Pub. Resources Code § 5097.991).

11. Prerequisites for Certifying an Environmental Impact Report or Adopting a Mitigated Negative Declaration or Negative Declaration with a Significant Impact on an Identified Tribal Cultural Resource: An environmental impact report may not be certified, nor may a mitigated negative declaration or a negative declaration be adopted unless one of the following occurs:
    a. The consultation process between the tribes and the lead agency has occurred as provided in Public Resources Code sections 21080.3.1 and 21080.3.2 and concluded pursuant to Public Resources Code section 21080.3.2.
    b. The tribe that requested consultation failed to provide comments to the lead agency or otherwise failed to engage in the consultation process.
    c. The lead agency provided notice of the project to the tribe in compliance with Public Resources Code section 21080.3.1 (d) and the tribe failed to request consultation within 30 days. (Pub. Resources Code § 21082.3 (d)).

The NAHC's PowerPoint presentation titled, "Tribal Consultation Under AB 52: Requirements and Best Practices" may be found online at: http://nahc.ca.gov/wp-content/uploads/2015/10/AB52TribalConsultation_CalEPAPDF.pdf

SB 18

SB 18 applies to local governments and requires local governments to contact, provide notice to, refer plans to, and consult with tribes prior to the adoption or amendment of a general plan or a specific plan, or the designation of open space. (Gov. Code § 65352.3). Local governments should consult the Governor's Office of Planning and Research's "Tribal Consultation Guidelines," which can be found online at: https://www.opr.ca.gov/docs/09_14_05_Updated_Guidelines_922.pdf

Some of SB 18's provisions include:

1. Tribal Consultation: If a local government considers a proposal to adopt or amend a general plan or a specific plan, or to designate open space it is required to contact the appropriate tribes identified by the NAHC by requesting a "Tribal Consultation List." If a tribe, once contacted, requests consultation the local government must consult with the tribe on the plan proposal. **A tribe has 90 days from the date of receipt of notification to request consultation unless a shorter timeframe has been agreed to by the tribe.** (Gov. Code § 65352.3 (a)(2)).
2. No Statutory Time Limit on SB 18 Tribal Consultation. There is no statutory time limit on SB 18 tribal consultation.
3. Confidentiality: Consistent with the guidelines developed and adopted by the Office of Planning and Research pursuant to Gov. Code section 65040.2, the city or county shall protect the confidentiality of the information concerning the specific identity, location, character, and use of places, features and objects described in Public Resources Code sections 5097.9 and 5097.993 that are within the city's or county's jurisdiction. (Gov. Code § 65352.3 (b)).
4. Conclusion of SB 18 Tribal Consultation: Consultation should be concluded at the point in which:
    a. The parties to the consultation come to a mutual agreement concerning the appropriate measures for preservation or mitigation; or
    b. Either the local government or the tribe, acting in good faith and after reasonable effort, concludes that mutual agreement cannot be reached concerning the appropriate measures of preservation or mitigation. (Tribal Consultation Guidelines, Governor's Office of Planning and Research (2005) at p. 18).

Agencies should be aware that neither AB 52 nor SB 18 precludes agencies from initiating tribal consultation with tribes that are traditionally and culturally affiliated with their jurisdictions before the timeframes provided in AB 52 and SB 18. For that reason, we urge you to continue to request Native American Tribal Contact Lists and "Sacred Lands File" searches from the NAHC. The request forms can be found online at: http://nahc.ca.gov/resources/forms/

NAHC Recommendations for Cultural Resources Assessments

To adequately assess the existence and significance of tribal cultural resources and plan for avoidance, preservation in place, or barring both, mitigation of project-related impacts to tribal cultural resources, the NAHC recommends the following actions:

1. Contact the appropriate regional California Historical Research Information System (CHRIS) Center (http://ohp.parks.ca.gov/?page_id=1068) for an archaeological records search. The records search will determine:
    a. If part or all of the APE has been previously surveyed for cultural resources.
    b. If any known cultural resources have been already been recorded on or adjacent to the APE.
    c. If the probability is low, moderate, or high that cultural resources are located in the APE.
    d. If a survey is required to determine whether previously unrecorded cultural resources are present.

2. If an archaeological inventory survey is required, the final stage is the preparation of a professional report detailing the findings and recommendations of the records search and field survey.
    a. The final report containing site forms, site significance, and mitigation measures should be submitted immediately to the planning department. All information regarding site locations, Native American human remains, and associated funerary objects should be in a separate confidential addendum and not be made available for public disclosure.
    b. The final written report should be submitted within 3 months after work has been completed to the appropriate regional CHRIS center.

3. Contact the NAHC for:
    a. A Sacred Lands File search. Remember that tribes do not always record their sacred sites in the Sacred Lands File, nor are they required to do so. A Sacred Lands File search is not a substitute for consultation with tribes that are traditionally and culturally affiliated with the geographic area of the project's APE.

  b. A Native American Tribal Consultation List of appropriate tribes for consultation concerning the project site and to assist in planning for avoidance, preservation in place, or, failing both, mitigation measures.

4. Remember that the lack of surface evidence of archaeological resources (including tribal cultural resources) does not preclude their subsurface existence.
   a. Lead agencies should include in their mitigation and monitoring reporting program plan provisions for the identification and evaluation of inadvertently discovered archaeological resources per Cal. Code Regs., tit. 14, section 15064.5(f) (CEQA Guidelines section 15064.5(f)). In areas of identified archaeological sensitivity, a certified archaeologist and a culturally affiliated Native American with knowledge of cultural resources should monitor all ground-disturbing activities.
   b. Lead agencies should include in their mitigation and monitoring reporting program plans provisions for the disposition of recovered cultural items that are not burial associated in consultation with culturally affiliated Native Americans.
   c. Lead agencies should include in their mitigation and monitoring reporting program plans provisions for the treatment and disposition of inadvertently discovered Native American human remains. Health and Safety Code section 7050.5, Public Resources Code section 5097.98, and Cal. Code Regs., tit. 14, section 15064.5, subdivisions (d) and (e) (CEQA Guidelines section 15064.5, subds. (d) and (e)) address the processes to be followed in the event of an inadvertent discovery of any Native American human remains and associated grave goods in a location other than a dedicated cemetery.

If you have any questions, please contact me at my email address: sharaya.souza@nahc.ca.gov.

Sincerely,

Sharaya Souza
Staff Services Analyst
cc: State Clearinghouse

Steve,
Thank you for the NOP distribution notice.
TAM as the Congestion Management Agency of Marin county prepares a biannual congestion management plan for Marin, that monitors the performance of roadway segments including portions of Novato Boulevard, Bel Marin Keys, US 101 and Highway 37. Under current CEQA guidelines, the general plan should assess current and future impacts to the performance of these roadways identified in the congestion management plan. TAM would appreciate the opportunity to work with the city of Novato to develop the methodology for conducting this analysis, and for assessing the impacts resulting from GP build out.
Furthermore, as final guidance on SB 743 is made available and coordinating agencies modify their impact assessments, TAM would like to continue to work with the city of Novato to maintain and assess performance of the local CMP roadway system.
Thank you and please let me know if you have any questions or comments.

Derek McGill, AICP
Planning Manager
Transportation Authority of Marin
dmcgill@tam.ca.gov
(415) 226-0825
900 5th Avenue, Suite 100
San Rafael, CA 94901

**From:** Steve Marshall [mailto:smarshall@novato.org]
**Sent:** Monday, December 19, 2016 2:16 PM
**To:** Bill Tyler; dmcintyre@nmwd.com; erikb@novatosan.com; TWilliams@marincounty.org; jhogeboom@nusd.org; yhawkins@nusd.org; phils@msmosquito.com; rrojas@marincounty.org; bcrawford@marincounty.org; lgradia@marintransit.org; rdowning@goldengate.org; Derek McGill; bgamlen@sonomamarintrain.org; bmcquillen@gratonrancheria.com; THPO@gratonrancheria.com; jada@pge.com; KSimonds@marinlafco.org; ncamargo@bmkcsd.us; nancy@marinrcd.org; dweisz@mcecleanenergy.org; michael@michaelsfrank.com; mkorten@marincounty.org; rdoyle@marinsheriff.org; Paul.Jensen@cityofsanrafael.org
**Cc:** Matthew Maddox; Bob Brown; Christine O'Rourke
**Subject:** Draft Novato General Plan 2035 - Notice of Preparation of Environmental Impact Report

Dear Agency Staff:

The attached Notice of Preparation (NOP) has been issued to notify interested parties of the preparation of an environmental impact report (EIR) for the Novato General Plan 2035 (General Plan update). The City of Novato will be the lead agency under the California Environmental Quality Act (CEQA) and will prepare a programmatic Environmental Impact Report (Program EIR) to evaluate the environmental effects associated with the General Plan update.

In accordance with the time limits identified in state law, your response to this NOP must be submitted to the City at the earliest possible date, but not later than 5:00 p.m. on January 19, 2017 (32 days following the date this notice was first posted). In addition, a public scoping meeting will be conducted on Thursday, January 12, 2017, at 7:00 pm as part of the regularly scheduled Planning Commission hearing which will be held at: Novato City Hall, 901 Sherman

Avenue, Novato, California 94945. This NOP, the Draft General Plan 2035 update, and background documents are available for review on the City's General Plan Update webpage at: http://novato.org/government/community-development/general-plan-update

Sincerely,

Steve Marshall, AICP
Planning & Environmental Services Manager

City of Novato
Community Development Department
922 Machin Avenue
Novato, CA 94945

Main: (415)899-8989
Direct: (415)899-8942
Fax: (415)899-8216

www.novato.org

# Appendix B

General Plan 2035 Implementing Ordinances

## General Plan Land Use Map and Zoning Map Revisions

| Description | Policy Implications |
|---|---|
| 1. General Plan land use map and zoning map change for 15 parcels on both sides of Redwood Boulevard between Vallejo Avenue and Pinheiro Circle from General Commercial (CG) to Downtown Core (CD) with Downtown Core Business (CDB) as the implementing zoning district. | Changes in allowable uses: precludes auto uses (several become non-conforming) and allows residential mixed use development.<br><br>Increases maximum FAR from 0.4 to 2.0 (with potential to include housing in a mixed-use project).<br><br>Increases maximum height limit from 42-feet to 45-feet. |
| 2. General Plan land use map and zoning map change for 7 parcels on the east side of Redwood Boulevard between Olive Avenue and Rush Creek Place from Commercial Industrial (CI) to General Commercial (CG). | Changes allowable land uses from industrial activities to retail. Decreases FAR from 1.0 to 0.4, with exception of hotels assigned an FAR of 0.7. |
| 3. General Plan land use map change for 5 parcels on the west side of Redwood Boulevard between San Marin Drive and the Novato city limits from Light Industrial Office (LIO) to Business and Professional Office (BPO). | Changes allowable land uses from industrial activities to offices. |
| 4. General Plan land use map and zoning map change for a property owned by North Marin Water District located off of Reservoir Drive and Oleander Lane (APN 153-111-15) from Business and Professional Office (BPO) to Very Low Density Residential (RVL) and application of Planned District (PD) zoning. | Projected development potential of one (1) single-family residence due to hillside constraints. |
| 5. Rezone two parcels owned by North Marin Water District located off of Spinosa Way (APNs: 141-110-06 & 07) from Community Facilities (CF) to Low Density Residential (R1) with a minimum lot size of 40,000 sq. ft. (R1-40). | Parcels are assigned Low Density Residential (R1) land use designation. Rezone would correct inconsistency between land use designation and zoning classification. Projected development potential of one (1) single-family residence due to hillside constraints. |

| | |
|---|---|
| 6. General Plan land use map and zoning map change for 12 parcels on Clayton Court from Medium Density Multiple Family Residential (R10) to Low Density Residential (R1) and R10-4.5 zoning to R1-7.5 zoning. | Places existing single-family homes in a single-family land use category and zoning district. |
| 7. General Plan land use map and zoning map change for 12 parcels on the west side of First Street between Vallejo Avenue and Olive Avenue from Mixed Use (MU) to Medium Density Multiple Family (R10) and Mixed Use (MU) zoning to R10-2.2 zoning. | Sites currently developed with multi-family uses. Change would eliminate the requirement for commercial uses when redevelopment occurs. |
| 8. Rezone 200 parcels in the Northwest Quad from R10-4.5 to R10-NWQ (new form-based zoning district). | Retains existing General Plan land use designation and density allowing up to 20 du/acre. However, rescinds previous zoning limitation requiring retention of existing single-family homes.<br><br>New zoning is projected to increase redevelopment by 10 multi-family units by 2035. |
| 9. Change boundary of Downtown Overlay on General Plan Land Use Map and Zoning Map to remove three parcels from the Overlay, including APNs 153-390-01, 153-091-10, and 153-121-03. | Parcels will be regulated by standard Mixed-Use (MU) zoning. |
| 10. General Plan land use map and zoning map change for 2 parcels in Bahia (APNs 143-151-20 and 153-151-24) from Low Density Residential (R1) and Planned District (PD) zoning to the Conservation (CON) land use designation and zoning classification. | These parcels are owned by the Marin County Open Space District and Marin Audubon and are held for conservation. Accordingly, a residential land use designation is no longer appropriate. This action reduces the development potential of these properties. |
| 11. Change GP Land Use Map for 3 parcels at Hamilton from Multi-Family to Open Space (APNs 155-500-66; 157-180-53; 157-180-72) and one parcel from Single Family and Multi-Family to Community Facilities (157-860-04). | Reduces development potential of publically owned property. |
| 12. General Plan land use map and zoning map change for 5 parcels (APNs 155-400-01, -02, -04, -06, and -07) south of Marin Valley Mobile Country Club from Low Density Residential (R1) to Open Space (OS). | Property acquired by the City of Novato for open space. |

## General Plan Implementing Ordinances

| Ordinance Description |
|---|
| 1. Modify Novato Industrial Park Master Plan and Precise Development Plan to:<br><br>a. Allow ancillary retail sale of products made or commonly wholesaled on-site; up to 10% of total floor area may be devoted to retail sales and display area.<br><br>b. Allow existing non-conforming recreational uses to expand provided other zoning requirements (e.g., parking) are met.<br><br>c. Modify the auto related uses conditionally permitted in the Bel Marin Commerce Park and Ignacio Industrial Park areas to allow commercial auto restoration.<br><br>d. Create an allowance for life science/biotech campuses comprised of proximate, related properties with approval of a use permit and offering an allowable increase in maximum FAR from 0.6 to 1.2 (up to maximum net increase of 500,00 sq. ft. of additional floor area above an FAR of 0.6) and an increase in building height from a maximum of 42 feet to 68 feet (plus allowance for 8’ additional height for mechanical equipment screening of up to 10% of roof area). |
| 2. Modify Hillside/Ridgeline Ordinance (Municipal Code Division 19.26) to clarify development standards (e.g., height, maximum home size, and home placement) for lots created prior to January 13, 2004. |
| 3. Modify Downtown Core Retail (CDR) and Downtown Core Business (CDB) zoning regulations (Novato Municipal Code Section 19.12.030) to eliminate tobacco product shops as an allowed use in these zoning districts. |
| 4. Modify General Commercial (CG) zoning regulations (Novato Municipal Code Section 19.12.030) to allow tobacco product shops as a conditionally permitted use. |
| 5. Modify Downtown Overlay Zoning District (Novato Municipal Code Section 19.14.040) to:<br><br>a. Eliminate reference to compliance with design guidelines as being mandatory.<br><br>b. Eliminate references to Downtown Specific Plan. |
| 6. Modify procedures and findings in Novato Municipal Code 19.56.070.B for granting amendments to the Urban Growth Boundary due to threats to public health and safety based on voter approval of Measure D on November 7, 2017. |

| |
|---|
| 7. Modify Municipal Code Section 19.20.030 to prohibit gated communities consistent with 1996 General Plan Community Identity Policy 1A. |
| 8. Modify woodland tree removal mitigation requirements (Novato Municipal Code Section 19.39.040.G) to prioritize replacement planting of native species and to consider requiring fewer, but larger replacement trees based on site conditions. |
| 9. Modify animal keeping regulations (Novato Municipal Code Section 19.34.060) to allow beekeeping in all residential zoning districts, subject to performance standards limiting number of hives based on site area (min. 2 hives), orientation of entrance, setbacks, maintenance and on-site water source. |
| 10. Modify parking lot landscape requirements (Novato Municipal Code Section 19.30.70.H) to increase the minimum interior parking lot tree well dimension from 4-feet to 6-feet (exempting parking lots in the Downtown area and the renovation of existing parking lots) and requiring on-site monitoring and certification by a landscape architect of interior parking lot tree installation to verify maximum soil compaction of 75% and proper soil amendments. Adopt a list of recommended 20'+ canopy shade trees for parking lot interiors. Allow deviation from parking lot design standards through Design Review. |
| 11. Amend the Wetland Protection and Restoration Ordinance (Novato Municipal Code Section 19.36.070.A) to include the protection of special status species as a reason to require an expanded wetland buffer area. |
| 12. Modify Tables 2-8 and 2-10 of Novato Municipal Code Sections 19.12.040 and 19.14.040 to allow hotels to have a maximum FAR of 0.7 (increased from 0.4) in LIO, BPO, MU, CN and CG zoning districts. |
| 13. Modify lighting performance standards (Novato Municipal Code Section 19.22.060) to eliminate 11 PM curfew on non-essential interior and exterior lighting, and call for Dark Sky certified exterior lighting fixtures in new development subject to Design Review. |
| 14. Add new solar facility permitting section to the Novato Municipal Code allowing commercial solar panels, solar carports, and ground-mounted solar installations in specified zoning districts, subject to height and size limits, setbacks and performance standards. |
| 15. Allow community gardens as a permitted use in all zoning districts. Allow market gardens (small commercial garden) as a conditional use in all residential zoning districts. Limited on-site retail sales allowed for both garden types. |

# Appendix C

Sensitive Species Inventory Tables

## Table 1 Special-Status Wildlife Species with the Potential to Occur in the Novato Vicinity and Nine USGS Quadrangles

| Common Name | Scientific Name | Agency Status (Federal/State /Other) | Habitat Requirements |
|---|---|---|---|
| **Reptiles** | | | |
| Western pond turtle | *Emys marmorata* | --/--/SSC | Streams/ponds/lakes |
| **Amphibians** | | | |
| California giant salamander | *Dicamptodon ensatus* | --/--/SSC | Meadow and seep |
| California red-legged frog | *Rana draytonii* | **FT**/--/SSC | Semi-permanent or permanent water at least 2 feet deep, bordered by emergent or riparian vegetation, and upland grassland, forest or scrub habitats for refugia and dispersal. |
| California tiger salamander | *Ambystoma califomiense* | **FT**/**ST**/--- | Vernal pools, grasslands, oak savanna, woodland, and coastal scrub. Needs underground refuges. |
| Foothill yellow-legged frog | *Rana boylii* | --/--/SSC | Partly-shaded, shallow streams and riffles with a rocky substrate in a variety of habitats. Need at least some cobble-sized substrate for egg-laying |
| Red-bellied newt | *Taricha rivularis* | --/--/SSC | Broadleaved upland forest, north coast coniferous forest, redwood, riparian forest and woodland |
| **Invertebrates** | | | |
| California freshwater shrimp | *Syncaris pacifica* | **FE**/**SE**/-- | Freshwater streams and undercut banks |
| San Bruno elfin butterfly | *Callophrys mossii bayensis* | **FE**/--/-- | Grassland |
| **Fish** | | | |
| Coho salmon-central California Coast | *Oncorhynchus kisutch* | **FE**/**SE**/-- | Spawns in freshwater |
| Eulachon | *Thaleichthys pacificus* | **FT**/--/-- | Coast flowing waters |
| Longfin smelt | *Spirinchus thaleichthys* | --/**ST**/SSC | Aquatic, estuary |
| Sacramento splittail | *Pogonichthys macrolepidotus* | --/--/SSC | Estuary, freshwater, marsh |
| Steelhead-central California coast | *Oncorhynchus mykiss irideus* | **FT**/--/-- | Inhabits fresh water, fast flowing, highly oxygenated, clear, cool stream where riffles tend to predominate pools; small streams with high elevation headwaters close to the ocean that have no impassible barriers; spawning: high elevation headwaters. |
| Tidewater goby | *Eucyclogobis newberryi* | **FE**/--/SSC | Brackish water, marsh/bay |
| Tomales roach | *Lavinia symmetricus* spp. | --/--/SSC | Aquatic, flowing waters |
| **Birds** | | | |
| Alameda song sparrow | *Melospiza melodia pusillua* | --/--/SSC | Salt marsh |
| Bank Swallow | *Riparia riparia* | --/**ST**/-- | Riparian scrub and riparian woodland |

| Common Name | Scientific Name | Agency Status (Federal/State /Other) | Habitat Requirements |
|---|---|---|---|
| Black swift | *Cypseloides niger* | --/--/SSC | Damp forest |
| Burrowing owl | *Athene cunicularia* | --/--/SSC | Burrow sites in open dry annual or perennial grasslands, deserts and scrublands characterized by low growing vegetation. Also inhabits anthropogenic habitats such as campuses, golf courses, cemeteries, airports, and grazed pastures. |
| California Black Rail | *Laterallus jamaicensis cotumiculus* | --/**ST**/FP | Brackish marsh, freshwater marsh, salt marsh, and wetland |
| California Clapper Rail | *Rallus longirostris obsoletus* | **FE**/**SE**/-- | Slat and brackish marsh |
| California Ridegeway's rail | *Rallus obsoletus obsoletus* | **FE**/**SE**/**FP** | Brackish marsh, salt marsh, wetland |
| Northern harrier | *Circus cyaneus* | --/--/SSC | Nests in marsh and low shrubs |
| Saltmarsh common yellowthroat | *Geothlypis trichas sinuosa* | --/--/SSC | Slat and brackish water marsh |
| San Pablo song sparrow | *Melospiza melodia samuelis* | --/--/SSC | Coastal saltmarsh and brackish marsh |
| Short-eared owl | *Asio flammeus* | --/--/SSC | Grasslands and marsh |
| Swainson's hawk | *Buteo swainsoni* | --/**ST**/-- | Breeds in grasslands with scattered trees, juniper-sage flats, riparian areas, savannahs, and agricultural or ranch lands. Requires adjacent suitable foraging areas such as grasslands, or alfalfa or grain fields that support rodent populations. |
| Tricolored blackbird | *Agelaius tricolor* | --/CE/SSC | Open water, protected nesting substrate, and foraging area with insect prey within a few miles of the colony. |
| Western snowy plover | *Charadrius alexandrines nivosus* | **FT**/--/SSC | Standing water, sand shore, and wetlands |
| White-tailed kite | *Elanus leucurus* | --/FP/-- | Nests in grassland and marshland with trees |
| **Mammals** | | | |
| American badger | *Taxidea taxus* | --/--/SSC | Most abundant in drier open stages of most shrub, forest, and herbaceous habitats with friable soils. Needs sufficient food, friable soils, and open uncultivated ground. Cannot live in frequently plowed fields. Preys on burrowing rodents. |
| Pallid bat | *Antrozous pallidus* | --/--/SSC | Rocky canyons, open farmland, scattered desert scrub, grassland, shrubland, woodland, and mixed conifer forest. Roosts in caves, crevices, and trees; forages in a variety of habitats. |
| Point Reyes mountain beaver | *Aplodontia rufa phaea* | --/--/SSC | Coastal scrub, meadows, seeps |
| Salt-marsh harvest mouse | *Reithrodontomys raviventris* | **FE**/**SE**/FP | Marsh, swamp, wetland |

| Common Name | Scientific Name | Agency Status (Federal/State /Other) | Habitat Requirements |
|---|---|---|---|
| Salt-marsh wandering shrew | *Sorex vagrans halicoetes* | --/--/SSC | Marsh and swamp, wetland |
| San Pablo vole | *Microtus californicus sanpabloensis* | --/--/SSC | Marsh, swamp, grassland, wetland |
| Suisun shrew | *Sorex omatus sinuosus* | --/--/SSC | Marsh, swamp, wetland |
| Townsend's big-eared bat | *Corynorhinus townsendii* | --/--/SSC | Mesic habitats throughout California. Requires caves, tunnels, mines, or abandon buildings for roosting. |

| | | |
|---|---|---|
| FE=Federally Endangered | SE=State Endangered | FP = CDFW fully protected |
| FT=Federally Threatened | ST=State Threatened | SSC = CDFW species of special concern |
| FC=Federal Candidate | CFP=California Fully Protected | Rare = Rare species, State ranking as rare |
| DL=Federal Delisted | CSC=California Species of Concern | MMPA=Marine Mammal Protection Act |

Source: California Natural Diversity Database (CNDDB) (USGS 7.5-minute Novato and eight surrounding quadrangles), April 2018

## Table 2 Special-Status Plants with the Potential to Occur in the Novato Vicinity and Nine USGS Quadrangles

| Common Name | Scientific Name | Agency Status (Federal/State/ CRPR/Other) | Habitat Requirements |
|---|---|---|---|
| Franciscan onion | *Allium peninsulare var. franciscanum* | --/--/1B.2 | Woodland/grassland |
| Sonoma alopecurus | *Alopecurus aequalis* var. *sonomensis* | **FE**/--/1B.1 | Freshwater marsh/riparian scrub |
| Napa false indigo | *Amorpha californica var. napensis* | --/--/1B.2 | Forest/chaparral/woodland |
| Bent-flowered fiddleneck | *Amsinckia lunaris* | --/--/1B.2 | Coastal bluff scrub/woodland/grassland |
| Coast rockcress | *Arabis blepharophylla* | --/--/4.3 | Broadleafed upland forest and coastal bluff scrub/prairie/scrub |
| Mt. Tamalpais manzanita | *Arctostaphylos montana ssp. montana* | --/--/1B.3 | Chaparral/grassland |
| Marin manzanita | *Arctostaphylos virgata* | --/--/1B.2 | Forest/chaparral |
| Carlotta Hall's lace fern | *Aspidotis carlotta-halliae* | --/--/4.2 | Chaparral/cismontane woodland |
| Brewer's milk-vetch | *Astragalus breweri* | --/--/4.2 | Chaparral/cismontane woodland/meadows and seeps/grassland |
| Coastal marsh milk-vetch | *Astragalus pycnostachyus* var. *pycnostachyus* | --/--/1B.2 | Coastal scrub/dunes/marsh/swamps |
| Alkali milk-vetch | *Astragalus tener* var. *tener* | --/--/1B.2 | Vernal pools/grassland/playas |

| Common Name | Scientific Name | Agency Status (Federal/State/ CRPR/Other) | Habitat Requirements |
|---|---|---|---|
| Sonoma sunshine | *Blennosperma bakeri* | **FE**/**SE**/1B.1 | Vernal pools/mesic grassland |
| Thurber's reed grass | *Calamagrostis crassiglumis* | --/--/2B.1 | Coastal scrub/marshes/swamps |
| Serpentine reed grass | *Calamagrostis ophitidis* | --/--/4.3 | Serpentine/chaparral/meadows/seeps/grassland |
| Brewer's calandrinia | *Calandrinia breweri* | --/--/4.2 | Chaparral/coastal scrub |
| Tiburon mariposa lily | *Calochortus tiburonensis* | **FT**/**ST**/1B.1 | Serpentine grassland |
| Oakland star-tulip | *Calochortus umbellatus* | --/--/4.2 | Chaparral/forest/cismontane woodland/grassland |
| Seaside bittercress | *Cardamine angulata* | --**/**--/2B.1 | Forests |
| Lyngbye's sedge | *Carex lyngbyei* | --/--/2B.2 | Marshes/swamps |
| Tiburon paintbrush | *Castilleja affinis* var. *neglecta* | **FE**/**ST**/1B.2 | Serpentine grassland |
| Johnny-nip | *Castilleja ambigua* var. *ambigua* | --/--/4.2 | Coastal bluff/prairie/scrub and marshes/swamps/grassland/vernal pools |
| Nicasio ceanothus | *Ceanothus decornutus* | --/--/1B.2 | Chaparral |
| Glory brush | *Ceanothus gloriosus* var. *exaltatus* | --/--/4.3 | Chaparral |
| Point Reyes ceanothus | *Ceanothus gloriosus* var. *gloriosus* | --/--/4.3 | Coastal bluff/dunes/scrub and forest |
| Mason's ceanothus | *Ceanothus masonii* | --/--/1B.2 | Chaparral/serpentine |
| Kern ceanothus | *Ceanothus pinetorum* | --/--/4.3 | Forest |
| Monterey ceanothus | *Ceanothus rigidus* | --/--/4.2 | Chaparral/forest/coastal scrub |
| Pappose tarplant | *Centromadia parryi* ssp. *parryi* | --/--/1B.2 | Chaparral/mesic grassland/marshes/coastal prairie |
| Point Reyes salty bird's-beak | *Chloropyron maritimum* ssp. *palustre* | --/--/1B.2 | Marshes/swamps |
| Soft salty bird's-beak | *Chloropyron molle* ssp. *molle* | **FE/**--/1B.2 | Marshes/swamps |
| San Francisco Bay spineflower | *Chorizanthe cuspidata* var. *cuspidata* | --/--/1B.2 | Coastal scrub/prairie/dunes |
| Sonoma spineflower | *Chorizanthe valida* | **FE**/**SE**/1B.1 | Coastal prairie |
| Mt. Tamalpais thistle | *Cirsium hydrophilum* var. *vaseyi* | --/--/1B.2 | Forest/chaparral |
| Seaside cistanthe | *Cistanthe maritima* | --/--/4.2 | Coastal bluff scrub/scrub and grassland |

| Common Name | Scientific Name | Agency Status (Federal/State/ CRPR/Other) | Habitat Requirements |
|---|---|---|---|
| Round-headed Chinese-houses | *Collinsia corymbosa* | --/--/1B.2 | Coastal dunes |
| California lady's-slipper | *Cypripedium californicum* | --/--/4.2 | |
| Baker's larkspur | *Delphinium bakeri* | **FE**/**SE**/1B.1 | Coastal scrub |
| Golden larkspur | *Delphinium luteum* | **FE**/--/1B.1 | Chaparral, coastal prairie, coastal scrub |
| Western leatherwood | *Dirca occidentalis* | --**/**--/1B.2 | Forest/chaparral/woodland |
| Dwarf downingia | *Downingia pusilla* | --/--/2B.2 | Vernal pools/mesic grassland |
| Small spikerush | *Eleocharis parvula* | --/--/4.3 | Bogs/forest |
| California bottle-brush grass | *Elymus californicus* | --/--/4.3 | Forest/cismontane woodland/riparian woodland |
| Koch's cord moss | *Entosthodon kochii* | --/--/1B.2 | Woodland |
| Streamside daisy | *Erigeron biolettii* | --/--/3 | Forest/woodland |
| Tiburon buckwheat | *Eriogonum luteolum* var. *caninum* | --/--/1B.2 | Chaparral/woodland/grassland/coastal pine |
| San Francisco wallflower | *Erysimum franciscanum* | --/--/4.2 | Chaparral/coastal dunes/coastal scrub/grassland |
| Minute pocket moss | *Fissidens pauperculus* | --/--/1B.2 | Forest with damp soil |
| Marin checker lily | *Fritillaria lanceolata* var. *tristulis* | --/--/1B.1 | Coastal bluff scrub/prairie |
| Fragrant fritillary | *Fritillaria liliacea* | --/--/1B.2 | Coastal scrub/prairie/grassland |
| Blue coast gilia | *Gilia capitata* ssp. *chamissonis* | --/--/1B.1 | Coastal scrub/dunes |
| Woolly-headed gilia | *Gilia capitata* ssp. *tomentosa* | --**/**--/1B.1 | Coastal bluff scrub |
| Dark-eyed gilia | *Gilia millefoliata* | --/--/1B.2 | Coastal dunes |
| San Francisco gumplant | *Grindelia hirsutula* var. *maritima* | --/--/3.2 | Coastal bluff scrub/coastal scrub/grassland |
| Diablo helianthella | *Helianthella castanea* | --/--/1B.2 | Forest/chaparral/woodland/coastal scrub/grassland |
| Congested-headed hayfield tarplant | *Hemizonia congesta ssp. congesta* | --/--/1B.2 | Grassland |
| Marin western flax | *Hesperolinon congestum* | **FT**/**ST**/1B.1 | Chaparral/grassland |
| Santa Cruz tarplant | *Holocarpha macradenia* | **FT**/**SE**/1B.1 | Coastal prairie/coastal scrub/grassland |

| Common Name | Scientific Name | Agency Status (Federal/State/ CRPR/Other) | Habitat Requirements |
|---|---|---|---|
| Thin-lobed horkelia | *Horkelia tenuiloba* | --/--/1B.2 | Mesic grassland/chaparral/forest |
| Small groundcone | *Kopsiopsis hookeri* | --/--/2B.3 | North coast coniferous forest |
| Contra Costa goldfields | *Lasthenia conjugens* | **FE/**--/1B.1 | Vernal pools/grassland/woodland |
| Bristly leptosiphon | *Leptosiphon acicularis* | --/--/4.2 | Chaparral/cismontane woodland/coastal prairie/grassland |
| Coast yellow leptosiphon | *Leptosiphon croceus* | --/--/1B.1 | Coastal bluff scrub/coastal prairie |
| Large-flowered leptosiphon | *Leptosiphon grandiflorus* | --/--/4.2 | Coastal bluff scrub/dunes/prairie/scrub and forest/cismontane woodland/grassland |
| Woolly-headed lessingia | *Lessingia hololeuca* | --/--/3 | Forest/scrub/grassland |
| Tamalpais lessingia | *Lessingia micradenia* var. *micradenia* | --/--/1B.2 | Chaparral/grassland |
| Pitkin Marsh lily | *Lilium pardalinum* ssp. *pitkinense* | **FE**/**SE**/1B.1 | Cismontane woodland/meadows/seeps/marshes/swamp |
| Mt. Diablo cottonweed | *Micropus amphibolus* | --/--/3.2 | Forest/woodland/chaparral/grassland |
| Marsh microseris | *Microseris paludosa* | --/--/1B.2 | Forest/woodland/coastal scrub/grassland |
| Elongate copper moss | *Mielichhoferia elongata* | --/--/4.3 | Woodland/vernally mesic rocks |
| Baker's navarretia | *Navarretia leucocephala* ssp. *bakeri* | --**/**--/1B.1 | Woodland/seeps/pools/grassland/forest |
| Marin County navarretia | *Navarretia rosulata* | --/--/1B.2 | Coniferous forest/chaparral |
| White-rayed pentachaeta | *Pentachaeta bellidiflora* | **FE**/**SE**/1B.1 | Grassland on serpentine |
| Gairdner's yampah | *Perideridia gairdneri* ssp. *gairdneri* | --/--/4.2 | Chaparral/forest/coastal prairie/grassland/vernal pools |
| Michael's rein orchid | *Piperia michaelii* | --/--/4.2 | Coastal bluff scrub/scrub and chaparral/forest/cismontane woodland |
| Hairless popcornflower | *Plagiobothrys glaber* | --/--/1A | Meadows/seeps/marshes/swamps |
| Petaluma popcornflower | *Plagiobothrys mollis* var. *vestitus* | --/--/1A | Marshes/swamps/grassland |
| North Coast semaphore grass | *Pleuropogon hooverianus* | --/**ST**/1B.1 | Forest/steeps |

| Common Name | Scientific Name | Agency Status (Federal/State/ CRPR/Other) | Habitat Requirements |
|---|---|---|---|
| Nodding semaphore grass | *Pleuropogon refractus* | --/--/4.2 | Meadows/seeps/forest/riparian forest |
| Marin knotweed | *Polygonum marinense* | --/--/3.1 | Marshes/swamps |
| Tamalpais oak | *Quercus parvula* var. *tamalpaisensis* | --/--/1B.3 | Lower montane coniferous forest |
| Lobb's aquatic buttercup | *Ranunculus lobbii* | --/--/4.2 | Vernal pools/cismontane woodland/forest/grassland |
| Victor's gooseberry | *Ribes victoris* | --/--/4.3 | Chaparral/forest |
| Point Reyes checkerbloom | *Sidalcea calycosa* ssp. *rhizomata* | --/--/1B.2 | Marshes/swamps |
| Marin checkerbloom | *Sidalcea hickmanii* ssp. *viridis* | --/--/1B.1 | Chaparral |
| Santa Cruz microseris | *Stebbinsoseris decipiens* | --/--/1B.2 | Forest/chaparral/coastal scrub and prairie |
| Tamalpais jewelflower | *Streptanthus batrachopus* | --/--/1B.1 | Chaparral/forest |
| Tiburon jewelflower | *Streptanthus glandulosus* ssp. *niger* | **FE**/**SE**/1B.1 | Grassland on serpentine |
| Mt. Tamalpais bristly jewelflower | *Streptanthus glandulosus* ssp. *pulchellus* | --/--/1B.2 | Chaparral/grassland |
| Suisun Marsh aster | *Symphyotrichum lentum* | --/--/1B.2 | Marshes/swamps |
| Two-fork clover | *Trifolium amoenum* | **FE**/--/1B.1 | Coastal bluff scrub/grassland |
| Saline clover | *Trifolium hydrophilum* | --/--/1B.2 | Marshes/swamps/grassland/vernal pools |
| Coastal triquetrella | *Triquetrella californica* | --/--/1B.2 | Coastal bluff scrub/scrub |

FE=Federally Endangered
FT=Federal Threatened
SE=California State Endangered
ST=California State Threatened

**California Native Plant Society (CNPS)**
1A: Plants presumed extinct in California
1B: Plants rare, threatened, or endangered in California and elsewhere
2: Plants rare, threatened, or endangered in California, but more common elsewhere.
3: Plants about which we need more information.
4: Plants of limited distribution, a watch list.

**California Rare Plant Rank (CRPR)**
0.1 - Seriously endangered in California (over 80% of occurrences threatened / high degree and immediacy of threat)
0.2 – Fairly endangered in California (20-80% occurrences threatened)
0.3 – Not very endangered in California (<20% of occurrences threatened or no current threats known)

Sources: California Native Plant Society (CNPS) (USGS 7.5-minute Novato and eight surrounding quadrangles), October 2016 California Natural Diversity Database (CNDDB) (USGS 7.5-minute Novato and eight surrounding quadrangles), November 2016

# Appendix D

Noise Measurement Results

- Freq Weight : A
- Time Weight : FAST
- Level Range : 40-100
- Max dB : 75.3 - 2018/05/09 13:53:39
- Level Range : 40-100
- SEL : 88.7
- Leq : 59.2
-

Noise Measurement 1

| No.s | Date Time | (dB) | | | | |
|---|---|---|---|---|---|---|
| 1 | 2018/05/09 13:38:44 | 53.3 | 53.6 | 53.9 | 55.3 | 57.0 |
| 6 | 2018/05/09 13:38:49 | 55.5 | 60.4 | 57.2 | 55.9 | 57.3 |
| 11 | 2018/05/09 13:38:54 | 57.8 | 57.6 | 57.5 | 56.3 | 57.1 |
| 16 | 2018/05/09 13:38:59 | 57.9 | 57.1 | 56.1 | 56.7 | 56.9 |
| 21 | 2018/05/09 13:39:04 | 57.4 | 58.5 | 60.4 | 63.3 | 62.7 |
| 26 | 2018/05/09 13:39:09 | 63.7 | 61.0 | 59.1 | 57.5 | 56.8 |
| 31 | 2018/05/09 13:39:14 | 57.1 | 55.9 | 57.1 | 57.8 | 58.2 |
| 36 | 2018/05/09 13:39:19 | 56.2 | 56.2 | 55.5 | 54.6 | 56.0 |
| 41 | 2018/05/09 13:39:24 | 56.5 | 55.8 | 56.4 | 56.9 | 56.5 |
| 46 | 2018/05/09 13:39:29 | 60.2 | 57.4 | 59.3 | 56.7 | 56.4 |
| 51 | 2018/05/09 13:39:34 | 56.3 | 57.1 | 55.7 | 56.9 | 57.2 |
| 56 | 2018/05/09 13:39:39 | 56.9 | 57.0 | 55.8 | 55.1 | 56.1 |
| 61 | 2018/05/09 13:39:44 | 54.4 | 55.1 | 56.5 | 55.7 | 57.7 |
| 66 | 2018/05/09 13:39:49 | 56.0 | 54.3 | 52.7 | 52.2 | 51.7 |
| 71 | 2018/05/09 13:39:54 | 52.8 | 52.3 | 53.0 | 53.5 | 53.7 |
| 76 | 2018/05/09 13:39:59 | 53.6 | 54.3 | 54.9 | 54.0 | 54.3 |
| 81 | 2018/05/09 13:40:04 | 54.9 | 55.2 | 55.4 | 55.5 | 57.4 |
| 86 | 2018/05/09 13:40:09 | 54.3 | 54.1 | 55.5 | 55.7 | 59.8 |
| 91 | 2018/05/09 13:40:14 | 55.7 | 55.8 | 54.6 | 53.8 | 55.0 |
| 96 | 2018/05/09 13:40:19 | 57.0 | 56.4 | 55.8 | 54.3 | 55.1 |
| 101 | 2018/05/09 13:40:24 | 56.7 | 57.2 | 57.0 | 57.3 | 57.2 |
| 106 | 2018/05/09 13:40:29 | 56.5 | 56.3 | 55.5 | 55.2 | 54.4 |
| 111 | 2018/05/09 13:40:34 | 54.8 | 55.1 | 57.7 | 55.7 | 57.1 |
| 116 | 2018/05/09 13:40:39 | 56.3 | 55.8 | 55.5 | 56.1 | 56.0 |
| 121 | 2018/05/09 13:40:44 | 55.3 | 55.4 | 55.1 | 55.7 | 55.3 |
| 126 | 2018/05/09 13:40:49 | 55.8 | 55.6 | 55.4 | 57.5 | 58.6 |
| 131 | 2018/05/09 13:40:54 | 58.0 | 57.3 | 57.9 | 57.4 | 58.1 |
| 136 | 2018/05/09 13:40:59 | 56.4 | 56.4 | 56.6 | 56.0 | 57.1 |
| 141 | 2018/05/09 13:41:04 | 56.3 | 56.0 | 54.9 | 53.4 | 55.0 |
| 146 | 2018/05/09 13:41:09 | 54.4 | 53.2 | 52.3 | 52.0 | 52.0 |
| 151 | 2018/05/09 13:41:14 | 52.7 | 52.6 | 52.6 | 52.9 | 52.2 |
| 156 | 2018/05/09 13:41:19 | 51.9 | 55.8 | 55.2 | 55.4 | 54.2 |
| 161 | 2018/05/09 13:41:24 | 55.2 | 54.6 | 55.2 | 55.7 | 56.9 |
| 166 | 2018/05/09 13:41:29 | 56.2 | 56.9 | 56.8 | 56.4 | 59.0 |
| 171 | 2018/05/09 13:41:34 | 57.5 | 57.7 | 58.0 | 57.0 | 57.6 |
| 176 | 2018/05/09 13:41:39 | 57.2 | 58.3 | 58.2 | 58.3 | 59.3 |
| 181 | 2018/05/09 13:41:44 | 59.9 | 59.4 | 60.2 | 60.1 | 60.3 |
| 186 | 2018/05/09 13:41:49 | 58.1 | 60.8 | 58.7 | 58.1 | 58.2 |
| 191 | 2018/05/09 13:41:54 | 58.9 | 59.5 | 61.9 | 60.7 | 60.0 |
| 196 | 2018/05/09 13:41:59 | 58.9 | 58.4 | 59.2 | 59.4 | 58.8 |
| 201 | 2018/05/09 13:42:04 | 58.8 | 58.4 | 57.7 | 59.6 | 59.4 |
| 206 | 2018/05/09 13:42:09 | 58.6 | 59.3 | 59.8 | 58.5 | 59.3 |
| 211 | 2018/05/09 13:42:14 | 58.7 | 59.8 | 57.7 | 58.3 | 57.4 |
| 216 | 2018/05/09 13:42:19 | 55.7 | 55.3 | 55.2 | 56.5 | 55.8 |
| 221 | 2018/05/09 13:42:24 | 56.7 | 57.4 | 58.4 | 59.3 | 59.1 |
| 226 | 2018/05/09 13:42:29 | 58.4 | 58.2 | 58.5 | 58.1 | 57.4 |
| 231 | 2018/05/09 13:42:34 | 57.0 | 56.9 | 56.8 | 56.3 | 56.7 |
| 236 | 2018/05/09 13:42:39 | 56.0 | 57.6 | 57.3 | 55.5 | 55.9 |
| 241 | 2018/05/09 13:42:44 | 56.0 | 54.5 | 54.2 | 53.9 | 54.8 |
| 246 | 2018/05/09 13:42:49 | 55.0 | 55.6 | 54.7 | 54.4 | 54.2 |
| 251 | 2018/05/09 13:42:54 | 54.2 | 55.0 | 54.8 | 55.0 | 55.1 |
| 256 | 2018/05/09 13:42:59 | 55.6 | 57.3 | 56.4 | 55.0 | 55.4 |
| 261 | 2018/05/09 13:43:04 | 58.8 | 61.5 | 60.1 | 61.6 | 60.7 |
| 266 | 2018/05/09 13:43:09 | 61.1 | 60.7 | 61.0 | 61.3 | 60.8 |
| 271 | 2018/05/09 13:43:14 | 62.1 | 61.4 | 60.6 | 60.5 | 61.5 |
| 276 | 2018/05/09 13:43:19 | 60.1 | 57.1 | 58.5 | 59.5 | 57.0 |
| 281 | 2018/05/09 13:43:24 | 57.2 | 57.0 | 58.3 | 58.3 | 60.0 |
| 286 | 2018/05/09 13:43:29 | 58.6 | 57.9 | 57.2 | 58.0 | 56.8 |
| 291 | 2018/05/09 13:43:34 | 57.1 | 55.5 | 55.2 | 55.7 | 55.1 |
| 296 | 2018/05/09 13:43:39 | 55.6 | 56.2 | 57.9 | 57.1 | 57.1 |
| 301 | 2018/05/09 13:43:44 | 57.1 | 57.7 | 58.5 | 58.7 | 58.9 |
| 306 | 2018/05/09 13:43:49 | 58.2 | 59.6 | 59.1 | 60.4 | 60.6 |
| 311 | 2018/05/09 13:43:54 | 60.9 | 61.9 | 61.6 | 63.7 | 59.9 |
| 316 | 2018/05/09 13:43:59 | 59.3 | 61.9 | 58.5 | 58.8 | 57.6 |
| 321 | 2018/05/09 13:44:04 | 56.1 | 55.7 | 56.3 | 57.8 | 58.2 |
| 326 | 2018/05/09 13:44:09 | 58.7 | 58.9 | 58.2 | 59.7 | 59.0 |
| 331 | 2018/05/09 13:44:14 | 62.0 | 61.1 | 61.0 | 61.8 | 61.4 |
| 336 | 2018/05/09 13:44:19 | 65.7 | 62.3 | 61.0 | 62.0 | 59.4 |
| 341 | 2018/05/09 13:44:24 | 59.0 | 58.5 | 62.1 | 57.9 | 57.6 |
| 346 | 2018/05/09 13:44:29 | 57.6 | 58.2 | 60.2 | 60.5 | 64.4 |
| 351 | 2018/05/09 13:44:34 | 61.8 | 62.2 | 61.9 | 61.3 | 61.6 |
| 356 | 2018/05/09 13:44:39 | 63.6 | 62.9 | 61.3 | 62.2 | 61.6 |
| 361 | 2018/05/09 13:44:44 | 61.9 | 60.3 | 60.6 | 60.8 | 61.3 |
| 366 | 2018/05/09 13:44:49 | 59.8 | 59.3 | 60.7 | 58.4 | 58.3 |
| 371 | 2018/05/09 13:44:54 | 56.8 | 55.7 | 56.4 | 54.8 | 55.9 |
| 376 | 2018/05/09 13:44:59 | 56.1 | 57.6 | 58.5 | 59.2 | 60.9 |
| 381 | 2018/05/09 13:45:04 | 64.2 | 65.4 | 62.0 | 61.3 | 64.3 |
| 386 | 2018/05/09 13:45:09 | 62.0 | 62.6 | 62.5 | 60.8 | 62.5 |
| 391 | 2018/05/09 13:45:14 | 61.6 | 60.0 | 60.3 | 60.2 | 59.4 |
| 396 | 2018/05/09 13:45:19 | 58.7 | 59.3 | 57.4 | 58.6 | 58.8 |
| 401 | 2018/05/09 13:45:24 | 58.5 | 58.6 | 58.2 | 60.4 | 57.5 |
| 406 | 2018/05/09 13:45:29 | 56.8 | 57.8 | 58.0 | 57.7 | 58.4 |
| 411 | 2018/05/09 13:45:34 | 57.7 | 58.8 | 59.0 | 60.3 | 58.3 |
| 416 | 2018/05/09 13:45:39 | 57.5 | 58.1 | 58.2 | 60.9 | 59.6 |
| 421 | 2018/05/09 13:45:44 | 57.4 | 58.4 | 58.9 | 58.0 | 57.1 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 426 | 2018/05/09 | 13:45:49 | 57.1 | 57.6 | 55.3 | 55.8 | 56.4 |
| 431 | 2018/05/09 | 13:45:54 | 56.5 | 55.9 | 55.2 | 55.2 | 56.0 |
| 436 | 2018/05/09 | 13:45:59 | 58.7 | 56.7 | 57.9 | 58.6 | 57.6 |
| 441 | 2018/05/09 | 13:46:04 | 59.4 | 59.8 | 67.8 | 60.5 | 60.4 |
| 446 | 2018/05/09 | 13:46:09 | 62.1 | 62.6 | 62.3 | 60.6 | 60.8 |
| 451 | 2018/05/09 | 13:46:14 | 60.5 | 60.1 | 60.6 | 59.8 | 59.7 |
| 456 | 2018/05/09 | 13:46:19 | 58.4 | 57.6 | 57.2 | 55.3 | 55.3 |
| 461 | 2018/05/09 | 13:46:24 | 55.3 | 54.4 | 56.0 | 56.4 | 58.1 |
| 466 | 2018/05/09 | 13:46:29 | 56.2 | 57.8 | 57.5 | 55.4 | 56.0 |
| 471 | 2018/05/09 | 13:46:34 | 55.1 | 56.0 | 55.5 | 55.5 | 54.5 |
| 476 | 2018/05/09 | 13:46:39 | 55.4 | 54.4 | 54.2 | 55.3 | 55.2 |
| 481 | 2018/05/09 | 13:46:44 | 55.1 | 54.7 | 54.1 | 54.2 | 53.9 |
| 486 | 2018/05/09 | 13:46:49 | 52.9 | 53.3 | 53.0 | 53.4 | 53.7 |
| 491 | 2018/05/09 | 13:46:54 | 54.4 | 53.1 | 53.7 | 53.1 | 52.9 |
| 496 | 2018/05/09 | 13:46:59 | 51.9 | 50.9 | 51.7 | 51.2 | 51.5 |
| 501 | 2018/05/09 | 13:47:04 | 52.0 | 53.3 | 52.1 | 55.4 | 53.4 |
| 506 | 2018/05/09 | 13:47:09 | 57.3 | 58.8 | 61.6 | 57.2 | 57.2 |
| 511 | 2018/05/09 | 13:47:14 | 57.5 | 59.9 | 62.2 | 61.9 | 56.6 |
| 516 | 2018/05/09 | 13:47:19 | 56.3 | 57.8 | 54.9 | 53.8 | 54.0 |
| 521 | 2018/05/09 | 13:47:24 | 54.6 | 56.5 | 56.2 | 60.9 | 55.9 |
| 526 | 2018/05/09 | 13:47:29 | 54.9 | 54.6 | 54.3 | 53.8 | 54.2 |
| 531 | 2018/05/09 | 13:47:34 | 54.4 | 54.0 | 54.3 | 54.5 | 55.5 |
| 536 | 2018/05/09 | 13:47:39 | 55.3 | 54.8 | 57.3 | 56.8 | 56.0 |
| 541 | 2018/05/09 | 13:47:44 | 57.3 | 57.8 | 58.4 | 58.0 | 59.3 |
| 546 | 2018/05/09 | 13:47:49 | 58.2 | 56.7 | 56.7 | 56.2 | 56.3 |
| 551 | 2018/05/09 | 13:47:54 | 56.8 | 57.3 | 55.3 | 56.2 | 55.4 |
| 556 | 2018/05/09 | 13:47:59 | 54.7 | 55.0 | 60.8 | 56.4 | 54.9 |
| 561 | 2018/05/09 | 13:48:04 | 54.9 | 57.4 | 54.8 | 56.6 | 57.2 |
| 566 | 2018/05/09 | 13:48:09 | 57.2 | 56.6 | 58.3 | 57.0 | 56.2 |
| 571 | 2018/05/09 | 13:48:14 | 57.7 | 57.0 | 56.2 | 57.0 | 59.0 |
| 576 | 2018/05/09 | 13:48:19 | 59.1 | 56.0 | 55.3 | 59.2 | 58.0 |
| 581 | 2018/05/09 | 13:48:24 | 58.4 | 56.1 | 63.8 | 55.1 | 54.4 |
| 586 | 2018/05/09 | 13:48:29 | 58.0 | 54.3 | 54.6 | 55.8 | 59.8 |
| 591 | 2018/05/09 | 13:48:34 | 58.5 | 60.6 | 58.4 | 57.8 | 57.6 |
| 596 | 2018/05/09 | 13:48:39 | 56.7 | 57.6 | 59.4 | 60.2 | 59.6 |
| 601 | 2018/05/09 | 13:48:44 | 58.6 | 58.3 | 56.7 | 57.6 | 56.8 |
| 606 | 2018/05/09 | 13:48:49 | 58.2 | 57.7 | 57.3 | 56.3 | 56.4 |
| 611 | 2018/05/09 | 13:48:54 | 56.3 | 56.8 | 56.7 | 56.7 | 57.8 |
| 616 | 2018/05/09 | 13:48:59 | 57.9 | 58.4 | 58.2 | 57.6 | 58.2 |
| 621 | 2018/05/09 | 13:49:04 | 58.9 | 58.2 | 58.0 | 58.7 | 57.4 |
| 626 | 2018/05/09 | 13:49:09 | 57.7 | 56.9 | 58.6 | 59.2 | 60.3 |
| 631 | 2018/05/09 | 13:49:14 | 61.8 | 60.8 | 59.3 | 59.2 | 58.9 |
| 636 | 2018/05/09 | 13:49:19 | 60.7 | 58.2 | 58.0 | 59.6 | 60.4 |
| 641 | 2018/05/09 | 13:49:24 | 58.5 | 58.0 | 59.0 | 59.1 | 58.2 |
| 646 | 2018/05/09 | 13:49:29 | 59.8 | 61.7 | 60.4 | 60.2 | 59.3 |
| 651 | 2018/05/09 | 13:49:34 | 58.9 | 58.7 | 58.2 | 59.4 | 58.7 |
| 656 | 2018/05/09 | 13:49:39 | 58.3 | 58.7 | 60.0 | 60.7 | 60.2 |
| 661 | 2018/05/09 | 13:49:44 | 58.3 | 57.2 | 59.3 | 60.2 | 58.8 |
| 666 | 2018/05/09 | 13:49:49 | 58.0 | 58.3 | 59.8 | 58.9 | 58.6 |
| 671 | 2018/05/09 | 13:49:54 | 58.7 | 58.0 | 58.5 | 58.4 | 59.8 |
| 676 | 2018/05/09 | 13:49:59 | 60.0 | 62.4 | 62.6 | 60.8 | 60.1 |
| 681 | 2018/05/09 | 13:50:04 | 61.2 | 60.7 | 61.8 | 61.0 | 62.5 |
| 686 | 2018/05/09 | 13:50:09 | 65.7 | 59.2 | 61.2 | 61.7 | 60.5 |
| 691 | 2018/05/09 | 13:50:14 | 64.4 | 64.9 | 65.0 | 63.6 | 67.5 |
| 696 | 2018/05/09 | 13:50:19 | 62.6 | 62.7 | 63.0 | 61.4 | 62.6 |
| 701 | 2018/05/09 | 13:50:24 | 61.5 | 67.1 | 63.9 | 61.8 | 64.9 |
| 706 | 2018/05/09 | 13:50:29 | 62.6 | 62.3 | 63.7 | 62.9 | 65.7 |
| 711 | 2018/05/09 | 13:50:34 | 64.4 | 62.9 | 64.0 | 63.6 | 63.2 |
| 716 | 2018/05/09 | 13:50:39 | 63.5 | 64.7 | 68.0 | 67.8 | 65.3 |
| 721 | 2018/05/09 | 13:50:44 | 63.3 | 61.6 | 63.1 | 63.4 | 61.3 |
| 726 | 2018/05/09 | 13:50:49 | 59.5 | 59.4 | 59.7 | 64.5 | 60.0 |
| 731 | 2018/05/09 | 13:50:54 | 61.2 | 59.1 | 58.2 | 58.8 | 62.6 |
| 736 | 2018/05/09 | 13:50:59 | 58.3 | 57.8 | 58.3 | 57.9 | 59.7 |
| 741 | 2018/05/09 | 13:51:04 | 57.9 | 58.1 | 59.2 | 59.1 | 58.8 |
| 746 | 2018/05/09 | 13:51:09 | 58.8 | 58.1 | 57.5 | 61.1 | 58.4 |
| 751 | 2018/05/09 | 13:51:14 | 59.4 | 61.4 | 61.8 | 58.8 | 59.4 |
| 756 | 2018/05/09 | 13:51:19 | 58.6 | 58.9 | 59.0 | 59.4 | 58.8 |
| 761 | 2018/05/09 | 13:51:24 | 59.3 | 59.6 | 58.8 | 59.1 | 59.9 |
| 766 | 2018/05/09 | 13:51:29 | 60.5 | 58.7 | 57.9 | 57.9 | 60.3 |
| 771 | 2018/05/09 | 13:51:34 | 59.3 | 59.8 | 58.9 | 58.9 | 58.9 |
| 776 | 2018/05/09 | 13:51:39 | 59.2 | 57.8 | 57.6 | 57.7 | 62.5 |
| 781 | 2018/05/09 | 13:51:44 | 59.1 | 57.7 | 57.8 | 57.4 | 58.3 |
| 786 | 2018/05/09 | 13:51:49 | 58.2 | 58.3 | 57.4 | 59.1 | 62.9 |
| 791 | 2018/05/09 | 13:51:54 | 64.2 | 62.4 | 63.8 | 67.9 | 69.5 |
| 796 | 2018/05/09 | 13:51:59 | 67.9 | 64.0 | 62.0 | 59.4 | 57.9 |
| 801 | 2018/05/09 | 13:52:04 | 58.1 | 57.7 | 57.2 | 58.7 | 57.4 |
| 806 | 2018/05/09 | 13:52:09 | 57.8 | 57.4 | 59.0 | 58.8 | 59.4 |
| 811 | 2018/05/09 | 13:52:14 | 61.1 | 57.4 | 55.9 | 55.6 | 54.9 |
| 816 | 2018/05/09 | 13:52:19 | 55.2 | 56.1 | 57.2 | 60.9 | 62.7 |
| 821 | 2018/05/09 | 13:52:24 | 65.3 | 62.7 | 59.3 | 57.7 | 56.3 |
| 826 | 2018/05/09 | 13:52:29 | 55.8 | 57.6 | 56.5 | 58.0 | 59.0 |
| 831 | 2018/05/09 | 13:52:34 | 62.5 | 60.7 | 61.6 | 62.0 | 63.1 |
| 836 | 2018/05/09 | 13:52:39 | 63.8 | 60.5 | 63.3 | 62.4 | 63.7 |
| 841 | 2018/05/09 | 13:52:44 | 62.1 | 61.3 | 59.0 | 59.8 | 58.3 |
| 846 | 2018/05/09 | 13:52:49 | 60.4 | 58.8 | 58.9 | 58.9 | 58.5 |
| 851 | 2018/05/09 | 13:52:54 | 58.4 | 58.9 | 58.8 | 58.4 | 58.4 |
| 856 | 2018/05/09 | 13:52:59 | 57.2 | 57.0 | 58.0 | 59.7 | 61.2 |
| 861 | 2018/05/09 | 13:53:04 | 61.4 | 59.9 | 58.6 | 58.6 | 58.9 |
| 866 | 2018/05/09 | 13:53:09 | 58.3 | 56.7 | 56.5 | 56.4 | 55.8 |
| 871 | 2018/05/09 | 13:53:14 | 55.1 | 55.4 | 55.6 | 55.6 | 57.3 |
| 876 | 2018/05/09 | 13:53:19 | 55.3 | 55.9 | 55.7 | 56.7 | 55.4 |
| 881 | 2018/05/09 | 13:53:24 | 56.0 | 56.6 | 56.4 | 56.8 | 56.4 |
| 886 | 2018/05/09 | 13:53:29 | 55.4 | 56.3 | 58.6 | 58.9 | 58.3 |
| 891 | 2018/05/09 | 13:53:34 | 58.1 | 58.0 | 59.2 | 65.5 | 59.9 |
| 896 | 2018/05/09 | 13:53:39 | 69.6 | 58.7 | 58.4 | 60.0 | 58.1 |

- Freq Weight : A
- Time Weight : FAST
- Level Range : 40-100
- Max dB : 80.2 - 2018/05/09 14:21:28
- Level Range : 40-100
- SEL : 95.2
- Leq : 65.7
-

Noise Measurement 2

| No.s | Date Time | (dB) | | | | |
|---|---|---|---|---|---|---|
| 1 | 2018/05/09 14:15:08 | 49.7 | 50.9 | 53.3 | 55.9 | 57.1 |
| 6 | 2018/05/09 14:15:13 | 58.0 | 58.2 | 57.6 | 56.6 | 53.9 |
| 11 | 2018/05/09 14:15:18 | 51.8 | 52.0 | 51.0 | 51.9 | 51.4 |
| 16 | 2018/05/09 14:15:23 | 51.7 | 52.0 | 54.6 | 51.2 | 51.0 |
| 21 | 2018/05/09 14:15:28 | 50.6 | 51.0 | 51.6 | 52.1 | 53.0 |
| 26 | 2018/05/09 14:15:33 | 54.2 | 57.0 | 63.0 | 68.1 | 70.0 |
| 31 | 2018/05/09 14:15:38 | 69.5 | 66.7 | 66.9 | 57.8 | 55.2 |
| 36 | 2018/05/09 14:15:43 | 54.8 | 56.0 | 60.1 | 60.8 | 64.4 |
| 41 | 2018/05/09 14:15:48 | 72.1 | 71.9 | 64.5 | 62.4 | 66.9 |
| 46 | 2018/05/09 14:15:53 | 69.1 | 70.6 | 69.0 | 62.6 | 63.5 |
| 51 | 2018/05/09 14:15:58 | 65.5 | 68.8 | 65.6 | 59.1 | 57.9 |
| 56 | 2018/05/09 14:16:03 | 58.7 | 61.3 | 65.1 | 67.2 | 66.6 |
| 61 | 2018/05/09 14:16:08 | 61.7 | 60.4 | 59.8 | 63.8 | 68.9 |
| 66 | 2018/05/09 14:16:13 | 71.1 | 70.6 | 69.5 | 68.5 | 67.2 |
| 71 | 2018/05/09 14:16:18 | 69.7 | 68.5 | 66.3 | 59.9 | 58.1 |
| 76 | 2018/05/09 14:16:23 | 58.8 | 58.2 | 61.2 | 63.1 | 67.6 |
| 81 | 2018/05/09 14:16:28 | 67.7 | 62.1 | 56.9 | 57.4 | 62.9 |
| 86 | 2018/05/09 14:16:33 | 63.6 | 66.7 | 65.9 | 65.8 | 64.9 |
| 91 | 2018/05/09 14:16:38 | 61.6 | 61.1 | 59.9 | 58.2 | 58.7 |
| 96 | 2018/05/09 14:16:43 | 60.8 | 64.9 | 67.0 | 67.9 | 67.8 |
| 101 | 2018/05/09 14:16:48 | 59.6 | 59.9 | 60.8 | 60.6 | 59.3 |
| 106 | 2018/05/09 14:16:53 | 57.8 | 59.0 | 61.6 | 63.5 | 70.6 |
| 111 | 2018/05/09 14:16:58 | 68.9 | 61.9 | 59.2 | 62.2 | 64.7 |
| 116 | 2018/05/09 14:17:03 | 71.4 | 77.2 | 72.8 | 73.2 | 67.2 |
| 121 | 2018/05/09 14:17:08 | 63.1 | 64.9 | 67.9 | 69.6 | 65.1 |
| 126 | 2018/05/09 14:17:13 | 58.8 | 58.6 | 58.7 | 61.3 | 62.0 |
| 131 | 2018/05/09 14:17:18 | 62.3 | 65.8 | 70.6 | 65.7 | 57.9 |
| 136 | 2018/05/09 14:17:23 | 56.8 | 58.4 | 63.2 | 69.2 | 75.3 |
| 141 | 2018/05/09 14:17:28 | 69.5 | 59.2 | 57.0 | 57.1 | 56.7 |
| 146 | 2018/05/09 14:17:33 | 59.4 | 59.9 | 60.8 | 60.4 | 59.0 |
| 151 | 2018/05/09 14:17:38 | 56.4 | 56.6 | 56.6 | 58.6 | 60.2 |
| 156 | 2018/05/09 14:17:43 | 59.7 | 62.5 | 64.6 | 67.8 | 66.6 |
| 161 | 2018/05/09 14:17:48 | 57.7 | 56.3 | 56.7 | 59.1 | 62.5 |
| 166 | 2018/05/09 14:17:53 | 64.5 | 66.7 | 65.8 | 58.0 | 57.5 |
| 171 | 2018/05/09 14:17:58 | 59.9 | 64.1 | 65.0 | 68.1 | 64.7 |
| 176 | 2018/05/09 14:18:03 | 62.6 | 65.3 | 69.3 | 65.7 | 61.4 |
| 181 | 2018/05/09 14:18:08 | 63.8 | 66.4 | 69.8 | 69.8 | 69.1 |
| 186 | 2018/05/09 14:18:13 | 68.6 | 73.9 | 77.6 | 70.0 | 61.2 |
| 191 | 2018/05/09 14:18:18 | 59.9 | 60.7 | 62.9 | 65.9 | 68.1 |
| 196 | 2018/05/09 14:18:23 | 70.6 | 73.1 | 71.3 | 71.8 | 70.7 |
| 201 | 2018/05/09 14:18:28 | 68.1 | 65.2 | 62.0 | 64.0 | 65.0 |
| 206 | 2018/05/09 14:18:33 | 67.7 | 66.9 | 62.4 | 60.1 | 63.5 |
| 211 | 2018/05/09 14:18:38 | 70.5 | 72.4 | 65.4 | 57.9 | 60.4 |
| 216 | 2018/05/09 14:18:43 | 64.8 | 67.2 | 72.4 | 71.4 | 73.7 |
| 221 | 2018/05/09 14:18:48 | 76.1 | 68.0 | 60.7 | 61.5 | 64.2 |
| 226 | 2018/05/09 14:18:53 | 68.9 | 72.7 | 64.2 | 59.6 | 61.2 |
| 231 | 2018/05/09 14:18:58 | 62.0 | 62.3 | 61.0 | 62.1 | 65.6 |
| 236 | 2018/05/09 14:19:03 | 69.7 | 66.2 | 62.0 | 63.7 | 67.4 |
| 241 | 2018/05/09 14:19:08 | 69.1 | 65.8 | 56.5 | 54.5 | 53.4 |
| 246 | 2018/05/09 14:19:13 | 52.9 | 50.8 | 49.6 | 50.5 | 52.5 |
| 251 | 2018/05/09 14:19:18 | 52.9 | 52.5 | 51.8 | 52.7 | 55.1 |
| 256 | 2018/05/09 14:19:23 | 56.3 | 58.6 | 60.5 | 68.7 | 72.6 |
| 261 | 2018/05/09 14:19:28 | 64.1 | 59.5 | 59.8 | 60.6 | 61.9 |
| 266 | 2018/05/09 14:19:33 | 61.6 | 64.0 | 63.4 | 62.7 | 58.3 |
| 271 | 2018/05/09 14:19:38 | 59.5 | 62.4 | 67.6 | 68.1 | 72.6 |
| 276 | 2018/05/09 14:19:43 | 72.1 | 75.3 | 70.8 | 63.1 | 60.4 |
| 281 | 2018/05/09 14:19:48 | 59.2 | 58.5 | 56.3 | 56.4 | 57.1 |
| 286 | 2018/05/09 14:19:53 | 54.5 | 55.1 | 55.3 | 58.4 | 64.4 |
| 291 | 2018/05/09 14:19:58 | 69.6 | 70.3 | 60.4 | 57.6 | 58.6 |
| 296 | 2018/05/09 14:20:03 | 56.5 | 57.3 | 59.5 | 61.6 | 66.6 |
| 301 | 2018/05/09 14:20:08 | 68.6 | 59.5 | 55.3 | 53.7 | 53.5 |
| 306 | 2018/05/09 14:20:13 | 54.7 | 55.8 | 59.1 | 61.1 | 61.7 |
| 311 | 2018/05/09 14:20:18 | 62.4 | 66.3 | 68.8 | 72.3 | 69.4 |
| 316 | 2018/05/09 14:20:23 | 60.8 | 58.3 | 56.6 | 55.1 | 55.3 |
| 321 | 2018/05/09 14:20:28 | 55.8 | 56.3 | 57.0 | 55.2 | 55.5 |
| 326 | 2018/05/09 14:20:33 | 52.8 | 51.7 | 50.9 | 50.2 | 49.8 |
| 331 | 2018/05/09 14:20:38 | 51.4 | 51.7 | 55.5 | 56.5 | 58.1 |
| 336 | 2018/05/09 14:20:43 | 55.5 | 55.4 | 52.8 | 50.1 | 50.3 |
| 341 | 2018/05/09 14:20:48 | 50.8 | 49.0 | 49.0 | 49.8 | 51.0 |
| 346 | 2018/05/09 14:20:53 | 50.7 | 52.7 | 56.4 | 61.0 | 64.3 |
| 351 | 2018/05/09 14:20:58 | 73.1 | 71.2 | 60.5 | 56.1 | 51.6 |
| 356 | 2018/05/09 14:21:03 | 51.4 | 54.1 | 58.5 | 61.8 | 63.7 |
| 361 | 2018/05/09 14:21:08 | 68.5 | 67.2 | 58.5 | 55.9 | 55.0 |
| 366 | 2018/05/09 14:21:13 | 55.6 | 56.5 | 60.3 | 62.6 | 65.2 |
| 371 | 2018/05/09 14:21:18 | 70.1 | 71.0 | 67.0 | 60.4 | 60.0 |
| 376 | 2018/05/09 14:21:23 | 59.2 | 60.5 | 64.8 | 68.7 | 70.8 |
| 381 | 2018/05/09 14:21:28 | 69.2 | 60.8 | 60.3 | 61.7 | 63.5 |
| 386 | 2018/05/09 14:21:33 | 65.4 | 68.9 | 72.1 | 67.0 | 60.7 |
| 391 | 2018/05/09 14:21:38 | 59.0 | 60.2 | 61.1 | 62.5 | 65.8 |
| 396 | 2018/05/09 14:21:43 | 70.8 | 69.8 | 65.9 | 71.9 | 71.9 |
| 401 | 2018/05/09 14:21:48 | 67.2 | 71.1 | 70.8 | 62.4 | 60.3 |
| 406 | 2018/05/09 14:21:53 | 61.9 | 61.0 | 61.1 | 61.0 | 64.6 |
| 411 | 2018/05/09 14:21:58 | 66.0 | 67.3 | 67.4 | 63.9 | 63.9 |
| 416 | 2018/05/09 14:22:03 | 67.0 | 68.6 | 65.5 | 59.6 | 59.3 |
| 421 | 2018/05/09 14:22:08 | 59.1 | 61.6 | 61.5 | 60.5 | 61.4 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 426 | 2018/05/09 | 14:22:13 | 61.1 | 58.9 | 61.1 | 56.9 | 55.5 |
| 431 | 2018/05/09 | 14:22:18 | 57.1 | 58.2 | 59.9 | 61.1 | 63.4 |
| 436 | 2018/05/09 | 14:22:23 | 60.7 | 60.6 | 59.3 | 59.0 | 59.8 |
| 441 | 2018/05/09 | 14:22:28 | 59.1 | 60.3 | 60.2 | 59.4 | 59.3 |
| 446 | 2018/05/09 | 14:22:33 | 67.2 | 71.2 | 76.0 | 76.0 | 73.7 |
| 451 | 2018/05/09 | 14:22:38 | 67.5 | 70.2 | 70.5 | 65.3 | 62.9 |
| 456 | 2018/05/09 | 14:22:43 | 61.3 | 61.1 | 63.8 | 67.6 | 68.2 |
| 461 | 2018/05/09 | 14:22:48 | 65.5 | 63.5 | 62.2 | 60.8 | 59.3 |
| 466 | 2018/05/09 | 14:22:53 | 56.6 | 58.6 | 59.6 | 63.5 | 63.5 |
| 471 | 2018/05/09 | 14:22:58 | 66.2 | 75.2 | 75.2 | 68.4 | 71.5 |
| 476 | 2018/05/09 | 14:23:03 | 70.1 | 61.9 | 57.6 | 56.5 | 56.7 |
| 481 | 2018/05/09 | 14:23:08 | 55.6 | 55.1 | 54.9 | 55.8 | 54.8 |
| 486 | 2018/05/09 | 14:23:13 | 54.1 | 53.9 | 54.9 | 52.4 | 52.0 |
| 491 | 2018/05/09 | 14:23:18 | 52.8 | 53.2 | 53.1 | 52.3 | 51.6 |
| 496 | 2018/05/09 | 14:23:23 | 51.1 | 52.5 | 53.8 | 54.0 | 56.0 |
| 501 | 2018/05/09 | 14:23:28 | 58.0 | 62.2 | 64.1 | 67.3 | 67.7 |
| 506 | 2018/05/09 | 14:23:33 | 70.3 | 69.7 | 67.7 | 67.9 | 68.7 |
| 511 | 2018/05/09 | 14:23:38 | 63.3 | 60.5 | 59.5 | 58.1 | 56.7 |
| 516 | 2018/05/09 | 14:23:43 | 57.3 | 57.8 | 59.4 | 60.9 | 62.8 |
| 521 | 2018/05/09 | 14:23:48 | 65.9 | 69.0 | 68.6 | 67.5 | 61.9 |
| 526 | 2018/05/09 | 14:23:53 | 62.2 | 67.8 | 70.7 | 74.9 | 63.6 |
| 531 | 2018/05/09 | 14:23:58 | 60.5 | 64.1 | 68.2 | 67.8 | 62.8 |
| 536 | 2018/05/09 | 14:24:03 | 56.9 | 56.0 | 57.1 | 57.6 | 60.9 |
| 541 | 2018/05/09 | 14:24:08 | 64.1 | 71.0 | 69.0 | 60.1 | 61.0 |
| 546 | 2018/05/09 | 14:24:13 | 65.9 | 69.2 | 69.6 | 69.2 | 66.9 |
| 551 | 2018/05/09 | 14:24:18 | 62.2 | 59.1 | 58.8 | 57.9 | 57.6 |
| 556 | 2018/05/09 | 14:24:23 | 59.2 | 62.3 | 68.8 | 74.1 | 73.5 |
| 561 | 2018/05/09 | 14:24:28 | 72.0 | 62.4 | 59.0 | 58.4 | 58.4 |
| 566 | 2018/05/09 | 14:24:33 | 59.8 | 65.3 | 68.6 | 71.8 | 70.8 |
| 571 | 2018/05/09 | 14:24:38 | 61.3 | 59.6 | 58.3 | 58.3 | 56.3 |
| 576 | 2018/05/09 | 14:24:43 | 56.4 | 55.2 | 52.9 | 53.0 | 53.2 |
| 581 | 2018/05/09 | 14:24:48 | 52.4 | 51.8 | 53.2 | 55.7 | 57.4 |
| 586 | 2018/05/09 | 14:24:53 | 58.3 | 57.9 | 57.4 | 56.0 | 54.8 |
| 591 | 2018/05/09 | 14:24:58 | 56.6 | 57.8 | 59.0 | 63.6 | 67.6 |
| 596 | 2018/05/09 | 14:25:03 | 72.6 | 74.0 | 64.8 | 64.9 | 69.3 |
| 601 | 2018/05/09 | 14:25:08 | 68.1 | 65.8 | 69.0 | 69.3 | 69.8 |
| 606 | 2018/05/09 | 14:25:13 | 74.3 | 64.7 | 58.6 | 58.1 | 56.5 |
| 611 | 2018/05/09 | 14:25:18 | 55.8 | 55.2 | 53.0 | 52.9 | 52.9 |
| 616 | 2018/05/09 | 14:25:23 | 52.3 | 53.2 | 52.8 | 54.8 | 55.1 |
| 621 | 2018/05/09 | 14:25:28 | 53.4 | 55.0 | 56.0 | 56.9 | 57.9 |
| 626 | 2018/05/09 | 14:25:33 | 60.6 | 61.7 | 62.4 | 63.0 | 65.7 |
| 631 | 2018/05/09 | 14:25:38 | 68.5 | 70.8 | 67.5 | 62.5 | 65.5 |
| 636 | 2018/05/09 | 14:25:43 | 66.8 | 66.6 | 66.3 | 68.9 | 66.3 |
| 641 | 2018/05/09 | 14:25:48 | 61.7 | 59.3 | 59.4 | 61.5 | 59.6 |
| 646 | 2018/05/09 | 14:25:53 | 58.5 | 59.6 | 60.8 | 64.3 | 66.0 |
| 651 | 2018/05/09 | 14:25:58 | 68.4 | 64.6 | 59.6 | 64.4 | 60.6 |
| 656 | 2018/05/09 | 14:26:03 | 67.0 | 60.3 | 58.8 | 58.8 | 60.6 |
| 661 | 2018/05/09 | 14:26:08 | 58.8 | 57.9 | 62.2 | 61.9 | 60.3 |
| 666 | 2018/05/09 | 14:26:13 | 61.6 | 64.7 | 67.6 | 69.2 | 69.7 |
| 671 | 2018/05/09 | 14:26:18 | 69.7 | 71.0 | 65.2 | 60.7 | 62.1 |
| 676 | 2018/05/09 | 14:26:23 | 59.4 | 56.8 | 57.3 | 60.6 | 60.4 |
| 681 | 2018/05/09 | 14:26:28 | 60.3 | 61.8 | 63.7 | 65.1 | 67.8 |
| 686 | 2018/05/09 | 14:26:33 | 75.2 | 74.5 | 62.8 | 60.0 | 61.0 |
| 691 | 2018/05/09 | 14:26:38 | 61.3 | 61.3 | 61.1 | 61.2 | 59.4 |
| 696 | 2018/05/09 | 14:26:43 | 60.0 | 60.1 | 64.1 | 65.1 | 65.7 |
| 701 | 2018/05/09 | 14:26:48 | 63.5 | 68.8 | 75.5 | 67.9 | 66.6 |
| 706 | 2018/05/09 | 14:26:53 | 71.0 | 68.8 | 68.7 | 71.7 | 61.6 |
| 711 | 2018/05/09 | 14:26:58 | 57.8 | 55.8 | 56.8 | 56.9 | 57.3 |
| 716 | 2018/05/09 | 14:27:03 | 61.8 | 63.7 | 70.4 | 70.0 | 59.7 |
| 721 | 2018/05/09 | 14:27:08 | 55.7 | 53.7 | 53.8 | 54.1 | 55.9 |
| 726 | 2018/05/09 | 14:27:13 | 60.8 | 61.0 | 66.0 | 66.3 | 65.0 |
| 731 | 2018/05/09 | 14:27:18 | 59.8 | 60.1 | 64.7 | 68.4 | 76.2 |
| 736 | 2018/05/09 | 14:27:23 | 74.8 | 63.9 | 63.3 | 64.6 | 70.0 |
| 741 | 2018/05/09 | 14:27:28 | 72.7 | 63.8 | 58.7 | 56.8 | 55.9 |
| 746 | 2018/05/09 | 14:27:33 | 56.7 | 57.1 | 55.9 | 55.0 | 56.0 |
| 751 | 2018/05/09 | 14:27:38 | 56.4 | 52.4 | 52.1 | 52.1 | 52.4 |
| 756 | 2018/05/09 | 14:27:43 | 52.4 | 50.9 | 50.9 | 49.8 | 50.9 |
| 761 | 2018/05/09 | 14:27:48 | 50.0 | 51.0 | 51.9 | 53.4 | 55.9 |
| 766 | 2018/05/09 | 14:27:53 | 58.0 | 58.4 | 56.9 | 57.5 | 56.2 |
| 771 | 2018/05/09 | 14:27:58 | 57.8 | 59.3 | 61.6 | 64.2 | 65.8 |
| 776 | 2018/05/09 | 14:28:03 | 66.6 | 65.9 | 62.4 | 63.7 | 65.6 |
| 781 | 2018/05/09 | 14:28:08 | 64.5 | 61.0 | 58.4 | 57.7 | 57.9 |
| 786 | 2018/05/09 | 14:28:13 | 59.7 | 60.6 | 63.0 | 66.5 | 70.7 |
| 791 | 2018/05/09 | 14:28:18 | 73.6 | 73.3 | 67.8 | 66.5 | 66.7 |
| 796 | 2018/05/09 | 14:28:23 | 69.8 | 67.4 | 61.2 | 60.8 | 61.1 |
| 801 | 2018/05/09 | 14:28:28 | 60.0 | 60.0 | 59.1 | 56.4 | 55.5 |
| 806 | 2018/05/09 | 14:28:33 | 53.9 | 53.5 | 51.4 | 50.9 | 51.9 |
| 811 | 2018/05/09 | 14:28:38 | 52.9 | 52.0 | 51.8 | 51.4 | 52.8 |
| 816 | 2018/05/09 | 14:28:43 | 54.0 | 56.1 | 58.6 | 62.3 | 69.1 |
| 821 | 2018/05/09 | 14:28:48 | 72.3 | 71.0 | 63.1 | 57.3 | 56.7 |
| 826 | 2018/05/09 | 14:28:53 | 56.3 | 56.3 | 55.6 | 56.2 | 54.7 |
| 831 | 2018/05/09 | 14:28:58 | 54.2 | 54.2 | 54.9 | 57.2 | 57.9 |
| 836 | 2018/05/09 | 14:29:03 | 59.0 | 59.4 | 59.9 | 60.4 | 60.5 |
| 841 | 2018/05/09 | 14:29:08 | 60.3 | 60.5 | 59.9 | 61.9 | 65.9 |
| 846 | 2018/05/09 | 14:29:13 | 70.7 | 70.2 | 66.4 | 61.0 | 59.5 |
| 851 | 2018/05/09 | 14:29:18 | 56.4 | 53.7 | 51.6 | 51.3 | 51.7 |
| 856 | 2018/05/09 | 14:29:23 | 50.9 | 52.7 | 54.2 | 55.7 | 57.3 |
| 861 | 2018/05/09 | 14:29:28 | 58.7 | 59.8 | 58.5 | 57.5 | 57.7 |
| 866 | 2018/05/09 | 14:29:33 | 59.3 | 60.4 | 60.7 | 59.6 | 60.4 |
| 871 | 2018/05/09 | 14:29:38 | 58.4 | 57.8 | 59.5 | 64.8 | 67.4 |
| 876 | 2018/05/09 | 14:29:43 | 69.4 | 66.7 | 65.7 | 71.1 | 68.4 |
| 881 | 2018/05/09 | 14:29:48 | 60.4 | 57.7 | 60.7 | 61.9 | 59.6 |
| 886 | 2018/05/09 | 14:29:53 | 61.6 | 65.8 | 68.2 | 67.1 | 62.3 |
| 891 | 2018/05/09 | 14:29:58 | 62.4 | 71.5 | 69.4 | 58.5 | 56.5 |
| 896 | 2018/05/09 | 14:30:03 | 55.6 | 55.6 | 55.0 | 54.9 | 55.3 |

Noise Measurement 3

- Freq Weight : A
- Time Weight : FAST
- Level Range : 40-100
- Max dB : 87.7 - 2018/05/09 14:55:34
- Level Range : 40-100
- SEL : 99.5
- Leq : 70.0
-

| No.s | Date Time | (dB) | | | | |
|---|---|---|---|---|---|---|
| 1 | 2018/05/09 14:45:42 | 61.8 | 61.7 | 61.8 | 61.7 | 65.2 |
| 6 | 2018/05/09 14:45:47 | 64.9 | 71.1 | 78.6 | 72.4 | 65.6 |
| 11 | 2018/05/09 14:45:52 | 63.8 | 61.6 | 61.3 | 60.7 | 60.4 |
| 16 | 2018/05/09 14:45:57 | 60.0 | 62.0 | 62.5 | 65.5 | 71.2 |
| 21 | 2018/05/09 14:46:02 | 75.9 | 66.5 | 61.7 | 63.3 | 62.5 |
| 26 | 2018/05/09 14:46:07 | 68.0 | 71.3 | 70.8 | 71.3 | 71.3 |
| 31 | 2018/05/09 14:46:12 | 71.8 | 76.2 | 79.7 | 72.1 | 66.6 |
| 36 | 2018/05/09 14:46:17 | 65.1 | 62.3 | 63.7 | 62.0 | 63.0 |
| 41 | 2018/05/09 14:46:22 | 63.4 | 63.7 | 62.9 | 64.2 | 62.6 |
| 46 | 2018/05/09 14:46:27 | 62.7 | 62.1 | 62.5 | 62.4 | 62.1 |
| 51 | 2018/05/09 14:46:32 | 63.6 | 62.7 | 61.3 | 61.9 | 64.5 |
| 56 | 2018/05/09 14:46:37 | 62.8 | 61.0 | 61.3 | 60.4 | 60.6 |
| 61 | 2018/05/09 14:46:42 | 61.6 | 63.1 | 65.6 | 69.6 | 71.0 |
| 66 | 2018/05/09 14:46:47 | 68.2 | 64.3 | 64.1 | 61.9 | 61.3 |
| 71 | 2018/05/09 14:46:52 | 61.2 | 59.9 | 58.0 | 59.6 | 58.8 |
| 76 | 2018/05/09 14:46:57 | 58.3 | 57.8 | 57.6 | 57.0 | 57.3 |
| 81 | 2018/05/09 14:47:02 | 58.0 | 61.7 | 66.2 | 71.5 | 80.0 |
| 86 | 2018/05/09 14:47:07 | 81.0 | 67.9 | 61.1 | 59.2 | 58.5 |
| 91 | 2018/05/09 14:47:12 | 57.7 | 59.4 | 59.8 | 58.8 | 58.7 |
| 96 | 2018/05/09 14:47:17 | 60.1 | 59.8 | 59.0 | 59.8 | 60.1 |
| 101 | 2018/05/09 14:47:22 | 59.4 | 58.9 | 61.5 | 59.6 | 60.9 |
| 106 | 2018/05/09 14:47:27 | 64.5 | 61.2 | 60.8 | 64.0 | 63.4 |
| 111 | 2018/05/09 14:47:32 | 63.1 | 61.4 | 61.3 | 61.2 | 62.7 |
| 116 | 2018/05/09 14:47:37 | 62.0 | 63.0 | 63.0 | 64.4 | 64.9 |
| 121 | 2018/05/09 14:47:42 | 69.9 | 75.3 | 72.8 | 69.9 | 66.1 |
| 126 | 2018/05/09 14:47:47 | 64.6 | 64.6 | 66.3 | 67.6 | 77.5 |
| 131 | 2018/05/09 14:47:52 | 78.1 | 68.7 | 63.0 | 61.4 | 60.3 |
| 136 | 2018/05/09 14:47:57 | 59.9 | 59.1 | 61.0 | 67.3 | 70.5 |
| 141 | 2018/05/09 14:48:02 | 79.5 | 76.9 | 64.1 | 61.8 | 62.4 |
| 146 | 2018/05/09 14:48:07 | 69.4 | 73.7 | 72.1 | 69.1 | 67.8 |
| 151 | 2018/05/09 14:48:12 | 68.3 | 70.1 | 74.9 | 78.6 | 69.6 |
| 156 | 2018/05/09 14:48:17 | 65.2 | 60.9 | 63.0 | 60.6 | 59.8 |
| 161 | 2018/05/09 14:48:22 | 60.4 | 60.3 | 66.0 | 70.9 | 70.6 |
| 166 | 2018/05/09 14:48:27 | 68.5 | 64.6 | 63.0 | 64.8 | 60.1 |
| 171 | 2018/05/09 14:48:32 | 59.5 | 61.2 | 61.7 | 64.8 | 66.2 |
| 176 | 2018/05/09 14:48:37 | 69.6 | 77.6 | 73.2 | 63.2 | 59.9 |
| 181 | 2018/05/09 14:48:42 | 60.5 | 61.8 | 64.7 | 67.9 | 74.8 |
| 186 | 2018/05/09 14:48:47 | 73.5 | 65.7 | 62.9 | 62.1 | 61.3 |
| 191 | 2018/05/09 14:48:52 | 62.4 | 63.0 | 66.6 | 73.3 | 78.4 |
| 196 | 2018/05/09 14:48:57 | 69.9 | 65.0 | 62.3 | 62.9 | 65.2 |
| 201 | 2018/05/09 14:49:02 | 68.1 | 68.2 | 66.1 | 64.5 | 65.5 |
| 206 | 2018/05/09 14:49:07 | 72.8 | 81.2 | 72.2 | 66.3 | 62.3 |
| 211 | 2018/05/09 14:49:12 | 60.6 | 61.9 | 60.5 | 59.6 | 59.6 |
| 216 | 2018/05/09 14:49:17 | 64.3 | 59.0 | 59.8 | 61.8 | 65.1 |
| 221 | 2018/05/09 14:49:22 | 67.5 | 66.8 | 64.2 | 61.9 | 62.6 |
| 226 | 2018/05/09 14:49:27 | 63.0 | 64.0 | 71.1 | 75.2 | 66.5 |
| 231 | 2018/05/09 14:49:32 | 66.3 | 70.7 | 69.5 | 65.7 | 64.4 |
| 236 | 2018/05/09 14:49:37 | 63.0 | 61.7 | 61.4 | 61.1 | 60.9 |
| 241 | 2018/05/09 14:49:42 | 60.1 | 60.1 | 60.5 | 61.0 | 59.8 |
| 246 | 2018/05/09 14:49:47 | 60.7 | 59.2 | 60.2 | 61.8 | 67.8 |
| 251 | 2018/05/09 14:49:52 | 72.0 | 82.0 | 72.4 | 63.8 | 61.5 |
| 256 | 2018/05/09 14:49:57 | 63.9 | 68.7 | 72.5 | 73.1 | 71.5 |
| 261 | 2018/05/09 14:50:02 | 76.3 | 79.6 | 71.0 | 67.7 | 70.2 |
| 266 | 2018/05/09 14:50:07 | 79.2 | 79.0 | 69.4 | 64.2 | 64.4 |
| 271 | 2018/05/09 14:50:12 | 68.3 | 76.1 | 74.5 | 65.4 | 62.5 |
| 276 | 2018/05/09 14:50:17 | 60.8 | 61.8 | 68.5 | 79.2 | 70.8 |
| 281 | 2018/05/09 14:50:22 | 62.5 | 59.7 | 62.8 | 60.5 | 62.1 |
| 286 | 2018/05/09 14:50:27 | 60.9 | 60.8 | 60.2 | 61.6 | 61.7 |
| 291 | 2018/05/09 14:50:32 | 61.6 | 60.0 | 62.3 | 64.5 | 62.6 |
| 296 | 2018/05/09 14:50:37 | 61.7 | 61.8 | 61.1 | 63.2 | 64.6 |
| 301 | 2018/05/09 14:50:42 | 69.7 | 80.3 | 74.6 | 77.6 | 69.4 |
| 306 | 2018/05/09 14:50:47 | 62.2 | 61.0 | 61.2 | 64.3 | 65.2 |
| 311 | 2018/05/09 14:50:52 | 68.6 | 68.2 | 68.2 | 74.8 | 83.1 |
| 316 | 2018/05/09 14:50:57 | 74.7 | 63.4 | 59.5 | 57.4 | 55.2 |
| 321 | 2018/05/09 14:51:02 | 55.8 | 56.5 | 55.9 | 56.6 | 58.8 |
| 326 | 2018/05/09 14:51:07 | 60.5 | 59.5 | 62.2 | 58.9 | 58.9 |
| 331 | 2018/05/09 14:51:12 | 60.5 | 60.8 | 60.1 | 61.3 | 63.0 |
| 336 | 2018/05/09 14:51:17 | 61.9 | 64.4 | 61.1 | 64.4 | 67.8 |
| 341 | 2018/05/09 14:51:22 | 69.0 | 67.0 | 66.4 | 63.8 | 62.8 |
| 346 | 2018/05/09 14:51:27 | 64.1 | 63.3 | 62.0 | 62.3 | 60.4 |
| 351 | 2018/05/09 14:51:32 | 60.3 | 60.5 | 60.7 | 61.4 | 60.1 |
| 356 | 2018/05/09 14:51:37 | 59.9 | 59.0 | 58.7 | 58.8 | 59.0 |
| 361 | 2018/05/09 14:51:42 | 59.5 | 59.2 | 58.6 | 59.3 | 58.5 |
| 366 | 2018/05/09 14:51:47 | 60.5 | 61.4 | 65.1 | 70.4 | 81.5 |
| 371 | 2018/05/09 14:51:52 | 79.2 | 67.3 | 62.9 | 61.5 | 61.0 |
| 376 | 2018/05/09 14:51:57 | 60.4 | 61.0 | 63.4 | 66.3 | 75.1 |
| 381 | 2018/05/09 14:52:02 | 78.4 | 67.6 | 61.8 | 59.3 | 59.7 |
| 386 | 2018/05/09 14:52:07 | 58.9 | 60.3 | 61.2 | 62.0 | 61.9 |
| 391 | 2018/05/09 14:52:12 | 61.4 | 60.8 | 61.0 | 64.5 | 64.0 |
| 396 | 2018/05/09 14:52:17 | 61.7 | 63.1 | 62.4 | 64.1 | 63.4 |
| 401 | 2018/05/09 14:52:22 | 63.8 | 65.8 | 70.5 | 78.2 | 78.0 |
| 406 | 2018/05/09 14:52:27 | 77.3 | 73.8 | 66.3 | 61.7 | 59.6 |
| 411 | 2018/05/09 14:52:32 | 60.5 | 59.1 | 60.5 | 60.5 | 61.0 |
| 416 | 2018/05/09 14:52:37 | 65.2 | 69.8 | 71.3 | 65.0 | 63.5 |
| 421 | 2018/05/09 14:52:42 | 69.6 | 63.7 | 60.9 | 59.8 | 58.8 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 426 | 2018/05/09 | 14:52:47 | 59.4 | 58.5 | 58.8 | 60.5 | 59.3 |
| 431 | 2018/05/09 | 14:52:52 | 60.4 | 60.8 | 59.0 | 59.2 | 59.5 |
| 436 | 2018/05/09 | 14:52:57 | 58.5 | 59.6 | 59.5 | 60.7 | 60.1 |
| 441 | 2018/05/09 | 14:53:02 | 58.6 | 60.3 | 61.5 | 61.0 | 59.9 |
| 446 | 2018/05/09 | 14:53:07 | 60.2 | 60.7 | 60.3 | 59.5 | 60.1 |
| 451 | 2018/05/09 | 14:53:12 | 59.8 | 58.6 | 57.9 | 58.8 | 59.5 |
| 456 | 2018/05/09 | 14:53:17 | 58.3 | 57.7 | 59.5 | 61.6 | 60.3 |
| 461 | 2018/05/09 | 14:53:22 | 59.5 | 61.0 | 60.6 | 62.5 | 62.3 |
| 466 | 2018/05/09 | 14:53:27 | 63.5 | 62.0 | 61.7 | 63.0 | 63.3 |
| 471 | 2018/05/09 | 14:53:32 | 64.2 | 62.1 | 62.8 | 62.1 | 63.1 |
| 476 | 2018/05/09 | 14:53:37 | 71.1 | 74.0 | 82.1 | 75.5 | 69.4 |
| 481 | 2018/05/09 | 14:53:42 | 65.4 | 65.7 | 61.6 | 62.8 | 60.8 |
| 486 | 2018/05/09 | 14:53:47 | 61.4 | 61.4 | 61.3 | 60.6 | 59.5 |
| 491 | 2018/05/09 | 14:53:52 | 60.0 | 61.2 | 60.3 | 60.3 | 62.3 |
| 496 | 2018/05/09 | 14:53:57 | 62.3 | 62.4 | 62.9 | 62.0 | 63.4 |
| 501 | 2018/05/09 | 14:54:02 | 64.8 | 69.6 | 73.9 | 73.6 | 75.6 |
| 506 | 2018/05/09 | 14:54:07 | 81.1 | 69.8 | 70.9 | 72.5 | 74.3 |
| 511 | 2018/05/09 | 14:54:12 | 73.3 | 71.5 | 71.0 | 69.2 | 69.8 |
| 516 | 2018/05/09 | 14:54:17 | 68.6 | 68.2 | 69.5 | 63.8 | 62.8 |
| 521 | 2018/05/09 | 14:54:22 | 62.1 | 61.7 | 60.7 | 60.7 | 61.0 |
| 526 | 2018/05/09 | 14:54:27 | 61.2 | 60.1 | 58.9 | 59.4 | 58.6 |
| 531 | 2018/05/09 | 14:54:32 | 57.5 | 58.5 | 57.3 | 58.4 | 58.1 |
| 536 | 2018/05/09 | 14:54:37 | 59.2 | 58.7 | 61.4 | 58.8 | 59.4 |
| 541 | 2018/05/09 | 14:54:42 | 59.3 | 60.3 | 61.4 | 63.7 | 69.7 |
| 546 | 2018/05/09 | 14:54:47 | 73.3 | 70.5 | 67.8 | 64.7 | 62.9 |
| 551 | 2018/05/09 | 14:54:52 | 62.2 | 64.6 | 63.0 | 64.9 | 66.4 |
| 556 | 2018/05/09 | 14:54:57 | 69.4 | 68.5 | 64.9 | 61.8 | 60.6 |
| 561 | 2018/05/09 | 14:55:02 | 61.9 | 61.7 | 60.7 | 59.2 | 62.5 |
| 566 | 2018/05/09 | 14:55:07 | 61.7 | 60.9 | 60.1 | 59.6 | 62.0 |
| 571 | 2018/05/09 | 14:55:12 | 59.2 | 59.0 | 59.1 | 60.7 | 66.8 |
| 576 | 2018/05/09 | 14:55:17 | 68.2 | 62.7 | 63.8 | 63.8 | 63.0 |
| 581 | 2018/05/09 | 14:55:22 | 63.2 | 62.9 | 64.2 | 64.3 | 66.8 |
| 586 | 2018/05/09 | 14:55:27 | 70.0 | 71.2 | 69.6 | 64.6 | 63.4 |
| 591 | 2018/05/09 | 14:55:32 | 61.3 | 82.3 | 68.8 | 69.3 | 71.9 |
| 596 | 2018/05/09 | 14:55:37 | 73.4 | 71.9 | 69.5 | 74.3 | 78.9 |
| 601 | 2018/05/09 | 14:55:42 | 67.9 | 64.0 | 63.8 | 63.6 | 63.3 |
| 606 | 2018/05/09 | 14:55:47 | 63.4 | 65.5 | 65.9 | 65.0 | 65.6 |
| 611 | 2018/05/09 | 14:55:52 | 63.5 | 63.3 | 63.9 | 64.5 | 68.9 |
| 616 | 2018/05/09 | 14:55:57 | 68.3 | 74.0 | 82.9 | 76.7 | 70.2 |
| 621 | 2018/05/09 | 14:56:02 | 70.0 | 65.6 | 67.4 | 70.2 | 68.0 |
| 626 | 2018/05/09 | 14:56:07 | 66.3 | 64.3 | 68.2 | 69.4 | 72.0 |
| 631 | 2018/05/09 | 14:56:12 | 71.7 | 74.5 | 79.0 | 67.3 | 65.6 |
| 636 | 2018/05/09 | 14:56:17 | 64.5 | 63.2 | 62.0 | 61.3 | 62.5 |
| 641 | 2018/05/09 | 14:56:22 | 62.6 | 61.8 | 62.8 | 66.5 | 68.3 |
| 646 | 2018/05/09 | 14:56:27 | 75.6 | 76.2 | 69.2 | 65.8 | 69.2 |
| 651 | 2018/05/09 | 14:56:32 | 78.9 | 77.0 | 76.7 | 78.3 | 70.3 |
| 656 | 2018/05/09 | 14:56:37 | 69.5 | 75.5 | 71.1 | 66.0 | 63.4 |
| 661 | 2018/05/09 | 14:56:42 | 61.6 | 60.9 | 60.8 | 59.7 | 59.4 |
| 666 | 2018/05/09 | 14:56:47 | 58.9 | 58.6 | 58.3 | 58.6 | 59.2 |
| 671 | 2018/05/09 | 14:56:52 | 58.6 | 59.6 | 60.0 | 60.0 | 59.2 |
| 676 | 2018/05/09 | 14:56:57 | 60.1 | 60.8 | 62.3 | 63.3 | 59.5 |
| 681 | 2018/05/09 | 14:57:02 | 61.3 | 62.1 | 60.2 | 61.9 | 62.4 |
| 686 | 2018/05/09 | 14:57:07 | 61.4 | 60.7 | 61.4 | 60.5 | 61.4 |
| 691 | 2018/05/09 | 14:57:12 | 63.0 | 62.7 | 64.9 | 62.5 | 60.3 |
| 696 | 2018/05/09 | 14:57:17 | 60.7 | 59.9 | 60.9 | 61.0 | 60.2 |
| 701 | 2018/05/09 | 14:57:22 | 60.3 | 61.2 | 60.3 | 60.1 | 61.6 |
| 706 | 2018/05/09 | 14:57:27 | 61.9 | 60.9 | 61.8 | 62.2 | 61.6 |
| 711 | 2018/05/09 | 14:57:32 | 59.4 | 60.0 | 60.8 | 60.6 | 60.9 |
| 716 | 2018/05/09 | 14:57:37 | 60.4 | 60.6 | 60.7 | 61.9 | 61.7 |
| 721 | 2018/05/09 | 14:57:42 | 61.8 | 62.7 | 62.7 | 62.8 | 63.0 |
| 726 | 2018/05/09 | 14:57:47 | 62.0 | 62.4 | 62.5 | 62.4 | 64.0 |
| 731 | 2018/05/09 | 14:57:52 | 68.3 | 77.3 | 74.8 | 66.1 | 63.2 |
| 736 | 2018/05/09 | 14:57:57 | 60.9 | 61.9 | 60.9 | 62.4 | 66.2 |
| 741 | 2018/05/09 | 14:58:02 | 69.7 | 78.2 | 82.3 | 71.2 | 62.5 |
| 746 | 2018/05/09 | 14:58:07 | 60.3 | 59.9 | 58.4 | 59.9 | 59.8 |
| 751 | 2018/05/09 | 14:58:12 | 60.2 | 59.8 | 60.7 | 61.1 | 62.3 |
| 756 | 2018/05/09 | 14:58:17 | 61.4 | 61.4 | 60.8 | 61.0 | 61.2 |
| 761 | 2018/05/09 | 14:58:22 | 59.3 | 59.7 | 59.3 | 60.2 | 61.0 |
| 766 | 2018/05/09 | 14:58:27 | 60.5 | 61.8 | 62.4 | 62.5 | 62.9 |
| 771 | 2018/05/09 | 14:58:32 | 61.9 | 63.3 | 67.0 | 71.1 | 71.9 |
| 776 | 2018/05/09 | 14:58:37 | 70.9 | 72.8 | 77.9 | 70.8 | 65.0 |
| 781 | 2018/05/09 | 14:58:42 | 68.0 | 72.0 | 74.1 | 70.0 | 65.9 |
| 786 | 2018/05/09 | 14:58:47 | 63.8 | 63.0 | 63.3 | 64.5 | 63.7 |
| 791 | 2018/05/09 | 14:58:52 | 61.5 | 61.9 | 62.1 | 63.1 | 64.3 |
| 796 | 2018/05/09 | 14:58:57 | 62.7 | 61.6 | 61.7 | 61.2 | 62.5 |
| 801 | 2018/05/09 | 14:59:02 | 66.1 | 72.4 | 81.2 | 72.6 | 67.3 |
| 806 | 2018/05/09 | 14:59:07 | 64.7 | 70.3 | 79.5 | 74.2 | 82.2 |
| 811 | 2018/05/09 | 14:59:12 | 81.7 | 71.3 | 68.0 | 77.9 | 83.0 |
| 816 | 2018/05/09 | 14:59:17 | 70.7 | 68.8 | 71.0 | 79.8 | 77.4 |
| 821 | 2018/05/09 | 14:59:22 | 69.9 | 65.2 | 63.8 | 62.8 | 65.9 |
| 826 | 2018/05/09 | 14:59:27 | 71.7 | 78.5 | 71.8 | 66.0 | 67.9 |
| 831 | 2018/05/09 | 14:59:32 | 74.4 | 79.1 | 69.3 | 66.3 | 67.4 |
| 836 | 2018/05/09 | 14:59:37 | 75.7 | 78.8 | 70.9 | 66.1 | 70.3 |
| 841 | 2018/05/09 | 14:59:42 | 79.1 | 75.9 | 69.2 | 75.4 | 77.9 |
| 846 | 2018/05/09 | 14:59:47 | 79.0 | 75.0 | 66.3 | 64.0 | 62.4 |
| 851 | 2018/05/09 | 14:59:52 | 63.9 | 64.0 | 65.2 | 65.2 | 65.2 |
| 856 | 2018/05/09 | 14:59:57 | 64.5 | 64.4 | 64.9 | 63.7 | 63.6 |
| 861 | 2018/05/09 | 15:00:02 | 62.9 | 63.4 | 64.4 | 65.6 | 68.5 |
| 866 | 2018/05/09 | 15:00:07 | 72.7 | 73.3 | 67.5 | 64.7 | 66.5 |
| 871 | 2018/05/09 | 15:00:12 | 67.5 | 69.1 | 70.5 | 73.5 | 77.8 |
| 876 | 2018/05/09 | 15:00:17 | 72.7 | 75.8 | 75.3 | 73.4 | 75.1 |
| 881 | 2018/05/09 | 15:00:22 | 83.1 | 76.6 | 68.2 | 66.1 | 64.7 |
| 886 | 2018/05/09 | 15:00:27 | 64.2 | 64.7 | 63.8 | 64.1 | 63.9 |
| 891 | 2018/05/09 | 15:00:32 | 62.2 | 61.9 | 62.3 | 61.4 | 62.9 |
| 896 | 2018/05/09 | 15:00:37 | 63.9 | 67.0 | 70.1 | 70.3 | 68.3 |

Noise Measurement 4

- Freq Weight : A
- Time Weight : FAST
- Level Range : 40-100
- Max dB : 79.8 - 2018/05/09 10:30:52
- Level Range : 40-100
- SEL : 94.2
- Leq : 64.7
-

| No.s | Date Time | (dB) | | | | |
|---|---|---|---|---|---|---|
| 1 | 2018/05/09 10:26:30 | 61.5 | 60.1 | 59.8 | 59.7 | 60.3 |
| 6 | 2018/05/09 10:26:35 | 63.9 | 66.9 | 71.6 | 68.4 | 64.7 |
| 11 | 2018/05/09 10:26:40 | 63.3 | 65.1 | 68.5 | 68.7 | 66.7 |
| 16 | 2018/05/09 10:26:45 | 62.5 | 59.7 | 58.1 | 57.0 | 56.7 |
| 21 | 2018/05/09 10:26:50 | 56.0 | 58.4 | 60.3 | 62.7 | 66.6 |
| 26 | 2018/05/09 10:26:55 | 68.7 | 68.9 | 69.7 | 67.9 | 66.2 |
| 31 | 2018/05/09 10:27:00 | 67.0 | 69.5 | 66.3 | 62.9 | 59.6 |
| 36 | 2018/05/09 10:27:05 | 60.8 | 61.1 | 63.1 | 62.8 | 61.3 |
| 41 | 2018/05/09 10:27:10 | 61.3 | 59.1 | 57.3 | 55.8 | 56.8 |
| 46 | 2018/05/09 10:27:15 | 56.6 | 56.2 | 57.1 | 57.1 | 58.9 |
| 51 | 2018/05/09 10:27:20 | 60.6 | 62.1 | 64.0 | 66.1 | 65.4 |
| 56 | 2018/05/09 10:27:25 | 67.2 | 66.6 | 66.4 | 70.0 | 70.4 |
| 61 | 2018/05/09 10:27:30 | 71.0 | 73.1 | 69.2 | 67.4 | 61.8 |
| 66 | 2018/05/09 10:27:35 | 59.4 | 58.0 | 56.3 | 57.9 | 58.7 |
| 71 | 2018/05/09 10:27:40 | 62.5 | 67.4 | 67.8 | 67.0 | 67.5 |
| 76 | 2018/05/09 10:27:45 | 65.0 | 60.8 | 60.8 | 62.8 | 65.5 |
| 81 | 2018/05/09 10:27:50 | 64.9 | 62.8 | 60.1 | 58.2 | 58.0 |
| 86 | 2018/05/09 10:27:55 | 59.7 | 67.0 | 66.1 | 64.8 | 57.8 |
| 91 | 2018/05/09 10:28:00 | 56.3 | 55.9 | 55.0 | 55.2 | 56.5 |
| 96 | 2018/05/09 10:28:05 | 57.2 | 58.4 | 57.4 | 60.0 | 61.1 |
| 101 | 2018/05/09 10:28:10 | 63.4 | 66.4 | 68.1 | 71.9 | 72.8 |
| 106 | 2018/05/09 10:28:15 | 73.5 | 69.9 | 68.2 | 65.7 | 65.1 |
| 111 | 2018/05/09 10:28:20 | 63.9 | 66.9 | 70.0 | 64.0 | 59.6 |
| 116 | 2018/05/09 10:28:25 | 59.3 | 64.6 | 63.8 | 67.6 | 64.3 |
| 121 | 2018/05/09 10:28:30 | 62.9 | 61.5 | 61.4 | 61.2 | 60.5 |
| 126 | 2018/05/09 10:28:35 | 61.9 | 60.1 | 59.0 | 58.1 | 59.4 |
| 131 | 2018/05/09 10:28:40 | 60.8 | 61.0 | 63.4 | 65.6 | 65.5 |
| 136 | 2018/05/09 10:28:45 | 64.1 | 62.5 | 64.9 | 67.4 | 67.2 |
| 141 | 2018/05/09 10:28:50 | 67.0 | 66.8 | 68.4 | 68.2 | 67.6 |
| 146 | 2018/05/09 10:28:55 | 68.4 | 70.2 | 69.0 | 66.2 | 65.1 |
| 151 | 2018/05/09 10:29:00 | 64.1 | 62.2 | 61.0 | 61.2 | 65.1 |
| 156 | 2018/05/09 10:29:05 | 69.1 | 66.6 | 63.8 | 60.1 | 59.0 |
| 161 | 2018/05/09 10:29:10 | 60.5 | 64.7 | 62.2 | 67.8 | 63.3 |
| 166 | 2018/05/09 10:29:15 | 64.4 | 63.3 | 63.5 | 65.0 | 64.6 |
| 171 | 2018/05/09 10:29:20 | 63.7 | 65.0 | 64.1 | 65.7 | 66.4 |
| 176 | 2018/05/09 10:29:25 | 68.7 | 69.2 | 67.2 | 64.7 | 65.6 |
| 181 | 2018/05/09 10:29:30 | 67.5 | 66.6 | 65.4 | 65.6 | 64.8 |
| 186 | 2018/05/09 10:29:35 | 62.7 | 62.4 | 63.6 | 66.2 | 68.3 |
| 191 | 2018/05/09 10:29:40 | 66.8 | 64.4 | 63.7 | 59.7 | 57.8 |
| 196 | 2018/05/09 10:29:45 | 56.2 | 54.7 | 54.1 | 53.6 | 53.1 |
| 201 | 2018/05/09 10:29:50 | 53.9 | 53.8 | 55.7 | 55.3 | 55.3 |
| 206 | 2018/05/09 10:29:55 | 55.7 | 57.2 | 58.4 | 58.3 | 59.5 |
| 211 | 2018/05/09 10:30:00 | 59.2 | 57.5 | 57.6 | 58.8 | 60.4 |
| 216 | 2018/05/09 10:30:05 | 63.5 | 67.8 | 69.0 | 68.0 | 68.2 |
| 221 | 2018/05/09 10:30:10 | 66.8 | 65.1 | 63.8 | 63.8 | 63.6 |
| 226 | 2018/05/09 10:30:15 | 63.6 | 61.5 | 62.8 | 63.1 | 63.6 |
| 231 | 2018/05/09 10:30:20 | 62.9 | 64.0 | 65.7 | 68.9 | 65.3 |
| 236 | 2018/05/09 10:30:25 | 62.1 | 60.5 | 58.5 | 61.1 | 60.2 |
| 241 | 2018/05/09 10:30:30 | 58.0 | 58.0 | 57.2 | 58.0 | 57.9 |
| 246 | 2018/05/09 10:30:35 | 59.2 | 58.0 | 58.3 | 60.0 | 63.8 |
| 251 | 2018/05/09 10:30:40 | 68.3 | 66.8 | 67.8 | 66.8 | 64.1 |
| 256 | 2018/05/09 10:30:45 | 63.6 | 66.8 | 67.9 | 68.3 | 66.0 |
| 261 | 2018/05/09 10:30:50 | 75.5 | 77.2 | 78.0 | 74.6 | 72.9 |
| 266 | 2018/05/09 10:30:55 | 71.5 | 69.3 | 69.1 | 70.6 | 69.8 |
| 271 | 2018/05/09 10:31:00 | 65.4 | 62.7 | 65.6 | 65.7 | 60.8 |
| 276 | 2018/05/09 10:31:05 | 62.8 | 58.1 | 66.5 | 73.2 | 64.2 |
| 281 | 2018/05/09 10:31:10 | 59.3 | 67.9 | 60.9 | 60.4 | 58.2 |
| 286 | 2018/05/09 10:31:15 | 55.8 | 55.6 | 55.5 | 56.3 | 57.7 |
| 291 | 2018/05/09 10:31:20 | 58.7 | 60.2 | 64.4 | 68.8 | 69.3 |
| 296 | 2018/05/09 10:31:25 | 69.5 | 69.1 | 68.0 | 68.2 | 67.1 |
| 301 | 2018/05/09 10:31:30 | 65.5 | 63.7 | 60.8 | 59.3 | 58.5 |
| 306 | 2018/05/09 10:31:35 | 58.7 | 59.9 | 64.0 | 63.5 | 66.2 |
| 311 | 2018/05/09 10:31:40 | 65.4 | 66.8 | 68.8 | 69.9 | 69.2 |
| 316 | 2018/05/09 10:31:45 | 68.8 | 63.6 | 61.2 | 60.5 | 61.0 |
| 321 | 2018/05/09 10:31:50 | 60.2 | 57.5 | 56.5 | 56.2 | 54.3 |
| 326 | 2018/05/09 10:31:55 | 55.8 | 58.4 | 59.7 | 60.3 | 60.0 |
| 331 | 2018/05/09 10:32:00 | 59.7 | 60.7 | 61.4 | 59.2 | 58.6 |
| 336 | 2018/05/09 10:32:05 | 57.4 | 56.9 | 56.0 | 56.7 | 57.4 |
| 341 | 2018/05/09 10:32:10 | 58.2 | 58.5 | 61.2 | 62.7 | 64.7 |
| 346 | 2018/05/09 10:32:15 | 67.5 | 68.2 | 69.3 | 69.6 | 69.2 |
| 351 | 2018/05/09 10:32:20 | 64.1 | 59.2 | 56.8 | 56.2 | 55.2 |
| 356 | 2018/05/09 10:32:25 | 55.4 | 55.8 | 58.0 | 60.2 | 62.1 |
| 361 | 2018/05/09 10:32:30 | 61.6 | 62.1 | 63.9 | 65.6 | 65.2 |
| 366 | 2018/05/09 10:32:35 | 63.5 | 61.2 | 57.7 | 55.7 | 56.0 |
| 371 | 2018/05/09 10:32:40 | 56.9 | 58.0 | 59.6 | 60.1 | 60.3 |
| 376 | 2018/05/09 10:32:45 | 61.3 | 63.5 | 66.4 | 68.7 | 66.4 |
| 381 | 2018/05/09 10:32:50 | 62.6 | 61.6 | 64.3 | 65.8 | 63.9 |
| 386 | 2018/05/09 10:32:55 | 61.6 | 60.4 | 59.2 | 58.6 | 57.3 |
| 391 | 2018/05/09 10:33:00 | 58.4 | 60.0 | 61.4 | 59.9 | 59.2 |
| 396 | 2018/05/09 10:33:05 | 64.4 | 59.6 | 59.3 | 61.3 | 61.9 |
| 401 | 2018/05/09 10:33:10 | 61.0 | 60.2 | 57.7 | 57.6 | 59.2 |
| 406 | 2018/05/09 10:33:15 | 58.8 | 59.4 | 59.4 | 60.9 | 59.1 |
| 411 | 2018/05/09 10:33:20 | 58.9 | 60.8 | 62.3 | 64.3 | 69.1 |
| 416 | 2018/05/09 10:33:25 | 69.5 | 66.5 | 64.1 | 63.5 | 61.7 |
| 421 | 2018/05/09 10:33:30 | 61.7 | 64.3 | 66.6 | 67.2 | 66.6 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 426 | 2018/05/09 | 10:33:35 | 65.8 | 64.2 | 62.2 | 60.6 | 58.8 |
| 431 | 2018/05/09 | 10:33:40 | 58.3 | 57.3 | 57.3 | 57.6 | 57.9 |
| 436 | 2018/05/09 | 10:33:45 | 58.5 | 59.8 | 61.1 | 64.9 | 66.1 |
| 441 | 2018/05/09 | 10:33:50 | 66.2 | 65.6 | 66.9 | 67.9 | 66.4 |
| 446 | 2018/05/09 | 10:33:55 | 65.1 | 63.8 | 62.1 | 65.8 | 65.4 |
| 451 | 2018/05/09 | 10:34:00 | 61.9 | 57.2 | 54.4 | 54.4 | 53.7 |
| 456 | 2018/05/09 | 10:34:05 | 53.0 | 53.3 | 52.9 | 53.8 | 53.1 |
| 461 | 2018/05/09 | 10:34:10 | 53.4 | 57.7 | 62.0 | 62.2 | 63.6 |
| 466 | 2018/05/09 | 10:34:15 | 63.9 | 63.2 | 64.4 | 63.4 | 64.5 |
| 471 | 2018/05/09 | 10:34:20 | 61.5 | 57.1 | 54.9 | 53.8 | 56.5 |
| 476 | 2018/05/09 | 10:34:25 | 57.2 | 57.5 | 62.6 | 64.6 | 65.4 |
| 481 | 2018/05/09 | 10:34:30 | 63.6 | 60.4 | 57.9 | 56.1 | 53.5 |
| 486 | 2018/05/09 | 10:34:35 | 52.9 | 54.4 | 57.8 | 56.7 | 57.0 |
| 491 | 2018/05/09 | 10:34:40 | 55.9 | 54.9 | 54.8 | 54.4 | 58.1 |
| 496 | 2018/05/09 | 10:34:45 | 61.0 | 63.8 | 65.5 | 64.7 | 66.0 |
| 501 | 2018/05/09 | 10:34:50 | 66.9 | 68.9 | 68.3 | 65.3 | 65.0 |
| 506 | 2018/05/09 | 10:34:55 | 61.1 | 56.6 | 55.5 | 53.7 | 53.8 |
| 511 | 2018/05/09 | 10:35:00 | 53.8 | 53.9 | 54.1 | 55.7 | 58.4 |
| 516 | 2018/05/09 | 10:35:05 | 59.6 | 62.2 | 62.4 | 61.5 | 61.0 |
| 521 | 2018/05/09 | 10:35:10 | 60.3 | 60.3 | 64.2 | 66.5 | 68.1 |
| 526 | 2018/05/09 | 10:35:15 | 71.2 | 69.2 | 67.0 | 65.0 | 63.5 |
| 531 | 2018/05/09 | 10:35:20 | 62.3 | 64.1 | 66.6 | 70.9 | 63.5 |
| 536 | 2018/05/09 | 10:35:25 | 61.8 | 61.6 | 60.5 | 60.4 | 60.5 |
| 541 | 2018/05/09 | 10:35:30 | 59.5 | 57.1 | 58.2 | 60.2 | 62.4 |
| 546 | 2018/05/09 | 10:35:35 | 59.3 | 58.7 | 59.5 | 58.6 | 57.7 |
| 551 | 2018/05/09 | 10:35:40 | 60.7 | 62.2 | 64.8 | 66.2 | 64.4 |
| 556 | 2018/05/09 | 10:35:45 | 65.3 | 66.0 | 66.0 | 64.6 | 66.7 |
| 561 | 2018/05/09 | 10:35:50 | 68.1 | 66.7 | 64.6 | 61.8 | 64.1 |
| 566 | 2018/05/09 | 10:35:55 | 65.9 | 64.9 | 63.6 | 59.7 | 57.5 |
| 571 | 2018/05/09 | 10:36:00 | 56.2 | 55.2 | 55.6 | 55.5 | 54.2 |
| 576 | 2018/05/09 | 10:36:05 | 53.7 | 53.8 | 54.8 | 54.6 | 54.5 |
| 581 | 2018/05/09 | 10:36:10 | 56.1 | 56.1 | 54.1 | 56.4 | 59.0 |
| 586 | 2018/05/09 | 10:36:15 | 60.2 | 59.2 | 58.6 | 57.1 | 55.9 |
| 591 | 2018/05/09 | 10:36:20 | 54.9 | 56.5 | 56.3 | 59.8 | 55.4 |
| 596 | 2018/05/09 | 10:36:25 | 55.4 | 56.2 | 58.4 | 60.9 | 62.0 |
| 601 | 2018/05/09 | 10:36:30 | 61.4 | 61.9 | 66.3 | 69.2 | 68.7 |
| 606 | 2018/05/09 | 10:36:35 | 68.7 | 71.6 | 71.3 | 67.6 | 66.5 |
| 611 | 2018/05/09 | 10:36:40 | 67.4 | 65.8 | 64.2 | 62.1 | 61.6 |
| 616 | 2018/05/09 | 10:36:45 | 61.5 | 61.3 | 60.3 | 60.7 | 60.2 |
| 621 | 2018/05/09 | 10:36:50 | 61.4 | 63.8 | 64.0 | 63.0 | 63.3 |
| 626 | 2018/05/09 | 10:36:55 | 62.0 | 60.4 | 60.2 | 62.9 | 62.0 |
| 631 | 2018/05/09 | 10:37:00 | 60.9 | 60.1 | 62.0 | 61.0 | 57.7 |
| 636 | 2018/05/09 | 10:37:05 | 58.1 | 58.4 | 58.4 | 60.1 | 62.0 |
| 641 | 2018/05/09 | 10:37:10 | 62.8 | 64.0 | 63.4 | 60.2 | 61.3 |
| 646 | 2018/05/09 | 10:37:15 | 62.2 | 61.7 | 63.8 | 65.2 | 63.6 |
| 651 | 2018/05/09 | 10:37:20 | 65.5 | 60.2 | 58.8 | 59.8 | 60.4 |
| 656 | 2018/05/09 | 10:37:25 | 61.1 | 63.6 | 64.9 | 66.3 | 66.0 |
| 661 | 2018/05/09 | 10:37:30 | 65.3 | 64.5 | 63.8 | 63.5 | 61.3 |
| 666 | 2018/05/09 | 10:37:35 | 57.5 | 55.2 | 53.7 | 54.6 | 54.1 |
| 671 | 2018/05/09 | 10:37:40 | 54.0 | 54.7 | 54.2 | 53.6 | 53.6 |
| 676 | 2018/05/09 | 10:37:45 | 56.4 | 56.9 | 56.8 | 57.6 | 57.2 |
| 681 | 2018/05/09 | 10:37:50 | 56.0 | 56.3 | 57.9 | 60.4 | 62.5 |
| 686 | 2018/05/09 | 10:37:55 | 64.5 | 68.5 | 73.3 | 72.6 | 66.0 |
| 691 | 2018/05/09 | 10:38:00 | 62.8 | 61.5 | 62.6 | 62.4 | 63.8 |
| 696 | 2018/05/09 | 10:38:05 | 64.9 | 64.8 | 65.5 | 68.0 | 69.6 |
| 701 | 2018/05/09 | 10:38:10 | 67.9 | 65.7 | 63.3 | 60.5 | 59.4 |
| 706 | 2018/05/09 | 10:38:15 | 58.5 | 57.8 | 57.7 | 58.2 | 59.4 |
| 711 | 2018/05/09 | 10:38:20 | 61.1 | 62.1 | 62.9 | 62.0 | 59.5 |
| 716 | 2018/05/09 | 10:38:25 | 58.0 | 57.7 | 58.7 | 60.0 | 63.4 |
| 721 | 2018/05/09 | 10:38:30 | 67.4 | 66.4 | 65.5 | 66.5 | 65.1 |
| 726 | 2018/05/09 | 10:38:35 | 63.2 | 60.2 | 56.9 | 56.6 | 56.1 |
| 731 | 2018/05/09 | 10:38:40 | 56.5 | 57.2 | 57.7 | 58.6 | 60.6 |
| 736 | 2018/05/09 | 10:38:45 | 61.9 | 63.6 | 62.1 | 61.8 | 61.4 |
| 741 | 2018/05/09 | 10:38:50 | 61.6 | 64.4 | 66.2 | 67.9 | 66.2 |
| 746 | 2018/05/09 | 10:38:55 | 63.5 | 62.5 | 62.5 | 63.1 | 64.6 |
| 751 | 2018/05/09 | 10:39:00 | 65.5 | 65.1 | 65.6 | 70.5 | 77.0 |
| 756 | 2018/05/09 | 10:39:05 | 76.1 | 68.3 | 67.4 | 66.2 | 67.0 |
| 761 | 2018/05/09 | 10:39:10 | 66.4 | 66.3 | 66.9 | 67.9 | 67.2 |
| 766 | 2018/05/09 | 10:39:15 | 62.8 | 62.4 | 61.9 | 59.5 | 57.6 |
| 771 | 2018/05/09 | 10:39:20 | 58.6 | 59.3 | 60.6 | 60.4 | 59.4 |
| 776 | 2018/05/09 | 10:39:25 | 61.6 | 64.3 | 65.3 | 64.8 | 64.4 |
| 781 | 2018/05/09 | 10:39:30 | 64.1 | 64.7 | 66.3 | 66.5 | 66.3 |
| 786 | 2018/05/09 | 10:39:35 | 65.9 | 66.3 | 65.7 | 64.3 | 64.3 |
| 791 | 2018/05/09 | 10:39:40 | 61.4 | 59.8 | 62.2 | 62.7 | 61.9 |
| 796 | 2018/05/09 | 10:39:45 | 61.3 | 62.8 | 62.2 | 62.9 | 62.9 |
| 801 | 2018/05/09 | 10:39:50 | 63.4 | 65.5 | 68.1 | 68.3 | 66.8 |
| 806 | 2018/05/09 | 10:39:55 | 67.1 | 64.6 | 62.0 | 61.4 | 60.3 |
| 811 | 2018/05/09 | 10:40:00 | 60.0 | 60.3 | 62.8 | 62.7 | 62.3 |
| 816 | 2018/05/09 | 10:40:05 | 63.6 | 62.4 | 63.1 | 63.7 | 64.2 |
| 821 | 2018/05/09 | 10:40:10 | 65.7 | 61.8 | 61.0 | 61.0 | 63.7 |
| 826 | 2018/05/09 | 10:40:15 | 64.0 | 63.1 | 63.7 | 65.2 | 66.3 |
| 831 | 2018/05/09 | 10:40:20 | 66.3 | 64.9 | 66.1 | 63.9 | 64.4 |
| 836 | 2018/05/09 | 10:40:25 | 61.9 | 60.9 | 59.0 | 60.4 | 59.6 |
| 841 | 2018/05/09 | 10:40:30 | 57.7 | 56.9 | 56.9 | 57.3 | 57.3 |
| 846 | 2018/05/09 | 10:40:35 | 58.7 | 58.4 | 61.0 | 61.6 | 63.2 |
| 851 | 2018/05/09 | 10:40:40 | 65.5 | 66.6 | 70.3 | 69.7 | 66.9 |
| 856 | 2018/05/09 | 10:40:45 | 64.0 | 66.3 | 69.1 | 68.1 | 65.4 |
| 861 | 2018/05/09 | 10:40:50 | 62.6 | 60.0 | 58.8 | 57.3 | 58.0 |
| 866 | 2018/05/09 | 10:40:55 | 57.3 | 66.6 | 57.6 | 59.2 | 61.8 |
| 871 | 2018/05/09 | 10:41:00 | 62.3 | 64.3 | 62.4 | 62.0 | 61.4 |
| 876 | 2018/05/09 | 10:41:05 | 62.1 | 64.8 | 65.6 | 65.2 | 63.6 |
| 881 | 2018/05/09 | 10:41:10 | 63.8 | 64.1 | 65.3 | 64.0 | 63.4 |
| 886 | 2018/05/09 | 10:41:15 | 63.9 | 63.7 | 64.7 | 66.0 | 67.5 |
| 891 | 2018/05/09 | 10:41:20 | 68.2 | 67.7 | 68.0 | 66.3 | 69.1 |
| 896 | 2018/05/09 | 10:41:25 | 69.2 | 67.2 | 65.3 | 66.0 | 64.9 |

Noise Measurement 5

- Freq Weight : A
- Time Weight : FAST
- Level Range : 40-100
- Max dB : 72.6 - 2018/05/09 11:02:38
- Level Range : 40-100
- SEL : 90.2
- Leq : 60.7
-

| No.s | Date Time | (dB) | | | | |
|---|---|---|---|---|---|---|
| 1 | 2018/05/09 10:56:42 | 63.2 | 60.2 | 58.8 | 59.0 | 58.8 |
| 6 | 2018/05/09 10:56:47 | 58.2 | 58.5 | 60.0 | 59.9 | 63.6 |
| 11 | 2018/05/09 10:56:52 | 62.5 | 63.0 | 62.1 | 62.5 | 62.7 |
| 16 | 2018/05/09 10:56:57 | 62.4 | 63.5 | 62.7 | 63.2 | 63.3 |
| 21 | 2018/05/09 10:57:02 | 63.2 | 62.5 | 63.1 | 63.6 | 62.8 |
| 26 | 2018/05/09 10:57:07 | 61.9 | 61.0 | 65.0 | 64.6 | 63.4 |
| 31 | 2018/05/09 10:57:12 | 63.1 | 62.5 | 62.0 | 61.4 | 61.0 |
| 36 | 2018/05/09 10:57:17 | 60.7 | 60.7 | 61.2 | 62.1 | 61.9 |
| 41 | 2018/05/09 10:57:22 | 63.5 | 64.1 | 64.1 | 62.1 | 62.9 |
| 46 | 2018/05/09 10:57:27 | 61.3 | 59.3 | 58.6 | 59.3 | 59.1 |
| 51 | 2018/05/09 10:57:32 | 59.0 | 59.0 | 60.7 | 61.7 | 62.0 |
| 56 | 2018/05/09 10:57:37 | 63.0 | 61.7 | 63.0 | 65.5 | 64.5 |
| 61 | 2018/05/09 10:57:42 | 61.5 | 60.5 | 59.6 | 59.8 | 60.6 |
| 66 | 2018/05/09 10:57:47 | 60.5 | 59.8 | 58.5 | 58.9 | 58.2 |
| 71 | 2018/05/09 10:57:52 | 59.3 | 59.0 | 61.7 | 59.2 | 59.4 |
| 76 | 2018/05/09 10:57:57 | 59.2 | 59.0 | 59.6 | 60.2 | 58.8 |
| 81 | 2018/05/09 10:58:02 | 58.9 | 58.5 | 60.0 | 59.3 | 59.2 |
| 86 | 2018/05/09 10:58:07 | 59.0 | 59.4 | 57.7 | 57.6 | 58.6 |
| 91 | 2018/05/09 10:58:12 | 57.9 | 58.8 | 58.9 | 58.6 | 60.3 |
| 96 | 2018/05/09 10:58:17 | 59.6 | 60.5 | 59.7 | 59.3 | 58.5 |
| 101 | 2018/05/09 10:58:22 | 58.9 | 59.3 | 60.2 | 61.8 | 63.8 |
| 106 | 2018/05/09 10:58:27 | 64.8 | 67.0 | 66.0 | 65.9 | 64.5 |
| 111 | 2018/05/09 10:58:32 | 63.2 | 63.0 | 63.0 | 64.3 | 62.7 |
| 116 | 2018/05/09 10:58:37 | 62.9 | 63.3 | 62.9 | 62.2 | 61.9 |
| 121 | 2018/05/09 10:58:42 | 61.0 | 61.2 | 60.5 | 60.1 | 59.0 |
| 126 | 2018/05/09 10:58:47 | 60.2 | 59.9 | 60.2 | 60.7 | 60.2 |
| 131 | 2018/05/09 10:58:52 | 59.0 | 58.0 | 58.4 | 58.2 | 58.1 |
| 136 | 2018/05/09 10:58:57 | 57.8 | 57.7 | 58.2 | 58.3 | 58.3 |
| 141 | 2018/05/09 10:59:02 | 58.5 | 58.5 | 58.8 | 58.8 | 59.8 |
| 146 | 2018/05/09 10:59:07 | 60.6 | 60.4 | 59.9 | 59.8 | 58.9 |
| 151 | 2018/05/09 10:59:12 | 59.8 | 58.9 | 58.4 | 58.2 | 59.8 |
| 156 | 2018/05/09 10:59:17 | 59.5 | 62.6 | 62.1 | 61.8 | 60.6 |
| 161 | 2018/05/09 10:59:22 | 60.1 | 60.9 | 60.7 | 62.5 | 61.9 |
| 166 | 2018/05/09 10:59:27 | 62.8 | 60.8 | 60.7 | 60.0 | 60.6 |
| 171 | 2018/05/09 10:59:32 | 60.1 | 59.8 | 60.6 | 58.3 | 58.6 |
| 176 | 2018/05/09 10:59:37 | 58.7 | 59.2 | 60.4 | 60.0 | 61.6 |
| 181 | 2018/05/09 10:59:42 | 62.8 | 61.5 | 59.0 | 59.3 | 60.7 |
| 186 | 2018/05/09 10:59:47 | 63.3 | 64.2 | 62.6 | 60.9 | 61.9 |
| 191 | 2018/05/09 10:59:52 | 60.8 | 61.0 | 60.1 | 61.9 | 62.2 |
| 196 | 2018/05/09 10:59:57 | 62.6 | 62.0 | 62.5 | 63.6 | 62.6 |
| 201 | 2018/05/09 11:00:02 | 63.2 | 63.2 | 62.2 | 60.3 | 59.8 |
| 206 | 2018/05/09 11:00:07 | 58.8 | 59.0 | 58.8 | 59.0 | 59.2 |
| 211 | 2018/05/09 11:00:12 | 58.6 | 57.9 | 58.0 | 58.0 | 57.8 |
| 216 | 2018/05/09 11:00:17 | 57.3 | 57.5 | 57.8 | 58.5 | 58.6 |
| 221 | 2018/05/09 11:00:22 | 59.5 | 59.0 | 59.6 | 59.7 | 62.3 |
| 226 | 2018/05/09 11:00:27 | 61.7 | 61.6 | 59.3 | 58.0 | 58.4 |
| 231 | 2018/05/09 11:00:32 | 57.6 | 59.4 | 58.9 | 60.0 | 61.6 |
| 236 | 2018/05/09 11:00:37 | 64.1 | 64.6 | 64.9 | 61.6 | 60.7 |
| 241 | 2018/05/09 11:00:42 | 59.8 | 59.1 | 60.1 | 60.0 | 59.0 |
| 246 | 2018/05/09 11:00:47 | 59.1 | 59.9 | 58.8 | 57.9 | 60.5 |
| 251 | 2018/05/09 11:00:52 | 60.8 | 62.6 | 60.5 | 58.9 | 58.1 |
| 256 | 2018/05/09 11:00:57 | 56.6 | 57.0 | 57.3 | 57.5 | 57.8 |
| 261 | 2018/05/09 11:01:02 | 58.3 | 57.4 | 58.3 | 59.1 | 60.9 |
| 266 | 2018/05/09 11:01:07 | 60.9 | 61.7 | 60.7 | 62.0 | 62.4 |
| 271 | 2018/05/09 11:01:12 | 61.8 | 61.5 | 61.3 | 62.7 | 68.5 |
| 276 | 2018/05/09 11:01:17 | 64.1 | 62.1 | 64.2 | 64.1 | 62.3 |
| 281 | 2018/05/09 11:01:22 | 63.2 | 62.9 | 62.2 | 62.4 | 61.1 |
| 286 | 2018/05/09 11:01:27 | 61.0 | 59.8 | 59.6 | 60.3 | 59.6 |
| 291 | 2018/05/09 11:01:32 | 59.9 | 60.0 | 60.0 | 61.1 | 60.3 |
| 296 | 2018/05/09 11:01:37 | 58.8 | 58.3 | 58.9 | 58.1 | 59.1 |
| 301 | 2018/05/09 11:01:42 | 59.1 | 59.4 | 59.0 | 59.4 | 59.1 |
| 306 | 2018/05/09 11:01:47 | 59.1 | 59.2 | 59.5 | 60.1 | 60.3 |
| 311 | 2018/05/09 11:01:52 | 61.1 | 61.5 | 60.8 | 60.8 | 60.7 |
| 316 | 2018/05/09 11:01:57 | 61.3 | 61.6 | 62.0 | 61.8 | 61.4 |
| 321 | 2018/05/09 11:02:02 | 61.6 | 61.3 | 61.3 | 60.7 | 61.5 |
| 326 | 2018/05/09 11:02:07 | 61.4 | 62.7 | 60.1 | 58.6 | 60.1 |
| 331 | 2018/05/09 11:02:12 | 60.6 | 59.3 | 60.1 | 60.1 | 59.6 |
| 336 | 2018/05/09 11:02:17 | 60.4 | 61.7 | 62.8 | 61.0 | 60.1 |
| 341 | 2018/05/09 11:02:22 | 58.9 | 57.8 | 57.6 | 57.8 | 59.2 |
| 346 | 2018/05/09 11:02:27 | 58.0 | 58.5 | 59.4 | 59.7 | 60.0 |
| 351 | 2018/05/09 11:02:32 | 61.1 | 63.9 | 63.4 | 61.5 | 62.8 |
| 356 | 2018/05/09 11:02:37 | 64.4 | 68.6 | 63.6 | 63.0 | 61.4 |
| 361 | 2018/05/09 11:02:42 | 61.6 | 62.2 | 62.5 | 62.9 | 62.5 |
| 366 | 2018/05/09 11:02:47 | 63.7 | 63.9 | 62.9 | 63.8 | 62.2 |
| 371 | 2018/05/09 11:02:52 | 61.4 | 61.8 | 63.6 | 62.1 | 62.2 |
| 376 | 2018/05/09 11:02:57 | 60.4 | 60.0 | 61.1 | 59.7 | 58.9 |
| 381 | 2018/05/09 11:03:02 | 58.4 | 59.4 | 60.6 | 62.2 | 62.6 |
| 386 | 2018/05/09 11:03:07 | 61.0 | 59.3 | 59.1 | 59.9 | 59.0 |
| 391 | 2018/05/09 11:03:12 | 58.5 | 59.1 | 57.8 | 57.2 | 56.8 |
| 396 | 2018/05/09 11:03:17 | 57.7 | 57.4 | 58.1 | 56.9 | 56.7 |
| 401 | 2018/05/09 11:03:22 | 56.8 | 57.1 | 57.0 | 56.6 | 55.9 |
| 406 | 2018/05/09 11:03:27 | 57.1 | 58.1 | 58.7 | 58.2 | 60.5 |
| 411 | 2018/05/09 11:03:32 | 60.7 | 61.8 | 60.6 | 61.2 | 61.0 |
| 416 | 2018/05/09 11:03:37 | 62.9 | 62.8 | 66.4 | 63.8 | 62.7 |
| 421 | 2018/05/09 11:03:42 | 63.2 | 63.3 | 65.0 | 63.3 | 62.3 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 426 | 2018/05/09 11:03:47 | 61.3 | 60.5 | 65.6 | 65.8 | 63.2 |
| 431 | 2018/05/09 11:03:52 | 60.5 | 61.2 | 62.3 | 62.2 | 62.3 |
| 436 | 2018/05/09 11:03:57 | 62.5 | 60.8 | 59.4 | 61.1 | 62.0 |
| 441 | 2018/05/09 11:04:02 | 62.7 | 59.2 | 59.2 | 59.3 | 59.3 |
| 446 | 2018/05/09 11:04:07 | 59.6 | 60.5 | 63.1 | 62.2 | 59.8 |
| 451 | 2018/05/09 11:04:12 | 57.6 | 56.8 | 56.6 | 56.6 | 57.9 |
| 456 | 2018/05/09 11:04:17 | 57.1 | 57.0 | 57.5 | 57.7 | 57.5 |
| 461 | 2018/05/09 11:04:22 | 57.2 | 56.3 | 56.2 | 56.9 | 56.3 |
| 466 | 2018/05/09 11:04:27 | 56.2 | 56.1 | 55.8 | 56.0 | 55.3 |
| 471 | 2018/05/09 11:04:32 | 56.6 | 56.1 | 56.9 | 57.0 | 55.6 |
| 476 | 2018/05/09 11:04:37 | 56.7 | 56.6 | 56.3 | 55.8 | 56.1 |
| 481 | 2018/05/09 11:04:42 | 55.3 | 55.5 | 55.2 | 55.4 | 56.8 |
| 486 | 2018/05/09 11:04:47 | 57.0 | 57.9 | 59.6 | 60.2 | 61.1 |
| 491 | 2018/05/09 11:04:52 | 60.3 | 61.0 | 59.0 | 60.5 | 61.9 |
| 496 | 2018/05/09 11:04:57 | 60.8 | 60.9 | 60.3 | 60.7 | 58.9 |
| 501 | 2018/05/09 11:05:02 | 59.7 | 61.1 | 61.0 | 62.2 | 62.6 |
| 506 | 2018/05/09 11:05:07 | 62.6 | 61.1 | 60.7 | 62.5 | 62.9 |
| 511 | 2018/05/09 11:05:12 | 63.1 | 60.7 | 60.1 | 59.0 | 59.1 |
| 516 | 2018/05/09 11:05:17 | 61.5 | 62.1 | 63.7 | 63.6 | 63.8 |
| 521 | 2018/05/09 11:05:22 | 64.7 | 63.0 | 62.9 | 63.7 | 62.4 |
| 526 | 2018/05/09 11:05:27 | 63.0 | 66.3 | 66.2 | 62.6 | 62.8 |
| 531 | 2018/05/09 11:05:32 | 60.3 | 59.9 | 61.6 | 62.2 | 63.5 |
| 536 | 2018/05/09 11:05:37 | 64.0 | 62.2 | 62.1 | 63.0 | 60.2 |
| 541 | 2018/05/09 11:05:42 | 59.6 | 59.1 | 58.9 | 58.6 | 57.7 |
| 546 | 2018/05/09 11:05:47 | 58.6 | 58.2 | 58.2 | 58.1 | 57.7 |
| 551 | 2018/05/09 11:05:52 | 57.7 | 56.2 | 56.4 | 56.9 | 57.5 |
| 556 | 2018/05/09 11:05:57 | 57.5 | 58.1 | 61.4 | 59.4 | 58.9 |
| 561 | 2018/05/09 11:06:02 | 56.6 | 56.4 | 56.9 | 58.3 | 58.7 |
| 566 | 2018/05/09 11:06:07 | 57.2 | 58.4 | 58.0 | 59.1 | 59.1 |
| 571 | 2018/05/09 11:06:12 | 58.7 | 57.6 | 58.6 | 57.7 | 59.9 |
| 576 | 2018/05/09 11:06:17 | 58.3 | 59.0 | 60.4 | 62.3 | 63.8 |
| 581 | 2018/05/09 11:06:22 | 63.2 | 62.5 | 61.6 | 61.3 | 61.5 |
| 586 | 2018/05/09 11:06:27 | 62.1 | 64.2 | 64.3 | 65.0 | 64.5 |
| 591 | 2018/05/09 11:06:32 | 63.9 | 61.8 | 62.0 | 62.8 | 61.7 |
| 596 | 2018/05/09 11:06:37 | 62.4 | 62.8 | 62.8 | 62.2 | 62.1 |
| 601 | 2018/05/09 11:06:42 | 63.4 | 62.7 | 62.5 | 61.3 | 61.4 |
| 606 | 2018/05/09 11:06:47 | 60.6 | 60.7 | 61.5 | 61.2 | 61.0 |
| 611 | 2018/05/09 11:06:52 | 61.0 | 62.3 | 61.6 | 61.3 | 62.9 |
| 616 | 2018/05/09 11:06:57 | 62.5 | 61.1 | 60.4 | 62.8 | 59.6 |
| 621 | 2018/05/09 11:07:02 | 59.4 | 59.6 | 58.7 | 57.3 | 56.8 |
| 626 | 2018/05/09 11:07:07 | 56.7 | 56.1 | 55.2 | 56.2 | 56.7 |
| 631 | 2018/05/09 11:07:12 | 56.7 | 59.8 | 57.6 | 58.0 | 57.0 |
| 636 | 2018/05/09 11:07:17 | 57.0 | 57.8 | 58.1 | 57.1 | 57.6 |
| 641 | 2018/05/09 11:07:22 | 55.9 | 56.7 | 56.2 | 56.6 | 57.1 |
| 646 | 2018/05/09 11:07:27 | 56.6 | 56.2 | 56.8 | 56.2 | 56.0 |
| 651 | 2018/05/09 11:07:32 | 56.7 | 57.3 | 57.7 | 58.6 | 57.7 |
| 656 | 2018/05/09 11:07:37 | 56.9 | 56.4 | 55.6 | 56.9 | 57.7 |
| 661 | 2018/05/09 11:07:42 | 58.4 | 58.1 | 62.1 | 60.2 | 62.3 |
| 666 | 2018/05/09 11:07:47 | 62.0 | 60.9 | 63.8 | 64.8 | 63.2 |
| 671 | 2018/05/09 11:07:52 | 63.4 | 63.3 | 64.4 | 64.9 | 65.7 |
| 676 | 2018/05/09 11:07:57 | 64.0 | 63.6 | 61.5 | 61.2 | 58.9 |
| 681 | 2018/05/09 11:08:02 | 59.7 | 59.1 | 59.5 | 66.0 | 60.3 |
| 686 | 2018/05/09 11:08:07 | 59.4 | 59.5 | 59.4 | 58.7 | 58.8 |
| 691 | 2018/05/09 11:08:12 | 57.6 | 58.3 | 57.9 | 57.1 | 57.4 |
| 696 | 2018/05/09 11:08:17 | 56.7 | 57.2 | 57.1 | 57.4 | 57.2 |
| 701 | 2018/05/09 11:08:22 | 58.0 | 57.4 | 57.7 | 57.1 | 56.7 |
| 706 | 2018/05/09 11:08:27 | 58.0 | 58.9 | 60.0 | 59.4 | 58.3 |
| 711 | 2018/05/09 11:08:32 | 57.2 | 57.0 | 57.4 | 60.0 | 61.0 |
| 716 | 2018/05/09 11:08:37 | 61.2 | 60.1 | 58.8 | 58.9 | 58.3 |
| 721 | 2018/05/09 11:08:42 | 59.2 | 59.5 | 59.2 | 59.4 | 58.5 |
| 726 | 2018/05/09 11:08:47 | 58.4 | 58.1 | 59.4 | 58.8 | 60.3 |
| 731 | 2018/05/09 11:08:52 | 59.4 | 59.1 | 61.7 | 61.0 | 61.0 |
| 736 | 2018/05/09 11:08:57 | 57.6 | 57.7 | 57.4 | 57.1 | 56.9 |
| 741 | 2018/05/09 11:09:02 | 57.0 | 57.1 | 57.0 | 57.8 | 60.0 |
| 746 | 2018/05/09 11:09:07 | 58.9 | 58.0 | 58.2 | 59.7 | 58.7 |
| 751 | 2018/05/09 11:09:12 | 59.0 | 63.9 | 63.8 | 60.3 | 59.8 |
| 756 | 2018/05/09 11:09:17 | 59.5 | 60.7 | 62.2 | 60.0 | 59.6 |
| 761 | 2018/05/09 11:09:22 | 58.5 | 57.9 | 59.1 | 59.3 | 59.8 |
| 766 | 2018/05/09 11:09:27 | 60.1 | 60.1 | 60.4 | 60.8 | 60.7 |
| 771 | 2018/05/09 11:09:32 | 60.8 | 61.2 | 62.4 | 64.1 | 63.1 |
| 776 | 2018/05/09 11:09:37 | 60.4 | 60.2 | 59.3 | 59.4 | 59.4 |
| 781 | 2018/05/09 11:09:42 | 59.8 | 60.0 | 60.0 | 60.1 | 59.2 |
| 786 | 2018/05/09 11:09:47 | 59.2 | 59.7 | 60.1 | 60.3 | 60.4 |
| 791 | 2018/05/09 11:09:52 | 61.5 | 62.4 | 64.6 | 63.7 | 61.5 |
| 796 | 2018/05/09 11:09:57 | 59.8 | 59.2 | 63.8 | 62.8 | 62.5 |
| 801 | 2018/05/09 11:10:02 | 60.7 | 62.2 | 62.5 | 60.1 | 57.4 |
| 806 | 2018/05/09 11:10:07 | 57.5 | 57.0 | 56.8 | 56.8 | 57.5 |
| 811 | 2018/05/09 11:10:12 | 57.0 | 58.1 | 57.6 | 58.5 | 58.9 |
| 816 | 2018/05/09 11:10:17 | 59.0 | 59.7 | 59.3 | 57.2 | 57.4 |
| 821 | 2018/05/09 11:10:22 | 58.6 | 56.8 | 57.8 | 58.1 | 58.6 |
| 826 | 2018/05/09 11:10:27 | 58.9 | 59.2 | 59.6 | 57.9 | 57.4 |
| 831 | 2018/05/09 11:10:32 | 57.3 | 58.1 | 57.6 | 57.1 | 57.9 |
| 836 | 2018/05/09 11:10:37 | 57.0 | 56.8 | 57.6 | 56.7 | 56.4 |
| 841 | 2018/05/09 11:10:42 | 56.0 | 56.0 | 55.6 | 56.8 | 57.8 |
| 846 | 2018/05/09 11:10:47 | 58.1 | 59.9 | 60.0 | 61.5 | 62.4 |
| 851 | 2018/05/09 11:10:52 | 62.5 | 63.6 | 62.9 | 62.5 | 62.2 |
| 856 | 2018/05/09 11:10:57 | 61.5 | 61.0 | 59.9 | 59.6 | 59.0 |
| 861 | 2018/05/09 11:11:02 | 58.1 | 58.3 | 57.2 | 57.2 | 58.2 |
| 866 | 2018/05/09 11:11:07 | 58.7 | 58.4 | 58.6 | 59.0 | 59.1 |
| 871 | 2018/05/09 11:11:12 | 58.1 | 56.5 | 57.0 | 57.5 | 56.9 |
| 876 | 2018/05/09 11:11:17 | 56.1 | 55.8 | 56.2 | 57.0 | 57.3 |
| 881 | 2018/05/09 11:11:22 | 59.1 | 59.5 | 60.4 | 63.0 | 63.1 |
| 886 | 2018/05/09 11:11:27 | 60.3 | 60.4 | 60.0 | 59.1 | 58.3 |
| 891 | 2018/05/09 11:11:32 | 57.3 | 56.6 | 57.4 | 57.4 | 56.8 |
| 896 | 2018/05/09 11:11:37 | 57.4 | 57.7 | 58.8 | 60.0 | 59.5 |

Noise Measurement 6

- Freq Weight : A
- Time Weight : FAST
- Level Range : 40-100
- Max dB : 83.9 - 2018/05/09 11:34:15
- Level Range : 40-100
- SEL : 97.1
- Leq : 67.6
-

| No.s | Date Time | (dB) | | | | |
|---|---|---|---|---|---|---|
| 1 | 2018/05/09 11:26:20 | 55.7 | 52.7 | 57.8 | 50.0 | 50.8 |
| 6 | 2018/05/09 11:26:25 | 51.2 | 49.1 | 48.4 | 50.7 | 50.1 |
| 11 | 2018/05/09 11:26:30 | 49.5 | 49.4 | 50.7 | 49.1 | 49.8 |
| 16 | 2018/05/09 11:26:35 | 49.8 | 50.5 | 52.0 | 50.7 | 49.7 |
| 21 | 2018/05/09 11:26:40 | 54.8 | 56.7 | 54.6 | 55.8 | 60.2 |
| 26 | 2018/05/09 11:26:45 | 61.6 | 63.9 | 63.6 | 66.5 | 65.7 |
| 31 | 2018/05/09 11:26:50 | 67.1 | 69.8 | 69.3 | 72.2 | 69.3 |
| 36 | 2018/05/09 11:26:55 | 67.6 | 67.0 | 65.6 | 59.4 | 58.8 |
| 41 | 2018/05/09 11:27:00 | 58.9 | 59.2 | 58.5 | 58.7 | 63.3 |
| 46 | 2018/05/09 11:27:05 | 67.1 | 69.3 | 69.5 | 70.3 | 71.3 |
| 51 | 2018/05/09 11:27:10 | 68.8 | 66.4 | 67.3 | 64.4 | 58.3 |
| 56 | 2018/05/09 11:27:15 | 59.4 | 57.3 | 56.8 | 59.6 | 67.4 |
| 61 | 2018/05/09 11:27:20 | 69.5 | 64.7 | 60.8 | 55.0 | 52.1 |
| 66 | 2018/05/09 11:27:25 | 51.4 | 50.6 | 51.0 | 51.9 | 50.9 |
| 71 | 2018/05/09 11:27:30 | 49.3 | 49.1 | 50.1 | 52.4 | 52.5 |
| 76 | 2018/05/09 11:27:35 | 55.0 | 58.5 | 61.8 | 65.0 | 67.5 |
| 81 | 2018/05/09 11:27:40 | 67.6 | 66.5 | 67.6 | 70.1 | 68.6 |
| 86 | 2018/05/09 11:27:45 | 70.9 | 69.6 | 67.2 | 65.1 | 62.8 |
| 91 | 2018/05/09 11:27:50 | 63.9 | 63.6 | 62.2 | 62.8 | 64.2 |
| 96 | 2018/05/09 11:27:55 | 63.0 | 62.1 | 64.1 | 66.5 | 66.0 |
| 101 | 2018/05/09 11:28:00 | 67.3 | 70.5 | 72.3 | 69.5 | 70.4 |
| 106 | 2018/05/09 11:28:05 | 69.1 | 69.7 | 69.5 | 66.6 | 61.7 |
| 111 | 2018/05/09 11:28:10 | 59.5 | 57.1 | 54.8 | 54.1 | 52.7 |
| 116 | 2018/05/09 11:28:15 | 50.5 | 49.4 | 49.8 | 48.2 | 48.9 |
| 121 | 2018/05/09 11:28:20 | 49.5 | 49.9 | 51.1 | 52.9 | 53.5 |
| 126 | 2018/05/09 11:28:25 | 52.1 | 51.6 | 51.3 | 50.1 | 49.7 |
| 131 | 2018/05/09 11:28:30 | 50.0 | 50.8 | 54.3 | 55.8 | 60.5 |
| 136 | 2018/05/09 11:28:35 | 68.2 | 70.1 | 68.1 | 61.1 | 58.4 |
| 141 | 2018/05/09 11:28:40 | 62.5 | 64.1 | 65.4 | 62.8 | 59.9 |
| 146 | 2018/05/09 11:28:45 | 57.0 | 56.3 | 54.7 | 56.4 | 60.8 |
| 151 | 2018/05/09 11:28:50 | 63.5 | 67.7 | 71.2 | 70.0 | 69.7 |
| 156 | 2018/05/09 11:28:55 | 68.4 | 63.7 | 61.5 | 55.0 | 56.5 |
| 161 | 2018/05/09 11:29:00 | 56.4 | 59.8 | 58.9 | 61.9 | 68.2 |
| 166 | 2018/05/09 11:29:05 | 71.5 | 70.0 | 67.9 | 62.8 | 60.0 |
| 171 | 2018/05/09 11:29:10 | 58.5 | 56.1 | 57.5 | 57.8 | 53.0 |
| 176 | 2018/05/09 11:29:15 | 54.5 | 54.3 | 53.0 | 51.0 | 49.8 |
| 181 | 2018/05/09 11:29:20 | 50.0 | 52.6 | 57.5 | 53.7 | 54.5 |
| 186 | 2018/05/09 11:29:25 | 55.0 | 55.1 | 56.8 | 60.5 | 63.2 |
| 191 | 2018/05/09 11:29:30 | 68.5 | 71.7 | 75.2 | 74.6 | 72.8 |
| 196 | 2018/05/09 11:29:35 | 72.1 | 69.6 | 67.4 | 65.0 | 63.2 |
| 201 | 2018/05/09 11:29:40 | 60.3 | 60.8 | 62.4 | 62.4 | 63.5 |
| 206 | 2018/05/09 11:29:45 | 64.9 | 61.8 | 62.9 | 63.2 | 68.1 |
| 211 | 2018/05/09 11:29:50 | 70.0 | 72.2 | 72.0 | 70.0 | 62.7 |
| 216 | 2018/05/09 11:29:55 | 62.6 | 64.0 | 65.8 | 67.4 | 66.7 |
| 221 | 2018/05/09 11:30:00 | 65.9 | 65.7 | 61.6 | 58.3 | 58.3 |
| 226 | 2018/05/09 11:30:05 | 57.0 | 55.8 | 56.4 | 53.5 | 52.1 |
| 231 | 2018/05/09 11:30:10 | 51.5 | 52.7 | 53.3 | 53.8 | 54.9 |
| 236 | 2018/05/09 11:30:15 | 57.8 | 61.3 | 64.2 | 66.7 | 64.1 |
| 241 | 2018/05/09 11:30:20 | 61.6 | 56.8 | 53.4 | 49.8 | 48.7 |
| 246 | 2018/05/09 11:30:25 | 48.2 | 49.9 | 48.4 | 52.0 | 49.3 |
| 251 | 2018/05/09 11:30:30 | 48.6 | 47.5 | 48.1 | 51.1 | 52.5 |
| 256 | 2018/05/09 11:30:35 | 53.8 | 57.4 | 60.1 | 64.5 | 66.0 |
| 261 | 2018/05/09 11:30:40 | 66.8 | 66.3 | 68.6 | 65.9 | 64.9 |
| 266 | 2018/05/09 11:30:45 | 65.3 | 68.9 | 68.2 | 70.0 | 68.7 |
| 271 | 2018/05/09 11:30:50 | 66.3 | 65.2 | 67.5 | 71.7 | 70.6 |
| 276 | 2018/05/09 11:30:55 | 70.7 | 67.0 | 61.5 | 61.2 | 58.6 |
| 281 | 2018/05/09 11:31:00 | 59.9 | 62.7 | 65.2 | 70.0 | 74.6 |
| 286 | 2018/05/09 11:31:05 | 77.1 | 70.3 | 67.6 | 67.5 | 69.5 |
| 291 | 2018/05/09 11:31:10 | 70.1 | 69.6 | 67.9 | 65.0 | 64.8 |
| 296 | 2018/05/09 11:31:15 | 64.9 | 66.9 | 66.6 | 66.6 | 65.7 |
| 301 | 2018/05/09 11:31:20 | 63.8 | 63.6 | 62.1 | 59.9 | 62.8 |
| 306 | 2018/05/09 11:31:25 | 64.2 | 67.8 | 65.5 | 64.3 | 66.9 |
| 311 | 2018/05/09 11:31:30 | 61.5 | 58.5 | 57.1 | 55.5 | 58.7 |
| 316 | 2018/05/09 11:31:35 | 60.4 | 60.2 | 63.8 | 61.0 | 55.0 |
| 321 | 2018/05/09 11:31:40 | 55.4 | 55.2 | 55.7 | 58.2 | 64.0 |
| 326 | 2018/05/09 11:31:45 | 68.3 | 71.0 | 66.6 | 62.3 | 56.1 |
| 331 | 2018/05/09 11:31:50 | 53.0 | 52.4 | 53.1 | 54.1 | 55.8 |
| 336 | 2018/05/09 11:31:55 | 59.0 | 63.9 | 67.2 | 67.5 | 66.4 |
| 341 | 2018/05/09 11:32:00 | 62.8 | 63.0 | 64.6 | 69.4 | 67.7 |
| 346 | 2018/05/09 11:32:05 | 66.6 | 68.0 | 67.9 | 69.8 | 68.7 |
| 351 | 2018/05/09 11:32:10 | 70.5 | 71.9 | 69.0 | 66.0 | 64.5 |
| 356 | 2018/05/09 11:32:15 | 65.1 | 64.9 | 64.5 | 63.4 | 68.5 |
| 361 | 2018/05/09 11:32:20 | 68.8 | 70.7 | 70.7 | 68.3 | 66.5 |
| 366 | 2018/05/09 11:32:25 | 64.4 | 64.8 | 66.0 | 58.8 | 56.5 |
| 371 | 2018/05/09 11:32:30 | 53.9 | 50.3 | 49.7 | 57.0 | 50.0 |
| 376 | 2018/05/09 11:32:35 | 51.5 | 53.0 | 55.6 | 61.8 | 63.0 |
| 381 | 2018/05/09 11:32:40 | 63.7 | 65.4 | 63.1 | 66.9 | 69.2 |
| 386 | 2018/05/09 11:32:45 | 67.9 | 65.5 | 64.2 | 62.4 | 64.2 |
| 391 | 2018/05/09 11:32:50 | 67.2 | 64.5 | 61.5 | 63.8 | 66.5 |
| 396 | 2018/05/09 11:32:55 | 65.4 | 61.5 | 56.3 | 55.0 | 57.8 |
| 401 | 2018/05/09 11:33:00 | 64.1 | 67.0 | 64.9 | 60.2 | 55.7 |
| 406 | 2018/05/09 11:33:05 | 52.0 | 52.2 | 55.1 | 57.8 | 60.3 |
| 411 | 2018/05/09 11:33:10 | 67.2 | 69.2 | 67.1 | 64.6 | 66.1 |
| 416 | 2018/05/09 11:33:15 | 64.0 | 62.3 | 63.5 | 64.0 | 64.0 |
| 421 | 2018/05/09 11:33:20 | 62.6 | 63.5 | 65.3 | 65.5 | 64.9 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 426 | 2018/05/09 11:33:25 | 65.8 | 68.2 | 70.5 | 72.0 | 73.7 |
| 431 | 2018/05/09 11:33:30 | 76.0 | 76.5 | 75.6 | 73.0 | 68.0 |
| 436 | 2018/05/09 11:33:35 | 66.3 | 63.4 | 62.1 | 63.8 | 69.3 |
| 441 | 2018/05/09 11:33:40 | 73.0 | 71.0 | 68.3 | 61.6 | 59.3 |
| 446 | 2018/05/09 11:33:45 | 61.0 | 65.2 | 71.6 | 70.7 | 66.8 |
| 451 | 2018/05/09 11:33:50 | 63.3 | 64.4 | 65.0 | 67.5 | 64.3 |
| 456 | 2018/05/09 11:33:55 | 63.8 | 63.7 | 65.9 | 60.5 | 58.1 |
| 461 | 2018/05/09 11:34:00 | 62.6 | 65.8 | 71.7 | 75.3 | 72.8 |
| 466 | 2018/05/09 11:34:05 | 71.0 | 70.0 | 74.5 | 76.6 | 78.6 |
| 471 | 2018/05/09 11:34:10 | 80.5 | 80.2 | 82.7 | 81.9 | 83.7 |
| 476 | 2018/05/09 11:34:15 | 82.2 | 80.7 | 74.8 | 71.6 | 67.8 |
| 481 | 2018/05/09 11:34:20 | 66.6 | 64.3 | 61.9 | 60.8 | 59.0 |
| 486 | 2018/05/09 11:34:25 | 56.6 | 55.0 | 54.4 | 54.4 | 53.0 |
| 491 | 2018/05/09 11:34:30 | 51.3 | 50.7 | 50.1 | 48.9 | 49.4 |
| 496 | 2018/05/09 11:34:35 | 49.7 | 52.7 | 51.4 | 52.3 | 53.9 |
| 501 | 2018/05/09 11:34:40 | 51.2 | 53.7 | 56.8 | 57.3 | 61.4 |
| 506 | 2018/05/09 11:34:45 | 63.8 | 67.7 | 71.3 | 71.4 | 70.6 |
| 511 | 2018/05/09 11:34:50 | 71.4 | 71.3 | 67.8 | 64.3 | 66.5 |
| 516 | 2018/05/09 11:34:55 | 66.0 | 70.9 | 71.4 | 67.3 | 63.8 |
| 521 | 2018/05/09 11:35:00 | 65.8 | 67.4 | 69.0 | 66.0 | 62.7 |
| 526 | 2018/05/09 11:35:05 | 64.0 | 67.4 | 69.6 | 69.7 | 70.9 |
| 531 | 2018/05/09 11:35:10 | 71.2 | 73.0 | 70.8 | 69.2 | 72.5 |
| 536 | 2018/05/09 11:35:15 | 73.9 | 71.1 | 66.1 | 59.2 | 58.0 |
| 541 | 2018/05/09 11:35:20 | 57.1 | 59.1 | 62.3 | 65.4 | 68.5 |
| 546 | 2018/05/09 11:35:25 | 69.2 | 69.6 | 63.5 | 58.8 | 56.2 |
| 551 | 2018/05/09 11:35:30 | 52.8 | 51.8 | 52.3 | 54.3 | 56.3 |
| 556 | 2018/05/09 11:35:35 | 61.7 | 64.8 | 66.5 | 63.9 | 61.9 |
| 561 | 2018/05/09 11:35:40 | 62.9 | 64.2 | 66.6 | 68.6 | 64.0 |
| 566 | 2018/05/09 11:35:45 | 65.8 | 67.2 | 69.2 | 70.1 | 68.1 |
| 571 | 2018/05/09 11:35:50 | 69.2 | 69.0 | 70.5 | 73.1 | 72.3 |
| 576 | 2018/05/09 11:35:55 | 69.1 | 61.6 | 59.7 | 55.7 | 53.7 |
| 581 | 2018/05/09 11:36:00 | 53.0 | 51.2 | 50.8 | 51.3 | 53.0 |
| 586 | 2018/05/09 11:36:05 | 55.2 | 55.1 | 56.6 | 56.6 | 54.2 |
| 591 | 2018/05/09 11:36:10 | 55.1 | 57.3 | 61.9 | 66.4 | 67.7 |
| 596 | 2018/05/09 11:36:15 | 64.3 | 58.9 | 58.2 | 60.4 | 65.7 |
| 601 | 2018/05/09 11:36:20 | 70.5 | 67.0 | 62.9 | 58.7 | 58.0 |
| 606 | 2018/05/09 11:36:25 | 56.9 | 60.4 | 65.3 | 68.0 | 69.8 |
| 611 | 2018/05/09 11:36:30 | 70.5 | 72.4 | 71.3 | 67.7 | 65.9 |
| 616 | 2018/05/09 11:36:35 | 69.2 | 70.9 | 71.2 | 76.1 | 74.4 |
| 621 | 2018/05/09 11:36:40 | 67.2 | 61.8 | 61.3 | 60.6 | 63.5 |
| 626 | 2018/05/09 11:36:45 | 67.6 | 70.5 | 69.1 | 63.2 | 59.2 |
| 631 | 2018/05/09 11:36:50 | 54.8 | 55.0 | 55.0 | 56.5 | 57.9 |
| 636 | 2018/05/09 11:36:55 | 62.9 | 69.1 | 72.1 | 69.8 | 65.2 |
| 641 | 2018/05/09 11:37:00 | 65.8 | 66.4 | 64.5 | 60.1 | 56.1 |
| 646 | 2018/05/09 11:37:05 | 57.0 | 58.7 | 60.4 | 67.5 | 70.3 |
| 651 | 2018/05/09 11:37:10 | 74.6 | 70.3 | 63.0 | 63.1 | 66.8 |
| 656 | 2018/05/09 11:37:15 | 69.2 | 64.0 | 58.6 | 57.9 | 61.3 |
| 661 | 2018/05/09 11:37:20 | 66.2 | 68.5 | 74.1 | 73.9 | 68.4 |
| 666 | 2018/05/09 11:37:25 | 63.4 | 68.3 | 71.8 | 69.3 | 70.8 |
| 671 | 2018/05/09 11:37:30 | 73.2 | 67.1 | 71.0 | 67.6 | 67.0 |
| 676 | 2018/05/09 11:37:35 | 65.6 | 65.3 | 61.8 | 62.6 | 63.9 |
| 681 | 2018/05/09 11:37:40 | 67.3 | 70.0 | 69.3 | 67.1 | 69.4 |
| 686 | 2018/05/09 11:37:45 | 70.7 | 69.7 | 67.3 | 62.1 | 60.4 |
| 691 | 2018/05/09 11:37:50 | 57.4 | 57.8 | 61.8 | 63.5 | 64.8 |
| 696 | 2018/05/09 11:37:55 | 64.3 | 68.2 | 67.1 | 67.1 | 66.6 |
| 701 | 2018/05/09 11:38:00 | 59.9 | 57.9 | 55.4 | 55.5 | 56.6 |
| 706 | 2018/05/09 11:38:05 | 57.2 | 63.2 | 68.1 | 68.5 | 63.9 |
| 711 | 2018/05/09 11:38:10 | 59.2 | 54.1 | 52.4 | 49.9 | 54.4 |
| 716 | 2018/05/09 11:38:15 | 52.8 | 56.4 | 59.1 | 61.7 | 65.2 |
| 721 | 2018/05/09 11:38:20 | 69.8 | 71.3 | 67.7 | 61.4 | 57.7 |
| 726 | 2018/05/09 11:38:25 | 57.1 | 55.0 | 54.3 | 51.9 | 54.2 |
| 731 | 2018/05/09 11:38:30 | 54.0 | 54.1 | 55.2 | 59.5 | 67.2 |
| 736 | 2018/05/09 11:38:35 | 70.3 | 67.5 | 62.4 | 57.9 | 54.2 |
| 741 | 2018/05/09 11:38:40 | 55.0 | 58.9 | 61.6 | 66.9 | 67.5 |
| 746 | 2018/05/09 11:38:45 | 69.7 | 66.6 | 65.6 | 65.3 | 66.3 |
| 751 | 2018/05/09 11:38:50 | 59.2 | 60.3 | 60.1 | 63.8 | 65.7 |
| 756 | 2018/05/09 11:38:55 | 66.9 | 67.3 | 59.6 | 59.4 | 56.6 |
| 761 | 2018/05/09 11:39:00 | 56.4 | 58.5 | 60.3 | 66.8 | 71.4 |
| 766 | 2018/05/09 11:39:05 | 69.9 | 64.6 | 58.4 | 54.6 | 52.7 |
| 771 | 2018/05/09 11:39:10 | 51.9 | 52.6 | 53.7 | 54.8 | 58.8 |
| 776 | 2018/05/09 11:39:15 | 59.8 | 63.9 | 65.2 | 68.5 | 63.7 |
| 781 | 2018/05/09 11:39:20 | 58.8 | 56.2 | 56.2 | 56.9 | 57.0 |
| 786 | 2018/05/09 11:39:25 | 58.2 | 64.2 | 68.6 | 67.1 | 63.1 |
| 791 | 2018/05/09 11:39:30 | 57.9 | 52.9 | 53.1 | 54.5 | 53.8 |
| 796 | 2018/05/09 11:39:35 | 55.7 | 58.7 | 62.6 | 68.5 | 69.0 |
| 801 | 2018/05/09 11:39:40 | 66.6 | 66.9 | 69.2 | 65.1 | 60.8 |
| 806 | 2018/05/09 11:39:45 | 56.0 | 53.4 | 57.3 | 57.8 | 62.3 |
| 811 | 2018/05/09 11:39:50 | 69.1 | 72.7 | 69.4 | 62.0 | 54.8 |
| 816 | 2018/05/09 11:39:55 | 51.0 | 49.1 | 47.5 | 45.8 | 48.8 |
| 821 | 2018/05/09 11:40:00 | 52.1 | 50.0 | 56.7 | 53.9 | 56.4 |
| 826 | 2018/05/09 11:40:05 | 59.6 | 62.3 | 65.6 | 66.2 | 66.0 |
| 831 | 2018/05/09 11:40:10 | 66.4 | 68.1 | 68.5 | 69.5 | 69.4 |
| 836 | 2018/05/09 11:40:15 | 69.8 | 69.3 | 67.6 | 68.1 | 64.8 |
| 841 | 2018/05/09 11:40:20 | 65.7 | 64.6 | 60.3 | 56.8 | 54.7 |
| 846 | 2018/05/09 11:40:25 | 52.7 | 52.6 | 52.4 | 55.3 | 58.6 |
| 851 | 2018/05/09 11:40:30 | 59.8 | 65.7 | 68.8 | 71.4 | 67.5 |
| 856 | 2018/05/09 11:40:35 | 66.1 | 67.8 | 67.1 | 65.3 | 64.3 |
| 861 | 2018/05/09 11:40:40 | 64.6 | 62.6 | 65.1 | 71.8 | 73.5 |
| 866 | 2018/05/09 11:40:45 | 68.4 | 62.3 | 57.6 | 56.7 | 55.1 |
| 871 | 2018/05/09 11:40:50 | 54.7 | 53.7 | 52.7 | 53.0 | 52.6 |
| 876 | 2018/05/09 11:40:55 | 53.2 | 56.2 | 58.3 | 61.3 | 66.2 |
| 881 | 2018/05/09 11:41:00 | 71.7 | 77.8 | 75.1 | 78.6 | 81.5 |
| 886 | 2018/05/09 11:41:05 | 79.3 | 73.3 | 69.3 | 64.3 | 62.3 |
| 891 | 2018/05/09 11:41:10 | 61.2 | 61.9 | 59.6 | 58.8 | 59.3 |
| 896 | 2018/05/09 11:41:15 | 66.8 | 70.6 | 71.3 | 71.6 | 68.8 |

-
Freq Weight : A
-
Time Weight : SLOW
-
Level Range : 40-100
-
Max dB : 84.2 - 2018/05/09 16:59:19
-
Level Range : 40-100
-
SEL : 93.6
-
Leq : 64.1
-

Noise Measurement 7

| No.s | Date Time | (dB) | | | | |
|---|---|---|---|---|---|---|
| 1 | 2018/05/09 16:51:45 | 72.1 | 68.1 | 64.7 | 62.3 | 60.8 |
| 6 | 2018/05/09 16:51:50 | 62.5 | 65.0 | 66.2 | 63.8 | 63.5 |
| 11 | 2018/05/09 16:51:55 | 63.9 | 62.8 | 60.7 | 59.7 | 58.4 |
| 16 | 2018/05/09 16:52:00 | 60.1 | 63.4 | 62.9 | 61.7 | 61.6 |
| 21 | 2018/05/09 16:52:05 | 60.6 | 59.5 | 59.0 | 59.4 | 60.4 |
| 26 | 2018/05/09 16:52:10 | 61.7 | 62.4 | 63.9 | 64.4 | 63.4 |
| 31 | 2018/05/09 16:52:15 | 62.8 | 61.8 | 60.4 | 59.7 | 60.1 |
| 36 | 2018/05/09 16:52:20 | 59.7 | 60.5 | 59.4 | 58.7 | 57.6 |
| 41 | 2018/05/09 16:52:25 | 57.0 | 56.8 | 56.1 | 55.9 | 55.5 |
| 46 | 2018/05/09 16:52:30 | 56.0 | 58.5 | 61.8 | 63.6 | 62.5 |
| 51 | 2018/05/09 16:52:35 | 61.0 | 62.1 | 61.8 | 61.0 | 59.8 |
| 56 | 2018/05/09 16:52:40 | 59.3 | 59.1 | 60.4 | 59.9 | 59.6 |
| 61 | 2018/05/09 16:52:45 | 58.3 | 57.4 | 56.7 | 56.7 | 56.3 |
| 66 | 2018/05/09 16:52:50 | 55.8 | 55.1 | 55.3 | 55.8 | 57.0 |
| 71 | 2018/05/09 16:52:55 | 57.9 | 59.9 | 61.3 | 61.4 | 64.0 |
| 76 | 2018/05/09 16:53:00 | 67.3 | 68.1 | 66.9 | 66.2 | 66.9 |
| 81 | 2018/05/09 16:53:05 | 71.1 | 73.4 | 71.7 | 68.6 | 66.7 |
| 86 | 2018/05/09 16:53:10 | 65.2 | 62.6 | 61.1 | 59.4 | 57.7 |
| 91 | 2018/05/09 16:53:15 | 56.9 | 57.2 | 62.0 | 65.2 | 65.3 |
| 96 | 2018/05/09 16:53:20 | 63.7 | 64.8 | 67.8 | 67.7 | 65.3 |
| 101 | 2018/05/09 16:53:25 | 63.6 | 63.9 | 64.2 | 64.4 | 62.4 |
| 106 | 2018/05/09 16:53:30 | 61.2 | 60.5 | 59.5 | 59.0 | 59.7 |
| 111 | 2018/05/09 16:53:35 | 61.1 | 62.5 | 62.6 | 61.3 | 60.8 |
| 116 | 2018/05/09 16:53:40 | 60.5 | 59.3 | 57.3 | 56.6 | 56.6 |
| 121 | 2018/05/09 16:53:45 | 56.9 | 58.2 | 57.1 | 56.2 | 56.0 |
| 126 | 2018/05/09 16:53:50 | 56.1 | 56.5 | 57.6 | 61.6 | 66.4 |
| 131 | 2018/05/09 16:53:55 | 66.4 | 66.0 | 64.6 | 64.0 | 62.3 |
| 136 | 2018/05/09 16:54:00 | 60.9 | 59.5 | 61.6 | 65.6 | 66.3 |
| 141 | 2018/05/09 16:54:05 | 63.9 | 62.8 | 63.0 | 61.5 | 60.6 |
| 146 | 2018/05/09 16:54:10 | 59.0 | 57.8 | 56.6 | 56.7 | 56.8 |
| 151 | 2018/05/09 16:54:15 | 57.6 | 57.5 | 58.7 | 59.4 | 59.7 |
| 156 | 2018/05/09 16:54:20 | 62.0 | 64.6 | 67.5 | 66.6 | 65.7 |
| 161 | 2018/05/09 16:54:25 | 64.3 | 63.7 | 61.9 | 60.5 | 59.6 |
| 166 | 2018/05/09 16:54:30 | 60.8 | 63.0 | 64.1 | 63.1 | 62.1 |
| 171 | 2018/05/09 16:54:35 | 63.4 | 62.8 | 62.9 | 62.1 | 60.6 |
| 176 | 2018/05/09 16:54:40 | 59.4 | 57.8 | 57.1 | 56.8 | 57.2 |
| 181 | 2018/05/09 16:54:45 | 57.6 | 59.7 | 62.1 | 64.5 | 64.7 |
| 186 | 2018/05/09 16:54:50 | 64.9 | 63.4 | 62.9 | 63.6 | 62.9 |
| 191 | 2018/05/09 16:54:55 | 60.8 | 59.1 | 57.9 | 56.8 | 56.1 |
| 196 | 2018/05/09 16:55:00 | 54.9 | 53.5 | 52.6 | 52.5 | 53.6 |
| 201 | 2018/05/09 16:55:05 | 54.3 | 54.2 | 55.6 | 56.7 | 58.4 |
| 206 | 2018/05/09 16:55:10 | 60.1 | 61.6 | 61.3 | 59.5 | 58.4 |
| 211 | 2018/05/09 16:55:15 | 58.4 | 58.2 | 57.6 | 57.6 | 57.4 |
| 216 | 2018/05/09 16:55:20 | 58.1 | 58.5 | 57.6 | 57.1 | 58.5 |
| 221 | 2018/05/09 16:55:25 | 58.5 | 59.9 | 60.8 | 62.4 | 59.6 |
| 226 | 2018/05/09 16:55:30 | 57.1 | 56.0 | 56.0 | 55.5 | 55.7 |
| 231 | 2018/05/09 16:55:35 | 56.1 | 55.6 | 56.1 | 57.7 | 63.3 |
| 236 | 2018/05/09 16:55:40 | 61.5 | 60.4 | 61.2 | 59.7 | 58.1 |
| 241 | 2018/05/09 16:55:45 | 58.6 | 58.3 | 58.5 | 58.8 | 58.3 |
| 246 | 2018/05/09 16:55:50 | 59.5 | 62.5 | 64.7 | 63.4 | 61.7 |
| 251 | 2018/05/09 16:55:55 | 61.6 | 62.0 | 60.5 | 59.7 | 60.3 |
| 256 | 2018/05/09 16:56:00 | 60.8 | 59.9 | 58.9 | 57.7 | 57.3 |
| 261 | 2018/05/09 16:56:05 | 58.1 | 62.6 | 66.6 | 66.6 | 64.8 |
| 266 | 2018/05/09 16:56:10 | 65.2 | 66.1 | 64.8 | 62.4 | 60.9 |
| 271 | 2018/05/09 16:56:15 | 60.1 | 59.9 | 59.4 | 61.1 | 61.7 |
| 276 | 2018/05/09 16:56:20 | 61.4 | 60.4 | 58.9 | 57.6 | 56.9 |
| 281 | 2018/05/09 16:56:25 | 56.8 | 61.1 | 63.3 | 63.2 | 63.5 |
| 286 | 2018/05/09 16:56:30 | 63.2 | 63.6 | 64.5 | 69.7 | 70.8 |
| 291 | 2018/05/09 16:56:35 | 71.6 | 69.5 | 67.8 | 64.9 | 62.3 |
| 296 | 2018/05/09 16:56:40 | 61.5 | 62.5 | 67.7 | 68.2 | 71.0 |
| 301 | 2018/05/09 16:56:45 | 70.6 | 69.6 | 68.4 | 67.0 | 64.8 |
| 306 | 2018/05/09 16:56:50 | 62.6 | 60.5 | 59.0 | 58.0 | 58.8 |
| 311 | 2018/05/09 16:56:55 | 61.3 | 62.5 | 63.2 | 62.0 | 63.2 |
| 316 | 2018/05/09 16:57:00 | 64.9 | 63.6 | 61.5 | 59.7 | 58.4 |
| 321 | 2018/05/09 16:57:05 | 58.1 | 57.7 | 56.1 | 54.6 | 54.0 |
| 326 | 2018/05/09 16:57:10 | 54.3 | 56.4 | 57.2 | 59.4 | 59.4 |
| 331 | 2018/05/09 16:57:15 | 58.2 | 57.2 | 55.7 | 54.6 | 54.7 |
| 336 | 2018/05/09 16:57:20 | 57.0 | 58.6 | 61.2 | 60.2 | 59.4 |
| 341 | 2018/05/09 16:57:25 | 58.6 | 58.5 | 59.8 | 59.5 | 59.0 |
| 346 | 2018/05/09 16:57:30 | 58.4 | 58.1 | 59.0 | 58.5 | 58.9 |
| 351 | 2018/05/09 16:57:35 | 58.9 | 60.8 | 60.1 | 62.4 | 64.0 |
| 356 | 2018/05/09 16:57:40 | 66.0 | 66.3 | 66.8 | 67.4 | 66.6 |
| 361 | 2018/05/09 16:57:45 | 64.5 | 61.9 | 59.3 | 57.3 | 56.8 |
| 366 | 2018/05/09 16:57:50 | 57.6 | 57.6 | 57.6 | 57.7 | 57.0 |
| 371 | 2018/05/09 16:57:55 | 56.3 | 56.6 | 57.6 | 59.8 | 62.7 |
| 376 | 2018/05/09 16:58:00 | 66.4 | 67.6 | 65.5 | 63.7 | 65.2 |
| 381 | 2018/05/09 16:58:05 | 67.7 | 66.9 | 64.7 | 65.1 | 63.8 |
| 386 | 2018/05/09 16:58:10 | 62.4 | 61.6 | 59.7 | 57.9 | 56.8 |
| 391 | 2018/05/09 16:58:15 | 55.4 | 55.8 | 55.3 | 54.9 | 56.1 |
| 396 | 2018/05/09 16:58:20 | 55.8 | 57.6 | 56.9 | 56.7 | 56.9 |
| 401 | 2018/05/09 16:58:25 | 57.6 | 57.5 | 58.8 | 58.5 | 58.1 |
| 406 | 2018/05/09 16:58:30 | 56.8 | 57.9 | 59.2 | 61.5 | 60.3 |
| 411 | 2018/05/09 16:58:35 | 58.6 | 57.8 | 61.8 | 65.3 | 71.9 |
| 416 | 2018/05/09 16:58:40 | 72.2 | 69.4 | 69.5 | 68.5 | 68.5 |
| 421 | 2018/05/09 16:58:45 | 66.5 | 63.9 | 61.6 | 61.4 | 64.3 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 426 | 2018/05/09 16:58:50 | 67.0 | 65.1 | 63.1 | 62.9 | 62.0 |
| 431 | 2018/05/09 16:58:55 | 60.5 | 58.4 | 57.9 | 58.4 | 58.6 |
| 436 | 2018/05/09 16:59:00 | 58.4 | 58.1 | 57.3 | 57.5 | 57.3 |
| 441 | 2018/05/09 16:59:05 | 57.8 | 57.5 | 56.9 | 59.8 | 59.2 |
| 446 | 2018/05/09 16:59:10 | 58.0 | 57.9 | 58.6 | 61.0 | 61.8 |
| 451 | 2018/05/09 16:59:15 | 65.9 | 72.8 | 73.8 | 81.0 | 83.5 |
| 456 | 2018/05/09 16:59:20 | 81.6 | 79.2 | 75.4 | 71.8 | 68.7 |
| 461 | 2018/05/09 16:59:25 | 66.3 | 63.5 | 61.6 | 61.1 | 61.0 |
| 466 | 2018/05/09 16:59:30 | 60.2 | 60.8 | 63.9 | 66.1 | 64.3 |
| 471 | 2018/05/09 16:59:35 | 63.1 | 63.4 | 62.9 | 61.7 | 60.3 |
| 476 | 2018/05/09 16:59:40 | 59.7 | 60.7 | 61.2 | 62.2 | 62.1 |
| 481 | 2018/05/09 16:59:45 | 62.9 | 62.9 | 61.1 | 59.0 | 57.7 |
| 486 | 2018/05/09 16:59:50 | 57.6 | 57.6 | 57.2 | 56.3 | 55.5 |
| 491 | 2018/05/09 16:59:55 | 56.7 | 56.7 | 58.4 | 59.4 | 58.7 |
| 496 | 2018/05/09 17:00:00 | 57.2 | 55.8 | 55.0 | 55.2 | 56.1 |
| 501 | 2018/05/09 17:00:05 | 56.7 | 57.4 | 58.2 | 57.7 | 57.8 |
| 506 | 2018/05/09 17:00:10 | 57.6 | 57.8 | 60.0 | 59.2 | 60.5 |
| 511 | 2018/05/09 17:00:15 | 60.9 | 63.1 | 62.7 | 61.6 | 61.0 |
| 516 | 2018/05/09 17:00:20 | 59.9 | 57.7 | 57.0 | 56.7 | 56.8 |
| 521 | 2018/05/09 17:00:25 | 56.9 | 57.6 | 57.2 | 56.5 | 55.5 |
| 526 | 2018/05/09 17:00:30 | 54.8 | 54.3 | 54.2 | 53.8 | 55.1 |
| 531 | 2018/05/09 17:00:35 | 57.0 | 57.9 | 59.6 | 61.0 | 60.2 |
| 536 | 2018/05/09 17:00:40 | 59.3 | 59.0 | 57.4 | 56.2 | 55.7 |
| 541 | 2018/05/09 17:00:45 | 56.5 | 61.4 | 63.1 | 64.3 | 65.2 |
| 546 | 2018/05/09 17:00:50 | 64.8 | 64.4 | 65.1 | 65.5 | 64.9 |
| 551 | 2018/05/09 17:00:55 | 63.2 | 62.4 | 61.5 | 59.8 | 58.2 |
| 556 | 2018/05/09 17:01:00 | 57.8 | 57.5 | 57.1 | 57.8 | 58.2 |
| 561 | 2018/05/09 17:01:05 | 58.3 | 57.5 | 58.4 | 58.5 | 59.9 |
| 566 | 2018/05/09 17:01:10 | 60.1 | 60.4 | 60.4 | 61.8 | 63.5 |
| 571 | 2018/05/09 17:01:15 | 64.1 | 64.0 | 63.0 | 63.1 | 61.8 |
| 576 | 2018/05/09 17:01:20 | 61.6 | 61.7 | 62.6 | 64.1 | 64.6 |
| 581 | 2018/05/09 17:01:25 | 63.3 | 60.7 | 59.0 | 59.1 | 58.3 |
| 586 | 2018/05/09 17:01:30 | 56.2 | 55.1 | 54.7 | 54.7 | 54.9 |
| 591 | 2018/05/09 17:01:35 | 56.8 | 61.9 | 67.3 | 67.5 | 64.9 |
| 596 | 2018/05/09 17:01:40 | 63.6 | 63.3 | 61.5 | 59.6 | 61.6 |
| 601 | 2018/05/09 17:01:45 | 61.8 | 62.4 | 62.4 | 61.7 | 60.8 |
| 606 | 2018/05/09 17:01:50 | 60.2 | 60.1 | 59.9 | 58.7 | 58.5 |
| 611 | 2018/05/09 17:01:55 | 58.7 | 59.8 | 59.4 | 58.4 | 57.7 |
| 616 | 2018/05/09 17:02:00 | 57.7 | 59.4 | 63.8 | 66.2 | 67.0 |
| 621 | 2018/05/09 17:02:05 | 67.4 | 65.1 | 63.8 | 64.6 | 65.7 |
| 626 | 2018/05/09 17:02:10 | 64.2 | 63.3 | 64.2 | 64.2 | 63.0 |
| 631 | 2018/05/09 17:02:15 | 61.7 | 60.6 | 60.2 | 58.4 | 58.0 |
| 636 | 2018/05/09 17:02:20 | 57.0 | 57.0 | 59.7 | 62.2 | 63.0 |
| 641 | 2018/05/09 17:02:25 | 61.8 | 60.2 | 59.9 | 59.3 | 59.1 |
| 646 | 2018/05/09 17:02:30 | 58.0 | 57.8 | 57.9 | 57.2 | 57.4 |
| 651 | 2018/05/09 17:02:35 | 59.3 | 64.3 | 67.2 | 65.1 | 63.2 |
| 656 | 2018/05/09 17:02:40 | 62.8 | 63.5 | 65.1 | 63.9 | 61.5 |
| 661 | 2018/05/09 17:02:45 | 59.9 | 57.6 | 57.8 | 56.6 | 55.6 |
| 666 | 2018/05/09 17:02:50 | 54.9 | 54.5 | 54.1 | 54.2 | 54.5 |
| 671 | 2018/05/09 17:02:55 | 54.8 | 55.3 | 58.3 | 61.1 | 61.9 |
| 676 | 2018/05/09 17:03:00 | 59.5 | 57.7 | 58.0 | 58.7 | 60.3 |
| 681 | 2018/05/09 17:03:05 | 61.8 | 62.8 | 66.9 | 70.4 | 71.5 |
| 686 | 2018/05/09 17:03:10 | 68.4 | 65.6 | 63.9 | 62.1 | 61.9 |
| 691 | 2018/05/09 17:03:15 | 62.9 | 64.6 | 63.5 | 64.1 | 67.7 |
| 696 | 2018/05/09 17:03:20 | 67.6 | 65.5 | 65.5 | 65.0 | 63.8 |
| 701 | 2018/05/09 17:03:25 | 62.1 | 60.5 | 59.5 | 58.8 | 57.8 |
| 706 | 2018/05/09 17:03:30 | 56.7 | 56.4 | 55.3 | 55.3 | 55.7 |
| 711 | 2018/05/09 17:03:35 | 56.4 | 57.5 | 58.7 | 59.0 | 58.0 |
| 716 | 2018/05/09 17:03:40 | 58.4 | 61.1 | 62.8 | 62.1 | 61.2 |
| 721 | 2018/05/09 17:03:45 | 62.4 | 62.5 | 61.1 | 59.5 | 58.4 |
| 726 | 2018/05/09 17:03:50 | 58.2 | 59.2 | 59.0 | 58.8 | 57.9 |
| 731 | 2018/05/09 17:03:55 | 58.0 | 58.3 | 58.1 | 57.5 | 57.3 |
| 736 | 2018/05/09 17:04:00 | 58.3 | 61.1 | 63.6 | 65.6 | 63.8 |
| 741 | 2018/05/09 17:04:05 | 63.7 | 65.7 | 68.8 | 69.1 | 66.8 |
| 746 | 2018/05/09 17:04:10 | 65.0 | 64.1 | 63.1 | 62.3 | 61.9 |
| 751 | 2018/05/09 17:04:15 | 61.0 | 60.2 | 58.7 | 58.3 | 58.0 |
| 756 | 2018/05/09 17:04:20 | 59.5 | 62.0 | 63.2 | 63.2 | 63.4 |
| 761 | 2018/05/09 17:04:25 | 63.7 | 62.2 | 61.3 | 60.5 | 59.8 |
| 766 | 2018/05/09 17:04:30 | 59.5 | 59.6 | 59.0 | 58.0 | 56.7 |
| 771 | 2018/05/09 17:04:35 | 55.8 | 55.6 | 57.2 | 58.4 | 58.7 |
| 776 | 2018/05/09 17:04:40 | 59.0 | 60.2 | 61.7 | 64.0 | 65.0 |
| 781 | 2018/05/09 17:04:45 | 63.1 | 63.0 | 63.7 | 63.3 | 64.9 |
| 786 | 2018/05/09 17:04:50 | 65.7 | 65.7 | 63.6 | 63.2 | 63.8 |
| 791 | 2018/05/09 17:04:55 | 64.3 | 64.2 | 64.3 | 65.6 | 69.9 |
| 796 | 2018/05/09 17:05:00 | 71.0 | 70.6 | 71.1 | 69.3 | 68.1 |
| 801 | 2018/05/09 17:05:05 | 67.0 | 65.9 | 65.2 | 64.6 | 63.1 |
| 806 | 2018/05/09 17:05:10 | 62.1 | 60.7 | 59.8 | 59.3 | 59.2 |
| 811 | 2018/05/09 17:05:15 | 59.8 | 58.5 | 57.2 | 57.4 | 57.9 |
| 816 | 2018/05/09 17:05:20 | 57.4 | 57.2 | 58.5 | 59.9 | 60.6 |
| 821 | 2018/05/09 17:05:25 | 62.2 | 63.0 | 62.4 | 62.5 | 62.0 |
| 826 | 2018/05/09 17:05:30 | 61.4 | 60.0 | 59.1 | 57.9 | 56.6 |
| 831 | 2018/05/09 17:05:35 | 56.9 | 58.5 | 60.1 | 59.6 | 57.8 |
| 836 | 2018/05/09 17:05:40 | 58.7 | 58.0 | 57.8 | 57.4 | 57.3 |
| 841 | 2018/05/09 17:05:45 | 58.6 | 59.0 | 58.9 | 57.7 | 58.8 |
| 846 | 2018/05/09 17:05:50 | 61.1 | 63.4 | 64.6 | 64.7 | 62.6 |
| 851 | 2018/05/09 17:05:55 | 60.3 | 59.6 | 59.9 | 61.2 | 62.5 |
| 856 | 2018/05/09 17:06:00 | 65.4 | 65.2 | 65.0 | 64.5 | 62.5 |
| 861 | 2018/05/09 17:06:05 | 61.4 | 60.4 | 59.0 | 58.7 | 59.5 |
| 866 | 2018/05/09 17:06:10 | 67.5 | 69.4 | 68.4 | 68.3 | 67.0 |
| 871 | 2018/05/09 17:06:15 | 66.0 | 65.1 | 64.6 | 63.9 | 66.0 |
| 876 | 2018/05/09 17:06:20 | 64.4 | 64.4 | 62.7 | 60.7 | 60.4 |
| 881 | 2018/05/09 17:06:25 | 60.0 | 58.6 | 58.8 | 60.0 | 59.4 |
| 886 | 2018/05/09 17:06:30 | 59.0 | 60.1 | 61.8 | 63.0 | 65.9 |
| 891 | 2018/05/09 17:06:35 | 64.7 | 62.9 | 63.7 | 63.2 | 62.4 |
| 896 | 2018/05/09 17:06:40 | 63.9 | 65.5 | 65.5 | 64.0 | 63.8 |

Noise Measurement 8

- Freq Weight : A
- Time Weight : FAST
- Level Range : 40-100
- Max dB : 88.0 - 2018/05/09 16:28:57
- Level Range : 40-100
- SEL : 99.5
- Leq : 70.0
-

| No.s | Date Time | (dB) | | | | |
|---|---|---|---|---|---|---|
| 1 | 2018/05/09 16:23:54 | 76.4 | 68.6 | 66.0 | 63.7 | 62.4 |
| 6 | 2018/05/09 16:23:59 | 64.5 | 67.2 | 70.5 | 76.2 | 78.9 |
| 11 | 2018/05/09 16:24:04 | 80.2 | 71.8 | 69.1 | 69.4 | 75.6 |
| 16 | 2018/05/09 16:24:09 | 69.0 | 63.5 | 61.8 | 62.1 | 61.0 |
| 21 | 2018/05/09 16:24:14 | 65.1 | 69.7 | 74.1 | 72.2 | 67.9 |
| 26 | 2018/05/09 16:24:19 | 71.0 | 70.0 | 64.3 | 62.7 | 62.3 |
| 31 | 2018/05/09 16:24:24 | 63.2 | 70.0 | 73.8 | 72.2 | 71.9 |
| 36 | 2018/05/09 16:24:29 | 78.6 | 67.3 | 64.6 | 60.9 | 60.2 |
| 41 | 2018/05/09 16:24:34 | 59.8 | 60.7 | 63.4 | 67.2 | 72.7 |
| 46 | 2018/05/09 16:24:39 | 81.2 | 77.8 | 68.9 | 66.3 | 69.0 |
| 51 | 2018/05/09 16:24:44 | 69.3 | 72.3 | 73.8 | 75.4 | 74.9 |
| 56 | 2018/05/09 16:24:49 | 74.6 | 73.2 | 71.3 | 68.1 | 66.5 |
| 61 | 2018/05/09 16:24:54 | 63.5 | 62.4 | 61.5 | 61.6 | 62.1 |
| 66 | 2018/05/09 16:24:59 | 64.6 | 71.3 | 77.2 | 69.1 | 63.4 |
| 71 | 2018/05/09 16:25:04 | 60.7 | 60.6 | 59.1 | 58.4 | 59.0 |
| 76 | 2018/05/09 16:25:09 | 60.0 | 60.9 | 62.5 | 69.0 | 76.4 |
| 81 | 2018/05/09 16:25:14 | 76.4 | 68.4 | 62.0 | 62.3 | 63.7 |
| 86 | 2018/05/09 16:25:19 | 66.9 | 72.3 | 80.8 | 75.0 | 71.1 |
| 91 | 2018/05/09 16:25:24 | 75.2 | 67.6 | 63.8 | 63.7 | 63.9 |
| 96 | 2018/05/09 16:25:29 | 68.0 | 75.1 | 75.4 | 68.5 | 63.6 |
| 101 | 2018/05/09 16:25:34 | 59.6 | 60.3 | 60.7 | 62.4 | 64.8 |
| 106 | 2018/05/09 16:25:39 | 69.5 | 74.3 | 73.4 | 70.1 | 70.8 |
| 111 | 2018/05/09 16:25:44 | 76.5 | 74.9 | 67.8 | 61.7 | 63.0 |
| 116 | 2018/05/09 16:25:49 | 61.4 | 60.5 | 59.7 | 59.2 | 60.2 |
| 121 | 2018/05/09 16:25:54 | 60.6 | 60.9 | 61.0 | 61.4 | 64.1 |
| 126 | 2018/05/09 16:25:59 | 69.0 | 75.3 | 72.7 | 69.1 | 70.0 |
| 131 | 2018/05/09 16:26:04 | 69.9 | 67.2 | 66.9 | 72.3 | 75.1 |
| 136 | 2018/05/09 16:26:09 | 73.9 | 69.5 | 67.7 | 66.6 | 70.9 |
| 141 | 2018/05/09 16:26:14 | 78.5 | 73.4 | 65.9 | 61.9 | 61.6 |
| 146 | 2018/05/09 16:26:19 | 61.9 | 65.0 | 68.4 | 69.9 | 71.8 |
| 151 | 2018/05/09 16:26:24 | 69.0 | 65.1 | 66.6 | 70.6 | 68.7 |
| 156 | 2018/05/09 16:26:29 | 66.0 | 64.0 | 61.8 | 60.4 | 58.8 |
| 161 | 2018/05/09 16:26:34 | 59.5 | 58.2 | 57.7 | 58.0 | 59.7 |
| 166 | 2018/05/09 16:26:39 | 60.9 | 59.9 | 59.4 | 61.2 | 64.2 |
| 171 | 2018/05/09 16:26:44 | 68.9 | 74.6 | 72.1 | 66.5 | 60.6 |
| 176 | 2018/05/09 16:26:49 | 58.8 | 58.9 | 58.5 | 58.3 | 58.2 |
| 181 | 2018/05/09 16:26:54 | 58.8 | 58.6 | 60.6 | 63.1 | 66.2 |
| 186 | 2018/05/09 16:26:59 | 74.1 | 76.0 | 73.7 | 67.7 | 66.1 |
| 191 | 2018/05/09 16:27:04 | 69.4 | 72.4 | 71.7 | 69.9 | 71.6 |
| 196 | 2018/05/09 16:27:09 | 72.3 | 70.6 | 66.0 | 63.9 | 65.5 |
| 201 | 2018/05/09 16:27:14 | 70.6 | 74.0 | 69.4 | 64.3 | 61.4 |
| 206 | 2018/05/09 16:27:19 | 62.9 | 64.4 | 68.8 | 74.4 | 77.7 |
| 211 | 2018/05/09 16:27:24 | 71.0 | 64.3 | 65.8 | 69.3 | 70.1 |
| 216 | 2018/05/09 16:27:29 | 67.3 | 64.1 | 64.9 | 68.2 | 69.3 |
| 221 | 2018/05/09 16:27:34 | 66.4 | 63.6 | 65.7 | 68.1 | 67.8 |
| 226 | 2018/05/09 16:27:39 | 65.1 | 68.8 | 73.4 | 76.7 | 68.1 |
| 231 | 2018/05/09 16:27:44 | 67.2 | 68.9 | 67.6 | 65.0 | 65.0 |
| 236 | 2018/05/09 16:27:49 | 66.7 | 70.9 | 70.1 | 68.4 | 66.6 |
| 241 | 2018/05/09 16:27:54 | 68.8 | 75.7 | 74.6 | 66.2 | 62.4 |
| 246 | 2018/05/09 16:27:59 | 61.7 | 64.7 | 66.7 | 71.7 | 74.3 |
| 251 | 2018/05/09 16:28:04 | 74.1 | 80.2 | 69.2 | 64.9 | 62.2 |
| 256 | 2018/05/09 16:28:09 | 61.7 | 62.0 | 62.6 | 65.5 | 70.5 |
| 261 | 2018/05/09 16:28:14 | 75.3 | 70.0 | 64.5 | 66.5 | 69.7 |
| 266 | 2018/05/09 16:28:19 | 71.8 | 65.3 | 62.6 | 62.5 | 63.1 |
| 271 | 2018/05/09 16:28:24 | 61.5 | 61.0 | 59.6 | 66.8 | 71.1 |
| 276 | 2018/05/09 16:28:29 | 70.8 | 70.2 | 73.5 | 72.8 | 71.0 |
| 281 | 2018/05/09 16:28:34 | 68.7 | 67.9 | 68.2 | 69.0 | 73.9 |
| 286 | 2018/05/09 16:28:39 | 75.1 | 67.5 | 64.0 | 67.1 | 72.9 |
| 291 | 2018/05/09 16:28:44 | 75.3 | 67.5 | 67.0 | 70.7 | 73.2 |
| 296 | 2018/05/09 16:28:49 | 71.4 | 72.9 | 79.9 | 71.6 | 73.6 |
| 301 | 2018/05/09 16:28:54 | 74.0 | 79.7 | 74.9 | 85.3 | 69.8 |
| 306 | 2018/05/09 16:28:59 | 74.5 | 78.5 | 68.1 | 63.5 | 58.8 |
| 311 | 2018/05/09 16:29:04 | 57.2 | 56.7 | 55.6 | 56.2 | 56.0 |
| 316 | 2018/05/09 16:29:09 | 55.5 | 55.7 | 56.2 | 56.4 | 56.3 |
| 321 | 2018/05/09 16:29:14 | 55.9 | 56.7 | 57.3 | 60.0 | 62.1 |
| 326 | 2018/05/09 16:29:19 | 68.0 | 70.4 | 67.8 | 65.3 | 63.1 |
| 331 | 2018/05/09 16:29:24 | 60.4 | 60.5 | 58.8 | 57.5 | 57.8 |
| 336 | 2018/05/09 16:29:29 | 57.9 | 59.6 | 60.4 | 62.1 | 63.3 |
| 341 | 2018/05/09 16:29:34 | 66.3 | 69.6 | 75.6 | 75.1 | 73.1 |
| 346 | 2018/05/09 16:29:39 | 75.1 | 78.3 | 76.9 | 77.5 | 76.7 |
| 351 | 2018/05/09 16:29:44 | 79.4 | 75.0 | 72.8 | 71.8 | 70.8 |
| 356 | 2018/05/09 16:29:49 | 71.1 | 71.9 | 70.6 | 69.6 | 73.4 |
| 361 | 2018/05/09 16:29:54 | 76.7 | 71.7 | 66.7 | 64.5 | 63.8 |
| 366 | 2018/05/09 16:29:59 | 62.2 | 61.7 | 67.2 | 69.5 | 69.0 |
| 371 | 2018/05/09 16:30:04 | 66.6 | 63.7 | 63.3 | 61.5 | 60.9 |
| 376 | 2018/05/09 16:30:09 | 58.7 | 58.9 | 57.8 | 57.7 | 58.5 |
| 381 | 2018/05/09 16:30:14 | 57.8 | 57.1 | 57.7 | 56.7 | 57.0 |
| 386 | 2018/05/09 16:30:19 | 56.9 | 56.8 | 57.5 | 57.2 | 57.1 |
| 391 | 2018/05/09 16:30:24 | 56.8 | 56.0 | 56.3 | 56.8 | 58.3 |
| 396 | 2018/05/09 16:30:29 | 57.2 | 57.7 | 58.8 | 61.2 | 64.5 |
| 401 | 2018/05/09 16:30:34 | 67.6 | 74.4 | 77.3 | 66.2 | 60.8 |
| 406 | 2018/05/09 16:30:39 | 58.3 | 57.6 | 58.8 | 57.3 | 57.2 |
| 411 | 2018/05/09 16:30:44 | 57.3 | 57.9 | 60.2 | 65.3 | 72.1 |
| 416 | 2018/05/09 16:30:49 | 72.7 | 72.1 | 69.1 | 72.6 | 75.9 |
| 421 | 2018/05/09 16:30:54 | 68.4 | 69.3 | 71.4 | 74.5 | 74.3 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 426 | 2018/05/09 16:30:59 | 73.4 | 71.6 | 70.8 | 71.3 | 73.9 |
| 431 | 2018/05/09 16:31:04 | 72.6 | 69.4 | 68.4 | 73.2 | 80.4 |
| 436 | 2018/05/09 16:31:09 | 79.2 | 77.0 | 73.7 | 70.1 | 67.7 |
| 441 | 2018/05/09 16:31:14 | 63.6 | 63.7 | 65.0 | 64.9 | 62.2 |
| 446 | 2018/05/09 16:31:19 | 62.4 | 63.3 | 64.1 | 66.4 | 66.0 |
| 451 | 2018/05/09 16:31:24 | 68.1 | 73.1 | 77.7 | 69.2 | 64.2 |
| 456 | 2018/05/09 16:31:29 | 62.2 | 62.4 | 63.3 | 67.7 | 74.5 |
| 461 | 2018/05/09 16:31:34 | 71.3 | 65.4 | 61.3 | 59.8 | 60.5 |
| 466 | 2018/05/09 16:31:39 | 61.1 | 63.1 | 61.9 | 61.6 | 61.1 |
| 471 | 2018/05/09 16:31:44 | 61.3 | 64.2 | 66.0 | 66.7 | 71.0 |
| 476 | 2018/05/09 16:31:49 | 76.4 | 79.2 | 73.5 | 71.9 | 69.7 |
| 481 | 2018/05/09 16:31:54 | 67.6 | 64.7 | 64.5 | 64.9 | 62.2 |
| 486 | 2018/05/09 16:31:59 | 61.2 | 60.8 | 59.4 | 60.5 | 62.8 |
| 491 | 2018/05/09 16:32:04 | 66.4 | 70.2 | 76.1 | 77.0 | 73.8 |
| 496 | 2018/05/09 16:32:09 | 73.5 | 69.3 | 67.5 | 69.8 | 71.2 |
| 501 | 2018/05/09 16:32:14 | 68.0 | 65.3 | 63.9 | 63.7 | 65.0 |
| 506 | 2018/05/09 16:32:19 | 70.0 | 71.3 | 74.5 | 78.7 | 72.5 |
| 511 | 2018/05/09 16:32:24 | 68.0 | 67.3 | 70.1 | 76.1 | 76.1 |
| 516 | 2018/05/09 16:32:29 | 75.7 | 74.5 | 76.5 | 83.2 | 73.2 |
| 521 | 2018/05/09 16:32:34 | 74.1 | 77.3 | 82.6 | 74.0 | 72.8 |
| 526 | 2018/05/09 16:32:39 | 70.7 | 68.5 | 70.3 | 70.9 | 68.8 |
| 531 | 2018/05/09 16:32:44 | 69.6 | 76.7 | 75.7 | 66.9 | 64.2 |
| 536 | 2018/05/09 16:32:49 | 60.9 | 61.4 | 60.8 | 63.1 | 66.9 |
| 541 | 2018/05/09 16:32:54 | 72.8 | 75.0 | 65.8 | 68.2 | 71.5 |
| 546 | 2018/05/09 16:32:59 | 77.6 | 68.9 | 63.6 | 64.6 | 65.6 |
| 551 | 2018/05/09 16:33:04 | 67.2 | 69.1 | 65.3 | 62.6 | 59.1 |
| 556 | 2018/05/09 16:33:09 | 59.2 | 61.0 | 59.9 | 62.2 | 63.9 |
| 561 | 2018/05/09 16:33:14 | 70.9 | 73.3 | 69.4 | 61.8 | 60.1 |
| 566 | 2018/05/09 16:33:19 | 60.9 | 62.7 | 68.9 | 73.4 | 71.0 |
| 571 | 2018/05/09 16:33:24 | 66.2 | 67.7 | 70.3 | 74.6 | 73.5 |
| 576 | 2018/05/09 16:33:29 | 65.8 | 62.5 | 61.4 | 62.9 | 64.6 |
| 581 | 2018/05/09 16:33:34 | 68.1 | 74.4 | 77.5 | 76.1 | 75.7 |
| 586 | 2018/05/09 16:33:39 | 77.3 | 78.4 | 79.4 | 74.5 | 73.6 |
| 591 | 2018/05/09 16:33:44 | 71.2 | 70.6 | 71.4 | 71.8 | 72.9 |
| 596 | 2018/05/09 16:33:49 | 72.8 | 70.6 | 69.5 | 66.6 | 67.0 |
| 601 | 2018/05/09 16:33:54 | 66.7 | 72.0 | 76.9 | 72.9 | 72.3 |
| 606 | 2018/05/09 16:33:59 | 75.4 | 76.3 | 74.2 | 72.2 | 67.0 |
| 611 | 2018/05/09 16:34:04 | 71.6 | 70.5 | 69.9 | 68.3 | 68.2 |
| 616 | 2018/05/09 16:34:09 | 71.7 | 73.7 | 72.2 | 75.9 | 70.8 |
| 621 | 2018/05/09 16:34:14 | 68.9 | 71.2 | 78.2 | 70.3 | 67.4 |
| 626 | 2018/05/09 16:34:19 | 68.7 | 70.8 | 70.5 | 66.2 | 66.4 |
| 631 | 2018/05/09 16:34:24 | 69.4 | 73.3 | 79.0 | 76.1 | 72.5 |
| 636 | 2018/05/09 16:34:29 | 75.3 | 78.9 | 78.2 | 74.4 | 74.4 |
| 641 | 2018/05/09 16:34:34 | 74.4 | 75.8 | 80.6 | 74.1 | 69.7 |
| 646 | 2018/05/09 16:34:39 | 71.5 | 78.0 | 74.1 | 69.1 | 72.8 |
| 651 | 2018/05/09 16:34:44 | 74.9 | 70.1 | 71.0 | 75.7 | 73.0 |
| 656 | 2018/05/09 16:34:49 | 71.1 | 73.0 | 72.0 | 70.8 | 72.4 |
| 661 | 2018/05/09 16:34:54 | 71.5 | 68.3 | 65.3 | 65.0 | 63.1 |
| 666 | 2018/05/09 16:34:59 | 65.1 | 65.6 | 65.6 | 65.8 | 64.3 |
| 671 | 2018/05/09 16:35:04 | 68.4 | 73.4 | 77.3 | 78.3 | 72.5 |
| 676 | 2018/05/09 16:35:09 | 72.6 | 69.7 | 65.1 | 64.7 | 63.4 |
| 681 | 2018/05/09 16:35:14 | 62.7 | 66.8 | 66.5 | 69.8 | 72.4 |
| 686 | 2018/05/09 16:35:19 | 72.0 | 69.6 | 67.4 | 66.9 | 71.5 |
| 691 | 2018/05/09 16:35:24 | 79.9 | 80.3 | 70.5 | 71.2 | 79.0 |
| 696 | 2018/05/09 16:35:29 | 73.5 | 76.2 | 71.1 | 70.7 | 74.4 |
| 701 | 2018/05/09 16:35:34 | 70.4 | 67.6 | 71.5 | 75.0 | 74.5 |
| 706 | 2018/05/09 16:35:39 | 74.0 | 67.4 | 64.1 | 62.6 | 66.6 |
| 711 | 2018/05/09 16:35:44 | 69.5 | 73.1 | 72.3 | 67.2 | 63.5 |
| 716 | 2018/05/09 16:35:49 | 63.0 | 63.4 | 67.1 | 69.5 | 71.1 |
| 721 | 2018/05/09 16:35:54 | 67.2 | 64.3 | 62.4 | 64.5 | 66.1 |
| 726 | 2018/05/09 16:35:59 | 71.2 | 72.9 | 71.4 | 75.3 | 70.6 |
| 731 | 2018/05/09 16:36:04 | 70.4 | 77.4 | 72.7 | 67.9 | 69.8 |
| 736 | 2018/05/09 16:36:09 | 77.8 | 77.9 | 75.0 | 79.7 | 71.0 |
| 741 | 2018/05/09 16:36:14 | 67.1 | 71.8 | 75.3 | 69.0 | 65.3 |
| 746 | 2018/05/09 16:36:19 | 64.1 | 62.6 | 63.7 | 65.1 | 68.2 |
| 751 | 2018/05/09 16:36:24 | 74.2 | 78.0 | 76.5 | 73.7 | 66.0 |
| 756 | 2018/05/09 16:36:29 | 61.0 | 59.5 | 59.4 | 59.5 | 59.1 |
| 761 | 2018/05/09 16:36:34 | 59.8 | 62.9 | 61.3 | 63.4 | 66.4 |
| 766 | 2018/05/09 16:36:39 | 70.5 | 80.1 | 74.4 | 69.8 | 73.4 |
| 771 | 2018/05/09 16:36:44 | 74.6 | 68.3 | 68.0 | 70.3 | 70.1 |
| 776 | 2018/05/09 16:36:49 | 75.7 | 72.8 | 71.0 | 77.0 | 70.3 |
| 781 | 2018/05/09 16:36:54 | 65.8 | 62.4 | 61.8 | 62.5 | 68.3 |
| 786 | 2018/05/09 16:36:59 | 64.8 | 68.1 | 67.6 | 64.8 | 62.5 |
| 791 | 2018/05/09 16:37:04 | 61.4 | 61.3 | 60.7 | 60.7 | 62.3 |
| 796 | 2018/05/09 16:37:09 | 63.8 | 71.6 | 76.7 | 78.1 | 68.6 |
| 801 | 2018/05/09 16:37:14 | 65.4 | 66.7 | 68.7 | 69.3 | 70.1 |
| 806 | 2018/05/09 16:37:19 | 70.3 | 76.1 | 73.3 | 65.9 | 62.9 |
| 811 | 2018/05/09 16:37:24 | 62.9 | 61.5 | 60.8 | 60.5 | 61.3 |
| 816 | 2018/05/09 16:37:29 | 64.1 | 70.0 | 70.0 | 67.5 | 68.7 |
| 821 | 2018/05/09 16:37:34 | 71.7 | 70.9 | 66.9 | 66.6 | 63.8 |
| 826 | 2018/05/09 16:37:39 | 67.1 | 67.3 | 69.7 | 71.8 | 75.1 |
| 831 | 2018/05/09 16:37:44 | 70.4 | 65.3 | 60.1 | 59.7 | 59.3 |
| 836 | 2018/05/09 16:37:49 | 59.1 | 58.5 | 59.3 | 59.2 | 58.9 |
| 841 | 2018/05/09 16:37:54 | 60.3 | 61.2 | 63.0 | 64.8 | 71.0 |
| 846 | 2018/05/09 16:37:59 | 78.2 | 73.6 | 78.1 | 72.8 | 75.7 |
| 851 | 2018/05/09 16:38:04 | 75.2 | 76.3 | 69.5 | 65.7 | 61.6 |
| 856 | 2018/05/09 16:38:09 | 64.5 | 62.5 | 68.7 | 73.1 | 80.7 |
| 861 | 2018/05/09 16:38:14 | 75.3 | 69.9 | 67.8 | 67.2 | 70.4 |
| 866 | 2018/05/09 16:38:19 | 73.8 | 74.5 | 77.6 | 78.9 | 79.4 |
| 871 | 2018/05/09 16:38:24 | 71.6 | 70.8 | 70.6 | 73.8 | 75.8 |
| 876 | 2018/05/09 16:38:29 | 76.9 | 78.3 | 79.0 | 75.5 | 71.9 |
| 881 | 2018/05/09 16:38:34 | 74.7 | 74.9 | 70.9 | 71.2 | 77.4 |
| 886 | 2018/05/09 16:38:39 | 79.0 | 74.8 | 73.8 | 71.2 | 69.1 |
| 891 | 2018/05/09 16:38:44 | 73.7 | 75.0 | 68.2 | 68.1 | 71.3 |
| 896 | 2018/05/09 16:38:49 | 71.0 | 70.9 | 70.4 | 66.9 | 62.9 |

- Freq Weight : A
- Time Weight : FAST
- Level Range : 40-100
- Max dB : 83.3 - 2018/05/09 15:55:31
- Level Range : 40-100
- SEL : 97.5
- Leq : 68.0
-

Noise Measurement 9

| No.s | Date Time | (dB) | | | | |
|---|---|---|---|---|---|---|
| 1 | 2018/05/09 15:50:49 | 65.1 | 63.9 | 65.0 | 64.1 | 63.2 |
| 6 | 2018/05/09 15:50:54 | 64.2 | 66.6 | 68.2 | 70.3 | 70.5 |
| 11 | 2018/05/09 15:50:59 | 68.4 | 66.6 | 68.4 | 73.8 | 71.2 |
| 16 | 2018/05/09 15:51:04 | 66.3 | 65.5 | 68.9 | 72.9 | 71.9 |
| 21 | 2018/05/09 15:51:09 | 71.5 | 70.4 | 71.6 | 68.3 | 68.5 |
| 26 | 2018/05/09 15:51:14 | 71.4 | 70.8 | 67.6 | 70.5 | 69.4 |
| 31 | 2018/05/09 15:51:19 | 63.7 | 62.2 | 62.5 | 62.0 | 61.0 |
| 36 | 2018/05/09 15:51:24 | 61.2 | 60.9 | 60.4 | 63.1 | 67.7 |
| 41 | 2018/05/09 15:51:29 | 67.4 | 64.9 | 65.7 | 66.4 | 70.1 |
| 46 | 2018/05/09 15:51:34 | 71.1 | 71.1 | 67.6 | 68.9 | 65.8 |
| 51 | 2018/05/09 15:51:39 | 63.8 | 62.8 | 62.8 | 65.7 | 70.3 |
| 56 | 2018/05/09 15:51:44 | 72.4 | 70.7 | 72.5 | 70.2 | 65.3 |
| 61 | 2018/05/09 15:51:49 | 65.8 | 71.6 | 68.4 | 67.0 | 72.5 |
| 66 | 2018/05/09 15:51:54 | 70.4 | 66.2 | 64.7 | 64.9 | 66.3 |
| 71 | 2018/05/09 15:51:59 | 67.1 | 70.6 | 72.9 | 68.9 | 65.8 |
| 76 | 2018/05/09 15:52:04 | 65.2 | 62.4 | 62.7 | 64.3 | 64.5 |
| 81 | 2018/05/09 15:52:09 | 63.3 | 66.1 | 62.4 | 62.2 | 64.4 |
| 86 | 2018/05/09 15:52:14 | 67.1 | 64.0 | 63.6 | 62.0 | 58.2 |
| 91 | 2018/05/09 15:52:19 | 57.8 | 57.6 | 56.8 | 56.7 | 58.9 |
| 96 | 2018/05/09 15:52:24 | 59.8 | 60.5 | 63.6 | 70.4 | 71.5 |
| 101 | 2018/05/09 15:52:29 | 70.0 | 67.8 | 65.1 | 63.7 | 63.0 |
| 106 | 2018/05/09 15:52:34 | 64.7 | 66.4 | 66.2 | 64.7 | 62.4 |
| 111 | 2018/05/09 15:52:39 | 61.4 | 60.3 | 63.0 | 65.4 | 65.2 |
| 116 | 2018/05/09 15:52:44 | 64.8 | 64.4 | 63.6 | 63.4 | 62.8 |
| 121 | 2018/05/09 15:52:49 | 63.1 | 64.0 | 62.1 | 62.2 | 61.8 |
| 126 | 2018/05/09 15:52:54 | 61.9 | 60.8 | 61.2 | 60.2 | 62.3 |
| 131 | 2018/05/09 15:52:59 | 62.3 | 63.9 | 64.4 | 65.1 | 66.3 |
| 136 | 2018/05/09 15:53:04 | 68.4 | 73.4 | 73.3 | 71.9 | 70.0 |
| 141 | 2018/05/09 15:53:09 | 70.2 | 69.5 | 69.4 | 67.2 | 66.6 |
| 146 | 2018/05/09 15:53:14 | 67.3 | 66.4 | 65.7 | 65.8 | 66.2 |
| 151 | 2018/05/09 15:53:19 | 66.1 | 69.9 | 73.5 | 74.1 | 75.6 |
| 156 | 2018/05/09 15:53:24 | 73.9 | 74.0 | 73.6 | 73.9 | 72.4 |
| 161 | 2018/05/09 15:53:29 | 70.5 | 69.9 | 68.3 | 67.6 | 66.9 |
| 166 | 2018/05/09 15:53:34 | 69.0 | 67.7 | 72.0 | 71.6 | 73.4 |
| 171 | 2018/05/09 15:53:39 | 73.3 | 73.0 | 72.9 | 69.1 | 68.1 |
| 176 | 2018/05/09 15:53:44 | 66.4 | 66.6 | 67.5 | 72.4 | 69.4 |
| 181 | 2018/05/09 15:53:49 | 68.1 | 67.6 | 71.4 | 71.2 | 67.1 |
| 186 | 2018/05/09 15:53:54 | 65.7 | 63.1 | 61.5 | 62.7 | 60.8 |
| 191 | 2018/05/09 15:53:59 | 61.3 | 62.6 | 61.9 | 63.3 | 65.3 |
| 196 | 2018/05/09 15:54:04 | 66.1 | 64.3 | 64.5 | 72.3 | 71.6 |
| 201 | 2018/05/09 15:54:09 | 65.8 | 63.1 | 62.9 | 66.8 | 72.6 |
| 206 | 2018/05/09 15:54:14 | 74.5 | 74.1 | 67.7 | 68.1 | 72.3 |
| 211 | 2018/05/09 15:54:19 | 68.3 | 65.3 | 63.6 | 63.5 | 61.8 |
| 216 | 2018/05/09 15:54:24 | 62.7 | 62.5 | 61.4 | 61.2 | 60.6 |
| 221 | 2018/05/09 15:54:29 | 61.8 | 61.7 | 61.8 | 64.5 | 65.9 |
| 226 | 2018/05/09 15:54:34 | 64.5 | 62.9 | 62.8 | 65.9 | 67.5 |
| 231 | 2018/05/09 15:54:39 | 64.7 | 61.8 | 60.2 | 59.8 | 61.3 |
| 236 | 2018/05/09 15:54:44 | 63.6 | 65.8 | 63.1 | 59.9 | 58.0 |
| 241 | 2018/05/09 15:54:49 | 62.3 | 59.2 | 58.0 | 62.8 | 64.1 |
| 246 | 2018/05/09 15:54:54 | 58.2 | 62.5 | 64.7 | 67.8 | 65.6 |
| 251 | 2018/05/09 15:54:59 | 62.8 | 65.1 | 69.3 | 68.7 | 70.1 |
| 256 | 2018/05/09 15:55:04 | 68.4 | 67.9 | 70.0 | 66.4 | 64.6 |
| 261 | 2018/05/09 15:55:09 | 62.5 | 62.5 | 62.9 | 62.1 | 60.8 |
| 266 | 2018/05/09 15:55:14 | 59.2 | 60.8 | 59.2 | 57.7 | 56.5 |
| 271 | 2018/05/09 15:55:19 | 57.8 | 60.4 | 60.0 | 61.5 | 66.0 |
| 276 | 2018/05/09 15:55:24 | 71.0 | 73.0 | 69.1 | 70.4 | 71.7 |
| 281 | 2018/05/09 15:55:29 | 72.8 | 79.8 | 81.2 | 75.5 | 73.8 |
| 286 | 2018/05/09 15:55:34 | 75.4 | 71.8 | 69.1 | 67.4 | 65.7 |
| 291 | 2018/05/09 15:55:39 | 64.0 | 64.1 | 64.8 | 67.3 | 67.2 |
| 296 | 2018/05/09 15:55:44 | 67.1 | 71.1 | 71.8 | 67.1 | 64.4 |
| 301 | 2018/05/09 15:55:49 | 64.4 | 65.4 | 66.9 | 69.1 | 71.5 |
| 306 | 2018/05/09 15:55:54 | 67.3 | 69.4 | 70.6 | 67.5 | 67.9 |
| 311 | 2018/05/09 15:55:59 | 65.0 | 61.4 | 56.9 | 55.5 | 54.2 |
| 316 | 2018/05/09 15:56:04 | 56.3 | 58.6 | 59.6 | 62.7 | 64.9 |
| 321 | 2018/05/09 15:56:09 | 62.8 | 62.1 | 63.6 | 66.6 | 68.7 |
| 326 | 2018/05/09 15:56:14 | 69.6 | 68.0 | 64.8 | 60.5 | 60.3 |
| 331 | 2018/05/09 15:56:19 | 60.0 | 58.2 | 58.1 | 57.6 | 59.2 |
| 336 | 2018/05/09 15:56:24 | 56.7 | 58.5 | 60.5 | 61.2 | 64.4 |
| 341 | 2018/05/09 15:56:29 | 60.1 | 61.1 | 63.5 | 67.9 | 69.6 |
| 346 | 2018/05/09 15:56:34 | 67.4 | 62.5 | 61.4 | 64.4 | 66.3 |
| 351 | 2018/05/09 15:56:39 | 70.1 | 69.7 | 66.9 | 62.9 | 60.6 |
| 356 | 2018/05/09 15:56:44 | 60.8 | 64.9 | 71.1 | 74.4 | 73.3 |
| 361 | 2018/05/09 15:56:49 | 70.6 | 72.2 | 72.1 | 69.1 | 68.9 |
| 366 | 2018/05/09 15:56:54 | 68.4 | 66.6 | 66.3 | 68.2 | 67.9 |
| 371 | 2018/05/09 15:56:59 | 67.1 | 65.6 | 65.5 | 64.2 | 63.5 |
| 376 | 2018/05/09 15:57:04 | 63.8 | 64.9 | 68.9 | 72.3 | 73.6 |
| 381 | 2018/05/09 15:57:09 | 70.3 | 71.1 | 67.3 | 62.2 | 56.6 |
| 386 | 2018/05/09 15:57:14 | 53.8 | 54.1 | 54.2 | 54.3 | 54.7 |
| 391 | 2018/05/09 15:57:19 | 56.4 | 57.1 | 57.2 | 58.1 | 59.7 |
| 396 | 2018/05/09 15:57:24 | 60.5 | 59.9 | 59.4 | 58.7 | 58.7 |
| 401 | 2018/05/09 15:57:29 | 59.1 | 60.5 | 61.5 | 66.0 | 72.0 |
| 406 | 2018/05/09 15:57:34 | 71.8 | 67.3 | 63.7 | 58.9 | 57.4 |
| 411 | 2018/05/09 15:57:39 | 58.1 | 58.4 | 57.8 | 59.1 | 59.1 |
| 416 | 2018/05/09 15:57:44 | 64.1 | 68.5 | 69.0 | 70.3 | 70.5 |
| 421 | 2018/05/09 15:57:49 | 64.1 | 70.9 | 69.7 | 71.1 | 68.6 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 426 | 2018/05/09 15:57:54 | 66.6 | 63.3 | 61.9 | 61.5 | 61.1 |
| 431 | 2018/05/09 15:57:59 | 59.5 | 58.7 | 60.8 | 61.0 | 59.7 |
| 436 | 2018/05/09 15:58:04 | 59.6 | 58.0 | 58.2 | 71.0 | 70.4 |
| 441 | 2018/05/09 15:58:09 | 69.0 | 68.6 | 71.7 | 71.1 | 69.1 |
| 446 | 2018/05/09 15:58:14 | 64.9 | 64.7 | 64.5 | 66.9 | 69.5 |
| 451 | 2018/05/09 15:58:19 | 67.0 | 63.5 | 63.1 | 61.6 | 61.0 |
| 456 | 2018/05/09 15:58:24 | 61.9 | 61.6 | 62.8 | 63.2 | 63.9 |
| 461 | 2018/05/09 15:58:29 | 67.5 | 74.3 | 76.8 | 71.4 | 71.7 |
| 466 | 2018/05/09 15:58:34 | 74.1 | 72.3 | 70.0 | 71.4 | 72.1 |
| 471 | 2018/05/09 15:58:39 | 72.8 | 72.4 | 68.9 | 67.3 | 67.4 |
| 476 | 2018/05/09 15:58:44 | 68.8 | 68.1 | 67.3 | 65.9 | 64.9 |
| 481 | 2018/05/09 15:58:49 | 65.7 | 65.5 | 66.7 | 66.2 | 66.6 |
| 486 | 2018/05/09 15:58:54 | 65.6 | 66.2 | 64.5 | 65.5 | 65.7 |
| 491 | 2018/05/09 15:58:59 | 64.6 | 67.8 | 70.5 | 67.2 | 64.9 |
| 496 | 2018/05/09 15:59:04 | 63.0 | 63.9 | 66.0 | 67.3 | 64.8 |
| 501 | 2018/05/09 15:59:09 | 63.8 | 63.7 | 63.4 | 61.9 | 62.6 |
| 506 | 2018/05/09 15:59:14 | 64.9 | 63.8 | 61.9 | 60.4 | 60.7 |
| 511 | 2018/05/09 15:59:19 | 61.5 | 62.0 | 61.5 | 62.6 | 64.7 |
| 516 | 2018/05/09 15:59:24 | 65.4 | 65.7 | 66.5 | 67.8 | 67.6 |
| 521 | 2018/05/09 15:59:29 | 66.3 | 65.2 | 64.5 | 64.0 | 64.5 |
| 526 | 2018/05/09 15:59:34 | 60.9 | 61.1 | 61.1 | 59.7 | 59.4 |
| 531 | 2018/05/09 15:59:39 | 59.5 | 60.2 | 60.5 | 60.8 | 62.9 |
| 536 | 2018/05/09 15:59:44 | 63.8 | 65.0 | 68.0 | 69.0 | 67.7 |
| 541 | 2018/05/09 15:59:49 | 66.3 | 65.5 | 65.2 | 65.7 | 64.2 |
| 546 | 2018/05/09 15:59:54 | 63.1 | 66.1 | 72.1 | 72.8 | 72.0 |
| 551 | 2018/05/09 15:59:59 | 74.0 | 69.5 | 65.8 | 66.3 | 68.9 |
| 556 | 2018/05/09 16:00:04 | 69.7 | 67.5 | 67.6 | 68.3 | 66.6 |
| 561 | 2018/05/09 16:00:09 | 67.8 | 68.1 | 66.6 | 66.5 | 65.3 |
| 566 | 2018/05/09 16:00:14 | 65.8 | 64.9 | 62.0 | 61.3 | 63.9 |
| 571 | 2018/05/09 16:00:19 | 66.8 | 64.8 | 62.8 | 60.0 | 59.3 |
| 576 | 2018/05/09 16:00:24 | 61.4 | 63.0 | 63.4 | 62.7 | 60.1 |
| 581 | 2018/05/09 16:00:29 | 57.3 | 56.8 | 57.6 | 57.9 | 58.2 |
| 586 | 2018/05/09 16:00:34 | 61.0 | 58.3 | 60.0 | 60.4 | 61.4 |
| 591 | 2018/05/09 16:00:39 | 61.6 | 61.3 | 60.6 | 61.2 | 62.1 |
| 596 | 2018/05/09 16:00:44 | 62.1 | 62.0 | 65.8 | 65.6 | 65.9 |
| 601 | 2018/05/09 16:00:49 | 66.6 | 67.3 | 65.9 | 63.4 | 62.9 |
| 606 | 2018/05/09 16:00:54 | 63.4 | 64.7 | 65.2 | 66.0 | 65.2 |
| 611 | 2018/05/09 16:00:59 | 65.4 | 68.9 | 70.9 | 69.7 | 69.1 |
| 616 | 2018/05/09 16:01:04 | 70.8 | 67.9 | 65.7 | 60.5 | 58.2 |
| 621 | 2018/05/09 16:01:09 | 56.3 | 58.3 | 59.1 | 62.0 | 64.3 |
| 626 | 2018/05/09 16:01:14 | 74.3 | 74.0 | 69.3 | 73.3 | 71.5 |
| 631 | 2018/05/09 16:01:19 | 67.2 | 68.0 | 67.6 | 65.2 | 65.9 |
| 636 | 2018/05/09 16:01:24 | 66.1 | 65.1 | 66.3 | 70.0 | 68.8 |
| 641 | 2018/05/09 16:01:29 | 65.3 | 64.0 | 63.9 | 67.1 | 70.4 |
| 646 | 2018/05/09 16:01:34 | 72.0 | 71.3 | 71.0 | 70.6 | 70.8 |
| 651 | 2018/05/09 16:01:39 | 71.4 | 70.6 | 66.6 | 67.1 | 71.1 |
| 656 | 2018/05/09 16:01:44 | 69.1 | 68.2 | 71.9 | 72.9 | 69.2 |
| 661 | 2018/05/09 16:01:49 | 69.9 | 70.4 | 68.0 | 65.5 | 65.4 |
| 666 | 2018/05/09 16:01:54 | 66.5 | 70.3 | 69.7 | 64.0 | 61.6 |
| 671 | 2018/05/09 16:01:59 | 62.3 | 63.2 | 63.1 | 64.4 | 64.9 |
| 676 | 2018/05/09 16:02:04 | 64.4 | 62.8 | 62.0 | 61.8 | 64.4 |
| 681 | 2018/05/09 16:02:09 | 68.1 | 67.2 | 65.7 | 65.1 | 63.0 |
| 686 | 2018/05/09 16:02:14 | 60.7 | 60.2 | 59.3 | 58.2 | 58.1 |
| 691 | 2018/05/09 16:02:19 | 58.0 | 57.6 | 57.4 | 58.3 | 59.3 |
| 696 | 2018/05/09 16:02:24 | 59.5 | 63.2 | 70.2 | 72.4 | 66.3 |
| 701 | 2018/05/09 16:02:29 | 61.9 | 59.1 | 56.3 | 56.0 | 56.5 |
| 706 | 2018/05/09 16:02:34 | 57.7 | 58.8 | 60.3 | 64.3 | 66.4 |
| 711 | 2018/05/09 16:02:39 | 68.1 | 68.6 | 69.4 | 71.2 | 72.8 |
| 716 | 2018/05/09 16:02:44 | 70.0 | 67.5 | 67.1 | 67.6 | 67.2 |
| 721 | 2018/05/09 16:02:49 | 66.8 | 64.9 | 61.4 | 60.5 | 63.3 |
| 726 | 2018/05/09 16:02:54 | 62.7 | 66.6 | 73.2 | 71.8 | 70.9 |
| 731 | 2018/05/09 16:02:59 | 71.8 | 72.2 | 70.9 | 72.4 | 69.7 |
| 736 | 2018/05/09 16:03:04 | 66.6 | 68.7 | 67.4 | 64.1 | 60.7 |
| 741 | 2018/05/09 16:03:09 | 60.4 | 61.1 | 62.1 | 65.7 | 66.4 |
| 746 | 2018/05/09 16:03:14 | 64.8 | 65.1 | 63.6 | 59.8 | 62.6 |
| 751 | 2018/05/09 16:03:19 | 59.4 | 62.9 | 66.4 | 64.6 | 62.7 |
| 756 | 2018/05/09 16:03:24 | 60.8 | 60.2 | 62.1 | 62.1 | 60.8 |
| 761 | 2018/05/09 16:03:29 | 61.7 | 61.9 | 61.1 | 58.9 | 58.1 |
| 766 | 2018/05/09 16:03:34 | 58.8 | 58.4 | 56.9 | 56.2 | 55.9 |
| 771 | 2018/05/09 16:03:39 | 55.6 | 55.4 | 56.3 | 57.0 | 59.6 |
| 776 | 2018/05/09 16:03:44 | 61.4 | 63.6 | 66.1 | 69.0 | 69.5 |
| 781 | 2018/05/09 16:03:49 | 67.7 | 64.7 | 67.2 | 70.7 | 70.5 |
| 786 | 2018/05/09 16:03:54 | 69.0 | 67.9 | 66.0 | 62.9 | 60.3 |
| 791 | 2018/05/09 16:03:59 | 60.4 | 61.6 | 61.5 | 61.8 | 60.7 |
| 796 | 2018/05/09 16:04:04 | 61.6 | 64.6 | 63.1 | 65.5 | 65.7 |
| 801 | 2018/05/09 16:04:09 | 64.4 | 64.7 | 65.5 | 64.5 | 62.9 |
| 806 | 2018/05/09 16:04:14 | 63.2 | 64.5 | 63.7 | 65.8 | 68.3 |
| 811 | 2018/05/09 16:04:19 | 72.0 | 71.3 | 72.9 | 72.3 | 70.4 |
| 816 | 2018/05/09 16:04:24 | 70.3 | 67.1 | 64.3 | 63.9 | 62.9 |
| 821 | 2018/05/09 16:04:29 | 62.9 | 64.1 | 66.6 | 72.2 | 70.3 |
| 826 | 2018/05/09 16:04:34 | 65.8 | 63.8 | 61.2 | 61.4 | 62.7 |
| 831 | 2018/05/09 16:04:39 | 62.5 | 61.0 | 60.0 | 61.6 | 62.4 |
| 836 | 2018/05/09 16:04:44 | 63.8 | 69.2 | 65.8 | 63.5 | 65.2 |
| 841 | 2018/05/09 16:04:49 | 69.9 | 70.3 | 65.3 | 62.9 | 68.3 |
| 846 | 2018/05/09 16:04:54 | 74.5 | 65.4 | 64.9 | 60.8 | 61.1 |
| 851 | 2018/05/09 16:04:59 | 61.9 | 64.3 | 66.9 | 72.3 | 79.4 |
| 856 | 2018/05/09 16:05:04 | 73.8 | 70.2 | 68.0 | 67.6 | 67.9 |
| 861 | 2018/05/09 16:05:09 | 75.8 | 72.8 | 75.5 | 76.8 | 75.0 |
| 866 | 2018/05/09 16:05:14 | 80.5 | 77.9 | 74.6 | 72.4 | 68.8 |
| 871 | 2018/05/09 16:05:19 | 69.3 | 70.4 | 69.1 | 68.2 | 70.8 |
| 876 | 2018/05/09 16:05:24 | 73.8 | 72.8 | 68.5 | 66.8 | 64.7 |
| 881 | 2018/05/09 16:05:29 | 62.9 | 61.3 | 62.9 | 62.1 | 63.4 |
| 886 | 2018/05/09 16:05:34 | 61.7 | 62.2 | 63.8 | 67.9 | 67.7 |
| 891 | 2018/05/09 16:05:39 | 71.5 | 70.6 | 68.8 | 66.6 | 68.4 |
| 896 | 2018/05/09 16:05:44 | 71.7 | 70.2 | 71.2 | 71.2 | 70.5 |

- Freq Weight : A
- Time Weight : FAST
- Level Range : 40-100
- Max dB : 82.7 - 2018/05/09 15:23:58
- Level Range : 40-100
- SEL : 99.5
- Leq : 70.0
-

Noise Measurement 10

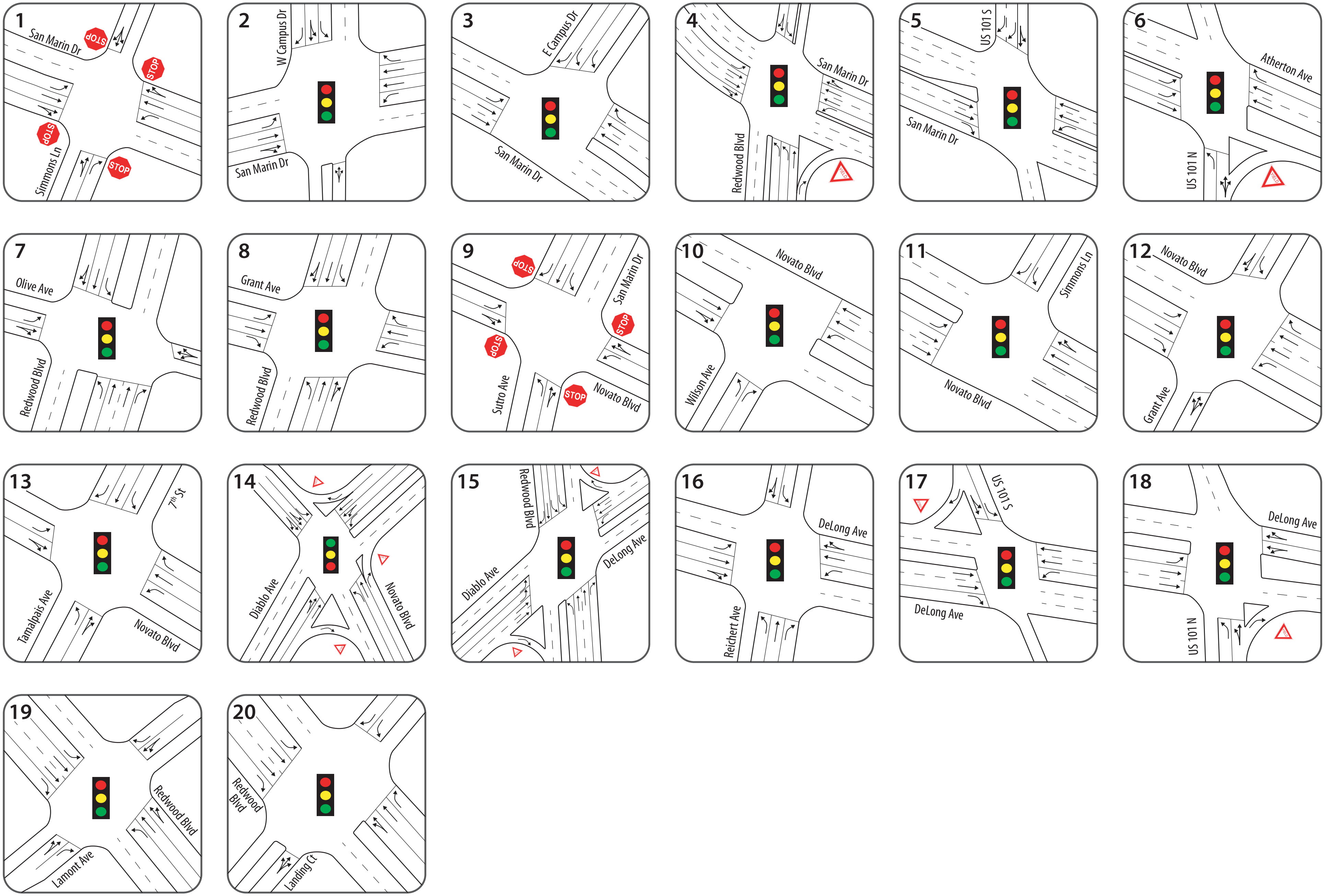
| No.s | Date Time | (dB) | | | | |
|---|---|---|---|---|---|---|
| 1 | 2018/05/09 15:20:04 | 73.3 | 70.5 | 68.9 | 69.5 | 70.5 |
| 6 | 2018/05/09 15:20:09 | 69.7 | 67.8 | 64.8 | 64.5 | 63.5 |
| 11 | 2018/05/09 15:20:14 | 64.1 | 65.8 | 68.7 | 70.5 | 68.0 |
| 16 | 2018/05/09 15:20:19 | 67.8 | 67.0 | 68.0 | 70.3 | 73.9 |
| 21 | 2018/05/09 15:20:24 | 76.0 | 74.9 | 76.3 | 74.8 | 73.5 |
| 26 | 2018/05/09 15:20:29 | 76.9 | 76.5 | 73.9 | 70.9 | 68.7 |
| 31 | 2018/05/09 15:20:34 | 69.1 | 72.0 | 78.4 | 73.3 | 70.5 |
| 36 | 2018/05/09 15:20:39 | 73.4 | 71.6 | 69.1 | 73.0 | 72.2 |
| 41 | 2018/05/09 15:20:44 | 74.1 | 75.6 | 71.8 | 71.3 | 72.5 |
| 46 | 2018/05/09 15:20:49 | 73.8 | 76.1 | 73.4 | 71.6 | 71.9 |
| 51 | 2018/05/09 15:20:54 | 68.9 | 70.6 | 69.3 | 68.5 | 70.3 |
| 56 | 2018/05/09 15:20:59 | 68.1 | 68.3 | 67.1 | 65.9 | 64.9 |
| 61 | 2018/05/09 15:21:04 | 66.7 | 67.2 | 68.5 | 68.6 | 67.7 |
| 66 | 2018/05/09 15:21:09 | 68.5 | 64.3 | 63.2 | 62.7 | 62.9 |
| 71 | 2018/05/09 15:21:14 | 63.1 | 63.0 | 64.1 | 65.1 | 66.4 |
| 76 | 2018/05/09 15:21:19 | 68.7 | 70.8 | 72.3 | 73.0 | 69.8 |
| 81 | 2018/05/09 15:21:24 | 67.2 | 66.2 | 68.7 | 70.3 | 70.0 |
| 86 | 2018/05/09 15:21:29 | 72.0 | 76.0 | 76.5 | 76.7 | 73.3 |
| 91 | 2018/05/09 15:21:34 | 73.7 | 75.4 | 74.3 | 77.9 | 75.1 |
| 96 | 2018/05/09 15:21:39 | 72.3 | 73.5 | 73.6 | 75.0 | 72.3 |
| 101 | 2018/05/09 15:21:44 | 70.9 | 76.5 | 77.9 | 72.6 | 71.6 |
| 106 | 2018/05/09 15:21:49 | 75.1 | 74.2 | 70.6 | 68.9 | 69.2 |
| 111 | 2018/05/09 15:21:54 | 72.1 | 76.4 | 77.7 | 70.4 | 69.6 |
| 116 | 2018/05/09 15:21:59 | 70.0 | 71.1 | 70.5 | 69.9 | 68.5 |
| 121 | 2018/05/09 15:22:04 | 67.9 | 66.7 | 66.2 | 66.3 | 65.6 |
| 126 | 2018/05/09 15:22:09 | 65.4 | 65.4 | 65.8 | 66.1 | 67.1 |
| 131 | 2018/05/09 15:22:14 | 65.5 | 65.0 | 64.2 | 65.0 | 66.2 |
| 136 | 2018/05/09 15:22:19 | 67.4 | 72.6 | 72.6 | 70.8 | 75.0 |
| 141 | 2018/05/09 15:22:24 | 72.6 | 73.1 | 73.3 | 75.3 | 74.0 |
| 146 | 2018/05/09 15:22:29 | 69.7 | 69.5 | 72.3 | 72.4 | 73.0 |
| 151 | 2018/05/09 15:22:34 | 72.5 | 71.7 | 71.3 | 71.2 | 71.4 |
| 156 | 2018/05/09 15:22:39 | 68.5 | 70.5 | 75.1 | 75.3 | 69.5 |
| 161 | 2018/05/09 15:22:44 | 65.5 | 65.4 | 63.7 | 63.8 | 65.4 |
| 166 | 2018/05/09 15:22:49 | 66.6 | 66.8 | 66.6 | 67.5 | 67.0 |
| 171 | 2018/05/09 15:22:54 | 68.0 | 68.4 | 69.1 | 67.8 | 64.8 |
| 176 | 2018/05/09 15:22:59 | 63.9 | 62.6 | 63.2 | 64.1 | 63.7 |
| 181 | 2018/05/09 15:23:04 | 65.1 | 66.0 | 71.7 | 71.1 | 67.2 |
| 186 | 2018/05/09 15:23:09 | 65.5 | 65.0 | 64.9 | 64.8 | 63.7 |
| 191 | 2018/05/09 15:23:14 | 63.7 | 65.5 | 66.3 | 63.2 | 63.4 |
| 196 | 2018/05/09 15:23:19 | 66.2 | 66.3 | 66.4 | 68.1 | 68.5 |
| 201 | 2018/05/09 15:23:24 | 66.2 | 66.8 | 67.6 | 66.8 | 67.3 |
| 206 | 2018/05/09 15:23:29 | 67.4 | 66.7 | 67.3 | 67.4 | 68.8 |
| 211 | 2018/05/09 15:23:34 | 69.6 | 71.8 | 75.4 | 72.9 | 75.0 |
| 216 | 2018/05/09 15:23:39 | 73.1 | 72.3 | 71.3 | 70.5 | 70.4 |
| 221 | 2018/05/09 15:23:44 | 69.4 | 70.3 | 69.9 | 68.1 | 66.9 |
| 226 | 2018/05/09 15:23:49 | 64.6 | 63.1 | 64.3 | 65.3 | 64.7 |
| 231 | 2018/05/09 15:23:54 | 66.2 | 68.6 | 73.6 | 80.0 | 79.1 |
| 236 | 2018/05/09 15:23:59 | 72.4 | 70.7 | 69.7 | 69.8 | 71.0 |
| 241 | 2018/05/09 15:24:04 | 76.4 | 72.1 | 70.3 | 70.4 | 69.9 |
| 246 | 2018/05/09 15:24:09 | 66.5 | 67.0 | 68.1 | 68.5 | 68.5 |
| 251 | 2018/05/09 15:24:14 | 68.7 | 67.5 | 68.3 | 72.7 | 71.4 |
| 256 | 2018/05/09 15:24:19 | 69.4 | 68.9 | 68.9 | 67.5 | 66.1 |
| 261 | 2018/05/09 15:24:24 | 65.2 | 66.8 | 67.1 | 66.3 | 65.0 |
| 266 | 2018/05/09 15:24:29 | 66.1 | 67.3 | 68.5 | 68.7 | 67.4 |
| 271 | 2018/05/09 15:24:34 | 67.5 | 68.8 | 68.8 | 68.3 | 69.0 |
| 276 | 2018/05/09 15:24:39 | 69.0 | 67.6 | 67.2 | 68.2 | 69.0 |
| 281 | 2018/05/09 15:24:44 | 74.1 | 73.4 | 70.4 | 71.2 | 72.1 |
| 286 | 2018/05/09 15:24:49 | 72.8 | 69.7 | 68.0 | 68.8 | 68.8 |
| 291 | 2018/05/09 15:24:54 | 68.1 | 67.7 | 68.6 | 70.1 | 69.7 |
| 296 | 2018/05/09 15:24:59 | 70.2 | 69.7 | 68.1 | 68.5 | 70.8 |
| 301 | 2018/05/09 15:25:04 | 74.0 | 71.5 | 69.4 | 66.4 | 66.6 |
| 306 | 2018/05/09 15:25:09 | 67.0 | 70.0 | 71.7 | 69.5 | 68.0 |
| 311 | 2018/05/09 15:25:14 | 69.5 | 70.2 | 72.5 | 68.7 | 68.4 |
| 316 | 2018/05/09 15:25:19 | 66.3 | 65.7 | 66.5 | 69.1 | 68.9 |
| 321 | 2018/05/09 15:25:24 | 67.3 | 67.2 | 66.5 | 67.1 | 67.8 |
| 326 | 2018/05/09 15:25:29 | 68.5 | 68.0 | 66.7 | 67.2 | 67.7 |
| 331 | 2018/05/09 15:25:34 | 67.6 | 68.6 | 65.9 | 67.6 | 66.7 |
| 336 | 2018/05/09 15:25:39 | 68.4 | 73.2 | 72.9 | 70.7 | 70.5 |
| 341 | 2018/05/09 15:25:44 | 68.6 | 67.9 | 66.5 | 64.8 | 62.7 |
| 346 | 2018/05/09 15:25:49 | 62.9 | 64.6 | 69.2 | 76.0 | 71.9 |
| 351 | 2018/05/09 15:25:54 | 68.3 | 70.1 | 73.7 | 73.0 | 68.3 |
| 356 | 2018/05/09 15:25:59 | 65.9 | 65.3 | 68.0 | 68.5 | 75.4 |
| 361 | 2018/05/09 15:26:04 | 77.0 | 76.8 | 74.0 | 73.7 | 75.5 |
| 366 | 2018/05/09 15:26:09 | 73.1 | 68.6 | 66.7 | 66.2 | 66.1 |
| 371 | 2018/05/09 15:26:14 | 66.0 | 67.2 | 67.2 | 66.7 | 68.7 |
| 376 | 2018/05/09 15:26:19 | 69.4 | 68.8 | 69.4 | 69.5 | 68.2 |
| 381 | 2018/05/09 15:26:24 | 71.8 | 75.1 | 75.0 | 76.8 | 75.8 |
| 386 | 2018/05/09 15:26:29 | 75.3 | 75.5 | 77.3 | 75.8 | 76.1 |
| 391 | 2018/05/09 15:26:34 | 75.0 | 77.5 | 75.9 | 73.9 | 75.6 |
| 396 | 2018/05/09 15:26:39 | 73.8 | 72.6 | 72.2 | 74.3 | 72.1 |
| 401 | 2018/05/09 15:26:44 | 68.5 | 67.1 | 66.4 | 66.1 | 65.0 |
| 406 | 2018/05/09 15:26:49 | 64.8 | 65.5 | 65.3 | 64.1 | 65.4 |
| 411 | 2018/05/09 15:26:54 | 64.2 | 65.4 | 66.6 | 67.0 | 65.3 |
| 416 | 2018/05/09 15:26:59 | 64.1 | 64.1 | 63.0 | 62.5 | 63.4 |
| 421 | 2018/05/09 15:27:04 | 63.7 | 64.7 | 66.7 | 66.0 | 68.4 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 426 | 2018/05/09 15:27:09 | 65.9 | 67.8 | 73.8 | 75.6 | 72.5 |
| 431 | 2018/05/09 15:27:14 | 75.3 | 73.6 | 74.6 | 74.6 | 75.2 |
| 436 | 2018/05/09 15:27:19 | 71.2 | 68.3 | 67.2 | 66.8 | 68.6 |
| 441 | 2018/05/09 15:27:24 | 69.9 | 71.8 | 76.5 | 81.7 | 77.3 |
| 446 | 2018/05/09 15:27:29 | 74.9 | 73.4 | 73.0 | 73.8 | 73.1 |
| 451 | 2018/05/09 15:27:34 | 72.2 | 71.6 | 71.6 | 71.9 | 70.4 |
| 456 | 2018/05/09 15:27:39 | 69.3 | 67.6 | 67.4 | 68.3 | 65.8 |
| 461 | 2018/05/09 15:27:44 | 66.7 | 66.3 | 64.9 | 66.0 | 67.5 |
| 466 | 2018/05/09 15:27:49 | 65.9 | 68.5 | 69.5 | 67.4 | 65.8 |
| 471 | 2018/05/09 15:27:54 | 66.9 | 66.8 | 65.9 | 67.7 | 68.2 |
| 476 | 2018/05/09 15:27:59 | 67.2 | 67.1 | 66.5 | 64.7 | 63.8 |
| 481 | 2018/05/09 15:28:04 | 65.0 | 66.8 | 67.2 | 69.8 | 71.7 |
| 486 | 2018/05/09 15:28:09 | 72.1 | 70.6 | 69.7 | 67.7 | 67.9 |
| 491 | 2018/05/09 15:28:14 | 68.1 | 69.0 | 72.9 | 77.5 | 76.2 |
| 496 | 2018/05/09 15:28:19 | 74.5 | 75.3 | 75.8 | 75.1 | 75.3 |
| 501 | 2018/05/09 15:28:24 | 76.9 | 76.4 | 76.8 | 77.7 | 77.0 |
| 506 | 2018/05/09 15:28:29 | 75.8 | 74.5 | 73.5 | 74.4 | 76.9 |
| 511 | 2018/05/09 15:28:34 | 76.5 | 70.9 | 67.7 | 67.4 | 68.4 |
| 516 | 2018/05/09 15:28:39 | 67.1 | 65.8 | 64.0 | 63.4 | 62.7 |
| 521 | 2018/05/09 15:28:44 | 63.9 | 63.4 | 62.6 | 63.4 | 64.1 |
| 526 | 2018/05/09 15:28:49 | 65.0 | 66.1 | 65.1 | 66.8 | 68.3 |
| 531 | 2018/05/09 15:28:54 | 66.4 | 67.8 | 67.2 | 65.6 | 63.6 |
| 536 | 2018/05/09 15:28:59 | 64.3 | 64.5 | 64.8 | 66.2 | 71.8 |
| 541 | 2018/05/09 15:29:04 | 71.1 | 73.2 | 79.6 | 74.8 | 79.0 |
| 546 | 2018/05/09 15:29:09 | 76.8 | 75.3 | 71.7 | 70.1 | 68.6 |
| 551 | 2018/05/09 15:29:14 | 68.8 | 68.8 | 74.0 | 78.4 | 71.9 |
| 556 | 2018/05/09 15:29:19 | 69.9 | 70.5 | 76.0 | 76.4 | 76.3 |
| 561 | 2018/05/09 15:29:24 | 70.4 | 67.8 | 66.7 | 66.8 | 68.6 |
| 566 | 2018/05/09 15:29:29 | 69.8 | 68.7 | 66.4 | 63.6 | 64.0 |
| 571 | 2018/05/09 15:29:34 | 64.1 | 66.8 | 65.5 | 65.6 | 65.6 |
| 576 | 2018/05/09 15:29:39 | 65.6 | 65.1 | 65.0 | 65.8 | 64.6 |
| 581 | 2018/05/09 15:29:44 | 66.0 | 67.0 | 68.6 | 66.1 | 64.6 |
| 586 | 2018/05/09 15:29:49 | 65.5 | 68.3 | 72.0 | 73.5 | 74.9 |
| 591 | 2018/05/09 15:29:54 | 73.8 | 75.2 | 77.4 | 78.0 | 74.9 |
| 596 | 2018/05/09 15:29:59 | 72.0 | 69.6 | 70.6 | 70.5 | 74.9 |
| 601 | 2018/05/09 15:30:04 | 79.2 | 74.5 | 78.4 | 75.6 | 69.6 |
| 606 | 2018/05/09 15:30:09 | 68.8 | 69.6 | 73.6 | 79.7 | 77.1 |
| 611 | 2018/05/09 15:30:14 | 79.2 | 72.8 | 67.9 | 61.1 | 63.2 |
| 616 | 2018/05/09 15:30:19 | 66.7 | 66.8 | 66.2 | 67.2 | 68.3 |
| 621 | 2018/05/09 15:30:24 | 69.3 | 69.9 | 71.1 | 67.6 | 66.0 |
| 626 | 2018/05/09 15:30:29 | 65.5 | 65.2 | 64.5 | 64.9 | 65.8 |
| 631 | 2018/05/09 15:30:34 | 67.2 | 68.8 | 70.1 | 70.0 | 75.7 |
| 636 | 2018/05/09 15:30:39 | 72.1 | 71.4 | 71.3 | 71.4 | 73.0 |
| 641 | 2018/05/09 15:30:44 | 73.0 | 72.1 | 74.3 | 73.8 | 72.2 |
| 646 | 2018/05/09 15:30:49 | 71.5 | 75.0 | 77.7 | 67.8 | 64.2 |
| 651 | 2018/05/09 15:30:54 | 65.0 | 65.4 | 68.2 | 72.2 | 74.5 |
| 656 | 2018/05/09 15:30:59 | 72.3 | 66.2 | 65.6 | 65.2 | 63.9 |
| 661 | 2018/05/09 15:31:04 | 65.0 | 65.4 | 67.0 | 71.1 | 73.5 |
| 666 | 2018/05/09 15:31:09 | 77.2 | 70.6 | 67.4 | 70.4 | 71.6 |
| 671 | 2018/05/09 15:31:14 | 70.1 | 66.9 | 64.8 | 65.5 | 64.3 |
| 676 | 2018/05/09 15:31:19 | 63.5 | 61.8 | 62.5 | 63.4 | 65.0 |
| 681 | 2018/05/09 15:31:24 | 66.0 | 65.5 | 66.6 | 67.4 | 67.6 |
| 686 | 2018/05/09 15:31:29 | 68.9 | 68.1 | 65.9 | 65.8 | 66.3 |
| 691 | 2018/05/09 15:31:34 | 65.1 | 65.3 | 66.8 | 70.9 | 73.4 |
| 696 | 2018/05/09 15:31:39 | 71.6 | 68.2 | 68.5 | 69.7 | 71.6 |
| 701 | 2018/05/09 15:31:44 | 74.1 | 73.7 | 75.4 | 73.4 | 68.6 |
| 706 | 2018/05/09 15:31:49 | 66.2 | 64.7 | 64.7 | 64.1 | 63.7 |
| 711 | 2018/05/09 15:31:54 | 62.5 | 62.2 | 62.8 | 65.0 | 68.8 |
| 716 | 2018/05/09 15:31:59 | 66.5 | 64.1 | 63.5 | 64.1 | 63.7 |
| 721 | 2018/05/09 15:32:04 | 62.4 | 62.9 | 64.4 | 62.9 | 64.3 |
| 726 | 2018/05/09 15:32:09 | 63.5 | 63.9 | 63.4 | 64.4 | 64.2 |
| 731 | 2018/05/09 15:32:14 | 64.5 | 64.5 | 65.4 | 65.4 | 65.9 |
| 736 | 2018/05/09 15:32:19 | 66.3 | 68.2 | 69.3 | 69.6 | 71.7 |
| 741 | 2018/05/09 15:32:24 | 70.0 | 71.8 | 71.9 | 72.8 | 74.3 |
| 746 | 2018/05/09 15:32:29 | 72.0 | 70.4 | 70.3 | 72.4 | 72.7 |
| 751 | 2018/05/09 15:32:34 | 70.5 | 67.7 | 66.6 | 66.1 | 67.4 |
| 756 | 2018/05/09 15:32:39 | 73.7 | 74.2 | 69.9 | 71.0 | 74.5 |
| 761 | 2018/05/09 15:32:44 | 72.0 | 74.6 | 74.4 | 77.1 | 74.8 |
| 766 | 2018/05/09 15:32:49 | 75.7 | 74.6 | 71.5 | 68.6 | 68.9 |
| 771 | 2018/05/09 15:32:54 | 71.8 | 77.3 | 76.4 | 75.6 | 77.5 |
| 776 | 2018/05/09 15:32:59 | 72.6 | 70.9 | 70.2 | 68.1 | 68.2 |
| 781 | 2018/05/09 15:33:04 | 67.2 | 65.8 | 67.1 | 68.6 | 69.6 |
| 786 | 2018/05/09 15:33:09 | 67.5 | 67.9 | 67.1 | 66.7 | 65.6 |
| 791 | 2018/05/09 15:33:14 | 67.2 | 64.6 | 65.8 | 66.1 | 65.3 |
| 796 | 2018/05/09 15:33:19 | 66.2 | 65.6 | 65.4 | 65.2 | 67.3 |
| 801 | 2018/05/09 15:33:24 | 69.2 | 69.0 | 67.3 | 67.3 | 68.3 |
| 806 | 2018/05/09 15:33:29 | 71.5 | 70.9 | 69.9 | 69.6 | 71.3 |
| 811 | 2018/05/09 15:33:34 | 69.1 | 66.7 | 65.9 | 67.4 | 68.4 |
| 816 | 2018/05/09 15:33:39 | 72.8 | 75.6 | 74.0 | 76.1 | 71.7 |
| 821 | 2018/05/09 15:33:44 | 71.0 | 76.6 | 75.3 | 72.7 | 72.1 |
| 826 | 2018/05/09 15:33:49 | 71.0 | 72.7 | 75.0 | 81.7 | 74.6 |
| 831 | 2018/05/09 15:33:54 | 72.1 | 76.1 | 76.9 | 74.2 | 75.7 |
| 836 | 2018/05/09 15:33:59 | 75.5 | 70.7 | 68.1 | 67.5 | 64.6 |
| 841 | 2018/05/09 15:34:04 | 64.4 | 64.6 | 66.9 | 67.0 | 66.5 |
| 846 | 2018/05/09 15:34:09 | 64.8 | 65.2 | 65.8 | 66.0 | 66.8 |
| 851 | 2018/05/09 15:34:14 | 72.3 | 72.8 | 67.8 | 65.7 | 65.9 |
| 856 | 2018/05/09 15:34:19 | 64.4 | 64.5 | 65.3 | 65.3 | 64.2 |
| 861 | 2018/05/09 15:34:24 | 65.0 | 65.0 | 64.7 | 65.0 | 65.5 |
| 866 | 2018/05/09 15:34:29 | 66.3 | 66.2 | 66.5 | 67.1 | 67.4 |
| 871 | 2018/05/09 15:34:34 | 70.9 | 73.1 | 70.1 | 70.0 | 71.9 |
| 876 | 2018/05/09 15:34:39 | 70.1 | 70.9 | 73.0 | 72.3 | 70.8 |
| 881 | 2018/05/09 15:34:44 | 71.7 | 73.2 | 72.0 | 69.8 | 66.7 |
| 886 | 2018/05/09 15:34:49 | 66.1 | 65.5 | 66.7 | 68.5 | 69.3 |
| 891 | 2018/05/09 15:34:54 | 75.3 | 74.5 | 74.8 | 73.2 | 73.5 |
| 896 | 2018/05/09 15:34:59 | 73.8 | 72.8 | 73.8 | 71.2 | 73.8 |

# Appendix E

Traffic Data

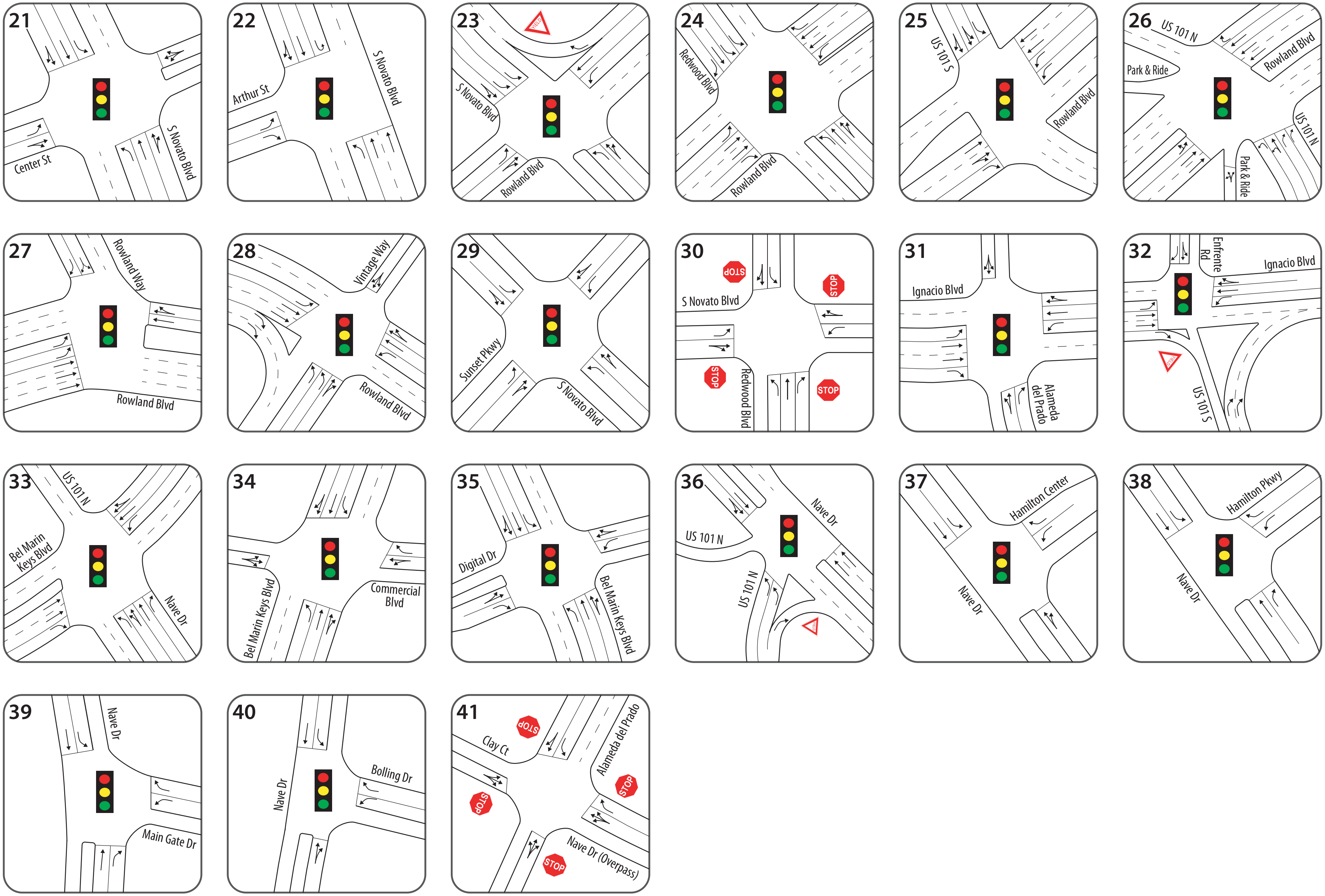
# Intersection Lane Configuration and Traffic Volume Figures




nov126.ai 3/18

Novato General Plan Update EIR

**Figure 1A – Existing Lane Configurations**

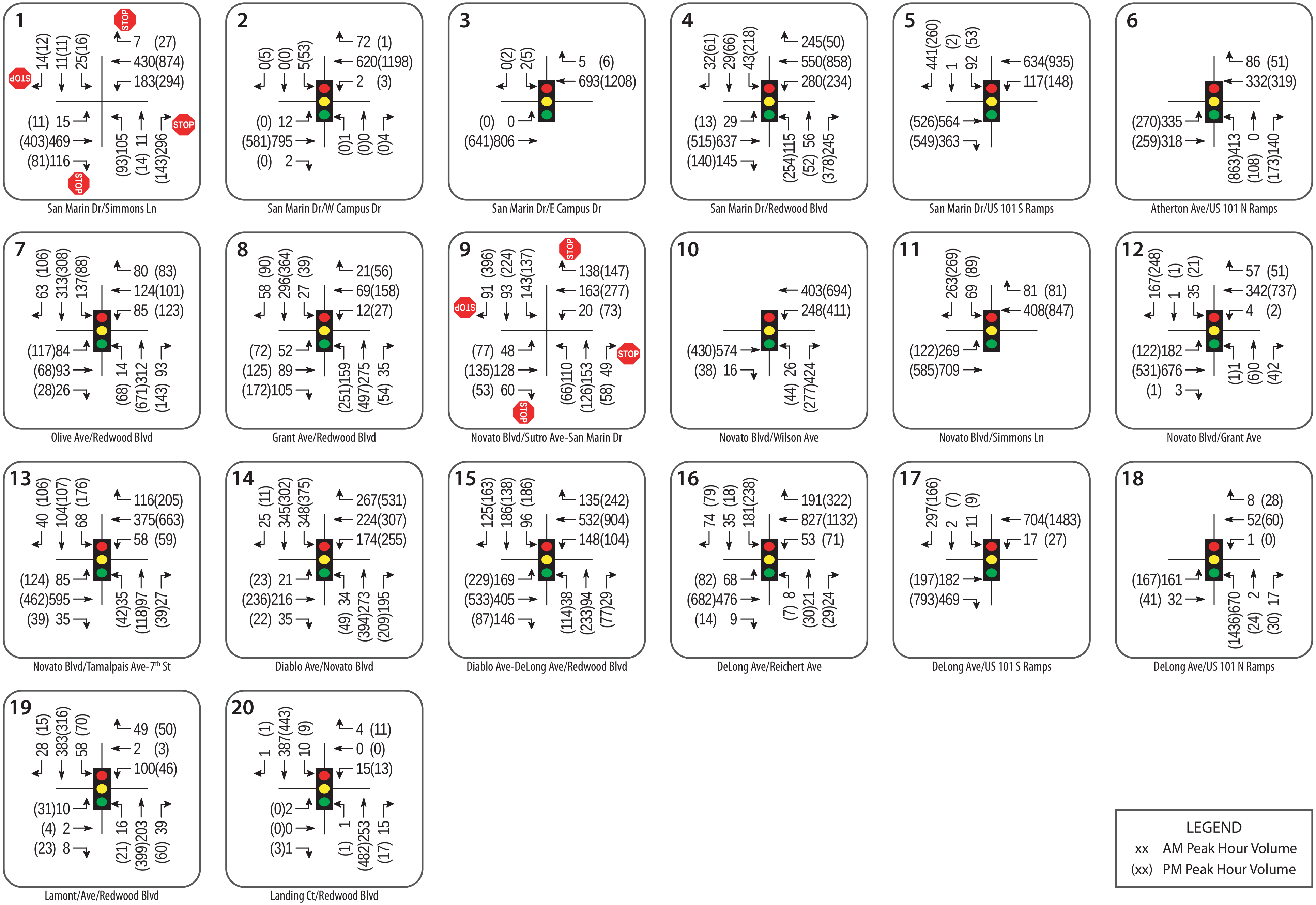



nov126.ai 3/18

Novato General Plan Update EIR

**Figure 1B – Existing Lane Configurations**

W-Trans

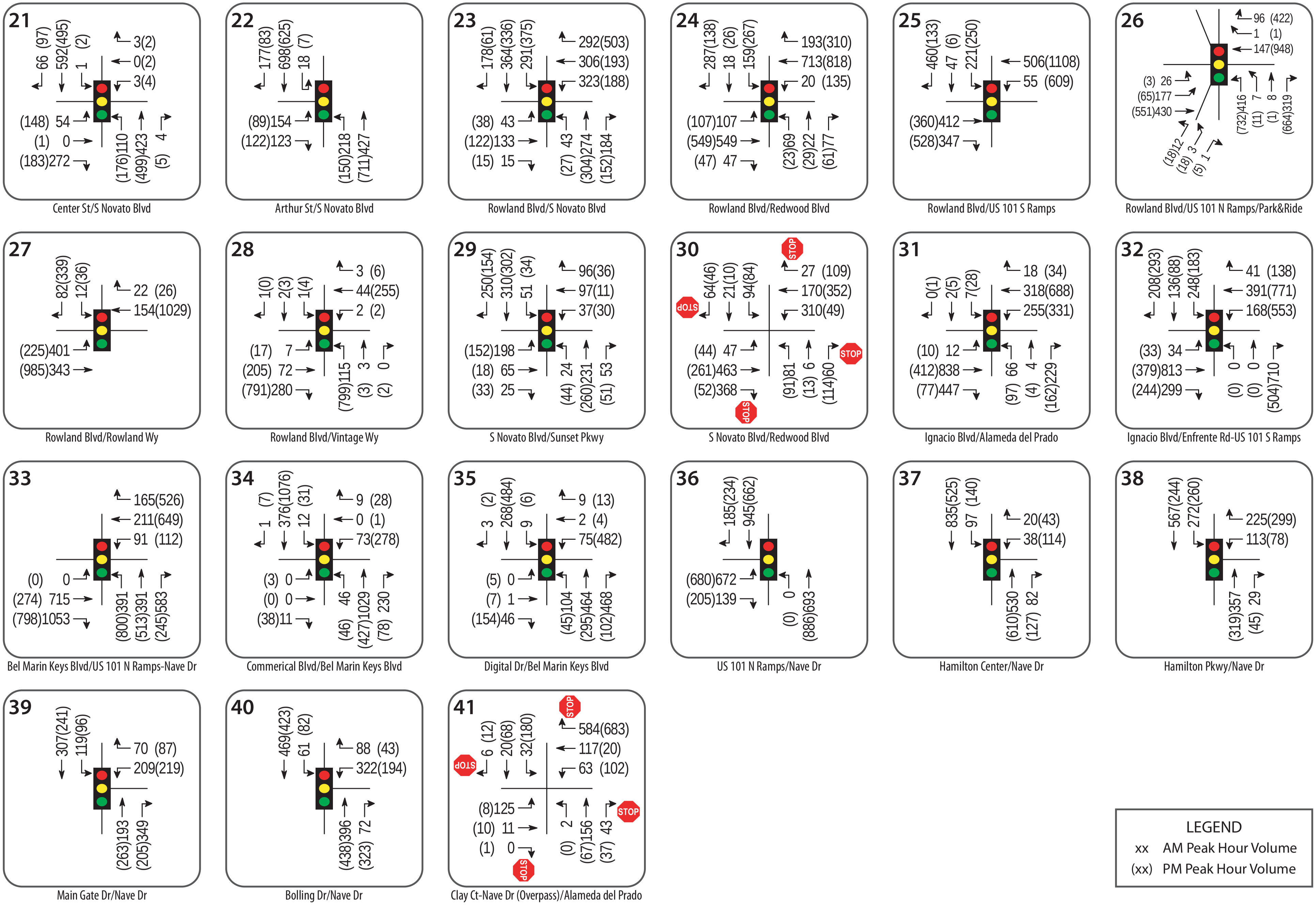



nov126.ai 3/18

Novato General Plan Update EIR

**Figure 2A – Existing Traffic Volumes**

W-Trans

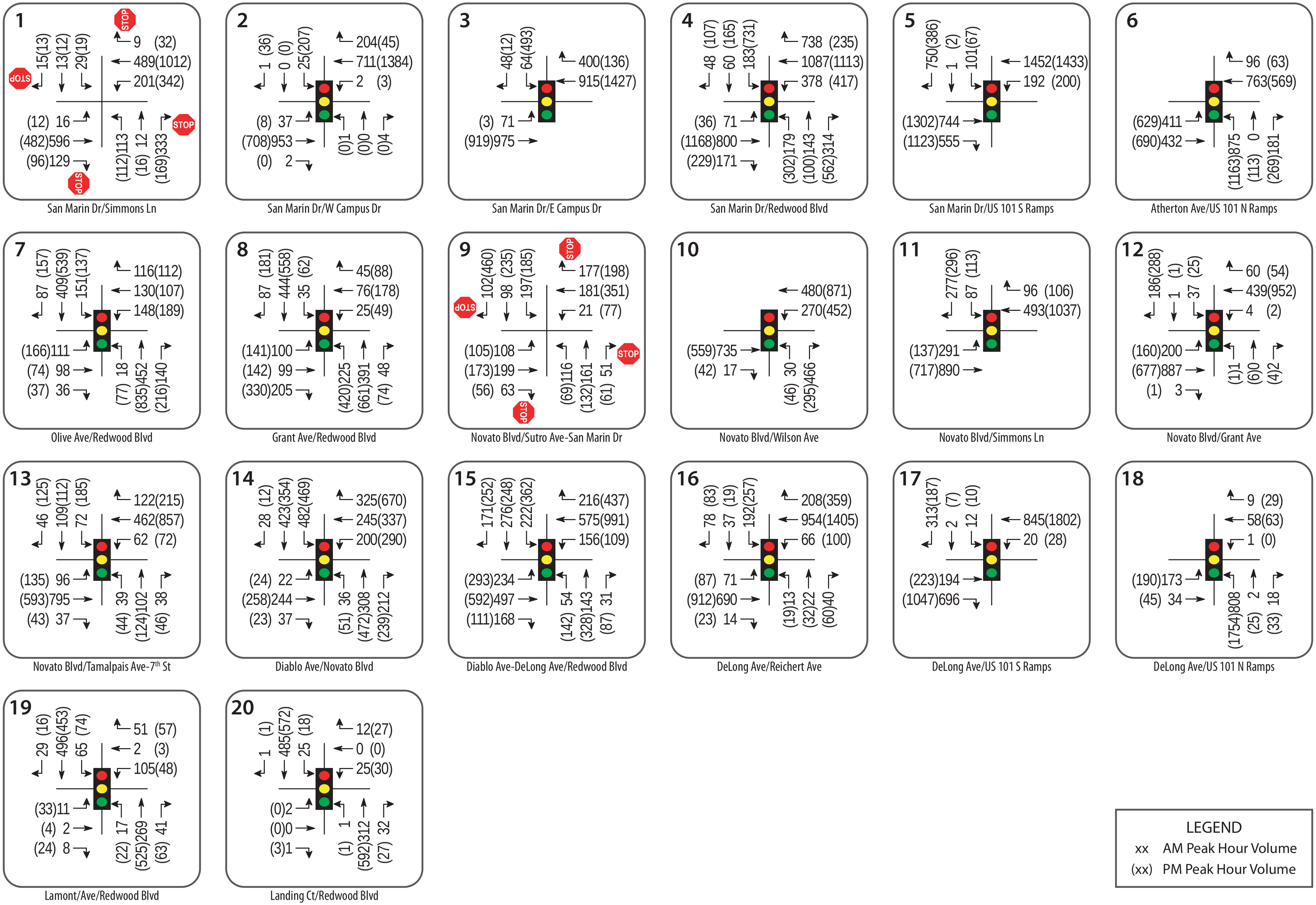



nov126.ai 3/18

Novato General Plan Update EIR

**Figure 2B – Existing Traffic Volumes**

W-Trans




nov126.ai 3/18

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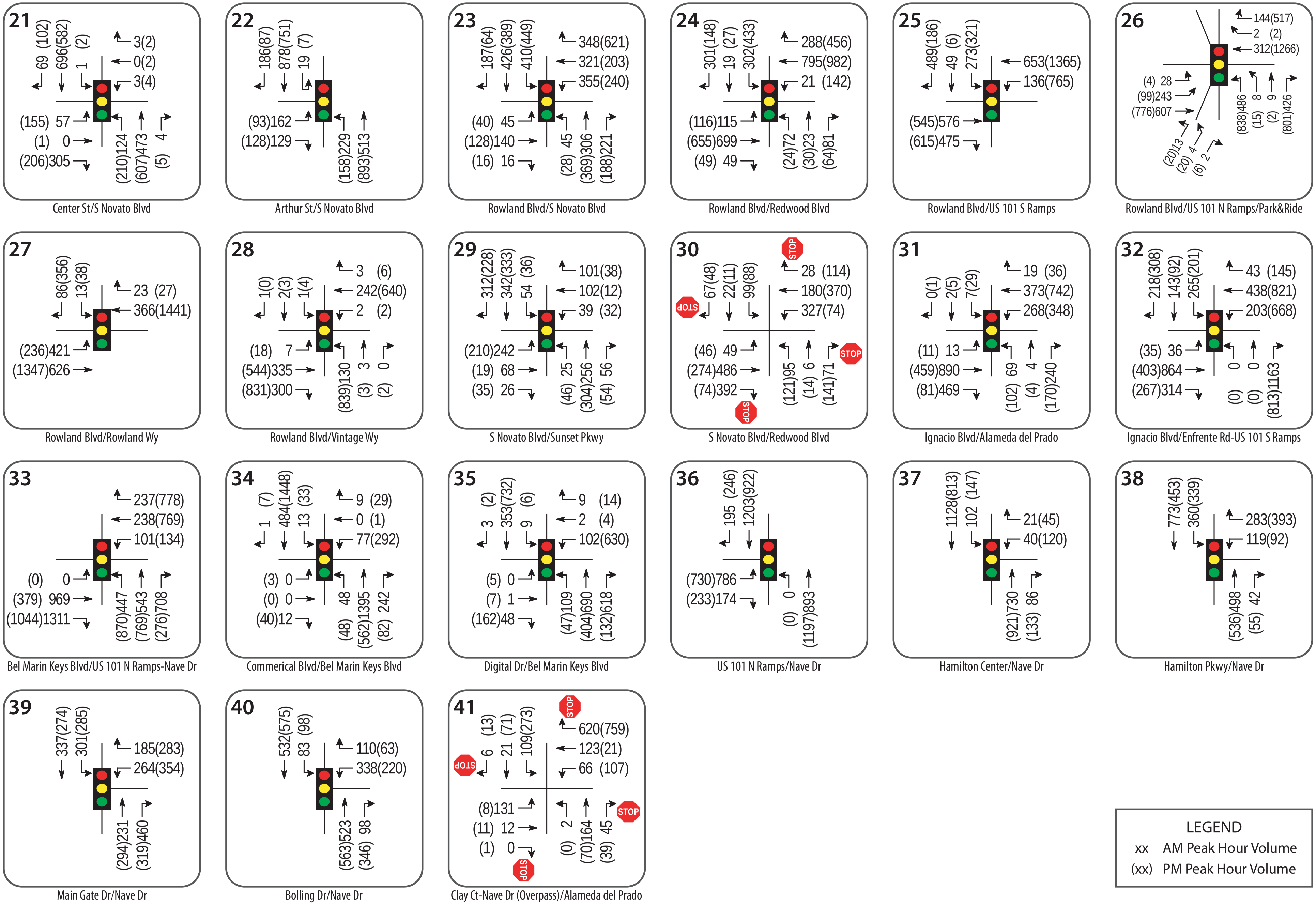
# Figure 3A – Cumulative Traffic Volumes

W-Trans

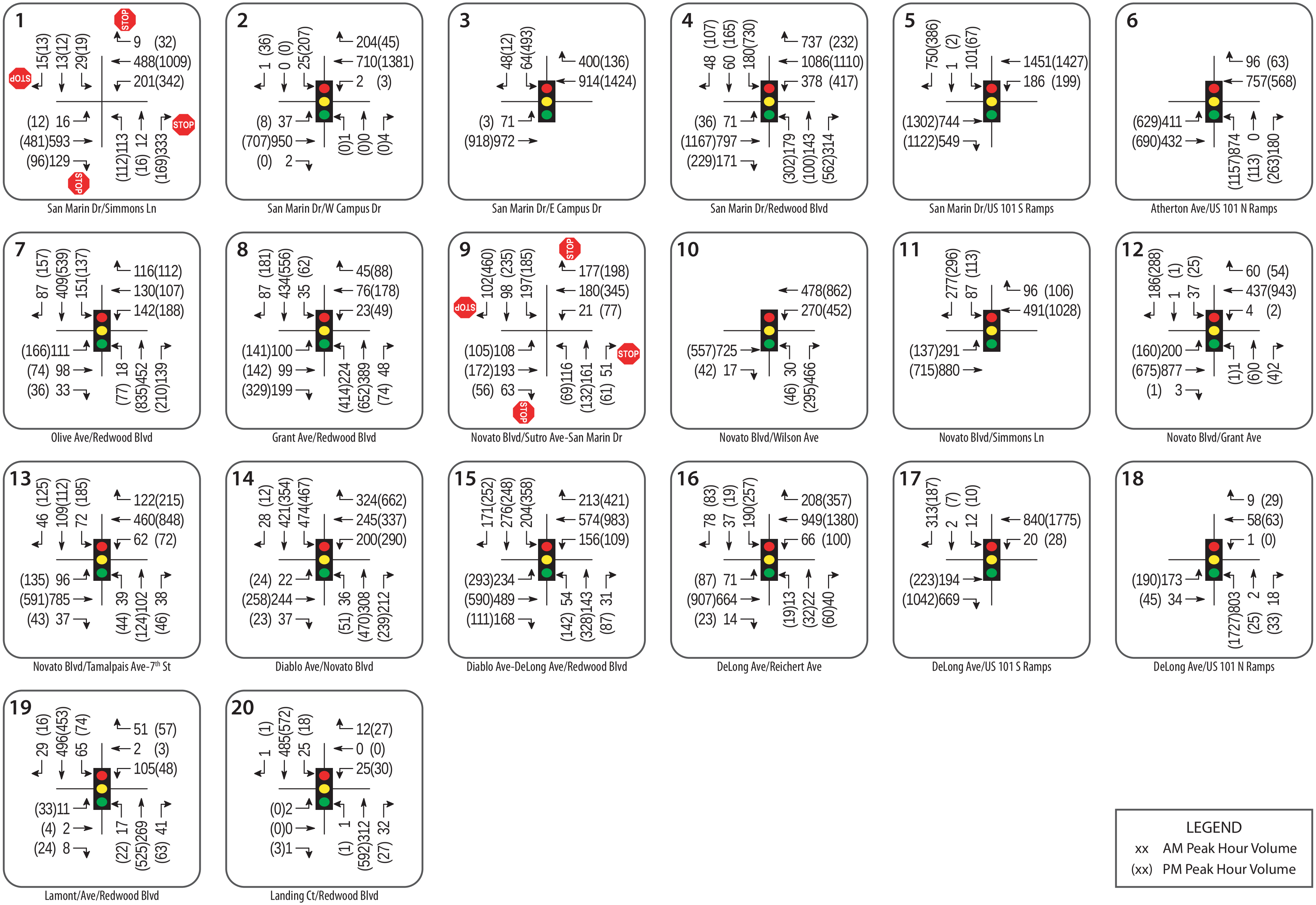



nov126.ai 3/18

Novato General Plan Update EIR

**Figure 3B – Cumulative Traffic Volumes**

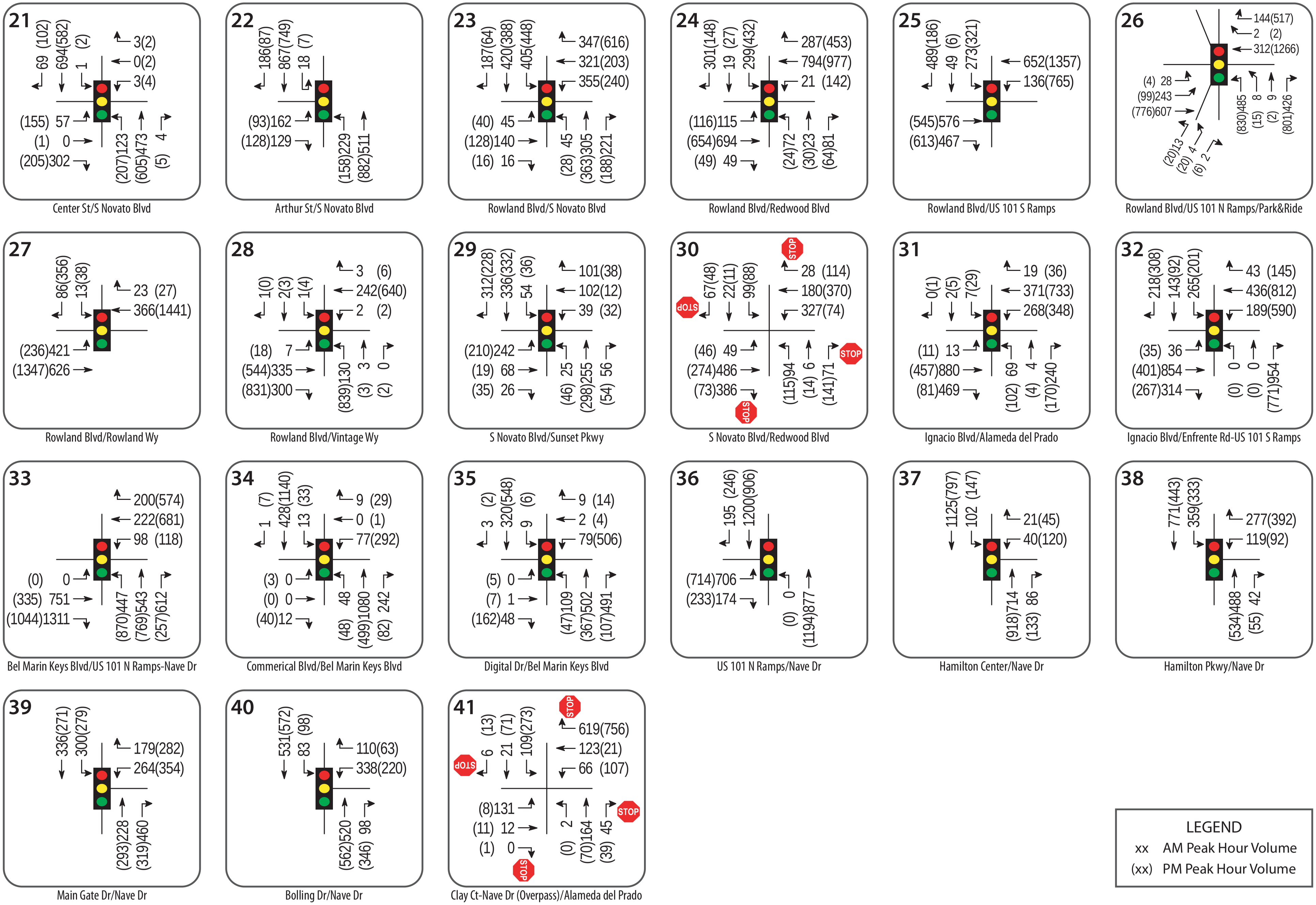
W-Trans




nov126.ai 3/18

Novato General Plan Update EIR

# Figure 4A – Cumulative plus Project Alternative Traffic Volumes




nov126.ai 3/18

Novato General Plan Update EIR

**Figure 4B – Cumulative plus Project Alternative Traffic Volumes**

# Intersection Level of Service Calculations

| Intersection | |
|---|---|
| Intersection Delay, s/veh | 29.9 |
| Intersection LOS | D |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 15 | 469 | 116 | 183 | 430 | 7 | 105 | 11 | 296 | 25 | 11 | 14 |
| Future Vol, veh/h | 15 | 469 | 116 | 183 | 430 | 7 | 105 | 11 | 296 | 25 | 11 | 14 |
| Peak Hour Factor | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| Heavy Vehicles, % | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Mvmt Flow | 16 | 504 | 125 | 197 | 462 | 8 | 113 | 12 | 318 | 27 | 12 | 15 |
| Number of Lanes | 1 | 2 | 0 | 1 | 2 | 0 | 0 | 1 | 1 | 0 | 1 | 0 |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Opposing Approach | WB | EB | SB | NB |
| Opposing Lanes | 3 | 3 | 1 | 2 |
| Conflicting Approach Left | SB | NB | EB | WB |
| Conflicting Lanes Left | 1 | 2 | 3 | 3 |
| Conflicting Approach Right | NB | SB | WB | EB |
| Conflicting Lanes Right | 2 | 1 | 3 | 3 |
| HCM Control Delay | 35.5 | 26 | 29.5 | 15.7 |
| HCM LOS | E | D | D | C |

| Lane | NBLn1 | NBLn2 | EBLn1 | EBLn2 | EBLn3 | WBLn1 | WBLn2 | WBLn3 | SBLn1 |
|---|---|---|---|---|---|---|---|---|---|
| Vol Left, % | 91% | 0% | 100% | 0% | 0% | 100% | 0% | 0% | 50% |
| Vol Thru, % | 9% | 0% | 0% | 100% | 57% | 0% | 100% | 95% | 22% |
| Vol Right, % | 0% | 100% | 0% | 0% | 43% | 0% | 0% | 5% | 28% |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 116 | 296 | 15 | 313 | 272 | 183 | 287 | 150 | 50 |
| LT Vol | 105 | 0 | 15 | 0 | 0 | 183 | 0 | 0 | 25 |
| Through Vol | 11 | 0 | 0 | 313 | 156 | 0 | 287 | 143 | 11 |
| RT Vol | 0 | 296 | 0 | 0 | 116 | 0 | 0 | 7 | 14 |
| Lane Flow Rate | 125 | 318 | 16 | 336 | 293 | 197 | 308 | 162 | 54 |
| Geometry Grp | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Degree of Util (X) | 0.339 | 0.761 | 0.042 | 0.828 | 0.696 | 0.508 | 0.751 | 0.392 | 0.162 |
| Departure Headway (Hd) | 9.777 | 8.602 | 9.385 | 8.866 | 8.557 | 9.287 | 8.768 | 8.734 | 10.829 |
| Convergence, Y/N | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Cap | 368 | 420 | 381 | 407 | 422 | 388 | 413 | 412 | 331 |
| Service Time | 7.546 | 6.371 | 7.149 | 6.63 | 6.321 | 7.046 | 6.527 | 6.493 | 8.616 |
| HCM Lane V/C Ratio | 0.34 | 0.757 | 0.042 | 0.826 | 0.694 | 0.508 | 0.746 | 0.393 | 0.163 |
| HCM Control Delay | 17.5 | 34.2 | 12.6 | 42.4 | 28.8 | 21.3 | 33.7 | 17 | 15.7 |
| HCM Lane LOS | C | D | B | E | D | C | D | C | C |
| HCM 95th-tile Q | 1.5 | 6.3 | 0.1 | 7.7 | 5.2 | 2.8 | 6.1 | 1.8 | 0.6 |





| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 12 | 795 | 2 | 2 | 620 | 72 | 1 | 0 | 4 | 5 | 0 | 0 |
| Future Volume (vph) | 12 | 795 | 2 | 2 | 620 | 72 | 1 | 0 | 4 | 5 | 0 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.8 | | 4.0 | 4.8 | 4.8 | | 4.0 | | 4.0 | 4.0 | |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 | | 1.00 | | 0.95 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 1.00 | | 1.00 | 1.00 | 0.85 | | 0.89 | | 1.00 | 1.00 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | | 0.99 | | 0.95 | 0.95 | |
| Satd. Flow (prot) | 1805 | 3573 | | 1805 | 3574 | 1615 | | 1678 | | 1715 | 1715 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | |
| Satd. Flow (perm) | 1805 | 3573 | | 1805 | 3574 | 1615 | | 1695 | | 1805 | 1805 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 13 | 864 | 2 | 2 | 674 | 78 | 1 | 0 | 4 | 5 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 38 | 0 | 5 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 13 | 866 | 0 | 2 | 674 | 40 | 0 | 0 | 0 | 2 | 3 | 0 |
| Confl. Peds. (#/hr) | | | 2 | | | | | | | | | |
| Heavy Vehicles (%) | 0% | 1% | 0% | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Prot | NA | | Prot | NA | Perm | Perm | NA | | Perm | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | | | | 6 | 8 | | | 4 | | 4 |
| Actuated Green, G (s) | 0.8 | 15.1 | | 0.8 | 15.1 | 15.1 | | 0.8 | | 0.8 | 0.8 | |
| Effective Green, g (s) | 0.8 | 15.1 | | 0.8 | 15.1 | 15.1 | | 0.8 | | 0.8 | 0.8 | |
| Actuated g/C Ratio | 0.03 | 0.51 | | 0.03 | 0.51 | 0.51 | | 0.03 | | 0.03 | 0.03 | |
| Clearance Time (s) | 4.0 | 4.8 | | 4.0 | 4.8 | 4.8 | | 4.0 | | 4.0 | 4.0 | |
| Vehicle Extension (s) | 2.0 | 4.0 | | 2.0 | 4.0 | 4.0 | | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 48 | 1828 | | 48 | 1829 | 826 | | 45 | | 48 | 48 | |
| v/s Ratio Prot | c0.01 | c0.24 | | 0.00 | 0.19 | | | | | | | |
| v/s Ratio Perm | | | | | | 0.02 | | 0.00 | | 0.00 | c0.00 | |
| v/c Ratio | 0.27 | 0.47 | | 0.04 | 0.37 | 0.05 | | 0.00 | | 0.04 | 0.06 | |
| Uniform Delay, d1 | 14.1 | 4.6 | | 14.0 | 4.3 | 3.6 | | 14.0 | | 14.0 | 14.0 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 1.1 | 0.3 | | 0.1 | 0.2 | 0.0 | | 0.0 | | 0.1 | 0.2 | |
| Delay (s) | 15.2 | 4.9 | | 14.1 | 4.5 | 3.6 | | 14.0 | | 14.1 | 14.2 | |
| Level of Service | B | A | | B | A | A | | B | | B | B | |
| Approach Delay (s) | | 5.1 | | | 4.4 | | | 14.0 | | | 14.2 | |
| Approach LOS | | A | | | A | | | B | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 4.8 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.44 | | |
| Actuated Cycle Length (s) | 29.5 | Sum of lost time (s) | 12.8 |
| Intersection Capacity Utilization | 37.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
3: San Marin Dr & E Campus Drive 02/15/2018

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 0 | 806 | 693 | 5 | 2 | 0 |
| Future Volume (vph) | 0 | 806 | 693 | 5 | 2 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.3 | 4.3 | 4.3 | 3.0 | |
| Lane Util. Factor | | 0.95 | 0.95 | 1.00 | 0.97 | |
| Frpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | | 1.00 | 1.00 | 0.85 | 1.00 | |
| Flt Protected | | 1.00 | 1.00 | 1.00 | 0.95 | |
| Satd. Flow (prot) | | 3574 | 3574 | 1615 | 3502 | |
| Flt Permitted | | 1.00 | 1.00 | 1.00 | 0.95 | |
| Satd. Flow (perm) | | 3574 | 3574 | 1615 | 3502 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 0 | 876 | 753 | 5 | 2 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 1 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 876 | 753 | 4 | 2 | 0 |
| Confl. Peds. (#/hr) | | | | | | 1 |
| Heavy Vehicles (%) | 0% | 1% | 1% | 0% | 0% | 0% |
| Turn Type | Prot | NA | NA | Perm | Perm | Perm |
| Protected Phases | 5 | 2 | 6 | | | |
| Permitted Phases | | | | 6 | 4 | 4 |
| Actuated Green, G (s) | | 116.3 | 116.3 | 116.3 | 6.4 | |
| Effective Green, g (s) | | 116.3 | 116.3 | 116.3 | 6.4 | |
| Actuated g/C Ratio | | 0.89 | 0.89 | 0.89 | 0.05 | |
| Clearance Time (s) | | 4.3 | 4.3 | 4.3 | 3.0 | |
| Vehicle Extension (s) | | 4.0 | 4.0 | 4.0 | 2.0 | |
| Lane Grp Cap (vph) | | 3197 | 3197 | 1444 | 172 | |
| v/s Ratio Prot | | c0.25 | 0.21 | | | |
| v/s Ratio Perm | | | | 0.00 | c0.00 | |
| v/c Ratio | | 0.27 | 0.24 | 0.00 | 0.01 | |
| Uniform Delay, d1 | | 1.0 | 0.9 | 0.7 | 58.8 | |
| Progression Factor | | 1.00 | 0.73 | 0.92 | 1.00 | |
| Incremental Delay, d2 | | 0.2 | 0.1 | 0.0 | 0.0 | |
| Delay (s) | | 1.2 | 0.7 | 0.7 | 58.8 | |
| Level of Service | | A | A | A | E | |
| Approach Delay (s) | | 1.2 | 0.7 | | 58.8 | |
| Approach LOS | | A | A | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 1.0 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.27 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 10.3 |
| Intersection Capacity Utilization | 34.9% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



HCM Signalized Intersection Capacity Analysis
4: Redwood Blvd & San Marin Dr 02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 29 | 637 | 145 | 280 | 550 | 245 | 115 | 56 | 245 | 43 | 29 | 32 |
| Future Volume (vph) | 29 | 637 | 145 | 280 | 550 | 245 | 115 | 56 | 245 | 43 | 29 | 32 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.6 | | 3.0 | 4.0 | | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 | |
| Lane Util. Factor | 1.00 | 0.91 | | 1.00 | 0.91 | | 0.97 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 0.99 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 0.97 | | 1.00 | 0.95 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.92 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1787 | 4978 | | 1752 | 4898 | | 3467 | 1881 | 1568 | 1787 | 1717 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1787 | 4978 | | 1752 | 4898 | | 3467 | 1881 | 1568 | 1787 | 1717 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 31 | 671 | 153 | 295 | 579 | 258 | 121 | 59 | 258 | 45 | 31 | 34 |
| RTOR Reduction (vph) | 0 | 25 | 0 | 0 | 37 | 0 | 0 | 0 | 236 | 0 | 30 | 0 |
| Lane Group Flow (vph) | 31 | 799 | 0 | 295 | 800 | 0 | 121 | 59 | 22 | 45 | 35 | 0 |
| Confl. Peds. (#/hr) | | | 4 | | | | | | | | | 5 |
| Confl. Bikes (#/hr) | | | | | | | | | | | | 1 |
| Heavy Vehicles (%) | 1% | 1% | 1% | 3% | 1% | 1% | 1% | 1% | 3% | 1% | 1% | 1% |
| Turn Type | Prot | NA | | Prot | NA | | Split | NA | Perm | Split | NA | |
| Protected Phases | 1 | 6 | | 5 | 2 | | 7 | 7 | | 8 | 8 | |
| Permitted Phases | | | | | 2 | | | | 7 | | | |
| Actuated Green, G (s) | 6.0 | 55.8 | | 34.4 | 83.8 | | 11.0 | 11.0 | 11.0 | 13.6 | 13.6 | |
| Effective Green, g (s) | 6.0 | 55.8 | | 34.4 | 83.8 | | 11.0 | 11.0 | 11.0 | 13.6 | 13.6 | |
| Actuated g/C Ratio | 0.05 | 0.43 | | 0.26 | 0.64 | | 0.08 | 0.08 | 0.08 | 0.10 | 0.10 | |
| Clearance Time (s) | 3.0 | 3.6 | | 3.0 | 4.0 | | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 | |
| Vehicle Extension (s) | 2.0 | 4.0 | | 5.0 | 4.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 82 | 2136 | | 463 | 3157 | | 293 | 159 | 132 | 186 | 179 | |
| v/s Ratio Prot | 0.02 | c0.16 | | c0.17 | 0.16 | | c0.03 | 0.03 | | c0.03 | 0.02 | |
| v/s Ratio Perm | | | | | | | | | 0.01 | | | |
| v/c Ratio | 0.38 | 0.37 | | 0.64 | 0.25 | | 0.41 | 0.37 | 0.17 | 0.24 | 0.19 | |
| Uniform Delay, d1 | 60.2 | 25.2 | | 42.3 | 9.8 | | 56.4 | 56.2 | 55.2 | 53.5 | 53.2 | |
| Progression Factor | 1.19 | 0.91 | | 1.05 | 1.01 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 1.0 | 0.5 | | 3.8 | 0.2 | | 0.3 | 0.5 | 0.2 | 0.2 | 0.2 | |
| Delay (s) | 72.8 | 23.5 | | 48.1 | 10.1 | | 56.8 | 56.8 | 55.5 | 53.7 | 53.4 | |
| Level of Service | E | C | | D | B | | E | E | E | D | D | |
| Approach Delay (s) | | 25.3 | | | 20.0 | | | 56.0 | | | 53.5 | |
| Approach LOS | | C | | | B | | | E | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 29.5 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.44 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 15.6 |
| Intersection Capacity Utilization | 75.6% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 5: US 101 SB Ramps & San Marin Dr

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 564 | 363 | 117 | 634 | 0 | 0 | 0 | 0 | 92 | 1 | 441 |
| Future Volume (vph) | 0 | 564 | 363 | 117 | 634 | 0 | 0 | 0 | 0 | 92 | 1 | 441 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.9 | 4.9 | 3.0 | 5.3 | | | | | | 4.0 | 4.0 |
| Lane Util. Factor | | 0.95 | 1.00 | 1.00 | 0.95 | | | | | | 1.00 | 0.88 |
| Frpb, ped/bikes | | 1.00 | 0.99 | 1.00 | 1.00 | | | | | | 1.00 | 1.00 |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | | | | | 1.00 | 1.00 |
| Frt | | 1.00 | 0.85 | 1.00 | 1.00 | | | | | | 1.00 | 0.85 |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | | 0.95 | 1.00 |
| Satd. Flow (prot) | | 3574 | 1575 | 1805 | 3574 | | | | | | 1810 | 2814 |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | | 0.95 | 1.00 |
| Satd. Flow (perm) | | 3574 | 1575 | 1805 | 3574 | | | | | | 1810 | 2814 |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 0 | 600 | 386 | 124 | 674 | 0 | 0 | 0 | 0 | 98 | 1 | 469 |
| RTOR Reduction (vph) | 0 | 0 | 166 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 384 |
| Lane Group Flow (vph) | 0 | 600 | 220 | 124 | 674 | 0 | 0 | 0 | 0 | 0 | 99 | 85 |
| Confl. Peds. (#/hr) | | | 4 | | | | | | | | | |
| Heavy Vehicles (%) | 0% | 1% | 1% | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 1% |
| Turn Type | | NA | Perm | Prot | NA | | | | | Split | NA | Perm |
| Protected Phases | | 2 | | 1 | 6 | | | | | 4 | 4 | |
| Permitted Phases | | | 2 | | | | | | | | | 4 |
| Actuated Green, G (s) | | 37.1 | 37.1 | 7.8 | 47.5 | | | | | | 8.2 | 8.2 |
| Effective Green, g (s) | | 37.1 | 37.1 | 7.8 | 47.5 | | | | | | 8.2 | 8.2 |
| Actuated g/C Ratio | | 0.57 | 0.57 | 0.12 | 0.73 | | | | | | 0.13 | 0.13 |
| Clearance Time (s) | | 4.9 | 4.9 | 3.0 | 5.3 | | | | | | 4.0 | 4.0 |
| Vehicle Extension (s) | | 4.0 | 4.0 | 2.0 | 4.0 | | | | | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | | 2039 | 898 | 216 | 2611 | | | | | | 228 | 354 |
| v/s Ratio Prot | | c0.17 | | c0.07 | 0.19 | | | | | | c0.05 | |
| v/s Ratio Perm | | | 0.14 | | | | | | | | | 0.03 |
| v/c Ratio | | 0.29 | 0.25 | 0.57 | 0.26 | | | | | | 0.43 | 0.24 |
| Uniform Delay, d1 | | 7.2 | 7.0 | 27.0 | 2.9 | | | | | | 26.3 | 25.6 |
| Progression Factor | | 0.70 | 1.79 | 1.00 | 1.00 | | | | | | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.3 | 0.6 | 2.3 | 0.2 | | | | | | 0.5 | 0.1 |
| Delay (s) | | 5.3 | 13.1 | 29.3 | 3.1 | | | | | | 26.7 | 25.7 |
| Level of Service | | A | B | C | A | | | | | | C | C |
| Approach Delay (s) | | 8.4 | | | 7.2 | | | 0.0 | | | 25.9 | |
| Approach LOS | | A | | | A | | | A | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 12.2 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.36 | | |
| Actuated Cycle Length (s) | 65.0 | Sum of lost time (s) | 11.9 |
| Intersection Capacity Utilization | 45.3% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 6: US 101 NB Ramps & San Marin Dr

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 335 | 318 | 0 | 0 | 332 | 86 | 413 | 0 | 140 | 0 | 0 | 0 |
| Future Volume (vph) | 335 | 318 | 0 | 0 | 332 | 86 | 413 | 0 | 140 | 0 | 0 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.6 | | | 4.9 | 4.9 | 3.5 | 3.5 | | | | |
| Lane Util. Factor | 0.97 | 1.00 | | | 0.95 | 1.00 | 0.95 | 0.95 | | | | |
| Frpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | 0.99 | 1.00 | 0.99 | | | | |
| Flpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | | | |
| Frt | 1.00 | 1.00 | | | 1.00 | 0.85 | 1.00 | 0.92 | | | | |
| Flt Protected | 0.95 | 1.00 | | | 1.00 | 1.00 | 0.95 | 0.98 | | | | |
| Satd. Flow (prot) | 3467 | 1881 | | | 3574 | 1594 | 1681 | 1567 | | | | |
| Flt Permitted | 0.95 | 1.00 | | | 1.00 | 1.00 | 0.95 | 0.98 | | | | |
| Satd. Flow (perm) | 3467 | 1881 | | | 3574 | 1594 | 1681 | 1567 | | | | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 353 | 335 | 0 | 0 | 349 | 91 | 435 | 0 | 147 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 68 | 0 | 73 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 353 | 335 | 0 | 0 | 349 | 23 | 300 | 209 | 0 | 0 | 0 | 0 |
| Confl. Peds. (#/hr) | | | 3 | | | 1 | | | 1 | 1 | | |
| Heavy Vehicles (%) | 1% | 1% | 0% | 0% | 1% | 0% | 2% | 0% | 3% | 0% | 0% | 0% |
| Turn Type | Prot | NA | | | NA | Perm | Split | NA | | | | |
| Protected Phases | 5 | 2 | | | 6 | | 8 | 8 | | | | |
| Permitted Phases | | | | | | 6 | | | | | | |
| Actuated Green, G (s) | 9.5 | 25.0 | | | 11.7 | 11.7 | 13.2 | 13.2 | | | | |
| Effective Green, g (s) | 9.5 | 25.0 | | | 11.7 | 11.7 | 13.2 | 13.2 | | | | |
| Actuated g/C Ratio | 0.21 | 0.54 | | | 0.25 | 0.25 | 0.29 | 0.29 | | | | |
| Clearance Time (s) | 3.5 | 4.6 | | | 4.9 | 4.9 | 3.5 | 3.5 | | | | |
| Vehicle Extension (s) | 2.0 | 4.0 | | | 4.0 | 4.0 | 2.5 | 2.5 | | | | |
| Lane Grp Cap (vph) | 711 | 1015 | | | 903 | 402 | 479 | 446 | | | | |
| v/s Ratio Prot | c0.10 | c0.18 | | | 0.10 | | c0.18 | 0.13 | | | | |
| v/s Ratio Perm | | | | | | 0.01 | | | | | | |
| v/c Ratio | 0.50 | 0.33 | | | 0.39 | 0.06 | 0.63 | 0.47 | | | | |
| Uniform Delay, d1 | 16.3 | 6.0 | | | 14.3 | 13.1 | 14.4 | 13.7 | | | | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | | | |
| Incremental Delay, d2 | 0.2 | 0.3 | | | 0.4 | 0.1 | 2.2 | 0.6 | | | | |
| Delay (s) | 16.5 | 6.2 | | | 14.7 | 13.2 | 16.6 | 14.2 | | | | |
| Level of Service | B | A | | | B | B | B | B | | | | |
| Approach Delay (s) | | 11.5 | | | 14.4 | | | 15.5 | | | 0.0 | |
| Approach LOS | | B | | | B | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 13.6 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.52 | | |
| Actuated Cycle Length (s) | 46.3 | Sum of lost time (s) | 11.9 |
| Intersection Capacity Utilization | 45.3% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 7: Redwood Blvd & Olive St

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 84 | 93 | 26 | 85 | 124 | 80 | 14 | 312 | 93 | 137 | 313 | 63 |
| Future Volume (vph) | 84 | 93 | 26 | 85 | 124 | 80 | 14 | 312 | 93 | 137 | 313 | 63 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 5.1 | 5.1 | | | 5.1 | | 4.0 | 3.9 | 3.9 | 4.0 | 3.9 | |
| Lane Util. Factor | 1.00 | 1.00 | | | 1.00 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | |
| Frt | 1.00 | 0.97 | | | 0.96 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.97 | |
| Flt Protected | 0.95 | 1.00 | | | 0.99 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1770 | 1802 | | | 1767 | | 1770 | 3539 | 1583 | 1770 | 3451 | |
| Flt Permitted | 0.95 | 1.00 | | | 0.99 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1770 | 1802 | | | 1767 | | 1770 | 3539 | 1583 | 1770 | 3451 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 91 | 101 | 28 | 92 | 135 | 87 | 15 | 339 | 101 | 149 | 340 | 68 |
| RTOR Reduction (vph) | 0 | 10 | 0 | 0 | 13 | 0 | 0 | 0 | 79 | 0 | 13 | 0 |
| Lane Group Flow (vph) | 91 | 119 | 0 | 0 | 301 | 0 | 15 | 339 | 22 | 149 | 395 | 0 |
| Turn Type | Split | NA | | Split | NA | | Prot | NA | Perm | Prot | NA | |
| Protected Phases | 4 | 4 | | 8 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | | | | | | | 2 | | | |
| Actuated Green, G (s) | 11.2 | 11.2 | | | 15.8 | | 1.3 | 15.9 | 15.9 | 11.5 | 26.1 | |
| Effective Green, g (s) | 11.2 | 11.2 | | | 15.8 | | 1.3 | 15.9 | 15.9 | 11.5 | 26.1 | |
| Actuated g/C Ratio | 0.15 | 0.15 | | | 0.22 | | 0.02 | 0.22 | 0.22 | 0.16 | 0.36 | |
| Clearance Time (s) | 5.1 | 5.1 | | | 5.1 | | 4.0 | 3.9 | 3.9 | 4.0 | 3.9 | |
| Vehicle Extension (s) | 1.0 | 1.0 | | | 1.0 | | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | |
| Lane Grp Cap (vph) | 273 | 278 | | | 385 | | 31 | 776 | 347 | 280 | 1242 | |
| v/s Ratio Prot | 0.05 | c0.07 | | | c0.17 | | 0.01 | c0.10 | | c0.08 | 0.11 | |
| v/s Ratio Perm | | | | | | | | | 0.01 | | | |
| v/c Ratio | 0.33 | 0.43 | | | 0.78 | | 0.48 | 0.44 | 0.06 | 0.53 | 0.32 | |
| Uniform Delay, d1 | 27.3 | 27.7 | | | 26.7 | | 35.3 | 24.4 | 22.4 | 28.0 | 16.8 | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 0.3 | 0.4 | | | 9.3 | | 4.3 | 0.1 | 0.0 | 1.0 | 0.1 | |
| Delay (s) | 27.6 | 28.1 | | | 36.0 | | 39.5 | 24.6 | 22.4 | 29.0 | 16.8 | |
| Level of Service | C | C | | | D | | D | C | C | C | B | |
| Approach Delay (s) | | 27.9 | | | 36.0 | | | 24.6 | | | 20.1 | |
| Approach LOS | | C | | | D | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 25.8 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.56 | | |
| Actuated Cycle Length (s) | 72.5 | Sum of lost time (s) | 18.1 |
| Intersection Capacity Utilization | 52.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 8: Redwood Blvd & Grant Ave

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 52 | 89 | 105 | 12 | 69 | 21 | 159 | 275 | 35 | 27 | 296 | 58 |
| Future Volume (vph) | 52 | 89 | 105 | 12 | 69 | 21 | 159 | 275 | 35 | 27 | 296 | 58 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.5 | 3.5 | | 3.5 | 3.7 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | | 1.00 | 0.99 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.98 | | 1.00 | 0.98 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1763 | 1900 | 1564 | 1804 | 1900 | 1587 | 1805 | 3473 | | 1805 | 3441 | |
| Flt Permitted | 0.71 | 1.00 | 1.00 | 0.69 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1313 | 1900 | 1564 | 1317 | 1900 | 1587 | 1805 | 3473 | | 1805 | 3441 | |
| Peak-hour factor, PHF | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Adj. Flow (vph) | 57 | 98 | 115 | 13 | 76 | 23 | 175 | 302 | 38 | 30 | 325 | 64 |
| RTOR Reduction (vph) | 0 | 0 | 89 | 0 | 0 | 18 | 0 | 7 | 0 | 0 | 15 | 0 |
| Lane Group Flow (vph) | 57 | 98 | 26 | 13 | 76 | 5 | 175 | 333 | 0 | 30 | 374 | 0 |
| Confl. Peds. (#/hr) | 9 | | 11 | 2 | | 1 | | | 10 | | | 9 |
| Confl. Bikes (#/hr) | | | 5 | | | 5 | | | 5 | | | 5 |
| Heavy Vehicles (%) | 2% | 0% | 1% | 0% | 0% | 0% | 0% | 2% | 0% | 0% | 2% | 0% |
| Turn Type | Perm | NA | Perm | Perm | NA | Perm | Prot | NA | | Prot | NA | |
| Protected Phases | | 8 | | | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | 8 | | 8 | 4 | | 4 | | | | | | |
| Actuated Green, G (s) | 13.3 | 13.3 | 13.3 | 13.3 | 13.3 | 13.3 | 14.9 | 31.2 | | 2.6 | 18.7 | |
| Effective Green, g (s) | 13.3 | 13.3 | 13.3 | 13.3 | 13.3 | 13.3 | 14.9 | 31.2 | | 2.6 | 18.7 | |
| Actuated g/C Ratio | 0.23 | 0.23 | 0.23 | 0.23 | 0.23 | 0.23 | 0.26 | 0.54 | | 0.04 | 0.32 | |
| Clearance Time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.5 | 3.5 | | 3.5 | 3.7 | |
| Vehicle Extension (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 2.5 | 3.0 | | 2.5 | 3.0 | |
| Lane Grp Cap (vph) | 300 | 434 | 358 | 301 | 434 | 363 | 462 | 1865 | | 80 | 1107 | |
| v/s Ratio Prot | | c0.05 | | | 0.04 | | c0.10 | 0.10 | | 0.02 | c0.11 | |
| v/s Ratio Perm | 0.04 | | 0.02 | 0.01 | | 0.00 | | | | | | |
| v/c Ratio | 0.19 | 0.23 | 0.07 | 0.04 | 0.18 | 0.01 | 0.38 | 0.18 | | 0.38 | 0.34 | |
| Uniform Delay, d1 | 18.1 | 18.2 | 17.6 | 17.4 | 18.0 | 17.3 | 17.8 | 6.9 | | 27.0 | 15.0 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 0.4 | 0.4 | 0.1 | 0.1 | 0.3 | 0.0 | 0.4 | 0.0 | | 2.1 | 0.2 | |
| Delay (s) | 18.5 | 18.6 | 17.7 | 17.5 | 18.3 | 17.4 | 18.2 | 6.9 | | 29.1 | 15.2 | |
| Level of Service | B | B | B | B | B | B | B | A | | C | B | |
| Approach Delay (s) | | 18.2 | | | 18.0 | | | 10.8 | | | 16.2 | |
| Approach LOS | | B | | | B | | | B | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 14.6 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.32 | | |
| Actuated Cycle Length (s) | 58.1 | Sum of lost time (s) | 11.2 |
| Intersection Capacity Utilization | 49.6% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM 2010 AWSC
## 9: San Marin Dr/Sutro Ave & Novato Blvd


| Intersection | |
|---|---|
| Intersection Delay, s/veh | 23.8 |
| Intersection LOS | C |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 48 | 128 | 60 | 20 | 163 | 138 | 110 | 153 | 49 | 143 | 93 | 91 |
| Future Vol, veh/h | 48 | 128 | 60 | 20 | 163 | 138 | 110 | 153 | 49 | 143 | 93 | 91 |
| Peak Hour Factor | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 56 | 151 | 71 | 24 | 192 | 162 | 129 | 180 | 58 | 168 | 109 | 107 |
| Number of Lanes | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Opposing Approach | WB | EB | SB | NB |
| Opposing Lanes | 2 | 2 | 3 | 2 |
| Conflicting Approach Left | SB | NB | EB | WB |
| Conflicting Lanes Left | 3 | 2 | 2 | 2 |
| Conflicting Approach Right | NB | SB | WB | EB |
| Conflicting Lanes Right | 2 | 3 | 2 | 2 |
| HCM Control Delay | 20 | 37.5 | 20.4 | 16.3 |
| HCM LOS | C | E | C | C |

| Lane | NBLn1 | NBLn2 | EBLn1 | EBLn2 | WBLn1 | WBLn2 | SBLn1 | SBLn2 | SBLn3 |
|---|---|---|---|---|---|---|---|---|---|
| Vol Left, % | 100% | 0% | 100% | 0% | 100% | 0% | 100% | 0% | 0% |
| Vol Thru, % | 0% | 76% | 0% | 68% | 0% | 54% | 0% | 100% | 0% |
| Vol Right, % | 0% | 24% | 0% | 32% | 0% | 46% | 0% | 0% | 100% |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 110 | 202 | 48 | 188 | 20 | 301 | 143 | 93 | 91 |
| LT Vol | 110 | 0 | 48 | 0 | 20 | 0 | 143 | 0 | 0 |
| Through Vol | 0 | 153 | 0 | 128 | 0 | 163 | 0 | 93 | 0 |
| RT Vol | 0 | 49 | 0 | 60 | 0 | 138 | 0 | 0 | 91 |
| Lane Flow Rate | 129 | 238 | 56 | 221 | 24 | 354 | 168 | 109 | 107 |
| Geometry Grp | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Degree of Util (X) | 0.336 | 0.57 | 0.15 | 0.541 | 0.06 | 0.818 | 0.436 | 0.268 | 0.241 |
| Departure Headway (Hd) | 9.337 | 8.641 | 9.545 | 8.798 | 9.162 | 8.319 | 9.333 | 8.816 | 8.091 |
| Convergence, Y/N | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Cap | 384 | 416 | 375 | 409 | 390 | 436 | 385 | 407 | 443 |
| Service Time | 7.109 | 6.412 | 7.317 | 6.57 | 6.929 | 6.085 | 7.104 | 6.586 | 5.861 |
| HCM Lane V/C Ratio | 0.336 | 0.572 | 0.149 | 0.54 | 0.062 | 0.812 | 0.436 | 0.268 | 0.242 |
| HCM Control Delay | 16.8 | 22.3 | 14 | 21.5 | 12.5 | 39.2 | 19.2 | 14.8 | 13.4 |
| HCM Lane LOS | C | C | B | C | B | E | C | B | B |
| HCM 95th-tile Q | 1.5 | 3.4 | 0.5 | 3.1 | 0.2 | 7.6 | 2.1 | 1.1 | 0.9 |



## HCM Signalized Intersection Capacity Analysis
## 10: Wilson Ave & Novato Blvd


| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 574 | 16 | 248 | 403 | 26 | 424 |
| Future Volume (vph) | 574 | 16 | 248 | 403 | 26 | 424 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.9 | | 3.0 | 3.6 | 3.6 | 3.6 |
| Lane Util. Factor | 0.95 | | 1.00 | 0.95 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | | 1.00 | 1.00 | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | | 1.00 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 1.00 | | 0.95 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (prot) | 3558 | | 1787 | 3610 | 1805 | 1593 |
| Flt Permitted | 1.00 | | 0.95 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (perm) | 3558 | | 1787 | 3610 | 1805 | 1593 |
| Peak-hour factor, PHF | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 |
| Adj. Flow (vph) | 675 | 19 | 292 | 474 | 31 | 499 |
| RTOR Reduction (vph) | 2 | 0 | 0 | 0 | 0 | 242 |
| Lane Group Flow (vph) | 692 | 0 | 292 | 474 | 31 | 257 |
| Confl. Peds. (#/hr) | | 3 | | | 6 | 2 |
| Heavy Vehicles (%) | 1% | 0% | 1% | 0% | 0% | 0% |
| Turn Type | NA | | Prot | NA | Prot | Perm |
| Protected Phases | 2 | | 1 | 6 | 4 | |
| Permitted Phases | | | | | | 4 |
| Actuated Green, G (s) | 32.1 | | 20.3 | 42.7 | 17.1 | 17.1 |
| Effective Green, g (s) | 32.1 | | 20.3 | 42.7 | 17.1 | 17.1 |
| Actuated g/C Ratio | 0.40 | | 0.25 | 0.53 | 0.21 | 0.21 |
| Clearance Time (s) | 3.9 | | 3.0 | 3.6 | 3.6 | 3.6 |
| Vehicle Extension (s) | 3.0 | | 2.0 | 3.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 1427 | | 453 | 1926 | 385 | 340 |
| v/s Ratio Prot | c0.19 | | c0.16 | 0.13 | 0.02 | |
| v/s Ratio Perm | | | | | | c0.16 |
| v/c Ratio | 0.48 | | 0.64 | 0.25 | 0.08 | 0.76 |
| Uniform Delay, d1 | 17.8 | | 26.6 | 10.0 | 25.2 | 29.5 |
| Progression Factor | 1.00 | | 0.90 | 0.56 | 1.00 | 1.00 |
| Incremental Delay, d2 | 1.2 | | 2.3 | 0.3 | 0.0 | 8.2 |
| Delay (s) | 19.0 | | 26.2 | 5.9 | 25.2 | 37.7 |
| Level of Service | B | | C | A | C | D |
| Approach Delay (s) | 19.0 | | | 13.6 | 37.0 | |
| Approach LOS | B | | | B | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 21.7 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.60 | | |
| Actuated Cycle Length (s) | 80.0 | Sum of lost time (s) | 10.5 |
| Intersection Capacity Utilization | 51.5% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 11: Novato Blvd & Simmons Ln

02/15/2018

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 269 | 709 | 408 | 81 | 69 | 263 |
| Future Volume (vph) | 269 | 709 | 408 | 81 | 69 | 263 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.9 | 3.6 | | 3.0 | 3.0 |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.98 | | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 3574 | 3508 | | 1805 | 1599 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | 1805 | 3574 | 3508 | | 1805 | 1599 |
| Peak-hour factor, PHF | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 |
| Adj. Flow (vph) | 316 | 834 | 480 | 95 | 81 | 309 |
| RTOR Reduction (vph) | 0 | 0 | 15 | 0 | 0 | 241 |
| Lane Group Flow (vph) | 316 | 834 | 560 | 0 | 81 | 68 |
| Confl. Peds. (#/hr) | | | | | 2 | |
| Confl. Bikes (#/hr) | | | | 1 | | |
| Heavy Vehicles (%) | 0% | 1% | 0% | 0% | 0% | 1% |
| Turn Type | Prot | NA | NA | | Prot | Perm |
| Protected Phases | 5 | 2 | 6 | | 8 | |
| Permitted Phases | | | | | | 8 |
| Actuated Green, G (s) | 10.0 | 32.1 | 42.7 | | 17.7 | 17.7 |
| Effective Green, g (s) | 10.0 | 32.1 | 42.7 | | 17.7 | 17.7 |
| Actuated g/C Ratio | 0.12 | 0.40 | 0.53 | | 0.22 | 0.22 |
| Clearance Time (s) | 3.0 | 3.9 | 3.6 | | 3.0 | 3.0 |
| Vehicle Extension (s) | 2.0 | 3.0 | 3.0 | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 225 | 1434 | 1872 | | 399 | 353 |
| v/s Ratio Prot | c0.18 | c0.23 | c0.16 | | c0.04 | |
| v/s Ratio Perm | | | | | | 0.04 |
| v/c Ratio | 1.40 | 0.58 | 0.30 | | 0.20 | 0.19 |
| Uniform Delay, d1 | 35.0 | 18.7 | 10.3 | | 25.4 | 25.3 |
| Progression Factor | 0.80 | 0.64 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 203.1 | 1.5 | 0.4 | | 0.1 | 0.1 |
| Delay (s) | 231.1 | 13.5 | 10.8 | | 25.5 | 25.4 |
| Level of Service | F | B | B | | C | C |
| Approach Delay (s) | | 73.3 | 10.8 | | 25.5 | |
| Approach LOS | | E | B | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 47.5 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.51 | | |
| Actuated Cycle Length (s) | 80.0 | Sum of lost time (s) | 10.5 |
| Intersection Capacity Utilization | 43.8% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 12: Novato Blvd & Grant Ave

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 182 | 676 | 3 | 4 | 342 | 57 | 1 | 0 | 2 | 35 | 1 | 167 |
| Future Volume (vph) | 182 | 676 | 3 | 4 | 342 | 57 | 1 | 0 | 2 | 35 | 1 | 167 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.5 | 4.5 | 3.5 | 4.9 | 4.9 | | 4.0 | | 3.5 | 3.5 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 | | 1.00 | | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.96 | | 0.97 | | 1.00 | 0.98 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | | 0.98 | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | | 0.91 | | 1.00 | 0.85 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 0.98 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1787 | 1863 | 1576 | 1805 | 3539 | 1534 | | 1644 | | 1748 | 1570 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 0.80 | | 0.76 | 1.00 | |
| Satd. Flow (perm) | 1787 | 1863 | 1576 | 1805 | 3539 | 1534 | | 1335 | | 1390 | 1570 | |
| Peak-hour factor, PHF | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 |
| Adj. Flow (vph) | 214 | 795 | 4 | 5 | 402 | 67 | 1 | 0 | 2 | 41 | 1 | 196 |
| RTOR Reduction (vph) | 0 | 0 | 1 | 0 | 0 | 26 | 0 | 3 | 0 | 0 | 174 | 0 |
| Lane Group Flow (vph) | 214 | 795 | 3 | 5 | 402 | 41 | 0 | 0 | 0 | 41 | 23 | 0 |
| Confl. Peds. (#/hr) | | | 1 | | | 8 | 5 | | 12 | 12 | | 5 |
| Confl. Bikes (#/hr) | | | 4 | | | 2 | | | 2 | | | 1 |
| Heavy Vehicles (%) | 1% | 2% | 0% | 0% | 2% | 1% | 0% | 0% | 0% | 1% | 0% | 1% |
| Turn Type | Prot | NA | Perm | Prot | NA | Perm | Perm | NA | | Perm | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | 2 | | | 6 | 8 | | | 4 | | |
| Actuated Green, G (s) | 15.6 | 76.0 | 76.0 | 1.2 | 61.2 | 61.2 | | 10.8 | | 11.3 | 11.3 | |
| Effective Green, g (s) | 15.6 | 76.0 | 76.0 | 1.2 | 61.2 | 61.2 | | 10.8 | | 11.3 | 11.3 | |
| Actuated g/C Ratio | 0.16 | 0.76 | 0.76 | 0.01 | 0.61 | 0.61 | | 0.11 | | 0.11 | 0.11 | |
| Clearance Time (s) | 3.5 | 4.5 | 4.5 | 3.5 | 4.9 | 4.9 | | 4.0 | | 3.5 | 3.5 | |
| Vehicle Extension (s) | 2.0 | 3.0 | 3.0 | 2.0 | 3.0 | 3.0 | | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 278 | 1415 | 1197 | 21 | 2165 | 938 | | 144 | | 157 | 177 | |
| v/s Ratio Prot | c0.12 | c0.43 | | 0.00 | 0.11 | | | | | | 0.01 | |
| v/s Ratio Perm | | | 0.00 | | | 0.03 | | 0.00 | | c0.03 | | |
| v/c Ratio | 0.77 | 0.56 | 0.00 | 0.24 | 0.19 | 0.04 | | 0.00 | | 0.26 | 0.13 | |
| Uniform Delay, d1 | 40.5 | 5.0 | 2.9 | 48.9 | 8.5 | 7.7 | | 39.8 | | 40.5 | 39.9 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 0.91 | 0.85 | 0.62 | | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 11.0 | 0.5 | 0.0 | 2.1 | 0.2 | 0.1 | | 0.0 | | 0.3 | 0.1 | |
| Delay (s) | 51.4 | 5.5 | 2.9 | 46.7 | 7.4 | 4.9 | | 39.8 | | 40.9 | 40.1 | |
| Level of Service | D | A | A | D | A | A | | D | | D | D | |
| Approach Delay (s) | | 15.2 | | | 7.5 | | | 39.8 | | | 40.2 | |
| Approach LOS | | B | | | A | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 16.6 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.58 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 12.4 |
| Intersection Capacity Utilization | 63.7% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 13: Tamalpais Ave/7th St & Novato Blvd

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 85 | 595 | 35 | 58 | 375 | 116 | 35 | 97 | 27 | 68 | 104 | 40 |
| Future Volume (vph) | 85 | 595 | 35 | 58 | 375 | 116 | 35 | 97 | 27 | 68 | 104 | 40 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 5.0 | | 3.5 | 5.0 | 5.0 | 3.5 | 3.5 | | 3.5 | 3.5 | 3.5 |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 0.95 | 1.00 | 0.99 | | 1.00 | 1.00 | 0.96 |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 0.99 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.99 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.97 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1787 | 1843 | | 1787 | 1863 | 1523 | 1770 | 1809 | | 1784 | 1881 | 1531 |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.57 | 1.00 | | 0.50 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1787 | 1843 | | 1787 | 1863 | 1523 | 1068 | 1809 | | 947 | 1881 | 1531 |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 90 | 633 | 37 | 62 | 399 | 123 | 37 | 103 | 29 | 72 | 111 | 43 |
| RTOR Reduction (vph) | 0 | 1 | 0 | 0 | 0 | 22 | 0 | 12 | 0 | 0 | 0 | 37 |
| Lane Group Flow (vph) | 90 | 669 | 0 | 62 | 399 | 101 | 37 | 120 | 0 | 72 | 111 | 6 |
| Confl. Peds. (#/hr) | | | 11 | | | 17 | 6 | | 1 | 1 | | 6 |
| Confl. Bikes (#/hr) | | | 9 | | | 1 | | | 1 | | | 4 |
| Heavy Vehicles (%) | 1% | 2% | 1% | 1% | 2% | 1% | 1% | 1% | 1% | 1% | 1% | 1% |
| Turn Type | Prot | NA | | Prot | NA | Perm | Perm | NA | | Perm | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | | | | 6 | 8 | | | 4 | | 4 |
| Actuated Green, G (s) | 8.9 | 66.9 | | 7.7 | 65.7 | 65.7 | 13.4 | 13.4 | | 13.4 | 13.4 | 13.4 |
| Effective Green, g (s) | 8.9 | 66.9 | | 7.7 | 65.7 | 65.7 | 13.4 | 13.4 | | 13.4 | 13.4 | 13.4 |
| Actuated g/C Ratio | 0.09 | 0.67 | | 0.08 | 0.66 | 0.66 | 0.13 | 0.13 | | 0.13 | 0.13 | 0.13 |
| Clearance Time (s) | 3.5 | 5.0 | | 3.5 | 5.0 | 5.0 | 3.5 | 3.5 | | 3.5 | 3.5 | 3.5 |
| Vehicle Extension (s) | 2.0 | 5.0 | | 2.0 | 5.0 | 5.0 | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 159 | 1232 | | 137 | 1223 | 1000 | 143 | 242 | | 126 | 252 | 205 |
| v/s Ratio Prot | c0.05 | c0.36 | | 0.03 | 0.21 | | | 0.07 | | | 0.06 | |
| v/s Ratio Perm | | | | | | 0.07 | 0.03 | | | c0.08 | | 0.00 |
| v/c Ratio | 0.57 | 0.54 | | 0.45 | 0.33 | 0.10 | 0.26 | 0.50 | | 0.57 | 0.44 | 0.03 |
| Uniform Delay, d1 | 43.7 | 8.6 | | 44.1 | 7.5 | 6.3 | 38.8 | 40.2 | | 40.6 | 39.8 | 37.6 |
| Progression Factor | 0.88 | 1.16 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 2.4 | 1.5 | | 0.9 | 0.7 | 0.2 | 0.4 | 0.6 | | 3.8 | 0.4 | 0.0 |
| Delay (s) | 40.9 | 11.5 | | 45.0 | 8.2 | 6.5 | 39.2 | 40.7 | | 44.5 | 40.3 | 37.7 |
| Level of Service | D | B | | D | A | A | D | D | | D | D | D |
| Approach Delay (s) | | 15.0 | | | 11.7 | | | 40.4 | | | 41.1 | |
| Approach LOS | | B | | | B | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 19.8 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.55 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 71.9% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 14: Novato Blvd & Diablo Ave

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 21 | 216 | 35 | 174 | 224 | 267 | 34 | 273 | 195 | 348 | 345 | 25 |
| Future Volume (vph) | 21 | 216 | 35 | 174 | 224 | 267 | 34 | 273 | 195 | 348 | 345 | 25 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 12 | 12 | 11 | 11 | 12 | 11 | 11 | 12 | 12 | 12 | 12 |
| Total Lost time (s) | | 3.7 | | 4.1 | 4.1 | 4.1 | 4.4 | 4.4 | 4.4 | 4.1 | 4.1 | |
| Lane Util. Factor | | 0.95 | | 0.91 | 0.91 | 1.00 | 1.00 | 1.00 | 1.00 | 0.91 | 0.91 | |
| Frpb, ped/bikes | | 1.00 | | 1.00 | 1.00 | 0.96 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | | 0.98 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | |
| Flt Protected | | 1.00 | | 0.95 | 0.99 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.99 | |
| Satd. Flow (prot) | | 3482 | | 1557 | 3277 | 1515 | 1728 | 1801 | 1557 | 1610 | 3323 | |
| Flt Permitted | | 1.00 | | 0.95 | 0.99 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.99 | |
| Satd. Flow (perm) | | 3482 | | 1557 | 3277 | 1515 | 1728 | 1801 | 1557 | 1610 | 3323 | |
| Peak-hour factor, PHF | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Adj. Flow (vph) | 21 | 220 | 36 | 178 | 229 | 272 | 35 | 279 | 199 | 355 | 352 | 26 |
| RTOR Reduction (vph) | 0 | 9 | 0 | 0 | 0 | 198 | 0 | 0 | 153 | 0 | 3 | 0 |
| Lane Group Flow (vph) | 0 | 268 | 0 | 132 | 275 | 74 | 35 | 279 | 46 | 241 | 489 | 0 |
| Confl. Peds. (#/hr) | | | 7 | | | 15 | | | 2 | | | 4 |
| Confl. Bikes (#/hr) | | | 1 | | | 1 | | | 3 | | | 5 |
| Heavy Vehicles (%) | 1% | 1% | 1% | 2% | 1% | 2% | 1% | 2% | 2% | 2% | 2% | 1% |
| Turn Type | Split | NA | | Split | NA | Perm | Split | NA | Perm | Split | NA | |
| Protected Phases | 3 | 3 | | 4 | 4 | | 1 | 1 | | 2 | 2 | |
| Permitted Phases | | | | | | 4 | | | 1 | | 2 | |
| Actuated Green, G (s) | | 13.8 | | 13.9 | 13.9 | 13.9 | 18.5 | 18.5 | 18.5 | 18.1 | 18.1 | |
| Effective Green, g (s) | | 13.8 | | 13.9 | 13.9 | 13.9 | 18.5 | 18.5 | 18.5 | 18.1 | 18.1 | |
| Actuated g/C Ratio | | 0.17 | | 0.17 | 0.17 | 0.17 | 0.23 | 0.23 | 0.23 | 0.22 | 0.22 | |
| Clearance Time (s) | | 3.7 | | 4.1 | 4.1 | 4.1 | 4.4 | 4.4 | 4.4 | 4.1 | 4.1 | |
| Vehicle Extension (s) | | 2.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | | 596 | | 268 | 565 | 261 | 396 | 413 | 357 | 361 | 746 | |
| v/s Ratio Prot | | c0.08 | | c0.08 | 0.08 | | 0.02 | c0.15 | | c0.15 | 0.15 | |
| v/s Ratio Perm | | | | | | 0.05 | | | 0.03 | | | |
| v/c Ratio | | 0.45 | | 0.49 | 0.49 | 0.28 | 0.09 | 0.68 | 0.13 | 0.67 | 0.66 | |
| Uniform Delay, d1 | | 30.0 | | 30.2 | 30.1 | 29.0 | 24.4 | 28.3 | 24.6 | 28.5 | 28.4 | |
| Progression Factor | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 0.2 | | 0.5 | 0.2 | 0.2 | 0.0 | 3.4 | 0.1 | 3.6 | 1.6 | |
| Delay (s) | | 30.2 | | 30.7 | 30.4 | 29.2 | 24.5 | 31.7 | 24.7 | 32.1 | 30.0 | |
| Level of Service | | C | | C | C | C | C | C | C | C | C | |
| Approach Delay (s) | | 30.2 | | | 30.0 | | | 28.5 | | | 30.7 | |
| Approach LOS | | C | | | C | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 29.9 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.58 | | |
| Actuated Cycle Length (s) | 80.6 | Sum of lost time (s) | 16.3 |
| Intersection Capacity Utilization | 67.2% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 15: Redwood Blvd & Diablo Ave/De Long Ave

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 169 | 405 | 146 | 148 | 532 | 135 | 38 | 94 | 29 | 96 | 186 | 125 |
| Future Volume (vph) | 169 | 405 | 146 | 148 | 532 | 135 | 38 | 94 | 29 | 96 | 186 | 125 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 9 |
| Total Lost time (s) | 5.0 | 4.0 | | 5.0 | 4.1 | | 4.0 | 4.8 | 4.8 | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 0.95 | | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 | 0.97 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 0.99 | | 1.00 | 1.00 | | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.98 |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.96 | | 1.00 | 0.97 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3467 | 3448 | | 1805 | 3398 | | 1805 | 3610 | 1505 | 3303 | 1900 | 1408 |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3467 | 3448 | | 1805 | 3398 | | 1805 | 3610 | 1505 | 3303 | 1900 | 1408 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 184 | 440 | 159 | 161 | 578 | 147 | 41 | 102 | 32 | 104 | 202 | 136 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 0 | 0 | 58 |
| Lane Group Flow (vph) | 184 | 599 | 0 | 161 | 725 | 0 | 41 | 102 | 17 | 104 | 202 | 78 |
| Confl. Peds. (#/hr) | | | 5 | | | 5 | | | 5 | | | 5 |
| Confl. Bikes (#/hr) | | | 5 | | | 5 | | | 5 | | | 5 |
| Heavy Vehicles (%) | 1% | 0% | 0% | 0% | 2% | 5% | 0% | 0% | 5% | 6% | 0% | 1% |
| Turn Type | Prot | NA | | Prot | NA | | Prot | NA | Perm | Prot | NA | Perm |
| Protected Phases | 3 | 8 | | 7 | 4 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | | | | | | | 2 | | | 6 |
| Actuated Green, G (s) | 17.0 | 48.2 | | 17.0 | 48.1 | | 10.4 | 36.0 | 36.0 | 11.0 | 37.4 | 37.4 |
| Effective Green, g (s) | 17.0 | 48.2 | | 17.0 | 48.1 | | 10.4 | 36.0 | 36.0 | 11.0 | 37.4 | 37.4 |
| Actuated g/C Ratio | 0.13 | 0.37 | | 0.13 | 0.37 | | 0.08 | 0.28 | 0.28 | 0.08 | 0.29 | 0.29 |
| Clearance Time (s) | 5.0 | 4.0 | | 5.0 | 4.1 | | 4.0 | 4.8 | 4.8 | 4.0 | 4.0 | 4.0 |
| Vehicle Extension (s) | 2.5 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 453 | 1278 | | 236 | 1257 | | 144 | 999 | 416 | 279 | 546 | 405 |
| v/s Ratio Prot | 0.05 | 0.17 | | c0.09 | c0.21 | | 0.02 | 0.03 | | c0.03 | c0.11 | |
| v/s Ratio Perm | | | | | | | | | 0.01 | | | 0.06 |
| v/c Ratio | 0.41 | 0.47 | | 0.68 | 0.58 | | 0.28 | 0.10 | 0.04 | 0.37 | 0.37 | 0.19 |
| Uniform Delay, d1 | 51.9 | 31.1 | | 53.9 | 32.8 | | 56.3 | 35.0 | 34.4 | 56.2 | 36.9 | 34.9 |
| Progression Factor | 1.00 | 1.00 | | 1.15 | 0.84 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.4 | 1.2 | | 5.8 | 1.8 | | 0.4 | 0.2 | 0.2 | 0.3 | 1.9 | 1.1 |
| Delay (s) | 52.3 | 32.4 | | 67.7 | 29.2 | | 56.7 | 35.2 | 34.6 | 56.5 | 38.8 | 36.0 |
| Level of Service | D | C | | E | C | | E | D | C | E | D | D |
| Approach Delay (s) | | 37.1 | | | 36.2 | | | 40.1 | | | 42.1 | |
| Approach LOS | | D | | | D | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 37.9 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.51 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 17.9 |
| Intersection Capacity Utilization | 93.2% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 16: Reichert Ave & De Long Ave

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 68 | 476 | 9 | 53 | 827 | 191 | 8 | 21 | 24 | 181 | 35 | 74 |
| Future Volume (vph) | 68 | 476 | 9 | 53 | 827 | 191 | 8 | 21 | 24 | 181 | 35 | 74 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 0.95 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 0.99 | | 1.00 | 1.00 | 0.98 | 1.00 | 0.98 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 0.99 | 1.00 | 1.00 | 0.99 | 1.00 | |
| Frt | 1.00 | 1.00 | | 1.00 | 0.97 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.90 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1805 | 3528 | | 1805 | 3454 | | 1793 | 1900 | 1578 | 1778 | 1676 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.56 | 1.00 | 1.00 | 0.74 | 1.00 | |
| Satd. Flow (perm) | 1805 | 3528 | | 1805 | 3454 | | 1055 | 1900 | 1578 | 1389 | 1676 | |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Adj. Flow (vph) | 76 | 529 | 10 | 59 | 919 | 212 | 9 | 23 | 27 | 201 | 39 | 82 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 9 | 0 | 28 | 0 |
| Lane Group Flow (vph) | 76 | 539 | 0 | 59 | 1125 | 0 | 9 | 23 | 18 | 201 | 93 | 0 |
| Confl. Peds. (#/hr) | | | 6 | | | 3 | 6 | | 4 | 4 | | 6 |
| Confl. Bikes (#/hr) | | | 5 | | | 5 | | | 5 | | | 5 |
| Heavy Vehicles (%) | 0% | 2% | 0% | 0% | 1% | 1% | 0% | 0% | 0% | 1% | 0% | 0% |
| Turn Type | Prot | NA | | Prot | NA | | Perm | NA | Perm | Perm | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | | | | | 8 | | 8 | 4 | | |
| Actuated Green, G (s) | 8.9 | 87.7 | | 8.1 | 86.9 | | 23.6 | 23.6 | 23.6 | 23.6 | 23.6 | |
| Effective Green, g (s) | 8.9 | 87.7 | | 8.1 | 86.9 | | 23.6 | 23.6 | 23.6 | 23.6 | 23.6 | |
| Actuated g/C Ratio | 0.07 | 0.67 | | 0.06 | 0.67 | | 0.18 | 0.18 | 0.18 | 0.18 | 0.18 | |
| Clearance Time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | |
| Vehicle Extension (s) | 2.0 | 3.0 | | 2.0 | 3.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 123 | 2380 | | 112 | 2308 | | 191 | 344 | 286 | 252 | 304 | |
| v/s Ratio Prot | c0.04 | 0.15 | | 0.03 | c0.33 | | | 0.01 | | | 0.06 | |
| v/s Ratio Perm | | | | | | | 0.01 | | 0.01 | c0.14 | | |
| v/c Ratio | 0.62 | 0.23 | | 0.53 | 0.49 | | 0.05 | 0.07 | 0.06 | 0.80 | 0.31 | |
| Uniform Delay, d1 | 58.9 | 8.1 | | 59.1 | 10.6 | | 43.9 | 44.1 | 44.0 | 50.9 | 46.1 | |
| Progression Factor | 1.07 | 0.87 | | 1.03 | 0.90 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 5.9 | 0.2 | | 2.0 | 0.7 | | 0.0 | 0.0 | 0.0 | 15.0 | 0.2 | |
| Delay (s) | 69.1 | 7.3 | | 63.1 | 10.3 | | 44.0 | 44.1 | 44.1 | 65.9 | 46.3 | |
| Level of Service | E | A | | E | B | | D | D | D | E | D | |
| Approach Delay (s) | | 14.9 | | | 12.9 | | | 44.1 | | | 58.5 | |
| Approach LOS | | B | | | B | | | D | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 21.0 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.56 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 64.3% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 17: US 101 SB Ramps & De Long Ave

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 182 | 469 | 17 | 704 | 0 | 0 | 0 | 0 | 11 | 2 | 297 |
| Future Volume (vph) | 0 | 182 | 469 | 17 | 704 | 0 | 0 | 0 | 0 | 11 | 2 | 297 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.6 | 3.6 | 3.0 | 3.6 | | | | | 4.0 | 4.0 | |
| Lane Util. Factor | | 0.95 | 1.00 | 1.00 | 0.95 | | | | | 0.95 | 0.95 | |
| Frt | | 1.00 | 0.85 | 1.00 | 1.00 | | | | | 1.00 | 0.85 | |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 3574 | 1599 | 1770 | 3539 | | | | | 1681 | 1506 | |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | 0.95 | 1.00 | |
| Satd. Flow (perm) | | 3574 | 1599 | 1770 | 3539 | | | | | 1681 | 1506 | |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 0 | 194 | 499 | 18 | 749 | 0 | 0 | 0 | 0 | 12 | 2 | 316 |
| RTOR Reduction (vph) | 0 | 0 | 180 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 163 | 0 |
| Lane Group Flow (vph) | 0 | 194 | 319 | 18 | 749 | 0 | 0 | 0 | 0 | 11 | 156 | 0 |
| Heavy Vehicles (%) | 0% | 1% | 1% | 2% | 2% | 2% | 2% | 2% | 2% | 2% | 2% | 2% |
| Turn Type | | NA | Perm | Prot | NA | | | | | Split | NA | |
| Protected Phases | | 6 | | 5 | 2 | | | | | 4 | 4 | |
| Permitted Phases | | | 6 | | | | | | | | | |
| Actuated Green, G (s) | | 41.6 | 41.6 | 1.3 | 45.9 | | | | | 11.5 | 11.5 | |
| Effective Green, g (s) | | 41.6 | 41.6 | 1.3 | 45.9 | | | | | 11.5 | 11.5 | |
| Actuated g/C Ratio | | 0.64 | 0.64 | 0.02 | 0.71 | | | | | 0.18 | 0.18 | |
| Clearance Time (s) | | 3.6 | 3.6 | 3.0 | 3.6 | | | | | 4.0 | 4.0 | |
| Vehicle Extension (s) | | 4.0 | 4.0 | 2.0 | 4.0 | | | | | 2.5 | 2.5 | |
| Lane Grp Cap (vph) | | 2287 | 1023 | 35 | 2499 | | | | | 297 | 266 | |
| v/s Ratio Prot | | 0.05 | | c0.01 | c0.21 | | | | | 0.01 | c0.10 | |
| v/s Ratio Perm | | | 0.20 | | | | | | | | | |
| v/c Ratio | | 0.08 | 0.31 | 0.51 | 0.30 | | | | | 0.04 | 0.59 | |
| Uniform Delay, d1 | | 4.5 | 5.3 | 31.5 | 3.6 | | | | | 22.2 | 24.6 | |
| Progression Factor | | 0.81 | 2.01 | 1.00 | 1.00 | | | | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 0.1 | 0.8 | 5.2 | 0.3 | | | | | 0.0 | 2.7 | |
| Delay (s) | | 3.7 | 11.4 | 36.7 | 3.9 | | | | | 22.2 | 27.3 | |
| Level of Service | | A | B | D | A | | | | | C | C | |
| Approach Delay (s) | | 9.2 | | | 4.6 | | | 0.0 | | | 27.1 | |
| Approach LOS | | A | | | A | | | A | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 10.6 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.38 | | |
| Actuated Cycle Length (s) | 65.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 51.9% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 18: US 101 NB Ramps & De Long Ave

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 161 | 32 | 0 | 1 | 52 | 8 | 670 | 2 | 17 | 0 | 0 | 0 |
| Future Volume (vph) | 161 | 32 | 0 | 1 | 52 | 8 | 670 | 2 | 17 | 0 | 0 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 3.6 | | | 3.6 | | 4.5 | 4.5 | | | | |
| Lane Util. Factor | 1.00 | 0.95 | | | 0.95 | | 0.95 | 0.95 | | | | |
| Frt | 1.00 | 1.00 | | | 0.98 | | 1.00 | 0.99 | | | | |
| Flt Protected | 0.95 | 1.00 | | | 1.00 | | 0.95 | 0.95 | | | | |
| Satd. Flow (prot) | 1770 | 3610 | | | 3482 | | 1698 | 1688 | | | | |
| Flt Permitted | 0.95 | 1.00 | | | 0.95 | | 0.95 | 0.95 | | | | |
| Satd. Flow (perm) | 1770 | 3610 | | | 3313 | | 1698 | 1688 | | | | |
| Peak-hour factor, PHF | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 |
| Adj. Flow (vph) | 183 | 36 | 0 | 1 | 59 | 9 | 761 | 2 | 19 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 183 | 36 | 0 | 0 | 61 | 0 | 396 | 384 | 0 | 0 | 0 | 0 |
| Heavy Vehicles (%) | 2% | 0% | 0% | 0% | 0% | 12% | 1% | 0% | 8% | 0% | 0% | 0% |
| Turn Type | Prot | NA | | | NA | | Split | NA | | | | |
| Protected Phases | 1 | 6 | | | 2 | | 4 | 4 | | | | |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | 8.8 | 16.6 | | | 4.3 | | 18.2 | 18.2 | | | | |
| Effective Green, g (s) | 8.8 | 16.6 | | | 4.3 | | 18.2 | 18.2 | | | | |
| Actuated g/C Ratio | 0.21 | 0.39 | | | 0.10 | | 0.42 | 0.42 | | | | |
| Clearance Time (s) | 3.5 | 3.6 | | | 3.6 | | 4.5 | 4.5 | | | | |
| Vehicle Extension (s) | 2.5 | 2.0 | | | 2.0 | | 3.0 | 3.0 | | | | |
| Lane Grp Cap (vph) | 363 | 1396 | | | 332 | | 720 | 716 | | | | |
| v/s Ratio Prot | c0.10 | 0.01 | | | | | c0.23 | 0.23 | | | | |
| v/s Ratio Perm | | | | | c0.02 | | | | | | | |
| v/c Ratio | 0.50 | 0.03 | | | 1.00dr | | 0.55 | 0.54 | | | | |
| Uniform Delay, d1 | 15.1 | 8.1 | | | 17.7 | | 9.3 | 9.2 | | | | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | | | | |
| Incremental Delay, d2 | 0.8 | 0.0 | | | 0.1 | | 0.9 | 0.8 | | | | |
| Delay (s) | 15.9 | 8.1 | | | 17.8 | | 10.2 | 10.0 | | | | |
| Level of Service | B | A | | | B | | B | A | | | | |
| Approach Delay (s) | | 14.6 | | | 17.8 | | | 10.1 | | | 0.0 | |
| Approach LOS | | B | | | B | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 11.5 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.49 | | |
| Actuated Cycle Length (s) | 42.9 | Sum of lost time (s) | 11.6 |
| Intersection Capacity Utilization | 41.8% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

dr Defacto Right Lane. Recode with 1 though lane as a right lane.
c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis
## 19: Redwood Blvd & Lamont Ave

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 10 | 2 | 8 | 100 | 2 | 49 | 16 | 203 | 39 | 58 | 383 | 28 |
| Future Volume (vph) | 10 | 2 | 8 | 100 | 2 | 49 | 16 | 203 | 39 | 58 | 383 | 28 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.5 | 3.5 | | 3.5 | 3.5 | 3.5 | 4.8 | | 3.5 | 4.8 | 4.8 |
| Lane Util. Factor | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 |
| Frpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | 0.99 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Flpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | | 1.00 | 0.85 | | 1.00 | 0.85 | 1.00 | 0.98 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | | 0.96 | 1.00 | | 0.95 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | | 1822 | 1615 | | 1811 | 1595 | 1805 | 3510 | | 1805 | 3610 | 1615 |
| Flt Permitted | | 0.84 | 1.00 | | 0.74 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | | 1599 | 1615 | | 1405 | 1595 | 1805 | 3510 | | 1805 | 3610 | 1615 |
| Peak-hour factor, PHF | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Adj. Flow (vph) | 11 | 2 | 9 | 110 | 2 | 54 | 18 | 223 | 43 | 64 | 421 | 31 |
| RTOR Reduction (vph) | 0 | 0 | 7 | 0 | 0 | 39 | 0 | 15 | 0 | 0 | 0 | 17 |
| Lane Group Flow (vph) | 0 | 13 | 2 | 0 | 112 | 15 | 18 | 251 | 0 | 64 | 421 | 14 |
| Confl. Peds. (#/hr) | 1 | | | | | 1 | | | 2 | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Perm | NA | Perm | Perm | NA | Perm | Prot | NA | | Prot | NA | Perm |
| Protected Phases | | 8 | | | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | 8 | | 8 | 4 | | 4 | | | | | | 2 |
| Actuated Green, G (s) | | 12.7 | 12.7 | | 12.7 | 12.7 | 0.9 | 18.8 | | 3.1 | 21.0 | 21.0 |
| Effective Green, g (s) | | 12.7 | 12.7 | | 12.7 | 12.7 | 0.9 | 18.8 | | 3.1 | 21.0 | 21.0 |
| Actuated g/C Ratio | | 0.27 | 0.27 | | 0.27 | 0.27 | 0.02 | 0.41 | | 0.07 | 0.45 | 0.45 |
| Clearance Time (s) | | 3.5 | 3.5 | | 3.5 | 3.5 | 3.5 | 4.8 | | 3.5 | 4.8 | 4.8 |
| Vehicle Extension (s) | | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 | 3.0 | | 2.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | 437 | 442 | | 384 | 436 | 35 | 1422 | | 120 | 1633 | 730 |
| v/s Ratio Prot | | | | | | | 0.01 | 0.07 | | c0.04 | c0.12 | |
| v/s Ratio Perm | | 0.01 | 0.00 | | c0.08 | 0.01 | | | | | | 0.01 |
| v/c Ratio | | 0.03 | 0.01 | | 0.29 | 0.03 | 0.51 | 0.18 | | 0.53 | 0.26 | 0.02 |
| Uniform Delay, d1 | | 12.3 | 12.3 | | 13.3 | 12.4 | 22.5 | 8.8 | | 21.0 | 7.9 | 7.0 |
| Progression Factor | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.0 | 0.0 | | 0.2 | 0.0 | 5.2 | 0.1 | | 2.3 | 0.1 | 0.0 |
| Delay (s) | | 12.3 | 12.3 | | 13.5 | 12.4 | 27.7 | 8.9 | | 23.2 | 8.0 | 7.0 |
| Level of Service | | B | B | | B | B | C | A | | C | A | A |
| Approach Delay (s) | | 12.3 | | | 13.1 | | | 10.1 | | | 9.8 | |
| Approach LOS | | B | | | B | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 10.5 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.29 | | |
| Actuated Cycle Length (s) | 46.4 | Sum of lost time (s) | 11.8 |
| Intersection Capacity Utilization | 41.8% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



# HCM Signalized Intersection Capacity Analysis
## 20: Redwood Blvd & Landing Ct

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 2 | 0 | 1 | 15 | 0 | 4 | 1 | 253 | 15 | 10 | 387 | 1 |
| Future Volume (vph) | 2 | 0 | 1 | 15 | 0 | 4 | 1 | 253 | 15 | 10 | 387 | 1 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.5 | | 3.5 | | 3.5 | | 4.8 | 4.8 | 3.5 | 4.8 | 4.8 |
| Lane Util. Factor | | 1.00 | | 1.00 | | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |
| Frpb, ped/bikes | | 1.00 | | 1.00 | | 1.00 | | 1.00 | 0.98 | 1.00 | 1.00 | 0.97 |
| Flpb, ped/bikes | | 1.00 | | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.95 | | 1.00 | | 0.85 | | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | | 0.97 | | 0.95 | | 1.00 | | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | | 1748 | | 1803 | | 1615 | | 3609 | 1579 | 1805 | 3610 | 1573 |
| Flt Permitted | | 0.97 | | 1.00 | | 1.00 | | 0.95 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | | 1748 | | 1898 | | 1615 | | 3444 | 1579 | 1805 | 3610 | 1573 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 2 | 0 | 1 | 16 | 0 | 4 | 1 | 275 | 16 | 11 | 421 | 1 |
| RTOR Reduction (vph) | 0 | 3 | 0 | 0 | 0 | 4 | 0 | 0 | 6 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 16 | 0 | 0 | 0 | 276 | 10 | 11 | 421 | 1 |
| Confl. Peds. (#/hr) | | | 4 | 4 | | | | | 3 | | | 6 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Perm | NA | | Perm | | Perm | Perm | NA | Perm | Prot | NA | Perm |
| Protected Phases | | 4 | | | | | | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | 2 | | | 6 |
| Actuated Green, G (s) | | 4.0 | | 4.0 | | 4.0 | | 26.2 | 26.2 | 0.8 | 30.5 | 30.5 |
| Effective Green, g (s) | | 4.0 | | 4.0 | | 4.0 | | 26.2 | 26.2 | 0.8 | 30.5 | 30.5 |
| Actuated g/C Ratio | | 0.09 | | 0.09 | | 0.09 | | 0.61 | 0.61 | 0.02 | 0.71 | 0.71 |
| Clearance Time (s) | | 3.5 | | 3.5 | | 3.5 | | 4.8 | 4.8 | 3.5 | 4.8 | 4.8 |
| Vehicle Extension (s) | | 3.0 | | 2.0 | | 2.0 | | 4.0 | 4.0 | 2.0 | 4.0 | 4.0 |
| Lane Grp Cap (vph) | | 163 | | 177 | | 150 | | 2108 | 966 | 33 | 2572 | 1120 |
| v/s Ratio Prot | | | | | | | | | | 0.01 | c0.12 | |
| v/s Ratio Perm | | 0.00 | | c0.01 | | 0.00 | | 0.08 | 0.01 | | | 0.00 |
| v/c Ratio | | 0.00 | | 0.09 | | 0.00 | | 0.13 | 0.01 | 0.33 | 0.16 | 0.00 |
| Uniform Delay, d1 | | 17.6 | | 17.7 | | 17.6 | | 3.5 | 3.2 | 20.7 | 2.0 | 1.8 |
| Progression Factor | | 1.00 | | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.0 | | 0.1 | | 0.0 | | 0.0 | 0.0 | 2.2 | 0.0 | 0.0 |
| Delay (s) | | 17.6 | | 17.8 | | 17.6 | | 3.5 | 3.2 | 22.9 | 2.0 | 1.8 |
| Level of Service | | B | | B | | B | | A | A | C | A | A |
| Approach Delay (s) | | 17.6 | | | 17.8 | | | 3.5 | | | 2.6 | |
| Approach LOS | | B | | | B | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 3.4 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.17 | | |
| Actuated Cycle Length (s) | 42.8 | Sum of lost time (s) | 11.8 |
| Intersection Capacity Utilization | 38.4% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 21: Novato Blvd & Center Rd/Garden Ct



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 54 | 0 | 272 | 3 | 0 | 3 | 110 | 423 | 4 | 1 | 592 | 66 |
| Future Volume (vph) | 54 | 0 | 272 | 3 | 0 | 3 | 110 | 423 | 4 | 1 | 592 | 66 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.2 | 3.2 | | | 3.0 | | 3.0 | 4.4 | | 3.0 | 4.4 | |
| Lane Util. Factor | 1.00 | 1.00 | | | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.85 | | | 0.93 | | 1.00 | 1.00 | | 1.00 | 0.98 | |
| Flt Protected | 0.95 | 1.00 | | | 0.98 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1805 | 1615 | | | 1729 | | 1805 | 3604 | | 1805 | 3512 | |
| Flt Permitted | 0.75 | 1.00 | | | 0.58 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1432 | 1615 | | | 1031 | | 1805 | 3604 | | 1805 | 3512 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 59 | 0 | 296 | 3 | 0 | 3 | 120 | 460 | 4 | 1 | 643 | 72 |
| RTOR Reduction (vph) | 0 | 263 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 5 | 0 |
| Lane Group Flow (vph) | 59 | 33 | 0 | 0 | 1 | 0 | 120 | 464 | 0 | 1 | 710 | 0 |
| Confl. Peds. (#/hr) | | | | | | | | | 9 | | | 6 |
| Confl. Bikes (#/hr) | | | | | | | | | 2 | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 1% | 0% |
| Turn Type | Perm | NA | | Perm | NA | | Prot | NA | | Prot | NA | |
| Protected Phases | | 8 | | | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | 8 | | | 4 | | | | | | | | |
| Actuated Green, G (s) | 11.1 | 11.1 | | | 11.3 | | 11.9 | 76.1 | | 2.2 | 66.4 | |
| Effective Green, g (s) | 11.1 | 11.1 | | | 11.3 | | 11.9 | 76.1 | | 2.2 | 66.4 | |
| Actuated g/C Ratio | 0.11 | 0.11 | | | 0.11 | | 0.12 | 0.76 | | 0.02 | 0.66 | |
| Clearance Time (s) | 3.2 | 3.2 | | | 3.0 | | 3.0 | 4.4 | | 3.0 | 4.4 | |
| Vehicle Extension (s) | 3.0 | 3.0 | | | 2.0 | | 2.0 | 4.0 | | 2.0 | 4.0 | |
| Lane Grp Cap (vph) | 158 | 179 | | | 116 | | 214 | 2742 | | 39 | 2331 | |
| v/s Ratio Prot | | 0.02 | | | | | c0.07 | 0.13 | | 0.00 | c0.20 | |
| v/s Ratio Perm | c0.04 | | | | 0.00 | | | | | | | |
| v/c Ratio | 0.37 | 0.18 | | | 0.01 | | 0.56 | 0.17 | | 0.03 | 0.30 | |
| Uniform Delay, d1 | 41.2 | 40.3 | | | 39.4 | | 41.6 | 3.3 | | 47.9 | 7.1 | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | | 0.83 | 1.07 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 1.5 | 0.5 | | | 0.0 | | 2.0 | 0.1 | | 0.1 | 0.3 | |
| Delay (s) | 42.7 | 40.8 | | | 39.4 | | 36.4 | 3.6 | | 47.9 | 7.4 | |
| Level of Service | D | D | | | D | | D | A | | D | A | |
| Approach Delay (s) | | 41.1 | | | 39.4 | | | 10.4 | | | 7.5 | |
| Approach LOS | | D | | | D | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 15.8 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.35 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 54.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 22: Novato Blvd & Arthur St



| Movement | EBL | EBR | NBL | NBT | SBU | SBT | SBR |
|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | |
| Traffic Volume (vph) | 154 | 123 | 218 | 427 | 18 | 698 | 177 |
| Future Volume (vph) | 154 | 123 | 218 | 427 | 18 | 698 | 177 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 3.5 | 3.5 | 4.9 | 3.5 | 4.9 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 0.98 | 1.00 | 1.00 | 1.00 | 0.99 | |
| Flpb, ped/bikes | 0.99 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 0.85 | 1.00 | 1.00 | 1.00 | 0.97 | |
| Flt Protected | 0.95 | 1.00 | 0.95 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1785 | 1579 | 1805 | 3610 | 1805 | 3451 | |
| Flt Permitted | 0.95 | 1.00 | 0.95 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1785 | 1579 | 1805 | 3610 | 1805 | 3451 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 167 | 134 | 237 | 464 | 20 | 759 | 192 |
| RTOR Reduction (vph) | 0 | 113 | 0 | 0 | 0 | 16 | 0 |
| Lane Group Flow (vph) | 167 | 21 | 237 | 464 | 20 | 935 | 0 |
| Confl. Peds. (#/hr) | 10 | 8 | | | | | 5 |
| Confl. Bikes (#/hr) | | 1 | | | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 1% | 0% |
| Turn Type | Perm | Perm | Prot | NA | Prot | NA | |
| Protected Phases | | | 1 | 6 | 5 | 2 | |
| Permitted Phases | 4 | 4 | | | | | |
| Actuated Green, G (s) | 15.3 | 15.3 | 17.2 | 70.1 | 2.7 | 55.6 | |
| Effective Green, g (s) | 15.3 | 15.3 | 17.2 | 70.1 | 2.7 | 55.6 | |
| Actuated g/C Ratio | 0.15 | 0.15 | 0.17 | 0.70 | 0.03 | 0.56 | |
| Clearance Time (s) | 3.5 | 3.5 | 3.5 | 4.9 | 3.5 | 4.9 | |
| Vehicle Extension (s) | 2.0 | 2.0 | 2.0 | 4.0 | 2.0 | 4.0 | |
| Lane Grp Cap (vph) | 273 | 241 | 310 | 2530 | 48 | 1918 | |
| v/s Ratio Prot | | | c0.13 | 0.13 | 0.01 | c0.27 | |
| v/s Ratio Perm | c0.09 | 0.01 | | | | | |
| v/c Ratio | 0.61 | 0.09 | 0.76 | 0.18 | 0.42 | 0.49 | |
| Uniform Delay, d1 | 39.6 | 36.3 | 39.5 | 5.1 | 47.9 | 13.5 | |
| Progression Factor | 1.00 | 1.00 | 0.99 | 0.54 | 1.36 | 0.71 | |
| Incremental Delay, d2 | 2.8 | 0.1 | 8.7 | 0.1 | 2.0 | 0.9 | |
| Delay (s) | 42.4 | 36.4 | 47.9 | 2.9 | 67.1 | 10.4 | |
| Level of Service | D | D | D | A | E | B | |
| Approach Delay (s) | 39.7 | | | 18.1 | | 11.6 | |
| Approach LOS | D | | | B | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 18.2 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.56 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 11.9 |
| Intersection Capacity Utilization | 59.7% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 23: Novato Blvd & Rowland Blvd

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 43 | 133 | 15 | 323 | 306 | 292 | 43 | 274 | 184 | 291 | 364 | 178 |
| Future Volume (vph) | 43 | 133 | 15 | 323 | 306 | 292 | 43 | 274 | 184 | 291 | 364 | 178 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 3.5 | | 3.5 | 4.1 | 4.1 | 3.5 | 4.1 | | 3.5 | 4.4 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 0.97 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 0.99 | | 1.00 | 1.00 | 0.99 | 1.00 | 0.99 | | 1.00 | 0.99 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.98 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.94 | | 1.00 | 0.95 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1805 | 1858 | | 1770 | 1900 | 1576 | 1805 | 1752 | | 3502 | 1783 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1805 | 1858 | | 1770 | 1900 | 1576 | 1805 | 1752 | | 3502 | 1783 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 45 | 140 | 16 | 340 | 322 | 307 | 45 | 288 | 194 | 306 | 383 | 187 |
| RTOR Reduction (vph) | 0 | 5 | 0 | 0 | 0 | 222 | 0 | 21 | 0 | 0 | 14 | 0 |
| Lane Group Flow (vph) | 45 | 151 | 0 | 340 | 322 | 85 | 45 | 461 | 0 | 306 | 556 | 0 |
| Confl. Peds. (#/hr) | | | 24 | | | 2 | | | 13 | | | 10 |
| Confl. Bikes (#/hr) | | | 1 | | | | | | 1 | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 2% | 0% | 1% | 0% | 0% | 2% | 0% | 0% | 0% |
| Turn Type | Prot | NA | | Prot | NA | Perm | Prot | NA | | Prot | NA | |
| Protected Phases | 3 | 8 | | 7 | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | | | | | | 4 | | | | | | |
| Actuated Green, G (s) | 5.5 | 18.4 | | 15.5 | 27.8 | 27.8 | 6.0 | 38.8 | | 12.7 | 45.2 | |
| Effective Green, g (s) | 5.5 | 18.4 | | 15.5 | 27.8 | 27.8 | 6.0 | 38.8 | | 12.7 | 45.2 | |
| Actuated g/C Ratio | 0.06 | 0.18 | | 0.16 | 0.28 | 0.28 | 0.06 | 0.39 | | 0.13 | 0.45 | |
| Clearance Time (s) | 3.5 | 3.5 | | 3.5 | 4.1 | 4.1 | 3.5 | 4.1 | | 3.5 | 4.4 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 3.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 99 | 341 | | 274 | 528 | 438 | 108 | 679 | | 444 | 805 | |
| v/s Ratio Prot | 0.02 | 0.08 | | c0.19 | c0.17 | | 0.02 | 0.26 | | c0.09 | c0.31 | |
| v/s Ratio Perm | | | | | | 0.05 | | | | | | |
| v/c Ratio | 0.45 | 0.44 | | 1.24 | 0.61 | 0.19 | 0.42 | 0.68 | | 0.69 | 0.69 | |
| Uniform Delay, d1 | 45.8 | 36.2 | | 42.2 | 31.4 | 27.6 | 45.3 | 25.4 | | 41.8 | 21.8 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 0.90 | 0.61 | |
| Incremental Delay, d2 | 1.2 | 0.3 | | 135.5 | 1.4 | 0.1 | 0.9 | 5.4 | | 3.2 | 4.4 | |
| Delay (s) | 47.0 | 36.6 | | 177.7 | 32.8 | 27.6 | 46.3 | 30.8 | | 41.0 | 17.7 | |
| Level of Service | D | D | | F | C | C | D | C | | D | B | |
| Approach Delay (s) | | 38.9 | | | 82.0 | | | 32.1 | | | 25.8 | |
| Approach LOS | | D | | | F | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 49.3 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.81 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 15.5 |
| Intersection Capacity Utilization | 85.4% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 24: Redwood Blvd & Rowland Blvd

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 107 | 549 | 47 | 20 | 713 | 193 | 69 | 22 | 77 | 159 | 18 | 287 |
| Future Volume (vph) | 107 | 549 | 47 | 20 | 713 | 193 | 69 | 22 | 77 | 159 | 18 | 287 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.4 | 4.4 | 3.5 | 3.7 | 3.7 | 3.5 | 4.1 | | 3.5 | 4.8 | 4.8 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | 0.97 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.99 | 1.00 | 0.99 | | 1.00 | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.88 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1805 | 3574 | 1589 | 1805 | 3574 | 1578 | 1805 | 3151 | | 3502 | 1900 | 1593 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1805 | 3574 | 1589 | 1805 | 3574 | 1578 | 1805 | 3151 | | 3502 | 1900 | 1593 |
| Peak-hour factor, PHF | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 |
| Adj. Flow (vph) | 120 | 617 | 53 | 22 | 801 | 217 | 78 | 25 | 87 | 179 | 20 | 322 |
| RTOR Reduction (vph) | 0 | 0 | 28 | 0 | 0 | 59 | 0 | 74 | 0 | 0 | 0 | 253 |
| Lane Group Flow (vph) | 120 | 617 | 25 | 22 | 801 | 158 | 78 | 38 | 0 | 179 | 20 | 69 |
| Confl. Peds. (#/hr) | | | 6 | | | 2 | | | 3 | | | 2 |
| Confl. Bikes (#/hr) | | | | | | | | | 1 | | | |
| Heavy Vehicles (%) | 0% | 1% | 0% | 0% | 1% | 1% | 0% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Prot | NA | Perm | Prot | NA | Perm | Prot | NA | | Prot | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | 3 | 8 | | 7 | 4 | |
| Permitted Phases | | | 2 | | | 6 | | | | | | 4 |
| Actuated Green, G (s) | 11.0 | 35.7 | 35.7 | 3.0 | 28.4 | 28.4 | 8.1 | 11.1 | | 10.6 | 12.9 | 12.9 |
| Effective Green, g (s) | 11.0 | 35.7 | 35.7 | 3.0 | 28.4 | 28.4 | 8.1 | 11.1 | | 10.6 | 12.9 | 12.9 |
| Actuated g/C Ratio | 0.14 | 0.47 | 0.47 | 0.04 | 0.37 | 0.37 | 0.11 | 0.15 | | 0.14 | 0.17 | 0.17 |
| Clearance Time (s) | 3.5 | 4.4 | 4.4 | 3.5 | 3.7 | 3.7 | 3.5 | 4.1 | | 3.5 | 4.8 | 4.8 |
| Vehicle Extension (s) | 2.0 | 4.0 | 4.0 | 2.0 | 4.0 | 4.0 | 2.0 | 2.5 | | 2.5 | 2.5 | 2.5 |
| Lane Grp Cap (vph) | 261 | 1681 | 747 | 71 | 1337 | 590 | 192 | 460 | | 489 | 322 | 270 |
| v/s Ratio Prot | c0.07 | 0.17 | | 0.01 | c0.22 | | 0.04 | 0.01 | | c0.05 | 0.01 | |
| v/s Ratio Perm | | | 0.02 | | | 0.10 | | | | | | c0.04 |
| v/c Ratio | 0.46 | 0.37 | 0.03 | 0.31 | 0.60 | 0.27 | 0.41 | 0.08 | | 0.37 | 0.06 | 0.25 |
| Uniform Delay, d1 | 29.7 | 12.9 | 10.8 | 35.4 | 19.2 | 16.5 | 31.7 | 28.0 | | 29.6 | 26.4 | 27.3 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.5 | 0.2 | 0.0 | 0.9 | 0.9 | 0.3 | 0.5 | 0.1 | | 0.3 | 0.1 | 0.4 |
| Delay (s) | 30.2 | 13.1 | 10.8 | 36.4 | 20.0 | 16.8 | 32.2 | 28.1 | | 29.9 | 26.5 | 27.7 |
| Level of Service | C | B | B | D | C | B | C | C | | C | C | C |
| Approach Delay (s) | | 15.5 | | | 19.7 | | | 29.7 | | | 28.4 | |
| Approach LOS | | B | | | B | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 20.9 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.48 | | |
| Actuated Cycle Length (s) | 75.9 | Sum of lost time (s) | 16.2 |
| Intersection Capacity Utilization | 58.0% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 25: US 101 SB Ramps & Rowland Blvd



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 412 | 347 | 55 | 506 | 0 | 0 | 0 | 0 | 221 | 47 | 460 |
| Future Volume (vph) | 0 | 412 | 347 | 55 | 506 | 0 | 0 | 0 | 0 | 221 | 47 | 460 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.6 | 3.6 | 3.0 | 3.6 | | | | | 3.0 | 3.0 | |
| Lane Util. Factor | | 0.91 | 0.91 | 0.97 | 0.95 | | | | | 0.91 | 0.91 | |
| Frpb, ped/bikes | | 1.00 | 0.99 | 1.00 | 1.00 | | | | | 1.00 | 0.99 | |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | | | | 1.00 | 1.00 | |
| Frt | | 0.97 | 0.85 | 1.00 | 1.00 | | | | | 1.00 | 0.87 | |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 3310 | 1450 | 3367 | 3574 | | | | | 1643 | 2840 | |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | 0.95 | 1.00 | |
| Satd. Flow (perm) | | 3310 | 1450 | 3367 | 3574 | | | | | 1643 | 2840 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 0 | 448 | 377 | 60 | 550 | 0 | 0 | 0 | 0 | 240 | 51 | 500 |
| RTOR Reduction (vph) | 0 | 29 | 156 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 123 | 0 |
| Lane Group Flow (vph) | 0 | 543 | 97 | 60 | 550 | 0 | 0 | 0 | 0 | 216 | 452 | 0 |
| Confl. Peds. (#/hr) | | | 2 | | | | | | | | | 2 |
| Confl. Bikes (#/hr) | | | | | | | | | | | | 1 |
| Heavy Vehicles (%) | 0% | 1% | 0% | 4% | 1% | 0% | 0% | 0% | 0% | 0% | 40% | 1% |
| Turn Type | | NA | Perm | Prot | NA | | | | | Split | NA | |
| Protected Phases | | 2 | | 1 | 6 | | | | | 4 | 4 | |
| Permitted Phases | | | 2 | | | | | | | | | |
| Actuated Green, G (s) | | 15.1 | 15.1 | 1.4 | 19.5 | | | | | 13.1 | 13.1 | |
| Effective Green, g (s) | | 15.1 | 15.1 | 1.4 | 19.5 | | | | | 13.1 | 13.1 | |
| Actuated g/C Ratio | | 0.39 | 0.39 | 0.04 | 0.50 | | | | | 0.33 | 0.33 | |
| Clearance Time (s) | | 3.6 | 3.6 | 3.0 | 3.6 | | | | | 3.0 | 3.0 | |
| Vehicle Extension (s) | | 4.0 | 4.0 | 2.0 | 2.5 | | | | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | | 1275 | 558 | 120 | 1777 | | | | | 549 | 949 | |
| v/s Ratio Prot | | c0.16 | | c0.02 | 0.15 | | | | | 0.13 | c0.16 | |
| v/s Ratio Perm | | | 0.07 | | | | | | | | | |
| v/c Ratio | | 0.43 | 0.17 | 0.50 | 0.31 | | | | | 0.39 | 0.48 | |
| Uniform Delay, d1 | | 8.9 | 7.9 | 18.6 | 5.9 | | | | | 10.0 | 10.3 | |
| Progression Factor | | 1.00 | 1.00 | 1.00 | 1.00 | | | | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 0.3 | 0.2 | 1.2 | 0.1 | | | | | 0.2 | 0.1 | |
| Delay (s) | | 9.2 | 8.1 | 19.8 | 5.9 | | | | | 10.2 | 10.5 | |
| Level of Service | | A | A | B | A | | | | | B | B | |
| Approach Delay (s) | | 8.9 | | | 7.3 | | | 0.0 | | | 10.4 | |
| Approach LOS | | A | | | A | | | A | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 9.0 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.45 | | |
| Actuated Cycle Length (s) | 39.2 | Sum of lost time (s) | 9.6 |
| Intersection Capacity Utilization | 44.6% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 26: US 101 NB Ramps & Rowland Blvd



| Movement | EBL2 | EBL | EBT | WBT | WBR | WBR2 | NBL2 | NBL | NBT | NBR | NEL2 | NEL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 26 | 177 | 430 | 147 | 1 | 96 | 416 | 7 | 8 | 319 | 12 | 3 |
| Future Volume (vph) | 26 | 177 | 430 | 147 | 1 | 96 | 416 | 7 | 8 | 319 | 12 | 3 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | 3.6 | 3.6 | | 3.6 | 3.5 | | 3.5 | 3.0 | | 3.5 |
| Lane Util. Factor | | 1.00 | 0.95 | 0.86 | | 0.86 | 0.95 | | 0.95 | 0.88 | | 1.00 |
| Frpb, ped/bikes | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Frt | | 1.00 | 1.00 | 0.97 | | 0.85 | 1.00 | | 1.00 | 0.85 | | 0.99 |
| Flt Protected | | 0.95 | 1.00 | 1.00 | | 1.00 | 0.95 | | 0.95 | 1.00 | | 0.96 |
| Satd. Flow (prot) | | 1805 | 3574 | 4550 | | 1323 | 1715 | | 1679 | 2787 | | 1800 |
| Flt Permitted | | 0.95 | 1.00 | 1.00 | | 1.00 | 0.95 | | 0.95 | 1.00 | | 0.96 |
| Satd. Flow (perm) | | 1805 | 3574 | 4550 | | 1323 | 1715 | | 1679 | 2787 | | 1800 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 28 | 192 | 467 | 160 | 1 | 104 | 452 | 8 | 9 | 347 | 13 | 3 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 34 | 0 | 46 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 220 | 467 | 171 | 0 | 14 | 235 | 0 | 234 | 347 | 0 | 17 |
| Confl. Peds. (#/hr) | | | | | | | | | | 2 | | |
| Heavy Vehicles (%) | 0% | 0% | 1% | 4% | 0% | 5% | 0% | 0% | 67% | 2% | 0% | 0% |
| Turn Type | Prot | Prot | NA | NA | | Perm | Split | Split | NA | custom | Perm | Prot |
| Protected Phases | 5 | 5 | 2 | 6 | | | 8 | 8 | 8 | 1 8 | | 7 |
| Permitted Phases | | | | | | 6 | | | | | 7 | |
| Actuated Green, G (s) | | 14.8 | 15.9 | 13.6 | | 13.6 | 14.7 | | 14.7 | 30.7 | | 1.2 |
| Effective Green, g (s) | | 14.8 | 15.9 | 13.6 | | 13.6 | 14.7 | | 14.7 | 27.2 | | 1.2 |
| Actuated g/C Ratio | | 0.26 | 0.27 | 0.23 | | 0.23 | 0.25 | | 0.25 | 0.47 | | 0.02 |
| Clearance Time (s) | | 3.0 | 3.6 | 3.6 | | 3.6 | 3.5 | | 3.5 | | | 3.5 |
| Vehicle Extension (s) | | 2.0 | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | | | 2.0 |
| Lane Grp Cap (vph) | | 461 | 981 | 1068 | | 310 | 435 | | 426 | 1309 | | 37 |
| v/s Ratio Prot | | 0.12 | c0.13 | 0.04 | | | 0.14 | | c0.14 | c0.12 | | |
| v/s Ratio Perm | | | | | | 0.01 | | | | | | 0.01 |
| v/c Ratio | | 0.48 | 0.48 | 0.16 | | 0.05 | 0.54 | | 0.55 | 0.27 | | 0.46 |
| Uniform Delay, d1 | | 18.3 | 17.5 | 17.6 | | 17.1 | 18.7 | | 18.7 | 9.3 | | 28.0 |
| Progression Factor | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Incremental Delay, d2 | | 0.3 | 0.1 | 0.0 | | 0.0 | 0.7 | | 0.8 | 0.0 | | 3.3 |
| Delay (s) | | 18.6 | 17.7 | 17.6 | | 17.2 | 19.4 | | 19.5 | 9.3 | | 31.3 |
| Level of Service | | B | B | B | | B | B | | B | A | | C |
| Approach Delay (s) | | | 17.9 | 17.5 | | | | | 15.2 | | | 31.3 |
| Approach LOS | | | B | B | | | | | B | | | C |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 16.7 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.44 | | |
| Actuated Cycle Length (s) | 57.9 | Sum of lost time (s) | 13.6 |
| Intersection Capacity Utilization | 56.8% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
## 26: US 101 NB Ramps & Rowland Blvd

02/15/2018

| Movement | NER |
|---|---|
| Lane Configurations | |
| Traffic Volume (vph) | 1 |
| Future Volume (vph) | 1 |
| Ideal Flow (vphpl) | 1900 |
| Total Lost time (s) | |
| Lane Util. Factor | |
| Frpb, ped/bikes | |
| Flpb, ped/bikes | |
| Frt | |
| Flt Protected | |
| Satd. Flow (prot) | |
| Flt Permitted | |
| Satd. Flow (perm) | |
| Peak-hour factor, PHF | 0.92 |
| Adj. Flow (vph) | 1 |
| RTOR Reduction (vph) | 0 |
| Lane Group Flow (vph) | 0 |
| Confl. Peds. (#/hr) | |
| Heavy Vehicles (%) | 0% |
| Turn Type | |
| Protected Phases | |
| Permitted Phases | |
| Actuated Green, G (s) | |
| Effective Green, g (s) | |
| Actuated g/C Ratio | |
| Clearance Time (s) | |
| Vehicle Extension (s) | |
| Lane Grp Cap (vph) | |
| v/s Ratio Prot | |
| v/s Ratio Perm | |
| v/c Ratio | |
| Uniform Delay, d1 | |
| Progression Factor | |
| Incremental Delay, d2 | |
| Delay (s) | |
| Level of Service | |
| Approach Delay (s) | |
| Approach LOS | |

Intersection Summary



## HCM Signalized Intersection Capacity Analysis
## 27: Rowland Blvd & Rowland Way

02/15/2018

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 401 | 343 | 154 | 22 | 12 | 82 |
| Future Volume (vph) | 401 | 343 | 154 | 22 | 12 | 82 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 3.6 | 3.2 | | 3.2 | 3.2 |
| Lane Util. Factor | 0.97 | 0.91 | 0.95 | | 1.00 | 0.95 |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.98 | | 0.89 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | | 0.99 | 1.00 |
| Satd. Flow (prot) | 3467 | 5085 | 3352 | | 1605 | 1490 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | | 0.99 | 1.00 |
| Satd. Flow (perm) | 3467 | 5085 | 3352 | | 1605 | 1490 |
| Peak-hour factor, PHF | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 |
| Adj. Flow (vph) | 451 | 385 | 173 | 25 | 13 | 92 |
| RTOR Reduction (vph) | 0 | 0 | 15 | 0 | 34 | 45 |
| Lane Group Flow (vph) | 451 | 385 | 183 | 0 | 19 | 7 |
| Confl. Peds. (#/hr) | | | | 1 | 2 | |
| Heavy Vehicles (%) | 1% | 2% | 5% | 9% | 6% | 3% |
| Turn Type | Prot | NA | NA | | Prot | Perm |
| Protected Phases | 5 | 2 | 6 | | 4 | |
| Permitted Phases | | | | | | 4 |
| Actuated Green, G (s) | 14.8 | 28.8 | 10.9 | | 5.9 | 5.9 |
| Effective Green, g (s) | 14.8 | 28.8 | 10.9 | | 5.9 | 5.9 |
| Actuated g/C Ratio | 0.36 | 0.69 | 0.26 | | 0.14 | 0.14 |
| Clearance Time (s) | 3.5 | 3.6 | 3.2 | | 3.2 | 3.2 |
| Vehicle Extension (s) | 2.0 | 4.0 | 4.0 | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 1236 | 3528 | 880 | | 228 | 211 |
| v/s Ratio Prot | c0.13 | 0.08 | c0.05 | | c0.01 | |
| v/s Ratio Perm | | | | | | 0.00 |
| v/c Ratio | 0.36 | 0.11 | 0.21 | | 0.08 | 0.04 |
| Uniform Delay, d1 | 9.9 | 2.1 | 11.9 | | 15.4 | 15.3 |
| Progression Factor | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.1 | 0.0 | 0.2 | | 0.1 | 0.0 |
| Delay (s) | 9.9 | 2.1 | 12.1 | | 15.5 | 15.4 |
| Level of Service | A | A | B | | B | B |
| Approach Delay (s) | | 6.3 | 12.1 | | 15.4 | |
| Approach LOS | | A | B | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 8.2 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.26 | | |
| Actuated Cycle Length (s) | 41.5 | Sum of lost time (s) | 9.9 |
| Intersection Capacity Utilization | 36.2% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 28: Vintage Way & Rowland Blvd

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 7 | 72 | 280 | 2 | 44 | 3 | 115 | 3 | 0 | 1 | 2 | 1 |
| Future Volume (vph) | 7 | 72 | 280 | 2 | 44 | 3 | 115 | 3 | 0 | 1 | 2 | 1 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.6 | 3.6 | 3.0 | 3.6 | | 3.6 | 3.6 | | | 3.2 | |
| Lane Util. Factor | 1.00 | 0.95 | 0.88 | 1.00 | 0.95 | | 0.97 | 1.00 | | | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | | 1.00 | 1.00 | | | 0.97 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | | 0.99 | |
| Satd. Flow (prot) | 1805 | 3195 | 2814 | 1805 | 3234 | | 3367 | 1900 | | | 1813 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | | 0.99 | |
| Satd. Flow (perm) | 1805 | 3195 | 2814 | 1805 | 3234 | | 3367 | 1900 | | | 1813 | |
| Peak-hour factor, PHF | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 |
| Adj. Flow (vph) | 8 | 85 | 329 | 2 | 52 | 4 | 135 | 4 | 0 | 1 | 2 | 1 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| Lane Group Flow (vph) | 8 | 85 | 329 | 2 | 53 | 0 | 135 | 4 | 0 | 0 | 3 | 0 |
| Confl. Peds. (#/hr) | | | 1 | | | 3 | | | 1 | | | |
| Confl. Bikes (#/hr) | | | 2 | | | 2 | | | | | | |
| Heavy Vehicles (%) | 0% | 13% | 1% | 0% | 11% | 0% | 4% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Prot | NA | pt+ov | Prot | NA | | Split | NA | | Split | NA | |
| Protected Phases | 5 | 2 | 2 3 | 1 | 6 | | 3 | 3 | | 4 | 4 | |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | 1.0 | 9.6 | 30.0 | 0.5 | 9.1 | | 16.8 | 16.8 | | | 1.0 | |
| Effective Green, g (s) | 1.0 | 9.6 | 30.0 | 0.5 | 9.1 | | 16.8 | 16.8 | | | 1.0 | |
| Actuated g/C Ratio | 0.02 | 0.23 | 0.73 | 0.01 | 0.22 | | 0.41 | 0.41 | | | 0.02 | |
| Clearance Time (s) | 3.0 | 3.6 | | 3.0 | 3.6 | | 3.6 | 3.6 | | | 3.2 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | | 3.0 | 3.0 | | | 2.0 | |
| Lane Grp Cap (vph) | 43 | 742 | 2044 | 21 | 712 | | 1369 | 772 | | | 43 | |
| v/s Ratio Prot | c0.00 | 0.03 | c0.12 | 0.00 | 0.02 | | 0.04 | 0.00 | | | c0.00 | |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | 0.19 | 0.11 | 0.16 | 0.10 | 0.07 | | 0.10 | 0.01 | | | 0.07 | |
| Uniform Delay, d1 | 19.8 | 12.5 | 1.8 | 20.2 | 12.8 | | 7.6 | 7.3 | | | 19.7 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | | 1.00 | |
| Incremental Delay, d2 | 0.8 | 0.0 | 0.0 | 0.7 | 0.0 | | 0.0 | 0.0 | | | 0.3 | |
| Delay (s) | 20.5 | 12.5 | 1.8 | 20.9 | 12.8 | | 7.6 | 7.3 | | | 19.9 | |
| Level of Service | C | B | A | C | B | | A | A | | | B | |
| Approach Delay (s) | | 4.3 | | | 13.1 | | | 7.6 | | | 19.9 | |
| Approach LOS | | A | | | B | | | A | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 5.9 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.18 | | |
| Actuated Cycle Length (s) | 41.3 | Sum of lost time (s) | 13.4 |
| Intersection Capacity Utilization | 35.3% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 29: Novato Blvd & Sunset Pkwy

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 198 | 65 | 25 | 37 | 97 | 96 | 24 | 231 | 53 | 51 | 310 | 250 |
| Future Volume (vph) | 198 | 65 | 25 | 37 | 97 | 96 | 24 | 231 | 53 | 51 | 310 | 250 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.0 | | 3.5 | 3.5 | | 3.5 | 4.9 | | 3.5 | 4.6 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 0.99 | | 1.00 | 0.97 | | 1.00 | 1.00 | | 1.00 | 0.99 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.96 | | 1.00 | 0.93 | | 1.00 | 0.97 | | 1.00 | 0.93 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1787 | 1808 | | 1805 | 1713 | | 1805 | 1839 | | 1770 | 1727 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1787 | 1808 | | 1805 | 1713 | | 1805 | 1839 | | 1770 | 1727 | |
| Peak-hour factor, PHF | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Adj. Flow (vph) | 218 | 71 | 27 | 41 | 107 | 105 | 26 | 254 | 58 | 56 | 341 | 275 |
| RTOR Reduction (vph) | 0 | 14 | 0 | 0 | 39 | 0 | 0 | 8 | 0 | 0 | 26 | 0 |
| Lane Group Flow (vph) | 218 | 84 | 0 | 41 | 173 | 0 | 26 | 304 | 0 | 56 | 590 | 0 |
| Confl. Peds. (#/hr) | | | 4 | | | 21 | | | 3 | | | 5 |
| Confl. Bikes (#/hr) | | | | | | 1 | | | | | | |
| Heavy Vehicles (%) | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 2% | 1% | 2% |
| Turn Type | Prot | NA | | Prot | NA | | Prot | NA | | Prot | NA | |
| Protected Phases | 3 | 8 | | 7 | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | 12.9 | 23.1 | | 5.6 | 16.3 | | 3.3 | 30.1 | | 5.6 | 32.7 | |
| Effective Green, g (s) | 12.9 | 23.1 | | 5.6 | 16.3 | | 3.3 | 30.1 | | 5.6 | 32.7 | |
| Actuated g/C Ratio | 0.16 | 0.29 | | 0.07 | 0.20 | | 0.04 | 0.37 | | 0.07 | 0.41 | |
| Clearance Time (s) | 3.5 | 4.0 | | 3.5 | 3.5 | | 3.5 | 4.9 | | 3.5 | 4.6 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 287 | 520 | | 125 | 347 | | 74 | 689 | | 123 | 703 | |
| v/s Ratio Prot | c0.12 | 0.05 | | 0.02 | c0.10 | | 0.01 | 0.17 | | c0.03 | c0.34 | |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | 0.76 | 0.16 | | 0.33 | 0.50 | | 0.35 | 0.44 | | 0.46 | 0.84 | |
| Uniform Delay, d1 | 32.2 | 21.4 | | 35.6 | 28.4 | | 37.5 | 18.8 | | 35.9 | 21.4 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 9.8 | 0.1 | | 0.6 | 0.4 | | 1.1 | 0.2 | | 1.0 | 8.3 | |
| Delay (s) | 42.0 | 21.4 | | 36.1 | 28.8 | | 38.5 | 19.0 | | 36.9 | 29.7 | |
| Level of Service | D | C | | D | C | | D | B | | D | C | |
| Approach Delay (s) | | 35.6 | | | 30.0 | | | 20.5 | | | 30.3 | |
| Approach LOS | | D | | | C | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 29.2 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.73 | | |
| Actuated Cycle Length (s) | 80.3 | Sum of lost time (s) | 15.9 |
| Intersection Capacity Utilization | 81.1% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

# HCM 2010 AWSC
## 30: Redwood Blvd & Novato Blvd



| Intersection | |
|---|---|
| Intersection Delay, s/veh | 206.7 |
| Intersection LOS | F |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 47 | 463 | 368 | 310 | 170 | 27 | 81 | 6 | 60 | 94 | 21 | 64 |
| Future Vol, veh/h | 47 | 463 | 368 | 310 | 170 | 27 | 81 | 6 | 60 | 94 | 21 | 64 |
| Peak Hour Factor | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| Heavy Vehicles, % | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Mvmt Flow | 51 | 498 | 396 | 333 | 183 | 29 | 87 | 6 | 65 | 101 | 23 | 69 |
| Number of Lanes | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Opposing Approach | WB | EB | SB | NB |
| Opposing Lanes | 2 | 2 | 2 | 3 |
| Conflicting Approach Left | SB | NB | EB | WB |
| Conflicting Lanes Left | 2 | 3 | 2 | 2 |
| Conflicting Approach Right | NB | SB | WB | EB |
| Conflicting Lanes Right | 3 | 2 | 2 | 2 |
| HCM Control Delay | 379.6 | 29.8 | 15.9 | 16.5 |
| HCM LOS | F | D | C | C |

| Lane | NBLn1 | NBLn2 | NBLn3 | EBLn1 | EBLn2 | WBLn1 | WBLn2 | SBLn1 | SBLn2 |
|---|---|---|---|---|---|---|---|---|---|
| Vol Left, % | 100% | 0% | 0% | 100% | 0% | 100% | 0% | 100% | 0% |
| Vol Thru, % | 0% | 100% | 0% | 0% | 56% | 0% | 86% | 0% | 25% |
| Vol Right, % | 0% | 0% | 100% | 0% | 44% | 0% | 14% | 0% | 75% |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 81 | 6 | 60 | 47 | 831 | 310 | 197 | 94 | 85 |
| LT Vol | 81 | 0 | 0 | 47 | 0 | 310 | 0 | 94 | 0 |
| Through Vol | 0 | 6 | 0 | 0 | 463 | 0 | 170 | 0 | 21 |
| RT Vol | 0 | 0 | 60 | 0 | 368 | 0 | 27 | 0 | 64 |
| Lane Flow Rate | 87 | 6 | 65 | 51 | 894 | 333 | 212 | 101 | 91 |
| Geometry Grp | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Degree of Util (X) | 0.229 | 0.016 | 0.148 | 0.115 | 1.832 | 0.757 | 0.447 | 0.261 | 0.21 |
| Departure Headway (Hd) | 11.228 | 10.701 | 9.963 | 8.188 | 7.38 | 9.616 | 9.017 | 11.042 | 9.956 |
| Convergence, Y/N | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Cap | 322 | 337 | 363 | 436 | 491 | 380 | 402 | 327 | 363 |
| Service Time | 8.928 | 8.401 | 7.663 | 5.979 | 5.17 | 7.316 | 6.717 | 8.742 | 7.656 |
| HCM Lane V/C Ratio | 0.27 | 0.018 | 0.179 | 0.117 | 1.821 | 0.876 | 0.527 | 0.309 | 0.251 |
| HCM Control Delay | 17.2 | 13.6 | 14.4 | 12.1 | 400.4 | 36.8 | 18.8 | 17.6 | 15.3 |
| HCM Lane LOS | C | B | B | B | F | E | C | C | C |
| HCM 95th-tile Q | 0.9 | 0 | 0.5 | 0.4 | 56 | 6.1 | 2.2 | 1 | 0.8 |



# HCM Signalized Intersection Capacity Analysis
## 31: Alameda Del Prado & Ignacio Blvd



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 12 | 838 | 447 | 255 | 318 | 18 | 66 | 4 | 229 | 7 | 2 | 0 |
| Future Volume (vph) | 12 | 838 | 447 | 255 | 318 | 18 | 66 | 4 | 229 | 7 | 2 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.6 | 3.6 | 3.0 | 3.6 | | | 3.5 | 3.5 | | 3.7 | |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | | 1.00 | 1.00 | | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.97 | 1.00 | 1.00 | | | 1.00 | 0.98 | | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.99 | 1.00 | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | | | 1.00 | 0.85 | | 1.00 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 0.95 | 1.00 | | 0.96 | |
| Satd. Flow (prot) | 1770 | 3610 | 1573 | 1900 | 3581 | | | 1786 | 1589 | | 1824 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 0.73 | 1.00 | | 0.85 | |
| Satd. Flow (perm) | 1770 | 3610 | 1573 | 1805 | 3581 | | | 1372 | 1589 | | 1609 | |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 12 | 873 | 466 | 266 | 331 | 19 | 69 | 4 | 239 | 7 | 2 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 89 | 0 | 2 | 0 | 0 | 0 | 207 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 13 | 873 | 377 | 266 | 348 | 0 | 0 | 73 | 32 | 0 | 9 | 0 |
| Confl. Peds. (#/hr) | | | 4 | | | | 7 | | 4 | 4 | | 7 |
| Heavy Vehicles (%) | 2% | 0% | 0% | 0% | 0% | 0% | 1% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Prot | NA | Perm | Prot | NA | | Perm | NA | Perm | Perm | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | 2 | | | | 8 | | 8 | 4 | | |
| Actuated Green, G (s) | 1.3 | 49.3 | 49.3 | 27.4 | 75.4 | | | 13.2 | 13.2 | | 13.0 | |
| Effective Green, g (s) | 1.3 | 49.3 | 49.3 | 27.4 | 75.4 | | | 13.2 | 13.2 | | 13.0 | |
| Actuated g/C Ratio | 0.01 | 0.49 | 0.49 | 0.27 | 0.75 | | | 0.13 | 0.13 | | 0.13 | |
| Clearance Time (s) | 3.0 | 3.6 | 3.6 | 3.0 | 3.6 | | | 3.5 | 3.5 | | 3.7 | |
| Vehicle Extension (s) | 2.0 | 3.0 | 3.0 | 2.0 | 3.0 | | | 2.0 | 2.0 | | 2.0 | |
| Lane Grp Cap (vph) | 23 | 1779 | 775 | 520 | 2700 | | | 181 | 209 | | 209 | |
| v/s Ratio Prot | 0.01 | c0.24 | | c0.14 | 0.10 | | | | | | | |
| v/s Ratio Perm | | | 0.24 | | | | | c0.05 | 0.02 | | 0.01 | |
| v/c Ratio | 0.57 | 0.49 | 0.49 | 0.51 | 0.13 | | | 0.40 | 0.15 | | 0.04 | |
| Uniform Delay, d1 | 49.1 | 17.0 | 16.9 | 30.6 | 3.4 | | | 39.8 | 38.4 | | 38.1 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 0.63 | 0.48 | | | 1.00 | 1.00 | | 1.00 | |
| Incremental Delay, d2 | 17.6 | 1.0 | 2.2 | 0.3 | 0.1 | | | 0.5 | 0.1 | | 0.0 | |
| Delay (s) | 66.6 | 17.9 | 19.1 | 19.6 | 1.7 | | | 40.3 | 38.6 | | 38.1 | |
| Level of Service | E | B | B | B | A | | | D | D | | D | |
| Approach Delay (s) | | 18.8 | | | 9.4 | | | 39.0 | | | 38.1 | |
| Approach LOS | | B | | | A | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 19.1 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.48 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 10.3 |
| Intersection Capacity Utilization | 62.8% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 32: US 101 SB Off Ramp/Enfrente Rd & Ignacio Blvd

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 34 | 813 | 299 | 168 | 391 | 41 | 0 | 0 | 710 | 248 | 136 | 208 |
| Future Volume (vph) | 34 | 813 | 299 | 168 | 391 | 41 | 0 | 0 | 710 | 248 | 136 | 208 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Grade (%) | | 0% | | | 0% | | | 2% | | | 0% | |
| Total Lost time (s) | 3.0 | 8.0 | 8.0 | 4.0 | 5.0 | | | | 4.0 | | 4.0 | 4.0 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | | | 0.88 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.96 | 1.00 | 0.99 | | | | 1.00 | | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | | | | 0.85 | | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | | 1.00 | | 0.97 | 1.00 |
| Satd. Flow (prot) | 1805 | 3610 | 1550 | 1787 | 3540 | | | | 2814 | | 1809 | 1578 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | | 1.00 | | 0.97 | 1.00 |
| Satd. Flow (perm) | 1805 | 3610 | 1550 | 1787 | 3540 | | | | 2814 | | 1809 | 1578 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 35 | 847 | 311 | 175 | 407 | 43 | 0 | 0 | 740 | 258 | 142 | 217 |
| RTOR Reduction (vph) | 0 | 0 | 133 | 0 | 6 | 0 | 0 | 0 | 347 | 0 | 0 | 158 |
| Lane Group Flow (vph) | 35 | 847 | 178 | 175 | 444 | 0 | 0 | 0 | 393 | 0 | 400 | 59 |
| Confl. Peds. (#/hr) | | | 7 | | | 20 | | | | | | 1 |
| Confl. Bikes (#/hr) | | | | | | 3 | | | | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 5% | 1% |
| Turn Type | Prot | NA | Perm | Prot | NA | | | | Over | Split | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | | | 1 | 7 | 7 | |
| Permitted Phases | | | 2 | | | | | | | | | 7 |
| Actuated Green, G (s) | 6.6 | 29.5 | 29.5 | 27.2 | 54.1 | | | | 27.2 | | 27.3 | 27.3 |
| Effective Green, g (s) | 6.6 | 29.5 | 29.5 | 27.2 | 54.1 | | | | 27.2 | | 27.3 | 27.3 |
| Actuated g/C Ratio | 0.07 | 0.29 | 0.29 | 0.27 | 0.54 | | | | 0.27 | | 0.27 | 0.27 |
| Clearance Time (s) | 3.0 | 8.0 | 8.0 | 4.0 | 5.0 | | | | 4.0 | | 4.0 | 4.0 |
| Vehicle Extension (s) | 2.0 | 2.5 | 2.5 | 3.0 | 4.0 | | | | 3.0 | | 2.5 | 2.5 |
| Lane Grp Cap (vph) | 119 | 1064 | 457 | 486 | 1915 | | | | 765 | | 493 | 430 |
| v/s Ratio Prot | 0.02 | c0.23 | | 0.10 | 0.13 | | | | c0.14 | | c0.22 | |
| v/s Ratio Perm | | | 0.11 | | | | | | | | | 0.04 |
| v/c Ratio | 0.29 | 0.80 | 0.39 | 0.36 | 0.23 | | | | 0.51 | | 0.81 | 0.14 |
| Uniform Delay, d1 | 44.5 | 32.5 | 28.1 | 29.4 | 12.0 | | | | 30.8 | | 33.9 | 27.5 |
| Progression Factor | 0.90 | 0.66 | 0.42 | 1.62 | 1.95 | | | | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.5 | 5.8 | 2.3 | 0.4 | 0.3 | | | | 0.6 | | 9.6 | 0.1 |
| Delay (s) | 40.4 | 27.2 | 14.0 | 47.9 | 23.8 | | | | 31.4 | | 43.5 | 27.6 |
| Level of Service | D | C | B | D | C | | | | C | | D | C |
| Approach Delay (s) | | 24.1 | | | 30.6 | | | 31.4 | | | 37.9 | |
| Approach LOS | | C | | | C | | | C | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 29.8 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.71 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 81.7% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 33: Nave Dr & Ignacio Blvd/Bel Marin Keys Blvd

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 715 | 1053 | 91 | 211 | 165 | 391 | 391 | 583 | 0 | 0 | 0 |
| Future Volume (vph) | 0 | 715 | 1053 | 91 | 211 | 165 | 391 | 391 | 583 | 0 | 0 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.0 | 4.6 | 3.0 | 4.0 | | 4.6 | 4.6 | 3.0 | | | |
| Lane Util. Factor | | 0.95 | 1.00 | 1.00 | 0.95 | | 0.91 | 0.91 | 1.00 | | | |
| Frpb, ped/bikes | | 1.00 | 0.99 | 1.00 | 0.99 | | 1.00 | 1.00 | 0.99 | | | |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | | |
| Frt | | 1.00 | 0.85 | 1.00 | 0.93 | | 1.00 | 1.00 | 0.85 | | | |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 0.99 | 1.00 | | | |
| Satd. Flow (prot) | | 3610 | 1605 | 1805 | 3323 | | 1643 | 3389 | 1599 | | | |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 0.99 | 1.00 | | | |
| Satd. Flow (perm) | | 3610 | 1605 | 1805 | 3323 | | 1643 | 3389 | 1599 | | | |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 0 | 761 | 1120 | 97 | 224 | 176 | 416 | 416 | 620 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 90 | 0 | 89 | 0 | 0 | 0 | 13 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 761 | 1030 | 97 | 311 | 0 | 270 | 562 | 607 | 0 | 0 | 0 |
| Confl. Peds. (#/hr) | | | 1 | | | 1 | | | 1 | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 2% | 0% | 1% | 0% | 0% | 0% | 0% |
| Turn Type | | NA | pm+ov | Prot | NA | | Split | NA | pm+ov | | | |
| Protected Phases | | 2 | 3 | 1 | 6 | | 3 | 3 | 1 | | | |
| Permitted Phases | | | 2 | | | | | | 3 | | | |
| Actuated Green, G (s) | | 34.5 | 76.4 | 12.0 | 49.5 | | 41.9 | 41.9 | 53.9 | | | |
| Effective Green, g (s) | | 34.5 | 76.4 | 12.0 | 49.5 | | 41.9 | 41.9 | 53.9 | | | |
| Actuated g/C Ratio | | 0.34 | 0.76 | 0.12 | 0.50 | | 0.42 | 0.42 | 0.54 | | | |
| Clearance Time (s) | | 4.0 | 4.6 | 3.0 | 4.0 | | 4.6 | 4.6 | 3.0 | | | |
| Vehicle Extension (s) | | 4.0 | 2.0 | 2.0 | 4.0 | | 2.0 | 2.0 | 2.0 | | | |
| Lane Grp Cap (vph) | | 1245 | 1226 | 216 | 1644 | | 688 | 1419 | 861 | | | |
| v/s Ratio Prot | | 0.21 | c0.35 | 0.05 | 0.09 | | 0.16 | 0.17 | c0.08 | | | |
| v/s Ratio Perm | | | 0.29 | | | | | | 0.29 | | | |
| v/c Ratio | | 0.61 | 0.84 | 0.45 | 0.19 | | 0.39 | 0.40 | 0.70 | | | |
| Uniform Delay, d1 | | 27.2 | 7.8 | 40.9 | 14.1 | | 20.2 | 20.2 | 17.1 | | | |
| Progression Factor | | 0.76 | 1.96 | 1.19 | 0.89 | | 1.00 | 1.00 | 1.00 | | | |
| Incremental Delay, d2 | | 1.6 | 3.6 | 0.5 | 0.3 | | 0.1 | 0.1 | 2.2 | | | |
| Delay (s) | | 22.3 | 18.8 | 49.2 | 12.8 | | 20.3 | 20.3 | 19.3 | | | |
| Level of Service | | C | B | D | B | | C | C | B | | | |
| Approach Delay (s) | | 20.2 | | | 19.9 | | | 19.9 | | | 0.0 | |
| Approach LOS | | C | | | B | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 20.1 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.82 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 11.6 |
| Intersection Capacity Utilization | 82.5% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 34: Bel Marin Keys Blvd & Commercial Blvd

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 0 | 11 | 73 | 0 | 9 | 46 | 1029 | 230 | 12 | 376 | 1 |
| Future Volume (vph) | 0 | 0 | 11 | 73 | 0 | 9 | 46 | 1029 | 230 | 12 | 376 | 1 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.0 | | | 4.0 | 4.0 | 3.0 | 3.9 | | 3.0 | 3.5 | |
| Lane Util. Factor | | 1.00 | | | 1.00 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | | 0.99 | | | 1.00 | 0.98 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 0.86 | | | 1.00 | 0.85 | 1.00 | 0.97 | | 1.00 | 1.00 | |
| Flt Protected | | 1.00 | | | 0.95 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 1620 | | | 1801 | 1395 | 1805 | 3494 | | 1805 | 3573 | |
| Flt Permitted | | 1.00 | | | 0.75 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | | 1620 | | | 1421 | 1395 | 1805 | 3494 | | 1805 | 3573 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 0 | 0 | 12 | 77 | 0 | 9 | 48 | 1083 | 242 | 13 | 396 | 1 |
| RTOR Reduction (vph) | 0 | 11 | 0 | 0 | 0 | 8 | 0 | 10 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 1 | 0 | 0 | 77 | 1 | 48 | 1315 | 0 | 13 | 397 | 0 |
| Confl. Peds. (#/hr) | 3 | | 2 | 2 | | 3 | | | 3 | | | |
| Heavy Vehicles (%) | 2% | 0% | 0% | 0% | 0% | 14% | 0% | 0% | 0% | 0% | 1% | 0% |
| Turn Type | | NA | | Perm | NA | Perm | Prot | NA | | Prot | NA | |
| Protected Phases | | 4 | | | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | | | | | | |
| Actuated Green, G (s) | | 12.1 | | | 12.1 | 12.1 | 5.3 | 75.2 | | 1.8 | 72.1 | |
| Effective Green, g (s) | | 12.1 | | | 12.1 | 12.1 | 5.3 | 75.2 | | 1.8 | 72.1 | |
| Actuated g/C Ratio | | 0.12 | | | 0.12 | 0.12 | 0.05 | 0.75 | | 0.02 | 0.72 | |
| Clearance Time (s) | | 4.0 | | | 4.0 | 4.0 | 3.0 | 3.9 | | 3.0 | 3.5 | |
| Vehicle Extension (s) | | 3.0 | | | 3.0 | 3.0 | 2.5 | 3.0 | | 2.5 | 4.0 | |
| Lane Grp Cap (vph) | | 196 | | | 171 | 168 | 95 | 2627 | | 32 | 2576 | |
| v/s Ratio Prot | | 0.00 | | | | | c0.03 | c0.38 | | 0.01 | 0.11 | |
| v/s Ratio Perm | | | | | c0.05 | 0.00 | | | | | | |
| v/c Ratio | | 0.01 | | | 0.45 | 0.01 | 0.51 | 0.50 | | 0.41 | 0.15 | |
| Uniform Delay, d1 | | 38.7 | | | 40.9 | 38.7 | 46.1 | 4.9 | | 48.6 | 4.4 | |
| Progression Factor | | 1.00 | | | 1.00 | 1.00 | 0.90 | 0.59 | | 0.94 | 1.33 | |
| Incremental Delay, d2 | | 0.0 | | | 1.9 | 0.0 | 2.3 | 0.5 | | 6.0 | 0.1 | |
| Delay (s) | | 38.7 | | | 42.7 | 38.7 | 43.8 | 3.4 | | 51.5 | 5.9 | |
| Level of Service | | D | | | D | D | D | A | | D | A | |
| Approach Delay (s) | | 38.7 | | | 42.3 | | | 4.8 | | | 7.4 | |
| Approach LOS | | D | | | D | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 7.3 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.51 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 10.9 |
| Intersection Capacity Utilization | 58.7% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 35: Bel Marin Keys Blvd & Hamilton Dr/Digital Dr

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 1 | 46 | 75 | 2 | 9 | 104 | 464 | 468 | 9 | 268 | 3 |
| Future Volume (vph) | 0 | 1 | 46 | 75 | 2 | 9 | 104 | 464 | 468 | 9 | 268 | 3 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.5 | 3.5 | 3.5 | 3.5 | | 3.0 | 4.0 | | 3.0 | 4.0 | |
| Lane Util. Factor | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | | 1.00 | 0.99 | 1.00 | 0.99 | | 1.00 | 0.99 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 1.00 | 0.85 | 1.00 | 0.88 | | 1.00 | 0.92 | | 1.00 | 1.00 | |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 1900 | 1533 | 1803 | 1649 | | 1770 | 3298 | | 1805 | 3567 | |
| Flt Permitted | | 1.00 | 1.00 | 0.76 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | | 1900 | 1533 | 1437 | 1649 | | 1770 | 3298 | | 1805 | 3567 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 0 | 1 | 48 | 79 | 2 | 9 | 109 | 488 | 493 | 9 | 282 | 3 |
| RTOR Reduction (vph) | 0 | 0 | 42 | 0 | 8 | 0 | 0 | 86 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 1 | 6 | 79 | 3 | 0 | 109 | 895 | 0 | 9 | 285 | 0 |
| Confl. Peds. (#/hr) | 1 | | 1 | 1 | | 1 | | | 2 | | | 8 |
| Heavy Vehicles (%) | 0% | 0% | 4% | 0% | 0% | 0% | 2% | 0% | 0% | 0% | 1% | 0% |
| Turn Type | | NA | Perm | Perm | NA | | Prot | NA | | Prot | NA | |
| Protected Phases | | 4 | | | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | 4 | 8 | | | | | | | | |
| Actuated Green, G (s) | | 12.1 | 12.1 | 12.1 | 12.1 | | 11.2 | 75.6 | | 1.8 | 66.2 | |
| Effective Green, g (s) | | 12.1 | 12.1 | 12.1 | 12.1 | | 11.2 | 75.6 | | 1.8 | 66.2 | |
| Actuated g/C Ratio | | 0.12 | 0.12 | 0.12 | 0.12 | | 0.11 | 0.76 | | 0.02 | 0.66 | |
| Clearance Time (s) | | 3.5 | 3.5 | 3.5 | 3.5 | | 3.0 | 4.0 | | 3.0 | 4.0 | |
| Vehicle Extension (s) | | 2.0 | 2.0 | 2.5 | 2.5 | | 2.0 | 4.0 | | 2.0 | 4.0 | |
| Lane Grp Cap (vph) | | 229 | 185 | 173 | 199 | | 198 | 2493 | | 32 | 2361 | |
| v/s Ratio Prot | | 0.00 | | | 0.00 | | c0.06 | c0.27 | | 0.00 | 0.08 | |
| v/s Ratio Perm | | | 0.00 | c0.05 | | | | | | | | |
| v/c Ratio | | 0.00 | 0.03 | 0.46 | 0.02 | | 0.55 | 0.36 | | 0.28 | 0.12 | |
| Uniform Delay, d1 | | 38.7 | 38.8 | 40.9 | 38.7 | | 42.0 | 4.1 | | 48.5 | 6.2 | |
| Progression Factor | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.09 | 1.35 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 0.0 | 0.0 | 1.4 | 0.0 | | 1.7 | 0.4 | | 1.8 | 0.1 | |
| Delay (s) | | 38.7 | 38.8 | 42.3 | 38.7 | | 47.5 | 5.9 | | 50.2 | 6.3 | |
| Level of Service | | D | D | D | D | | D | A | | D | A | |
| Approach Delay (s) | | 38.8 | | | 41.8 | | | 10.1 | | | 7.7 | |
| Approach LOS | | D | | | D | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 12.4 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.41 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 10.5 |
| Intersection Capacity Utilization | 56.6% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 672 | 139 | 0 | 693 | 945 | 185 |
| Future Volume (vph) | 672 | 139 | 0 | 693 | 945 | 185 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | | 5.0 | 5.0 | |
| Lane Util. Factor | 0.97 | 1.00 | | 0.95 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 0.99 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.85 | | 1.00 | 0.98 | |
| Flt Protected | 0.95 | 1.00 | | 1.00 | 1.00 | |
| Satd. Flow (prot) | 3467 | 1563 | | 3574 | 3492 | |
| Flt Permitted | 0.95 | 1.00 | | 1.00 | 1.00 | |
| Satd. Flow (perm) | 3467 | 1563 | | 3574 | 3492 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 730 | 151 | 0 | 753 | 1027 | 201 |
| RTOR Reduction (vph) | 0 | 43 | 0 | 0 | 23 | 0 |
| Lane Group Flow (vph) | 730 | 108 | 0 | 753 | 1205 | 0 |
| Confl. Peds. (#/hr) | | 1 | | | | |
| Heavy Vehicles (%) | 1% | 2% | 0% | 1% | 1% | 0% |
| Turn Type | Prot | Perm | | NA | NA | |
| Protected Phases | 4 | | | 2 | 6 | |
| Permitted Phases | | 4 | | | | |
| Actuated Green, G (s) | 27.0 | 27.0 | | 35.0 | 35.0 | |
| Effective Green, g (s) | 27.0 | 27.0 | | 35.0 | 35.0 | |
| Actuated g/C Ratio | 0.39 | 0.39 | | 0.50 | 0.50 | |
| Clearance Time (s) | 3.0 | 3.0 | | 5.0 | 5.0 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 1337 | 602 | | 1787 | 1746 | |
| v/s Ratio Prot | c0.21 | | | 0.21 | c0.35 | |
| v/s Ratio Perm | | 0.07 | | | | |
| v/c Ratio | 0.55 | 0.18 | | 0.42 | 0.69 | |
| Uniform Delay, d1 | 16.7 | 14.2 | | 11.1 | 13.4 | |
| Progression Factor | 1.00 | 1.00 | | 0.43 | 1.00 | |
| Incremental Delay, d2 | 1.6 | 0.7 | | 0.7 | 2.3 | |
| Delay (s) | 18.3 | 14.8 | | 5.4 | 15.6 | |
| Level of Service | B | B | | A | B | |
| Approach Delay (s) | 17.7 | | | 5.4 | 15.6 | |
| Approach LOS | B | | | A | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 13.6 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.63 | | |
| Actuated Cycle Length (s) | 70.0 | Sum of lost time (s) | 8.0 |
| Intersection Capacity Utilization | 62.0% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group





| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 38 | 20 | 530 | 82 | 97 | 835 |
| Future Volume (vph) | 38 | 20 | 530 | 82 | 97 | 835 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.2 | 3.2 | 4.4 | | 3.0 | 4.4 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 0.85 | 0.98 | | 1.00 | 1.00 |
| Flt Protected | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 1615 | 1860 | | 1770 | 1881 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | 1805 | 1615 | 1860 | | 1770 | 1881 |
| Peak-hour factor, PHF | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Adj. Flow (vph) | 42 | 22 | 582 | 90 | 107 | 918 |
| RTOR Reduction (vph) | 0 | 21 | 7 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 42 | 1 | 665 | 0 | 107 | 918 |
| Confl. Peds. (#/hr) | | | | 2 | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 2% | 1% |
| Turn Type | Prot | Perm | NA | | Prot | NA |
| Protected Phases | 8 | | 2 | | 1 | 6 |
| Permitted Phases | | 8 | | | | |
| Actuated Green, G (s) | 3.6 | 3.6 | 48.6 | | 7.2 | 58.8 |
| Effective Green, g (s) | 3.6 | 3.6 | 48.6 | | 7.2 | 58.8 |
| Actuated g/C Ratio | 0.05 | 0.05 | 0.69 | | 0.10 | 0.84 |
| Clearance Time (s) | 3.2 | 3.2 | 4.4 | | 3.0 | 4.4 |
| Vehicle Extension (s) | 1.0 | 1.0 | 1.0 | | 1.0 | 1.0 |
| Lane Grp Cap (vph) | 92 | 83 | 1291 | | 182 | 1580 |
| v/s Ratio Prot | c0.02 | | 0.36 | | 0.06 | c0.49 |
| v/s Ratio Perm | | 0.00 | | | | |
| v/c Ratio | 0.46 | 0.01 | 0.52 | | 0.59 | 0.58 |
| Uniform Delay, d1 | 32.2 | 31.5 | 5.1 | | 30.0 | 1.8 |
| Progression Factor | 1.00 | 1.00 | 0.53 | | 1.25 | 1.37 |
| Incremental Delay, d2 | 1.3 | 0.0 | 1.4 | | 2.4 | 1.2 |
| Delay (s) | 33.6 | 31.5 | 4.1 | | 39.8 | 3.6 |
| Level of Service | C | C | A | | D | A |
| Approach Delay (s) | 32.9 | | 4.1 | | | 7.4 |
| Approach LOS | C | | A | | | A |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 7.0 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.60 | | |
| Actuated Cycle Length (s) | 70.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 55.9% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## 38: Nave Dr & Hamilton Pkwy


| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 113 | 225 | 357 | 29 | 272 | 567 |
| Future Volume (vph) | 113 | 225 | 357 | 29 | 272 | 567 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.2 | 3.2 | 4.4 | 4.4 | 3.0 | 4.4 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.85 | 1.00 | 0.85 | 1.00 | 1.00 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (prot) | 1770 | 1599 | 1900 | 1578 | 1787 | 1850 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (perm) | 1770 | 1599 | 1900 | 1578 | 1787 | 1900 |
| Peak-hour factor, PHF | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Adj. Flow (vph) | 124 | 247 | 392 | 32 | 299 | 623 |
| RTOR Reduction (vph) | 0 | 214 | 0 | 11 | 0 | 0 |
| Lane Group Flow (vph) | 124 | 33 | 392 | 21 | 299 | 623 |
| Confl. Peds. (#/hr) | | | | 2 | | |
| Heavy Vehicles (%) | 2% | 1% | 0% | 0% | 1% | 0% |
| Turn Type | Prot | Perm | NA | Perm | Prot | NA |
| Protected Phases | 8 | | 2 | | 1 | 6 |
| Permitted Phases | | 8 | | 2 | | |
| Actuated Green, G (s) | 9.4 | 9.4 | 30.7 | 30.7 | 19.3 | 53.0 |
| Effective Green, g (s) | 9.4 | 9.4 | 30.7 | 30.7 | 19.3 | 53.0 |
| Actuated g/C Ratio | 0.13 | 0.13 | 0.44 | 0.44 | 0.28 | 0.76 |
| Clearance Time (s) | 3.2 | 3.2 | 4.4 | 4.4 | 3.0 | 4.4 |
| Vehicle Extension (s) | 2.0 | 2.0 | 3.0 | 3.0 | 2.0 | 3.0 |
| Lane Grp Cap (vph) | 237 | 214 | 833 | 692 | 492 | 1400 |
| v/s Ratio Prot | c0.07 | | 0.21 | | c0.17 | c0.34 |
| v/s Ratio Perm | | 0.02 | | 0.01 | | |
| v/c Ratio | 0.52 | 0.15 | 0.47 | 0.03 | 0.61 | 0.45 |
| Uniform Delay, d1 | 28.2 | 26.8 | 13.9 | 11.2 | 22.1 | 3.1 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.39 | 0.32 |
| Incremental Delay, d2 | 1.0 | 0.1 | 1.9 | 0.1 | 1.2 | 0.9 |
| Delay (s) | 29.2 | 26.9 | 15.8 | 11.3 | 31.9 | 1.9 |
| Level of Service | C | C | B | B | C | A |
| Approach Delay (s) | 27.7 | | 15.5 | | | 11.6 |
| Approach LOS | C | | B | | | B |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 16.0 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.53 | | |
| Actuated Cycle Length (s) | 70.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 52.5% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |




## 39: Nave Dr & Main Gate Dr


| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 209 | 70 | 193 | 349 | 119 | 307 |
| Future Volume (vph) | 209 | 70 | 193 | 349 | 119 | 307 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | 4.1 | 4.1 | 3.0 | 4.4 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.85 | 1.00 | 0.85 | 1.00 | 1.00 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 1615 | 1900 | 1615 | 1805 | 1881 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (perm) | 1805 | 1615 | 1900 | 1615 | 1805 | 1881 |
| Peak-hour factor, PHF | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| Adj. Flow (vph) | 225 | 75 | 208 | 375 | 128 | 330 |
| RTOR Reduction (vph) | 0 | 61 | 0 | 251 | 0 | 0 |
| Lane Group Flow (vph) | 225 | 14 | 208 | 124 | 128 | 330 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 1% |
| Turn Type | Prot | Perm | NA | Perm | Prot | NA |
| Protected Phases | 8 | | 2 | | 1 | 6 |
| Permitted Phases | | 8 | | 2 | | |
| Actuated Green, G (s) | 7.3 | 7.3 | 12.7 | 12.7 | 8.3 | 23.7 |
| Effective Green, g (s) | 7.3 | 7.3 | 12.7 | 12.7 | 8.3 | 23.7 |
| Actuated g/C Ratio | 0.19 | 0.19 | 0.33 | 0.33 | 0.22 | 0.62 |
| Clearance Time (s) | 3.0 | 3.0 | 4.1 | 4.1 | 3.0 | 4.4 |
| Vehicle Extension (s) | 2.0 | 2.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| Lane Grp Cap (vph) | 343 | 307 | 628 | 534 | 390 | 1160 |
| v/s Ratio Prot | c0.12 | | c0.11 | | c0.07 | 0.18 |
| v/s Ratio Perm | | 0.01 | | 0.08 | | |
| v/c Ratio | 0.66 | 0.05 | 0.33 | 0.23 | 0.33 | 0.28 |
| Uniform Delay, d1 | 14.4 | 12.7 | 9.7 | 9.3 | 12.7 | 3.4 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 3.4 | 0.0 | 0.1 | 0.1 | 0.2 | 0.0 |
| Delay (s) | 17.8 | 12.7 | 9.8 | 9.4 | 12.9 | 3.5 |
| Level of Service | B | B | A | A | B | A |
| Approach Delay (s) | 16.5 | | 9.5 | | | 6.1 |
| Approach LOS | B | | A | | | A |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 9.9 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.41 | | |
| Actuated Cycle Length (s) | 38.4 | Sum of lost time (s) | 10.1 |
| Intersection Capacity Utilization | 41.8% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 322 | 88 | 396 | 72 | 61 | 469 |
| Future Volume (vph) | 322 | 88 | 396 | 72 | 61 | 469 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | 4.1 | | 3.0 | 3.5 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 0.97 | 1.00 | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 0.85 | 0.98 | | 1.00 | 1.00 |
| Flt Protected | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | 1787 | 1573 | 1845 | | 1805 | 1881 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | 1787 | 1573 | 1845 | | 1805 | 1881 |
| Peak-hour factor, PHF | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Adj. Flow (vph) | 354 | 97 | 435 | 79 | 67 | 515 |
| RTOR Reduction (vph) | 0 | 66 | 9 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 354 | 31 | 505 | 0 | 67 | 515 |
| Confl. Peds. (#/hr) | | 6 | | | | |
| Heavy Vehicles (%) | 1% | 0% | 1% | 0% | 0% | 1% |
| Turn Type | Prot | Perm | NA | | Prot | NA |
| Protected Phases | 4 | | 6 | | 5 | 2 |
| Permitted Phases | | 4 | | | | |
| Actuated Green, G (s) | 15.8 | 15.8 | 18.8 | | 4.2 | 26.6 |
| Effective Green, g (s) | 15.8 | 15.8 | 18.8 | | 4.2 | 26.6 |
| Actuated g/C Ratio | 0.32 | 0.32 | 0.38 | | 0.09 | 0.54 |
| Clearance Time (s) | 3.0 | 3.0 | 4.1 | | 3.0 | 3.5 |
| Vehicle Extension (s) | 2.0 | 2.0 | 2.0 | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 577 | 508 | 709 | | 155 | 1023 |
| v/s Ratio Prot | c0.20 | | c0.27 | | 0.04 | c0.27 |
| v/s Ratio Perm | | 0.02 | | | | |
| v/c Ratio | 0.61 | 0.06 | 0.71 | | 0.43 | 0.50 |
| Uniform Delay, d1 | 14.0 | 11.4 | 12.8 | | 21.2 | 7.0 |
| Progression Factor | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 1.4 | 0.0 | 2.8 | | 0.7 | 0.1 |
| Delay (s) | 15.3 | 11.4 | 15.6 | | 21.9 | 7.1 |
| Level of Service | B | B | B | | C | A |
| Approach Delay (s) | 14.5 | | 15.6 | | | 8.8 |
| Approach LOS | B | | B | | | A |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 12.7 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.66 | | |
| Actuated Cycle Length (s) | 48.9 | Sum of lost time (s) | 10.1 |
| Intersection Capacity Utilization | 61.0% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group





| Intersection | |
|---|---|
| Intersection Delay, s/veh | 21.2 |
| Intersection LOS | C |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 125 | 11 | 0 | 63 | 117 | 584 | 2 | 156 | 43 | 32 | 20 | 6 |
| Future Vol, veh/h | 125 | 11 | 0 | 63 | 117 | 584 | 2 | 156 | 43 | 32 | 20 | 6 |
| Peak Hour Factor | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 132 | 12 | 0 | 66 | 123 | 615 | 2 | 164 | 45 | 34 | 21 | 6 |
| Number of Lanes | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Opposing Approach | WB | EB | SB | NB |
| Opposing Lanes | 2 | 1 | 2 | 1 |
| Conflicting Approach Left | SB | NB | EB | WB |
| Conflicting Lanes Left | 2 | 1 | 1 | 2 |
| Conflicting Approach Right | NB | SB | WB | EB |
| Conflicting Lanes Right | 1 | 2 | 2 | 1 |
| HCM Control Delay | 12.1 | 25.5 | 14 | 10.8 |
| HCM LOS | B | D | B | B |

| Lane | NBLn1 | EBLn1 | WBLn1 | WBLn2 | SBLn1 | SBLn2 |
|---|---|---|---|---|---|---|
| Vol Left, % | 1% | 92% | 35% | 0% | 100% | 0% |
| Vol Thru, % | 78% | 8% | 65% | 0% | 0% | 77% |
| Vol Right, % | 21% | 0% | 0% | 100% | 0% | 23% |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 201 | 136 | 180 | 584 | 32 | 26 |
| LT Vol | 2 | 125 | 63 | 0 | 32 | 0 |
| Through Vol | 156 | 11 | 117 | 0 | 0 | 20 |
| RT Vol | 43 | 0 | 0 | 584 | 0 | 6 |
| Lane Flow Rate | 212 | 143 | 189 | 615 | 34 | 27 |
| Geometry Grp | 6 | 6 | 7 | 7 | 7 | 7 |
| Degree of Util (X) | 0.392 | 0.264 | 0.31 | 0.855 | 0.073 | 0.054 |
| Departure Headway (Hd) | 6.678 | 6.646 | 5.893 | 5.009 | 7.785 | 7.108 |
| Convergence, Y/N | Yes | Yes | Yes | Yes | Yes | Yes |
| Cap | 540 | 540 | 610 | 725 | 459 | 503 |
| Service Time | 4.723 | 4.698 | 3.63 | 2.745 | 5.545 | 4.868 |
| HCM Lane V/C Ratio | 0.393 | 0.265 | 0.31 | 0.848 | 0.074 | 0.054 |
| HCM Control Delay | 14 | 12.1 | 11.3 | 29.9 | 11.2 | 10.3 |
| HCM Lane LOS | B | B | B | D | B | B |
| HCM 95th-tile Q | 1.9 | 1.1 | 1.3 | 10 | 0.2 | 0.2 |

HCM 2010 AWSC
1: Simmons Ln & San Marin Dr 02/15/2018

| Intersection | |
|---|---|
| Intersection Delay, s/veh | 74.6 |
| Intersection LOS | F |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 11 | 403 | 81 | 294 | 874 | 27 | 93 | 14 | 143 | 16 | 11 | 12 |
| Future Vol, veh/h | 11 | 403 | 81 | 294 | 874 | 27 | 93 | 14 | 143 | 16 | 11 | 12 |
| Peak Hour Factor | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 12 | 433 | 87 | 316 | 940 | 29 | 100 | 15 | 154 | 17 | 12 | 13 |
| Number of Lanes | 1 | 2 | 0 | 1 | 2 | 0 | 0 | 1 | 1 | 0 | 1 | 0 |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Opposing Approach | WB | EB | SB | NB |
| Opposing Lanes | 3 | 3 | 1 | 2 |
| Conflicting Approach Left | SB | NB | EB | WB |
| Conflicting Lanes Left | 1 | 2 | 3 | 3 |
| Conflicting Approach Right | NB | SB | WB | EB |
| Conflicting Lanes Right | 2 | 1 | 3 | 3 |
| HCM Control Delay | 26.4 | 108.2 | 18.3 | 15.4 |
| HCM LOS | D | F | C | C |

| Lane | NBLn1 | NBLn2 | EBLn1 | EBLn2 | EBLn3 | WBLn1 | WBLn2 | WBLn3 | SBLn1 |
|---|---|---|---|---|---|---|---|---|---|
| Vol Left, % | 87% | 0% | 100% | 0% | 0% | 100% | 0% | 0% | 41% |
| Vol Thru, % | 13% | 0% | 0% | 100% | 62% | 0% | 100% | 92% | 28% |
| Vol Right, % | 0% | 100% | 0% | 0% | 38% | 0% | 0% | 8% | 31% |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 107 | 143 | 11 | 269 | 215 | 294 | 583 | 318 | 39 |
| LT Vol | 93 | 0 | 11 | 0 | 0 | 294 | 0 | 0 | 16 |
| Through Vol | 14 | 0 | 0 | 269 | 134 | 0 | 583 | 291 | 11 |
| RT Vol | 0 | 143 | 0 | 0 | 81 | 0 | 0 | 27 | 12 |
| Lane Flow Rate | 115 | 154 | 12 | 289 | 232 | 316 | 627 | 342 | 42 |
| Geometry Grp | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Degree of Util (X) | 0.324 | 0.385 | 0.03 | 0.698 | 0.543 | 0.723 | 1.344 | 0.729 | 0.124 |
| Departure Headway (Hd) | 10.748 | 9.593 | 9.723 | 9.209 | 8.938 | 8.237 | 7.724 | 7.663 | 11.144 |
| Convergence, Y/N | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Cap | 337 | 378 | 370 | 396 | 405 | 439 | 470 | 469 | 324 |
| Service Time | 8.448 | 7.293 | 7.423 | 6.909 | 6.638 | 6.008 | 5.495 | 5.434 | 8.844 |
| HCM Lane V/C Ratio | 0.341 | 0.407 | 0.032 | 0.73 | 0.573 | 0.72 | 1.334 | 0.729 | 0.13 |
| HCM Control Delay | 18.5 | 18.2 | 12.7 | 30.6 | 21.8 | 29.8 | 191.4 | 28.5 | 15.4 |
| HCM Lane LOS | C | C | B | D | C | D | F | D | C |
| HCM 95th-tile Q | 1.4 | 1.8 | 0.1 | 5.1 | 3.1 | 5.7 | 28.1 | 5.9 | 0.4 |



HCM Signalized Intersection Capacity Analysis
2: W Campus Dr & San Marin Dr 02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 581 | 0 | 3 | 1198 | 1 | 0 | 0 | 0 | 53 | 0 | 5 |
| Future Volume (vph) | 0 | 581 | 0 | 3 | 1198 | 1 | 0 | 0 | 0 | 53 | 0 | 5 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.8 | | 4.0 | 4.8 | 4.8 | | | | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | | 0.95 | | 1.00 | 0.95 | 1.00 | | | | 0.95 | 0.95 | 1.00 |
| Frpb, ped/bikes | | 1.00 | | 1.00 | 1.00 | 1.00 | | | | 1.00 | 1.00 | 1.00 |
| Flpb, ped/bikes | | 1.00 | | 1.00 | 1.00 | 1.00 | | | | 1.00 | 1.00 | 1.00 |
| Frt | | 1.00 | | 1.00 | 1.00 | 0.85 | | | | 1.00 | 1.00 | 0.85 |
| Flt Protected | | 1.00 | | 0.95 | 1.00 | 1.00 | | | | 0.95 | 0.95 | 1.00 |
| Satd. Flow (prot) | | 3574 | | 1805 | 3574 | 1615 | | | | 1715 | 1715 | 1615 |
| Flt Permitted | | 1.00 | | 0.95 | 1.00 | 1.00 | | | | 0.87 | 0.87 | 1.00 |
| Satd. Flow (perm) | | 3574 | | 1805 | 3574 | 1615 | | | | 1570 | 1570 | 1615 |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 0 | 618 | 0 | 3 | 1274 | 1 | 0 | 0 | 0 | 56 | 0 | 5 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| Lane Group Flow (vph) | 0 | 618 | 0 | 3 | 1274 | 1 | 0 | 0 | 0 | 28 | 28 | 1 |
| Confl. Peds. (#/hr) | | | 2 | | | | | | | | | |
| Heavy Vehicles (%) | 0% | 1% | 0% | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Prot | NA | | Prot | NA | Perm | | | | Perm | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | | | | 6 | 8 | | | 4 | | 4 |
| Actuated Green, G (s) | | 21.8 | | 1.2 | 27.0 | 27.0 | | | | 4.6 | 4.6 | 4.6 |
| Effective Green, g (s) | | 21.8 | | 1.2 | 27.0 | 27.0 | | | | 4.6 | 4.6 | 4.6 |
| Actuated g/C Ratio | | 0.54 | | 0.03 | 0.67 | 0.67 | | | | 0.11 | 0.11 | 0.11 |
| Clearance Time (s) | | 4.8 | | 4.0 | 4.8 | 4.8 | | | | 4.0 | 4.0 | 4.0 |
| Vehicle Extension (s) | | 4.0 | | 2.0 | 4.0 | 4.0 | | | | 2.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | | 1928 | | 53 | 2388 | 1079 | | | | 178 | 178 | 183 |
| v/s Ratio Prot | | 0.17 | | 0.00 | c0.36 | | | | | | | |
| v/s Ratio Perm | | | | | | 0.00 | | | | c0.02 | 0.02 | 0.00 |
| v/c Ratio | | 0.32 | | 0.06 | 0.53 | 0.00 | | | | 0.16 | 0.16 | 0.00 |
| Uniform Delay, d1 | | 5.2 | | 19.0 | 3.5 | 2.2 | | | | 16.2 | 16.2 | 15.9 |
| Progression Factor | | 1.00 | | 1.00 | 1.00 | 1.00 | | | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.1 | | 0.2 | 0.3 | 0.0 | | | | 0.2 | 0.2 | 0.0 |
| Delay (s) | | 5.3 | | 19.2 | 3.7 | 2.2 | | | | 16.3 | 16.3 | 15.9 |
| Level of Service | | A | | B | A | A | | | | B | B | B |
| Approach Delay (s) | | 5.3 | | | 3.8 | | | 0.0 | | | 16.3 | |
| Approach LOS | | A | | | A | | | A | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 4.7 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.55 | | |
| Actuated Cycle Length (s) | 40.4 | Sum of lost time (s) | 12.8 |
| Intersection Capacity Utilization | 48.8% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 3: San Marin Dr & E Campus Drive

02/15/2018

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 0 | 641 | 1208 | 6 | 5 | 2 |
| Future Volume (vph) | 0 | 641 | 1208 | 6 | 5 | 2 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.3 | 4.3 | 4.3 | 3.0 | 3.0 |
| Lane Util. Factor | | 0.95 | 0.95 | 1.00 | 0.97 | 1.00 |
| Frpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | 0.99 |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 1.00 | 1.00 | 0.85 | 1.00 | 0.85 |
| Flt Protected | | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (prot) | | 3574 | 3574 | 1615 | 3502 | 1595 |
| Flt Permitted | | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (perm) | | 3574 | 3574 | 1615 | 3502 | 1595 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 0 | 668 | 1258 | 6 | 5 | 2 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 2 | 0 | 2 |
| Lane Group Flow (vph) | 0 | 668 | 1258 | 4 | 5 | 0 |
| Confl. Peds. (#/hr) | | | | | | 1 |
| Heavy Vehicles (%) | 0% | 1% | 1% | 0% | 0% | 0% |
| Turn Type | Prot | NA | NA | Perm | Prot | Perm |
| Protected Phases | 5 | 2 | 6 | | 4 | |
| Permitted Phases | | | | 6 | | 4 |
| Actuated Green, G (s) | | 24.7 | 24.7 | 24.7 | 2.5 | 2.5 |
| Effective Green, g (s) | | 24.7 | 24.7 | 24.7 | 2.5 | 2.5 |
| Actuated g/C Ratio | | 0.72 | 0.72 | 0.72 | 0.07 | 0.07 |
| Clearance Time (s) | | 4.3 | 4.3 | 4.3 | 3.0 | 3.0 |
| Vehicle Extension (s) | | 4.0 | 4.0 | 4.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | | 2558 | 2558 | 1156 | 253 | 115 |
| v/s Ratio Prot | | 0.19 | c0.35 | | c0.00 | |
| v/s Ratio Perm | | | | 0.00 | | 0.00 |
| v/c Ratio | | 0.26 | 0.49 | 0.00 | 0.02 | 0.00 |
| Uniform Delay, d1 | | 1.7 | 2.1 | 1.4 | 14.9 | 14.8 |
| Progression Factor | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.1 | 0.2 | 0.0 | 0.0 | 0.0 |
| Delay (s) | | 1.8 | 2.4 | 1.4 | 14.9 | 14.8 |
| Level of Service | | A | A | A | B | B |
| Approach Delay (s) | | 1.8 | 2.3 | | 14.9 | |
| Approach LOS | | A | A | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 2.2 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.50 | | |
| Actuated Cycle Length (s) | 34.5 | Sum of lost time (s) | 10.3 |
| Intersection Capacity Utilization | 46.0% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 4: Redwood Blvd & San Marin Dr

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 13 | 515 | 140 | 234 | 858 | 50 | 254 | 52 | 378 | 218 | 66 | 61 |
| Future Volume (vph) | 13 | 515 | 140 | 234 | 858 | 50 | 254 | 52 | 378 | 218 | 66 | 61 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.6 | | 3.0 | 4.0 | | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 | |
| Lane Util. Factor | 1.00 | 0.91 | | 1.00 | 0.91 | | 0.97 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 0.99 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 0.97 | | 1.00 | 0.99 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.93 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1787 | 4955 | | 1752 | 5093 | | 3467 | 1881 | 1568 | 1787 | 1731 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1787 | 4955 | | 1752 | 5093 | | 3467 | 1881 | 1568 | 1787 | 1731 | |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 14 | 548 | 149 | 249 | 913 | 53 | 270 | 55 | 402 | 232 | 70 | 65 |
| RTOR Reduction (vph) | 0 | 37 | 0 | 0 | 3 | 0 | 0 | 0 | 354 | 0 | 31 | 0 |
| Lane Group Flow (vph) | 14 | 660 | 0 | 249 | 963 | 0 | 270 | 55 | 48 | 232 | 104 | 0 |
| Confl. Peds. (#/hr) | | | 4 | | | | | | | | | 5 |
| Confl. Bikes (#/hr) | | | | | | | | | | | | 1 |
| Heavy Vehicles (%) | 1% | 1% | 1% | 3% | 1% | 1% | 1% | 1% | 3% | 1% | 1% | 1% |
| Turn Type | Prot | NA | | Prot | NA | | Split | NA | Perm | Split | NA | |
| Protected Phases | 1 | 6 | | 5 | 2 | | 7 | 7 | | 8 | 8 | |
| Permitted Phases | | | | | 2 | | | | 7 | | | |
| Actuated Green, G (s) | 4.0 | 45.8 | | 33.1 | 74.5 | | 11.6 | 11.6 | 11.6 | 24.3 | 24.3 | |
| Effective Green, g (s) | 4.0 | 45.8 | | 33.1 | 74.5 | | 11.6 | 11.6 | 11.6 | 24.3 | 24.3 | |
| Actuated g/C Ratio | 0.03 | 0.35 | | 0.25 | 0.57 | | 0.09 | 0.09 | 0.09 | 0.19 | 0.19 | |
| Clearance Time (s) | 3.0 | 3.6 | | 3.0 | 4.0 | | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 | |
| Vehicle Extension (s) | 2.0 | 4.0 | | 5.0 | 4.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 54 | 1745 | | 446 | 2918 | | 309 | 167 | 139 | 334 | 323 | |
| v/s Ratio Prot | 0.01 | c0.13 | | c0.14 | 0.19 | | c0.08 | 0.03 | | c0.13 | 0.06 | |
| v/s Ratio Perm | | | | | | | | | 0.03 | | | |
| v/c Ratio | 0.26 | 0.38 | | 0.56 | 0.33 | | 0.87 | 0.33 | 0.34 | 0.69 | 0.32 | |
| Uniform Delay, d1 | 61.6 | 31.5 | | 42.1 | 14.6 | | 58.5 | 55.6 | 55.6 | 49.4 | 45.7 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 0.9 | 0.2 | | 5.0 | 0.3 | | 22.2 | 0.4 | 0.5 | 5.0 | 0.2 | |
| Delay (s) | 62.5 | 31.6 | | 47.1 | 14.9 | | 80.7 | 56.0 | 56.2 | 54.4 | 45.9 | |
| Level of Service | E | C | | D | B | | F | E | E | D | D | |
| Approach Delay (s) | | 32.3 | | | 21.5 | | | 65.3 | | | 51.3 | |
| Approach LOS | | C | | | C | | | E | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 38.2 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.55 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 15.6 |
| Intersection Capacity Utilization | 63.8% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 5: US 101 SB Ramps & San Marin Dr



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 526 | 549 | 148 | 935 | 0 | 0 | 0 | 0 | 53 | 2 | 260 |
| Future Volume (vph) | 0 | 526 | 549 | 148 | 935 | 0 | 0 | 0 | 0 | 53 | 2 | 260 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.9 | 4.9 | 3.0 | 5.3 | | | | | | 4.0 | 4.0 |
| Lane Util. Factor | | 0.95 | 1.00 | 1.00 | 0.95 | | | | | | 1.00 | 0.88 |
| Frpb, ped/bikes | | 1.00 | 0.98 | 1.00 | 1.00 | | | | | | 1.00 | 1.00 |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | | | | | 1.00 | 1.00 |
| Frt | | 1.00 | 0.85 | 1.00 | 1.00 | | | | | | 1.00 | 0.85 |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | | 0.95 | 1.00 |
| Satd. Flow (prot) | | 3574 | 1575 | 1805 | 3574 | | | | | | 1813 | 2814 |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | | 0.95 | 1.00 |
| Satd. Flow (perm) | | 3574 | 1575 | 1805 | 3574 | | | | | | 1813 | 2814 |
| Peak-hour factor, PHF | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| Adj. Flow (vph) | 0 | 542 | 566 | 153 | 964 | 0 | 0 | 0 | 0 | 55 | 2 | 268 |
| RTOR Reduction (vph) | 0 | 0 | 234 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 241 |
| Lane Group Flow (vph) | 0 | 542 | 332 | 153 | 964 | 0 | 0 | 0 | 0 | 0 | 57 | 27 |
| Confl. Peds. (#/hr) | | | 4 | | | | | | | | | |
| Heavy Vehicles (%) | 0% | 1% | 1% | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 1% |
| Turn Type | | NA | Perm | Prot | NA | | | | | Split | NA | Perm |
| Protected Phases | | 2 | | 1 | 6 | | | | | 4 | 4 | |
| Permitted Phases | | | 2 | | | | | | | | | 4 |
| Actuated Green, G (s) | | 41.1 | 41.1 | 10.0 | 53.7 | | | | | | 7.0 | 7.0 |
| Effective Green, g (s) | | 41.1 | 41.1 | 10.0 | 53.7 | | | | | | 7.0 | 7.0 |
| Actuated g/C Ratio | | 0.59 | 0.59 | 0.14 | 0.77 | | | | | | 0.10 | 0.10 |
| Clearance Time (s) | | 4.9 | 4.9 | 3.0 | 5.3 | | | | | | 4.0 | 4.0 |
| Vehicle Extension (s) | | 4.0 | 4.0 | 2.0 | 4.0 | | | | | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | | 2098 | 924 | 257 | 2741 | | | | | | 181 | 281 |
| v/s Ratio Prot | | 0.15 | | c0.08 | c0.27 | | | | | | c0.03 | |
| v/s Ratio Perm | | | 0.21 | | | | | | | | | 0.01 |
| v/c Ratio | | 0.26 | 0.36 | 0.60 | 0.35 | | | | | | 0.31 | 0.10 |
| Uniform Delay, d1 | | 7.0 | 7.6 | 28.1 | 2.6 | | | | | | 29.3 | 28.6 |
| Progression Factor | | 1.00 | 1.00 | 1.00 | 1.00 | | | | | | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.3 | 1.1 | 2.5 | 0.4 | | | | | | 0.4 | 0.1 |
| Delay (s) | | 7.3 | 8.7 | 30.6 | 3.0 | | | | | | 29.6 | 28.7 |
| Level of Service | | A | A | C | A | | | | | | C | C |
| Approach Delay (s) | | 8.0 | | | 6.7 | | | 0.0 | | | 28.8 | |
| Approach LOS | | A | | | A | | | A | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 10.1 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.40 | | |
| Actuated Cycle Length (s) | 70.0 | Sum of lost time (s) | 11.9 |
| Intersection Capacity Utilization | 86.8% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 6: US 101 NB Ramps & San Marin Dr



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 270 | 259 | 0 | 0 | 319 | 51 | 863 | 108 | 173 | 0 | 0 | 0 |
| Future Volume (vph) | 270 | 259 | 0 | 0 | 319 | 51 | 863 | 108 | 173 | 0 | 0 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.6 | | | 4.9 | 4.9 | 3.5 | 3.5 | | | | |
| Lane Util. Factor | 0.97 | 1.00 | | | 0.95 | 1.00 | 0.95 | 0.95 | | | | |
| Frpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | 0.99 | 1.00 | 0.99 | | | | |
| Flpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | | | |
| Frt | 1.00 | 1.00 | | | 1.00 | 0.85 | 1.00 | 0.95 | | | | |
| Flt Protected | 0.95 | 1.00 | | | 1.00 | 1.00 | 0.95 | 0.98 | | | | |
| Satd. Flow (prot) | 3467 | 1881 | | | 3574 | 1593 | 1681 | 1638 | | | | |
| Flt Permitted | 0.95 | 1.00 | | | 1.00 | 1.00 | 0.95 | 0.98 | | | | |
| Satd. Flow (perm) | 3467 | 1881 | | | 3574 | 1593 | 1681 | 1638 | | | | |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 281 | 270 | 0 | 0 | 332 | 53 | 899 | 112 | 180 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 43 | 0 | 26 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 281 | 270 | 0 | 0 | 332 | 10 | 602 | 564 | 0 | 0 | 0 | 0 |
| Confl. Peds. (#/hr) | | | 3 | | | 1 | | | 1 | 1 | | |
| Heavy Vehicles (%) | 1% | 1% | 0% | 0% | 1% | 0% | 2% | 0% | 3% | 0% | 0% | 0% |
| Turn Type | Prot | NA | | | NA | Perm | Split | NA | | | | |
| Protected Phases | 5 | 2 | | | 6 | | 8 | 8 | | | | |
| Permitted Phases | | | | | | 6 | | | | | | |
| Actuated Green, G (s) | 9.2 | 24.4 | | | 11.4 | 11.4 | 25.2 | 25.2 | | | | |
| Effective Green, g (s) | 9.2 | 24.4 | | | 11.4 | 11.4 | 25.2 | 25.2 | | | | |
| Actuated g/C Ratio | 0.16 | 0.42 | | | 0.20 | 0.20 | 0.44 | 0.44 | | | | |
| Clearance Time (s) | 3.5 | 4.6 | | | 4.9 | 4.9 | 3.5 | 3.5 | | | | |
| Vehicle Extension (s) | 2.0 | 4.0 | | | 4.0 | 4.0 | 2.5 | 2.5 | | | | |
| Lane Grp Cap (vph) | 552 | 795 | | | 706 | 314 | 734 | 715 | | | | |
| v/s Ratio Prot | c0.08 | 0.14 | | | c0.09 | | c0.36 | 0.34 | | | | |
| v/s Ratio Perm | | | | | | 0.01 | | | | | | |
| v/c Ratio | 0.51 | 0.34 | | | 0.47 | 0.03 | 0.82 | 0.79 | | | | |
| Uniform Delay, d1 | 22.2 | 11.2 | | | 20.5 | 18.7 | 14.3 | 14.0 | | | | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | | | |
| Incremental Delay, d2 | 0.3 | 0.3 | | | 0.7 | 0.1 | 7.2 | 5.6 | | | | |
| Delay (s) | 22.5 | 11.6 | | | 21.2 | 18.8 | 21.4 | 19.5 | | | | |
| Level of Service | C | B | | | C | B | C | B | | | | |
| Approach Delay (s) | | 17.1 | | | 20.8 | | | 20.5 | | | 0.0 | |
| Approach LOS | | B | | | C | | | C | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 19.7 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.67 | | |
| Actuated Cycle Length (s) | 57.7 | Sum of lost time (s) | 11.9 |
| Intersection Capacity Utilization | 86.8% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 7: Redwood Blvd & Olive St

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 117 | 68 | 28 | 123 | 101 | 83 | 68 | 671 | 143 | 88 | 308 | 106 |
| Future Volume (vph) | 117 | 68 | 28 | 123 | 101 | 83 | 68 | 671 | 143 | 88 | 308 | 106 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 5.1 | 5.1 | | | 5.1 | | 4.0 | 3.9 | 3.9 | 4.0 | 3.9 | |
| Lane Util. Factor | 1.00 | 1.00 | | | 1.00 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | |
| Frt | 1.00 | 0.96 | | | 0.96 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.96 | |
| Flt Protected | 0.95 | 1.00 | | | 0.98 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1770 | 1781 | | | 1760 | | 1770 | 3539 | 1583 | 1770 | 3403 | |
| Flt Permitted | 0.95 | 1.00 | | | 0.98 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1770 | 1781 | | | 1760 | | 1770 | 3539 | 1583 | 1770 | 3403 | |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 124 | 72 | 30 | 131 | 107 | 88 | 72 | 714 | 152 | 94 | 328 | 113 |
| RTOR Reduction (vph) | 0 | 15 | 0 | 0 | 12 | 0 | 0 | 0 | 81 | 0 | 31 | 0 |
| Lane Group Flow (vph) | 124 | 87 | 0 | 0 | 314 | 0 | 72 | 714 | 71 | 94 | 410 | 0 |
| Turn Type | Split | NA | | Split | NA | | Prot | NA | Perm | Prot | NA | |
| Protected Phases | 4 | 4 | | 8 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | | | | | | | 2 | | | |
| Actuated Green, G (s) | 12.2 | 12.2 | | | 17.9 | | 7.4 | 20.3 | 20.3 | 7.4 | 20.3 | |
| Effective Green, g (s) | 12.2 | 12.2 | | | 17.9 | | 7.4 | 20.3 | 20.3 | 7.4 | 20.3 | |
| Actuated g/C Ratio | 0.16 | 0.16 | | | 0.24 | | 0.10 | 0.27 | 0.27 | 0.10 | 0.27 | |
| Clearance Time (s) | 5.1 | 5.1 | | | 5.1 | | 4.0 | 3.9 | 3.9 | 4.0 | 3.9 | |
| Vehicle Extension (s) | 1.0 | 1.0 | | | 1.0 | | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | |
| Lane Grp Cap (vph) | 284 | 286 | | | 415 | | 172 | 946 | 423 | 172 | 910 | |
| v/s Ratio Prot | c0.07 | 0.05 | | | c0.18 | | 0.04 | c0.20 | | c0.05 | 0.12 | |
| v/s Ratio Perm | | | | | | | | | 0.04 | | | |
| v/c Ratio | 0.44 | 0.30 | | | 0.76 | | 0.42 | 0.75 | 0.17 | 0.55 | 0.45 | |
| Uniform Delay, d1 | 28.7 | 28.1 | | | 27.0 | | 32.2 | 25.5 | 21.3 | 32.7 | 23.2 | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 0.4 | 0.2 | | | 6.8 | | 0.6 | 3.1 | 0.1 | 1.9 | 0.1 | |
| Delay (s) | 29.1 | 28.3 | | | 33.8 | | 32.8 | 28.6 | 21.4 | 34.5 | 23.3 | |
| Level of Service | C | C | | | C | | C | C | C | C | C | |
| Approach Delay (s) | | 28.8 | | | 33.8 | | | 27.7 | | | 25.3 | |
| Approach LOS | | C | | | C | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 28.2 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.66 | | |
| Actuated Cycle Length (s) | 75.9 | Sum of lost time (s) | 18.1 |
| Intersection Capacity Utilization | 61.6% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 8: Redwood Blvd & Grant Ave

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 72 | 125 | 172 | 27 | 158 | 56 | 251 | 497 | 54 | 39 | 364 | 90 |
| Future Volume (vph) | 72 | 125 | 172 | 27 | 158 | 56 | 251 | 497 | 54 | 39 | 364 | 90 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.5 | 3.5 | | 3.5 | 3.7 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.96 | 1.00 | 1.00 | 0.97 | 1.00 | 0.99 | | 1.00 | 0.99 | |
| Flpb, ped/bikes | 0.99 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | | 1.00 | 0.97 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1755 | 1900 | 1537 | 1803 | 1900 | 1563 | 1805 | 3467 | | 1805 | 3419 | |
| Flt Permitted | 0.63 | 1.00 | 1.00 | 0.67 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1160 | 1900 | 1537 | 1277 | 1900 | 1563 | 1805 | 3467 | | 1805 | 3419 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 76 | 132 | 181 | 28 | 166 | 59 | 264 | 523 | 57 | 41 | 383 | 95 |
| RTOR Reduction (vph) | 0 | 0 | 131 | 0 | 0 | 43 | 0 | 7 | 0 | 0 | 21 | 0 |
| Lane Group Flow (vph) | 76 | 132 | 50 | 28 | 166 | 16 | 264 | 573 | 0 | 41 | 457 | 0 |
| Confl. Peds. (#/hr) | 22 | | 46 | 2 | | 34 | | | 36 | | | 10 |
| Confl. Bikes (#/hr) | | | 5 | | | 5 | | | 5 | | | 5 |
| Heavy Vehicles (%) | 2% | 0% | 1% | 0% | 0% | 0% | 0% | 2% | 0% | 0% | 2% | 0% |
| Turn Type | Perm | NA | Perm | Perm | NA | Perm | Prot | NA | | Prot | NA | |
| Protected Phases | | 8 | | | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | 8 | | 8 | 4 | | 4 | | | | | | |
| Actuated Green, G (s) | 17.2 | 17.2 | 17.2 | 17.2 | 17.2 | 17.2 | 16.0 | 29.1 | | 5.5 | 18.4 | |
| Effective Green, g (s) | 17.2 | 17.2 | 17.2 | 17.2 | 17.2 | 17.2 | 16.0 | 29.1 | | 5.5 | 18.4 | |
| Actuated g/C Ratio | 0.27 | 0.27 | 0.27 | 0.27 | 0.27 | 0.27 | 0.25 | 0.46 | | 0.09 | 0.29 | |
| Clearance Time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.5 | 3.5 | | 3.5 | 3.7 | |
| Vehicle Extension (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 2.5 | 3.0 | | 2.5 | 3.0 | |
| Lane Grp Cap (vph) | 317 | 520 | 420 | 349 | 520 | 428 | 459 | 1606 | | 158 | 1001 | |
| v/s Ratio Prot | | 0.07 | | | c0.09 | | c0.15 | 0.17 | | 0.02 | c0.13 | |
| v/s Ratio Perm | 0.07 | | 0.03 | 0.02 | | 0.01 | | | | | | |
| v/c Ratio | 0.24 | 0.25 | 0.12 | 0.08 | 0.32 | 0.04 | 0.58 | 0.36 | | 0.26 | 0.46 | |
| Uniform Delay, d1 | 17.7 | 17.8 | 17.1 | 16.9 | 18.1 | 16.7 | 20.4 | 10.8 | | 26.7 | 18.1 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 0.5 | 0.4 | 0.2 | 0.1 | 0.5 | 0.0 | 1.4 | 0.1 | | 0.6 | 0.3 | |
| Delay (s) | 18.3 | 18.1 | 17.3 | 17.1 | 18.6 | 16.8 | 21.9 | 11.0 | | 27.4 | 18.5 | |
| Level of Service | B | B | B | B | B | B | C | B | | C | B | |
| Approach Delay (s) | | 17.8 | | | 18.0 | | | 14.4 | | | 19.2 | |
| Approach LOS | | B | | | B | | | B | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 16.7 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.45 | | |
| Actuated Cycle Length (s) | 62.8 | Sum of lost time (s) | 11.2 |
| Intersection Capacity Utilization | 78.5% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

HCM 2010 AWSC
9: San Marin Dr/Sutro Ave & Novato Blvd #1 02/15/2018

| Intersection | |
|---|---|
| Intersection Delay, s/veh | 59.9 |
| Intersection LOS | F |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 77 | 135 | 53 | 73 | 277 | 147 | 66 | 126 | 58 | 137 | 224 | 396 |
| Future Vol, veh/h | 77 | 135 | 53 | 73 | 277 | 147 | 66 | 126 | 58 | 137 | 224 | 396 |
| Peak Hour Factor | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 81 | 142 | 56 | 77 | 292 | 155 | 69 | 133 | 61 | 144 | 236 | 417 |
| Number of Lanes | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Opposing Approach | WB | EB | SB | NB |
| Opposing Lanes | 2 | 2 | 3 | 2 |
| Conflicting Approach Left | SB | NB | EB | WB |
| Conflicting Lanes Left | 3 | 2 | 2 | 2 |
| Conflicting Approach Right | NB | SB | WB | EB |
| Conflicting Lanes Right | 2 | 3 | 2 | 2 |
| HCM Control Delay | 23.8 | 119 | 23.7 | 45.6 |
| HCM LOS | C | F | C | E |

| Lane | NBLn1 | NBLn2 | EBLn1 | EBLn2 | WBLn1 | WBLn2 | SBLn1 | SBLn2 | SBLn3 |
|---|---|---|---|---|---|---|---|---|---|
| Vol Left, % | 100% | 0% | 100% | 0% | 100% | 0% | 100% | 0% | 0% |
| Vol Thru, % | 0% | 68% | 0% | 72% | 0% | 65% | 0% | 100% | 0% |
| Vol Right, % | 0% | 32% | 0% | 28% | 0% | 35% | 0% | 0% | 100% |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 66 | 184 | 77 | 188 | 73 | 424 | 137 | 224 | 396 |
| LT Vol | 66 | 0 | 77 | 0 | 73 | 0 | 137 | 0 | 0 |
| Through Vol | 0 | 126 | 0 | 135 | 0 | 277 | 0 | 224 | 0 |
| RT Vol | 0 | 58 | 0 | 53 | 0 | 147 | 0 | 0 | 396 |
| Lane Flow Rate | 69 | 194 | 81 | 198 | 77 | 446 | 144 | 236 | 417 |
| Geometry Grp | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Degree of Util (X) | 0.211 | 0.549 | 0.245 | 0.559 | 0.22 | 1.185 | 0.382 | 0.591 | 0.964 |
| Departure Headway (Hd) | 11.609 | 10.846 | 11.434 | 10.705 | 10.328 | 9.56 | 10.174 | 9.652 | 8.923 |
| Convergence, Y/N | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Cap | 311 | 335 | 316 | 338 | 349 | 384 | 356 | 377 | 409 |
| Service Time | 9.309 | 8.546 | 9.134 | 8.405 | 8.056 | 7.288 | 7.874 | 7.352 | 6.623 |
| HCM Lane V/C Ratio | 0.222 | 0.579 | 0.256 | 0.586 | 0.221 | 1.161 | 0.404 | 0.626 | 1.02 |
| HCM Control Delay | 17.4 | 26 | 17.8 | 26.2 | 16 | 136.7 | 19 | 25.4 | 66.3 |
| HCM Lane LOS | C | D | C | D | C | F | C | D | F |
| HCM 95th-tile Q | 0.8 | 3.1 | 0.9 | 3.2 | 0.8 | 18 | 1.7 | 3.6 | 11.2 |



HCM Signalized Intersection Capacity Analysis
10: Wilson Ave & Novato Blvd #2 02/15/2018

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 430 | 38 | 411 | 694 | 44 | 277 |
| Future Volume (vph) | 430 | 38 | 411 | 694 | 44 | 277 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.9 | | 3.0 | 3.6 | 3.6 | 3.6 |
| Lane Util. Factor | 0.95 | | 1.00 | 0.95 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | | 1.00 | 1.00 | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 0.99 | | 1.00 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 1.00 | | 0.95 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (prot) | 3527 | | 1787 | 3610 | 1805 | 1593 |
| Flt Permitted | 1.00 | | 0.95 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (perm) | 3527 | | 1787 | 3610 | 1805 | 1593 |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 457 | 40 | 437 | 738 | 47 | 295 |
| RTOR Reduction (vph) | 6 | 0 | 0 | 0 | 0 | 251 |
| Lane Group Flow (vph) | 491 | 0 | 437 | 738 | 47 | 44 |
| Confl. Peds. (#/hr) | | 3 | | | 6 | 2 |
| Heavy Vehicles (%) | 1% | 0% | 1% | 0% | 0% | 0% |
| Turn Type | NA | | Prot | NA | Prot | Perm |
| Protected Phases | 2 | | 1 | 6 | 4 | |
| Permitted Phases | | | | | | 4 |
| Actuated Green, G (s) | 30.9 | | 19.3 | 38.3 | 10.7 | 10.7 |
| Effective Green, g (s) | 30.9 | | 19.3 | 38.3 | 10.7 | 10.7 |
| Actuated g/C Ratio | 0.43 | | 0.27 | 0.54 | 0.15 | 0.15 |
| Clearance Time (s) | 3.9 | | 3.0 | 3.6 | 3.6 | 3.6 |
| Vehicle Extension (s) | 3.0 | | 2.0 | 3.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 1526 | | 483 | 1936 | 270 | 238 |
| v/s Ratio Prot | c0.14 | | c0.24 | c0.20 | 0.03 | |
| v/s Ratio Perm | | | | | | c0.03 |
| v/c Ratio | 0.32 | | 0.90 | 0.38 | 0.17 | 0.19 |
| Uniform Delay, d1 | 13.3 | | 25.2 | 9.6 | 26.5 | 26.5 |
| Progression Factor | 1.00 | | 0.85 | 0.42 | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.6 | | 18.2 | 0.5 | 0.1 | 0.1 |
| Delay (s) | 13.9 | | 39.6 | 4.6 | 26.6 | 26.7 |
| Level of Service | B | | D | A | C | C |
| Approach Delay (s) | 13.9 | | | 17.6 | 26.7 | |
| Approach LOS | B | | | B | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 18.2 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.51 | | |
| Actuated Cycle Length (s) | 71.4 | Sum of lost time (s) | 10.5 |
| Intersection Capacity Utilization | 57.4% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## 11: Novato Blvd #2 & Simmons Ln



| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 122 | 585 | 847 | 81 | 89 | 269 |
| Future Volume (vph) | 122 | 585 | 847 | 81 | 89 | 269 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.9 | 3.6 | | 3.0 | 3.0 |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.99 | | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 3574 | 3556 | | 1805 | 1599 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | 1805 | 3574 | 3556 | | 1805 | 1599 |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 130 | 622 | 901 | 86 | 95 | 286 |
| RTOR Reduction (vph) | 0 | 0 | 6 | 0 | 0 | 241 |
| Lane Group Flow (vph) | 130 | 622 | 981 | 0 | 95 | 45 |
| Confl. Peds. (#/hr) | | | | | 2 | |
| Confl. Bikes (#/hr) | | | | 1 | | |
| Heavy Vehicles (%) | 0% | 1% | 0% | 0% | 0% | 1% |
| Turn Type | Prot | NA | NA | | Prot | Perm |
| Protected Phases | 5 | 2 | 6 | | 8 | |
| Permitted Phases | | | | | | 8 |
| Actuated Green, G (s) | 12.2 | 30.9 | 38.3 | | 11.3 | 11.3 |
| Effective Green, g (s) | 12.2 | 30.9 | 38.3 | | 11.3 | 11.3 |
| Actuated g/C Ratio | 0.17 | 0.43 | 0.54 | | 0.16 | 0.16 |
| Clearance Time (s) | 3.0 | 3.9 | 3.6 | | 3.0 | 3.0 |
| Vehicle Extension (s) | 2.0 | 3.0 | 3.0 | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 308 | 1546 | 1907 | | 285 | 253 |
| v/s Ratio Prot | 0.07 | c0.17 | c0.28 | | c0.05 | |
| v/s Ratio Perm | | | | | | 0.03 |
| v/c Ratio | 0.42 | 0.40 | 0.51 | | 0.33 | 0.18 |
| Uniform Delay, d1 | 26.4 | 13.9 | 10.6 | | 26.7 | 26.0 |
| Progression Factor | 0.73 | 0.57 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 4.0 | 0.7 | 1.0 | | 0.3 | 0.1 |
| Delay (s) | 23.4 | 8.7 | 11.6 | | 27.0 | 26.2 |
| Level of Service | C | A | B | | C | C |
| Approach Delay (s) | | 11.2 | 11.6 | | 26.4 | |
| Approach LOS | | B | B | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 14.1 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.48 | | |
| Actuated Cycle Length (s) | 71.4 | Sum of lost time (s) | 10.5 |
| Intersection Capacity Utilization | 49.3% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |





## 12: Grant Ave & Novato Blvd #2



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 122 | 531 | 1 | 2 | 737 | 51 | 1 | 6 | 4 | 24 | 1 | 248 |
| Future Volume (vph) | 122 | 531 | 1 | 2 | 737 | 51 | 1 | 6 | 4 | 24 | 1 | 248 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.5 | 4.5 | 3.5 | 4.9 | 4.9 | | 4.0 | | 3.5 | 3.5 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 | | 1.00 | | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.96 | | 0.98 | | 1.00 | 0.99 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | | 0.97 | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | | 0.95 | | 1.00 | 0.85 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1787 | 1863 | 1534 | 1805 | 3539 | 1529 | | 1762 | | 1737 | 1595 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 0.53 | | 0.75 | 1.00 | |
| Satd. Flow (perm) | 1787 | 1863 | 1534 | 1805 | 3539 | 1529 | | 940 | | 1372 | 1595 | |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 127 | 553 | 1 | 2 | 768 | 53 | 1 | 6 | 4 | 25 | 1 | 258 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 17 | 0 | 4 | 0 | 0 | 232 | 0 |
| Lane Group Flow (vph) | 127 | 553 | 1 | 2 | 768 | 36 | 0 | 7 | 0 | 25 | 27 | 0 |
| Confl. Peds. (#/hr) | | | 11 | | | 8 | 1 | | 14 | 14 | | 1 |
| Confl. Bikes (#/hr) | | | 1 | | | 4 | | | 2 | | | |
| Heavy Vehicles (%) | 1% | 2% | 0% | 0% | 2% | 1% | 0% | 0% | 0% | 1% | 0% | 0% |
| Turn Type | Prot | NA | Perm | Prot | NA | Perm | Perm | NA | | Perm | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | 2 | | | 6 | 8 | | | 4 | | |
| Actuated Green, G (s) | 12.5 | 86.2 | 86.2 | 1.2 | 74.5 | 74.5 | | 10.6 | | 11.1 | 11.1 | |
| Effective Green, g (s) | 12.5 | 86.2 | 86.2 | 1.2 | 74.5 | 74.5 | | 10.6 | | 11.1 | 11.1 | |
| Actuated g/C Ratio | 0.11 | 0.78 | 0.78 | 0.01 | 0.68 | 0.68 | | 0.10 | | 0.10 | 0.10 | |
| Clearance Time (s) | 3.5 | 4.5 | 4.5 | 3.5 | 4.9 | 4.9 | | 4.0 | | 3.5 | 3.5 | |
| Vehicle Extension (s) | 2.0 | 3.0 | 3.0 | 2.0 | 3.0 | 3.0 | | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 203 | 1459 | 1202 | 19 | 2396 | 1035 | | 90 | | 138 | 160 | |
| v/s Ratio Prot | c0.07 | c0.30 | | 0.00 | 0.22 | | | | | | 0.02 | |
| v/s Ratio Perm | | | 0.00 | | | 0.02 | | 0.01 | | c0.02 | | |
| v/c Ratio | 0.63 | 0.38 | 0.00 | 0.11 | 0.32 | 0.03 | | 0.08 | | 0.18 | 0.17 | |
| Uniform Delay, d1 | 46.5 | 3.7 | 2.6 | 53.9 | 7.3 | 5.9 | | 45.3 | | 45.3 | 45.2 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.38 | 0.20 | 0.14 | | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 4.3 | 0.8 | 0.0 | 0.7 | 0.3 | 0.1 | | 0.1 | | 0.2 | 0.2 | |
| Delay (s) | 50.8 | 4.4 | 2.6 | 75.1 | 1.7 | 0.9 | | 45.4 | | 45.5 | 45.4 | |
| Level of Service | D | A | A | E | A | A | | D | | D | D | |
| Approach Delay (s) | | 13.1 | | | 1.9 | | | 45.4 | | | 45.4 | |
| Approach LOS | | B | | | A | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 13.2 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.40 | | |
| Actuated Cycle Length (s) | 110.0 | Sum of lost time (s) | 12.4 |
| Intersection Capacity Utilization | 59.1% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 13: Tamalpais Ave/7th St & Novato Blvd #2

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 124 | 462 | 39 | 59 | 663 | 205 | 42 | 118 | 39 | 176 | 107 | 106 |
| Future Volume (vph) | 124 | 462 | 39 | 59 | 663 | 205 | 42 | 118 | 39 | 176 | 107 | 106 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 5.0 | | 3.5 | 5.0 | 5.0 | 3.5 | 3.5 | | 3.5 | 3.5 | 3.5 |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 0.96 | 1.00 | 0.99 | | 1.00 | 1.00 | 0.97 |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 0.99 | 1.00 | | 0.99 | 1.00 | 1.00 |
| Frt | 1.00 | 0.99 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.96 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1787 | 1835 | | 1787 | 1863 | 1542 | 1768 | 1790 | | 1764 | 1881 | 1547 |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.62 | 1.00 | | 0.51 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1787 | 1835 | | 1787 | 1863 | 1542 | 1155 | 1790 | | 941 | 1881 | 1547 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 129 | 481 | 41 | 61 | 691 | 214 | 44 | 123 | 41 | 183 | 111 | 110 |
| RTOR Reduction (vph) | 0 | 2 | 0 | 0 | 0 | 32 | 0 | 12 | 0 | 0 | 0 | 87 |
| Lane Group Flow (vph) | 129 | 520 | 0 | 61 | 691 | 182 | 44 | 152 | 0 | 183 | 111 | 23 |
| Confl. Peds. (#/hr) | | | 10 | | | 6 | 5 | | 7 | 7 | | 5 |
| Confl. Bikes (#/hr) | | | 3 | | | 2 | | | 5 | | | |
| Heavy Vehicles (%) | 1% | 2% | 1% | 1% | 2% | 1% | 1% | 1% | 1% | 1% | 1% | 1% |
| Turn Type | Prot | NA | | Prot | NA | Perm | Perm | NA | | Perm | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | | | | 6 | 8 | | | 4 | | 4 |
| Actuated Green, G (s) | 12.3 | 67.5 | | 7.3 | 62.5 | 62.5 | 23.2 | 23.2 | | 23.2 | 23.2 | 23.2 |
| Effective Green, g (s) | 12.3 | 67.5 | | 7.3 | 62.5 | 62.5 | 23.2 | 23.2 | | 23.2 | 23.2 | 23.2 |
| Actuated g/C Ratio | 0.11 | 0.61 | | 0.07 | 0.57 | 0.57 | 0.21 | 0.21 | | 0.21 | 0.21 | 0.21 |
| Clearance Time (s) | 3.5 | 5.0 | | 3.5 | 5.0 | 5.0 | 3.5 | 3.5 | | 3.5 | 3.5 | 3.5 |
| Vehicle Extension (s) | 2.0 | 5.0 | | 2.0 | 5.0 | 5.0 | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 199 | 1126 | | 118 | 1058 | 876 | 243 | 377 | | 198 | 396 | 326 |
| v/s Ratio Prot | c0.07 | 0.28 | | 0.03 | c0.37 | | | 0.09 | | | 0.06 | |
| v/s Ratio Perm | | | | | | 0.12 | 0.04 | | | c0.19 | | 0.02 |
| v/c Ratio | 0.65 | 0.46 | | 0.52 | 0.65 | 0.21 | 0.18 | 0.40 | | 0.92 | 0.28 | 0.07 |
| Uniform Delay, d1 | 46.8 | 11.5 | | 49.6 | 16.3 | 11.6 | 35.6 | 37.4 | | 42.5 | 36.4 | 34.8 |
| Progression Factor | 0.91 | 1.18 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 5.2 | 1.3 | | 1.6 | 3.1 | 0.5 | 0.1 | 0.3 | | 42.3 | 0.1 | 0.0 |
| Delay (s) | 47.6 | 14.8 | | 51.2 | 19.4 | 12.2 | 35.7 | 37.7 | | 84.9 | 36.5 | 34.8 |
| Level of Service | D | B | | D | B | B | D | D | | F | D | C |
| Approach Delay (s) | | 21.3 | | | 19.8 | | | 37.3 | | | 58.0 | |
| Approach LOS | | C | | | B | | | D | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 28.8 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.72 | | |
| Actuated Cycle Length (s) | 110.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 77.7% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 14: Diablo Ave & Novato Blvd #2

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 23 | 236 | 22 | 255 | 307 | 531 | 49 | 394 | 209 | 375 | 302 | 11 |
| Future Volume (vph) | 23 | 236 | 22 | 255 | 307 | 531 | 49 | 394 | 209 | 375 | 302 | 11 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 12 | 12 | 11 | 11 | 12 | 11 | 11 | 12 | 12 | 12 | 12 |
| Total Lost time (s) | | 3.7 | | 4.1 | 4.1 | 4.1 | 4.4 | 4.4 | 4.4 | 4.1 | 4.1 | |
| Lane Util. Factor | | 0.95 | | 0.91 | 0.91 | 1.00 | 1.00 | 1.00 | 1.00 | 0.91 | 0.91 | |
| Frpb, ped/bikes | | 1.00 | | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | | 0.99 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | |
| Flt Protected | | 1.00 | | 0.95 | 0.99 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.98 | |
| Satd. Flow (prot) | | 3512 | | 1557 | 3273 | 1504 | 1728 | 1801 | 1560 | 1610 | 3323 | |
| Flt Permitted | | 1.00 | | 0.95 | 0.99 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.98 | |
| Satd. Flow (perm) | | 3512 | | 1557 | 3273 | 1504 | 1728 | 1801 | 1560 | 1610 | 3323 | |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 24 | 251 | 23 | 271 | 327 | 565 | 52 | 419 | 222 | 399 | 321 | 12 |
| RTOR Reduction (vph) | 0 | 5 | 0 | 0 | 0 | 257 | 0 | 0 | 151 | 0 | 2 | 0 |
| Lane Group Flow (vph) | 0 | 293 | 0 | 195 | 403 | 308 | 52 | 419 | 71 | 239 | 491 | 0 |
| Confl. Peds. (#/hr) | | | 10 | | | 15 | | | 2 | | | 3 |
| Confl. Bikes (#/hr) | | | 1 | | | 1 | | | | | | 6 |
| Heavy Vehicles (%) | 1% | 1% | 1% | 2% | 1% | 2% | 1% | 2% | 2% | 2% | 2% | 1% |
| Turn Type | Split | NA | | Split | NA | Perm | Split | NA | Perm | Split | NA | |
| Protected Phases | 3 | 3 | | 4 | 4 | | 1 | 1 | | 2 | 2 | |
| Permitted Phases | | | | | | 4 | | | 1 | | 2 | |
| Actuated Green, G (s) | | 15.2 | | 26.6 | 26.6 | 26.6 | 30.3 | 30.3 | 30.3 | 21.0 | 21.0 | |
| Effective Green, g (s) | | 15.2 | | 26.6 | 26.6 | 26.6 | 30.3 | 30.3 | 30.3 | 21.0 | 21.0 | |
| Actuated g/C Ratio | | 0.14 | | 0.24 | 0.24 | 0.24 | 0.28 | 0.28 | 0.28 | 0.19 | 0.19 | |
| Clearance Time (s) | | 3.7 | | 4.1 | 4.1 | 4.1 | 4.4 | 4.4 | 4.4 | 4.1 | 4.1 | |
| Vehicle Extension (s) | | 2.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | | 487 | | 378 | 795 | 365 | 478 | 498 | 432 | 309 | 637 | |
| v/s Ratio Prot | | c0.08 | | 0.13 | 0.12 | | 0.03 | c0.23 | | c0.15 | 0.15 | |
| v/s Ratio Perm | | | | | | c0.21 | | | 0.05 | | | |
| v/c Ratio | | 0.60 | | 0.52 | 0.51 | 0.85 | 0.11 | 0.84 | 0.16 | 0.77 | 0.77 | |
| Uniform Delay, d1 | | 44.3 | | 35.8 | 35.7 | 39.4 | 29.5 | 37.3 | 30.0 | 41.9 | 41.9 | |
| Progression Factor | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 1.4 | | 0.5 | 0.2 | 15.6 | 0.0 | 11.7 | 0.1 | 10.5 | 5.3 | |
| Delay (s) | | 45.7 | | 36.3 | 35.9 | 55.1 | 29.5 | 49.0 | 30.0 | 52.4 | 47.2 | |
| Level of Service | | D | | D | D | E | C | D | C | D | D | |
| Approach Delay (s) | | 45.7 | | | 45.3 | | | 41.5 | | | 48.9 | |
| Approach LOS | | D | | | D | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 45.3 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.79 | | |
| Actuated Cycle Length (s) | 109.4 | Sum of lost time (s) | 16.3 |
| Intersection Capacity Utilization | 77.7% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 15: Redwood Blvd & Diablo Ave/De Long Ave

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 229 | 533 | 87 | 104 | 904 | 242 | 114 | 233 | 77 | 186 | 138 | 163 |
| Future Volume (vph) | 229 | 533 | 87 | 104 | 904 | 242 | 114 | 233 | 77 | 186 | 138 | 163 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 9 |
| Total Lost time (s) | 4.0 | 3.7 | | 4.0 | 4.1 | | 3.5 | 4.8 | 4.8 | 3.5 | 3.5 | 3.5 |
| Lane Util. Factor | 0.97 | 0.95 | | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 | 0.97 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.97 |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.98 | | 1.00 | 0.97 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3467 | 3534 | | 1805 | 3396 | | 1805 | 3610 | 1508 | 3303 | 1900 | 1393 |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3467 | 3534 | | 1805 | 3396 | | 1805 | 3610 | 1508 | 3303 | 1900 | 1393 |
| Peak-hour factor, PHF | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Adj. Flow (vph) | 234 | 544 | 89 | 106 | 922 | 247 | 116 | 238 | 79 | 190 | 141 | 166 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 34 | 0 | 0 | 51 |
| Lane Group Flow (vph) | 234 | 633 | 0 | 106 | 1169 | 0 | 116 | 238 | 45 | 190 | 141 | 115 |
| Confl. Peds. (#/hr) | | | | | | 2 | | | 7 | | | 14 |
| Confl. Bikes (#/hr) | | | | | | | | | | | | 3 |
| Heavy Vehicles (%) | 1% | 0% | 0% | 0% | 2% | 5% | 0% | 0% | 5% | 6% | 0% | 1% |
| Turn Type | Prot | NA | | Prot | NA | | Prot | NA | Perm | Prot | NA | Perm |
| Protected Phases | 3 | 8 | | 7 | 4 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | | | | | | | 2 | | | 6 |
| Actuated Green, G (s) | 17.0 | 65.7 | | 17.0 | 65.3 | | 14.0 | 19.1 | 19.1 | 12.2 | 18.6 | 18.6 |
| Effective Green, g (s) | 17.0 | 65.7 | | 17.0 | 65.3 | | 14.0 | 19.1 | 19.1 | 12.2 | 18.6 | 18.6 |
| Actuated g/C Ratio | 0.13 | 0.51 | | 0.13 | 0.50 | | 0.11 | 0.15 | 0.15 | 0.09 | 0.14 | 0.14 |
| Clearance Time (s) | 4.0 | 3.7 | | 4.0 | 4.1 | | 3.5 | 4.8 | 4.8 | 3.5 | 3.5 | 3.5 |
| Vehicle Extension (s) | 2.5 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 453 | 1786 | | 236 | 1705 | | 194 | 530 | 221 | 309 | 271 | 199 |
| v/s Ratio Prot | c0.07 | 0.18 | | 0.06 | c0.34 | | c0.06 | 0.07 | | 0.06 | 0.07 | |
| v/s Ratio Perm | | | | | | | | | 0.03 | | | c0.08 |
| v/c Ratio | 0.52 | 0.35 | | 0.45 | 0.69 | | 0.60 | 0.45 | 0.20 | 0.61 | 0.52 | 0.58 |
| Uniform Delay, d1 | 52.7 | 19.4 | | 52.2 | 24.6 | | 55.3 | 50.6 | 48.8 | 56.6 | 51.6 | 52.0 |
| Progression Factor | 1.00 | 1.00 | | 1.42 | 0.40 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.7 | 0.6 | | 0.4 | 1.7 | | 3.3 | 0.2 | 0.2 | 2.5 | 0.8 | 2.5 |
| Delay (s) | 53.4 | 19.9 | | 74.3 | 11.4 | | 58.6 | 50.9 | 48.9 | 59.2 | 52.4 | 54.5 |
| Level of Service | D | B | | E | B | | E | D | D | E | D | D |
| Approach Delay (s) | | 29.0 | | | 16.6 | | | 52.6 | | | 55.7 | |
| Approach LOS | | C | | | B | | | D | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 31.5 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.63 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 16.4 |
| Intersection Capacity Utilization | 91.6% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 16: Reichert Ave & De Long Ave

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 82 | 682 | 14 | 71 | 1132 | 322 | 7 | 30 | 29 | 238 | 18 | 79 |
| Future Volume (vph) | 82 | 682 | 14 | 71 | 1132 | 322 | 7 | 30 | 29 | 238 | 18 | 79 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 0.95 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 0.99 | | 1.00 | 1.00 | 0.98 | 1.00 | 0.98 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 0.99 | 1.00 | 1.00 | 0.99 | 1.00 | |
| Frt | 1.00 | 1.00 | | 1.00 | 0.97 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.88 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1805 | 3527 | | 1805 | 3416 | | 1794 | 1900 | 1577 | 1763 | 1635 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.62 | 1.00 | 1.00 | 0.74 | 1.00 | |
| Satd. Flow (perm) | 1805 | 3527 | | 1805 | 3416 | | 1178 | 1900 | 1577 | 1366 | 1635 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 86 | 718 | 15 | 75 | 1192 | 339 | 7 | 32 | 31 | 251 | 19 | 83 |
| RTOR Reduction (vph) | 0 | 1 | 0 | 0 | 14 | 0 | 0 | 0 | 15 | 0 | 28 | 0 |
| Lane Group Flow (vph) | 86 | 732 | 0 | 75 | 1517 | 0 | 7 | 32 | 16 | 251 | 74 | 0 |
| Confl. Peds. (#/hr) | | | 5 | | | 11 | 5 | | 5 | 11 | | 5 |
| Confl. Bikes (#/hr) | | | 5 | | | 5 | | | 5 | | | 5 |
| Heavy Vehicles (%) | 0% | 2% | 0% | 0% | 1% | 1% | 0% | 0% | 0% | 1% | 0% | 0% |
| Turn Type | Prot | NA | | Prot | NA | | Perm | NA | Perm | Perm | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | | | | | 8 | | 8 | 4 | | |
| Actuated Green, G (s) | 10.8 | 83.5 | | 8.5 | 81.2 | | 27.4 | 27.4 | 27.4 | 27.4 | 27.4 | |
| Effective Green, g (s) | 10.8 | 83.5 | | 8.5 | 81.2 | | 27.4 | 27.4 | 27.4 | 27.4 | 27.4 | |
| Actuated g/C Ratio | 0.08 | 0.64 | | 0.07 | 0.62 | | 0.21 | 0.21 | 0.21 | 0.21 | 0.21 | |
| Clearance Time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | |
| Vehicle Extension (s) | 2.0 | 3.0 | | 2.0 | 3.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 149 | 2265 | | 118 | 2133 | | 248 | 400 | 332 | 287 | 344 | |
| v/s Ratio Prot | 0.05 | 0.21 | | c0.04 | c0.44 | | | 0.02 | | | 0.05 | |
| v/s Ratio Perm | | | | | | | 0.01 | | 0.01 | c0.18 | | |
| v/c Ratio | 0.58 | 0.32 | | 0.64 | 0.71 | | 0.03 | 0.08 | 0.05 | 0.87 | 0.21 | |
| Uniform Delay, d1 | 57.4 | 10.5 | | 59.2 | 16.5 | | 40.7 | 41.2 | 40.9 | 49.6 | 42.4 | |
| Progression Factor | 0.80 | 1.13 | | 0.88 | 1.02 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 3.2 | 0.4 | | 6.6 | 1.7 | | 0.0 | 0.0 | 0.0 | 23.6 | 0.1 | |
| Delay (s) | 49.0 | 12.2 | | 58.5 | 18.6 | | 40.7 | 41.2 | 40.9 | 73.3 | 42.5 | |
| Level of Service | D | B | | E | B | | D | D | D | E | D | |
| Approach Delay (s) | | 16.0 | | | 20.4 | | | 41.0 | | | 64.4 | |
| Approach LOS | | B | | | C | | | D | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 25.1 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.73 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 79.7% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 17: US 101 SB Ramps & De Long Ave

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 197 | 793 | 27 | 1483 | 0 | 0 | 0 | 0 | 9 | 7 | 166 |
| Future Volume (vph) | 0 | 197 | 793 | 27 | 1483 | 0 | 0 | 0 | 0 | 9 | 7 | 166 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.6 | 3.6 | 3.0 | 3.6 | | | | | 4.0 | 4.0 | |
| Lane Util. Factor | | 0.95 | 1.00 | 1.00 | 0.95 | | | | | 0.95 | 0.95 | |
| Frt | | 1.00 | 0.85 | 1.00 | 1.00 | | | | | 1.00 | 0.86 | |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 3574 | 1599 | 1770 | 3539 | | | | | 1681 | 1516 | |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | 0.95 | 1.00 | |
| Satd. Flow (perm) | | 3574 | 1599 | 1770 | 3539 | | | | | 1681 | 1516 | |
| Peak-hour factor, PHF | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Adj. Flow (vph) | 0 | 201 | 809 | 28 | 1513 | 0 | 0 | 0 | 0 | 9 | 7 | 169 |
| RTOR Reduction (vph) | 0 | 0 | 273 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 51 | 0 |
| Lane Group Flow (vph) | 0 | 201 | 536 | 28 | 1513 | 0 | 0 | 0 | 0 | 8 | 126 | 0 |
| Heavy Vehicles (%) | 0% | 1% | 1% | 2% | 2% | 2% | 2% | 2% | 2% | 2% | 2% | 2% |
| Turn Type | | NA | Perm | Prot | NA | | | | | Split | NA | |
| Protected Phases | | 6 | | 5 | 2 | | | | | 4 | 4 | |
| Permitted Phases | | | 6 | | | | | | | | | |
| Actuated Green, G (s) | | 43.1 | 43.1 | 1.7 | 47.8 | | | | | 9.6 | 9.6 | |
| Effective Green, g (s) | | 43.1 | 43.1 | 1.7 | 47.8 | | | | | 9.6 | 9.6 | |
| Actuated g/C Ratio | | 0.66 | 0.66 | 0.03 | 0.74 | | | | | 0.15 | 0.15 | |
| Clearance Time (s) | | 3.6 | 3.6 | 3.0 | 3.6 | | | | | 4.0 | 4.0 | |
| Vehicle Extension (s) | | 4.0 | 4.0 | 2.0 | 4.0 | | | | | 2.5 | 2.5 | |
| Lane Grp Cap (vph) | | 2369 | 1060 | 46 | 2602 | | | | | 248 | 223 | |
| v/s Ratio Prot | | 0.06 | | 0.02 | c0.43 | | | | | 0.00 | c0.08 | |
| v/s Ratio Perm | | | 0.34 | | | | | | | | | |
| v/c Ratio | | 0.08 | 0.51 | 0.61 | 0.58 | | | | | 0.03 | 0.56 | |
| Uniform Delay, d1 | | 3.9 | 5.6 | 31.3 | 4.0 | | | | | 23.7 | 25.8 | |
| Progression Factor | | 1.05 | 9.73 | 0.77 | 0.43 | | | | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 0.1 | 1.6 | 7.4 | 0.5 | | | | | 0.0 | 2.6 | |
| Delay (s) | | 4.2 | 55.6 | 31.5 | 2.2 | | | | | 23.8 | 28.4 | |
| Level of Service | | A | E | C | A | | | | | C | C | |
| Approach Delay (s) | | 45.4 | | | 2.7 | | | 0.0 | | | 28.2 | |
| Approach LOS | | D | | | A | | | A | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 20.2 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.61 | | |
| Actuated Cycle Length (s) | 65.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 107.9% | ICU Level of Service | G |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 18: US 101 NB Ramps & De Long Ave

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 167 | 41 | 0 | 0 | 60 | 28 | 1436 | 24 | 30 | 0 | 0 | 0 |
| Future Volume (vph) | 167 | 41 | 0 | 0 | 60 | 28 | 1436 | 24 | 30 | 0 | 0 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 3.6 | | | 3.6 | | 4.5 | 4.5 | | | | |
| Lane Util. Factor | 1.00 | 0.95 | | | 0.95 | | 0.95 | 0.95 | | | | |
| Frpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | | | | |
| Flpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | | | | |
| Frt | 1.00 | 1.00 | | | 0.95 | | 1.00 | 0.99 | | | | |
| Flt Protected | 0.95 | 1.00 | | | 1.00 | | 0.95 | 0.96 | | | | |
| Satd. Flow (prot) | 1770 | 3610 | | | 3351 | | 1698 | 1695 | | | | |
| Flt Permitted | 0.95 | 1.00 | | | 1.00 | | 0.95 | 0.96 | | | | |
| Satd. Flow (perm) | 1770 | 3610 | | | 3351 | | 1698 | 1695 | | | | |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 174 | 43 | 0 | 0 | 62 | 29 | 1496 | 25 | 31 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 26 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 174 | 43 | 0 | 0 | 66 | 0 | 778 | 772 | 0 | 0 | 0 | 0 |
| Confl. Peds. (#/hr) | | | | | | 1 | | | | | | |
| Heavy Vehicles (%) | 2% | 0% | 0% | 0% | 0% | 7% | 1% | 0% | 6% | 0% | 0% | 0% |
| Turn Type | Prot | NA | | | NA | | Split | NA | | | | |
| Protected Phases | 1 | 6 | | | 2 | | 4 | 4 | | | | |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | 14.4 | 24.3 | | | 6.4 | | 32.6 | 32.6 | | | | |
| Effective Green, g (s) | 14.4 | 24.3 | | | 6.4 | | 32.6 | 32.6 | | | | |
| Actuated g/C Ratio | 0.22 | 0.37 | | | 0.10 | | 0.50 | 0.50 | | | | |
| Clearance Time (s) | 3.5 | 3.6 | | | 3.6 | | 4.5 | 4.5 | | | | |
| Vehicle Extension (s) | 2.5 | 2.0 | | | 2.0 | | 3.0 | 3.0 | | | | |
| Lane Grp Cap (vph) | 392 | 1349 | | | 329 | | 851 | 850 | | | | |
| v/s Ratio Prot | c0.10 | 0.01 | | | c0.02 | | c0.46 | 0.46 | | | | |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | 0.44 | 0.03 | | | 0.20 | | 0.91 | 0.91 | | | | |
| Uniform Delay, d1 | 21.8 | 12.9 | | | 26.9 | | 14.9 | 14.8 | | | | |
| Progression Factor | 1.16 | 1.11 | | | 1.00 | | 1.00 | 1.00 | | | | |
| Incremental Delay, d2 | 0.6 | 0.0 | | | 0.1 | | 16.0 | 15.3 | | | | |
| Delay (s) | 25.8 | 14.3 | | | 27.1 | | 30.9 | 30.1 | | | | |
| Level of Service | C | B | | | C | | C | C | | | | |
| Approach Delay (s) | | 23.5 | | | 27.1 | | | 30.5 | | | 0.0 | |
| Approach LOS | | C | | | C | | | C | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 29.5 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.70 | | |
| Actuated Cycle Length (s) | 65.0 | Sum of lost time (s) | 11.6 |
| Intersection Capacity Utilization | 107.9% | ICU Level of Service | G |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 19: Redwood Blvd & Lamont Ave

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 31 | 4 | 23 | 46 | 3 | 50 | 21 | 399 | 60 | 70 | 316 | 15 |
| Future Volume (vph) | 31 | 4 | 23 | 46 | 3 | 50 | 21 | 399 | 60 | 70 | 316 | 15 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.5 | 3.5 | | 3.5 | 3.5 | 3.5 | 4.8 | | 3.5 | 4.8 | 4.8 |
| Lane Util. Factor | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 |
| Frpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | 0.99 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Flpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | | 1.00 | 0.85 | | 1.00 | 0.85 | 1.00 | 0.98 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | | 0.96 | 1.00 | | 0.95 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | | 1820 | 1615 | | 1814 | 1595 | 1805 | 3529 | | 1805 | 3610 | 1615 |
| Flt Permitted | | 0.76 | 1.00 | | 0.73 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | | 1445 | 1615 | | 1393 | 1595 | 1805 | 3529 | | 1805 | 3610 | 1615 |
| Peak-hour factor, PHF | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 |
| Adj. Flow (vph) | 36 | 5 | 26 | 53 | 3 | 57 | 24 | 459 | 69 | 80 | 363 | 17 |
| RTOR Reduction (vph) | 0 | 0 | 21 | 0 | 0 | 47 | 0 | 10 | 0 | 0 | 0 | 7 |
| Lane Group Flow (vph) | 0 | 41 | 5 | 0 | 56 | 10 | 24 | 518 | 0 | 80 | 363 | 10 |
| Confl. Peds. (#/hr) | 1 | | | | | 1 | | | 2 | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Perm | NA | Perm | Perm | NA | Perm | Prot | NA | | Prot | NA | Perm |
| Protected Phases | | 8 | | | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | 8 | | 8 | 4 | | 4 | | | | | | 2 |
| Actuated Green, G (s) | | 8.6 | 8.6 | | 8.6 | 8.6 | 0.9 | 23.8 | | 5.1 | 28.0 | 28.0 |
| Effective Green, g (s) | | 8.6 | 8.6 | | 8.6 | 8.6 | 0.9 | 23.8 | | 5.1 | 28.0 | 28.0 |
| Actuated g/C Ratio | | 0.17 | 0.17 | | 0.17 | 0.17 | 0.02 | 0.48 | | 0.10 | 0.57 | 0.57 |
| Clearance Time (s) | | 3.5 | 3.5 | | 3.5 | 3.5 | 3.5 | 4.8 | | 3.5 | 4.8 | 4.8 |
| Vehicle Extension (s) | | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 | 3.0 | | 2.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | 252 | 281 | | 242 | 278 | 32 | 1703 | | 186 | 2050 | 917 |
| v/s Ratio Prot | | | | | | | 0.01 | c0.15 | | c0.04 | 0.10 | |
| v/s Ratio Perm | | 0.03 | 0.00 | | c0.04 | 0.01 | | | | | | 0.01 |
| v/c Ratio | | 0.16 | 0.02 | | 0.23 | 0.04 | 0.75 | 0.30 | | 0.43 | 0.18 | 0.01 |
| Uniform Delay, d1 | | 17.3 | 16.8 | | 17.5 | 16.9 | 24.1 | 7.7 | | 20.7 | 5.1 | 4.6 |
| Progression Factor | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.1 | 0.0 | | 0.2 | 0.0 | 59.6 | 0.1 | | 0.6 | 0.0 | 0.0 |
| Delay (s) | | 17.4 | 16.9 | | 17.7 | 16.9 | 83.7 | 7.8 | | 21.3 | 5.2 | 4.6 |
| Level of Service | | B | B | | B | B | F | A | | C | A | A |
| Approach Delay (s) | | 17.2 | | | 17.3 | | | 11.1 | | | 7.9 | |
| Approach LOS | | B | | | B | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 10.8 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.30 | | |
| Actuated Cycle Length (s) | 49.3 | Sum of lost time (s) | 11.8 |
| Intersection Capacity Utilization | 43.4% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 20: Redwood Blvd & Landing Ct

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 0 | 3 | 13 | 0 | 11 | 1 | 482 | 17 | 9 | 443 | 1 |
| Future Volume (vph) | 0 | 0 | 3 | 13 | 0 | 11 | 1 | 482 | 17 | 9 | 443 | 1 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.5 | | 3.5 | | 3.5 | | 4.8 | 4.8 | 3.5 | 4.8 | 4.8 |
| Lane Util. Factor | | 1.00 | | 1.00 | | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |
| Frpb, ped/bikes | | 0.99 | | 1.00 | | 1.00 | | 1.00 | 0.98 | 1.00 | 1.00 | 0.97 |
| Flpb, ped/bikes | | 1.00 | | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.86 | | 1.00 | | 0.85 | | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | | 1.00 | | 0.95 | | 1.00 | | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | | 1622 | | 1803 | | 1615 | | 3610 | 1579 | 1805 | 3610 | 1572 |
| Flt Permitted | | 1.00 | | 1.00 | | 1.00 | | 0.95 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | | 1622 | | 1898 | | 1615 | | 3446 | 1579 | 1805 | 3610 | 1572 |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Adj. Flow (vph) | 0 | 0 | 3 | 14 | 0 | 12 | 1 | 536 | 19 | 10 | 492 | 1 |
| RTOR Reduction (vph) | 0 | 3 | 0 | 0 | 0 | 11 | 0 | 0 | 7 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 14 | 0 | 1 | 0 | 537 | 12 | 10 | 492 | 1 |
| Confl. Peds. (#/hr) | | | 4 | 4 | | | | | 3 | | | 6 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | | NA | | Perm | | Perm | Perm | NA | Perm | Prot | NA | Perm |
| Protected Phases | | 4 | | | | | | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | 2 | | | 6 |
| Actuated Green, G (s) | | 3.8 | | 3.8 | | 3.8 | | 28.6 | 28.6 | 0.7 | 32.8 | 32.8 |
| Effective Green, g (s) | | 3.8 | | 3.8 | | 3.8 | | 28.6 | 28.6 | 0.7 | 32.8 | 32.8 |
| Actuated g/C Ratio | | 0.08 | | 0.08 | | 0.08 | | 0.64 | 0.64 | 0.02 | 0.73 | 0.73 |
| Clearance Time (s) | | 3.5 | | 3.5 | | 3.5 | | 4.8 | 4.8 | 3.5 | 4.8 | 4.8 |
| Vehicle Extension (s) | | 3.0 | | 2.0 | | 2.0 | | 4.0 | 4.0 | 2.0 | 4.0 | 4.0 |
| Lane Grp Cap (vph) | | 137 | | 160 | | 136 | | 2195 | 1005 | 28 | 2637 | 1148 |
| v/s Ratio Prot | | 0.00 | | | | | | | | 0.01 | c0.14 | |
| v/s Ratio Perm | | | | c0.01 | | 0.00 | | c0.16 | 0.01 | | | 0.00 |
| v/c Ratio | | 0.00 | | 0.09 | | 0.01 | | 0.24 | 0.01 | 0.36 | 0.19 | 0.00 |
| Uniform Delay, d1 | | 18.8 | | 19.0 | | 18.8 | | 3.5 | 3.0 | 21.9 | 1.9 | 1.6 |
| Progression Factor | | 1.00 | | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.0 | | 0.1 | | 0.0 | | 0.1 | 0.0 | 2.8 | 0.0 | 0.0 |
| Delay (s) | | 18.8 | | 19.0 | | 18.8 | | 3.6 | 3.0 | 24.7 | 1.9 | 1.6 |
| Level of Service | | B | | B | | B | | A | A | C | A | A |
| Approach Delay (s) | | 18.8 | | | 18.9 | | | 3.6 | | | 2.4 | |
| Approach LOS | | B | | | B | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 3.4 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.23 | | |
| Actuated Cycle Length (s) | 44.9 | Sum of lost time (s) | 11.8 |
| Intersection Capacity Utilization | 39.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 21: Novato Blvd #3 & Center Rd/Garden Ct

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 148 | 1 | 183 | 4 | 2 | 2 | 176 | 499 | 5 | 2 | 495 | 97 |
| Future Volume (vph) | 148 | 1 | 183 | 4 | 2 | 2 | 176 | 499 | 5 | 2 | 495 | 97 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.2 | 3.2 | | | 3.0 | | 3.0 | 4.4 | | 3.0 | 4.4 | |
| Lane Util. Factor | 1.00 | 1.00 | | | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | | 1.00 | 0.99 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.85 | | | 0.97 | | 1.00 | 1.00 | | 1.00 | 0.98 | |
| Flt Protected | 0.95 | 1.00 | | | 0.98 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1805 | 1616 | | | 1791 | | 1805 | 3604 | | 1805 | 3474 | |
| Flt Permitted | 0.75 | 1.00 | | | 0.90 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1430 | 1616 | | | 1660 | | 1805 | 3604 | | 1805 | 3474 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 161 | 1 | 199 | 4 | 2 | 2 | 191 | 542 | 5 | 2 | 538 | 105 |
| RTOR Reduction (vph) | 0 | 166 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 11 | 0 |
| Lane Group Flow (vph) | 161 | 34 | 0 | 0 | 6 | 0 | 191 | 547 | 0 | 2 | 632 | 0 |
| Confl. Peds. (#/hr) | | | | | | | | | 9 | | | 6 |
| Confl. Bikes (#/hr) | | | | | | | | | 2 | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 1% | 0% |
| Turn Type | Perm | NA | | Perm | NA | | Prot | NA | | Prot | NA | |
| Protected Phases | | 8 | | | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | 8 | | | 4 | | | | | | | | |
| Actuated Green, G (s) | 16.8 | 16.8 | | | 17.0 | | 15.1 | 70.4 | | 2.2 | 57.5 | |
| Effective Green, g (s) | 16.8 | 16.8 | | | 17.0 | | 15.1 | 70.4 | | 2.2 | 57.5 | |
| Actuated g/C Ratio | 0.17 | 0.17 | | | 0.17 | | 0.15 | 0.70 | | 0.02 | 0.58 | |
| Clearance Time (s) | 3.2 | 3.2 | | | 3.0 | | 3.0 | 4.4 | | 3.0 | 4.4 | |
| Vehicle Extension (s) | 3.0 | 3.0 | | | 2.0 | | 2.0 | 4.0 | | 2.0 | 4.0 | |
| Lane Grp Cap (vph) | 240 | 271 | | | 282 | | 272 | 2537 | | 39 | 1997 | |
| v/s Ratio Prot | | 0.02 | | | | | c0.11 | 0.15 | | 0.00 | c0.18 | |
| v/s Ratio Perm | c0.11 | | | | 0.00 | | | | | | | |
| v/c Ratio | 0.67 | 0.13 | | | 0.02 | | 0.70 | 0.22 | | 0.05 | 0.32 | |
| Uniform Delay, d1 | 39.0 | 35.4 | | | 34.6 | | 40.3 | 5.2 | | 47.9 | 11.0 | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | | 0.95 | 1.75 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 7.2 | 0.2 | | | 0.0 | | 6.4 | 0.2 | | 0.2 | 0.4 | |
| Delay (s) | 46.2 | 35.6 | | | 34.6 | | 44.5 | 9.2 | | 48.1 | 11.5 | |
| Level of Service | D | D | | | C | | D | A | | D | B | |
| Approach Delay (s) | | 40.3 | | | 34.6 | | | 18.4 | | | 11.6 | |
| Approach LOS | | D | | | C | | | B | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 20.5 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.45 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 53.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 22: Novato Blvd #3 & Arthur Street

02/15/2018

| Movement | EBL | EBR | NBL | NBT | SBU | SBT | SBR |
|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | |
| Traffic Volume (vph) | 89 | 122 | 150 | 711 | 7 | 625 | 83 |
| Future Volume (vph) | 89 | 122 | 150 | 711 | 7 | 625 | 83 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 3.5 | 3.5 | 4.9 | 3.5 | 4.9 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 0.98 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 0.85 | 1.00 | 1.00 | 1.00 | 0.98 | |
| Flt Protected | 0.95 | 1.00 | 0.95 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1797 | 1589 | 1805 | 3574 | 1805 | 3547 | |
| Flt Permitted | 0.95 | 1.00 | 0.95 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1797 | 1589 | 1805 | 3574 | 1805 | 3547 | |
| Peak-hour factor, PHF | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Adj. Flow (vph) | 98 | 134 | 165 | 781 | 8 | 687 | 91 |
| RTOR Reduction (vph) | 0 | 117 | 0 | 0 | 0 | 6 | 0 |
| Lane Group Flow (vph) | 98 | 17 | 165 | 781 | 8 | 772 | 0 |
| Confl. Peds. (#/hr) | 4 | 2 | | | | | |
| Confl. Bikes (#/hr) | | 1 | | | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 1% | 0% | 0% | 0% |
| Turn Type | Perm | Perm | Prot | NA | Prot | NA | |
| Protected Phases | | | 1 | 6 | 5 | 2 | |
| Permitted Phases | 4 | 4 | | | | | |
| Actuated Green, G (s) | 12.5 | 12.5 | 13.7 | 74.4 | 1.2 | 61.9 | |
| Effective Green, g (s) | 12.5 | 12.5 | 13.7 | 74.4 | 1.2 | 61.9 | |
| Actuated g/C Ratio | 0.12 | 0.12 | 0.14 | 0.74 | 0.01 | 0.62 | |
| Clearance Time (s) | 3.5 | 3.5 | 3.5 | 4.9 | 3.5 | 4.9 | |
| Vehicle Extension (s) | 2.0 | 2.0 | 2.0 | 4.0 | 2.0 | 4.0 | |
| Lane Grp Cap (vph) | 224 | 198 | 247 | 2659 | 21 | 2195 | |
| v/s Ratio Prot | | | c0.09 | 0.22 | 0.00 | c0.22 | |
| v/s Ratio Perm | c0.05 | 0.01 | | | | | |
| v/c Ratio | 0.44 | 0.08 | 0.67 | 0.29 | 0.38 | 0.35 | |
| Uniform Delay, d1 | 40.5 | 38.7 | 41.0 | 4.2 | 49.0 | 9.3 | |
| Progression Factor | 1.00 | 1.00 | 0.99 | 0.82 | 0.87 | 0.79 | |
| Incremental Delay, d2 | 0.5 | 0.1 | 3.6 | 0.2 | 4.0 | 0.4 | |
| Delay (s) | 41.0 | 38.8 | 44.3 | 3.6 | 46.6 | 7.7 | |
| Level of Service | D | D | D | A | D | A | |
| Approach Delay (s) | 39.7 | | | 10.7 | | 8.1 | |
| Approach LOS | D | | | B | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 13.1 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.41 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 11.9 |
| Intersection Capacity Utilization | 45.1% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 23: Novato Blvd #3 & Rowland Boulevard



| Movement | EBL | EBT | EBR | WBU | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 38 | 122 | 15 | 28 | 160 | 193 | 503 | 27 | 304 | 152 | 375 | 336 |
| Future Volume (vph) | 38 | 122 | 15 | 28 | 160 | 193 | 503 | 27 | 304 | 152 | 375 | 336 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 3.5 | | | 3.5 | 4.1 | 4.1 | 3.5 | 4.1 | | 3.5 | 4.4 |
| Lane Util. Factor | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 0.97 | 1.00 |
| Frpb, ped/bikes | 1.00 | 0.99 | | | 1.00 | 1.00 | 0.99 | 1.00 | 0.99 | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 0.98 | | | 1.00 | 1.00 | 0.85 | 1.00 | 0.95 | | 1.00 | 0.98 |
| Flt Protected | 0.95 | 1.00 | | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 1859 | | | 1790 | 1900 | 1592 | 1805 | 1776 | | 3502 | 1847 |
| Flt Permitted | 0.95 | 1.00 | | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | 1805 | 1859 | | | 1790 | 1900 | 1592 | 1805 | 1776 | | 3502 | 1847 |
| Peak-hour factor, PHF | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 |
| Adj. Flow (vph) | 43 | 137 | 17 | 31 | 180 | 217 | 565 | 30 | 342 | 171 | 421 | 378 |
| RTOR Reduction (vph) | 0 | 5 | 0 | 0 | 0 | 0 | 371 | 0 | 18 | 0 | 0 | 5 |
| Lane Group Flow (vph) | 43 | 149 | 0 | 0 | 211 | 217 | 194 | 30 | 495 | 0 | 421 | 442 |
| Confl. Peds. (#/hr) | | | 13 | | | | 2 | | | 5 | | |
| Confl. Bikes (#/hr) | | | 1 | | | | | | | 1 | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 1% | 0% | 0% | 0% | 1% | 1% | 0% | 0% |
| Turn Type | Prot | NA | | Prot | Prot | NA | Perm | Prot | NA | | Prot | NA |
| Protected Phases | 3 | 8 | | 7 | 7 | 4 | | 1 | 6 | | 5 | 2 |
| Permitted Phases | | | | | | | 4 | | | | | |
| Actuated Green, G (s) | 5.4 | 15.7 | | | 14.2 | 23.9 | 23.9 | 6.0 | 34.6 | | 20.9 | 49.2 |
| Effective Green, g (s) | 5.4 | 15.7 | | | 14.2 | 23.9 | 23.9 | 6.0 | 34.6 | | 20.9 | 49.2 |
| Actuated g/C Ratio | 0.05 | 0.16 | | | 0.14 | 0.24 | 0.24 | 0.06 | 0.35 | | 0.21 | 0.49 |
| Clearance Time (s) | 3.5 | 3.5 | | | 3.5 | 4.1 | 4.1 | 3.5 | 4.1 | | 3.5 | 4.4 |
| Vehicle Extension (s) | 2.0 | 2.0 | | | 2.0 | 2.0 | 2.0 | 2.0 | 3.0 | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 97 | 291 | | | 254 | 454 | 380 | 108 | 614 | | 731 | 908 |
| v/s Ratio Prot | 0.02 | 0.08 | | | c0.12 | 0.11 | | 0.02 | c0.28 | | c0.12 | 0.24 |
| v/s Ratio Perm | | | | | | | c0.12 | | | | | |
| v/c Ratio | 0.44 | 0.51 | | | 0.83 | 0.48 | 0.51 | 0.28 | 0.81 | | 0.58 | 0.49 |
| Uniform Delay, d1 | 45.8 | 38.6 | | | 41.7 | 32.7 | 33.0 | 44.9 | 29.7 | | 35.6 | 17.0 |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.18 | 0.69 |
| Incremental Delay, d2 | 1.2 | 0.6 | | | 19.3 | 0.3 | 0.5 | 0.5 | 7.6 | | 3.2 | 1.8 |
| Delay (s) | 47.0 | 39.3 | | | 61.0 | 33.0 | 33.5 | 45.4 | 37.3 | | 45.0 | 13.6 |
| Level of Service | D | D | | | E | C | C | D | D | | D | B |
| Approach Delay (s) | | 41.0 | | | | 39.2 | | | 37.8 | | | 28.8 |
| Approach LOS | | D | | | | D | | | D | | | C |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 35.6 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.72 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 15.5 |
| Intersection Capacity Utilization | 74.5% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 23: Novato Blvd #3 & Rowland Boulevard



| Movement | SBR |
|---|---|
| Lane Configurations | |
| Traffic Volume (vph) | 61 |
| Future Volume (vph) | 61 |
| Ideal Flow (vphpl) | 1900 |
| Total Lost time (s) | |
| Lane Util. Factor | |
| Frpb, ped/bikes | |
| Flpb, ped/bikes | |
| Frt | |
| Flt Protected | |
| Satd. Flow (prot) | |
| Flt Permitted | |
| Satd. Flow (perm) | |
| Peak-hour factor, PHF | 0.89 |
| Adj. Flow (vph) | 69 |
| RTOR Reduction (vph) | 0 |
| Lane Group Flow (vph) | 0 |
| Confl. Peds. (#/hr) | 6 |
| Confl. Bikes (#/hr) | |
| Heavy Vehicles (%) | 0% |
| Turn Type | |
| Protected Phases | |
| Permitted Phases | |
| Actuated Green, G (s) | |
| Effective Green, g (s) | |
| Actuated g/C Ratio | |
| Clearance Time (s) | |
| Vehicle Extension (s) | |
| Lane Grp Cap (vph) | |
| v/s Ratio Prot | |
| v/s Ratio Perm | |
| v/c Ratio | |
| Uniform Delay, d1 | |
| Progression Factor | |
| Incremental Delay, d2 | |
| Delay (s) | |
| Level of Service | |
| Approach Delay (s) | |
| Approach LOS | |

Intersection Summary

| Movement | EBL | EBT | EBR | WBU | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 107 | 549 | 47 | 1 | 134 | 818 | 310 | 23 | 29 | 61 | 267 | 26 |
| Future Volume (vph) | 107 | 549 | 47 | 1 | 134 | 818 | 310 | 23 | 29 | 61 | 267 | 26 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.5 | 4.5 | | 3.5 | 4.5 | | 3.5 | 4.1 | | 3.5 | 4.8 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | | 0.97 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.98 | | 1.00 | 1.00 | | 1.00 | 0.99 | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | | 1.00 | 0.96 | | 1.00 | 0.90 | | 1.00 | 1.00 |
| Flt Protected | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 3574 | 1590 | | 1805 | 3447 | | 1805 | 3209 | | 3502 | 1900 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | 1805 | 3574 | 1590 | | 1805 | 3447 | | 1805 | 3209 | | 3502 | 1900 |
| Peak-hour factor, PHF | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 |
| Adj. Flow (vph) | 122 | 624 | 53 | 1 | 152 | 930 | 352 | 26 | 33 | 69 | 303 | 30 |
| RTOR Reduction (vph) | 0 | 0 | 31 | 0 | 0 | 30 | 0 | 0 | 59 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 122 | 624 | 22 | 0 | 153 | 1252 | 0 | 26 | 43 | 0 | 303 | 30 |
| Confl. Peds. (#/hr) | | | 4 | | | | 4 | | | 3 | | |
| Confl. Bikes (#/hr) | | | | | | | | | | 1 | | |
| Heavy Vehicles (%) | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Prot | NA | Perm | Prot | Prot | NA | | Prot | NA | | Prot | NA |
| Protected Phases | 5 | 2 | | 1 | 1 | 6 | | 3 | 8 | | 7 | 4 |
| Permitted Phases | | | 2 | | | | | | | | | |
| Actuated Green, G (s) | 11.3 | 38.5 | 38.5 | | 12.8 | 40.0 | | 4.0 | 13.9 | | 12.4 | 21.6 |
| Effective Green, g (s) | 11.3 | 38.5 | 38.5 | | 12.8 | 40.0 | | 4.0 | 13.9 | | 12.4 | 21.6 |
| Actuated g/C Ratio | 0.12 | 0.41 | 0.41 | | 0.14 | 0.43 | | 0.04 | 0.15 | | 0.13 | 0.23 |
| Clearance Time (s) | 3.5 | 4.5 | 4.5 | | 3.5 | 4.5 | | 3.5 | 4.1 | | 3.5 | 4.8 |
| Vehicle Extension (s) | 2.0 | 4.0 | 4.0 | | 2.0 | 4.0 | | 2.0 | 2.5 | | 2.5 | 2.5 |
| Lane Grp Cap (vph) | 218 | 1476 | 656 | | 247 | 1479 | | 77 | 478 | | 465 | 440 |
| v/s Ratio Prot | 0.07 | 0.17 | | | c0.08 | c0.36 | | 0.01 | 0.01 | | c0.09 | 0.02 |
| v/s Ratio Perm | | | 0.01 | | | | | | | | | |
| v/c Ratio | 0.56 | 0.42 | 0.03 | | 0.62 | 0.85 | | 0.34 | 0.09 | | 0.65 | 0.07 |
| Uniform Delay, d1 | 38.6 | 19.4 | 16.3 | | 37.9 | 23.9 | | 43.3 | 34.2 | | 38.3 | 27.9 |
| Progression Factor | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 1.8 | 0.3 | 0.0 | | 3.2 | 4.9 | | 1.0 | 0.1 | | 2.9 | 0.0 |
| Delay (s) | 40.4 | 19.7 | 16.3 | | 41.1 | 28.7 | | 44.3 | 34.3 | | 41.3 | 28.0 |
| Level of Service | D | B | B | | D | C | | D | C | | D | C |
| Approach Delay (s) | | 22.6 | | | | 30.0 | | | 36.3 | | | 36.3 |
| Approach LOS | | C | | | | C | | | D | | | D |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 29.3 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.66 | | |
| Actuated Cycle Length (s) | 93.2 | Sum of lost time (s) | 16.3 |
| Intersection Capacity Utilization | 68.0% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |





| Movement | SBR |
|---|---|
| Lane Configurations | |
| Traffic Volume (vph) | 138 |
| Future Volume (vph) | 138 |
| Ideal Flow (vphpl) | 1900 |
| Total Lost time (s) | 4.8 |
| Lane Util. Factor | 1.00 |
| Frpb, ped/bikes | 0.99 |
| Flpb, ped/bikes | 1.00 |
| Frt | 0.85 |
| Flt Protected | 1.00 |
| Satd. Flow (prot) | 1593 |
| Flt Permitted | 1.00 |
| Satd. Flow (perm) | 1593 |
| Peak-hour factor, PHF | 0.88 |
| Adj. Flow (vph) | 157 |
| RTOR Reduction (vph) | 121 |
| Lane Group Flow (vph) | 36 |
| Confl. Peds. (#/hr) | 2 |
| Confl. Bikes (#/hr) | |
| Heavy Vehicles (%) | 0% |
| Turn Type | Perm |
| Protected Phases | |
| Permitted Phases | 4 |
| Actuated Green, G (s) | 21.6 |
| Effective Green, g (s) | 21.6 |
| Actuated g/C Ratio | 0.23 |
| Clearance Time (s) | 4.8 |
| Vehicle Extension (s) | 2.5 |
| Lane Grp Cap (vph) | 369 |
| v/s Ratio Prot | |
| v/s Ratio Perm | c0.02 |
| v/c Ratio | 0.10 |
| Uniform Delay, d1 | 28.1 |
| Progression Factor | 1.00 |
| Incremental Delay, d2 | 0.1 |
| Delay (s) | 28.2 |
| Level of Service | C |
| Approach Delay (s) | |
| Approach LOS | |

Intersection Summary

HCM Signalized Intersection Capacity Analysis
25: Rowland Boulevard & Highway 101 SB Ramps 02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 360 | 528 | 609 | 1108 | 0 | 0 | 0 | 0 | 250 | 6 | 133 |
| Future Volume (vph) | 0 | 360 | 528 | 609 | 1108 | 0 | 0 | 0 | 0 | 250 | 6 | 133 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.0 | 4.0 | 3.0 | 4.0 | | | | | 3.0 | 3.0 | |
| Lane Util. Factor | | 0.91 | 0.91 | 0.97 | 0.95 | | | | | 0.91 | 0.91 | |
| Frpb, ped/bikes | | 0.99 | 0.99 | 1.00 | 1.00 | | | | | 1.00 | 0.99 | |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | | | | 1.00 | 1.00 | |
| Frt | | 0.94 | 0.85 | 1.00 | 1.00 | | | | | 1.00 | 0.92 | |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | 0.95 | 0.98 | |
| Satd. Flow (prot) | | 3209 | 1450 | 3502 | 3610 | | | | | 1643 | 3065 | |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | 0.95 | 0.98 | |
| Satd. Flow (perm) | | 3209 | 1450 | 3502 | 3610 | | | | | 1643 | 3065 | |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Adj. Flow (vph) | 0 | 400 | 587 | 677 | 1231 | 0 | 0 | 0 | 0 | 278 | 7 | 148 |
| RTOR Reduction (vph) | 0 | 121 | 212 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 23 | 0 |
| Lane Group Flow (vph) | 0 | 555 | 99 | 677 | 1231 | 0 | 0 | 0 | 0 | 150 | 260 | 0 |
| Confl. Peds. (#/hr) | | | 2 | | | | | | | | | 7 |
| Confl. Bikes (#/hr) | | | | | | | | | | | | 1 |
| Heavy Vehicles (%) | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 33% | 0% |
| Turn Type | | NA | Perm | Prot | NA | | | | | Split | NA | |
| Protected Phases | | 2 | | 1 | 6 | | | | | 4 | 4 | |
| Permitted Phases | | | 2 | | | | | | | | | |
| Actuated Green, G (s) | | 16.9 | 16.9 | 13.8 | 33.7 | | | | | 12.3 | 12.3 | |
| Effective Green, g (s) | | 16.9 | 16.9 | 13.8 | 33.7 | | | | | 12.3 | 12.3 | |
| Actuated g/C Ratio | | 0.32 | 0.32 | 0.26 | 0.64 | | | | | 0.23 | 0.23 | |
| Clearance Time (s) | | 4.0 | 4.0 | 3.0 | 4.0 | | | | | 3.0 | 3.0 | |
| Vehicle Extension (s) | | 4.0 | 4.0 | 2.0 | 2.5 | | | | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | | 1023 | 462 | 911 | 2295 | | | | | 381 | 711 | |
| v/s Ratio Prot | | 0.17 | | c0.19 | c0.34 | | | | | c0.09 | 0.08 | |
| v/s Ratio Perm | | | 0.07 | | | | | | | | | |
| v/c Ratio | | 0.54 | 0.21 | 0.74 | 0.54 | | | | | 0.39 | 0.37 | |
| Uniform Delay, d1 | | 14.9 | 13.2 | 18.0 | 5.3 | | | | | 17.2 | 17.1 | |
| Progression Factor | | 1.00 | 1.00 | 1.00 | 1.00 | | | | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 0.7 | 0.3 | 2.9 | 0.2 | | | | | 0.2 | 0.1 | |
| Delay (s) | | 15.6 | 13.5 | 20.9 | 5.5 | | | | | 17.4 | 17.2 | |
| Level of Service | | B | B | C | A | | | | | B | B | |
| Approach Delay (s) | | 15.0 | | | 11.0 | | | 0.0 | | | 17.3 | |
| Approach LOS | | B | | | B | | | A | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 13.0 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.59 | | |
| Actuated Cycle Length (s) | 53.0 | Sum of lost time (s) | 10.0 |
| Intersection Capacity Utilization | 62.0% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



HCM Signalized Intersection Capacity Analysis
26: Highway 101 NB Ramps & Rowland Boulevard 02/15/2018

| Movement | EBL2 | EBL | EBT | WBT | WBR | WBR2 | NBL2 | NBL | NBT | NBR | NEL2 | NEL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 3 | 65 | 551 | 948 | 1 | 422 | 732 | 11 | 1 | 664 | 18 | 18 |
| Future Volume (vph) | 3 | 65 | 551 | 948 | 1 | 422 | 732 | 11 | 1 | 664 | 18 | 18 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | 4.0 | 4.0 | | 4.0 | 3.5 | | 3.5 | 3.0 | | 3.5 |
| Lane Util. Factor | | 1.00 | 0.95 | 0.86 | | 0.86 | 0.95 | | 0.95 | 0.88 | | 1.00 |
| Frpb, ped/bikes | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Frt | | 1.00 | 1.00 | 0.98 | | 0.85 | 1.00 | | 1.00 | 0.85 | | 0.98 |
| Flt Protected | | 0.95 | 1.00 | 1.00 | | 1.00 | 0.95 | | 0.95 | 1.00 | | 0.96 |
| Satd. Flow (prot) | | 1804 | 3574 | 4622 | | 1323 | 1715 | | 1718 | 2842 | | 1745 |
| Flt Permitted | | 0.95 | 1.00 | 1.00 | | 1.00 | 0.95 | | 0.95 | 1.00 | | 0.96 |
| Satd. Flow (perm) | | 1804 | 3574 | 4622 | | 1323 | 1715 | | 1718 | 2842 | | 1745 |
| Peak-hour factor, PHF | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| Adj. Flow (vph) | 3 | 70 | 592 | 1019 | 1 | 454 | 787 | 12 | 1 | 714 | 19 | 19 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 10 | 0 | 178 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 73 | 592 | 1133 | 0 | 153 | 401 | 0 | 399 | 714 | 0 | 43 |
| Confl. Peds. (#/hr) | | | | | 1 | | | | | 8 | | |
| Heavy Vehicles (%) | 2% | 0% | 1% | 4% | 0% | 5% | 0% | 2% | 13% | 0% | 2% | 0% |
| Turn Type | Prot | Prot | NA | NA | | Perm | Split | Split | NA | custom | Perm | Prot |
| Protected Phases | 5 | 5 | 2 | 6 | | | 8 | 8 | 8 | 1 8 | | 7 |
| Permitted Phases | | | | | | 6 | | | | | 7 | |
| Actuated Green, G (s) | | 7.5 | 52.0 | 55.5 | | 55.5 | 34.2 | | 34.2 | 45.2 | | 8.8 |
| Effective Green, g (s) | | 7.5 | 52.0 | 55.5 | | 55.5 | 34.2 | | 34.2 | 45.2 | | 8.8 |
| Actuated g/C Ratio | | 0.06 | 0.43 | 0.46 | | 0.46 | 0.29 | | 0.29 | 0.38 | | 0.07 |
| Clearance Time (s) | | 3.0 | 4.0 | 4.0 | | 4.0 | 3.5 | | 3.5 | | | 3.5 |
| Vehicle Extension (s) | | 2.0 | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | | | 2.0 |
| Lane Grp Cap (vph) | | 112 | 1548 | 2137 | | 611 | 488 | | 489 | 1070 | | 127 |
| v/s Ratio Prot | | 0.04 | 0.17 | c0.25 | | | c0.23 | | 0.23 | c0.25 | | |
| v/s Ratio Perm | | | | | | 0.12 | | | | | | 0.02 |
| v/c Ratio | | 0.65 | 0.38 | 0.53 | | 0.25 | 0.82 | | 0.82 | 0.67 | | 0.34 |
| Uniform Delay, d1 | | 55.0 | 23.1 | 23.0 | | 19.6 | 40.1 | | 40.0 | 31.1 | | 52.8 |
| Progression Factor | | 1.00 | 1.00 | 0.77 | | 1.04 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Incremental Delay, d2 | | 9.9 | 0.7 | 0.9 | | 0.9 | 10.2 | | 9.6 | 1.2 | | 0.6 |
| Delay (s) | | 64.9 | 23.8 | 18.6 | | 21.2 | 50.3 | | 49.6 | 32.4 | | 53.4 |
| Level of Service | | E | C | B | | C | D | | D | C | | D |
| Approach Delay (s) | | | 28.3 | 19.2 | | | | | 41.6 | | | 53.4 |
| Approach LOS | | | C | B | | | | | D | | | D |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 30.4 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.63 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 14.0 |
| Intersection Capacity Utilization | 74.0% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | NER |
|---|---|
| Lane Configurations | |
| Traffic Volume (vph) | 5 |
| Future Volume (vph) | 5 |
| Ideal Flow (vphpl) | 1900 |
| Total Lost time (s) | |
| Lane Util. Factor | |
| Frpb, ped/bikes | |
| Flpb, ped/bikes | |
| Frt | |
| Flt Protected | |
| Satd. Flow (prot) | |
| Flt Permitted | |
| Satd. Flow (perm) | |
| Peak-hour factor, PHF | 0.93 |
| Adj. Flow (vph) | 5 |
| RTOR Reduction (vph) | 0 |
| Lane Group Flow (vph) | 0 |
| Confl. Peds. (#/hr) | |
| Heavy Vehicles (%) | 15% |
| Turn Type | |
| Protected Phases | |
| Permitted Phases | |
| Actuated Green, G (s) | |
| Effective Green, g (s) | |
| Actuated g/C Ratio | |
| Clearance Time (s) | |
| Vehicle Extension (s) | |
| Lane Grp Cap (vph) | |
| v/s Ratio Prot | |
| v/s Ratio Perm | |
| v/c Ratio | |
| Uniform Delay, d1 | |
| Progression Factor | |
| Incremental Delay, d2 | |
| Delay (s) | |
| Level of Service | |
| Approach Delay (s) | |
| Approach LOS | |

Intersection Summary





| Movement | EBU | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | |
| Traffic Volume (vph) | 6 | 219 | 985 | 1029 | 26 | 36 | 339 |
| Future Volume (vph) | 6 | 219 | 985 | 1029 | 26 | 36 | 339 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.5 | 4.0 | 4.0 | | 3.2 | 3.2 |
| Lane Util. Factor | | 0.97 | 0.91 | 0.95 | | 1.00 | 0.95 |
| Frpb, ped/bikes | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | | 1.00 | 1.00 | 1.00 | | 0.88 | 0.85 |
| Flt Protected | | 0.95 | 1.00 | 1.00 | | 0.99 | 1.00 |
| Satd. Flow (prot) | | 3468 | 5187 | 3588 | | 1634 | 1519 |
| Flt Permitted | | 0.95 | 1.00 | 1.00 | | 0.99 | 1.00 |
| Satd. Flow (perm) | | 3468 | 5187 | 3588 | | 1634 | 1519 |
| Peak-hour factor, PHF | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| Adj. Flow (vph) | 6 | 226 | 1015 | 1061 | 27 | 37 | 349 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 1 | 0 | 140 | 171 |
| Lane Group Flow (vph) | 0 | 232 | 1015 | 1087 | 0 | 54 | 21 |
| Confl. Peds. (#/hr) | | | | | 12 | 2 | |
| Heavy Vehicles (%) | 0% | 1% | 0% | 0% | 7% | 2% | 1% |
| Turn Type | Prot | Prot | NA | NA | | Prot | Perm |
| Protected Phases | 5 | 5 | 2 | 6 | | 4 | |
| Permitted Phases | | | | | | | 4 |
| Actuated Green, G (s) | | 12.6 | 99.8 | 83.7 | | 13.0 | 13.0 |
| Effective Green, g (s) | | 12.6 | 99.8 | 83.7 | | 13.0 | 13.0 |
| Actuated g/C Ratio | | 0.10 | 0.83 | 0.70 | | 0.11 | 0.11 |
| Clearance Time (s) | | 3.5 | 4.0 | 4.0 | | 3.2 | 3.2 |
| Vehicle Extension (s) | | 2.0 | 4.0 | 4.0 | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | | 364 | 4313 | 2502 | | 177 | 164 |
| v/s Ratio Prot | | c0.07 | 0.20 | c0.30 | | c0.03 | |
| v/s Ratio Perm | | | | | | | 0.01 |
| v/c Ratio | | 0.64 | 0.24 | 0.43 | | 0.31 | 0.13 |
| Uniform Delay, d1 | | 51.5 | 2.1 | 7.9 | | 49.3 | 48.4 |
| Progression Factor | | 1.02 | 1.33 | 0.72 | | 1.00 | 1.00 |
| Incremental Delay, d2 | | 2.4 | 0.1 | 0.5 | | 0.4 | 0.1 |
| Delay (s) | | 55.1 | 2.9 | 6.2 | | 49.7 | 48.5 |
| Level of Service | | E | A | A | | D | D |
| Approach Delay (s) | | | 12.6 | 6.2 | | 49.1 | |
| Approach LOS | | | B | A | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 15.2 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.44 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 10.7 |
| Intersection Capacity Utilization | 61.6% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 28: Rowland Boulevard & Vintage Way

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 17 | 205 | 791 | 2 | 255 | 6 | 799 | 3 | 2 | 4 | 3 | 0 |
| Future Volume (vph) | 17 | 205 | 791 | 2 | 255 | 6 | 799 | 3 | 2 | 4 | 3 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 4.0 | 4.0 | 3.0 | 4.0 | | 3.6 | 3.6 | | | 3.2 | |
| Lane Util. Factor | 1.00 | 0.95 | 0.88 | 1.00 | 0.95 | | 0.97 | 1.00 | | | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 0.99 | | | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | | 1.00 | 0.94 | | | 1.00 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | | 0.97 | |
| Satd. Flow (prot) | 1805 | 3539 | 2842 | 1805 | 3558 | | 3502 | 1768 | | | 1847 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | | 0.97 | |
| Satd. Flow (perm) | 1805 | 3539 | 2842 | 1805 | 3558 | | 3502 | 1768 | | | 1847 | |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 18 | 218 | 841 | 2 | 271 | 6 | 850 | 3 | 2 | 4 | 3 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 18 | 218 | 841 | 2 | 276 | 0 | 850 | 4 | 0 | 0 | 7 | 0 |
| Confl. Peds. (#/hr) | | | 9 | 9 | | 13 | | | 11 | | | |
| Confl. Bikes (#/hr) | | | 2 | | | 2 | | | | | | |
| Heavy Vehicles (%) | 0% | 2% | 0% | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Prot | NA | pt+ov | Prot | NA | | Split | NA | | Split | NA | |
| Protected Phases | 5 | 2 | 2 3 | 1 | 6 | | 3 | 3 | | 4 | 4 | |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | 5.4 | 49.6 | 105.0 | 2.8 | 47.0 | | 51.4 | 51.4 | | | 2.4 | |
| Effective Green, g (s) | 5.4 | 49.6 | 105.0 | 2.8 | 47.0 | | 51.4 | 51.4 | | | 2.4 | |
| Actuated g/C Ratio | 0.05 | 0.41 | 0.88 | 0.02 | 0.39 | | 0.43 | 0.43 | | | 0.02 | |
| Clearance Time (s) | 3.0 | 4.0 | | 3.0 | 4.0 | | 3.6 | 3.6 | | | 3.2 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | | 3.0 | 3.0 | | | 2.0 | |
| Lane Grp Cap (vph) | 81 | 1462 | 2486 | 42 | 1393 | | 1500 | 757 | | | 36 | |
| v/s Ratio Prot | 0.01 | 0.06 | c0.30 | 0.00 | c0.08 | | c0.24 | 0.00 | | | c0.00 | |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | 0.22 | 0.15 | 0.34 | 0.05 | 0.20 | | 0.57 | 0.01 | | | 0.19 | |
| Uniform Delay, d1 | 55.3 | 22.0 | 1.3 | 57.3 | 24.1 | | 25.9 | 19.7 | | | 57.8 | |
| Progression Factor | 1.22 | 1.27 | 0.64 | 1.00 | 1.00 | | 1.00 | 1.00 | | | 1.00 | |
| Incremental Delay, d2 | 0.5 | 0.2 | 0.4 | 0.2 | 0.3 | | 1.6 | 0.0 | | | 1.0 | |
| Delay (s) | 67.7 | 28.1 | 1.2 | 57.5 | 24.4 | | 27.4 | 19.7 | | | 58.8 | |
| Level of Service | E | C | A | E | C | | C | B | | | E | |
| Approach Delay (s) | | 7.8 | | | 24.6 | | | 27.4 | | | 58.8 | |
| Approach LOS | | A | | | C | | | C | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 17.6 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.45 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 13.8 |
| Intersection Capacity Utilization | 59.5% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 29: Novato Blvd #3 & Sunset Parkway

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 152 | 18 | 33 | 30 | 11 | 36 | 44 | 260 | 51 | 34 | 302 | 154 |
| Future Volume (vph) | 152 | 18 | 33 | 30 | 11 | 36 | 44 | 260 | 51 | 34 | 302 | 154 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.0 | | 3.5 | 3.5 | | 3.5 | 4.9 | | 3.5 | 4.6 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 0.98 | | 1.00 | 0.98 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.90 | | 1.00 | 0.89 | | 1.00 | 0.98 | | 1.00 | 0.95 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1787 | 1674 | | 1805 | 1642 | | 1805 | 1831 | | 1805 | 1798 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1787 | 1674 | | 1805 | 1642 | | 1805 | 1831 | | 1805 | 1798 | |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 162 | 19 | 35 | 32 | 12 | 38 | 47 | 277 | 54 | 36 | 321 | 164 |
| RTOR Reduction (vph) | 0 | 28 | 0 | 0 | 34 | 0 | 0 | 6 | 0 | 0 | 14 | 0 |
| Lane Group Flow (vph) | 162 | 26 | 0 | 32 | 16 | 0 | 47 | 325 | 0 | 36 | 471 | 0 |
| Confl. Peds. (#/hr) | | | 11 | | | 6 | | | 3 | | | |
| Confl. Bikes (#/hr) | | | | | | 1 | | | | | | |
| Heavy Vehicles (%) | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 1% | 0% | 0% | 0% | 1% |
| Turn Type | Prot | NA | | Prot | NA | | Prot | NA | | Prot | NA | |
| Protected Phases | 3 | 8 | | 7 | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | 12.2 | 17.2 | | 3.4 | 8.9 | | 5.3 | 38.9 | | 5.3 | 39.2 | |
| Effective Green, g (s) | 12.2 | 17.2 | | 3.4 | 8.9 | | 5.3 | 38.9 | | 5.3 | 39.2 | |
| Actuated g/C Ratio | 0.15 | 0.21 | | 0.04 | 0.11 | | 0.07 | 0.48 | | 0.07 | 0.49 | |
| Clearance Time (s) | 3.5 | 4.0 | | 3.5 | 3.5 | | 3.5 | 4.9 | | 3.5 | 4.6 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 270 | 356 | | 76 | 181 | | 118 | 882 | | 118 | 873 | |
| v/s Ratio Prot | c0.09 | c0.02 | | 0.02 | 0.01 | | c0.03 | 0.18 | | 0.02 | c0.26 | |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | 0.60 | 0.07 | | 0.42 | 0.09 | | 0.40 | 0.37 | | 0.31 | 0.54 | |
| Uniform Delay, d1 | 32.0 | 25.4 | | 37.7 | 32.3 | | 36.2 | 13.2 | | 35.9 | 14.5 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 2.4 | 0.0 | | 1.4 | 0.1 | | 0.8 | 1.2 | | 0.5 | 2.4 | |
| Delay (s) | 34.4 | 25.4 | | 39.1 | 32.3 | | 37.0 | 14.4 | | 36.5 | 16.8 | |
| Level of Service | C | C | | D | C | | D | B | | D | B | |
| Approach Delay (s) | | 32.1 | | | 35.0 | | | 17.2 | | | 18.2 | |
| Approach LOS | | C | | | C | | | B | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 21.5 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.48 | | |
| Actuated Cycle Length (s) | 80.7 | Sum of lost time (s) | 15.9 |
| Intersection Capacity Utilization | 61.1% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM 2010 AWSC
### 30: Redwood Blvd & Novato Blvd #3

02/15/2018

| Intersection | |
|---|---|
| Intersection Delay, s/veh | 33.7 |
| Intersection LOS | D |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 44 | 261 | 52 | 49 | 352 | 109 | 91 | 13 | 114 | 84 | 10 | 46 |
| Future Vol, veh/h | 44 | 261 | 52 | 49 | 352 | 109 | 91 | 13 | 114 | 84 | 10 | 46 |
| Peak Hour Factor | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Heavy Vehicles, % | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Mvmt Flow | 46 | 275 | 55 | 52 | 371 | 115 | 96 | 14 | 120 | 88 | 11 | 48 |
| Number of Lanes | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Opposing Approach | WB | EB | SB | NB |
| Opposing Lanes | 2 | 2 | 2 | 3 |
| Conflicting Approach Left | SB | NB | EB | WB |
| Conflicting Lanes Left | 2 | 3 | 2 | 2 |
| Conflicting Approach Right | NB | SB | WB | EB |
| Conflicting Lanes Right | 3 | 2 | 2 | 2 |
| HCM Control Delay | 24.5 | 54.2 | 13.7 | 13.8 |
| HCM LOS | C | F | B | B |

| Lane | NBLn1 | NBLn2 | NBLn3 | EBLn1 | EBLn2 | WBLn1 | WBLn2 | SBLn1 | SBLn2 |
|---|---|---|---|---|---|---|---|---|---|
| Vol Left, % | 100% | 0% | 0% | 100% | 0% | 100% | 0% | 100% | 0% |
| Vol Thru, % | 0% | 100% | 0% | 0% | 83% | 0% | 76% | 0% | 18% |
| Vol Right, % | 0% | 0% | 100% | 0% | 17% | 0% | 24% | 0% | 82% |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 91 | 13 | 114 | 44 | 313 | 49 | 461 | 84 | 56 |
| LT Vol | 91 | 0 | 0 | 44 | 0 | 49 | 0 | 84 | 0 |
| Through Vol | 0 | 13 | 0 | 0 | 261 | 0 | 352 | 0 | 10 |
| RT Vol | 0 | 0 | 114 | 0 | 52 | 0 | 109 | 0 | 46 |
| Lane Flow Rate | 96 | 14 | 120 | 46 | 329 | 52 | 485 | 88 | 59 |
| Geometry Grp | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Degree of Util (X) | 0.241 | 0.033 | 0.261 | 0.106 | 0.697 | 0.112 | 0.965 | 0.23 | 0.135 |
| Departure Headway (Hd) | 9.069 | 8.552 | 7.829 | 8.334 | 7.722 | 7.817 | 7.158 | 9.347 | 8.229 |
| Convergence, Y/N | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Cap | 398 | 421 | 462 | 433 | 471 | 456 | 505 | 386 | 438 |
| Service Time | 6.769 | 6.252 | 5.529 | 6.034 | 5.422 | 5.613 | 4.953 | 7.057 | 5.938 |
| HCM Lane V/C Ratio | 0.241 | 0.033 | 0.26 | 0.106 | 0.699 | 0.114 | 0.96 | 0.228 | 0.135 |
| HCM Control Delay | 14.6 | 11.5 | 13.3 | 12 | 26.3 | 11.6 | 58.7 | 14.8 | 12.2 |
| HCM Lane LOS | B | B | B | B | D | B | F | B | B |
| HCM 95th-tile Q | 0.9 | 0.1 | 1 | 0.4 | 5.3 | 0.4 | 12.4 | 0.9 | 0.5 |



## HCM Signalized Intersection Capacity Analysis
### 31: Alameda Del Prado & Ignacio Blvd

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 10 | 412 | 77 | 331 | 688 | 34 | 97 | 4 | 162 | 28 | 5 | 1 |
| Future Volume (vph) | 10 | 412 | 77 | 331 | 688 | 34 | 97 | 4 | 162 | 28 | 5 | 1 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.6 | 3.6 | 3.0 | 3.6 | | | 3.5 | 3.5 | | 3.7 | |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | | 1.00 | 1.00 | | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.97 | 1.00 | 1.00 | | | 1.00 | 0.98 | | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.99 | 1.00 | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | | | 1.00 | 0.85 | | 1.00 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 0.95 | 1.00 | | 0.96 | |
| Satd. Flow (prot) | 1770 | 3610 | 1573 | 1900 | 3584 | | | 1784 | 1589 | | 1811 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 0.76 | 1.00 | | 0.75 | |
| Satd. Flow (perm) | 1770 | 3610 | 1573 | 1805 | 3584 | | | 1417 | 1589 | | 1424 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 11 | 448 | 84 | 360 | 748 | 37 | 105 | 4 | 176 | 30 | 5 | 1 |
| RTOR Reduction (vph) | 0 | 0 | 33 | 0 | 2 | 0 | 0 | 0 | 150 | 0 | 1 | 0 |
| Lane Group Flow (vph) | 11 | 448 | 51 | 360 | 783 | 0 | 0 | 109 | 26 | 0 | 35 | 0 |
| Confl. Peds. (#/hr) | | | 4 | | | | 7 | | 4 | 4 | | 7 |
| Heavy Vehicles (%) | 2% | 0% | 0% | 0% | 0% | 0% | 1% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Prot | NA | Perm | Prot | NA | | Perm | NA | Perm | Perm | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | 2 | | | | 8 | | 8 | 4 | | |
| Actuated Green, G (s) | 1.2 | 47.5 | 47.5 | 27.4 | 73.7 | | | 15.0 | 15.0 | | 14.8 | |
| Effective Green, g (s) | 1.2 | 47.5 | 47.5 | 27.4 | 73.7 | | | 15.0 | 15.0 | | 14.8 | |
| Actuated g/C Ratio | 0.01 | 0.48 | 0.48 | 0.27 | 0.74 | | | 0.15 | 0.15 | | 0.15 | |
| Clearance Time (s) | 3.0 | 3.6 | 3.6 | 3.0 | 3.6 | | | 3.5 | 3.5 | | 3.7 | |
| Vehicle Extension (s) | 2.0 | 3.0 | 3.0 | 2.0 | 3.0 | | | 2.0 | 2.0 | | 2.0 | |
| Lane Grp Cap (vph) | 21 | 1714 | 747 | 520 | 2641 | | | 212 | 238 | | 210 | |
| v/s Ratio Prot | c0.01 | 0.12 | | c0.19 | c0.22 | | | | | | | |
| v/s Ratio Perm | | | 0.03 | | | | | c0.08 | 0.02 | | 0.02 | |
| v/c Ratio | 0.52 | 0.26 | 0.07 | 0.69 | 0.30 | | | 0.51 | 0.11 | | 0.17 | |
| Uniform Delay, d1 | 49.1 | 15.7 | 14.2 | 32.5 | 4.4 | | | 39.1 | 36.7 | | 37.2 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 0.70 | 0.73 | | | 1.00 | 1.00 | | 1.00 | |
| Incremental Delay, d2 | 10.4 | 0.4 | 0.2 | 3.0 | 0.3 | | | 0.9 | 0.1 | | 0.1 | |
| Delay (s) | 59.5 | 16.1 | 14.4 | 25.6 | 3.5 | | | 40.0 | 36.8 | | 37.4 | |
| Level of Service | E | B | B | C | A | | | D | D | | D | |
| Approach Delay (s) | | 16.7 | | | 10.4 | | | 38.0 | | | 37.4 | |
| Approach LOS | | B | | | B | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 16.5 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.45 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 10.3 |
| Intersection Capacity Utilization | 68.0% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
## 32: US 101 SB Off Ramp/Enfrente Rd & Ignacio Blvd/Ignacio Blvd #3

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 33 | 379 | 244 | 553 | 771 | 138 | 0 | 0 | 504 | 183 | 88 | 293 |
| Future Volume (vph) | 33 | 379 | 244 | 553 | 771 | 138 | 0 | 0 | 504 | 183 | 88 | 293 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Grade (%) | | 0% | | | 0% | | | 2% | | | 0% | |
| Total Lost time (s) | 3.0 | 8.0 | 8.0 | 4.0 | 5.0 | | | | 4.0 | | 4.0 | 4.0 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | | | 0.88 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.96 | 1.00 | 0.99 | | | | 1.00 | | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.98 | | | | 0.85 | | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | | 1.00 | | 0.97 | 1.00 |
| Satd. Flow (prot) | 1805 | 3610 | 1550 | 1787 | 3499 | | | | 2814 | | 1809 | 1578 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | | 1.00 | | 0.97 | 1.00 |
| Satd. Flow (perm) | 1805 | 3610 | 1550 | 1787 | 3499 | | | | 2814 | | 1809 | 1578 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 34 | 395 | 254 | 576 | 803 | 144 | 0 | 0 | 525 | 191 | 92 | 305 |
| RTOR Reduction (vph) | 0 | 0 | 184 | 0 | 10 | 0 | 0 | 0 | 340 | 0 | 0 | 240 |
| Lane Group Flow (vph) | 34 | 395 | 70 | 576 | 937 | 0 | 0 | 0 | 185 | 0 | 283 | 65 |
| Confl. Peds. (#/hr) | | | 7 | | | 20 | | | | | | 1 |
| Confl. Bikes (#/hr) | | | | | | 3 | | | | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 5% | 1% |
| Turn Type | Prot | NA | Perm | Prot | NA | | | | Over | Split | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | | | 1 | 7 | 7 | |
| Permitted Phases | | | 2 | | | | | | | | | 7 |
| Actuated Green, G (s) | 6.6 | 27.4 | 27.4 | 35.2 | 60.0 | | | | 35.2 | | 21.4 | 21.4 |
| Effective Green, g (s) | 6.6 | 27.4 | 27.4 | 35.2 | 60.0 | | | | 35.2 | | 21.4 | 21.4 |
| Actuated g/C Ratio | 0.07 | 0.27 | 0.27 | 0.35 | 0.60 | | | | 0.35 | | 0.21 | 0.21 |
| Clearance Time (s) | 3.0 | 8.0 | 8.0 | 4.0 | 5.0 | | | | 4.0 | | 4.0 | 4.0 |
| Vehicle Extension (s) | 2.0 | 2.5 | 2.5 | 3.0 | 4.0 | | | | 3.0 | | 2.5 | 2.5 |
| Lane Grp Cap (vph) | 119 | 989 | 424 | 629 | 2099 | | | | 990 | | 387 | 337 |
| v/s Ratio Prot | 0.02 | c0.11 | | c0.32 | c0.27 | | | | 0.07 | | c0.16 | |
| v/s Ratio Perm | | | 0.04 | | | | | | | | | 0.04 |
| v/c Ratio | 0.29 | 0.40 | 0.16 | 0.92 | 0.45 | | | | 0.19 | | 0.73 | 0.19 |
| Uniform Delay, d1 | 44.5 | 29.6 | 27.6 | 31.0 | 10.9 | | | | 22.5 | | 36.6 | 32.2 |
| Progression Factor | 0.98 | 0.66 | 0.29 | 0.79 | 0.74 | | | | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.5 | 1.2 | 0.8 | 14.4 | 0.5 | | | | 0.1 | | 6.6 | 0.2 |
| Delay (s) | 43.8 | 20.8 | 8.9 | 38.9 | 8.6 | | | | 22.6 | | 43.2 | 32.4 |
| Level of Service | D | C | A | D | A | | | | C | | D | C |
| Approach Delay (s) | | 17.5 | | | 20.1 | | | 22.6 | | | 37.6 | |
| Approach LOS | | B | | | C | | | C | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 23.0 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.73 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 74.9% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
## 33: Nave Dr & Ignacio Blvd #3/Bel Marin Keys Blvd #3

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 274 | 796 | 112 | 649 | 526 | 800 | 513 | 245 | 0 | 0 | 0 |
| Future Volume (vph) | 0 | 274 | 796 | 112 | 649 | 526 | 800 | 513 | 245 | 0 | 0 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.0 | 4.6 | 3.0 | 4.0 | | 4.6 | 4.6 | 3.0 | | | |
| Lane Util. Factor | | 0.95 | 1.00 | 1.00 | 0.95 | | 0.91 | 0.91 | 1.00 | | | |
| Frpb, ped/bikes | | 1.00 | 0.99 | 1.00 | 0.99 | | 1.00 | 1.00 | 0.99 | | | |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | | |
| Frt | | 1.00 | 0.85 | 1.00 | 0.93 | | 1.00 | 1.00 | 0.85 | | | |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 0.98 | 1.00 | | | |
| Satd. Flow (prot) | | 3610 | 1604 | 1805 | 3318 | | 1643 | 3368 | 1600 | | | |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 0.98 | 1.00 | | | |
| Satd. Flow (perm) | | 3610 | 1604 | 1805 | 3318 | | 1643 | 3368 | 1600 | | | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 0 | 288 | 838 | 118 | 683 | 554 | 842 | 540 | 258 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 88 | 0 | 88 | 0 | 0 | 0 | 133 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 288 | 750 | 118 | 1149 | 0 | 455 | 927 | 125 | 0 | 0 | 0 |
| Confl. Peds. (#/hr) | | | 1 | | | 1 | | | 1 | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 2% | 0% | 1% | 0% | 0% | 0% | 0% |
| Turn Type | | NA | pm+ov | Prot | NA | | Split | NA | pm+ov | | | |
| Protected Phases | | 2 | 3 | 1 | 6 | | 3 | 3 | 1 | | | |
| Permitted Phases | | | 2 | | | | | | 3 | | | |
| Actuated Green, G (s) | | 39.8 | 75.9 | 12.5 | 55.3 | | 36.1 | 36.1 | 48.6 | | | |
| Effective Green, g (s) | | 39.8 | 75.9 | 12.5 | 55.3 | | 36.1 | 36.1 | 48.6 | | | |
| Actuated g/C Ratio | | 0.40 | 0.76 | 0.12 | 0.55 | | 0.36 | 0.36 | 0.49 | | | |
| Clearance Time (s) | | 4.0 | 4.6 | 3.0 | 4.0 | | 4.6 | 4.6 | 3.0 | | | |
| Vehicle Extension (s) | | 4.0 | 2.0 | 2.0 | 4.0 | | 2.0 | 2.0 | 2.0 | | | |
| Lane Grp Cap (vph) | | 1436 | 1217 | 225 | 1834 | | 593 | 1215 | 777 | | | |
| v/s Ratio Prot | | 0.08 | 0.22 | 0.07 | c0.35 | | c0.28 | 0.28 | 0.02 | | | |
| v/s Ratio Perm | | | 0.25 | | | | | | 0.06 | | | |
| v/c Ratio | | 0.20 | 0.62 | 0.52 | 0.63 | | 0.77 | 0.76 | 0.16 | | | |
| Uniform Delay, d1 | | 19.7 | 5.5 | 41.0 | 15.3 | | 28.2 | 28.2 | 14.3 | | | |
| Progression Factor | | 1.08 | 1.31 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | | |
| Incremental Delay, d2 | | 0.3 | 0.6 | 1.0 | 1.6 | | 5.3 | 2.6 | 0.0 | | | |
| Delay (s) | | 21.5 | 7.7 | 42.0 | 16.9 | | 33.6 | 30.8 | 14.4 | | | |
| Level of Service | | C | A | D | B | | C | C | B | | | |
| Approach Delay (s) | | 11.3 | | | 19.1 | | | 29.0 | | | 0.0 | |
| Approach LOS | | B | | | B | | | C | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 20.9 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.70 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 11.6 |
| Intersection Capacity Utilization | 68.0% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 34: Bel Marin Keys Blvd #3 & Commercial Blvd

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 3 | 0 | 38 | 278 | 1 | 28 | 46 | 427 | 78 | 31 | 1076 | 7 |
| Future Volume (vph) | 3 | 0 | 38 | 278 | 1 | 28 | 46 | 427 | 78 | 31 | 1076 | 7 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.0 | | | 4.0 | 4.0 | 3.0 | 3.9 | | 3.0 | 3.5 | |
| Lane Util. Factor | | 1.00 | | | 1.00 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | | 0.99 | | | 1.00 | 0.99 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 0.87 | | | 1.00 | 0.85 | 1.00 | 0.98 | | 1.00 | 1.00 | |
| Flt Protected | | 1.00 | | | 0.95 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 1631 | | | 1807 | 1396 | 1805 | 3512 | | 1805 | 3571 | |
| Flt Permitted | | 0.98 | | | 0.69 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | | 1608 | | | 1313 | 1396 | 1805 | 3512 | | 1805 | 3571 | |
| Peak-hour factor, PHF | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 |
| Adj. Flow (vph) | 3 | 0 | 44 | 320 | 1 | 32 | 53 | 491 | 90 | 36 | 1237 | 8 |
| RTOR Reduction (vph) | 0 | 33 | 0 | 0 | 0 | 22 | 0 | 15 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 14 | 0 | 0 | 321 | 10 | 53 | 566 | 0 | 36 | 1245 | 0 |
| Confl. Peds. (#/hr) | 3 | | 2 | 2 | | 3 | | | 3 | | | |
| Heavy Vehicles (%) | 2% | 0% | 0% | 0% | 0% | 14% | 0% | 0% | 0% | 0% | 1% | 0% |
| Turn Type | Perm | NA | | Perm | NA | Perm | Prot | NA | | Prot | NA | |
| Protected Phases | | 4 | | | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | | | | | | |
| Actuated Green, G (s) | | 22.6 | | | 22.6 | 22.6 | 4.0 | 37.9 | | 3.6 | 37.9 | |
| Effective Green, g (s) | | 22.6 | | | 22.6 | 22.6 | 4.0 | 37.9 | | 3.6 | 37.9 | |
| Actuated g/C Ratio | | 0.30 | | | 0.30 | 0.30 | 0.05 | 0.51 | | 0.05 | 0.51 | |
| Clearance Time (s) | | 4.0 | | | 4.0 | 4.0 | 3.0 | 3.9 | | 3.0 | 3.5 | |
| Vehicle Extension (s) | | 3.0 | | | 3.0 | 3.0 | 2.5 | 3.0 | | 2.5 | 4.0 | |
| Lane Grp Cap (vph) | | 484 | | | 395 | 420 | 96 | 1774 | | 86 | 1804 | |
| v/s Ratio Prot | | | | | | | c0.03 | 0.16 | | 0.02 | c0.35 | |
| v/s Ratio Perm | | 0.01 | | | c0.24 | 0.01 | | | | | | |
| v/c Ratio | | 0.03 | | | 0.81 | 0.02 | 0.55 | 0.32 | | 0.42 | 0.69 | |
| Uniform Delay, d1 | | 18.5 | | | 24.2 | 18.4 | 34.6 | 10.9 | | 34.7 | 14.1 | |
| Progression Factor | | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | 0.89 | 0.79 | |
| Incremental Delay, d2 | | 0.0 | | | 12.0 | 0.0 | 5.4 | 0.5 | | 1.9 | 1.8 | |
| Delay (s) | | 18.5 | | | 36.3 | 18.5 | 40.0 | 11.4 | | 32.7 | 12.9 | |
| Level of Service | | B | | | D | B | D | B | | C | B | |
| Approach Delay (s) | | 18.5 | | | 34.7 | | | 13.8 | | | 13.5 | |
| Approach LOS | | B | | | C | | | B | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 16.9 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.73 | | |
| Actuated Cycle Length (s) | 75.0 | Sum of lost time (s) | 10.9 |
| Intersection Capacity Utilization | 67.1% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 35: Bel Marin Keys Blvd #3 & Hamilton Dr/Digital Dr

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 5 | 7 | 154 | 482 | 4 | 13 | 45 | 295 | 102 | 6 | 484 | 2 |
| Future Volume (vph) | 5 | 7 | 154 | 482 | 4 | 13 | 45 | 295 | 102 | 6 | 484 | 2 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.5 | 3.5 | 3.5 | 3.5 | | 3.0 | 4.0 | | 3.0 | 4.0 | |
| Lane Util. Factor | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | | 1.00 | 0.99 | 1.00 | 0.99 | | 1.00 | 0.99 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 1.00 | 0.85 | 1.00 | 0.88 | | 1.00 | 0.96 | | 1.00 | 1.00 | |
| Flt Protected | | 0.98 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 1859 | 1533 | 1804 | 1658 | | 1770 | 3450 | | 1805 | 3572 | |
| Flt Permitted | | 0.95 | 1.00 | 0.75 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | | 1808 | 1533 | 1421 | 1658 | | 1770 | 3450 | | 1805 | 3572 | |
| Peak-hour factor, PHF | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 |
| Adj. Flow (vph) | 6 | 8 | 173 | 542 | 4 | 15 | 51 | 331 | 115 | 7 | 544 | 2 |
| RTOR Reduction (vph) | 0 | 0 | 104 | 0 | 9 | 0 | 0 | 39 | 0 | 0 | 1 | 0 |
| Lane Group Flow (vph) | 0 | 14 | 69 | 542 | 10 | 0 | 51 | 407 | 0 | 7 | 545 | 0 |
| Confl. Peds. (#/hr) | 1 | | 1 | 1 | | 1 | | | 2 | | | 8 |
| Heavy Vehicles (%) | 0% | 0% | 4% | 0% | 0% | 0% | 2% | 0% | 0% | 0% | 1% | 0% |
| Turn Type | Perm | NA | Perm | Perm | NA | | Prot | NA | | Prot | NA | |
| Protected Phases | | 4 | | | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | 4 | 8 | | | | | | | | |
| Actuated Green, G (s) | | 29.9 | 29.9 | 29.9 | 29.9 | | 5.4 | 32.8 | | 1.8 | 29.2 | |
| Effective Green, g (s) | | 29.9 | 29.9 | 29.9 | 29.9 | | 5.4 | 32.8 | | 1.8 | 29.2 | |
| Actuated g/C Ratio | | 0.40 | 0.40 | 0.40 | 0.40 | | 0.07 | 0.44 | | 0.02 | 0.39 | |
| Clearance Time (s) | | 3.5 | 3.5 | 3.5 | 3.5 | | 3.0 | 4.0 | | 3.0 | 4.0 | |
| Vehicle Extension (s) | | 2.0 | 2.0 | 2.5 | 2.5 | | 2.0 | 4.0 | | 2.0 | 4.0 | |
| Lane Grp Cap (vph) | | 720 | 611 | 566 | 660 | | 127 | 1508 | | 43 | 1390 | |
| v/s Ratio Prot | | | | | 0.01 | | c0.03 | 0.12 | | 0.00 | c0.15 | |
| v/s Ratio Perm | | 0.01 | 0.04 | c0.38 | | | | | | | | |
| v/c Ratio | | 0.02 | 0.11 | 0.96 | 0.02 | | 0.40 | 0.27 | | 0.16 | 0.39 | |
| Uniform Delay, d1 | | 13.7 | 14.2 | 21.9 | 13.6 | | 33.3 | 13.5 | | 35.9 | 16.5 | |
| Progression Factor | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.37 | 0.44 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 0.0 | 0.0 | 27.2 | 0.0 | | 0.7 | 0.4 | | 0.7 | 0.8 | |
| Delay (s) | | 13.7 | 14.2 | 49.2 | 13.6 | | 46.4 | 6.4 | | 36.5 | 17.3 | |
| Level of Service | | B | B | D | B | | D | A | | D | B | |
| Approach Delay (s) | | 14.2 | | | 48.0 | | | 10.5 | | | 17.6 | |
| Approach LOS | | B | | | D | | | B | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 24.8 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.65 | | |
| Actuated Cycle Length (s) | 75.0 | Sum of lost time (s) | 10.5 |
| Intersection Capacity Utilization | 71.7% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 680 | 205 | 0 | 886 | 662 | 234 |
| Future Volume (vph) | 680 | 205 | 0 | 886 | 662 | 234 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | | 5.0 | 5.0 | |
| Lane Util. Factor | 0.97 | 1.00 | | 0.95 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 0.99 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.85 | | 1.00 | 0.96 | |
| Flt Protected | 0.95 | 1.00 | | 1.00 | 1.00 | |
| Satd. Flow (prot) | 3467 | 1563 | | 3574 | 3443 | |
| Flt Permitted | 0.95 | 1.00 | | 1.00 | 1.00 | |
| Satd. Flow (perm) | 3467 | 1563 | | 3574 | 3443 | |
| Peak-hour factor, PHF | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Adj. Flow (vph) | 694 | 209 | 0 | 904 | 676 | 239 |
| RTOR Reduction (vph) | 0 | 81 | 0 | 0 | 51 | 0 |
| Lane Group Flow (vph) | 694 | 128 | 0 | 904 | 864 | 0 |
| Confl. Peds. (#/hr) | | 1 | | | | |
| Heavy Vehicles (%) | 1% | 2% | 0% | 1% | 1% | 0% |
| Turn Type | Prot | Perm | | NA | NA | |
| Protected Phases | 4 | | | 2 | 6 | |
| Permitted Phases | | 4 | | | | |
| Actuated Green, G (s) | 31.0 | 31.0 | | 31.0 | 31.0 | |
| Effective Green, g (s) | 31.0 | 31.0 | | 31.0 | 31.0 | |
| Actuated g/C Ratio | 0.44 | 0.44 | | 0.44 | 0.44 | |
| Clearance Time (s) | 3.0 | 3.0 | | 5.0 | 5.0 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 1535 | 692 | | 1582 | 1524 | |
| v/s Ratio Prot | c0.20 | | | c0.25 | 0.25 | |
| v/s Ratio Perm | | 0.08 | | | | |
| v/c Ratio | 0.45 | 0.18 | | 0.57 | 0.57 | |
| Uniform Delay, d1 | 13.6 | 11.8 | | 14.5 | 14.5 | |
| Progression Factor | 1.00 | 1.00 | | 0.54 | 1.00 | |
| Incremental Delay, d2 | 1.0 | 0.6 | | 1.4 | 1.5 | |
| Delay (s) | 14.5 | 12.4 | | 9.3 | 16.0 | |
| Level of Service | B | B | | A | B | |
| Approach Delay (s) | 14.1 | | | 9.3 | 16.0 | |
| Approach LOS | B | | | A | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 13.1 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.51 | | |
| Actuated Cycle Length (s) | 70.0 | Sum of lost time (s) | 8.0 |
| Intersection Capacity Utilization | 55.8% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group





| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 114 | 43 | 610 | 127 | 140 | 525 |
| Future Volume (vph) | 114 | 43 | 610 | 127 | 140 | 525 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.2 | 3.2 | 4.4 | | 3.0 | 4.4 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 0.85 | 0.98 | | 1.00 | 1.00 |
| Flt Protected | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 1615 | 1848 | | 1770 | 1881 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | 1805 | 1615 | 1848 | | 1770 | 1881 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 119 | 45 | 635 | 132 | 146 | 547 |
| RTOR Reduction (vph) | 0 | 41 | 9 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 119 | 4 | 758 | 0 | 146 | 547 |
| Confl. Peds. (#/hr) | | | | 2 | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 2% | 1% |
| Turn Type | Prot | Perm | NA | | Prot | NA |
| Protected Phases | 8 | | 2 | | 1 | 6 |
| Permitted Phases | | 8 | | | | |
| Actuated Green, G (s) | 6.4 | 6.4 | 45.0 | | 8.0 | 56.0 |
| Effective Green, g (s) | 6.4 | 6.4 | 45.0 | | 8.0 | 56.0 |
| Actuated g/C Ratio | 0.09 | 0.09 | 0.64 | | 0.11 | 0.80 |
| Clearance Time (s) | 3.2 | 3.2 | 4.4 | | 3.0 | 4.4 |
| Vehicle Extension (s) | 1.0 | 1.0 | 1.0 | | 1.0 | 1.0 |
| Lane Grp Cap (vph) | 165 | 147 | 1188 | | 202 | 1504 |
| v/s Ratio Prot | c0.07 | | c0.41 | | c0.08 | 0.29 |
| v/s Ratio Perm | | 0.00 | | | | |
| v/c Ratio | 0.72 | 0.03 | 0.64 | | 0.72 | 0.36 |
| Uniform Delay, d1 | 30.9 | 29.0 | 7.6 | | 29.9 | 2.0 |
| Progression Factor | 1.00 | 1.00 | 0.74 | | 0.90 | 0.66 |
| Incremental Delay, d2 | 12.3 | 0.0 | 2.5 | | 9.1 | 0.6 |
| Delay (s) | 43.3 | 29.0 | 8.1 | | 36.1 | 1.9 |
| Level of Service | D | C | A | | D | A |
| Approach Delay (s) | 39.4 | | 8.1 | | | 9.1 |
| Approach LOS | D | | A | | | A |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 11.7 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.66 | | |
| Actuated Cycle Length (s) | 70.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 64.3% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 38: Nave Dr & Hamilton Pkwy

02/15/2018

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 78 | 299 | 319 | 45 | 260 | 244 |
| Future Volume (vph) | 78 | 299 | 319 | 45 | 260 | 244 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.2 | 3.2 | 4.4 | 4.4 | 3.0 | 4.4 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.85 | 1.00 | 0.85 | 1.00 | 1.00 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (prot) | 1770 | 1599 | 1900 | 1578 | 1787 | 1850 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (perm) | 1770 | 1599 | 1900 | 1578 | 1787 | 1900 |
| Peak-hour factor, PHF | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Adj. Flow (vph) | 86 | 329 | 351 | 49 | 286 | 268 |
| RTOR Reduction (vph) | 0 | 289 | 0 | 18 | 0 | 0 |
| Lane Group Flow (vph) | 86 | 40 | 351 | 31 | 286 | 268 |
| Confl. Peds. (#/hr) | | | | 2 | | |
| Heavy Vehicles (%) | 2% | 1% | 0% | 0% | 1% | 0% |
| Turn Type | Prot | Perm | NA | Perm | Prot | NA |
| Protected Phases | 8 | | 2 | | 1 | 6 |
| Permitted Phases | | 8 | | 2 | | |
| Actuated Green, G (s) | 8.6 | 8.6 | 32.6 | 32.6 | 18.2 | 53.8 |
| Effective Green, g (s) | 8.6 | 8.6 | 32.6 | 32.6 | 18.2 | 53.8 |
| Actuated g/C Ratio | 0.12 | 0.12 | 0.47 | 0.47 | 0.26 | 0.77 |
| Clearance Time (s) | 3.2 | 3.2 | 4.4 | 4.4 | 3.0 | 4.4 |
| Vehicle Extension (s) | 2.0 | 2.0 | 3.0 | 3.0 | 2.0 | 3.0 |
| Lane Grp Cap (vph) | 217 | 196 | 884 | 734 | 464 | 1421 |
| v/s Ratio Prot | c0.05 | | c0.18 | | c0.16 | 0.14 |
| v/s Ratio Perm | | 0.03 | | 0.02 | | |
| v/c Ratio | 0.40 | 0.21 | 0.40 | 0.04 | 0.62 | 0.19 |
| Uniform Delay, d1 | 28.3 | 27.6 | 12.3 | 10.2 | 22.8 | 2.2 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 0.87 | 0.29 |
| Incremental Delay, d2 | 0.4 | 0.2 | 1.3 | 0.1 | 1.6 | 0.3 |
| Delay (s) | 28.7 | 27.8 | 13.6 | 10.3 | 21.5 | 0.9 |
| Level of Service | C | C | B | B | C | A |
| Approach Delay (s) | 28.0 | | 13.2 | | | 11.5 |
| Approach LOS | C | | B | | | B |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 17.0 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.46 | | |
| Actuated Cycle Length (s) | 70.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 50.6% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 39: Nave Dr & Main Gate Dr

02/15/2018

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 219 | 87 | 263 | 205 | 96 | 241 |
| Future Volume (vph) | 219 | 87 | 263 | 205 | 96 | 241 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | 4.1 | 4.1 | 3.0 | 4.4 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.85 | 1.00 | 0.85 | 1.00 | 1.00 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 1615 | 1900 | 1615 | 1805 | 1881 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (perm) | 1805 | 1615 | 1900 | 1615 | 1805 | 1881 |
| Peak-hour factor, PHF | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Adj. Flow (vph) | 241 | 96 | 289 | 225 | 105 | 265 |
| RTOR Reduction (vph) | 0 | 75 | 0 | 143 | 0 | 0 |
| Lane Group Flow (vph) | 241 | 21 | 289 | 82 | 105 | 265 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 1% |
| Turn Type | Prot | Perm | NA | Perm | Prot | NA |
| Protected Phases | 8 | | 2 | | 1 | 6 |
| Permitted Phases | | 8 | | 2 | | |
| Actuated Green, G (s) | 8.2 | 8.2 | 13.8 | 13.8 | 5.6 | 22.1 |
| Effective Green, g (s) | 8.2 | 8.2 | 13.8 | 13.8 | 5.6 | 22.1 |
| Actuated g/C Ratio | 0.22 | 0.22 | 0.37 | 0.37 | 0.15 | 0.59 |
| Clearance Time (s) | 3.0 | 3.0 | 4.1 | 4.1 | 3.0 | 4.4 |
| Vehicle Extension (s) | 2.0 | 2.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| Lane Grp Cap (vph) | 392 | 351 | 695 | 591 | 268 | 1102 |
| v/s Ratio Prot | c0.13 | | c0.15 | | c0.06 | 0.14 |
| v/s Ratio Perm | | 0.01 | | 0.05 | | |
| v/c Ratio | 0.61 | 0.06 | 0.42 | 0.14 | 0.39 | 0.24 |
| Uniform Delay, d1 | 13.3 | 11.7 | 8.9 | 8.0 | 14.5 | 3.8 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 2.0 | 0.0 | 0.1 | 0.0 | 0.3 | 0.0 |
| Delay (s) | 15.3 | 11.7 | 9.1 | 8.0 | 14.9 | 3.8 |
| Level of Service | B | B | A | A | B | A |
| Approach Delay (s) | 14.3 | | 8.6 | | | 6.9 |
| Approach LOS | B | | A | | | A |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 9.7 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.47 | | |
| Actuated Cycle Length (s) | 37.7 | Sum of lost time (s) | 10.1 |
| Intersection Capacity Utilization | 46.1% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
## 40: Nave Dr & Bolling Dr

02/15/2018

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 194 | 43 | 438 | 323 | 82 | 423 |
| Future Volume (vph) | 194 | 43 | 438 | 323 | 82 | 423 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | 4.1 | | 3.0 | 3.5 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 0.97 | 1.00 | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 0.85 | 0.94 | | 1.00 | 1.00 |
| Flt Protected | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | 1787 | 1571 | 1781 | | 1805 | 1881 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | 1787 | 1571 | 1781 | | 1805 | 1881 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 202 | 45 | 456 | 336 | 85 | 441 |
| RTOR Reduction (vph) | 0 | 35 | 31 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 202 | 10 | 761 | 0 | 85 | 441 |
| Confl. Peds. (#/hr) | | 6 | | | | |
| Heavy Vehicles (%) | 1% | 0% | 1% | 0% | 0% | 1% |
| Turn Type | Prot | Perm | NA | | Prot | NA |
| Protected Phases | 4 | | 6 | | 5 | 2 |
| Permitted Phases | | 4 | | | | |
| Actuated Green, G (s) | 13.8 | 13.8 | 31.0 | | 6.5 | 41.1 |
| Effective Green, g (s) | 13.8 | 13.8 | 31.0 | | 6.5 | 41.1 |
| Actuated g/C Ratio | 0.22 | 0.22 | 0.50 | | 0.11 | 0.67 |
| Clearance Time (s) | 3.0 | 3.0 | 4.1 | | 3.0 | 3.5 |
| Vehicle Extension (s) | 2.0 | 2.0 | 2.0 | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 401 | 353 | 899 | | 191 | 1259 |
| v/s Ratio Prot | c0.11 | | c0.43 | | c0.05 | 0.23 |
| v/s Ratio Perm | | 0.01 | | | | |
| v/c Ratio | 0.50 | 0.03 | 0.85 | | 0.45 | 0.35 |
| Uniform Delay, d1 | 20.8 | 18.6 | 13.1 | | 25.8 | 4.4 |
| Progression Factor | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.4 | 0.0 | 7.1 | | 0.6 | 0.1 |
| Delay (s) | 21.2 | 18.6 | 20.3 | | 26.4 | 4.4 |
| Level of Service | C | B | C | | C | A |
| Approach Delay (s) | 20.7 | | 20.3 | | | 8.0 |
| Approach LOS | C | | C | | | A |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 16.2 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.70 | | |
| Actuated Cycle Length (s) | 61.4 | Sum of lost time (s) | 10.1 |
| Intersection Capacity Utilization | 72.8% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM 2010 AWSC
## 41: Alameda Del Prado & Clay Ct/Nave Dr

02/15/2018

| Intersection | |
|---|---|
| Intersection Delay, s/veh | 14.8 |
| Intersection LOS | B |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 8 | 10 | 1 | 102 | 20 | 683 | 0 | 67 | 37 | 180 | 68 | 12 |
| Future Vol, veh/h | 8 | 10 | 1 | 102 | 20 | 683 | 0 | 67 | 37 | 180 | 68 | 12 |
| Peak Hour Factor | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 8 | 10 | 1 | 105 | 21 | 704 | 0 | 69 | 38 | 186 | 70 | 12 |
| Number of Lanes | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Opposing Approach | WB | EB | SB | NB |
| Opposing Lanes | 2 | 1 | 2 | 1 |
| Conflicting Approach Left | SB | NB | EB | WB |
| Conflicting Lanes Left | 2 | 1 | 1 | 2 |
| Conflicting Approach Right | NB | SB | WB | EB |
| Conflicting Lanes Right | 1 | 2 | 2 | 1 |
| HCM Control Delay | 10.1 | 15.9 | 11.2 | 13 |
| HCM LOS | B | C | B | B |

| Lane | NBLn1 | EBLn1 | WBLn1 | WBLn2 | SBLn1 | SBLn2 |
|---|---|---|---|---|---|---|
| Vol Left, % | 0% | 42% | 25% | 0% | 100% | 0% |
| Vol Thru, % | 64% | 53% | 5% | 0% | 0% | 85% |
| Vol Right, % | 36% | 5% | 70% | 100% | 0% | 15% |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 104 | 19 | 409 | 396 | 180 | 80 |
| LT Vol | 0 | 8 | 102 | 0 | 180 | 0 |
| Through Vol | 67 | 10 | 20 | 0 | 0 | 68 |
| RT Vol | 37 | 1 | 287 | 396 | 0 | 12 |
| Lane Flow Rate | 107 | 20 | 422 | 408 | 186 | 82 |
| Geometry Grp | 6 | 6 | 7 | 7 | 7 | 7 |
| Degree of Util (X) | 0.196 | 0.037 | 0.636 | 0.578 | 0.37 | 0.15 |
| Departure Headway (Hd) | 6.579 | 6.806 | 5.434 | 5.098 | 7.183 | 6.569 |
| Convergence, Y/N | Yes | Yes | Yes | Yes | Yes | Yes |
| Cap | 546 | 526 | 666 | 707 | 501 | 546 |
| Service Time | 4.615 | 4.854 | 3.164 | 2.827 | 4.919 | 4.305 |
| HCM Lane V/C Ratio | 0.196 | 0.038 | 0.634 | 0.577 | 0.371 | 0.15 |
| HCM Control Delay | 11.2 | 10.1 | 17.2 | 14.6 | 14.1 | 10.5 |
| HCM Lane LOS | B | B | C | B | B | B |
| HCM 95th-tile Q | 0.7 | 0.1 | 4.6 | 3.7 | 1.7 | 0.5 |

## HCM 2010 AWSC
1: Simmons Ln & San Marin Dr

02/15/2018

| Intersection | |
|---|---|
| Intersection Delay, s/veh | 46.9 |
| Intersection LOS | E |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 15 | 531 | 129 | 191 | 458 | 9 | 113 | 12 | 315 | 29 | 13 | 15 |
| Future Vol, veh/h | 15 | 531 | 129 | 191 | 458 | 9 | 113 | 12 | 315 | 29 | 13 | 15 |
| Peak Hour Factor | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| Heavy Vehicles, % | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Mvmt Flow | 16 | 571 | 139 | 205 | 492 | 10 | 122 | 13 | 339 | 31 | 14 | 16 |
| Number of Lanes | 1 | 2 | 0 | 1 | 2 | 0 | 0 | 1 | 1 | 0 | 1 | 0 |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Opposing Approach | WB | EB | SB | NB |
| Opposing Lanes | 3 | 3 | 1 | 2 |
| Conflicting Approach Left | SB | NB | EB | WB |
| Conflicting Lanes Left | 1 | 2 | 3 | 3 |
| Conflicting Approach Right | NB | SB | WB | EB |
| Conflicting Lanes Right | 2 | 1 | 3 | 3 |
| HCM Control Delay | 63.1 | 35.1 | 43.6 | 17.5 |
| HCM LOS | F | E | E | C |

| Lane | NBLn1 | NBLn2 | EBLn1 | EBLn2 | EBLn3 | WBLn1 | WBLn2 | WBLn3 | SBLn1 |
|---|---|---|---|---|---|---|---|---|---|
| Vol Left, % | 90% | 0% | 100% | 0% | 0% | 100% | 0% | 0% | 51% |
| Vol Thru, % | 10% | 0% | 0% | 100% | 58% | 0% | 100% | 94% | 23% |
| Vol Right, % | 0% | 100% | 0% | 0% | 42% | 0% | 0% | 6% | 26% |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 125 | 315 | 15 | 354 | 306 | 191 | 305 | 162 | 57 |
| LT Vol | 113 | 0 | 15 | 0 | 0 | 191 | 0 | 0 | 29 |
| Through Vol | 12 | 0 | 0 | 354 | 177 | 0 | 305 | 153 | 13 |
| RT Vol | 0 | 315 | 0 | 0 | 129 | 0 | 0 | 9 | 15 |
| Lane Flow Rate | 134 | 339 | 16 | 381 | 329 | 205 | 328 | 174 | 61 |
| Geometry Grp | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Degree of Util (X) | 0.395 | 0.885 | 0.045 | 1.009 | 0.844 | 0.57 | 0.863 | 0.455 | 0.2 |
| Departure Headway (Hd) | 10.58 | 9.401 | 10.062 | 9.54 | 9.233 | 9.984 | 9.462 | 9.421 | 11.766 |
| Convergence, Y/N | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Cap | 340 | 386 | 357 | 381 | 395 | 364 | 384 | 384 | 305 |
| Service Time | 8.345 | 7.165 | 7.786 | 7.265 | 6.957 | 7.704 | 7.182 | 7.141 | 9.536 |
| HCM Lane V/C Ratio | 0.394 | 0.878 | 0.045 | 1 | 0.833 | 0.563 | 0.854 | 0.453 | 0.2 |
| HCM Control Delay | 20.1 | 52.9 | 13.3 | 80.2 | 45.8 | 25.2 | 49.4 | 19.8 | 17.5 |
| HCM Lane LOS | C | F | B | F | E | D | E | C | C |
| HCM 95th-tile Q | 1.8 | 8.8 | 0.1 | 12.1 | 7.9 | 3.4 | 8.3 | 2.3 | 0.7 |



## HCM Signalized Intersection Capacity Analysis
1: Simmons Ln & San Marin Dr

02/23/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 15 | 531 | 129 | 191 | 458 | 9 | 113 | 12 | 315 | 29 | 13 | 15 |
| Future Volume (vph) | 15 | 531 | 129 | 191 | 458 | 9 | 113 | 12 | 315 | 29 | 13 | 15 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | | 4.0 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | | 1.00 | 0.85 | | 0.96 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 0.96 | 1.00 | | 0.98 | |
| Satd. Flow (prot) | 1787 | 1881 | 1599 | 1787 | 1881 | 1599 | | 1800 | 1599 | | 1770 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 0.77 | 1.00 | | 0.83 | |
| Satd. Flow (perm) | 1787 | 1881 | 1599 | 1787 | 1881 | 1599 | | 1445 | 1599 | | 1497 | |
| Peak-hour factor, PHF | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| Adj. Flow (vph) | 16 | 571 | 139 | 205 | 492 | 10 | 122 | 13 | 339 | 31 | 14 | 16 |
| RTOR Reduction (vph) | 0 | 0 | 62 | 0 | 0 | 4 | 0 | 0 | 108 | 0 | 13 | 0 |
| Lane Group Flow (vph) | 16 | 571 | 77 | 205 | 492 | 6 | 0 | 135 | 231 | 0 | 48 | 0 |
| Heavy Vehicles (%) | 1% | 1% | 1% | 1% | 1% | 1% | 1% | 1% | 1% | 1% | 1% | 1% |
| Turn Type | Prot | NA | Perm | Prot | NA | Perm | Perm | NA | pm+ov | Perm | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | | 2 | 3 | | 6 | |
| Permitted Phases | | | 4 | | | 8 | 2 | | 2 | 6 | | |
| Actuated Green, G (s) | 0.6 | 28.5 | 28.5 | 12.5 | 40.4 | 40.4 | | 13.0 | 25.5 | | 13.0 | |
| Effective Green, g (s) | 0.6 | 28.5 | 28.5 | 12.5 | 40.4 | 40.4 | | 13.0 | 25.5 | | 13.0 | |
| Actuated g/C Ratio | 0.01 | 0.43 | 0.43 | 0.19 | 0.61 | 0.61 | | 0.20 | 0.39 | | 0.20 | |
| Clearance Time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | | 4.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | |
| Lane Grp Cap (vph) | 16 | 812 | 690 | 338 | 1151 | 978 | | 284 | 714 | | 294 | |
| v/s Ratio Prot | 0.01 | c0.30 | | c0.11 | 0.26 | | | | c0.06 | | | |
| v/s Ratio Perm | | | 0.05 | | | 0.00 | | c0.09 | 0.08 | | 0.03 | |
| v/c Ratio | 1.00 | 0.70 | 0.11 | 0.61 | 0.43 | 0.01 | | 0.48 | 0.32 | | 0.16 | |
| Uniform Delay, d1 | 32.7 | 15.3 | 11.2 | 24.5 | 6.7 | 5.0 | | 23.5 | 14.2 | | 22.0 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | |
| Incremental Delay, d2 | 225.0 | 2.8 | 0.1 | 3.1 | 0.3 | 0.0 | | 1.3 | 0.3 | | 0.3 | |
| Delay (s) | 257.7 | 18.1 | 11.3 | 27.6 | 7.0 | 5.0 | | 24.7 | 14.5 | | 22.3 | |
| Level of Service | F | B | B | C | A | A | | C | B | | C | |
| Approach Delay (s) | | 22.1 | | | 12.9 | | | 17.4 | | | 22.3 | |
| Approach LOS | | C | | | B | | | B | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 17.7 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.63 | | |
| Actuated Cycle Length (s) | 66.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 60.8% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

# MOVEMENT SUMMARY

**Site: 1 [AM E+P]**

Simmons Lane/San Marin Drive
AM Existing plus Project
Roundabout

**Movement Performance - Vehicles**

| Mov ID | OD Mov | Demand Flows Total veh/h | Demand Flows HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance ft | Prop. Queued | Effective Stop Rate per veh | Average Speed mph |
|---|---|---|---|---|---|---|---|---|---|---|---|
| South: NB Simmons Ln | | | | | | | | | | | |
| 3 | L2 | 122 | 2.0 | 0.665 | 17.9 | LOS B | 6.3 | 160.4 | 0.84 | 1.08 | 28.6 |
| 8 | T1 | 13 | 2.0 | 0.665 | 17.9 | LOS B | 6.3 | 160.4 | 0.84 | 1.08 | 28.6 |
| 18 | R2 | 339 | 2.0 | 0.665 | 17.9 | LOS B | 6.3 | 160.4 | 0.84 | 1.08 | 27.9 |
| Approach | | 473 | 2.0 | 0.665 | 17.9 | LOS B | 6.3 | 160.4 | 0.84 | 1.08 | 28.1 |
| East: WB San Marin Drive | | | | | | | | | | | |
| 1 | L2 | 205 | 2.0 | 0.170 | 4.4 | LOS A | 0.7 | 18.7 | 0.30 | 0.17 | 32.6 |
| 6 | T1 | 492 | 2.0 | 0.415 | 7.1 | LOS A | 2.4 | 60.6 | 0.39 | 0.25 | 33.7 |
| 16 | R2 | 10 | 2.0 | 0.415 | 7.1 | LOS A | 2.4 | 60.6 | 0.39 | 0.25 | 32.8 |
| Approach | | 708 | 2.0 | 0.415 | 6.4 | LOS A | 2.4 | 60.6 | 0.36 | 0.23 | 33.4 |
| North: SB Simmons Ln | | | | | | | | | | | |
| 7 | L2 | 31 | 2.0 | 0.090 | 6.2 | LOS A | 0.3 | 7.8 | 0.57 | 0.56 | 32.9 |
| 4 | T1 | 14 | 2.0 | 0.090 | 6.2 | LOS A | 0.3 | 7.8 | 0.57 | 0.56 | 32.9 |
| 14 | R2 | 16 | 2.0 | 0.090 | 6.2 | LOS A | 0.3 | 7.8 | 0.57 | 0.56 | 32.1 |
| Approach | | 61 | 2.0 | 0.090 | 6.2 | LOS A | 0.3 | 7.8 | 0.57 | 0.56 | 32.7 |
| West: EB San Marin Drive | | | | | | | | | | | |
| 5 | L2 | 16 | 2.0 | 0.696 | 14.4 | LOS B | 10.8 | 275.4 | 0.77 | 0.83 | 30.5 |
| 2 | T1 | 571 | 2.0 | 0.696 | 14.4 | LOS B | 10.8 | 275.4 | 0.77 | 0.83 | 30.5 |
| 12 | R2 | 139 | 2.0 | 0.696 | 14.4 | LOS B | 10.8 | 275.4 | 0.77 | 0.83 | 29.7 |
| Approach | | 726 | 2.0 | 0.696 | 14.4 | LOS B | 10.8 | 275.4 | 0.77 | 0.83 | 30.3 |
| All Vehicles | | 1968 | 2.0 | 0.696 | 12.1 | LOS B | 10.8 | 275.4 | 0.63 | 0.66 | 30.8 |

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.


Organisation: W-TRANS | Processed: Tuesday, February 27, 2018 3:47:18 PM
Project: N:\AAA\MAX\NOV\126NOV\SIDRA\Simmons-San Marin.sip7



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 13 | 893 | 2 | 2 | 670 | 77 | 1 | 0 | 4 | 8 | 0 | 1 |
| Future Volume (vph) | 13 | 893 | 2 | 2 | 670 | 77 | 1 | 0 | 4 | 8 | 0 | 1 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.8 | | 4.0 | 4.8 | 4.8 | | 4.0 | | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 | | 1.00 | | 0.95 | 0.95 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | | 1.00 | 1.00 | 0.85 | | 0.89 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | | 0.99 | | 0.95 | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 3573 | | 1805 | 3574 | 1615 | | 1678 | | 1715 | 1715 | 1615 |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1805 | 3573 | | 1805 | 3574 | 1615 | | 1695 | | 1805 | 1805 | 1615 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 14 | 971 | 2 | 2 | 728 | 84 | 1 | 0 | 4 | 9 | 0 | 1 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 39 | 0 | 5 | 0 | 0 | 0 | 1 |
| Lane Group Flow (vph) | 14 | 973 | 0 | 2 | 728 | 45 | 0 | 0 | 0 | 4 | 5 | 0 |
| Confl. Peds. (#/hr) | | | 2 | | | | | | | | | |
| Heavy Vehicles (%) | 0% | 1% | 0% | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Prot | NA | | Prot | NA | Perm | Perm | NA | | Perm | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | | | | 6 | 8 | | | 4 | | 4 |
| Actuated Green, G (s) | 0.8 | 16.4 | | 0.7 | 16.3 | 16.3 | | 0.8 | | 0.8 | 0.8 | 0.8 |
| Effective Green, g (s) | 0.8 | 16.4 | | 0.7 | 16.3 | 16.3 | | 0.8 | | 0.8 | 0.8 | 0.8 |
| Actuated g/C Ratio | 0.03 | 0.53 | | 0.02 | 0.53 | 0.53 | | 0.03 | | 0.03 | 0.03 | 0.03 |
| Clearance Time (s) | 4.0 | 4.8 | | 4.0 | 4.8 | 4.8 | | 4.0 | | 4.0 | 4.0 | 4.0 |
| Vehicle Extension (s) | 2.0 | 4.0 | | 2.0 | 4.0 | 4.0 | | 2.0 | | 2.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 47 | 1908 | | 41 | 1897 | 857 | | 44 | | 47 | 47 | 42 |
| v/s Ratio Prot | c0.01 | c0.27 | | 0.00 | 0.20 | | | | | | | |
| v/s Ratio Perm | | | | | | 0.03 | | 0.00 | | 0.00 | c0.00 | 0.00 |
| v/c Ratio | 0.30 | 0.51 | | 0.05 | 0.38 | 0.05 | | 0.00 | | 0.09 | 0.11 | 0.00 |
| Uniform Delay, d1 | 14.7 | 4.6 | | 14.7 | 4.2 | 3.5 | | 14.6 | | 14.6 | 14.6 | 14.6 |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 1.3 | 0.3 | | 0.2 | 0.2 | 0.0 | | 0.0 | | 0.3 | 0.4 | 0.0 |
| Delay (s) | 16.0 | 4.9 | | 14.9 | 4.4 | 3.5 | | 14.6 | | 14.9 | 15.0 | 14.6 |
| Level of Service | B | A | | B | A | A | | B | | B | B | B |
| Approach Delay (s) | | 5.0 | | | 4.4 | | | 14.6 | | | 14.9 | |
| Approach LOS | | A | | | A | | | B | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 4.8 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.49 | | |
| Actuated Cycle Length (s) | 30.7 | Sum of lost time (s) | 12.8 |
| Intersection Capacity Utilization | 45.9% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 3: San Marin Dr & E Campus Drive

02/15/2018

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 0 | 906 | 747 | 20 | 11 | 0 |
| Future Volume (vph) | 0 | 906 | 747 | 20 | 11 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.3 | 4.3 | 4.3 | 3.0 | |
| Lane Util. Factor | | 0.95 | 0.95 | 1.00 | 0.97 | |
| Frpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | | 1.00 | 1.00 | 0.85 | 1.00 | |
| Flt Protected | | 1.00 | 1.00 | 1.00 | 0.95 | |
| Satd. Flow (prot) | | 3574 | 3574 | 1615 | 3502 | |
| Flt Permitted | | 1.00 | 1.00 | 1.00 | 0.95 | |
| Satd. Flow (perm) | | 3574 | 3574 | 1615 | 3502 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 0 | 985 | 812 | 22 | 12 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 3 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 985 | 812 | 19 | 12 | 0 |
| Confl. Peds. (#/hr) | | | | | | 1 |
| Heavy Vehicles (%) | 0% | 1% | 1% | 0% | 0% | 0% |
| Turn Type | Prot | NA | NA | Perm | Perm | Perm |
| Protected Phases | 5 | 2 | 6 | | | |
| Permitted Phases | | | | 6 | 4 | 4 |
| Actuated Green, G (s) | | 115.1 | 115.1 | 115.1 | 7.6 | |
| Effective Green, g (s) | | 115.1 | 115.1 | 115.1 | 7.6 | |
| Actuated g/C Ratio | | 0.89 | 0.89 | 0.89 | 0.06 | |
| Clearance Time (s) | | 4.3 | 4.3 | 4.3 | 3.0 | |
| Vehicle Extension (s) | | 4.0 | 4.0 | 4.0 | 2.0 | |
| Lane Grp Cap (vph) | | 3164 | 3164 | 1429 | 204 | |
| v/s Ratio Prot | | c0.28 | 0.23 | | | |
| v/s Ratio Perm | | | | 0.01 | c0.00 | |
| v/c Ratio | | 0.31 | 0.26 | 0.01 | 0.06 | |
| Uniform Delay, d1 | | 1.2 | 1.1 | 0.9 | 57.8 | |
| Progression Factor | | 1.00 | 0.91 | 1.09 | 1.00 | |
| Incremental Delay, d2 | | 0.3 | 0.1 | 0.0 | 0.0 | |
| Delay (s) | | 1.4 | 1.1 | 0.9 | 57.9 | |
| Level of Service | | A | A | A | E | |
| Approach Delay (s) | | 1.4 | 1.1 | | 57.9 | |
| Approach LOS | | A | A | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 1.6 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.30 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 10.3 |
| Intersection Capacity Utilization | 37.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

Novato General Plan Update EIR
AM Peak Hour Existing plus Project

W-Trans

## HCM Signalized Intersection Capacity Analysis
### 4: Redwood Blvd & San Marin Dr

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 67 | 689 | 165 | 352 | 590 | 670 | 134 | 133 | 302 | 170 | 58 | 43 |
| Future Volume (vph) | 67 | 689 | 165 | 352 | 590 | 670 | 134 | 133 | 302 | 170 | 58 | 43 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.6 | | 3.0 | 4.0 | | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 | |
| Lane Util. Factor | 1.00 | 0.91 | | 1.00 | 0.91 | | 0.97 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 0.99 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 0.97 | | 1.00 | 0.92 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.94 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1787 | 4972 | | 1752 | 4726 | | 3467 | 1881 | 1568 | 1787 | 1748 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1787 | 4972 | | 1752 | 4726 | | 3467 | 1881 | 1568 | 1787 | 1748 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 71 | 725 | 174 | 371 | 621 | 705 | 141 | 140 | 318 | 179 | 61 | 45 |
| RTOR Reduction (vph) | 0 | 31 | 0 | 0 | 115 | 0 | 0 | 0 | 283 | 0 | 23 | 0 |
| Lane Group Flow (vph) | 71 | 868 | 0 | 371 | 1211 | 0 | 141 | 140 | 35 | 179 | 83 | 0 |
| Confl. Peds. (#/hr) | | | 4 | | | | | | | | | 5 |
| Confl. Bikes (#/hr) | | | | | | | | | | | | 1 |
| Heavy Vehicles (%) | 1% | 1% | 1% | 3% | 1% | 1% | 1% | 1% | 3% | 1% | 1% | 1% |
| Turn Type | Prot | NA | | Prot | NA | | Split | NA | Perm | Split | NA | |
| Protected Phases | 1 | 6 | | 5 | 2 | | 7 | 7 | | 8 | 8 | |
| Permitted Phases | | | | | 2 | | | | 7 | | | |
| Actuated Green, G (s) | 8.2 | 44.8 | | 36.3 | 72.5 | | 14.4 | 14.4 | 14.4 | 19.3 | 19.3 | |
| Effective Green, g (s) | 8.2 | 44.8 | | 36.3 | 72.5 | | 14.4 | 14.4 | 14.4 | 19.3 | 19.3 | |
| Actuated g/C Ratio | 0.06 | 0.34 | | 0.28 | 0.56 | | 0.11 | 0.11 | 0.11 | 0.15 | 0.15 | |
| Clearance Time (s) | 3.0 | 3.6 | | 3.0 | 4.0 | | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 | |
| Vehicle Extension (s) | 2.0 | 4.0 | | 5.0 | 4.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 112 | 1713 | | 489 | 2635 | | 384 | 208 | 173 | 265 | 259 | |
| v/s Ratio Prot | 0.04 | c0.17 | | c0.21 | 0.26 | | 0.04 | c0.07 | | c0.10 | 0.05 | |
| v/s Ratio Perm | | | | | | | | | 0.02 | | | |
| v/c Ratio | 0.63 | 0.51 | | 0.76 | 0.46 | | 0.37 | 0.67 | 0.20 | 0.68 | 0.32 | |
| Uniform Delay, d1 | 59.4 | 33.8 | | 42.8 | 17.1 | | 53.6 | 55.5 | 52.6 | 52.4 | 49.5 | |
| Progression Factor | 1.15 | 0.93 | | 1.05 | 1.07 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 8.1 | 1.0 | | 6.6 | 0.5 | | 0.2 | 6.6 | 0.2 | 5.3 | 0.3 | |
| Delay (s) | 76.7 | 32.5 | | 51.6 | 18.8 | | 53.8 | 62.1 | 52.8 | 57.7 | 49.7 | |
| Level of Service | E | C | | D | B | | D | E | D | E | D | |
| Approach Delay (s) | | 35.8 | | | 26.0 | | | 55.2 | | | 54.7 | |
| Approach LOS | | D | | | C | | | E | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 35.9 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.64 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 15.6 |
| Intersection Capacity Utilization | 90.9% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 4: Redwood Blvd & San Marin Dr

02/23/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 67 | 689 | 165 | 352 | 590 | 670 | 134 | 133 | 302 | 170 | 58 | 43 |
| Future Volume (vph) | 67 | 689 | 165 | 352 | 590 | 670 | 134 | 133 | 302 | 170 | 58 | 43 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.6 | | 3.0 | 4.0 | 4.3 | 4.3 | 4.3 | 3.0 | 4.3 | 4.3 | |
| Lane Util. Factor | 1.00 | 0.91 | | 0.97 | 0.95 | 1.00 | 0.95 | 0.95 | 0.88 | 0.91 | 0.91 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 0.97 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.96 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.98 | |
| Satd. Flow (prot) | 1787 | 4972 | | 3400 | 3574 | 1599 | 1698 | 1779 | 2760 | 1626 | 3217 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.98 | |
| Satd. Flow (perm) | 1787 | 4972 | | 3400 | 3574 | 1599 | 1698 | 1779 | 2760 | 1626 | 3217 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 71 | 725 | 174 | 371 | 621 | 705 | 141 | 140 | 318 | 179 | 61 | 45 |
| RTOR Reduction (vph) | 0 | 27 | 0 | 0 | 0 | 75 | 0 | 0 | 222 | 0 | 28 | 0 |
| Lane Group Flow (vph) | 71 | 872 | 0 | 371 | 621 | 630 | 127 | 154 | 96 | 97 | 160 | 0 |
| Confl. Peds. (#/hr) | | | 4 | | | | | | | | | 5 |
| Confl. Bikes (#/hr) | | | | | | | | | | | | 1 |
| Heavy Vehicles (%) | 1% | 1% | 1% | 3% | 1% | 1% | 1% | 1% | 3% | 1% | 1% | 1% |
| Turn Type | Prot | NA | | Prot | NA | pm+ov | Split | NA | pm+ov | Split | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | 4 | 8 | 8 | 1 | 4 | 4 | |
| Permitted Phases | | | | | | 6 | | | 8 | | | |
| Actuated Green, G (s) | 8.0 | 55.1 | | 24.0 | 70.7 | 89.7 | 14.7 | 14.7 | 38.7 | 19.0 | 19.0 | |
| Effective Green, g (s) | 8.0 | 55.1 | | 24.0 | 70.7 | 89.7 | 14.7 | 14.7 | 38.7 | 19.0 | 19.0 | |
| Actuated g/C Ratio | 0.06 | 0.43 | | 0.19 | 0.55 | 0.70 | 0.11 | 0.11 | 0.30 | 0.15 | 0.15 | |
| Clearance Time (s) | 3.0 | 3.6 | | 3.0 | 4.0 | 4.3 | 4.3 | 4.3 | 3.0 | 4.3 | 4.3 | |
| Vehicle Extension (s) | 2.0 | 4.0 | | 5.0 | 4.0 | 2.0 | 2.0 | 2.0 | 5.0 | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 111 | 2140 | | 637 | 1974 | 1120 | 195 | 204 | 834 | 241 | 477 | |
| v/s Ratio Prot | c0.04 | 0.18 | | c0.11 | 0.17 | c0.08 | 0.07 | c0.09 | 0.02 | 0.06 | 0.05 | |
| v/s Ratio Perm | | | | | | 0.31 | | | 0.01 | | | |
| v/c Ratio | 0.64 | 0.41 | | 0.58 | 0.31 | 0.56 | 0.65 | 0.75 | 0.12 | 0.40 | 0.34 | |
| Uniform Delay, d1 | 58.6 | 25.2 | | 47.4 | 15.5 | 9.5 | 54.2 | 54.9 | 32.3 | 49.4 | 48.8 | |
| Progression Factor | 1.00 | 1.00 | | 0.79 | 0.63 | 1.46 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 8.6 | 0.6 | | 1.9 | 0.4 | 0.3 | 5.8 | 13.1 | 0.1 | 0.4 | 0.2 | |
| Delay (s) | 67.2 | 25.8 | | 39.5 | 10.1 | 14.1 | 60.0 | 68.0 | 32.4 | 49.8 | 49.0 | |
| Level of Service | E | C | | D | B | B | E | E | C | D | D | |
| Approach Delay (s) | | 28.8 | | | 18.2 | | | 47.4 | | | 49.3 | |
| Approach LOS | | C | | | B | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 28.5 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.59 | | |
| Actuated Cycle Length (s) | 128.0 | Sum of lost time (s) | 15.6 |
| Intersection Capacity Utilization | 81.4% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 5: US 101 SB Ramps & San Marin Dr

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 655 | 509 | 133 | 1033 | 0 | 0 | 0 | 0 | 92 | 1 | 579 |
| Future Volume (vph) | 0 | 655 | 509 | 133 | 1033 | 0 | 0 | 0 | 0 | 92 | 1 | 579 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.9 | 4.9 | 3.0 | 5.3 | | | | | | 4.0 | 4.0 |
| Lane Util. Factor | | 0.95 | 1.00 | 1.00 | 0.95 | | | | | | 1.00 | 0.88 |
| Frpb, ped/bikes | | 1.00 | 0.99 | 1.00 | 1.00 | | | | | | 1.00 | 1.00 |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | | | | | 1.00 | 1.00 |
| Frt | | 1.00 | 0.85 | 1.00 | 1.00 | | | | | | 1.00 | 0.85 |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | | 0.95 | 1.00 |
| Satd. Flow (prot) | | 3574 | 1575 | 1805 | 3574 | | | | | | 1810 | 2814 |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | | 0.95 | 1.00 |
| Satd. Flow (perm) | | 3574 | 1575 | 1805 | 3574 | | | | | | 1810 | 2814 |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 0 | 697 | 541 | 141 | 1099 | 0 | 0 | 0 | 0 | 98 | 1 | 616 |
| RTOR Reduction (vph) | 0 | 0 | 275 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 128 |
| Lane Group Flow (vph) | 0 | 697 | 266 | 141 | 1099 | 0 | 0 | 0 | 0 | 0 | 99 | 488 |
| Confl. Peds. (#/hr) | | | 4 | | | | | | | | | |
| Heavy Vehicles (%) | 0% | 1% | 1% | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 1% |
| Turn Type | | NA | Perm | Prot | NA | | | | | Split | NA | Perm |
| Protected Phases | | 2 | | 1 | 6 | | | | | 4 | 4 | |
| Permitted Phases | | | 2 | | | | | | | | | 4 |
| Actuated Green, G (s) | | 31.9 | 31.9 | 6.8 | 41.3 | | | | | | 14.4 | 14.4 |
| Effective Green, g (s) | | 31.9 | 31.9 | 6.8 | 41.3 | | | | | | 14.4 | 14.4 |
| Actuated g/C Ratio | | 0.49 | 0.49 | 0.10 | 0.64 | | | | | | 0.22 | 0.22 |
| Clearance Time (s) | | 4.9 | 4.9 | 3.0 | 5.3 | | | | | | 4.0 | 4.0 |
| Vehicle Extension (s) | | 4.0 | 4.0 | 2.0 | 4.0 | | | | | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | | 1754 | 772 | 188 | 2270 | | | | | | 400 | 623 |
| v/s Ratio Prot | | 0.20 | | c0.08 | c0.31 | | | | | | 0.05 | |
| v/s Ratio Perm | | | 0.17 | | | | | | | | | c0.17 |
| v/c Ratio | | 0.40 | 0.34 | 0.75 | 0.48 | | | | | | 0.25 | 0.78 |
| Uniform Delay, d1 | | 10.5 | 10.1 | 28.3 | 6.2 | | | | | | 20.8 | 23.8 |
| Progression Factor | | 0.46 | 1.63 | 1.00 | 1.00 | | | | | | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.6 | 1.1 | 13.8 | 0.7 | | | | | | 0.1 | 5.9 |
| Delay (s) | | 5.4 | 17.6 | 42.1 | 7.0 | | | | | | 21.0 | 29.7 |
| Level of Service | | A | B | D | A | | | | | | C | C |
| Approach Delay (s) | | 10.7 | | | 11.0 | | | 0.0 | | | 28.5 | |
| Approach LOS | | B | | | B | | | A | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 14.8 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.62 | | |
| Actuated Cycle Length (s) | 65.0 | Sum of lost time (s) | 11.9 |
| Intersection Capacity Utilization | 58.4% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 6: US 101 NB Ramps & San Marin Dr

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 380 | 364 | 0 | 0 | 491 | 86 | 669 | 0 | 153 | 0 | 0 | 0 |
| Future Volume (vph) | 380 | 364 | 0 | 0 | 491 | 86 | 669 | 0 | 153 | 0 | 0 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.6 | | | 4.9 | 4.9 | 3.5 | 3.5 | | | | |
| Lane Util. Factor | 0.97 | 1.00 | | | 0.95 | 1.00 | 0.95 | 0.95 | | | | |
| Frpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | 0.99 | 1.00 | 0.99 | | | | |
| Flpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | | | |
| Frt | 1.00 | 1.00 | | | 1.00 | 0.85 | 1.00 | 0.94 | | | | |
| Flt Protected | 0.95 | 1.00 | | | 1.00 | 1.00 | 0.95 | 0.97 | | | | |
| Satd. Flow (prot) | 3467 | 1881 | | | 3574 | 1594 | 1681 | 1599 | | | | |
| Flt Permitted | 0.95 | 1.00 | | | 1.00 | 1.00 | 0.95 | 0.97 | | | | |
| Satd. Flow (perm) | 3467 | 1881 | | | 3574 | 1594 | 1681 | 1599 | | | | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 400 | 383 | 0 | 0 | 517 | 91 | 704 | 0 | 161 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 68 | 0 | 60 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 400 | 383 | 0 | 0 | 517 | 23 | 444 | 361 | 0 | 0 | 0 | 0 |
| Confl. Peds. (#/hr) | | | 3 | | | 1 | | | 1 | 1 | | |
| Heavy Vehicles (%) | 1% | 1% | 0% | 0% | 1% | 0% | 2% | 0% | 3% | 0% | 0% | 0% |
| Turn Type | Prot | NA | | | NA | Perm | Split | NA | | | | |
| Protected Phases | 5 | 2 | | | 6 | | 8 | 8 | | | | |
| Permitted Phases | | | | | | 6 | | | | | | |
| Actuated Green, G (s) | 10.2 | 27.7 | | | 13.7 | 13.7 | 18.9 | 18.9 | | | | |
| Effective Green, g (s) | 10.2 | 27.7 | | | 13.7 | 13.7 | 18.9 | 18.9 | | | | |
| Actuated g/C Ratio | 0.19 | 0.51 | | | 0.25 | 0.25 | 0.35 | 0.35 | | | | |
| Clearance Time (s) | 3.5 | 4.6 | | | 4.9 | 4.9 | 3.5 | 3.5 | | | | |
| Vehicle Extension (s) | 2.0 | 4.0 | | | 4.0 | 4.0 | 2.5 | 2.5 | | | | |
| Lane Grp Cap (vph) | 646 | 952 | | | 895 | 399 | 580 | 552 | | | | |
| v/s Ratio Prot | c0.12 | 0.20 | | | c0.14 | | c0.26 | 0.23 | | | | |
| v/s Ratio Perm | | | | | | 0.01 | | | | | | |
| v/c Ratio | 0.62 | 0.40 | | | 0.58 | 0.06 | 0.77 | 0.65 | | | | |
| Uniform Delay, d1 | 20.5 | 8.4 | | | 18.0 | 15.6 | 15.9 | 15.1 | | | | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | | | |
| Incremental Delay, d2 | 1.3 | 0.4 | | | 1.1 | 0.1 | 5.7 | 2.5 | | | | |
| Delay (s) | 21.7 | 8.7 | | | 19.1 | 15.7 | 21.7 | 17.6 | | | | |
| Level of Service | C | A | | | B | B | C | B | | | | |
| Approach Delay (s) | | 15.4 | | | 18.5 | | | 19.7 | | | 0.0 | |
| Approach LOS | | B | | | B | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 17.9 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.67 | | |
| Actuated Cycle Length (s) | 54.7 | Sum of lost time (s) | 11.9 |
| Intersection Capacity Utilization | 58.4% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 7: Redwood Blvd & Olive St

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 102 | 95 | 35 | 144 | 126 | 107 | 17 | 408 | 133 | 149 | 390 | 77 |
| Future Volume (vph) | 102 | 95 | 35 | 144 | 126 | 107 | 17 | 408 | 133 | 149 | 390 | 77 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 5.1 | 5.1 | | | 5.1 | | 4.0 | 3.9 | 3.9 | 4.0 | 3.9 | |
| Lane Util. Factor | 1.00 | 1.00 | | | 1.00 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | |
| Frt | 1.00 | 0.96 | | | 0.96 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.98 | |
| Flt Protected | 0.95 | 1.00 | | | 0.98 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1770 | 1787 | | | 1758 | | 1770 | 3539 | 1583 | 1770 | 3451 | |
| Flt Permitted | 0.95 | 1.00 | | | 0.98 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1770 | 1787 | | | 1758 | | 1770 | 3539 | 1583 | 1770 | 3451 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 111 | 103 | 38 | 157 | 137 | 116 | 18 | 443 | 145 | 162 | 424 | 84 |
| RTOR Reduction (vph) | 0 | 14 | 0 | 0 | 12 | 0 | 0 | 0 | 108 | 0 | 14 | 0 |
| Lane Group Flow (vph) | 111 | 127 | 0 | 0 | 398 | 0 | 18 | 443 | 37 | 162 | 494 | 0 |
| Turn Type | Split | NA | | Split | NA | | Prot | NA | Perm | Prot | NA | |
| Protected Phases | 4 | 4 | | 8 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | | | | | | | 2 | | | |
| Actuated Green, G (s) | 11.6 | 11.6 | | | 24.7 | | 1.5 | 18.0 | 18.0 | 11.6 | 28.1 | |
| Effective Green, g (s) | 11.6 | 11.6 | | | 24.7 | | 1.5 | 18.0 | 18.0 | 11.6 | 28.1 | |
| Actuated g/C Ratio | 0.14 | 0.14 | | | 0.29 | | 0.02 | 0.21 | 0.21 | 0.14 | 0.33 | |
| Clearance Time (s) | 5.1 | 5.1 | | | 5.1 | | 4.0 | 3.9 | 3.9 | 4.0 | 3.9 | |
| Vehicle Extension (s) | 1.0 | 1.0 | | | 1.0 | | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | |
| Lane Grp Cap (vph) | 244 | 246 | | | 516 | | 31 | 758 | 339 | 244 | 1154 | |
| v/s Ratio Prot | 0.06 | c0.07 | | | c0.23 | | 0.01 | c0.13 | | c0.09 | 0.14 | |
| v/s Ratio Perm | | | | | | | | | 0.02 | | | |
| v/c Ratio | 0.45 | 0.52 | | | 0.77 | | 0.58 | 0.58 | 0.11 | 0.66 | 0.43 | |
| Uniform Delay, d1 | 33.3 | 33.6 | | | 27.1 | | 40.9 | 29.6 | 26.6 | 34.4 | 21.7 | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 0.5 | 0.8 | | | 6.4 | | 16.6 | 0.7 | 0.1 | 5.2 | 0.1 | |
| Delay (s) | 33.8 | 34.4 | | | 33.5 | | 57.5 | 30.4 | 26.6 | 39.5 | 21.8 | |
| Level of Service | C | C | | | C | | E | C | C | D | C | |
| Approach Delay (s) | | 34.1 | | | 33.5 | | | 30.3 | | | 26.1 | |
| Approach LOS | | C | | | C | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 30.0 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.66 | | |
| Actuated Cycle Length (s) | 84.0 | Sum of lost time (s) | 18.1 |
| Intersection Capacity Utilization | 65.0% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 84 | 99 | 202 | 24 | 76 | 40 | 215 | 365 | 46 | 34 | 429 | 77 |
| Future Volume (vph) | 84 | 99 | 202 | 24 | 76 | 40 | 215 | 365 | 46 | 34 | 429 | 77 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.5 | 3.5 | | 3.5 | 3.7 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | | 1.00 | 0.99 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.98 | | 1.00 | 0.98 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1763 | 1900 | 1564 | 1803 | 1900 | 1588 | 1805 | 3472 | | 1805 | 3447 | |
| Flt Permitted | 0.70 | 1.00 | 1.00 | 0.69 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1303 | 1900 | 1564 | 1304 | 1900 | 1588 | 1805 | 3472 | | 1805 | 3447 | |
| Peak-hour factor, PHF | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Adj. Flow (vph) | 92 | 109 | 222 | 26 | 84 | 44 | 236 | 401 | 51 | 37 | 471 | 85 |
| RTOR Reduction (vph) | 0 | 0 | 162 | 0 | 0 | 32 | 0 | 7 | 0 | 0 | 14 | 0 |
| Lane Group Flow (vph) | 92 | 109 | 60 | 26 | 84 | 12 | 236 | 445 | 0 | 37 | 542 | 0 |
| Confl. Peds. (#/hr) | 9 | | 11 | 2 | | 1 | | | 10 | | | 9 |
| Confl. Bikes (#/hr) | | | 5 | | | 5 | | | 5 | | | 5 |
| Heavy Vehicles (%) | 2% | 0% | 1% | 0% | 0% | 0% | 0% | 2% | 0% | 0% | 2% | 0% |
| Turn Type | Perm | NA | Perm | Perm | NA | Perm | Prot | NA | | Prot | NA | |
| Protected Phases | | 8 | | | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | 8 | | 8 | 4 | | 4 | | | | | | |
| Actuated Green, G (s) | 17.4 | 17.4 | 17.4 | 17.4 | 17.4 | 17.4 | 15.5 | 32.7 | | 3.2 | 20.2 | |
| Effective Green, g (s) | 17.4 | 17.4 | 17.4 | 17.4 | 17.4 | 17.4 | 15.5 | 32.7 | | 3.2 | 20.2 | |
| Actuated g/C Ratio | 0.27 | 0.27 | 0.27 | 0.27 | 0.27 | 0.27 | 0.24 | 0.51 | | 0.05 | 0.31 | |
| Clearance Time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.5 | 3.5 | | 3.5 | 3.7 | |
| Vehicle Extension (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 2.5 | 3.0 | | 2.5 | 3.0 | |
| Lane Grp Cap (vph) | 352 | 514 | 423 | 352 | 514 | 429 | 435 | 1765 | | 89 | 1082 | |
| v/s Ratio Prot | | 0.06 | | | 0.04 | | c0.13 | 0.13 | | 0.02 | c0.16 | |
| v/s Ratio Perm | c0.07 | | 0.04 | 0.02 | | 0.01 | | | | | | |
| v/c Ratio | 0.26 | 0.21 | 0.14 | 0.07 | 0.16 | 0.03 | 0.54 | 0.25 | | 0.42 | 0.50 | |
| Uniform Delay, d1 | 18.4 | 18.1 | 17.8 | 17.5 | 17.9 | 17.2 | 21.3 | 8.9 | | 29.6 | 17.9 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 0.5 | 0.3 | 0.2 | 0.1 | 0.2 | 0.0 | 1.1 | 0.1 | | 2.3 | 0.4 | |
| Delay (s) | 18.9 | 18.4 | 18.0 | 17.6 | 18.1 | 17.3 | 22.4 | 9.0 | | 31.9 | 18.3 | |
| Level of Service | B | B | B | B | B | B | C | A | | C | B | |
| Approach Delay (s) | | 18.3 | | | 17.8 | | | 13.6 | | | 19.2 | |
| Approach LOS | | B | | | B | | | B | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 16.8 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.43 | | |
| Actuated Cycle Length (s) | 64.3 | Sum of lost time (s) | 11.2 |
| Intersection Capacity Utilization | 54.8% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |





| Intersection | |
|---|---|
| Intersection Delay, s/veh | 41.3 |
| Intersection LOS | E |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 62 | 153 | 60 | 20 | 178 | 170 | 111 | 160 | 50 | 194 | 95 | 97 |
| Future Vol, veh/h | 62 | 153 | 60 | 20 | 178 | 170 | 111 | 160 | 50 | 194 | 95 | 97 |
| Peak Hour Factor | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 73 | 180 | 71 | 24 | 209 | 200 | 131 | 188 | 59 | 228 | 112 | 114 |
| Number of Lanes | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Opposing Approach | WB | EB | SB | NB |
| Opposing Lanes | 2 | 2 | 3 | 2 |
| Conflicting Approach Left | SB | NB | EB | WB |
| Conflicting Lanes Left | 3 | 2 | 2 | 2 |
| Conflicting Approach Right | NB | SB | WB | EB |
| Conflicting Lanes Right | 2 | 3 | 2 | 2 |
| HCM Control Delay | 27.1 | 84.8 | 25.8 | 22.8 |
| HCM LOS | D | F | D | C |

| Lane | NBLn1 | NBLn2 | EBLn1 | EBLn2 | WBLn1 | WBLn2 | SBLn1 | SBLn2 | SBLn3 |
|---|---|---|---|---|---|---|---|---|---|
| Vol Left, % | 100% | 0% | 100% | 0% | 100% | 0% | 100% | 0% | 0% |
| Vol Thru, % | 0% | 76% | 0% | 72% | 0% | 51% | 0% | 100% | 0% |
| Vol Right, % | 0% | 24% | 0% | 28% | 0% | 49% | 0% | 0% | 100% |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 111 | 210 | 62 | 213 | 20 | 348 | 194 | 95 | 97 |
| LT Vol | 111 | 0 | 62 | 0 | 20 | 0 | 194 | 0 | 0 |
| Through Vol | 0 | 160 | 0 | 153 | 0 | 178 | 0 | 95 | 0 |
| RT Vol | 0 | 50 | 0 | 60 | 0 | 170 | 0 | 0 | 97 |
| Lane Flow Rate | 131 | 247 | 73 | 251 | 24 | 409 | 228 | 112 | 114 |
| Geometry Grp | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Degree of Util (X) | 0.371 | 0.654 | 0.209 | 0.667 | 0.066 | 1.046 | 0.636 | 0.295 | 0.279 |
| Departure Headway (Hd) | 10.544 | 9.843 | 10.622 | 9.895 | 10.072 | 9.2 | 10.347 | 9.824 | 9.093 |
| Convergence, Y/N | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Cap | 343 | 371 | 340 | 368 | 358 | 397 | 351 | 368 | 397 |
| Service Time | 8.244 | 7.543 | 8.322 | 7.595 | 7.772 | 6.9 | 8.047 | 7.524 | 6.793 |
| HCM Lane V/C Ratio | 0.382 | 0.666 | 0.215 | 0.682 | 0.067 | 1.03 | 0.65 | 0.304 | 0.287 |
| HCM Control Delay | 19.3 | 29.3 | 16.1 | 30.3 | 13.5 | 88.9 | 29.5 | 16.6 | 15.3 |
| HCM Lane LOS | C | D | C | D | B | F | D | C | C |
| HCM 95th-tile Q | 1.7 | 4.4 | 0.8 | 4.6 | 0.2 | 13.6 | 4.2 | 1.2 | 1.1 |

HCM Signalized Intersection Capacity Analysis
9: San Marin Dr/Sutro Ave & Novato Blvd #1 02/23/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 62 | 153 | 60 | 20 | 178 | 170 | 111 | 160 | 50 | 194 | 95 | 97 |
| Future Volume (vph) | 62 | 153 | 60 | 20 | 178 | 170 | 111 | 160 | 50 | 194 | 95 | 97 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 4.0 | | 3.0 | 4.0 | | 3.0 | 4.0 | | 3.0 | 4.0 | 4.0 |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.96 | | 1.00 | 0.93 | | 1.00 | 0.96 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1770 | 1784 | | 1770 | 1726 | | 1770 | 1797 | | 1770 | 1863 | 1583 |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1770 | 1784 | | 1770 | 1726 | | 1770 | 1797 | | 1770 | 1863 | 1583 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 67 | 166 | 65 | 22 | 193 | 185 | 121 | 174 | 54 | 211 | 103 | 105 |
| RTOR Reduction (vph) | 0 | 15 | 0 | 0 | 38 | 0 | 0 | 13 | 0 | 0 | 0 | 72 |
| Lane Group Flow (vph) | 67 | 216 | 0 | 22 | 340 | 0 | 121 | 215 | 0 | 211 | 103 | 33 |
| Turn Type | Prot | NA | | Prot | NA | | Prot | NA | | Prot | NA | Perm |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | | | | | | | | | | 6 |
| Actuated Green, G (s) | 4.5 | 21.9 | | 1.5 | 18.9 | | 7.8 | 15.5 | | 13.3 | 21.0 | 21.0 |
| Effective Green, g (s) | 4.5 | 21.9 | | 1.5 | 18.9 | | 7.8 | 15.5 | | 13.3 | 21.0 | 21.0 |
| Actuated g/C Ratio | 0.07 | 0.33 | | 0.02 | 0.29 | | 0.12 | 0.23 | | 0.20 | 0.32 | 0.32 |
| Clearance Time (s) | 3.0 | 4.0 | | 3.0 | 4.0 | | 3.0 | 4.0 | | 3.0 | 4.0 | 4.0 |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | 120 | 590 | | 40 | 492 | | 208 | 420 | | 355 | 590 | 502 |
| v/s Ratio Prot | c0.04 | c0.12 | | 0.01 | c0.20 | | 0.07 | c0.12 | | c0.12 | 0.06 | |
| v/s Ratio Perm | | | | | | | | | | | | 0.02 |
| v/c Ratio | 0.56 | 0.37 | | 0.55 | 0.69 | | 0.58 | 0.51 | | 0.59 | 0.17 | 0.07 |
| Uniform Delay, d1 | 29.9 | 16.9 | | 32.0 | 21.1 | | 27.7 | 22.1 | | 24.0 | 16.3 | 15.8 |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 5.5 | 0.4 | | 15.3 | 4.2 | | 4.1 | 1.1 | | 2.7 | 0.1 | 0.1 |
| Delay (s) | 35.4 | 17.2 | | 47.4 | 25.2 | | 31.8 | 23.1 | | 26.7 | 16.5 | 15.8 |
| Level of Service | D | B | | D | C | | C | C | | C | B | B |
| Approach Delay (s) | | 21.3 | | | 26.4 | | | 26.1 | | | 21.4 | |
| Approach LOS | | C | | | C | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 23.9 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.58 | | |
| Actuated Cycle Length (s) | 66.2 | Sum of lost time (s) | 14.0 |
| Intersection Capacity Utilization | 58.7% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



# MOVEMENT SUMMARY

## Site: 9 [AM Existing + Project]

Novato Boulevard/San Marin Dr-Sutro Ave
AM Existing + Project

Roundabout

**Movement Performance - Vehicles**

| Mov ID | OD Mov | Demand Flows Total veh/h | Demand Flows HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance ft | Prop. Queued | Effective Stop Rate per veh | Average Speed mph |
|---|---|---|---|---|---|---|---|---|---|---|---|
| South: NB Sutro Ave | | | | | | | | | | | |
| 3 | L2 | 121 | 2.0 | 0.410 | 9.2 | LOS A | 2.2 | 57.0 | 0.64 | 0.63 | 32.0 |
| 8 | T1 | 174 | 2.0 | 0.410 | 9.2 | LOS A | 2.2 | 57.0 | 0.64 | 0.63 | 32.0 |
| 18 | R2 | 54 | 2.0 | 0.410 | 9.2 | LOS A | 2.2 | 57.0 | 0.64 | 0.63 | 31.2 |
| Approach | | 349 | 2.0 | 0.410 | 9.2 | LOS A | 2.2 | 57.0 | 0.64 | 0.63 | 31.9 |
| East: WB Novato Blvd | | | | | | | | | | | |
| 1 | L2 | 22 | 2.0 | 0.431 | 8.9 | LOS A | 2.4 | 60.5 | 0.61 | 0.55 | 32.8 |
| 6 | T1 | 193 | 2.0 | 0.431 | 8.9 | LOS A | 2.4 | 60.5 | 0.61 | 0.55 | 32.8 |
| 16 | R2 | 185 | 2.0 | 0.431 | 8.9 | LOS A | 2.4 | 60.5 | 0.61 | 0.55 | 31.9 |
| Approach | | 400 | 2.0 | 0.431 | 8.9 | LOS A | 2.4 | 60.5 | 0.61 | 0.55 | 32.4 |
| North: SB San Marin Drive | | | | | | | | | | | |
| 7 | L2 | 211 | 2.0 | 0.308 | 6.6 | LOS A | 1.4 | 36.6 | 0.50 | 0.41 | 32.4 |
| 4 | T1 | 103 | 2.0 | 0.308 | 6.6 | LOS A | 1.4 | 36.6 | 0.50 | 0.41 | 32.4 |
| 14 | R2 | 105 | 2.0 | 0.103 | 4.5 | LOS A | 0.4 | 10.3 | 0.42 | 0.31 | 34.1 |
| Approach | | 420 | 2.0 | 0.308 | 6.1 | LOS A | 1.4 | 36.6 | 0.48 | 0.38 | 32.8 |
| West: EB Novato Blvd | | | | | | | | | | | |
| 5 | L2 | 67 | 2.0 | 0.313 | 7.1 | LOS A | 1.6 | 39.7 | 0.54 | 0.45 | 33.3 |
| 2 | T1 | 166 | 2.0 | 0.313 | 7.1 | LOS A | 1.6 | 39.7 | 0.54 | 0.45 | 33.3 |
| 12 | R2 | 65 | 2.0 | 0.313 | 7.1 | LOS A | 1.6 | 39.7 | 0.54 | 0.45 | 32.4 |
| Approach | | 299 | 2.0 | 0.313 | 7.1 | LOS A | 1.6 | 39.7 | 0.54 | 0.45 | 33.1 |
| All Vehicles | | 1467 | 2.0 | 0.431 | 7.8 | LOS A | 2.4 | 60.5 | 0.57 | 0.50 | 32.5 |

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.


Organisation: W-TRANS | Processed: Tuesday, February 27, 2018 3:53:36 PM
Project: N:\AAA\MAX\NOV\126NOV\SIDRA\Novato-San Marin.sip7

## 10: Wilson Ave & Novato Blvd



| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 680 | 17 | 262 | 466 | 28 | 458 |
| Future Volume (vph) | 680 | 17 | 262 | 466 | 28 | 458 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.9 | | 3.0 | 3.6 | 3.6 | 3.6 |
| Lane Util. Factor | 0.95 | | 1.00 | 0.95 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | | 1.00 | 1.00 | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | | 1.00 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 1.00 | | 0.95 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (prot) | 3560 | | 1787 | 3610 | 1805 | 1593 |
| Flt Permitted | 1.00 | | 0.95 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (perm) | 3560 | | 1787 | 3610 | 1805 | 1593 |
| Peak-hour factor, PHF | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 |
| Adj. Flow (vph) | 800 | 20 | 308 | 548 | 33 | 539 |
| RTOR Reduction (vph) | 2 | 0 | 0 | 0 | 0 | 206 |
| Lane Group Flow (vph) | 818 | 0 | 308 | 548 | 33 | 333 |
| Confl. Peds. (#/hr) | | 3 | | | 6 | 2 |
| Heavy Vehicles (%) | 1% | 0% | 1% | 0% | 0% | 0% |
| Turn Type | NA | | Prot | NA | Prot | Perm |
| Protected Phases | 2 | | 1 | 6 | 4 | |
| Permitted Phases | | | | | | 4 |
| Actuated Green, G (s) | 32.1 | | 17.3 | 39.7 | 20.1 | 20.1 |
| Effective Green, g (s) | 32.1 | | 17.3 | 39.7 | 20.1 | 20.1 |
| Actuated g/C Ratio | 0.40 | | 0.22 | 0.50 | 0.25 | 0.25 |
| Clearance Time (s) | 3.9 | | 3.0 | 3.6 | 3.6 | 3.6 |
| Vehicle Extension (s) | 3.0 | | 2.0 | 3.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 1428 | | 386 | 1791 | 453 | 400 |
| v/s Ratio Prot | c0.23 | | c0.17 | 0.15 | 0.02 | |
| v/s Ratio Perm | | | | | | c0.21 |
| v/c Ratio | 0.57 | | 0.80 | 0.31 | 0.07 | 0.83 |
| Uniform Delay, d1 | 18.6 | | 29.7 | 12.0 | 22.8 | 28.4 |
| Progression Factor | 1.00 | | 1.00 | 0.51 | 1.00 | 1.00 |
| Incremental Delay, d2 | 1.7 | | 9.7 | 0.4 | 0.0 | 13.2 |
| Delay (s) | 20.3 | | 39.4 | 6.6 | 22.9 | 41.6 |
| Level of Service | C | | D | A | C | D |
| Approach Delay (s) | 20.3 | | | 18.4 | 40.5 | |
| Approach LOS | C | | | B | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 24.7 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.70 | | |
| Actuated Cycle Length (s) | 80.0 | Sum of lost time (s) | 10.5 |
| Intersection Capacity Utilization | 54.6% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |





## 11: Novato Blvd & Simmons Ln



| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 278 | 840 | 480 | 91 | 86 | 268 |
| Future Volume (vph) | 278 | 840 | 480 | 91 | 86 | 268 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.9 | 3.6 | | 3.0 | 3.0 |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.98 | | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 3574 | 3512 | | 1805 | 1599 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | 1805 | 3574 | 3512 | | 1805 | 1599 |
| Peak-hour factor, PHF | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 |
| Adj. Flow (vph) | 327 | 988 | 565 | 107 | 101 | 315 |
| RTOR Reduction (vph) | 0 | 0 | 16 | 0 | 0 | 233 |
| Lane Group Flow (vph) | 327 | 988 | 656 | 0 | 101 | 82 |
| Confl. Peds. (#/hr) | | | | | 2 | |
| Confl. Bikes (#/hr) | | | | 1 | | |
| Heavy Vehicles (%) | 0% | 1% | 0% | 0% | 0% | 1% |
| Turn Type | Prot | NA | NA | | Prot | Perm |
| Protected Phases | 5 | 2 | 6 | | 8 | |
| Permitted Phases | | | | | | 8 |
| Actuated Green, G (s) | 10.0 | 32.1 | 39.7 | | 20.7 | 20.7 |
| Effective Green, g (s) | 10.0 | 32.1 | 39.7 | | 20.7 | 20.7 |
| Actuated g/C Ratio | 0.12 | 0.40 | 0.50 | | 0.26 | 0.26 |
| Clearance Time (s) | 3.0 | 3.9 | 3.6 | | 3.0 | 3.0 |
| Vehicle Extension (s) | 2.0 | 3.0 | 3.0 | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 225 | 1434 | 1742 | | 467 | 413 |
| v/s Ratio Prot | c0.18 | c0.28 | c0.19 | | c0.06 | |
| v/s Ratio Perm | | | | | | 0.05 |
| v/c Ratio | 1.45 | 0.69 | 0.38 | | 0.22 | 0.20 |
| Uniform Delay, d1 | 35.0 | 19.8 | 12.5 | | 23.3 | 23.2 |
| Progression Factor | 0.79 | 0.63 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 222.4 | 2.1 | 0.6 | | 0.1 | 0.1 |
| Delay (s) | 250.1 | 14.7 | 13.1 | | 23.4 | 23.2 |
| Level of Service | F | B | B | | C | C |
| Approach Delay (s) | | 73.2 | 13.1 | | 23.3 | |
| Approach LOS | | E | B | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 47.8 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.57 | | |
| Actuated Cycle Length (s) | 80.0 | Sum of lost time (s) | 10.5 |
| Intersection Capacity Utilization | 46.6% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 12: Novato Blvd & Grant Ave

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 199 | 826 | 3 | 4 | 416 | 57 | 1 | 0 | 2 | 35 | 1 | 184 |
| Future Volume (vph) | 199 | 826 | 3 | 4 | 416 | 57 | 1 | 0 | 2 | 35 | 1 | 184 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.5 | 4.5 | 3.5 | 4.9 | 4.9 | | 4.0 | | 3.5 | 3.5 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 | | 1.00 | | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.96 | | 0.97 | | 1.00 | 0.98 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | | 0.98 | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | | 0.91 | | 1.00 | 0.85 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 0.98 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1787 | 1863 | 1576 | 1805 | 3539 | 1534 | | 1644 | | 1748 | 1569 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 0.70 | | 0.76 | 1.00 | |
| Satd. Flow (perm) | 1787 | 1863 | 1576 | 1805 | 3539 | 1534 | | 1175 | | 1390 | 1569 | |
| Peak-hour factor, PHF | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 |
| Adj. Flow (vph) | 234 | 972 | 4 | 5 | 489 | 67 | 1 | 0 | 2 | 41 | 1 | 216 |
| RTOR Reduction (vph) | 0 | 0 | 1 | 0 | 0 | 27 | 0 | 3 | 0 | 0 | 192 | 0 |
| Lane Group Flow (vph) | 234 | 972 | 3 | 5 | 489 | 40 | 0 | 0 | 0 | 41 | 25 | 0 |
| Confl. Peds. (#/hr) | | | 1 | | | 8 | 5 | | 12 | 12 | | 5 |
| Confl. Bikes (#/hr) | | | 4 | | | 2 | | | 2 | | | 1 |
| Heavy Vehicles (%) | 1% | 2% | 0% | 0% | 2% | 1% | 0% | 0% | 0% | 1% | 0% | 1% |
| Turn Type | Prot | NA | Perm | Prot | NA | Perm | Perm | NA | | Perm | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | 2 | | | 6 | 8 | | | 4 | | |
| Actuated Green, G (s) | 16.7 | 76.0 | 76.0 | 1.2 | 60.1 | 60.1 | | 10.8 | | 11.3 | 11.3 | |
| Effective Green, g (s) | 16.7 | 76.0 | 76.0 | 1.2 | 60.1 | 60.1 | | 10.8 | | 11.3 | 11.3 | |
| Actuated g/C Ratio | 0.17 | 0.76 | 0.76 | 0.01 | 0.60 | 0.60 | | 0.11 | | 0.11 | 0.11 | |
| Clearance Time (s) | 3.5 | 4.5 | 4.5 | 3.5 | 4.9 | 4.9 | | 4.0 | | 3.5 | 3.5 | |
| Vehicle Extension (s) | 2.0 | 3.0 | 3.0 | 2.0 | 3.0 | 3.0 | | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 298 | 1415 | 1197 | 21 | 2126 | 921 | | 126 | | 157 | 177 | |
| v/s Ratio Prot | c0.13 | c0.52 | | 0.00 | 0.14 | | | | | | 0.02 | |
| v/s Ratio Perm | | | 0.00 | | | 0.03 | | 0.00 | | c0.03 | | |
| v/c Ratio | 0.79 | 0.69 | 0.00 | 0.24 | 0.23 | 0.04 | | 0.00 | | 0.26 | 0.14 | |
| Uniform Delay, d1 | 39.9 | 6.0 | 2.9 | 48.9 | 9.2 | 8.2 | | 39.8 | | 40.5 | 40.0 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 0.89 | 0.98 | 1.43 | | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 11.8 | 1.4 | 0.0 | 2.0 | 0.2 | 0.1 | | 0.0 | | 0.3 | 0.1 | |
| Delay (s) | 51.7 | 7.4 | 2.9 | 45.4 | 9.3 | 11.8 | | 39.8 | | 40.9 | 40.1 | |
| Level of Service | D | A | A | D | A | B | | D | | D | D | |
| Approach Delay (s) | | 16.0 | | | 9.9 | | | 39.8 | | | 40.2 | |
| Approach LOS | | B | | | A | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 17.4 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.68 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 12.4 |
| Intersection Capacity Utilization | 72.5% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 13: Tamalpais Ave/7th St & Novato Blvd

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 93 | 736 | 36 | 60 | 442 | 121 | 37 | 99 | 34 | 72 | 105 | 45 |
| Future Volume (vph) | 93 | 736 | 36 | 60 | 442 | 121 | 37 | 99 | 34 | 72 | 105 | 45 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 5.0 | | 3.5 | 5.0 | 5.0 | 3.5 | 3.5 | | 3.5 | 3.5 | 3.5 |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 0.95 | 1.00 | 0.99 | | 1.00 | 1.00 | 0.96 |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 0.99 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.99 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.96 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1787 | 1847 | | 1787 | 1863 | 1523 | 1770 | 1798 | | 1784 | 1881 | 1531 |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.57 | 1.00 | | 0.48 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1787 | 1847 | | 1787 | 1863 | 1523 | 1068 | 1798 | | 902 | 1881 | 1531 |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 99 | 783 | 38 | 64 | 470 | 129 | 39 | 105 | 36 | 77 | 112 | 48 |
| RTOR Reduction (vph) | 0 | 1 | 0 | 0 | 0 | 20 | 0 | 15 | 0 | 0 | 0 | 41 |
| Lane Group Flow (vph) | 99 | 820 | 0 | 64 | 470 | 109 | 39 | 126 | 0 | 77 | 112 | 7 |
| Confl. Peds. (#/hr) | | | 11 | | | 17 | 6 | | 1 | 1 | | 6 |
| Confl. Bikes (#/hr) | | | 9 | | | 1 | | | 1 | | | 4 |
| Heavy Vehicles (%) | 1% | 2% | 1% | 1% | 2% | 1% | 1% | 1% | 1% | 1% | 1% | 1% |
| Turn Type | Prot | NA | | Prot | NA | Perm | Perm | NA | | Perm | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | | | | 6 | 8 | | | 4 | | 4 |
| Actuated Green, G (s) | 9.1 | 66.6 | | 7.7 | 65.2 | 65.2 | 13.7 | 13.7 | | 13.7 | 13.7 | 13.7 |
| Effective Green, g (s) | 9.1 | 66.6 | | 7.7 | 65.2 | 65.2 | 13.7 | 13.7 | | 13.7 | 13.7 | 13.7 |
| Actuated g/C Ratio | 0.09 | 0.67 | | 0.08 | 0.65 | 0.65 | 0.14 | 0.14 | | 0.14 | 0.14 | 0.14 |
| Clearance Time (s) | 3.5 | 5.0 | | 3.5 | 5.0 | 5.0 | 3.5 | 3.5 | | 3.5 | 3.5 | 3.5 |
| Vehicle Extension (s) | 2.0 | 5.0 | | 2.0 | 5.0 | 5.0 | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 162 | 1230 | | 137 | 1214 | 992 | 146 | 246 | | 123 | 257 | 209 |
| v/s Ratio Prot | c0.06 | c0.44 | | 0.04 | 0.25 | | | 0.07 | | | 0.06 | |
| v/s Ratio Perm | | | | | | 0.07 | 0.04 | | | c0.09 | | 0.00 |
| v/c Ratio | 0.61 | 0.67 | | 0.47 | 0.39 | 0.11 | 0.27 | 0.51 | | 0.63 | 0.44 | 0.03 |
| Uniform Delay, d1 | 43.7 | 10.0 | | 44.2 | 8.1 | 6.5 | 38.7 | 40.1 | | 40.7 | 39.6 | 37.4 |
| Progression Factor | 0.87 | 1.08 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 3.6 | 2.2 | | 0.9 | 0.9 | 0.2 | 0.4 | 0.8 | | 7.0 | 0.4 | 0.0 |
| Delay (s) | 41.7 | 13.1 | | 45.1 | 9.0 | 6.7 | 39.0 | 40.8 | | 47.7 | 40.0 | 37.4 |
| Level of Service | D | B | | D | A | A | D | D | | D | D | D |
| Approach Delay (s) | | 16.1 | | | 12.1 | | | 40.4 | | | 42.0 | |
| Approach LOS | | B | | | B | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 20.0 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.66 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 79.4% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 14: Novato Blvd & Diablo Ave

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 22 | 234 | 35 | 200 | 236 | 318 | 34 | 295 | 207 | 451 | 391 | 28 |
| Future Volume (vph) | 22 | 234 | 35 | 200 | 236 | 318 | 34 | 295 | 207 | 451 | 391 | 28 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 12 | 12 | 11 | 11 | 12 | 11 | 11 | 12 | 12 | 12 | 12 |
| Total Lost time (s) | | 3.7 | | 4.1 | 4.1 | 4.1 | 4.4 | 4.4 | 4.4 | 4.1 | 4.1 | |
| Lane Util. Factor | | 0.95 | | 0.91 | 0.91 | 1.00 | 1.00 | 1.00 | 1.00 | 0.91 | 0.91 | |
| Frpb, ped/bikes | | 1.00 | | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | | 0.98 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | |
| Flt Protected | | 1.00 | | 0.95 | 0.99 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.99 | |
| Satd. Flow (prot) | | 3488 | | 1557 | 3271 | 1512 | 1728 | 1801 | 1557 | 1610 | 3317 | |
| Flt Permitted | | 1.00 | | 0.95 | 0.99 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.99 | |
| Satd. Flow (perm) | | 3488 | | 1557 | 3271 | 1512 | 1728 | 1801 | 1557 | 1610 | 3317 | |
| Peak-hour factor, PHF | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Adj. Flow (vph) | 22 | 239 | 36 | 204 | 241 | 324 | 35 | 301 | 211 | 460 | 399 | 29 |
| RTOR Reduction (vph) | 0 | 8 | 0 | 0 | 0 | 216 | 0 | 0 | 163 | 0 | 2 | 0 |
| Lane Group Flow (vph) | 0 | 289 | 0 | 145 | 300 | 108 | 35 | 301 | 48 | 290 | 596 | 0 |
| Confl. Peds. (#/hr) | | | 7 | | | 15 | | | 2 | | | 4 |
| Confl. Bikes (#/hr) | | | 1 | | | 1 | | | 3 | | | 5 |
| Heavy Vehicles (%) | 1% | 1% | 1% | 2% | 1% | 2% | 1% | 2% | 2% | 2% | 2% | 1% |
| Turn Type | Split | NA | | Split | NA | Perm | Split | NA | Perm | Split | NA | |
| Protected Phases | 3 | 3 | | 4 | 4 | | 1 | 1 | | 2 | 2 | |
| Permitted Phases | | | | | | 4 | | | 1 | | 2 | |
| Actuated Green, G (s) | | 14.3 | | 15.0 | 15.0 | 15.0 | 20.2 | 20.2 | 20.2 | 22.6 | 22.6 | |
| Effective Green, g (s) | | 14.3 | | 15.0 | 15.0 | 15.0 | 20.2 | 20.2 | 20.2 | 22.6 | 22.6 | |
| Actuated g/C Ratio | | 0.16 | | 0.17 | 0.17 | 0.17 | 0.23 | 0.23 | 0.23 | 0.26 | 0.26 | |
| Clearance Time (s) | | 3.7 | | 4.1 | 4.1 | 4.1 | 4.4 | 4.4 | 4.4 | 4.1 | 4.1 | |
| Vehicle Extension (s) | | 2.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | | 564 | | 264 | 555 | 256 | 394 | 411 | 355 | 411 | 848 | |
| v/s Ratio Prot | | c0.08 | | c0.09 | 0.09 | | 0.02 | c0.17 | | c0.18 | 0.18 | |
| v/s Ratio Perm | | | | | | 0.07 | | | 0.03 | | | |
| v/c Ratio | | 0.51 | | 0.55 | 0.54 | 0.42 | 0.09 | 0.73 | 0.14 | 0.71 | 0.70 | |
| Uniform Delay, d1 | | 33.9 | | 33.6 | 33.5 | 32.8 | 26.9 | 31.6 | 27.2 | 29.9 | 29.9 | |
| Progression Factor | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 0.3 | | 1.3 | 0.6 | 0.4 | 0.0 | 5.7 | 0.1 | 4.5 | 2.2 | |
| Delay (s) | | 34.2 | | 34.9 | 34.1 | 33.2 | 26.9 | 37.3 | 27.2 | 34.3 | 32.0 | |
| Level of Service | | C | | C | C | C | C | D | C | C | C | |
| Approach Delay (s) | | 34.2 | | | 33.9 | | | 32.8 | | | 32.8 | |
| Approach LOS | | C | | | C | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 33.3 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.64 | | |
| Actuated Cycle Length (s) | 88.4 | Sum of lost time (s) | 16.3 |
| Intersection Capacity Utilization | 71.6% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 14: Diablo Ave & Novato Blvd

02/23/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 22 | 234 | 35 | 200 | 236 | 318 | 34 | 295 | 207 | 451 | 391 | 28 |
| Future Volume (vph) | 22 | 234 | 35 | 200 | 236 | 318 | 34 | 295 | 207 | 451 | 391 | 28 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 11 | 11 | 11 | 11 | 11 | 12 | 11 | 11 | 12 | 10 | 12 | 12 |
| Total Lost time (s) | 4.0 | 4.1 | 4.1 | 4.0 | 4.0 | 4.0 | 4.0 | 4.1 | | 4.0 | 4.0 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | | 0.97 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.98 | 1.00 | 0.99 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.94 | | 1.00 | 0.99 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1728 | 1818 | 1518 | 1711 | 1818 | 1558 | 1728 | 3188 | | 3204 | 1841 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1728 | 1818 | 1518 | 1711 | 1818 | 1558 | 1728 | 3188 | | 3204 | 1841 | |
| Peak-hour factor, PHF | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Adj. Flow (vph) | 22 | 239 | 36 | 204 | 241 | 324 | 35 | 301 | 211 | 460 | 399 | 29 |
| RTOR Reduction (vph) | 0 | 0 | 28 | 0 | 0 | 138 | 0 | 128 | 0 | 0 | 3 | 0 |
| Lane Group Flow (vph) | 22 | 239 | 8 | 204 | 241 | 186 | 35 | 384 | 0 | 460 | 425 | 0 |
| Confl. Peds. (#/hr) | | | 7 | | | 15 | | | 2 | | | 4 |
| Confl. Bikes (#/hr) | | | 1 | | | 1 | | | 3 | | | 5 |
| Heavy Vehicles (%) | 1% | 1% | 1% | 2% | 1% | 2% | 1% | 2% | 2% | 2% | 2% | 1% |
| Turn Type | Prot | NA | Perm | Prot | NA | pm+ov | Prot | NA | | Prot | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | 1 | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | 4 | | | 8 | | | | | | |
| Actuated Green, G (s) | 1.7 | 18.9 | 18.9 | 13.5 | 30.8 | 47.4 | 3.3 | 17.5 | | 16.6 | 30.9 | |
| Effective Green, g (s) | 1.7 | 18.9 | 18.9 | 13.5 | 30.8 | 47.4 | 3.3 | 17.5 | | 16.6 | 30.9 | |
| Actuated g/C Ratio | 0.02 | 0.23 | 0.23 | 0.16 | 0.37 | 0.57 | 0.04 | 0.21 | | 0.20 | 0.37 | |
| Clearance Time (s) | 4.0 | 4.1 | 4.1 | 4.0 | 4.0 | 4.0 | 4.0 | 4.1 | | 4.0 | 4.0 | |
| Vehicle Extension (s) | 3.0 | 2.0 | 2.0 | 3.0 | 3.0 | 3.0 | 3.0 | 2.0 | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 35 | 415 | 346 | 279 | 677 | 968 | 68 | 674 | | 643 | 687 | |
| v/s Ratio Prot | 0.01 | c0.13 | | c0.12 | 0.13 | 0.04 | 0.02 | 0.12 | | c0.14 | c0.23 | |
| v/s Ratio Perm | | | 0.01 | | | 0.08 | | | | | | |
| v/c Ratio | 0.63 | 0.58 | 0.02 | 0.73 | 0.36 | 0.19 | 0.51 | 0.57 | | 0.72 | 0.62 | |
| Uniform Delay, d1 | 40.2 | 28.3 | 24.7 | 32.9 | 18.8 | 8.5 | 38.9 | 29.2 | | 30.8 | 21.1 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 30.3 | 1.2 | 0.0 | 9.5 | 0.3 | 0.1 | 6.4 | 0.7 | | 3.8 | 1.7 | |
| Delay (s) | 70.5 | 29.5 | 24.8 | 42.3 | 19.1 | 8.6 | 45.4 | 30.0 | | 34.6 | 22.8 | |
| Level of Service | E | C | C | D | B | A | D | C | | C | C | |
| Approach Delay (s) | | 32.0 | | | 20.8 | | | 30.9 | | | 28.9 | |
| Approach LOS | | C | | | C | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 27.2 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.68 | | |
| Actuated Cycle Length (s) | 82.7 | Sum of lost time (s) | 16.2 |
| Intersection Capacity Utilization | 68.6% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## 15: Redwood Blvd & Diablo Ave/De Long Ave



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 214 | 471 | 167 | 156 | 566 | 202 | 53 | 138 | 30 | 214 | 271 | 164 |
| Future Volume (vph) | 214 | 471 | 167 | 156 | 566 | 202 | 53 | 138 | 30 | 214 | 271 | 164 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 9 |
| Total Lost time (s) | 5.0 | 4.0 | | 5.0 | 4.1 | | 4.0 | 4.8 | 4.8 | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 0.95 | | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 | 0.97 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 0.99 | | 1.00 | 0.99 | | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.98 |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.96 | | 1.00 | 0.96 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3467 | 3450 | | 1805 | 3356 | | 1805 | 3610 | 1505 | 3303 | 1900 | 1408 |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3467 | 3450 | | 1805 | 3356 | | 1805 | 3610 | 1505 | 3303 | 1900 | 1408 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 233 | 512 | 182 | 170 | 615 | 220 | 58 | 150 | 33 | 233 | 295 | 178 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 0 | 0 | 58 |
| Lane Group Flow (vph) | 233 | 694 | 0 | 170 | 835 | 0 | 58 | 150 | 18 | 233 | 295 | 120 |
| Confl. Peds. (#/hr) | | | 5 | | | 5 | | | 5 | | | 5 |
| Confl. Bikes (#/hr) | | | 5 | | | 5 | | | 5 | | | 5 |
| Heavy Vehicles (%) | 1% | 0% | 0% | 0% | 2% | 5% | 0% | 0% | 5% | 6% | 0% | 1% |
| Turn Type | Prot | NA | | Prot | NA | | Prot | NA | Perm | Prot | NA | Perm |
| Protected Phases | 3 | 8 | | 7 | 4 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | | | | | | | 2 | | | 6 |
| Actuated Green, G (s) | 17.0 | 48.2 | | 17.0 | 48.1 | | 10.4 | 36.0 | 36.0 | 11.0 | 37.4 | 37.4 |
| Effective Green, g (s) | 17.0 | 48.2 | | 17.0 | 48.1 | | 10.4 | 36.0 | 36.0 | 11.0 | 37.4 | 37.4 |
| Actuated g/C Ratio | 0.13 | 0.37 | | 0.13 | 0.37 | | 0.08 | 0.28 | 0.28 | 0.08 | 0.29 | 0.29 |
| Clearance Time (s) | 5.0 | 4.0 | | 5.0 | 4.1 | | 4.0 | 4.8 | 4.8 | 4.0 | 4.0 | 4.0 |
| Vehicle Extension (s) | 2.5 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 453 | 1279 | | 236 | 1241 | | 144 | 999 | 416 | 279 | 546 | 405 |
| v/s Ratio Prot | 0.07 | 0.20 | | c0.09 | c0.25 | | 0.03 | 0.04 | | c0.07 | c0.16 | |
| v/s Ratio Perm | | | | | | | | | 0.01 | | | 0.09 |
| v/c Ratio | 0.51 | 0.54 | | 0.72 | 0.67 | | 0.40 | 0.15 | 0.04 | 0.84 | 0.54 | 0.30 |
| Uniform Delay, d1 | 52.7 | 32.2 | | 54.2 | 34.4 | | 56.8 | 35.5 | 34.4 | 58.6 | 39.0 | 36.1 |
| Progression Factor | 1.00 | 1.00 | | 1.13 | 0.87 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.7 | 1.7 | | 7.7 | 2.6 | | 0.7 | 0.3 | 0.2 | 18.2 | 3.8 | 1.9 |
| Delay (s) | 53.4 | 33.9 | | 69.0 | 32.5 | | 57.5 | 35.8 | 34.6 | 76.8 | 42.9 | 37.9 |
| Level of Service | D | C | | E | C | | E | D | C | E | D | D |
| Approach Delay (s) | | 38.8 | | | 38.6 | | | 40.8 | | | 52.8 | |
| Approach LOS | | D | | | D | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 42.3 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.66 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 17.9 |
| Intersection Capacity Utilization | 103.4% | ICU Level of Service | G |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |





## 16: Reichert Ave & De Long Ave



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 68 | 659 | 11 | 61 | 931 | 201 | 12 | 21 | 38 | 190 | 35 | 75 |
| Future Volume (vph) | 68 | 659 | 11 | 61 | 931 | 201 | 12 | 21 | 38 | 190 | 35 | 75 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 0.95 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 0.99 | | 1.00 | 1.00 | 0.98 | 1.00 | 0.98 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 0.99 | 1.00 | 1.00 | 0.99 | 1.00 | |
| Frt | 1.00 | 1.00 | | 1.00 | 0.97 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.90 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1805 | 3530 | | 1805 | 3460 | | 1793 | 1900 | 1578 | 1778 | 1676 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.56 | 1.00 | 1.00 | 0.74 | 1.00 | |
| Satd. Flow (perm) | 1805 | 3530 | | 1805 | 3460 | | 1065 | 1900 | 1578 | 1389 | 1676 | |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Adj. Flow (vph) | 76 | 732 | 12 | 68 | 1034 | 223 | 13 | 23 | 42 | 211 | 39 | 83 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 9 | 0 | 28 | 0 |
| Lane Group Flow (vph) | 76 | 744 | 0 | 68 | 1251 | 0 | 13 | 23 | 33 | 211 | 94 | 0 |
| Confl. Peds. (#/hr) | | | 6 | | | 3 | 6 | | 4 | 4 | | 6 |
| Confl. Bikes (#/hr) | | | 5 | | | 5 | | | 5 | | | 5 |
| Heavy Vehicles (%) | 0% | 2% | 0% | 0% | 1% | 1% | 0% | 0% | 0% | 1% | 0% | 0% |
| Turn Type | Prot | NA | | Prot | NA | | Perm | NA | Perm | Perm | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | | | | | 8 | | 8 | 4 | | |
| Actuated Green, G (s) | 8.9 | 86.2 | | 8.5 | 85.8 | | 24.7 | 24.7 | 24.7 | 24.7 | 24.7 | |
| Effective Green, g (s) | 8.9 | 86.2 | | 8.5 | 85.8 | | 24.7 | 24.7 | 24.7 | 24.7 | 24.7 | |
| Actuated g/C Ratio | 0.07 | 0.66 | | 0.07 | 0.66 | | 0.19 | 0.19 | 0.19 | 0.19 | 0.19 | |
| Clearance Time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | |
| Vehicle Extension (s) | 2.0 | 3.0 | | 2.0 | 3.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 123 | 2340 | | 118 | 2283 | | 202 | 361 | 299 | 263 | 318 | |
| v/s Ratio Prot | c0.04 | 0.21 | | 0.04 | c0.36 | | | 0.01 | | | 0.06 | |
| v/s Ratio Perm | | | | | | | 0.01 | | 0.02 | c0.15 | | |
| v/c Ratio | 0.62 | 0.32 | | 0.58 | 0.55 | | 0.06 | 0.06 | 0.11 | 0.80 | 0.30 | |
| Uniform Delay, d1 | 58.9 | 9.3 | | 59.0 | 11.8 | | 43.2 | 43.2 | 43.6 | 50.3 | 45.2 | |
| Progression Factor | 0.99 | 1.19 | | 1.07 | 0.98 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 5.3 | 0.3 | | 3.9 | 0.9 | | 0.0 | 0.0 | 0.1 | 15.2 | 0.2 | |
| Delay (s) | 63.7 | 11.4 | | 67.2 | 12.4 | | 43.2 | 43.2 | 43.6 | 65.5 | 45.4 | |
| Level of Service | E | B | | E | B | | D | D | D | E | D | |
| Approach Delay (s) | | 16.3 | | | 15.2 | | | 43.4 | | | 58.1 | |
| Approach LOS | | B | | | B | | | D | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 22.0 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.60 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 67.9% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 17: US 101 SB Ramps & De Long Ave

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 188 | 669 | 20 | 820 | 0 | 0 | 0 | 0 | 11 | 2 | 303 |
| Future Volume (vph) | 0 | 188 | 669 | 20 | 820 | 0 | 0 | 0 | 0 | 11 | 2 | 303 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.6 | 3.6 | 3.0 | 3.6 | | | | | 4.0 | 4.0 | |
| Lane Util. Factor | | 0.95 | 1.00 | 1.00 | 0.95 | | | | | 0.95 | 0.95 | |
| Frt | | 1.00 | 0.85 | 1.00 | 1.00 | | | | | 1.00 | 0.85 | |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 3574 | 1599 | 1770 | 3539 | | | | | 1681 | 1506 | |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | 0.95 | 1.00 | |
| Satd. Flow (perm) | | 3574 | 1599 | 1770 | 3539 | | | | | 1681 | 1506 | |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 0 | 200 | 712 | 21 | 872 | 0 | 0 | 0 | 0 | 12 | 2 | 322 |
| RTOR Reduction (vph) | 0 | 0 | 276 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 118 | 0 |
| Lane Group Flow (vph) | 0 | 200 | 436 | 21 | 872 | 0 | 0 | 0 | 0 | 11 | 207 | 0 |
| Heavy Vehicles (%) | 0% | 1% | 1% | 2% | 2% | 2% | 2% | 2% | 2% | 2% | 2% | 2% |
| Turn Type | | NA | Perm | Prot | NA | | | | | Split | NA | |
| Protected Phases | | 6 | | 5 | 2 | | | | | 4 | 4 | |
| Permitted Phases | | | 6 | | | | | | | | | |
| Actuated Green, G (s) | | 39.8 | 39.8 | 1.4 | 44.2 | | | | | 13.2 | 13.2 | |
| Effective Green, g (s) | | 39.8 | 39.8 | 1.4 | 44.2 | | | | | 13.2 | 13.2 | |
| Actuated g/C Ratio | | 0.61 | 0.61 | 0.02 | 0.68 | | | | | 0.20 | 0.20 | |
| Clearance Time (s) | | 3.6 | 3.6 | 3.0 | 3.6 | | | | | 4.0 | 4.0 | |
| Vehicle Extension (s) | | 4.0 | 4.0 | 2.0 | 4.0 | | | | | 2.5 | 2.5 | |
| Lane Grp Cap (vph) | | 2188 | 979 | 38 | 2406 | | | | | 341 | 305 | |
| v/s Ratio Prot | | 0.06 | | c0.01 | 0.25 | | | | | 0.01 | c0.14 | |
| v/s Ratio Perm | | | c0.27 | | | | | | | | | |
| v/c Ratio | | 0.09 | 0.45 | 0.55 | 0.36 | | | | | 0.03 | 0.68 | |
| Uniform Delay, d1 | | 5.2 | 6.7 | 31.5 | 4.4 | | | | | 20.8 | 23.9 | |
| Progression Factor | | 1.03 | 6.58 | 1.00 | 1.00 | | | | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 0.1 | 1.4 | 9.5 | 0.4 | | | | | 0.0 | 5.4 | |
| Delay (s) | | 5.4 | 45.6 | 41.0 | 4.8 | | | | | 20.8 | 29.3 | |
| Level of Service | | A | D | D | A | | | | | C | C | |
| Approach Delay (s) | | 36.8 | | | 5.7 | | | 0.0 | | | 29.0 | |
| Approach LOS | | D | | | A | | | A | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 22.6 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.50 | | |
| Actuated Cycle Length (s) | 65.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 64.5% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 18: US 101 NB Ramps & De Long Ave

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 166 | 33 | 0 | 1 | 58 | 9 | 783 | 2 | 17 | 0 | 0 | 0 |
| Future Volume (vph) | 166 | 33 | 0 | 1 | 58 | 9 | 783 | 2 | 17 | 0 | 0 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 3.6 | | | 3.6 | | 4.5 | 4.5 | | | | |
| Lane Util. Factor | 1.00 | 0.95 | | | 0.95 | | 0.95 | 0.95 | | | | |
| Frt | 1.00 | 1.00 | | | 0.98 | | 1.00 | 0.99 | | | | |
| Flt Protected | 0.95 | 1.00 | | | 1.00 | | 0.95 | 0.95 | | | | |
| Satd. Flow (prot) | 1770 | 3610 | | | 3483 | | 1698 | 1690 | | | | |
| Flt Permitted | 0.95 | 1.00 | | | 0.95 | | 0.95 | 0.95 | | | | |
| Satd. Flow (perm) | 1770 | 3610 | | | 3316 | | 1698 | 1690 | | | | |
| Peak-hour factor, PHF | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 |
| Adj. Flow (vph) | 189 | 38 | 0 | 1 | 66 | 10 | 890 | 2 | 19 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 189 | 38 | 0 | 0 | 68 | 0 | 454 | 455 | 0 | 0 | 0 | 0 |
| Heavy Vehicles (%) | 2% | 0% | 0% | 0% | 0% | 12% | 1% | 0% | 8% | 0% | 0% | 0% |
| Turn Type | Prot | NA | | | NA | | Split | NA | | | | |
| Protected Phases | 1 | 6 | | | 2 | | 4 | 4 | | | | |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | 8.9 | 17.0 | | | 4.6 | | 20.8 | 20.8 | | | | |
| Effective Green, g (s) | 8.9 | 17.0 | | | 4.6 | | 20.8 | 20.8 | | | | |
| Actuated g/C Ratio | 0.19 | 0.37 | | | 0.10 | | 0.45 | 0.45 | | | | |
| Clearance Time (s) | 3.5 | 3.6 | | | 3.6 | | 4.5 | 4.5 | | | | |
| Vehicle Extension (s) | 2.5 | 2.0 | | | 2.0 | | 3.0 | 3.0 | | | | |
| Lane Grp Cap (vph) | 343 | 1337 | | | 332 | | 769 | 765 | | | | |
| v/s Ratio Prot | c0.11 | 0.01 | | | | | 0.27 | c0.27 | | | | |
| v/s Ratio Perm | | | | | c0.02 | | | | | | | |
| v/c Ratio | 0.55 | 0.03 | | | 1.00dr | | 0.59 | 0.60 | | | | |
| Uniform Delay, d1 | 16.7 | 9.2 | | | 19.0 | | 9.4 | 9.4 | | | | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | | | | |
| Incremental Delay, d2 | 1.5 | 0.0 | | | 0.1 | | 1.2 | 1.3 | | | | |
| Delay (s) | 18.2 | 9.2 | | | 19.1 | | 10.6 | 10.6 | | | | |
| Level of Service | B | A | | | B | | B | B | | | | |
| Approach Delay (s) | | 16.7 | | | 19.1 | | | 10.6 | | | 0.0 | |
| Approach LOS | | B | | | B | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 12.3 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.53 | | |
| Actuated Cycle Length (s) | 45.9 | Sum of lost time (s) | 11.6 |
| Intersection Capacity Utilization | 45.2% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| dr Defacto Right Lane. Recode with 1 though lane as a right lane. | | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 19: Redwood Blvd & Lamont Ave

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 10 | 2 | 8 | 100 | 2 | 50 | 16 | 263 | 41 | 65 | 490 | 28 |
| Future Volume (vph) | 10 | 2 | 8 | 100 | 2 | 50 | 16 | 263 | 41 | 65 | 490 | 28 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.5 | 3.5 | | 3.5 | 3.5 | 3.5 | 4.8 | | 3.5 | 4.8 | 4.8 |
| Lane Util. Factor | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 |
| Frpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | 0.99 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Flpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | | 1.00 | 0.85 | | 1.00 | 0.85 | 1.00 | 0.98 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | | 0.96 | 1.00 | | 0.95 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | | 1822 | 1615 | | 1811 | 1595 | 1805 | 3527 | | 1805 | 3610 | 1615 |
| Flt Permitted | | 0.84 | 1.00 | | 0.74 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | | 1599 | 1615 | | 1405 | 1595 | 1805 | 3527 | | 1805 | 3610 | 1615 |
| Peak-hour factor, PHF | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Adj. Flow (vph) | 11 | 2 | 9 | 110 | 2 | 55 | 18 | 289 | 45 | 71 | 538 | 31 |
| RTOR Reduction (vph) | 0 | 0 | 7 | 0 | 0 | 40 | 0 | 12 | 0 | 0 | 0 | 17 |
| Lane Group Flow (vph) | 0 | 13 | 2 | 0 | 112 | 15 | 18 | 322 | 0 | 71 | 538 | 14 |
| Confl. Peds. (#/hr) | 1 | | | | | 1 | | | 2 | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Perm | NA | Perm | Perm | NA | Perm | Prot | NA | | Prot | NA | Perm |
| Protected Phases | | 8 | | | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | 8 | | 8 | 4 | | 4 | | | | | | 2 |
| Actuated Green, G (s) | | 12.7 | 12.7 | | 12.7 | 12.7 | 0.9 | 18.9 | | 3.1 | 21.1 | 21.1 |
| Effective Green, g (s) | | 12.7 | 12.7 | | 12.7 | 12.7 | 0.9 | 18.9 | | 3.1 | 21.1 | 21.1 |
| Actuated g/C Ratio | | 0.27 | 0.27 | | 0.27 | 0.27 | 0.02 | 0.41 | | 0.07 | 0.45 | 0.45 |
| Clearance Time (s) | | 3.5 | 3.5 | | 3.5 | 3.5 | 3.5 | 4.8 | | 3.5 | 4.8 | 4.8 |
| Vehicle Extension (s) | | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 | 3.0 | | 2.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | 436 | 441 | | 383 | 435 | 34 | 1433 | | 120 | 1638 | 732 |
| v/s Ratio Prot | | | | | | | 0.01 | 0.09 | | c0.04 | c0.15 | |
| v/s Ratio Perm | | 0.01 | 0.00 | | c0.08 | 0.01 | | | | | | 0.01 |
| v/c Ratio | | 0.03 | 0.01 | | 0.29 | 0.03 | 0.53 | 0.22 | | 0.59 | 0.33 | 0.02 |
| Uniform Delay, d1 | | 12.4 | 12.3 | | 13.4 | 12.4 | 22.6 | 9.0 | | 21.1 | 8.2 | 7.0 |
| Progression Factor | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.0 | 0.0 | | 0.2 | 0.0 | 6.7 | 0.1 | | 5.1 | 0.1 | 0.0 |
| Delay (s) | | 12.4 | 12.3 | | 13.5 | 12.4 | 29.3 | 9.1 | | 26.2 | 8.3 | 7.0 |
| Level of Service | | B | B | | B | B | C | A | | C | A | A |
| Approach Delay (s) | | 12.4 | | | 13.1 | | | 10.1 | | | 10.2 | |
| Approach LOS | | B | | | B | | | B | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 10.6 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.34 | | |
| Actuated Cycle Length (s) | 46.5 | Sum of lost time (s) | 11.8 |
| Intersection Capacity Utilization | 44.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 20: Redwood Blvd & Landing Ct

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 2 | 0 | 1 | 25 | 0 | 12 | 1 | 306 | 32 | 25 | 479 | 1 |
| Future Volume (vph) | 2 | 0 | 1 | 25 | 0 | 12 | 1 | 306 | 32 | 25 | 479 | 1 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.5 | | 3.5 | | 3.5 | | 4.8 | 4.8 | 3.5 | 4.8 | 4.8 |
| Lane Util. Factor | | 1.00 | | 1.00 | | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |
| Frpb, ped/bikes | | 1.00 | | 1.00 | | 1.00 | | 1.00 | 0.98 | 1.00 | 1.00 | 0.97 |
| Flpb, ped/bikes | | 1.00 | | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.95 | | 1.00 | | 0.85 | | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | | 0.97 | | 0.95 | | 1.00 | | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | | 1748 | | 1803 | | 1615 | | 3609 | 1579 | 1805 | 3610 | 1572 |
| Flt Permitted | | 0.97 | | 1.00 | | 1.00 | | 0.95 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | | 1748 | | 1898 | | 1615 | | 3444 | 1579 | 1805 | 3610 | 1572 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 2 | 0 | 1 | 27 | 0 | 13 | 1 | 333 | 35 | 27 | 521 | 1 |
| RTOR Reduction (vph) | 0 | 3 | 0 | 0 | 0 | 12 | 0 | 0 | 13 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 27 | 0 | 1 | 0 | 334 | 22 | 27 | 521 | 1 |
| Confl. Peds. (#/hr) | | | 4 | 4 | | | | | 3 | | | 6 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Perm | NA | | Perm | | Perm | Perm | NA | Perm | Prot | NA | Perm |
| Protected Phases | | 4 | | | | | | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | 2 | | | 6 |
| Actuated Green, G (s) | | 4.0 | | 4.0 | | 4.0 | | 26.9 | 26.9 | 0.8 | 31.2 | 31.2 |
| Effective Green, g (s) | | 4.0 | | 4.0 | | 4.0 | | 26.9 | 26.9 | 0.8 | 31.2 | 31.2 |
| Actuated g/C Ratio | | 0.09 | | 0.09 | | 0.09 | | 0.62 | 0.62 | 0.02 | 0.72 | 0.72 |
| Clearance Time (s) | | 3.5 | | 3.5 | | 3.5 | | 4.8 | 4.8 | 3.5 | 4.8 | 4.8 |
| Vehicle Extension (s) | | 3.0 | | 2.0 | | 2.0 | | 4.0 | 4.0 | 2.0 | 4.0 | 4.0 |
| Lane Grp Cap (vph) | | 160 | | 174 | | 148 | | 2129 | 976 | 33 | 2589 | 1127 |
| v/s Ratio Prot | | | | | | | | | | c0.01 | c0.14 | |
| v/s Ratio Perm | | 0.00 | | c0.01 | | 0.00 | | 0.10 | 0.01 | | | 0.00 |
| v/c Ratio | | 0.00 | | 0.16 | | 0.01 | | 0.16 | 0.02 | 0.82 | 0.20 | 0.00 |
| Uniform Delay, d1 | | 17.9 | | 18.2 | | 17.9 | | 3.5 | 3.2 | 21.3 | 2.0 | 1.7 |
| Progression Factor | | 1.00 | | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.0 | | 0.2 | | 0.0 | | 0.0 | 0.0 | 81.1 | 0.1 | 0.0 |
| Delay (s) | | 17.9 | | 18.3 | | 18.0 | | 3.6 | 3.2 | 102.4 | 2.1 | 1.7 |
| Level of Service | | B | | B | | B | | A | A | F | A | A |
| Approach Delay (s) | | 17.9 | | | 18.2 | | | 3.5 | | | 7.0 | |
| Approach LOS | | B | | | B | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 6.2 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.23 | | |
| Actuated Cycle Length (s) | 43.5 | Sum of lost time (s) | 11.8 |
| Intersection Capacity Utilization | 40.5% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 21: Novato Blvd & Center Rd/Garden Ct

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 56 | 0 | 298 | 3 | 0 | 3 | 121 | 455 | 4 | 1 | 663 | 66 |
| Future Volume (vph) | 56 | 0 | 298 | 3 | 0 | 3 | 121 | 455 | 4 | 1 | 663 | 66 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.2 | 3.2 | | | 3.0 | | 3.0 | 4.4 | | 3.0 | 4.4 | |
| Lane Util. Factor | 1.00 | 1.00 | | | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.85 | | | 0.93 | | 1.00 | 1.00 | | 1.00 | 0.99 | |
| Flt Protected | 0.95 | 1.00 | | | 0.98 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1805 | 1615 | | | 1729 | | 1805 | 3604 | | 1805 | 3518 | |
| Flt Permitted | 0.75 | 1.00 | | | 0.58 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1432 | 1615 | | | 1035 | | 1805 | 3604 | | 1805 | 3518 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 61 | 0 | 324 | 3 | 0 | 3 | 132 | 495 | 4 | 1 | 721 | 72 |
| RTOR Reduction (vph) | 0 | 288 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 4 | 0 |
| Lane Group Flow (vph) | 61 | 36 | 0 | 0 | 1 | 0 | 132 | 499 | 0 | 1 | 789 | 0 |
| Confl. Peds. (#/hr) | | | | | | | | | 9 | | | 6 |
| Confl. Bikes (#/hr) | | | | | | | | | 2 | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 1% | 0% |
| Turn Type | Perm | NA | | Perm | NA | | Prot | NA | | Prot | NA | |
| Protected Phases | | 8 | | | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | 8 | | | 4 | | | | | | | | |
| Actuated Green, G (s) | 11.2 | 11.2 | | | 11.4 | | 12.3 | 76.0 | | 2.2 | 65.9 | |
| Effective Green, g (s) | 11.2 | 11.2 | | | 11.4 | | 12.3 | 76.0 | | 2.2 | 65.9 | |
| Actuated g/C Ratio | 0.11 | 0.11 | | | 0.11 | | 0.12 | 0.76 | | 0.02 | 0.66 | |
| Clearance Time (s) | 3.2 | 3.2 | | | 3.0 | | 3.0 | 4.4 | | 3.0 | 4.4 | |
| Vehicle Extension (s) | 3.0 | 3.0 | | | 2.0 | | 2.0 | 4.0 | | 2.0 | 4.0 | |
| Lane Grp Cap (vph) | 160 | 180 | | | 117 | | 222 | 2739 | | 39 | 2318 | |
| v/s Ratio Prot | | 0.02 | | | | | c0.07 | 0.14 | | 0.00 | c0.22 | |
| v/s Ratio Perm | c0.04 | | | | 0.00 | | | | | | | |
| v/c Ratio | 0.38 | 0.20 | | | 0.01 | | 0.59 | 0.18 | | 0.03 | 0.34 | |
| Uniform Delay, d1 | 41.2 | 40.3 | | | 39.3 | | 41.5 | 3.3 | | 47.9 | 7.5 | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | | 0.73 | 1.24 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 1.5 | 0.6 | | | 0.0 | | 2.8 | 0.1 | | 0.1 | 0.4 | |
| Delay (s) | 42.7 | 40.9 | | | 39.3 | | 33.2 | 4.3 | | 47.9 | 7.9 | |
| Level of Service | D | D | | | D | | C | A | | D | A | |
| Approach Delay (s) | | 41.2 | | | 39.3 | | | 10.3 | | | 7.9 | |
| Approach LOS | | D | | | D | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 15.9 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.38 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 57.6% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 22: Novato Blvd & Arthur St

02/15/2018

| Movement | EBL | EBR | NBL | NBT | SBU | SBT | SBR |
|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | |
| Traffic Volume (vph) | 157 | 124 | 220 | 492 | 18 | 834 | 180 |
| Future Volume (vph) | 157 | 124 | 220 | 492 | 18 | 834 | 180 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 3.5 | 3.5 | 4.9 | 3.5 | 4.9 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 0.98 | 1.00 | 1.00 | 1.00 | 0.99 | |
| Flpb, ped/bikes | 0.99 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 0.85 | 1.00 | 1.00 | 1.00 | 0.97 | |
| Flt Protected | 0.95 | 1.00 | 0.95 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1785 | 1579 | 1805 | 3610 | 1805 | 3466 | |
| Flt Permitted | 0.95 | 1.00 | 0.95 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1785 | 1579 | 1805 | 3610 | 1805 | 3466 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 171 | 135 | 239 | 535 | 20 | 907 | 196 |
| RTOR Reduction (vph) | 0 | 114 | 0 | 0 | 0 | 13 | 0 |
| Lane Group Flow (vph) | 171 | 21 | 239 | 535 | 20 | 1090 | 0 |
| Confl. Peds. (#/hr) | 10 | 8 | | | | | 5 |
| Confl. Bikes (#/hr) | | 1 | | | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 1% | 0% |
| Turn Type | Perm | Perm | Prot | NA | Prot | NA | |
| Protected Phases | | | 1 | 6 | 5 | 2 | |
| Permitted Phases | 4 | 4 | | | | | |
| Actuated Green, G (s) | 15.5 | 15.5 | 17.3 | 69.9 | 2.7 | 55.3 | |
| Effective Green, g (s) | 15.5 | 15.5 | 17.3 | 69.9 | 2.7 | 55.3 | |
| Actuated g/C Ratio | 0.16 | 0.16 | 0.17 | 0.70 | 0.03 | 0.55 | |
| Clearance Time (s) | 3.5 | 3.5 | 3.5 | 4.9 | 3.5 | 4.9 | |
| Vehicle Extension (s) | 2.0 | 2.0 | 2.0 | 4.0 | 2.0 | 4.0 | |
| Lane Grp Cap (vph) | 276 | 244 | 312 | 2523 | 48 | 1916 | |
| v/s Ratio Prot | | | c0.13 | 0.15 | 0.01 | c0.31 | |
| v/s Ratio Perm | c0.10 | 0.01 | | | | | |
| v/c Ratio | 0.62 | 0.09 | 0.77 | 0.21 | 0.42 | 0.57 | |
| Uniform Delay, d1 | 39.5 | 36.2 | 39.4 | 5.3 | 47.9 | 14.6 | |
| Progression Factor | 1.00 | 1.00 | 0.88 | 0.76 | 1.37 | 0.74 | |
| Incremental Delay, d2 | 2.9 | 0.1 | 8.2 | 0.2 | 2.0 | 1.2 | |
| Delay (s) | 42.4 | 36.2 | 43.0 | 4.2 | 67.7 | 12.0 | |
| Level of Service | D | D | D | A | E | B | |
| Approach Delay (s) | 39.7 | | | 16.2 | | 13.0 | |
| Approach LOS | D | | | B | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 17.8 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.62 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 11.9 |
| Intersection Capacity Utilization | 63.8% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 23: Novato Blvd & Rowland Blvd

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 44 | 135 | 15 | 353 | 308 | 337 | 43 | 295 | 216 | 372 | 419 | 179 |
| Future Volume (vph) | 44 | 135 | 15 | 353 | 308 | 337 | 43 | 295 | 216 | 372 | 419 | 179 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 3.5 | | 3.5 | 4.1 | 4.1 | 3.5 | 4.1 | | 3.5 | 4.4 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 0.97 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 0.99 | | 1.00 | 1.00 | 0.99 | 1.00 | 0.99 | | 1.00 | 0.99 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.98 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.94 | | 1.00 | 0.96 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1805 | 1858 | | 1770 | 1900 | 1576 | 1805 | 1745 | | 3502 | 1794 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1805 | 1858 | | 1770 | 1900 | 1576 | 1805 | 1745 | | 3502 | 1794 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 46 | 142 | 16 | 372 | 324 | 355 | 45 | 311 | 227 | 392 | 441 | 188 |
| RTOR Reduction (vph) | 0 | 4 | 0 | 0 | 0 | 251 | 0 | 23 | 0 | 0 | 13 | 0 |
| Lane Group Flow (vph) | 46 | 154 | 0 | 372 | 324 | 104 | 45 | 515 | 0 | 392 | 616 | 0 |
| Confl. Peds. (#/hr) | | | 24 | | | 2 | | | 13 | | | 10 |
| Confl. Bikes (#/hr) | | | 1 | | | | | | 1 | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 2% | 0% | 1% | 0% | 0% | 2% | 0% | 0% | 0% |
| Turn Type | Prot | NA | | Prot | NA | Perm | Prot | NA | | Prot | NA | |
| Protected Phases | 3 | 8 | | 7 | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | | | | | | 4 | | | | | | |
| Actuated Green, G (s) | 5.6 | 18.1 | | 17.5 | 29.4 | 29.4 | 5.7 | 35.6 | | 14.2 | 43.8 | |
| Effective Green, g (s) | 5.6 | 18.1 | | 17.5 | 29.4 | 29.4 | 5.7 | 35.6 | | 14.2 | 43.8 | |
| Actuated g/C Ratio | 0.06 | 0.18 | | 0.18 | 0.29 | 0.29 | 0.06 | 0.36 | | 0.14 | 0.44 | |
| Clearance Time (s) | 3.5 | 3.5 | | 3.5 | 4.1 | 4.1 | 3.5 | 4.1 | | 3.5 | 4.4 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 3.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 101 | 336 | | 309 | 558 | 463 | 102 | 621 | | 497 | 785 | |
| v/s Ratio Prot | 0.03 | 0.08 | | c0.21 | c0.17 | | 0.02 | c0.30 | | 0.11 | c0.34 | |
| v/s Ratio Perm | | | | | | 0.07 | | | | | | |
| v/c Ratio | 0.46 | 0.46 | | 1.20 | 0.58 | 0.23 | 0.44 | 0.83 | | 0.79 | 0.78 | |
| Uniform Delay, d1 | 45.7 | 36.6 | | 41.2 | 30.1 | 26.7 | 45.6 | 29.4 | | 41.5 | 24.1 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.19 | 0.63 | |
| Incremental Delay, d2 | 1.2 | 0.4 | | 118.4 | 1.0 | 0.1 | 1.1 | 12.1 | | 6.5 | 6.7 | |
| Delay (s) | 46.9 | 36.9 | | 159.7 | 31.0 | 26.8 | 46.7 | 41.6 | | 55.8 | 21.9 | |
| Level of Service | D | D | | F | C | C | D | D | | E | C | |
| Approach Delay (s) | | 39.2 | | | 75.1 | | | 42.0 | | | 34.9 | |
| Approach LOS | | D | | | E | | | D | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 51.4 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.88 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 15.5 |
| Intersection Capacity Utilization | 88.3% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 24: Redwood Blvd & Rowland Blvd

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 112 | 659 | 47 | 20 | 783 | 269 | 69 | 22 | 77 | 288 | 18 | 294 |
| Future Volume (vph) | 112 | 659 | 47 | 20 | 783 | 269 | 69 | 22 | 77 | 288 | 18 | 294 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.4 | 4.4 | 3.5 | 3.7 | 3.7 | 3.5 | 4.1 | | 3.5 | 4.8 | 4.8 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | 0.97 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.99 | 1.00 | 0.99 | | 1.00 | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.88 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1805 | 3574 | 1589 | 1805 | 3574 | 1578 | 1805 | 3151 | | 3502 | 1900 | 1593 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1805 | 3574 | 1589 | 1805 | 3574 | 1578 | 1805 | 3151 | | 3502 | 1900 | 1593 |
| Peak-hour factor, PHF | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 |
| Adj. Flow (vph) | 126 | 740 | 53 | 22 | 880 | 302 | 78 | 25 | 87 | 324 | 20 | 330 |
| RTOR Reduction (vph) | 0 | 0 | 27 | 0 | 0 | 73 | 0 | 75 | 0 | 0 | 0 | 244 |
| Lane Group Flow (vph) | 126 | 740 | 26 | 22 | 880 | 229 | 78 | 37 | 0 | 324 | 20 | 86 |
| Confl. Peds. (#/hr) | | | 6 | | | 2 | | | 3 | | | 2 |
| Confl. Bikes (#/hr) | | | | | | | | | 1 | | | |
| Heavy Vehicles (%) | 0% | 1% | 0% | 0% | 1% | 1% | 0% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Prot | NA | Perm | Prot | NA | Perm | Prot | NA | | Prot | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | 3 | 8 | | 7 | 4 | |
| Permitted Phases | | | 2 | | | 6 | | | | | | 4 |
| Actuated Green, G (s) | 11.1 | 39.0 | 39.0 | 3.0 | 31.6 | 31.6 | 8.0 | 10.7 | | 12.6 | 14.6 | 14.6 |
| Effective Green, g (s) | 11.1 | 39.0 | 39.0 | 3.0 | 31.6 | 31.6 | 8.0 | 10.7 | | 12.6 | 14.6 | 14.6 |
| Actuated g/C Ratio | 0.14 | 0.48 | 0.48 | 0.04 | 0.39 | 0.39 | 0.10 | 0.13 | | 0.16 | 0.18 | 0.18 |
| Clearance Time (s) | 3.5 | 4.4 | 4.4 | 3.5 | 3.7 | 3.7 | 3.5 | 4.1 | | 3.5 | 4.8 | 4.8 |
| Vehicle Extension (s) | 2.0 | 4.0 | 4.0 | 2.0 | 4.0 | 4.0 | 2.0 | 2.5 | | 2.5 | 2.5 | 2.5 |
| Lane Grp Cap (vph) | 247 | 1725 | 766 | 67 | 1397 | 617 | 178 | 417 | | 546 | 343 | 287 |
| v/s Ratio Prot | c0.07 | 0.21 | | 0.01 | c0.25 | | 0.04 | 0.01 | | c0.09 | 0.01 | |
| v/s Ratio Perm | | | 0.02 | | | 0.15 | | | | | | c0.05 |
| v/c Ratio | 0.51 | 0.43 | 0.03 | 0.33 | 0.63 | 0.37 | 0.44 | 0.09 | | 0.59 | 0.06 | 0.30 |
| Uniform Delay, d1 | 32.3 | 13.6 | 11.0 | 37.9 | 19.9 | 17.5 | 34.3 | 30.8 | | 31.7 | 27.4 | 28.7 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.7 | 0.2 | 0.0 | 1.0 | 1.0 | 0.5 | 0.6 | 0.1 | | 1.5 | 0.1 | 0.4 |
| Delay (s) | 33.1 | 13.9 | 11.0 | 39.0 | 20.9 | 18.0 | 34.9 | 30.8 | | 33.2 | 27.5 | 29.1 |
| Level of Service | C | B | B | D | C | B | C | C | | C | C | C |
| Approach Delay (s) | | 16.3 | | | 20.5 | | | 32.5 | | | 31.0 | |
| Approach LOS | | B | | | C | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 22.4 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.57 | | |
| Actuated Cycle Length (s) | 80.8 | Sum of lost time (s) | 16.2 |
| Intersection Capacity Utilization | 60.2% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 25: US 101 SB Ramps & Rowland Blvd

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 563 | 435 | 132 | 632 | 0 | 0 | 0 | 0 | 269 | 47 | 480 |
| Future Volume (vph) | 0 | 563 | 435 | 132 | 632 | 0 | 0 | 0 | 0 | 269 | 47 | 480 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.6 | 3.6 | 3.0 | 3.6 | | | | | 3.0 | 3.0 | |
| Lane Util. Factor | | 0.91 | 0.91 | 0.97 | 0.95 | | | | | 0.91 | 0.91 | |
| Frpb, ped/bikes | | 1.00 | 0.99 | 1.00 | 1.00 | | | | | 1.00 | 0.99 | |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | | | | 1.00 | 1.00 | |
| Frt | | 0.97 | 0.85 | 1.00 | 1.00 | | | | | 1.00 | 0.87 | |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 3325 | 1450 | 3367 | 3574 | | | | | 1643 | 2845 | |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | 0.95 | 1.00 | |
| Satd. Flow (perm) | | 3325 | 1450 | 3367 | 3574 | | | | | 1643 | 2845 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 0 | 612 | 473 | 143 | 687 | 0 | 0 | 0 | 0 | 292 | 51 | 522 |
| RTOR Reduction (vph) | 0 | 23 | 204 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 78 | 0 |
| Lane Group Flow (vph) | 0 | 731 | 127 | 143 | 687 | 0 | 0 | 0 | 0 | 263 | 524 | 0 |
| Confl. Peds. (#/hr) | | | 2 | | | | | | | | | 2 |
| Confl. Bikes (#/hr) | | | | | | | | | | | | 1 |
| Heavy Vehicles (%) | 0% | 1% | 0% | 4% | 1% | 0% | 0% | 0% | 0% | 0% | 40% | 1% |
| Turn Type | | NA | Perm | Prot | NA | | | | | Split | NA | |
| Protected Phases | | 2 | | 1 | 6 | | | | | 4 | 4 | |
| Permitted Phases | | | 2 | | | | | | | | | |
| Actuated Green, G (s) | | 17.8 | 17.8 | 3.7 | 24.5 | | | | | 15.2 | 15.2 | |
| Effective Green, g (s) | | 17.8 | 17.8 | 3.7 | 24.5 | | | | | 15.2 | 15.2 | |
| Actuated g/C Ratio | | 0.38 | 0.38 | 0.08 | 0.53 | | | | | 0.33 | 0.33 | |
| Clearance Time (s) | | 3.6 | 3.6 | 3.0 | 3.6 | | | | | 3.0 | 3.0 | |
| Vehicle Extension (s) | | 4.0 | 4.0 | 2.0 | 2.5 | | | | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | | 1278 | 557 | 269 | 1891 | | | | | 539 | 933 | |
| v/s Ratio Prot | | c0.22 | | c0.04 | 0.19 | | | | | 0.16 | c0.18 | |
| v/s Ratio Perm | | | 0.09 | | | | | | | | | |
| v/c Ratio | | 0.57 | 0.23 | 0.53 | 0.36 | | | | | 0.49 | 0.92dr | |
| Uniform Delay, d1 | | 11.2 | 9.6 | 20.5 | 6.4 | | | | | 12.4 | 12.8 | |
| Progression Factor | | 1.00 | 1.00 | 1.00 | 1.00 | | | | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 0.7 | 0.3 | 1.0 | 0.1 | | | | | 0.3 | 0.5 | |
| Delay (s) | | 12.0 | 9.9 | 21.5 | 6.4 | | | | | 12.7 | 13.3 | |
| Level of Service | | B | A | C | A | | | | | B | B | |
| Approach Delay (s) | | 11.4 | | | 9.0 | | | 0.0 | | | 13.1 | |
| Approach LOS | | B | | | A | | | A | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 11.2 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.56 | | |
| Actuated Cycle Length (s) | 46.3 | Sum of lost time (s) | 9.6 |
| Intersection Capacity Utilization | 51.4% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

dr Defacto Right Lane. Recode with 1 though lane as a right lane.

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 26: US 101 NB Ramps & Rowland Blvd

02/15/2018

| Movement | EBL2 | EBL | EBT | WBT | WBR | WBR2 | NBL2 | NBL | NBT | NBR | NEL2 | NEL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 26 | 237 | 596 | 305 | 1 | 142 | 466 | 7 | 8 | 418 | 12 | 3 |
| Future Volume (vph) | 26 | 237 | 596 | 305 | 1 | 142 | 466 | 7 | 8 | 418 | 12 | 3 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | 3.6 | 3.6 | | 3.6 | 3.5 | | 3.5 | 3.0 | | 3.5 |
| Lane Util. Factor | | 1.00 | 0.95 | 0.86 | | 0.86 | 0.95 | | 0.95 | 0.88 | | 1.00 |
| Frpb, ped/bikes | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Frt | | 1.00 | 1.00 | 0.98 | | 0.85 | 1.00 | | 1.00 | 0.85 | | 0.99 |
| Flt Protected | | 0.95 | 1.00 | 1.00 | | 1.00 | 0.95 | | 0.95 | 1.00 | | 0.96 |
| Satd. Flow (prot) | | 1805 | 3574 | 4623 | | 1323 | 1715 | | 1683 | 2787 | | 1800 |
| Flt Permitted | | 0.95 | 1.00 | 1.00 | | 1.00 | 0.95 | | 0.95 | 1.00 | | 0.96 |
| Satd. Flow (perm) | | 1805 | 3574 | 4623 | | 1323 | 1715 | | 1683 | 2787 | | 1800 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 28 | 258 | 648 | 332 | 1 | 154 | 507 | 8 | 9 | 454 | 13 | 3 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 14 | 0 | 84 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 286 | 648 | 364 | 0 | 25 | 264 | 0 | 260 | 454 | 0 | 17 |
| Confl. Peds. (#/hr) | | | | | | | | | | 2 | | |
| Heavy Vehicles (%) | 0% | 0% | 1% | 4% | 0% | 5% | 0% | 0% | 67% | 2% | 0% | 0% |
| Turn Type | Prot | Prot | NA | NA | | Perm | Split | Split | NA | custom | Perm | Prot |
| Protected Phases | 5 | 5 | 2 | 6 | | | 8 | 8 | 8 | 1 8 | | 7 |
| Permitted Phases | | | | | | 6 | | | | | 7 | |
| Actuated Green, G (s) | | 16.0 | 17.5 | 13.9 | | 13.9 | 16.4 | | 16.4 | 32.3 | | 1.3 |
| Effective Green, g (s) | | 16.0 | 17.5 | 13.9 | | 13.9 | 16.4 | | 16.4 | 28.8 | | 1.3 |
| Actuated g/C Ratio | | 0.26 | 0.29 | 0.23 | | 0.23 | 0.27 | | 0.27 | 0.47 | | 0.02 |
| Clearance Time (s) | | 3.0 | 3.6 | 3.6 | | 3.6 | 3.5 | | 3.5 | | | 3.5 |
| Vehicle Extension (s) | | 2.0 | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | | | 2.0 |
| Lane Grp Cap (vph) | | 471 | 1021 | 1049 | | 300 | 459 | | 451 | 1311 | | 38 |
| v/s Ratio Prot | | 0.16 | c0.18 | c0.08 | | | 0.15 | | c0.15 | 0.16 | | |
| v/s Ratio Perm | | | | | | 0.02 | | | | | | 0.01 |
| v/c Ratio | | 0.61 | 0.63 | 0.35 | | 0.08 | 0.58 | | 0.58 | 0.35 | | 0.45 |
| Uniform Delay, d1 | | 19.8 | 19.1 | 19.8 | | 18.6 | 19.4 | | 19.4 | 10.2 | | 29.6 |
| Progression Factor | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Incremental Delay, d2 | | 1.5 | 1.0 | 0.1 | | 0.0 | 1.1 | | 1.1 | 0.1 | | 3.0 |
| Delay (s) | | 21.4 | 20.0 | 19.9 | | 18.7 | 20.5 | | 20.5 | 10.3 | | 32.6 |
| Level of Service | | C | C | B | | B | C | | C | B | | C |
| Approach Delay (s) | | | 20.4 | 19.6 | | | | | 15.8 | | | 32.6 |
| Approach LOS | | | C | B | | | | | B | | | C |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 18.5 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.54 | | |
| Actuated Cycle Length (s) | 61.2 | Sum of lost time (s) | 13.6 |
| Intersection Capacity Utilization | 61.4% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 26: US 101 NB Ramps & Rowland Blvd

02/15/2018

| Movement | NER |
|---|---|
| Lane Configurations | |
| Traffic Volume (vph) | 1 |
| Future Volume (vph) | 1 |
| Ideal Flow (vphpl) | 1900 |
| Total Lost time (s) | |
| Lane Util. Factor | |
| Frpb, ped/bikes | |
| Flpb, ped/bikes | |
| Frt | |
| Flt Protected | |
| Satd. Flow (prot) | |
| Flt Permitted | |
| Satd. Flow (perm) | |
| Peak-hour factor, PHF | 0.92 |
| Adj. Flow (vph) | 1 |
| RTOR Reduction (vph) | 0 |
| Lane Group Flow (vph) | 0 |
| Confl. Peds. (#/hr) | |
| Heavy Vehicles (%) | 0% |
| Turn Type | |
| Protected Phases | |
| Permitted Phases | |
| Actuated Green, G (s) | |
| Effective Green, g (s) | |
| Actuated g/C Ratio | |
| Clearance Time (s) | |
| Vehicle Extension (s) | |
| Lane Grp Cap (vph) | |
| v/s Ratio Prot | |
| v/s Ratio Perm | |
| v/c Ratio | |
| Uniform Delay, d1 | |
| Progression Factor | |
| Incremental Delay, d2 | |
| Delay (s) | |
| Level of Service | |
| Approach Delay (s) | |
| Approach LOS | |

Intersection Summary



## HCM Signalized Intersection Capacity Analysis
### 27: Rowland Blvd & Rowland Way

02/15/2018

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 401 | 608 | 356 | 22 | 12 | 82 |
| Future Volume (vph) | 401 | 608 | 356 | 22 | 12 | 82 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 3.6 | 3.2 | | 3.2 | 3.2 |
| Lane Util. Factor | 0.97 | 0.91 | 0.95 | | 1.00 | 0.95 |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.99 | | 0.89 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | | 0.99 | 1.00 |
| Satd. Flow (prot) | 3467 | 5085 | 3398 | | 1605 | 1490 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | | 0.99 | 1.00 |
| Satd. Flow (perm) | 3467 | 5085 | 3398 | | 1605 | 1490 |
| Peak-hour factor, PHF | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 |
| Adj. Flow (vph) | 451 | 683 | 400 | 25 | 13 | 92 |
| RTOR Reduction (vph) | 0 | 0 | 5 | 0 | 34 | 45 |
| Lane Group Flow (vph) | 451 | 683 | 420 | 0 | 19 | 7 |
| Confl. Peds. (#/hr) | | | | 1 | 2 | |
| Heavy Vehicles (%) | 1% | 2% | 5% | 9% | 6% | 3% |
| Turn Type | Prot | NA | NA | | Prot | Perm |
| Protected Phases | 5 | 2 | 6 | | 4 | |
| Permitted Phases | | | | | | 4 |
| Actuated Green, G (s) | 12.9 | 31.9 | 15.9 | | 6.2 | 6.2 |
| Effective Green, g (s) | 12.9 | 31.9 | 15.9 | | 6.2 | 6.2 |
| Actuated g/C Ratio | 0.29 | 0.71 | 0.35 | | 0.14 | 0.14 |
| Clearance Time (s) | 3.5 | 3.6 | 3.2 | | 3.2 | 3.2 |
| Vehicle Extension (s) | 2.0 | 4.0 | 4.0 | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 996 | 3612 | 1203 | | 221 | 205 |
| v/s Ratio Prot | c0.13 | 0.13 | c0.12 | | c0.01 | |
| v/s Ratio Perm | | | | | | 0.00 |
| v/c Ratio | 0.45 | 0.19 | 0.35 | | 0.08 | 0.04 |
| Uniform Delay, d1 | 13.1 | 2.2 | 10.7 | | 16.9 | 16.8 |
| Progression Factor | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.1 | 0.0 | 0.2 | | 0.1 | 0.0 |
| Delay (s) | 13.2 | 2.2 | 10.9 | | 16.9 | 16.8 |
| Level of Service | B | A | B | | B | B |
| Approach Delay (s) | | 6.6 | 10.9 | | 16.9 | |
| Approach LOS | | A | B | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 8.3 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.34 | | |
| Actuated Cycle Length (s) | 44.9 | Sum of lost time (s) | 9.9 |
| Intersection Capacity Utilization | 37.5% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis
## 28: Vintage Way & Rowland Blvd
02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 7 | 318 | 299 | 2 | 232 | 3 | 129 | 3 | 0 | 1 | 2 | 1 |
| Future Volume (vph) | 7 | 318 | 299 | 2 | 232 | 3 | 129 | 3 | 0 | 1 | 2 | 1 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.6 | 3.6 | 3.0 | 3.6 | | 3.6 | 3.6 | | | 3.2 | |
| Lane Util. Factor | 1.00 | 0.95 | 0.88 | 1.00 | 0.95 | | 0.97 | 1.00 | | | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | | 1.00 | 1.00 | | | 0.97 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | | 0.99 | |
| Satd. Flow (prot) | 1805 | 3195 | 2814 | 1805 | 3249 | | 3367 | 1900 | | | 1813 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | | 0.99 | |
| Satd. Flow (perm) | 1805 | 3195 | 2814 | 1805 | 3249 | | 3367 | 1900 | | | 1813 | |
| Peak-hour factor, PHF | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 |
| Adj. Flow (vph) | 8 | 374 | 352 | 2 | 273 | 4 | 152 | 4 | 0 | 1 | 2 | 1 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| Lane Group Flow (vph) | 8 | 374 | 352 | 2 | 275 | 0 | 152 | 4 | 0 | 0 | 3 | 0 |
| Confl. Peds. (#/hr) | | | 1 | | | 3 | | | 1 | | | |
| Confl. Bikes (#/hr) | | | 2 | | | 2 | | | | | | |
| Heavy Vehicles (%) | 0% | 13% | 1% | 0% | 11% | 0% | 4% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Prot | NA | pt+ov | Prot | NA | | Split | NA | | Split | NA | |
| Protected Phases | 5 | 2 | 2 3 | 1 | 6 | | 3 | 3 | | 4 | 4 | |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | 1.1 | 11.0 | 31.1 | 0.5 | 10.4 | | 16.5 | 16.5 | | | 1.1 | |
| Effective Green, g (s) | 1.1 | 11.0 | 31.1 | 0.5 | 10.4 | | 16.5 | 16.5 | | | 1.1 | |
| Actuated g/C Ratio | 0.03 | 0.26 | 0.73 | 0.01 | 0.24 | | 0.39 | 0.39 | | | 0.03 | |
| Clearance Time (s) | 3.0 | 3.6 | | 3.0 | 3.6 | | 3.6 | 3.6 | | | 3.2 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | | 3.0 | 3.0 | | | 2.0 | |
| Lane Grp Cap (vph) | 46 | 826 | 2059 | 21 | 795 | | 1307 | 737 | | | 46 | |
| v/s Ratio Prot | c0.00 | c0.12 | c0.13 | 0.00 | 0.08 | | 0.05 | 0.00 | | | c0.00 | |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | 0.17 | 0.45 | 0.17 | 0.10 | 0.35 | | 0.12 | 0.01 | | | 0.07 | |
| Uniform Delay, d1 | 20.3 | 13.2 | 1.7 | 20.8 | 13.2 | | 8.3 | 8.0 | | | 20.2 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | | 1.00 | |
| Incremental Delay, d2 | 0.7 | 0.1 | 0.0 | 0.7 | 0.1 | | 0.0 | 0.0 | | | 0.2 | |
| Delay (s) | 20.9 | 13.4 | 1.8 | 21.5 | 13.3 | | 8.4 | 8.0 | | | 20.4 | |
| Level of Service | C | B | A | C | B | | A | A | | | C | |
| Approach Delay (s) | | 7.9 | | | 13.4 | | | 8.4 | | | 20.4 | |
| Approach LOS | | A | | | B | | | A | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 9.3 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.29 | | |
| Actuated Cycle Length (s) | 42.5 | Sum of lost time (s) | 13.4 |
| Intersection Capacity Utilization | 36.0% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



# HCM Signalized Intersection Capacity Analysis
## 29: Novato Blvd & Sunset Pkwy
02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 239 | 65 | 25 | 37 | 97 | 96 | 24 | 243 | 53 | 51 | 336 | 310 |
| Future Volume (vph) | 239 | 65 | 25 | 37 | 97 | 96 | 24 | 243 | 53 | 51 | 336 | 310 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.0 | | 3.5 | 3.5 | | 3.5 | 4.9 | | 3.5 | 4.6 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 0.99 | | 1.00 | 0.97 | | 1.00 | 1.00 | | 1.00 | 0.99 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.96 | | 1.00 | 0.93 | | 1.00 | 0.97 | | 1.00 | 0.93 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1787 | 1808 | | 1805 | 1712 | | 1805 | 1841 | | 1770 | 1715 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1787 | 1808 | | 1805 | 1712 | | 1805 | 1841 | | 1770 | 1715 | |
| Peak-hour factor, PHF | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Adj. Flow (vph) | 263 | 71 | 27 | 41 | 107 | 105 | 26 | 267 | 58 | 56 | 369 | 341 |
| RTOR Reduction (vph) | 0 | 14 | 0 | 0 | 39 | 0 | 0 | 7 | 0 | 0 | 29 | 0 |
| Lane Group Flow (vph) | 263 | 84 | 0 | 41 | 173 | 0 | 26 | 318 | 0 | 56 | 681 | 0 |
| Confl. Peds. (#/hr) | | | 4 | | | 21 | | | 3 | | | 5 |
| Confl. Bikes (#/hr) | | | | | | 1 | | | | | | |
| Heavy Vehicles (%) | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 2% | 1% | 2% |
| Turn Type | Prot | NA | | Prot | NA | | Prot | NA | | Prot | NA | |
| Protected Phases | 3 | 8 | | 7 | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | 12.8 | 22.8 | | 5.7 | 16.2 | | 3.4 | 32.5 | | 5.8 | 35.2 | |
| Effective Green, g (s) | 12.8 | 22.8 | | 5.7 | 16.2 | | 3.4 | 32.5 | | 5.8 | 35.2 | |
| Actuated g/C Ratio | 0.15 | 0.28 | | 0.07 | 0.20 | | 0.04 | 0.39 | | 0.07 | 0.43 | |
| Clearance Time (s) | 3.5 | 4.0 | | 3.5 | 3.5 | | 3.5 | 4.9 | | 3.5 | 4.6 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 276 | 498 | | 124 | 335 | | 74 | 723 | | 124 | 729 | |
| v/s Ratio Prot | c0.15 | 0.05 | | 0.02 | c0.10 | | 0.01 | 0.17 | | c0.03 | c0.40 | |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | 0.95 | 0.17 | | 0.33 | 0.52 | | 0.35 | 0.44 | | 0.45 | 0.93 | |
| Uniform Delay, d1 | 34.7 | 22.8 | | 36.7 | 29.7 | | 38.6 | 18.4 | | 36.9 | 22.6 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 40.9 | 0.1 | | 0.6 | 0.6 | | 1.1 | 0.2 | | 1.0 | 18.7 | |
| Delay (s) | 75.6 | 22.8 | | 37.3 | 30.3 | | 39.6 | 18.6 | | 37.9 | 41.3 | |
| Level of Service | E | C | | D | C | | D | B | | D | D | |
| Approach Delay (s) | | 61.3 | | | 31.4 | | | 20.1 | | | 41.1 | |
| Approach LOS | | E | | | C | | | C | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 39.6 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.83 | | |
| Actuated Cycle Length (s) | 82.7 | Sum of lost time (s) | 15.9 |
| Intersection Capacity Utilization | 83.4% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Intersection | |
|---|---|
| Intersection Delay, s/veh | 233.5 |
| Intersection LOS | F |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 47 | 467 | 389 | 324 | 172 | 27 | 91 | 6 | 70 | 94 | 21 | 64 |
| Future Vol, veh/h | 47 | 467 | 389 | 324 | 172 | 27 | 91 | 6 | 70 | 94 | 21 | 64 |
| Peak Hour Factor | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| Heavy Vehicles, % | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Mvmt Flow | 51 | 502 | 418 | 348 | 185 | 29 | 98 | 6 | 75 | 101 | 23 | 69 |
| Number of Lanes | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Opposing Approach | WB | EB | SB | NB |
| Opposing Lanes | 2 | 2 | 2 | 3 |
| Conflicting Approach Left | SB | NB | EB | WB |
| Conflicting Lanes Left | 2 | 3 | 2 | 2 |
| Conflicting Approach Right | NB | SB | WB | EB |
| Conflicting Lanes Right | 3 | 2 | 2 | 2 |
| HCM Control Delay | 432.1 | 33.9 | 16.7 | 17.1 |
| HCM LOS | F | D | C | C |

| Lane | NBLn1 | NBLn2 | NBLn3 | EBLn1 | EBLn2 | WBLn1 | WBLn2 | SBLn1 | SBLn2 |
|---|---|---|---|---|---|---|---|---|---|
| Vol Left, % | 100% | 0% | 0% | 100% | 0% | 100% | 0% | 100% | 0% |
| Vol Thru, % | 0% | 100% | 0% | 0% | 55% | 0% | 86% | 0% | 25% |
| Vol Right, % | 0% | 0% | 100% | 0% | 45% | 0% | 14% | 0% | 75% |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 91 | 6 | 70 | 47 | 856 | 324 | 199 | 94 | 85 |
| LT Vol | 91 | 0 | 0 | 47 | 0 | 324 | 0 | 94 | 0 |
| Through Vol | 0 | 6 | 0 | 0 | 467 | 0 | 172 | 0 | 21 |
| RT Vol | 0 | 0 | 70 | 0 | 389 | 0 | 27 | 0 | 64 |
| Lane Flow Rate | 98 | 6 | 75 | 51 | 920 | 348 | 214 | 101 | 91 |
| Geometry Grp | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Degree of Util (X) | 0.26 | 0.016 | 0.175 | 0.119 | 1.955 | 0.801 | 0.458 | 0.266 | 0.214 |
| Departure Headway (Hd) | 11.528 | 10.999 | 10.259 | 8.465 | 7.647 | 9.941 | 9.341 | 11.447 | 10.357 |
| Convergence, Y/N | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Cap | 314 | 327 | 352 | 426 | 488 | 366 | 389 | 316 | 349 |
| Service Time | 9.228 | 8.699 | 7.959 | 6.165 | 5.347 | 7.641 | 7.041 | 9.147 | 8.057 |
| HCM Lane V/C Ratio | 0.312 | 0.018 | 0.213 | 0.12 | 1.885 | 0.951 | 0.55 | 0.32 | 0.261 |
| HCM Control Delay | 18.2 | 13.9 | 15.1 | 12.3 | 455.2 | 42.6 | 19.7 | 18.2 | 15.9 |
| HCM Lane LOS | C | B | C | B | F | E | C | C | C |
| HCM 95th-tile Q | 1 | 0 | 0.6 | 0.4 | 61.8 | 6.9 | 2.3 | 1 | 0.8 |





| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 47 | 467 | 389 | 324 | 172 | 27 | 91 | 6 | 70 | 94 | 21 | 64 |
| Future Volume (vph) | 47 | 467 | 389 | 324 | 172 | 27 | 91 | 6 | 70 | 94 | 21 | 64 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 16 | 16 | 12 | 16 | 16 | 12 | 12 | 12 | 12 | 12 | 12 |
| Total Lost time (s) | 3.5 | 4.0 | | 3.5 | 4.0 | | 3.5 | 4.0 | 4.0 | 3.5 | 4.0 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 0.93 | | 1.00 | 0.98 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.89 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1787 | 1976 | | 1787 | 2071 | | 1787 | 1881 | 1599 | 1787 | 1669 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1787 | 1976 | | 1787 | 2071 | | 1787 | 1881 | 1599 | 1787 | 1669 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 49 | 492 | 409 | 341 | 181 | 28 | 96 | 6 | 74 | 99 | 22 | 67 |
| RTOR Reduction (vph) | 0 | 21 | 0 | 0 | 3 | 0 | 0 | 0 | 68 | 0 | 61 | 0 |
| Lane Group Flow (vph) | 49 | 880 | 0 | 341 | 206 | 0 | 96 | 6 | 6 | 99 | 28 | 0 |
| Heavy Vehicles (%) | 1% | 2% | 1% | 1% | 2% | 1% | 1% | 1% | 1% | 1% | 1% | 1% |
| Turn Type | Prot | NA | | Prot | NA | | Prot | NA | Perm | Prot | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | | | | | | | 2 | | | |
| Actuated Green, G (s) | 6.8 | 56.0 | | 25.4 | 74.6 | | 8.5 | 8.8 | 8.8 | 10.5 | 10.8 | |
| Effective Green, g (s) | 6.8 | 56.0 | | 25.4 | 74.6 | | 8.5 | 8.8 | 8.8 | 10.5 | 10.8 | |
| Actuated g/C Ratio | 0.06 | 0.48 | | 0.22 | 0.64 | | 0.07 | 0.08 | 0.08 | 0.09 | 0.09 | |
| Clearance Time (s) | 3.5 | 4.0 | | 3.5 | 4.0 | | 3.5 | 4.0 | 4.0 | 3.5 | 4.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 105 | 956 | | 392 | 1335 | | 131 | 143 | 121 | 162 | 155 | |
| v/s Ratio Prot | 0.03 | c0.45 | | c0.19 | 0.10 | | c0.05 | 0.00 | | 0.06 | c0.02 | |
| v/s Ratio Perm | | | | | | | | | 0.00 | | | |
| v/c Ratio | 0.47 | 0.92 | | 0.87 | 0.15 | | 0.73 | 0.04 | 0.05 | 0.61 | 0.18 | |
| Uniform Delay, d1 | 52.7 | 27.8 | | 43.6 | 8.1 | | 52.5 | 49.5 | 49.6 | 50.6 | 48.4 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 3.3 | 13.8 | | 18.2 | 0.1 | | 18.9 | 0.1 | 0.2 | 6.7 | 0.6 | |
| Delay (s) | 56.0 | 41.6 | | 61.7 | 8.2 | | 71.4 | 49.7 | 49.7 | 57.3 | 48.9 | |
| Level of Service | E | D | | E | A | | E | D | D | E | D | |
| Approach Delay (s) | | 42.3 | | | 41.4 | | | 61.6 | | | 53.3 | |
| Approach LOS | | D | | | D | | | E | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 45.0 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.81 | | |
| Actuated Cycle Length (s) | 115.7 | Sum of lost time (s) | 15.0 |
| Intersection Capacity Utilization | 88.2% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

# MOVEMENT SUMMARY

## Site: 30 [AM Existing + Project]

Novato Boulevard/Redwood Boulevard
AM Existing + Project

Roundabout

**Movement Performance - Vehicles**

| Mov ID | OD Mov | Demand Flows Total veh/h | Demand Flows HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance ft | Prop. Queued | Effective Stop Rate per veh | Average Speed mph |
|---|---|---|---|---|---|---|---|---|---|---|---|
| South: NB Redwood Boulevard | | | | | | | | | | | |
| 3 | L2 | 98 | 2.0 | 0.262 | 8.4 | LOS A | 1.1 | 28.4 | 0.65 | 0.65 | 31.9 |
| 8 | T1 | 6 | 2.0 | 0.262 | 8.4 | LOS A | 1.1 | 28.4 | 0.65 | 0.65 | 31.8 |
| 18 | R2 | 75 | 2.0 | 0.262 | 8.4 | LOS A | 1.1 | 28.4 | 0.65 | 0.65 | 31.0 |
| Approach | | 180 | 2.0 | 0.262 | 8.4 | LOS A | 1.1 | 28.4 | 0.65 | 0.65 | 31.5 |
| East: WB Novato Blvd | | | | | | | | | | | |
| 1 | L2 | 348 | 2.0 | 0.488 | 8.5 | LOS A | 3.3 | 84.1 | 0.48 | 0.31 | 31.7 |
| 6 | T1 | 185 | 2.0 | 0.488 | 8.5 | LOS A | 3.3 | 84.1 | 0.48 | 0.31 | 31.7 |
| 16 | R2 | 29 | 2.0 | 0.488 | 8.5 | LOS A | 3.3 | 84.1 | 0.48 | 0.31 | 30.9 |
| Approach | | 562 | 2.0 | 0.488 | 8.5 | LOS A | 3.3 | 84.1 | 0.48 | 0.31 | 31.6 |
| North: SB Redwood Boulevard | | | | | | | | | | | |
| 7 | L2 | 101 | 2.0 | 0.274 | 8.4 | LOS A | 1.2 | 30.1 | 0.64 | 0.64 | 31.9 |
| 4 | T1 | 23 | 2.0 | 0.274 | 8.4 | LOS A | 1.2 | 30.1 | 0.64 | 0.64 | 31.9 |
| 14 | R2 | 69 | 2.0 | 0.274 | 8.4 | LOS A | 1.2 | 30.1 | 0.64 | 0.64 | 31.1 |
| Approach | | 192 | 2.0 | 0.274 | 8.4 | LOS A | 1.2 | 30.1 | 0.64 | 0.64 | 31.6 |
| West: EB Novato Blvd | | | | | | | | | | | |
| 5 | L2 | 51 | 2.0 | 0.669 | 15.7 | LOS B | 6.6 | 167.9 | 0.74 | 0.98 | 29.9 |
| 2 | T1 | 502 | 2.0 | 0.669 | 15.7 | LOS B | 6.6 | 167.9 | 0.74 | 0.98 | 29.8 |
| 12 | R2 | 418 | 2.0 | 0.466 | 9.8 | LOS A | 2.9 | 74.3 | 0.64 | 0.69 | 31.5 |
| Approach | | 971 | 2.0 | 0.669 | 13.1 | LOS B | 6.6 | 167.9 | 0.70 | 0.86 | 30.5 |
| All Vehicles | | 1905 | 2.0 | 0.669 | 10.9 | LOS B | 6.6 | 167.9 | 0.62 | 0.65 | 31.0 |

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.





| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 12 | 874 | 448 | 255 | 358 | 18 | 67 | 4 | 230 | 7 | 2 | 0 |
| Future Volume (vph) | 12 | 874 | 448 | 255 | 358 | 18 | 67 | 4 | 230 | 7 | 2 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.6 | 3.6 | 3.0 | 3.6 | | | 3.5 | 3.5 | | 3.7 | |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | | 1.00 | 1.00 | | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.97 | 1.00 | 1.00 | | | 1.00 | 0.98 | | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.99 | 1.00 | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | | | 1.00 | 0.85 | | 1.00 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 0.95 | 1.00 | | 0.96 | |
| Satd. Flow (prot) | 1770 | 3610 | 1573 | 1900 | 3584 | | | 1786 | 1589 | | 1824 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 0.73 | 1.00 | | 0.85 | |
| Satd. Flow (perm) | 1770 | 3610 | 1573 | 1805 | 3584 | | | 1371 | 1589 | | 1609 | |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 12 | 910 | 467 | 266 | 373 | 19 | 70 | 4 | 240 | 7 | 2 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 86 | 0 | 2 | 0 | 0 | 0 | 208 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 13 | 910 | 381 | 266 | 390 | 0 | 0 | 74 | 32 | 0 | 9 | 0 |
| Confl. Peds. (#/hr) | | | 4 | | | | 7 | | 4 | 4 | | 7 |
| Heavy Vehicles (%) | 2% | 0% | 0% | 0% | 0% | 0% | 1% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Prot | NA | Perm | Prot | NA | | Perm | NA | Perm | Perm | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | 2 | | | | 8 | | 8 | 4 | | |
| Actuated Green, G (s) | 1.3 | 49.3 | 49.3 | 27.4 | 75.4 | | | 13.2 | 13.2 | | 13.0 | |
| Effective Green, g (s) | 1.3 | 49.3 | 49.3 | 27.4 | 75.4 | | | 13.2 | 13.2 | | 13.0 | |
| Actuated g/C Ratio | 0.01 | 0.49 | 0.49 | 0.27 | 0.75 | | | 0.13 | 0.13 | | 0.13 | |
| Clearance Time (s) | 3.0 | 3.6 | 3.6 | 3.0 | 3.6 | | | 3.5 | 3.5 | | 3.7 | |
| Vehicle Extension (s) | 2.0 | 3.0 | 3.0 | 2.0 | 3.0 | | | 2.0 | 2.0 | | 2.0 | |
| Lane Grp Cap (vph) | 23 | 1779 | 775 | 520 | 2702 | | | 180 | 209 | | 209 | |
| v/s Ratio Prot | 0.01 | c0.25 | | c0.14 | 0.11 | | | | | | | |
| v/s Ratio Perm | | | 0.24 | | | | | c0.05 | 0.02 | | 0.01 | |
| v/c Ratio | 0.57 | 0.51 | 0.49 | 0.51 | 0.14 | | | 0.41 | 0.15 | | 0.04 | |
| Uniform Delay, d1 | 49.1 | 17.2 | 17.0 | 30.6 | 3.4 | | | 39.8 | 38.4 | | 38.1 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 0.61 | 0.53 | | | 1.00 | 1.00 | | 1.00 | |
| Incremental Delay, d2 | 17.6 | 1.1 | 2.2 | 0.3 | 0.1 | | | 0.6 | 0.1 | | 0.0 | |
| Delay (s) | 66.6 | 18.2 | 19.2 | 19.1 | 1.9 | | | 40.4 | 38.6 | | 38.1 | |
| Level of Service | E | B | B | B | A | | | D | D | | D | |
| Approach Delay (s) | | 19.0 | | | 8.8 | | | 39.0 | | | 38.1 | |
| Approach LOS | | B | | | A | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 18.9 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.50 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 10.3 |
| Intersection Capacity Utilization | 62.9% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 32: US 101 SB Off Ramp/Enfrente Rd & Ignacio Blvd

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 34 | 841 | 307 | 200 | 428 | 41 | 0 | 0 | 1147 | 264 | 137 | 211 |
| Future Volume (vph) | 34 | 841 | 307 | 200 | 428 | 41 | 0 | 0 | 1147 | 264 | 137 | 211 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Grade (%) | | 0% | | | 0% | | | 2% | | | 0% | |
| Total Lost time (s) | 3.0 | 8.0 | 8.0 | 4.0 | 5.0 | | | | 4.0 | | 4.0 | 4.0 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | | | 0.88 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.96 | 1.00 | 1.00 | | | | 1.00 | | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | | | | 0.85 | | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | | 1.00 | | 0.97 | 1.00 |
| Satd. Flow (prot) | 1805 | 3610 | 1550 | 1787 | 3546 | | | | 2814 | | 1809 | 1578 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | | 1.00 | | 0.97 | 1.00 |
| Satd. Flow (perm) | 1805 | 3610 | 1550 | 1787 | 3546 | | | | 2814 | | 1809 | 1578 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 35 | 876 | 320 | 208 | 446 | 43 | 0 | 0 | 1195 | 275 | 143 | 220 |
| RTOR Reduction (vph) | 0 | 0 | 134 | 0 | 6 | 0 | 0 | 0 | 324 | 0 | 0 | 158 |
| Lane Group Flow (vph) | 35 | 876 | 186 | 208 | 483 | 0 | 0 | 0 | 871 | 0 | 418 | 62 |
| Confl. Peds. (#/hr) | | | 7 | | | 20 | | | | | | 1 |
| Confl. Bikes (#/hr) | | | | | | 3 | | | | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 5% | 1% |
| Turn Type | Prot | NA | Perm | Prot | NA | | | | Over | Split | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | | | 1 | 7 | 7 | |
| Permitted Phases | | | 2 | | | | | | | | | 7 |
| Actuated Green, G (s) | 6.6 | 28.8 | 28.8 | 27.2 | 53.4 | | | | 27.2 | | 28.0 | 28.0 |
| Effective Green, g (s) | 6.6 | 28.8 | 28.8 | 27.2 | 53.4 | | | | 27.2 | | 28.0 | 28.0 |
| Actuated g/C Ratio | 0.07 | 0.29 | 0.29 | 0.27 | 0.53 | | | | 0.27 | | 0.28 | 0.28 |
| Clearance Time (s) | 3.0 | 8.0 | 8.0 | 4.0 | 5.0 | | | | 4.0 | | 4.0 | 4.0 |
| Vehicle Extension (s) | 2.0 | 2.5 | 2.5 | 3.0 | 4.0 | | | | 3.0 | | 2.5 | 2.5 |
| Lane Grp Cap (vph) | 119 | 1039 | 446 | 486 | 1893 | | | | 765 | | 506 | 441 |
| v/s Ratio Prot | 0.02 | c0.24 | | 0.12 | 0.14 | | | | c0.31 | | c0.23 | |
| v/s Ratio Perm | | | 0.12 | | | | | | | | | 0.04 |
| v/c Ratio | 0.29 | 0.84 | 0.42 | 0.43 | 0.26 | | | | 1.14 | | 0.83 | 0.14 |
| Uniform Delay, d1 | 44.5 | 33.5 | 28.8 | 30.0 | 12.6 | | | | 36.4 | | 33.7 | 27.0 |
| Progression Factor | 0.90 | 0.67 | 0.47 | 1.58 | 1.87 | | | | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.5 | 7.7 | 2.6 | 0.6 | 0.3 | | | | 77.9 | | 10.4 | 0.1 |
| Delay (s) | 40.7 | 30.2 | 16.0 | 47.8 | 23.8 | | | | 114.3 | | 44.1 | 27.1 |
| Level of Service | D | C | B | D | C | | | | F | | D | C |
| Approach Delay (s) | | 26.8 | | | 31.0 | | | 114.3 | | | 38.2 | |
| Approach LOS | | C | | | C | | | F | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 57.3 | HCM 2000 Level of Service | E |
| HCM 2000 Volume to Capacity ratio | 0.93 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 98.7% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 32: US 101 SB Off Ramp/Enfrente Rd & Ignacio Blvd

02/23/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 34 | 841 | 307 | 200 | 428 | 41 | 0 | 0 | 1147 | 264 | 137 | 211 |
| Future Volume (vph) | 34 | 841 | 307 | 200 | 428 | 41 | 0 | 0 | 1147 | 264 | 137 | 211 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Grade (%) | | 0% | | | 0% | | | 2% | | | 0% | |
| Total Lost time (s) | 3.0 | 8.0 | 8.0 | 4.0 | 5.0 | | | | 4.0 | | 4.0 | 4.0 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | | | 0.88 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.96 | 1.00 | 0.99 | | | | 1.00 | | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | | | | 0.85 | | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | | 1.00 | | 0.97 | 1.00 |
| Satd. Flow (prot) | 1805 | 3610 | 1546 | 1787 | 3544 | | | | 2814 | | 1809 | 1578 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | | 1.00 | | 0.97 | 1.00 |
| Satd. Flow (perm) | 1805 | 3610 | 1546 | 1787 | 3544 | | | | 2814 | | 1809 | 1578 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 35 | 876 | 320 | 208 | 446 | 43 | 0 | 0 | 1195 | 275 | 143 | 220 |
| RTOR Reduction (vph) | 0 | 0 | 130 | 0 | 6 | 0 | 0 | 0 | 184 | 0 | 0 | 164 |
| Lane Group Flow (vph) | 35 | 876 | 190 | 208 | 483 | 0 | 0 | 0 | 1011 | 0 | 418 | 56 |
| Confl. Peds. (#/hr) | | | 7 | | | 20 | | | | | | 1 |
| Confl. Bikes (#/hr) | | | | | | 3 | | | | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 5% | 1% |
| Turn Type | Prot | NA | Perm | Prot | NA | | | | Over | Split | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | | | 1 | 7 | 7 | |
| Permitted Phases | | | 2 | | | | | | | | | 7 |
| Actuated Green, G (s) | 3.6 | 28.0 | 28.0 | 39.3 | 67.7 | | | | 39.3 | | 28.7 | 28.7 |
| Effective Green, g (s) | 3.6 | 28.0 | 28.0 | 39.3 | 67.7 | | | | 39.3 | | 28.7 | 28.7 |
| Actuated g/C Ratio | 0.03 | 0.25 | 0.25 | 0.35 | 0.60 | | | | 0.35 | | 0.26 | 0.26 |
| Clearance Time (s) | 3.0 | 8.0 | 8.0 | 4.0 | 5.0 | | | | 4.0 | | 4.0 | 4.0 |
| Vehicle Extension (s) | 2.0 | 4.0 | 4.0 | 3.0 | 4.0 | | | | 3.0 | | 2.5 | 2.5 |
| Lane Grp Cap (vph) | 58 | 902 | 386 | 627 | 2142 | | | | 987 | | 463 | 404 |
| v/s Ratio Prot | 0.02 | c0.24 | | 0.12 | 0.14 | | | | c0.36 | | c0.23 | |
| v/s Ratio Perm | | | 0.12 | | | | | | | | | 0.04 |
| v/c Ratio | 0.60 | 0.97 | 0.49 | 0.33 | 0.23 | | | | 1.02 | | 0.90 | 0.14 |
| Uniform Delay, d1 | 53.5 | 41.6 | 35.9 | 26.7 | 10.1 | | | | 36.4 | | 40.3 | 32.1 |
| Progression Factor | 1.28 | 0.75 | 0.65 | 0.71 | 0.36 | | | | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 10.9 | 22.9 | 4.2 | 0.3 | 0.2 | | | | 34.9 | | 20.6 | 0.1 |
| Delay (s) | 79.4 | 54.3 | 27.4 | 19.1 | 3.9 | | | | 71.2 | | 60.9 | 32.2 |
| Level of Service | E | D | C | B | A | | | | E | | E | C |
| Approach Delay (s) | | 48.0 | | | 8.5 | | | 71.2 | | | 51.0 | |
| Approach LOS | | D | | | A | | | E | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 48.6 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.97 | | |
| Actuated Cycle Length (s) | 112.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 98.7% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
## 33: Nave Dr & Ignacio Blvd/Bel Marin Keys Blvd

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 955 | 1293 | 101 | 229 | 228 | 443 | 526 | 683 | 0 | 0 | 0 |
| Future Volume (vph) | 0 | 955 | 1293 | 101 | 229 | 228 | 443 | 526 | 683 | 0 | 0 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.0 | 4.6 | 3.0 | 4.0 | | 4.6 | 4.6 | 3.0 | | | |
| Lane Util. Factor | | 0.95 | 1.00 | 1.00 | 0.95 | | 0.91 | 0.91 | 1.00 | | | |
| Frpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 0.99 | | 1.00 | 1.00 | 0.99 | | | |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | | |
| Frt | | 1.00 | 0.85 | 1.00 | 0.93 | | 1.00 | 1.00 | 0.85 | | | |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 0.99 | 1.00 | | | |
| Satd. Flow (prot) | | 3610 | 1607 | 1805 | 3285 | | 1643 | 3397 | 1599 | | | |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 0.99 | 1.00 | | | |
| Satd. Flow (perm) | | 3610 | 1607 | 1805 | 3285 | | 1643 | 3397 | 1599 | | | |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 0 | 1016 | 1376 | 107 | 244 | 243 | 471 | 560 | 727 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 81 | 0 | 134 | 0 | 0 | 0 | 4 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 1016 | 1295 | 107 | 353 | 0 | 334 | 697 | 723 | 0 | 0 | 0 |
| Confl. Peds. (#/hr) | | | 1 | | | 1 | | | 1 | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 2% | 0% | 1% | 0% | 0% | 0% | 0% |
| Turn Type | | NA | pm+ov | Prot | NA | | Split | NA | pm+ov | | | |
| Protected Phases | | 2 | 3 | 1 | 6 | | 3 | 3 | 1 | | | |
| Permitted Phases | | | 2 | | | | | | 3 | | | |
| Actuated Green, G (s) | | 28.4 | 76.4 | 12.0 | 43.4 | | 48.0 | 48.0 | 60.0 | | | |
| Effective Green, g (s) | | 28.4 | 76.4 | 12.0 | 43.4 | | 48.0 | 48.0 | 60.0 | | | |
| Actuated g/C Ratio | | 0.28 | 0.76 | 0.12 | 0.43 | | 0.48 | 0.48 | 0.60 | | | |
| Clearance Time (s) | | 4.0 | 4.6 | 3.0 | 4.0 | | 4.6 | 4.6 | 3.0 | | | |
| Vehicle Extension (s) | | 4.0 | 2.0 | 2.0 | 4.0 | | 2.0 | 2.0 | 2.0 | | | |
| Lane Grp Cap (vph) | | 1025 | 1227 | 216 | 1425 | | 788 | 1630 | 959 | | | |
| v/s Ratio Prot | | 0.28 | c0.51 | 0.06 | 0.11 | | 0.20 | 0.21 | c0.09 | | | |
| v/s Ratio Perm | | | 0.30 | | | | | | 0.36 | | | |
| v/c Ratio | | 0.99 | 1.06 | 0.50 | 0.25 | | 0.42 | 0.43 | 0.75 | | | |
| Uniform Delay, d1 | | 35.7 | 11.8 | 41.2 | 17.9 | | 17.0 | 17.0 | 14.6 | | | |
| Progression Factor | | 0.98 | 1.26 | 1.20 | 0.90 | | 1.00 | 1.00 | 1.00 | | | |
| Incremental Delay, d2 | | 14.7 | 32.5 | 0.6 | 0.4 | | 0.1 | 0.1 | 3.0 | | | |
| Delay (s) | | 49.8 | 47.4 | 50.1 | 16.6 | | 17.1 | 17.1 | 17.6 | | | |
| Level of Service | | D | D | D | B | | B | B | B | | | |
| Approach Delay (s) | | 48.4 | | | 22.6 | | | 17.3 | | | 0.0 | |
| Approach LOS | | D | | | C | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 33.7 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 1.01 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 11.6 |
| Intersection Capacity Utilization | 97.3% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
## 34: Bel Marin Keys Blvd & Commercial Blvd

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 0 | 11 | 73 | 0 | 9 | 46 | 1369 | 230 | 12 | 466 | 1 |
| Future Volume (vph) | 0 | 0 | 11 | 73 | 0 | 9 | 46 | 1369 | 230 | 12 | 466 | 1 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.0 | | | 4.0 | 4.0 | 3.0 | 3.9 | | 3.0 | 3.5 | |
| Lane Util. Factor | | 1.00 | | | 1.00 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | | 0.99 | | | 1.00 | 0.98 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 0.86 | | | 1.00 | 0.85 | 1.00 | 0.98 | | 1.00 | 1.00 | |
| Flt Protected | | 1.00 | | | 0.95 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 1620 | | | 1801 | 1395 | 1805 | 3518 | | 1805 | 3573 | |
| Flt Permitted | | 1.00 | | | 0.75 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | | 1620 | | | 1421 | 1395 | 1805 | 3518 | | 1805 | 3573 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 0 | 0 | 12 | 77 | 0 | 9 | 48 | 1441 | 242 | 13 | 491 | 1 |
| RTOR Reduction (vph) | 0 | 11 | 0 | 0 | 0 | 8 | 0 | 7 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 1 | 0 | 0 | 77 | 1 | 48 | 1676 | 0 | 13 | 492 | 0 |
| Confl. Peds. (#/hr) | 3 | | 2 | 2 | | 3 | | | 3 | | | |
| Heavy Vehicles (%) | 2% | 0% | 0% | 0% | 0% | 14% | 0% | 0% | 0% | 0% | 1% | 0% |
| Turn Type | | NA | | Perm | NA | Perm | Prot | NA | | Prot | NA | |
| Protected Phases | | 4 | | | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | | | | | | |
| Actuated Green, G (s) | | 12.1 | | | 12.1 | 12.1 | 5.3 | 75.2 | | 1.8 | 72.1 | |
| Effective Green, g (s) | | 12.1 | | | 12.1 | 12.1 | 5.3 | 75.2 | | 1.8 | 72.1 | |
| Actuated g/C Ratio | | 0.12 | | | 0.12 | 0.12 | 0.05 | 0.75 | | 0.02 | 0.72 | |
| Clearance Time (s) | | 4.0 | | | 4.0 | 4.0 | 3.0 | 3.9 | | 3.0 | 3.5 | |
| Vehicle Extension (s) | | 3.0 | | | 3.0 | 3.0 | 2.5 | 3.0 | | 2.5 | 4.0 | |
| Lane Grp Cap (vph) | | 196 | | | 171 | 168 | 95 | 2645 | | 32 | 2576 | |
| v/s Ratio Prot | | 0.00 | | | | | c0.03 | c0.48 | | 0.01 | 0.14 | |
| v/s Ratio Perm | | | | | c0.05 | 0.00 | | | | | | |
| v/c Ratio | | 0.01 | | | 0.45 | 0.01 | 0.51 | 0.63 | | 0.41 | 0.19 | |
| Uniform Delay, d1 | | 38.7 | | | 40.9 | 38.7 | 46.1 | 5.9 | | 48.6 | 4.5 | |
| Progression Factor | | 1.00 | | | 1.00 | 1.00 | 0.93 | 0.78 | | 0.93 | 1.31 | |
| Incremental Delay, d2 | | 0.0 | | | 1.9 | 0.0 | 1.4 | 0.5 | | 6.0 | 0.2 | |
| Delay (s) | | 38.7 | | | 42.7 | 38.7 | 44.2 | 5.1 | | 51.1 | 6.1 | |
| Level of Service | | D | | | D | D | D | A | | D | A | |
| Approach Delay (s) | | 38.7 | | | 42.3 | | | 6.2 | | | 7.3 | |
| Approach LOS | | D | | | D | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 7.9 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.62 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 10.9 |
| Intersection Capacity Utilization | 68.1% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 1 | 46 | 98 | 2 | 9 | 104 | 678 | 595 | 9 | 336 | 3 |
| Future Volume (vph) | 0 | 1 | 46 | 98 | 2 | 9 | 104 | 678 | 595 | 9 | 336 | 3 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.5 | 3.5 | 3.5 | 3.5 | | 3.0 | 4.0 | | 3.0 | 4.0 | |
| Lane Util. Factor | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | | 1.00 | 0.99 | 1.00 | 0.99 | | 1.00 | 0.99 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 1.00 | 0.85 | 1.00 | 0.88 | | 1.00 | 0.93 | | 1.00 | 1.00 | |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 1900 | 1533 | 1803 | 1649 | | 1770 | 3320 | | 1805 | 3569 | |
| Flt Permitted | | 1.00 | 1.00 | 0.76 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | | 1900 | 1533 | 1437 | 1649 | | 1770 | 3320 | | 1805 | 3569 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 0 | 1 | 48 | 103 | 2 | 9 | 109 | 714 | 626 | 9 | 354 | 3 |
| RTOR Reduction (vph) | 0 | 0 | 42 | 0 | 8 | 0 | 0 | 77 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 1 | 6 | 103 | 3 | 0 | 109 | 1263 | 0 | 9 | 357 | 0 |
| Confl. Peds. (#/hr) | 1 | | 1 | 1 | | 1 | | | 2 | | | 8 |
| Heavy Vehicles (%) | 0% | 0% | 4% | 0% | 0% | 0% | 2% | 0% | 0% | 0% | 1% | 0% |
| Turn Type | | NA | Perm | Perm | NA | | Prot | NA | | Prot | NA | |
| Protected Phases | | 4 | | | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | 4 | 8 | | | | | | | | |
| Actuated Green, G (s) | | 13.0 | 13.0 | 13.0 | 13.0 | | 11.2 | 74.7 | | 1.8 | 65.3 | |
| Effective Green, g (s) | | 13.0 | 13.0 | 13.0 | 13.0 | | 11.2 | 74.7 | | 1.8 | 65.3 | |
| Actuated g/C Ratio | | 0.13 | 0.13 | 0.13 | 0.13 | | 0.11 | 0.75 | | 0.02 | 0.65 | |
| Clearance Time (s) | | 3.5 | 3.5 | 3.5 | 3.5 | | 3.0 | 4.0 | | 3.0 | 4.0 | |
| Vehicle Extension (s) | | 2.0 | 2.0 | 2.5 | 2.5 | | 2.0 | 4.0 | | 2.0 | 4.0 | |
| Lane Grp Cap (vph) | | 247 | 199 | 186 | 214 | | 198 | 2480 | | 32 | 2330 | |
| v/s Ratio Prot | | 0.00 | | | 0.00 | | c0.06 | c0.38 | | 0.00 | 0.10 | |
| v/s Ratio Perm | | | 0.00 | c0.07 | | | | | | | | |
| v/c Ratio | | 0.00 | 0.03 | 0.55 | 0.01 | | 0.55 | 0.51 | | 0.28 | 0.15 | |
| Uniform Delay, d1 | | 37.9 | 38.0 | 40.8 | 37.9 | | 42.0 | 5.2 | | 48.5 | 6.7 | |
| Progression Factor | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.02 | 1.35 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 0.0 | 0.0 | 2.8 | 0.0 | | 1.5 | 0.6 | | 1.8 | 0.1 | |
| Delay (s) | | 37.9 | 38.0 | 43.6 | 37.9 | | 44.5 | 7.6 | | 50.2 | 6.8 | |
| Level of Service | | D | D | D | D | | D | A | | D | A | |
| Approach Delay (s) | | 38.0 | | | 43.1 | | | 10.4 | | | 7.9 | |
| Approach LOS | | D | | | D | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 12.5 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.53 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 10.5 |
| Intersection Capacity Utilization | 67.8% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group





| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 776 | 174 | 0 | 876 | 1192 | 188 |
| Future Volume (vph) | 776 | 174 | 0 | 876 | 1192 | 188 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | | 5.0 | 5.0 | |
| Lane Util. Factor | 0.97 | 1.00 | | 0.95 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 0.99 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.85 | | 1.00 | 0.98 | |
| Flt Protected | 0.95 | 1.00 | | 1.00 | 1.00 | |
| Satd. Flow (prot) | 3467 | 1563 | | 3574 | 3506 | |
| Flt Permitted | 0.95 | 1.00 | | 1.00 | 1.00 | |
| Satd. Flow (perm) | 3467 | 1563 | | 3574 | 3506 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 843 | 189 | 0 | 952 | 1296 | 204 |
| RTOR Reduction (vph) | 0 | 20 | 0 | 0 | 18 | 0 |
| Lane Group Flow (vph) | 843 | 169 | 0 | 952 | 1482 | 0 |
| Confl. Peds. (#/hr) | | 1 | | | | |
| Heavy Vehicles (%) | 1% | 2% | 0% | 1% | 1% | 0% |
| Turn Type | Prot | Perm | | NA | NA | |
| Protected Phases | 4 | | | 2 | 6 | |
| Permitted Phases | | 4 | | | | |
| Actuated Green, G (s) | 27.0 | 27.0 | | 35.0 | 35.0 | |
| Effective Green, g (s) | 27.0 | 27.0 | | 35.0 | 35.0 | |
| Actuated g/C Ratio | 0.39 | 0.39 | | 0.50 | 0.50 | |
| Clearance Time (s) | 3.0 | 3.0 | | 5.0 | 5.0 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 1337 | 602 | | 1787 | 1753 | |
| v/s Ratio Prot | c0.24 | | | 0.27 | c0.42 | |
| v/s Ratio Perm | | 0.11 | | | | |
| v/c Ratio | 0.63 | 0.28 | | 0.53 | 0.85 | |
| Uniform Delay, d1 | 17.5 | 14.8 | | 11.9 | 15.2 | |
| Progression Factor | 1.00 | 1.00 | | 0.36 | 1.00 | |
| Incremental Delay, d2 | 2.3 | 1.2 | | 1.0 | 5.2 | |
| Delay (s) | 19.7 | 16.0 | | 5.3 | 20.4 | |
| Level of Service | B | B | | A | C | |
| Approach Delay (s) | 19.0 | | | 5.3 | 20.4 | |
| Approach LOS | B | | | A | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 15.9 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.75 | | |
| Actuated Cycle Length (s) | 70.0 | Sum of lost time (s) | 8.0 |
| Intersection Capacity Utilization | 68.9% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 38 | 20 | 713 | 82 | 97 | 1117 |
| Future Volume (vph) | 38 | 20 | 713 | 82 | 97 | 1117 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.2 | 3.2 | 4.4 | | 3.0 | 4.4 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 0.85 | 0.99 | | 1.00 | 1.00 |
| Flt Protected | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 1615 | 1869 | | 1770 | 1881 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | 1805 | 1615 | 1869 | | 1770 | 1881 |
| Peak-hour factor, PHF | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Adj. Flow (vph) | 42 | 22 | 784 | 90 | 107 | 1227 |
| RTOR Reduction (vph) | 0 | 21 | 5 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 42 | 1 | 869 | 0 | 107 | 1227 |
| Confl. Peds. (#/hr) | | | | 2 | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 2% | 1% |
| Turn Type | Prot | Perm | NA | | Prot | NA |
| Protected Phases | 8 | | 2 | | 1 | 6 |
| Permitted Phases | | 8 | | | | |
| Actuated Green, G (s) | 3.6 | 3.6 | 48.6 | | 7.2 | 58.8 |
| Effective Green, g (s) | 3.6 | 3.6 | 48.6 | | 7.2 | 58.8 |
| Actuated g/C Ratio | 0.05 | 0.05 | 0.69 | | 0.10 | 0.84 |
| Clearance Time (s) | 3.2 | 3.2 | 4.4 | | 3.0 | 4.4 |
| Vehicle Extension (s) | 1.0 | 1.0 | 1.0 | | 1.0 | 1.0 |
| Lane Grp Cap (vph) | 92 | 83 | 1297 | | 182 | 1580 |
| v/s Ratio Prot | c0.02 | | 0.47 | | 0.06 | c0.65 |
| v/s Ratio Perm | | 0.00 | | | | |
| v/c Ratio | 0.46 | 0.01 | 0.67 | | 0.59 | 0.78 |
| Uniform Delay, d1 | 32.2 | 31.5 | 6.1 | | 30.0 | 2.6 |
| Progression Factor | 1.00 | 1.00 | 0.75 | | 1.28 | 1.58 |
| Incremental Delay, d2 | 1.3 | 0.0 | 2.2 | | 1.9 | 2.3 |
| Delay (s) | 33.6 | 31.5 | 6.8 | | 40.4 | 6.4 |
| Level of Service | C | C | A | | D | A |
| Approach Delay (s) | 32.9 | | 6.8 | | | 9.1 |
| Approach LOS | C | | A | | | A |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 8.9 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.80 | | |
| Actuated Cycle Length (s) | 70.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 70.8% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group





| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 119 | 271 | 494 | 41 | 358 | 764 |
| Future Volume (vph) | 119 | 271 | 494 | 41 | 358 | 764 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.2 | 3.2 | 4.4 | 4.4 | 3.0 | 4.4 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.85 | 1.00 | 0.85 | 1.00 | 1.00 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (prot) | 1770 | 1599 | 1900 | 1578 | 1787 | 1850 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (perm) | 1770 | 1599 | 1900 | 1578 | 1787 | 1900 |
| Peak-hour factor, PHF | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Adj. Flow (vph) | 131 | 298 | 543 | 45 | 393 | 840 |
| RTOR Reduction (vph) | 0 | 257 | 0 | 13 | 0 | 0 |
| Lane Group Flow (vph) | 131 | 41 | 543 | 32 | 393 | 840 |
| Confl. Peds. (#/hr) | | | | 2 | | |
| Heavy Vehicles (%) | 2% | 1% | 0% | 0% | 1% | 0% |
| Turn Type | Prot | Perm | NA | Perm | Prot | NA |
| Protected Phases | 8 | | 2 | | 1 | 6 |
| Permitted Phases | | 8 | | 2 | | |
| Actuated Green, G (s) | 9.7 | 9.7 | 25.4 | 25.4 | 24.3 | 52.7 |
| Effective Green, g (s) | 9.7 | 9.7 | 25.4 | 25.4 | 24.3 | 52.7 |
| Actuated g/C Ratio | 0.14 | 0.14 | 0.36 | 0.36 | 0.35 | 0.75 |
| Clearance Time (s) | 3.2 | 3.2 | 4.4 | 4.4 | 3.0 | 4.4 |
| Vehicle Extension (s) | 2.0 | 2.0 | 3.0 | 3.0 | 2.0 | 3.0 |
| Lane Grp Cap (vph) | 245 | 221 | 689 | 572 | 620 | 1392 |
| v/s Ratio Prot | c0.07 | | c0.29 | | c0.22 | 0.45 |
| v/s Ratio Perm | | 0.03 | | 0.02 | | |
| v/c Ratio | 0.53 | 0.19 | 0.79 | 0.06 | 0.63 | 0.60 |
| Uniform Delay, d1 | 28.1 | 26.7 | 19.9 | 14.5 | 19.1 | 3.9 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.25 | 0.67 |
| Incremental Delay, d2 | 1.1 | 0.1 | 8.9 | 0.2 | 1.1 | 1.3 |
| Delay (s) | 29.2 | 26.8 | 28.8 | 14.7 | 24.9 | 3.9 |
| Level of Service | C | C | C | B | C | A |
| Approach Delay (s) | 27.5 | | 27.7 | | | 10.6 |
| Approach LOS | C | | C | | | B |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 18.3 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.68 | | |
| Actuated Cycle Length (s) | 70.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 62.8% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 264 | 182 | 230 | 459 | 293 | 336 |
| Future Volume (vph) | 264 | 182 | 230 | 459 | 293 | 336 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | 4.1 | 4.1 | 3.0 | 4.4 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.85 | 1.00 | 0.85 | 1.00 | 1.00 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 1615 | 1900 | 1615 | 1805 | 1881 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (perm) | 1805 | 1615 | 1900 | 1615 | 1805 | 1881 |
| Peak-hour factor, PHF | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| Adj. Flow (vph) | 284 | 196 | 247 | 494 | 315 | 361 |
| RTOR Reduction (vph) | 0 | 147 | 0 | 368 | 0 | 0 |
| Lane Group Flow (vph) | 284 | 49 | 247 | 126 | 315 | 361 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 1% |
| Turn Type | Prot | Perm | NA | Perm | Prot | NA |
| Protected Phases | 8 | | 2 | | 1 | 6 |
| Permitted Phases | | 8 | | 2 | | |
| Actuated Green, G (s) | 11.4 | 11.4 | 11.5 | 11.5 | 12.2 | 26.4 |
| Effective Green, g (s) | 11.4 | 11.4 | 11.5 | 11.5 | 12.2 | 26.4 |
| Actuated g/C Ratio | 0.25 | 0.25 | 0.25 | 0.25 | 0.27 | 0.58 |
| Clearance Time (s) | 3.0 | 3.0 | 4.1 | 4.1 | 3.0 | 4.4 |
| Vehicle Extension (s) | 2.0 | 2.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| Lane Grp Cap (vph) | 455 | 407 | 483 | 410 | 487 | 1098 |
| v/s Ratio Prot | c0.16 | | c0.13 | | c0.17 | 0.19 |
| v/s Ratio Perm | | 0.03 | | 0.08 | | |
| v/c Ratio | 0.62 | 0.12 | 0.51 | 0.31 | 0.65 | 0.33 |
| Uniform Delay, d1 | 15.0 | 13.0 | 14.4 | 13.6 | 14.6 | 4.8 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 1.9 | 0.0 | 0.4 | 0.2 | 2.2 | 0.1 |
| Delay (s) | 16.9 | 13.1 | 14.8 | 13.8 | 16.8 | 4.9 |
| Level of Service | B | B | B | B | B | A |
| Approach Delay (s) | 15.4 | | 14.1 | | | 10.5 |
| Approach LOS | B | | B | | | B |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 13.1 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.59 | | |
| Actuated Cycle Length (s) | 45.2 | Sum of lost time (s) | 10.1 |
| Intersection Capacity Utilization | 53.0% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |





| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 336 | 110 | 521 | 98 | 83 | 530 |
| Future Volume (vph) | 336 | 110 | 521 | 98 | 83 | 530 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | 4.1 | | 3.0 | 3.5 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 0.97 | 1.00 | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 0.85 | 0.98 | | 1.00 | 1.00 |
| Flt Protected | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | 1787 | 1571 | 1844 | | 1805 | 1881 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | 1787 | 1571 | 1844 | | 1805 | 1881 |
| Peak-hour factor, PHF | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Adj. Flow (vph) | 369 | 121 | 573 | 108 | 91 | 582 |
| RTOR Reduction (vph) | 0 | 86 | 9 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 369 | 35 | 672 | 0 | 91 | 582 |
| Confl. Peds. (#/hr) | | 6 | | | | |
| Heavy Vehicles (%) | 1% | 0% | 1% | 0% | 0% | 1% |
| Turn Type | Prot | Perm | NA | | Prot | NA |
| Protected Phases | 4 | | 6 | | 5 | 2 |
| Permitted Phases | | 4 | | | | |
| Actuated Green, G (s) | 17.5 | 17.5 | 25.9 | | 6.4 | 35.9 |
| Effective Green, g (s) | 17.5 | 17.5 | 25.9 | | 6.4 | 35.9 |
| Actuated g/C Ratio | 0.29 | 0.29 | 0.43 | | 0.11 | 0.60 |
| Clearance Time (s) | 3.0 | 3.0 | 4.1 | | 3.0 | 3.5 |
| Vehicle Extension (s) | 2.0 | 2.0 | 2.0 | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 522 | 458 | 797 | | 192 | 1127 |
| v/s Ratio Prot | c0.21 | | c0.36 | | 0.05 | c0.31 |
| v/s Ratio Perm | | 0.02 | | | | |
| v/c Ratio | 0.71 | 0.08 | 0.84 | | 0.47 | 0.52 |
| Uniform Delay, d1 | 18.9 | 15.4 | 15.2 | | 25.2 | 7.0 |
| Progression Factor | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 3.6 | 0.0 | 7.8 | | 0.7 | 0.2 |
| Delay (s) | 22.5 | 15.4 | 23.0 | | 25.8 | 7.1 |
| Level of Service | C | B | C | | C | A |
| Approach Delay (s) | 20.7 | | 23.0 | | | 9.7 |
| Approach LOS | C | | C | | | A |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 17.5 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.76 | | |
| Actuated Cycle Length (s) | 59.9 | Sum of lost time (s) | 10.1 |
| Intersection Capacity Utilization | 69.8% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Intersection | |
|---|---|
| Intersection Delay, s/veh | 32.1 |
| Intersection LOS | D |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 125 | 11 | 0 | 63 | 117 | 618 | 2 | 157 | 43 | 109 | 21 | 6 |
| Future Vol, veh/h | 125 | 11 | 0 | 63 | 117 | 618 | 2 | 157 | 43 | 109 | 21 | 6 |
| Peak Hour Factor | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 132 | 12 | 0 | 66 | 123 | 651 | 2 | 165 | 45 | 115 | 22 | 6 |
| Number of Lanes | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Opposing Approach | WB | EB | SB | NB |
| Opposing Lanes | 2 | 1 | 2 | 1 |
| Conflicting Approach Left | SB | NB | EB | WB |
| Conflicting Lanes Left | 2 | 1 | 1 | 2 |
| Conflicting Approach Right | NB | SB | WB | EB |
| Conflicting Lanes Right | 1 | 2 | 2 | 1 |
| HCM Control Delay | 13.3 | 42.8 | 15.5 | 13.1 |
| HCM LOS | B | E | C | B |

| Lane | NBLn1 | EBLn1 | WBLn1 | WBLn2 | SBLn1 | SBLn2 |
|---|---|---|---|---|---|---|
| Vol Left, % | 1% | 92% | 35% | 0% | 100% | 0% |
| Vol Thru, % | 78% | 8% | 65% | 0% | 0% | 78% |
| Vol Right, % | 21% | 0% | 0% | 100% | 0% | 22% |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 202 | 136 | 180 | 618 | 109 | 27 |
| LT Vol | 2 | 125 | 63 | 0 | 109 | 0 |
| Through Vol | 157 | 11 | 117 | 0 | 0 | 21 |
| RT Vol | 43 | 0 | 0 | 618 | 0 | 6 |
| Lane Flow Rate | 213 | 143 | 189 | 651 | 115 | 28 |
| Geometry Grp | 6 | 6 | 7 | 7 | 7 | 7 |
| Degree of Util (X) | 0.427 | 0.29 | 0.33 | 0.974 | 0.259 | 0.059 |
| Departure Headway (Hd) | 7.221 | 7.304 | 6.279 | 5.392 | 8.116 | 7.444 |
| Convergence, Y/N | Yes | Yes | Yes | Yes | Yes | Yes |
| Cap | 502 | 492 | 568 | 664 | 444 | 483 |
| Service Time | 5.221 | 5.333 | 4.075 | 3.187 | 5.832 | 5.159 |
| HCM Lane V/C Ratio | 0.424 | 0.291 | 0.333 | 0.98 | 0.259 | 0.058 |
| HCM Control Delay | 15.5 | 13.3 | 12.2 | 51.7 | 13.7 | 10.6 |
| HCM Lane LOS | C | B | B | F | B | B |
| HCM 95th-tile Q | 2.1 | 1.2 | 1.4 | 14.5 | 1 | 0.2 |

| Intersection | |
|---|---|
| Intersection Delay, s/veh | 101.8 |
| Intersection LOS | F |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 12 | 449 | 96 | 320 | 944 | 32 | 112 | 16 | 158 | 19 | 12 | 12 |
| Future Vol, veh/h | 12 | 449 | 96 | 320 | 944 | 32 | 112 | 16 | 158 | 19 | 12 | 12 |
| Peak Hour Factor | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 13 | 473 | 101 | 337 | 994 | 34 | 118 | 17 | 166 | 20 | 13 | 13 |
| Number of Lanes | 1 | 2 | 0 | 1 | 2 | 0 | 0 | 1 | 1 | 0 | 1 | 0 |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Opposing Approach | WB | EB | SB | NB |
| Opposing Lanes | 3 | 3 | 1 | 2 |
| Conflicting Approach Left | SB | NB | EB | WB |
| Conflicting Lanes Left | 1 | 2 | 3 | 3 |
| Conflicting Approach Right | NB | SB | WB | EB |
| Conflicting Lanes Right | 2 | 1 | 3 | 3 |
| HCM Control Delay | 36.3 | 150.4 | 22.1 | 16.9 |
| HCM LOS | E | F | C | C |

| Lane | NBLn1 | NBLn2 | EBLn1 | EBLn2 | EBLn3 | WBLn1 | WBLn2 | WBLn3 | SBLn1 |
|---|---|---|---|---|---|---|---|---|---|
| Vol Left, % | 88% | 0% | 100% | 0% | 0% | 100% | 0% | 0% | 44% |
| Vol Thru, % | 12% | 0% | 0% | 100% | 61% | 0% | 100% | 91% | 28% |
| Vol Right, % | 0% | 100% | 0% | 0% | 39% | 0% | 0% | 9% | 28% |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 128 | 158 | 12 | 299 | 246 | 320 | 629 | 347 | 43 |
| LT Vol | 112 | 0 | 12 | 0 | 0 | 320 | 0 | 0 | 19 |
| Through Vol | 16 | 0 | 0 | 299 | 150 | 0 | 629 | 315 | 12 |
| RT Vol | 0 | 158 | 0 | 0 | 96 | 0 | 0 | 32 | 12 |
| Lane Flow Rate | 135 | 166 | 13 | 315 | 259 | 337 | 662 | 365 | 45 |
| Geometry Grp | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Degree of Util (X) | 0.407 | 0.45 | 0.034 | 0.81 | 0.645 | 0.821 | 1.519 | 0.83 | 0.143 |
| Departure Headway (Hd) | 11.801 | 10.639 | 10.472 | 9.956 | 9.673 | 8.772 | 8.256 | 8.19 | 12.205 |
| Convergence, Y/N | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Cap | 307 | 341 | 344 | 366 | 375 | 414 | 444 | 442 | 296 |
| Service Time | 9.501 | 8.339 | 8.172 | 7.656 | 7.373 | 6.515 | 5.999 | 5.933 | 9.905 |
| HCM Lane V/C Ratio | 0.44 | 0.487 | 0.038 | 0.861 | 0.691 | 0.814 | 1.491 | 0.826 | 0.152 |
| HCM Control Delay | 22.4 | 21.8 | 13.5 | 43.8 | 28.3 | 41.1 | 266.7 | 40 | 16.9 |
| HCM Lane LOS | C | C | B | E | D | E | F | E | C |
| HCM 95th-tile Q | 1.9 | 2.2 | 0.1 | 7 | 4.3 | 7.5 | 35.2 | 7.9 | 0.5 |





| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 12 | 449 | 96 | 320 | 944 | 32 | 112 | 16 | 158 | 19 | 12 | 12 |
| Future Volume (vph) | 12 | 449 | 96 | 320 | 944 | 32 | 112 | 16 | 158 | 19 | 12 | 12 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | | 4.0 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | | 1.00 | 0.85 | | 0.96 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 0.96 | 1.00 | | 0.98 | |
| Satd. Flow (prot) | 1770 | 1863 | 1583 | 1770 | 1863 | 1583 | | 1785 | 1583 | | 1754 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 0.72 | 1.00 | | 0.86 | |
| Satd. Flow (perm) | 1770 | 1863 | 1583 | 1770 | 1863 | 1583 | | 1341 | 1583 | | 1544 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 13 | 473 | 101 | 337 | 994 | 34 | 118 | 17 | 166 | 20 | 13 | 13 |
| RTOR Reduction (vph) | 0 | 0 | 62 | 0 | 0 | 12 | 0 | 0 | 92 | 0 | 11 | 0 |
| Lane Group Flow (vph) | 13 | 473 | 39 | 337 | 994 | 22 | 0 | 135 | 74 | 0 | 35 | 0 |
| Turn Type | Prot | NA | Perm | Prot | NA | Perm | Perm | NA | pm+ov | Perm | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | | 2 | 3 | | 6 | |
| Permitted Phases | | | 4 | | | 8 | 2 | | 2 | 6 | | |
| Actuated Green, G (s) | 0.6 | 27.2 | 27.2 | 18.2 | 44.8 | 44.8 | | 13.4 | 31.6 | | 13.4 | |
| Effective Green, g (s) | 0.6 | 27.2 | 27.2 | 18.2 | 44.8 | 44.8 | | 13.4 | 31.6 | | 13.4 | |
| Actuated g/C Ratio | 0.01 | 0.38 | 0.38 | 0.26 | 0.63 | 0.63 | | 0.19 | 0.45 | | 0.19 | |
| Clearance Time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | | 4.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | |
| Lane Grp Cap (vph) | 15 | 715 | 608 | 455 | 1178 | 1001 | | 253 | 795 | | 292 | |
| v/s Ratio Prot | 0.01 | 0.25 | | c0.19 | c0.53 | | | | 0.02 | | | |
| v/s Ratio Perm | | | 0.02 | | | 0.01 | | c0.10 | 0.02 | | 0.02 | |
| v/c Ratio | 0.87 | 0.66 | 0.06 | 0.74 | 0.84 | 0.02 | | 0.53 | 0.09 | | 0.12 | |
| Uniform Delay, d1 | 35.1 | 18.0 | 13.8 | 24.1 | 10.2 | 4.8 | | 25.9 | 11.3 | | 23.8 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | |
| Incremental Delay, d2 | 162.9 | 2.3 | 0.0 | 6.4 | 5.7 | 0.0 | | 2.2 | 0.1 | | 0.2 | |
| Delay (s) | 198.0 | 20.3 | 13.8 | 30.5 | 15.9 | 4.8 | | 28.0 | 11.4 | | 24.0 | |
| Level of Service | F | C | B | C | B | A | | C | B | | C | |
| Approach Delay (s) | | 23.1 | | | 19.3 | | | 18.8 | | | 24.0 | |
| Approach LOS | | C | | | B | | | B | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 20.3 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.79 | | |
| Actuated Cycle Length (s) | 70.8 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 75.8% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

# MOVEMENT SUMMARY

**Site: 1 [PM E+P]**

Simmons Lane/San Marin Drive
PM Existing plus Project

Roundabout

| Movement Performance - Vehicles | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Mov ID | OD Mov | Demand Flows Total veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | Distance ft | Prop. Queued | Effective Stop Rate per veh | Average Speed mph |
| South: NB Simmons Ln | | | | | | | | | | | |
| 3 | L2 | 118 | 2.0 | 0.376 | 9.1 | LOS A | 1.9 | 48.3 | 0.65 | 0.65 | 31.9 |
| 8 | T1 | 17 | 2.0 | 0.376 | 9.1 | LOS A | 1.9 | 48.3 | 0.65 | 0.65 | 31.9 |
| 18 | R2 | 166 | 2.0 | 0.376 | 9.1 | LOS A | 1.9 | 48.3 | 0.65 | 0.65 | 31.1 |
| Approach | | 301 | 2.0 | 0.376 | 9.1 | LOS A | 1.9 | 48.3 | 0.65 | 0.65 | 31.4 |
| East: WB San Marin Drive | | | | | | | | | | | |
| 1 | L2 | 337 | 2.0 | 0.277 | 5.5 | LOS A | 1.4 | 34.3 | 0.33 | 0.20 | 32.1 |
| 6 | T1 | 994 | 2.0 | 0.846 | 20.8 | LOS C | 26.2 | 666.4 | 0.90 | 0.91 | 28.0 |
| 16 | R2 | 34 | 2.0 | 0.846 | 20.8 | LOS C | 26.2 | 666.4 | 0.90 | 0.91 | 27.4 |
| Approach | | 1364 | 2.0 | 0.846 | 17.0 | LOS B | 26.2 | 666.4 | 0.76 | 0.73 | 28.9 |
| North: SB Simmons Ln | | | | | | | | | | | |
| 7 | L2 | 20 | 2.0 | 0.114 | 10.8 | LOS B | 0.4 | 9.1 | 0.74 | 0.74 | 31.0 |
| 4 | T1 | 13 | 2.0 | 0.114 | 10.8 | LOS B | 0.4 | 9.1 | 0.74 | 0.74 | 31.0 |
| 14 | R2 | 13 | 2.0 | 0.114 | 10.8 | LOS B | 0.4 | 9.1 | 0.74 | 0.74 | 30.3 |
| Approach | | 45 | 2.0 | 0.114 | 10.8 | LOS B | 0.4 | 9.1 | 0.74 | 0.74 | 30.8 |
| West: EB San Marin Drive | | | | | | | | | | | |
| 5 | L2 | 13 | 2.0 | 0.636 | 13.7 | LOS B | 7.3 | 184.4 | 0.77 | 0.90 | 30.8 |
| 2 | T1 | 473 | 2.0 | 0.636 | 13.7 | LOS B | 7.3 | 184.4 | 0.77 | 0.90 | 30.8 |
| 12 | R2 | 101 | 2.0 | 0.636 | 13.7 | LOS B | 7.3 | 184.4 | 0.77 | 0.90 | 30.0 |
| Approach | | 586 | 2.0 | 0.636 | 13.7 | LOS B | 7.3 | 184.4 | 0.77 | 0.90 | 30.6 |
| All Vehicles | | 2297 | 2.0 | 0.846 | 15.0 | LOS B | 26.2 | 666.4 | 0.75 | 0.76 | 29.7 |

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.





| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 3 | 664 | 0 | 3 | 1318 | 15 | 0 | 0 | 0 | 67 | 0 | 8 |
| Future Volume (vph) | 3 | 664 | 0 | 3 | 1318 | 15 | 0 | 0 | 0 | 67 | 0 | 8 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.8 | | 4.0 | 4.8 | 4.8 | | | | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 | | | | 0.95 | 0.95 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | | | 1.00 | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | | 1.00 | 1.00 | 0.85 | | | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | | | | 0.95 | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 3574 | | 1805 | 3574 | 1615 | | | | 1715 | 1715 | 1615 |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | | | | 0.82 | 0.82 | 1.00 |
| Satd. Flow (perm) | 1805 | 3574 | | 1805 | 3574 | 1615 | | | | 1473 | 1473 | 1615 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 3 | 699 | 0 | 3 | 1387 | 16 | 0 | 0 | 0 | 71 | 0 | 8 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 7 |
| Lane Group Flow (vph) | 3 | 699 | 0 | 3 | 1387 | 10 | 0 | 0 | 0 | 35 | 36 | 1 |
| Confl. Peds. (#/hr) | | | 2 | | | | | | | | | |
| Heavy Vehicles (%) | 0% | 1% | 0% | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Prot | NA | | Prot | NA | Perm | | | | Perm | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | | | | 6 | 8 | | | 4 | | 4 |
| Actuated Green, G (s) | 1.3 | 30.4 | | 1.2 | 30.3 | 30.3 | | | | 4.9 | 4.9 | 4.9 |
| Effective Green, g (s) | 1.3 | 30.4 | | 1.2 | 30.3 | 30.3 | | | | 4.9 | 4.9 | 4.9 |
| Actuated g/C Ratio | 0.03 | 0.62 | | 0.02 | 0.61 | 0.61 | | | | 0.10 | 0.10 | 0.10 |
| Clearance Time (s) | 4.0 | 4.8 | | 4.0 | 4.8 | 4.8 | | | | 4.0 | 4.0 | 4.0 |
| Vehicle Extension (s) | 2.0 | 4.0 | | 2.0 | 4.0 | 4.0 | | | | 2.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 47 | 2203 | | 43 | 2196 | 992 | | | | 146 | 146 | 160 |
| v/s Ratio Prot | c0.00 | 0.20 | | 0.00 | c0.39 | | | | | | | |
| v/s Ratio Perm | | | | | | 0.01 | | | | 0.02 | c0.02 | 0.00 |
| v/c Ratio | 0.06 | 0.32 | | 0.07 | 0.63 | 0.01 | | | | 0.24 | 0.25 | 0.00 |
| Uniform Delay, d1 | 23.4 | 4.5 | | 23.5 | 6.0 | 3.7 | | | | 20.5 | 20.5 | 20.0 |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.2 | 0.1 | | 0.3 | 0.7 | 0.0 | | | | 0.3 | 0.3 | 0.0 |
| Delay (s) | 23.6 | 4.6 | | 23.8 | 6.7 | 3.7 | | | | 20.8 | 20.8 | 20.0 |
| Level of Service | C | A | | C | A | A | | | | C | C | C |
| Approach Delay (s) | | 4.7 | | | 6.7 | | | 0.0 | | | 20.7 | |
| Approach LOS | | A | | | A | | | A | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 6.5 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.56 | | |
| Actuated Cycle Length (s) | 49.3 | Sum of lost time (s) | 12.8 |
| Intersection Capacity Utilization | 52.1% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 3: San Marin Dr & E Campus Drive

02/15/2018

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 1 | 737 | 1341 | 47 | 49 | 3 |
| Future Volume (vph) | 1 | 737 | 1341 | 47 | 49 | 3 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 4.3 | 4.3 | 4.3 | 3.0 | 3.0 |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | 1.00 | 0.97 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 1.00 | 0.85 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 3574 | 3574 | 1615 | 3502 | 1595 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (perm) | 1805 | 3574 | 3574 | 1615 | 3502 | 1595 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 1 | 768 | 1397 | 49 | 51 | 3 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 16 | 0 | 3 |
| Lane Group Flow (vph) | 1 | 768 | 1397 | 33 | 51 | 0 |
| Confl. Peds. (#/hr) | | | | | | 1 |
| Heavy Vehicles (%) | 0% | 1% | 1% | 0% | 0% | 0% |
| Turn Type | Prot | NA | NA | Perm | Prot | Perm |
| Protected Phases | 5 | 2 | 6 | | 4 | |
| Permitted Phases | | | | 6 | | 4 |
| Actuated Green, G (s) | 1.0 | 38.5 | 34.5 | 34.5 | 5.6 | 5.6 |
| Effective Green, g (s) | 1.0 | 38.5 | 34.5 | 34.5 | 5.6 | 5.6 |
| Actuated g/C Ratio | 0.02 | 0.75 | 0.67 | 0.67 | 0.11 | 0.11 |
| Clearance Time (s) | 3.0 | 4.3 | 4.3 | 4.3 | 3.0 | 3.0 |
| Vehicle Extension (s) | 2.0 | 4.0 | 4.0 | 4.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 35 | 2677 | 2398 | 1083 | 381 | 173 |
| v/s Ratio Prot | 0.00 | c0.21 | c0.39 | | c0.01 | |
| v/s Ratio Perm | | | | 0.02 | | 0.00 |
| v/c Ratio | 0.03 | 0.29 | 0.58 | 0.03 | 0.13 | 0.00 |
| Uniform Delay, d1 | 24.7 | 2.1 | 4.6 | 2.8 | 20.7 | 20.4 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.1 | 0.1 | 0.4 | 0.0 | 0.1 | 0.0 |
| Delay (s) | 24.8 | 2.1 | 5.0 | 2.9 | 20.8 | 20.4 |
| Level of Service | C | A | A | A | C | C |
| Approach Delay (s) | | 2.2 | 4.9 | | 20.7 | |
| Approach LOS | | A | A | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 4.4 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.52 | | |
| Actuated Cycle Length (s) | 51.4 | Sum of lost time (s) | 10.3 |
| Intersection Capacity Utilization | 49.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 4: Redwood Blvd & San Marin Dr

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 29 | 602 | 178 | 386 | 955 | 205 | 291 | 95 | 518 | 630 | 150 | 100 |
| Future Volume (vph) | 29 | 602 | 178 | 386 | 955 | 205 | 291 | 95 | 518 | 630 | 150 | 100 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.6 | | 3.0 | 4.0 | | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 | |
| Lane Util. Factor | 1.00 | 0.91 | | 1.00 | 0.91 | | 0.97 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 0.99 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 0.97 | | 1.00 | 0.97 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.94 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1787 | 4943 | | 1752 | 4999 | | 3467 | 1881 | 1568 | 1787 | 1756 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1787 | 4943 | | 1752 | 4999 | | 3467 | 1881 | 1568 | 1787 | 1756 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 31 | 634 | 187 | 406 | 1005 | 216 | 306 | 100 | 545 | 663 | 158 | 105 |
| RTOR Reduction (vph) | 0 | 43 | 0 | 0 | 27 | 0 | 0 | 0 | 209 | 0 | 19 | 0 |
| Lane Group Flow (vph) | 31 | 778 | 0 | 406 | 1194 | 0 | 306 | 100 | 336 | 663 | 244 | 0 |
| Confl. Peds. (#/hr) | | | 4 | | | | | | | | | 5 |
| Confl. Bikes (#/hr) | | | | | | | | | | | | 1 |
| Heavy Vehicles (%) | 1% | 1% | 1% | 3% | 1% | 1% | 1% | 1% | 3% | 1% | 1% | 1% |
| Turn Type | Prot | NA | | Prot | NA | | Split | NA | Perm | Split | NA | |
| Protected Phases | 1 | 6 | | 5 | 2 | | 7 | 7 | | 8 | 8 | |
| Permitted Phases | | | | | 2 | | | | 7 | | | |
| Actuated Green, G (s) | 6.0 | 40.0 | | 14.2 | 47.8 | | 16.9 | 16.9 | 16.9 | 43.7 | 43.7 | |
| Effective Green, g (s) | 6.0 | 40.0 | | 14.2 | 47.8 | | 16.9 | 16.9 | 16.9 | 43.7 | 43.7 | |
| Actuated g/C Ratio | 0.05 | 0.31 | | 0.11 | 0.37 | | 0.13 | 0.13 | 0.13 | 0.34 | 0.34 | |
| Clearance Time (s) | 3.0 | 3.6 | | 3.0 | 4.0 | | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 | |
| Vehicle Extension (s) | 2.0 | 4.0 | | 5.0 | 4.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 82 | 1520 | | 191 | 1838 | | 450 | 244 | 203 | 600 | 590 | |
| v/s Ratio Prot | 0.02 | c0.16 | | c0.23 | c0.24 | | 0.09 | 0.05 | | c0.37 | 0.14 | |
| v/s Ratio Perm | | | | | | | | | c0.21 | | | |
| v/c Ratio | 0.38 | 0.51 | | 2.13 | 0.65 | | 0.68 | 0.41 | 1.66 | 1.10 | 0.41 | |
| Uniform Delay, d1 | 60.2 | 37.0 | | 57.9 | 34.1 | | 54.0 | 52.0 | 56.5 | 43.1 | 33.3 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 1.1 | 0.4 | | 523.8 | 1.8 | | 3.4 | 0.4 | 316.2 | 68.9 | 0.2 | |
| Delay (s) | 61.3 | 37.4 | | 581.7 | 35.9 | | 57.3 | 52.4 | 372.7 | 112.1 | 33.5 | |
| Level of Service | E | D | | F | D | | E | D | F | F | C | |
| Approach Delay (s) | | 38.2 | | | 172.1 | | | 237.6 | | | 89.7 | |
| Approach LOS | | D | | | F | | | F | | | F | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 142.7 | HCM 2000 Level of Service | F |
| HCM 2000 Volume to Capacity ratio | 1.15 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 15.6 |
| Intersection Capacity Utilization | 96.8% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 4: Redwood Blvd & San Marin Dr

02/16/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 29 | 602 | 178 | 386 | 955 | 205 | 291 | 95 | 518 | 630 | 150 | 100 |
| Future Volume (vph) | 29 | 602 | 178 | 386 | 955 | 205 | 291 | 95 | 518 | 630 | 150 | 100 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.6 | | 3.0 | 4.0 | 4.3 | 4.3 | 4.3 | 3.0 | 4.3 | 4.3 | |
| Lane Util. Factor | 1.00 | 0.91 | | 0.97 | 0.95 | 1.00 | 0.95 | 0.95 | 0.88 | 0.91 | 0.91 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 0.97 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.97 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 0.98 | 1.00 | 0.95 | 0.97 | |
| Satd. Flow (prot) | 1787 | 4942 | | 3400 | 3574 | 1599 | 1698 | 1743 | 2760 | 1626 | 3233 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 0.98 | 1.00 | 0.95 | 0.97 | |
| Satd. Flow (perm) | 1787 | 4942 | | 3400 | 3574 | 1599 | 1698 | 1743 | 2760 | 1626 | 3233 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 31 | 634 | 187 | 406 | 1005 | 216 | 306 | 100 | 545 | 663 | 158 | 105 |
| RTOR Reduction (vph) | 0 | 35 | 0 | 0 | 0 | 64 | 0 | 0 | 87 | 0 | 14 | 0 |
| Lane Group Flow (vph) | 31 | 786 | 0 | 406 | 1005 | 152 | 202 | 204 | 458 | 331 | 581 | 0 |
| Confl. Peds. (#/hr) | | | 4 | | | | | | | | | 5 |
| Confl. Bikes (#/hr) | | | | | | | | | | | | 1 |
| Heavy Vehicles (%) | 1% | 1% | 1% | 3% | 1% | 1% | 1% | 1% | 3% | 1% | 1% | 1% |
| Turn Type | Prot | NA | | Prot | NA | pm+ov | Split | NA | pm+ov | Split | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | 4 | 8 | 8 | 1 | 4 | 4 | |
| Permitted Phases | | | | | | 6 | | | 8 | | | |
| Actuated Green, G (s) | 6.0 | 51.7 | | 19.2 | 64.5 | 98.2 | 20.2 | 20.2 | 39.4 | 33.7 | 33.7 | |
| Effective Green, g (s) | 6.0 | 51.7 | | 19.2 | 64.5 | 98.2 | 20.2 | 20.2 | 39.4 | 33.7 | 33.7 | |
| Actuated g/C Ratio | 0.04 | 0.37 | | 0.14 | 0.46 | 0.70 | 0.14 | 0.14 | 0.28 | 0.24 | 0.24 | |
| Clearance Time (s) | 3.0 | 3.6 | | 3.0 | 4.0 | 4.3 | 4.3 | 4.3 | 3.0 | 4.3 | 4.3 | |
| Vehicle Extension (s) | 2.0 | 4.0 | | 5.0 | 4.0 | 2.0 | 2.0 | 2.0 | 5.0 | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 76 | 1825 | | 466 | 1646 | 1121 | 244 | 251 | 776 | 391 | 778 | |
| v/s Ratio Prot | 0.02 | c0.16 | | c0.12 | c0.28 | 0.03 | c0.12 | 0.12 | 0.08 | c0.20 | 0.18 | |
| v/s Ratio Perm | | | | | | 0.06 | | | 0.09 | | | |
| v/c Ratio | 0.41 | 0.43 | | 0.87 | 0.61 | 0.14 | 0.83 | 0.81 | 0.59 | 0.85 | 0.75 | |
| Uniform Delay, d1 | 65.3 | 33.1 | | 59.2 | 28.3 | 6.9 | 58.2 | 58.1 | 43.3 | 50.7 | 49.2 | |
| Progression Factor | 1.00 | 1.00 | | 0.77 | 0.58 | 2.01 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 1.3 | 0.7 | | 15.9 | 1.5 | 0.0 | 19.2 | 17.0 | 1.8 | 14.9 | 3.5 | |
| Delay (s) | 66.6 | 33.9 | | 61.8 | 17.8 | 13.9 | 77.4 | 75.1 | 45.2 | 65.6 | 52.7 | |
| Level of Service | E | C | | E | B | B | E | E | D | E | D | |
| Approach Delay (s) | | 35.0 | | | 28.3 | | | 58.4 | | | 57.3 | |
| Approach LOS | | D | | | C | | | E | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 42.3 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.73 | | |
| Actuated Cycle Length (s) | 140.0 | Sum of lost time (s) | 15.6 |
| Intersection Capacity Utilization | 92.3% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 5: US 101 SB Ramps & San Marin Dr

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 837 | 877 | 156 | 1261 | 0 | 0 | 0 | 0 | 54 | 2 | 338 |
| Future Volume (vph) | 0 | 837 | 877 | 156 | 1261 | 0 | 0 | 0 | 0 | 54 | 2 | 338 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.9 | 4.9 | 3.0 | 5.3 | | | | | | 4.0 | 4.0 |
| Lane Util. Factor | | 0.95 | 1.00 | 1.00 | 0.95 | | | | | | 1.00 | 0.88 |
| Frpb, ped/bikes | | 1.00 | 0.98 | 1.00 | 1.00 | | | | | | 1.00 | 1.00 |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | | | | | 1.00 | 1.00 |
| Frt | | 1.00 | 0.85 | 1.00 | 1.00 | | | | | | 1.00 | 0.85 |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | | 0.95 | 1.00 |
| Satd. Flow (prot) | | 3574 | 1575 | 1805 | 3574 | | | | | | 1812 | 2814 |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | | 0.95 | 1.00 |
| Satd. Flow (perm) | | 3574 | 1575 | 1805 | 3574 | | | | | | 1812 | 2814 |
| Peak-hour factor, PHF | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| Adj. Flow (vph) | 0 | 863 | 904 | 161 | 1300 | 0 | 0 | 0 | 0 | 56 | 2 | 348 |
| RTOR Reduction (vph) | 0 | 0 | 274 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 174 |
| Lane Group Flow (vph) | 0 | 863 | 630 | 161 | 1300 | 0 | 0 | 0 | 0 | 0 | 58 | 174 |
| Confl. Peds. (#/hr) | | | 4 | | | | | | | | | |
| Heavy Vehicles (%) | 0% | 1% | 1% | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 1% |
| Turn Type | | NA | Perm | Prot | NA | | | | | Split | NA | Perm |
| Protected Phases | | 2 | | 1 | 6 | | | | | 4 | 4 | |
| Permitted Phases | | | 2 | | | | | | | | | 4 |
| Actuated Green, G (s) | | 41.7 | 41.7 | 9.0 | 53.3 | | | | | | 7.4 | 7.4 |
| Effective Green, g (s) | | 41.7 | 41.7 | 9.0 | 53.3 | | | | | | 7.4 | 7.4 |
| Actuated g/C Ratio | | 0.60 | 0.60 | 0.13 | 0.76 | | | | | | 0.11 | 0.11 |
| Clearance Time (s) | | 4.9 | 4.9 | 3.0 | 5.3 | | | | | | 4.0 | 4.0 |
| Vehicle Extension (s) | | 4.0 | 4.0 | 2.0 | 4.0 | | | | | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | | 2129 | 938 | 232 | 2721 | | | | | | 191 | 297 |
| v/s Ratio Prot | | 0.24 | | c0.09 | 0.36 | | | | | | 0.03 | |
| v/s Ratio Perm | | | c0.40 | | | | | | | | | c0.06 |
| v/c Ratio | | 0.41 | 0.67 | 0.69 | 0.48 | | | | | | 0.30 | 0.58 |
| Uniform Delay, d1 | | 7.5 | 9.5 | 29.2 | 3.1 | | | | | | 28.9 | 29.8 |
| Progression Factor | | 1.00 | 1.00 | 1.00 | 1.00 | | | | | | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.6 | 3.8 | 7.1 | 0.6 | | | | | | 0.3 | 1.9 |
| Delay (s) | | 8.1 | 13.4 | 36.2 | 3.7 | | | | | | 29.2 | 31.7 |
| Level of Service | | A | B | D | A | | | | | | C | C |
| Approach Delay (s) | | 10.8 | | | 7.3 | | | 0.0 | | | 31.4 | |
| Approach LOS | | B | | | A | | | A | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 11.7 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.66 | | |
| Actuated Cycle Length (s) | 70.0 | Sum of lost time (s) | 11.9 |
| Intersection Capacity Utilization | 119.4% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 6: US 101 NB Ramps & San Marin Dr

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 424 | 417 | 0 | 0 | 424 | 51 | 1093 | 108 | 202 | 0 | 0 | 0 |
| Future Volume (vph) | 424 | 417 | 0 | 0 | 424 | 51 | 1093 | 108 | 202 | 0 | 0 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.6 | | | 4.9 | 4.9 | 3.5 | 3.5 | | | | |
| Lane Util. Factor | 0.97 | 1.00 | | | 0.95 | 1.00 | 0.95 | 0.95 | | | | |
| Frpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | 0.99 | 1.00 | 0.99 | | | | |
| Flpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | | | |
| Frt | 1.00 | 1.00 | | | 1.00 | 0.85 | 1.00 | 0.96 | | | | |
| Flt Protected | 0.95 | 1.00 | | | 1.00 | 1.00 | 0.95 | 0.97 | | | | |
| Satd. Flow (prot) | 3467 | 1881 | | | 3574 | 1593 | 1681 | 1637 | | | | |
| Flt Permitted | 0.95 | 1.00 | | | 1.00 | 1.00 | 0.95 | 0.97 | | | | |
| Satd. Flow (perm) | 3467 | 1881 | | | 3574 | 1593 | 1681 | 1637 | | | | |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 442 | 434 | 0 | 0 | 442 | 53 | 1139 | 112 | 210 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 44 | 0 | 22 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 442 | 434 | 0 | 0 | 442 | 9 | 740 | 700 | 0 | 0 | 0 | 0 |
| Confl. Peds. (#/hr) | | | 3 | | | 1 | | | 1 | 1 | | |
| Heavy Vehicles (%) | 1% | 1% | 0% | 0% | 1% | 0% | 2% | 0% | 3% | 0% | 0% | 0% |
| Turn Type | Prot | NA | | | NA | Perm | Split | NA | | | | |
| Protected Phases | 5 | 2 | | | 6 | | 8 | 8 | | | | |
| Permitted Phases | | | | | | 6 | | | | | | |
| Actuated Green, G (s) | 10.1 | 25.6 | | | 11.7 | 11.7 | 31.8 | 31.8 | | | | |
| Effective Green, g (s) | 10.1 | 25.6 | | | 11.7 | 11.7 | 31.8 | 31.8 | | | | |
| Actuated g/C Ratio | 0.15 | 0.39 | | | 0.18 | 0.18 | 0.49 | 0.49 | | | | |
| Clearance Time (s) | 3.5 | 4.6 | | | 4.9 | 4.9 | 3.5 | 3.5 | | | | |
| Vehicle Extension (s) | 2.0 | 4.0 | | | 4.0 | 4.0 | 2.5 | 2.5 | | | | |
| Lane Grp Cap (vph) | 534 | 735 | | | 638 | 284 | 816 | 794 | | | | |
| v/s Ratio Prot | c0.13 | c0.23 | | | 0.12 | | c0.44 | 0.43 | | | | |
| v/s Ratio Perm | | | | | | 0.01 | | | | | | |
| v/c Ratio | 0.83 | 0.59 | | | 0.69 | 0.03 | 0.91 | 0.88 | | | | |
| Uniform Delay, d1 | 26.9 | 15.8 | | | 25.2 | 22.2 | 15.5 | 15.2 | | | | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | | | |
| Incremental Delay, d2 | 9.7 | 1.5 | | | 3.5 | 0.1 | 13.6 | 11.2 | | | | |
| Delay (s) | 36.6 | 17.3 | | | 28.7 | 22.3 | 29.1 | 26.4 | | | | |
| Level of Service | D | B | | | C | C | C | C | | | | |
| Approach Delay (s) | | 27.0 | | | 28.0 | | | 27.7 | | | 0.0 | |
| Approach LOS | | C | | | C | | | C | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 27.6 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.85 | | |
| Actuated Cycle Length (s) | 65.5 | Sum of lost time (s) | 11.9 |
| Intersection Capacity Utilization | 119.4% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 7: Redwood Blvd & Olive St

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 150 | 73 | 34 | 178 | 107 | 109 | 75 | 801 | 207 | 125 | 474 | 142 |
| Future Volume (vph) | 150 | 73 | 34 | 178 | 107 | 109 | 75 | 801 | 207 | 125 | 474 | 142 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 5.1 | 5.1 | | | 5.1 | | 4.0 | 3.9 | 3.9 | 4.0 | 3.9 | |
| Lane Util. Factor | 1.00 | 1.00 | | | 1.00 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | |
| Frt | 1.00 | 0.95 | | | 0.96 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.97 | |
| Flt Protected | 0.95 | 1.00 | | | 0.98 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1770 | 1774 | | | 1754 | | 1770 | 3539 | 1583 | 1770 | 3417 | |
| Flt Permitted | 0.95 | 1.00 | | | 0.98 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1770 | 1774 | | | 1754 | | 1770 | 3539 | 1583 | 1770 | 3417 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 158 | 77 | 36 | 187 | 113 | 115 | 79 | 843 | 218 | 132 | 499 | 149 |
| RTOR Reduction (vph) | 0 | 17 | 0 | 0 | 12 | 0 | 0 | 0 | 79 | 0 | 24 | 0 |
| Lane Group Flow (vph) | 158 | 96 | 0 | 0 | 403 | 0 | 79 | 843 | 139 | 132 | 624 | 0 |
| Turn Type | Split | NA | | Split | NA | | Prot | NA | Perm | Prot | NA | |
| Protected Phases | 4 | 4 | | 8 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | | | | | | | 2 | | | |
| Actuated Green, G (s) | 13.3 | 13.3 | | | 25.3 | | 7.7 | 27.1 | 27.1 | 10.1 | 29.5 | |
| Effective Green, g (s) | 13.3 | 13.3 | | | 25.3 | | 7.7 | 27.1 | 27.1 | 10.1 | 29.5 | |
| Actuated g/C Ratio | 0.14 | 0.14 | | | 0.27 | | 0.08 | 0.29 | 0.29 | 0.11 | 0.31 | |
| Clearance Time (s) | 5.1 | 5.1 | | | 5.1 | | 4.0 | 3.9 | 3.9 | 4.0 | 3.9 | |
| Vehicle Extension (s) | 1.0 | 1.0 | | | 1.0 | | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | |
| Lane Grp Cap (vph) | 250 | 251 | | | 472 | | 145 | 1021 | 456 | 190 | 1073 | |
| v/s Ratio Prot | c0.09 | 0.05 | | | c0.23 | | 0.04 | c0.24 | | c0.07 | 0.18 | |
| v/s Ratio Perm | | | | | | | | | 0.09 | | | |
| v/c Ratio | 0.63 | 0.38 | | | 0.85 | | 0.54 | 0.83 | 0.30 | 0.69 | 0.58 | |
| Uniform Delay, d1 | 38.0 | 36.6 | | | 32.6 | | 41.4 | 31.2 | 26.1 | 40.4 | 27.0 | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 3.8 | 0.4 | | | 13.5 | | 2.2 | 5.3 | 0.1 | 8.6 | 0.5 | |
| Delay (s) | 41.8 | 36.9 | | | 46.1 | | 43.7 | 36.5 | 26.2 | 49.0 | 27.5 | |
| Level of Service | D | D | | | D | | D | D | C | D | C | |
| Approach Delay (s) | | 39.8 | | | 46.1 | | | 35.0 | | | 31.2 | |
| Approach LOS | | D | | | D | | | D | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 36.1 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.77 | | |
| Actuated Cycle Length (s) | 93.9 | Sum of lost time (s) | 18.1 |
| Intersection Capacity Utilization | 70.2% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis
## 8: Redwood Blvd & Grant Ave

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 124 | 141 | 313 | 45 | 176 | 85 | 411 | 635 | 71 | 60 | 511 | 157 |
| Future Volume (vph) | 124 | 141 | 313 | 45 | 176 | 85 | 411 | 635 | 71 | 60 | 511 | 157 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.5 | 3.5 | | 3.5 | 3.7 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.96 | 1.00 | 1.00 | 0.96 | 1.00 | 0.99 | | 1.00 | 0.99 | |
| Flpb, ped/bikes | 0.99 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.98 | | 1.00 | 0.96 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1752 | 1900 | 1528 | 1803 | 1900 | 1557 | 1805 | 3461 | | 1805 | 3394 | |
| Flt Permitted | 0.56 | 1.00 | 1.00 | 0.63 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1033 | 1900 | 1528 | 1189 | 1900 | 1557 | 1805 | 3461 | | 1805 | 3394 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 131 | 148 | 329 | 47 | 185 | 89 | 433 | 668 | 75 | 63 | 538 | 165 |
| RTOR Reduction (vph) | 0 | 0 | 243 | 0 | 0 | 66 | 0 | 8 | 0 | 0 | 27 | 0 |
| Lane Group Flow (vph) | 131 | 148 | 86 | 47 | 185 | 23 | 433 | 735 | 0 | 63 | 676 | 0 |
| Confl. Peds. (#/hr) | 22 | | 46 | 2 | | 34 | | | 36 | | | 10 |
| Confl. Bikes (#/hr) | | | 5 | | | 5 | | | 5 | | | 5 |
| Heavy Vehicles (%) | 2% | 0% | 1% | 0% | 0% | 0% | 0% | 2% | 0% | 0% | 2% | 0% |
| Turn Type | Perm | NA | Perm | Perm | NA | Perm | Prot | NA | | Prot | NA | |
| Protected Phases | | 8 | | | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | 8 | | 8 | 4 | | 4 | | | | | | |
| Actuated Green, G (s) | 20.2 | 20.2 | 20.2 | 20.2 | 20.2 | 20.2 | 23.8 | 34.4 | | 11.7 | 22.1 | |
| Effective Green, g (s) | 20.2 | 20.2 | 20.2 | 20.2 | 20.2 | 20.2 | 23.8 | 34.4 | | 11.7 | 22.1 | |
| Actuated g/C Ratio | 0.26 | 0.26 | 0.26 | 0.26 | 0.26 | 0.26 | 0.31 | 0.45 | | 0.15 | 0.29 | |
| Clearance Time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.5 | 3.5 | | 3.5 | 3.7 | |
| Vehicle Extension (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 2.5 | 3.0 | | 2.5 | 3.0 | |
| Lane Grp Cap (vph) | 269 | 496 | 399 | 310 | 496 | 406 | 555 | 1540 | | 273 | 970 | |
| v/s Ratio Prot | | 0.08 | | | 0.10 | | c0.24 | 0.21 | | 0.03 | c0.20 | |
| v/s Ratio Perm | c0.13 | | 0.06 | 0.04 | | 0.01 | | | | | | |
| v/c Ratio | 0.49 | 0.30 | 0.22 | 0.15 | 0.37 | 0.06 | 0.78 | 0.48 | | 0.23 | 0.70 | |
| Uniform Delay, d1 | 24.2 | 22.9 | 22.3 | 22.0 | 23.4 | 21.4 | 24.4 | 15.1 | | 28.8 | 24.6 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 1.9 | 0.5 | 0.4 | 0.3 | 0.6 | 0.1 | 6.8 | 0.2 | | 0.3 | 2.2 | |
| Delay (s) | 26.1 | 23.3 | 22.7 | 22.3 | 24.0 | 21.5 | 31.1 | 15.4 | | 29.2 | 26.8 | |
| Level of Service | C | C | C | C | C | C | C | B | | C | C | |
| Approach Delay (s) | | 23.6 | | | 23.1 | | | 21.2 | | | 27.0 | |
| Approach LOS | | C | | | C | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 23.4 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.66 | | |
| Actuated Cycle Length (s) | 77.3 | Sum of lost time (s) | 11.2 |
| Intersection Capacity Utilization | 92.7% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



# HCM 2010 AWSC
## 9: San Marin Dr/Sutro Ave & Novato Blvd #1

02/15/2018

| Intersection | |
|---|---|
| Intersection Delay, s/veh | 92.2 |
| Intersection LOS | F |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 89 | 157 | 54 | 74 | 306 | 192 | 66 | 129 | 58 | 177 | 230 | 413 |
| Future Vol, veh/h | 89 | 157 | 54 | 74 | 306 | 192 | 66 | 129 | 58 | 177 | 230 | 413 |
| Peak Hour Factor | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 94 | 165 | 57 | 78 | 322 | 202 | 69 | 136 | 61 | 186 | 242 | 435 |
| Number of Lanes | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Opposing Approach | WB | EB | SB | NB |
| Opposing Lanes | 2 | 2 | 3 | 2 |
| Conflicting Approach Left | SB | NB | EB | WB |
| Conflicting Lanes Left | 3 | 2 | 2 | 2 |
| Conflicting Approach Right | NB | SB | WB | EB |
| Conflicting Lanes Right | 2 | 3 | 2 | 2 |
| HCM Control Delay | 28.8 | 203.5 | 26.6 | 58.1 |
| HCM LOS | D | F | D | F |

| Lane | NBLn1 | NBLn2 | EBLn1 | EBLn2 | WBLn1 | WBLn2 | SBLn1 | SBLn2 | SBLn3 |
|---|---|---|---|---|---|---|---|---|---|
| Vol Left, % | 100% | 0% | 100% | 0% | 100% | 0% | 100% | 0% | 0% |
| Vol Thru, % | 0% | 69% | 0% | 74% | 0% | 61% | 0% | 100% | 0% |
| Vol Right, % | 0% | 31% | 0% | 26% | 0% | 39% | 0% | 0% | 100% |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 66 | 187 | 89 | 211 | 74 | 498 | 177 | 230 | 413 |
| LT Vol | 66 | 0 | 89 | 0 | 74 | 0 | 177 | 0 | 0 |
| Through Vol | 0 | 129 | 0 | 157 | 0 | 306 | 0 | 230 | 0 |
| RT Vol | 0 | 58 | 0 | 54 | 0 | 192 | 0 | 0 | 413 |
| Lane Flow Rate | 69 | 197 | 94 | 222 | 78 | 524 | 186 | 242 | 435 |
| Geometry Grp | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Degree of Util (X) | 0.218 | 0.578 | 0.288 | 0.642 | 0.228 | 1.42 | 0.507 | 0.626 | 1.04 |
| Departure Headway (Hd) | 12.513 | 11.749 | 12.168 | 11.454 | 10.852 | 10.054 | 10.844 | 10.32 | 9.585 |
| Convergence, Y/N | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Cap | 289 | 309 | 297 | 318 | 333 | 367 | 335 | 353 | 383 |
| Service Time | 10.213 | 9.449 | 9.868 | 9.154 | 8.552 | 7.754 | 8.544 | 8.02 | 7.285 |
| HCM Lane V/C Ratio | 0.239 | 0.638 | 0.316 | 0.698 | 0.234 | 1.428 | 0.555 | 0.686 | 1.136 |
| HCM Control Delay | 18.7 | 29.4 | 19.7 | 32.6 | 16.7 | 231.2 | 24.2 | 28.8 | 88.9 |
| HCM Lane LOS | C | D | C | D | C | F | C | D | F |
| HCM 95th-tile Q | 0.8 | 3.4 | 1.2 | 4.2 | 0.9 | 26.1 | 2.7 | 4 | 13.1 |

HCM Signalized Intersection Capacity Analysis
9: San Marin Dr/Sutro Ave & Novato Blvd #1 02/16/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 89 | 157 | 54 | 74 | 306 | 192 | 66 | 129 | 58 | 177 | 230 | 413 |
| Future Volume (vph) | 89 | 157 | 54 | 74 | 306 | 192 | 66 | 129 | 58 | 177 | 230 | 413 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 4.0 | | 3.0 | 4.0 | | 3.0 | 4.0 | | 3.0 | 4.0 | 4.0 |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.96 | | 1.00 | 0.94 | | 1.00 | 0.95 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1770 | 1791 | | 1770 | 1755 | | 1770 | 1776 | | 1770 | 1863 | 1583 |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1770 | 1791 | | 1770 | 1755 | | 1770 | 1776 | | 1770 | 1863 | 1583 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 94 | 165 | 57 | 78 | 322 | 202 | 69 | 136 | 61 | 186 | 242 | 435 |
| RTOR Reduction (vph) | 0 | 13 | 0 | 0 | 25 | 0 | 0 | 20 | 0 | 0 | 0 | 309 |
| Lane Group Flow (vph) | 94 | 209 | 0 | 78 | 499 | 0 | 69 | 177 | 0 | 186 | 242 | 126 |
| Turn Type | Prot | NA | | Prot | NA | | Prot | NA | | Prot | NA | Perm |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | | | | | | | | | | 6 |
| Actuated Green, G (s) | 5.1 | 23.8 | | 6.2 | 24.9 | | 6.0 | 14.6 | | 11.9 | 20.5 | 20.5 |
| Effective Green, g (s) | 5.1 | 23.8 | | 6.2 | 24.9 | | 6.0 | 14.6 | | 11.9 | 20.5 | 20.5 |
| Actuated g/C Ratio | 0.07 | 0.34 | | 0.09 | 0.35 | | 0.09 | 0.21 | | 0.17 | 0.29 | 0.29 |
| Clearance Time (s) | 3.0 | 4.0 | | 3.0 | 4.0 | | 3.0 | 4.0 | | 3.0 | 4.0 | 4.0 |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | 128 | 604 | | 155 | 619 | | 150 | 367 | | 298 | 541 | 460 |
| v/s Ratio Prot | c0.05 | 0.12 | | 0.04 | c0.28 | | 0.04 | 0.10 | | c0.11 | c0.13 | |
| v/s Ratio Perm | | | | | | | | | | | | 0.08 |
| v/c Ratio | 0.73 | 0.35 | | 0.50 | 0.81 | | 0.46 | 0.48 | | 0.62 | 0.45 | 0.27 |
| Uniform Delay, d1 | 32.0 | 17.5 | | 30.7 | 20.6 | | 30.7 | 24.6 | | 27.2 | 20.4 | 19.3 |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 19.5 | 0.3 | | 2.6 | 7.6 | | 2.2 | 1.0 | | 4.0 | 0.6 | 0.3 |
| Delay (s) | 51.5 | 17.9 | | 33.2 | 28.2 | | 32.9 | 25.6 | | 31.3 | 21.0 | 19.6 |
| Level of Service | D | B | | C | C | | C | C | | C | C | B |
| Approach Delay (s) | | 27.9 | | | 28.9 | | | 27.5 | | | 22.5 | |
| Approach LOS | | C | | | C | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 25.9 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.69 | | |
| Actuated Cycle Length (s) | 70.5 | Sum of lost time (s) | 14.0 |
| Intersection Capacity Utilization | 67.0% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



# MOVEMENT SUMMARY

## Site: 9 [PM Existing + Project]

Novato Boulevard/San Marin Dr-Sutro Ave
PM Existing + Project

Roundabout

**Movement Performance - Vehicles**

| Mov ID | OD Mov | Demand Flows Total veh/h | Demand Flows HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance ft | Prop. Queued | Effective Stop Rate per veh | Average Speed mph |
|---|---|---|---|---|---|---|---|---|---|---|---|
| South: NB Sutro Ave | | | | | | | | | | | |
| 3 | L2 | 69 | 2.0 | 0.313 | 7.7 | LOS A | 1.5 | 37.8 | 0.59 | 0.55 | 32.9 |
| 8 | T1 | 136 | 2.0 | 0.313 | 7.7 | LOS A | 1.5 | 37.8 | 0.59 | 0.55 | 32.9 |
| 18 | R2 | 61 | 2.0 | 0.313 | 7.7 | LOS A | 1.5 | 37.8 | 0.59 | 0.55 | 32.0 |
| Approach | | 266 | 2.0 | 0.313 | 7.7 | LOS A | 1.5 | 37.8 | 0.59 | 0.55 | 32.7 |
| East: WB Novato Blvd | | | | | | | | | | | |
| 1 | L2 | 78 | 2.0 | 0.607 | 12.1 | LOS B | 6.5 | 165.3 | 0.71 | 0.73 | 31.2 |
| 6 | T1 | 322 | 2.0 | 0.607 | 12.1 | LOS B | 6.5 | 165.3 | 0.71 | 0.73 | 31.2 |
| 16 | R2 | 202 | 2.0 | 0.607 | 12.1 | LOS B | 6.5 | 165.3 | 0.71 | 0.73 | 30.4 |
| Approach | | 602 | 2.0 | 0.607 | 12.1 | LOS B | 6.5 | 165.3 | 0.71 | 0.73 | 30.9 |
| North: SB San Marin Drive | | | | | | | | | | | |
| 7 | L2 | 186 | 2.0 | 0.476 | 10.0 | LOS A | 3.1 | 78.3 | 0.65 | 0.70 | 31.5 |
| 4 | T1 | 242 | 2.0 | 0.476 | 10.0 | LOS A | 3.1 | 78.3 | 0.65 | 0.70 | 31.5 |
| 14 | R2 | 435 | 2.0 | 0.483 | 10.1 | LOS B | 3.2 | 81.1 | 0.65 | 0.71 | 31.3 |
| Approach | | 863 | 2.0 | 0.483 | 10.0 | LOS B | 3.2 | 81.1 | 0.65 | 0.71 | 31.4 |
| West: EB Novato Blvd | | | | | | | | | | | |
| 5 | L2 | 94 | 2.0 | 0.395 | 9.4 | LOS A | 2.1 | 53.6 | 0.66 | 0.68 | 32.0 |
| 2 | T1 | 165 | 2.0 | 0.395 | 9.4 | LOS A | 2.1 | 53.6 | 0.66 | 0.68 | 32.0 |
| 12 | R2 | 57 | 2.0 | 0.395 | 9.4 | LOS A | 2.1 | 53.6 | 0.66 | 0.68 | 31.2 |
| Approach | | 316 | 2.0 | 0.395 | 9.4 | LOS A | 2.1 | 53.6 | 0.66 | 0.68 | 31.9 |
| All Vehicles | | 2047 | 2.0 | 0.607 | 10.2 | LOS B | 6.5 | 165.3 | 0.66 | 0.69 | 31.5 |

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.


Organisation: W-TRANS | Processed: Tuesday, February 27, 2018 3:54:43 PM
Project: N:\AAA\MAX\NOV\126NOV\SIDRA\Novato-San Marin.sip7

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 526 | 40 | 442 | 812 | 45 | 292 |
| Future Volume (vph) | 526 | 40 | 442 | 812 | 45 | 292 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.9 | | 3.0 | 3.6 | 3.6 | 3.6 |
| Lane Util. Factor | 0.95 | | 1.00 | 0.95 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | | 1.00 | 1.00 | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 0.99 | | 1.00 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 1.00 | | 0.95 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (prot) | 3533 | | 1787 | 3610 | 1805 | 1593 |
| Flt Permitted | 1.00 | | 0.95 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (perm) | 3533 | | 1787 | 3610 | 1805 | 1593 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 554 | 42 | 465 | 855 | 47 | 307 |
| RTOR Reduction (vph) | 5 | 0 | 0 | 0 | 0 | 260 |
| Lane Group Flow (vph) | 591 | 0 | 465 | 855 | 47 | 47 |
| Confl. Peds. (#/hr) | | 3 | | | 6 | 2 |
| Heavy Vehicles (%) | 1% | 0% | 1% | 0% | 0% | 0% |
| Turn Type | NA | | Prot | NA | Prot | Perm |
| Protected Phases | 2 | | 1 | 6 | 4 | |
| Permitted Phases | | | | | | 4 |
| Actuated Green, G (s) | 30.9 | | 19.3 | 38.3 | 11.1 | 11.1 |
| Effective Green, g (s) | 30.9 | | 19.3 | 38.3 | 11.1 | 11.1 |
| Actuated g/C Ratio | 0.43 | | 0.27 | 0.53 | 0.15 | 0.15 |
| Clearance Time (s) | 3.9 | | 3.0 | 3.6 | 3.6 | 3.6 |
| Vehicle Extension (s) | 3.0 | | 2.0 | 3.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 1520 | | 480 | 1925 | 279 | 246 |
| v/s Ratio Prot | c0.17 | | c0.26 | c0.24 | 0.03 | |
| v/s Ratio Perm | | | | | | c0.03 |
| v/c Ratio | 0.39 | | 0.97 | 0.44 | 0.17 | 0.19 |
| Uniform Delay, d1 | 14.0 | | 26.0 | 10.2 | 26.3 | 26.4 |
| Progression Factor | 1.00 | | 0.91 | 0.44 | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.8 | | 29.4 | 0.6 | 0.1 | 0.1 |
| Delay (s) | 14.7 | | 53.1 | 5.2 | 26.4 | 26.6 |
| Level of Service | B | | D | A | C | C |
| Approach Delay (s) | 14.7 | | | 22.0 | 26.6 | |
| Approach LOS | B | | | C | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 20.8 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.56 | | |
| Actuated Cycle Length (s) | 71.8 | Sum of lost time (s) | 10.5 |
| Intersection Capacity Utilization | 59.1% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |





| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 128 | 691 | 984 | 104 | 106 | 281 |
| Future Volume (vph) | 128 | 691 | 984 | 104 | 106 | 281 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.9 | 3.6 | | 3.0 | 3.0 |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.99 | | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 3574 | 3551 | | 1805 | 1599 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | 1805 | 3574 | 3551 | | 1805 | 1599 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 135 | 727 | 1036 | 109 | 112 | 296 |
| RTOR Reduction (vph) | 0 | 0 | 7 | 0 | 0 | 246 |
| Lane Group Flow (vph) | 135 | 727 | 1138 | 0 | 112 | 50 |
| Confl. Peds. (#/hr) | | | | | 2 | |
| Confl. Bikes (#/hr) | | | | 1 | | |
| Heavy Vehicles (%) | 0% | 1% | 0% | 0% | 0% | 1% |
| Turn Type | Prot | NA | NA | | Prot | Perm |
| Protected Phases | 5 | 2 | 6 | | 8 | |
| Permitted Phases | | | | | | 8 |
| Actuated Green, G (s) | 12.2 | 30.9 | 38.3 | | 11.7 | 11.7 |
| Effective Green, g (s) | 12.2 | 30.9 | 38.3 | | 11.7 | 11.7 |
| Actuated g/C Ratio | 0.17 | 0.43 | 0.53 | | 0.16 | 0.16 |
| Clearance Time (s) | 3.0 | 3.9 | 3.6 | | 3.0 | 3.0 |
| Vehicle Extension (s) | 2.0 | 3.0 | 3.0 | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 306 | 1538 | 1894 | | 294 | 260 |
| v/s Ratio Prot | 0.07 | c0.20 | c0.32 | | c0.06 | |
| v/s Ratio Perm | | | | | | 0.03 |
| v/c Ratio | 0.44 | 0.47 | 0.60 | | 0.38 | 0.19 |
| Uniform Delay, d1 | 26.7 | 14.6 | 11.5 | | 26.8 | 26.0 |
| Progression Factor | 0.69 | 0.52 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 4.3 | 1.0 | 1.4 | | 0.3 | 0.1 |
| Delay (s) | 22.8 | 8.6 | 12.9 | | 27.1 | 26.1 |
| Level of Service | C | A | B | | C | C |
| Approach Delay (s) | | 10.9 | 12.9 | | 26.4 | |
| Approach LOS | | B | B | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 14.5 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.55 | | |
| Actuated Cycle Length (s) | 71.8 | Sum of lost time (s) | 10.5 |
| Intersection Capacity Utilization | 54.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 12: Grant Ave & Novato Blvd #2

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 160 | 638 | 1 | 2 | 885 | 51 | 1 | 6 | 4 | 24 | 1 | 288 |
| Future Volume (vph) | 160 | 638 | 1 | 2 | 885 | 51 | 1 | 6 | 4 | 24 | 1 | 288 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.5 | 4.5 | 3.5 | 4.9 | 4.9 | | 4.0 | | 3.5 | 3.5 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 | | 1.00 | | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.96 | | 0.98 | | 1.00 | 0.99 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | | 0.97 | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | | 0.95 | | 1.00 | 0.85 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1787 | 1863 | 1534 | 1805 | 3539 | 1529 | | 1762 | | 1737 | 1595 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 0.53 | | 0.75 | 1.00 | |
| Satd. Flow (perm) | 1787 | 1863 | 1534 | 1805 | 3539 | 1529 | | 947 | | 1372 | 1595 | |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 167 | 665 | 1 | 2 | 922 | 53 | 1 | 6 | 4 | 25 | 1 | 300 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 18 | 0 | 4 | 0 | 0 | 269 | 0 |
| Lane Group Flow (vph) | 167 | 665 | 1 | 2 | 922 | 35 | 0 | 7 | 0 | 25 | 32 | 0 |
| Confl. Peds. (#/hr) | | | 11 | | | 8 | 1 | | 14 | 14 | | 1 |
| Confl. Bikes (#/hr) | | | 1 | | | 4 | | | 2 | | | |
| Heavy Vehicles (%) | 1% | 2% | 0% | 0% | 2% | 1% | 0% | 0% | 0% | 1% | 0% | 0% |
| Turn Type | Prot | NA | Perm | Prot | NA | Perm | Perm | NA | | Perm | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | 2 | | | 6 | 8 | | | 4 | | |
| Actuated Green, G (s) | 14.6 | 86.1 | 86.1 | 1.2 | 72.3 | 72.3 | | 10.7 | | 11.2 | 11.2 | |
| Effective Green, g (s) | 14.6 | 86.1 | 86.1 | 1.2 | 72.3 | 72.3 | | 10.7 | | 11.2 | 11.2 | |
| Actuated g/C Ratio | 0.13 | 0.78 | 0.78 | 0.01 | 0.66 | 0.66 | | 0.10 | | 0.10 | 0.10 | |
| Clearance Time (s) | 3.5 | 4.5 | 4.5 | 3.5 | 4.9 | 4.9 | | 4.0 | | 3.5 | 3.5 | |
| Vehicle Extension (s) | 2.0 | 3.0 | 3.0 | 2.0 | 3.0 | 3.0 | | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 237 | 1458 | 1200 | 19 | 2326 | 1004 | | 92 | | 139 | 162 | |
| v/s Ratio Prot | c0.09 | c0.36 | | 0.00 | 0.26 | | | | | | c0.02 | |
| v/s Ratio Perm | | | 0.00 | | | 0.02 | | 0.01 | | 0.02 | | |
| v/c Ratio | 0.70 | 0.46 | 0.00 | 0.11 | 0.40 | 0.03 | | 0.08 | | 0.18 | 0.19 | |
| Uniform Delay, d1 | 45.6 | 4.0 | 2.6 | 53.9 | 8.7 | 6.6 | | 45.2 | | 45.2 | 45.3 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.34 | 0.22 | 0.22 | | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 7.5 | 1.0 | 0.0 | 0.6 | 0.4 | 0.0 | | 0.1 | | 0.2 | 0.2 | |
| Delay (s) | 53.2 | 5.1 | 2.6 | 73.1 | 2.3 | 1.5 | | 45.3 | | 45.4 | 45.5 | |
| Level of Service | D | A | A | E | A | A | | D | | D | D | |
| Approach Delay (s) | | 14.7 | | | 2.4 | | | 45.3 | | | 45.5 | |
| Approach LOS | | B | | | A | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 13.9 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.48 | | |
| Actuated Cycle Length (s) | 110.0 | Sum of lost time (s) | 12.4 |
| Intersection Capacity Utilization | 67.1% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 13: Tamalpais Ave/7th St & Novato Blvd #2

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 134 | 557 | 41 | 67 | 794 | 215 | 43 | 119 | 43 | 184 | 110 | 123 |
| Future Volume (vph) | 134 | 557 | 41 | 67 | 794 | 215 | 43 | 119 | 43 | 184 | 110 | 123 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 5.0 | | 3.5 | 5.0 | 5.0 | 3.5 | 3.5 | | 3.5 | 3.5 | 3.5 |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 0.96 | 1.00 | 0.99 | | 1.00 | 1.00 | 0.96 |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 0.99 | 1.00 | | 0.99 | 1.00 | 1.00 |
| Frt | 1.00 | 0.99 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.96 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1787 | 1839 | | 1787 | 1863 | 1541 | 1768 | 1786 | | 1765 | 1881 | 1533 |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.62 | 1.00 | | 0.51 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1787 | 1839 | | 1787 | 1863 | 1541 | 1148 | 1786 | | 939 | 1881 | 1533 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 140 | 580 | 43 | 70 | 827 | 224 | 45 | 124 | 45 | 192 | 115 | 128 |
| RTOR Reduction (vph) | 0 | 2 | 0 | 0 | 0 | 33 | 0 | 13 | 0 | 0 | 0 | 100 |
| Lane Group Flow (vph) | 140 | 621 | 0 | 70 | 827 | 191 | 45 | 156 | 0 | 192 | 115 | 28 |
| Confl. Peds. (#/hr) | | | 10 | | | 6 | 5 | | 7 | 7 | | 5 |
| Confl. Bikes (#/hr) | | | | | | 3 | | | 2 | | | 5 |
| Heavy Vehicles (%) | 1% | 2% | 1% | 1% | 2% | 1% | 1% | 1% | 1% | 1% | 1% | 1% |
| Turn Type | Prot | NA | | Prot | NA | Perm | Perm | NA | | Perm | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | | | | 6 | 8 | | | 4 | | 4 |
| Actuated Green, G (s) | 12.7 | 66.3 | | 7.5 | 61.1 | 61.1 | 24.2 | 24.2 | | 24.2 | 24.2 | 24.2 |
| Effective Green, g (s) | 12.7 | 66.3 | | 7.5 | 61.1 | 61.1 | 24.2 | 24.2 | | 24.2 | 24.2 | 24.2 |
| Actuated g/C Ratio | 0.12 | 0.60 | | 0.07 | 0.56 | 0.56 | 0.22 | 0.22 | | 0.22 | 0.22 | 0.22 |
| Clearance Time (s) | 3.5 | 5.0 | | 3.5 | 5.0 | 5.0 | 3.5 | 3.5 | | 3.5 | 3.5 | 3.5 |
| Vehicle Extension (s) | 2.0 | 5.0 | | 2.0 | 5.0 | 5.0 | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 206 | 1108 | | 121 | 1034 | 855 | 252 | 392 | | 206 | 413 | 337 |
| v/s Ratio Prot | c0.08 | 0.34 | | 0.04 | c0.44 | | | 0.09 | | | 0.06 | |
| v/s Ratio Perm | | | | | | 0.12 | 0.04 | | | c0.20 | | 0.02 |
| v/c Ratio | 0.68 | 0.56 | | 0.58 | 0.80 | 0.22 | 0.18 | 0.40 | | 0.93 | 0.28 | 0.08 |
| Uniform Delay, d1 | 46.7 | 13.1 | | 49.7 | 19.6 | 12.4 | 34.8 | 36.7 | | 42.1 | 35.6 | 34.1 |
| Progression Factor | 0.89 | 1.15 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 6.4 | 1.9 | | 4.1 | 6.5 | 0.6 | 0.1 | 0.2 | | 43.3 | 0.1 | 0.0 |
| Delay (s) | 48.1 | 17.0 | | 53.8 | 26.0 | 13.0 | 35.0 | 36.9 | | 85.4 | 35.8 | 34.1 |
| Level of Service | D | B | | D | C | B | C | D | | F | D | C |
| Approach Delay (s) | | 22.7 | | | 25.2 | | | 36.5 | | | 57.2 | |
| Approach LOS | | C | | | C | | | D | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 30.9 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.82 | | |
| Actuated Cycle Length (s) | 110.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 85.3% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
14: Diablo Ave & Novato Blvd #2 02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 24 | 254 | 22 | 284 | 327 | 633 | 49 | 439 | 238 | 448 | 334 | 12 |
| Future Volume (vph) | 24 | 254 | 22 | 284 | 327 | 633 | 49 | 439 | 238 | 448 | 334 | 12 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 12 | 12 | 11 | 11 | 12 | 11 | 11 | 12 | 12 | 12 | 12 |
| Total Lost time (s) | | 3.7 | | 4.1 | 4.1 | 4.1 | 4.4 | 4.4 | 4.4 | 4.1 | 4.1 | |
| Lane Util. Factor | | 0.95 | | 0.91 | 0.91 | 1.00 | 1.00 | 1.00 | 1.00 | 0.91 | 0.91 | |
| Frpb, ped/bikes | | 1.00 | | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | | 0.99 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | |
| Flt Protected | | 1.00 | | 0.95 | 0.99 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.98 | |
| Satd. Flow (prot) | | 3514 | | 1557 | 3269 | 1501 | 1728 | 1801 | 1560 | 1610 | 3319 | |
| Flt Permitted | | 1.00 | | 0.95 | 0.99 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.98 | |
| Satd. Flow (perm) | | 3514 | | 1557 | 3269 | 1501 | 1728 | 1801 | 1560 | 1610 | 3319 | |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 26 | 270 | 23 | 302 | 348 | 673 | 52 | 467 | 253 | 477 | 355 | 13 |
| RTOR Reduction (vph) | 0 | 4 | 0 | 0 | 0 | 278 | 0 | 0 | 155 | 0 | 2 | 0 |
| Lane Group Flow (vph) | 0 | 315 | 0 | 211 | 439 | 395 | 52 | 467 | 98 | 277 | 566 | 0 |
| Confl. Peds. (#/hr) | | | 10 | | | 15 | | | 2 | | | 3 |
| Confl. Bikes (#/hr) | | | 1 | | | 1 | | | | | | 6 |
| Heavy Vehicles (%) | 1% | 1% | 1% | 2% | 1% | 2% | 1% | 2% | 2% | 2% | 2% | 1% |
| Turn Type | Split | NA | | Split | NA | Perm | Split | NA | Perm | Split | NA | |
| Protected Phases | 3 | 3 | | 4 | 4 | | 1 | 1 | | 2 | 2 | |
| Permitted Phases | | | | | | 4 | | | 1 | | 2 | |
| Actuated Green, G (s) | | 15.9 | | 29.2 | 29.2 | 29.2 | 32.2 | 32.2 | 32.2 | 24.0 | 24.0 | |
| Effective Green, g (s) | | 15.9 | | 29.2 | 29.2 | 29.2 | 32.2 | 32.2 | 32.2 | 24.0 | 24.0 | |
| Actuated g/C Ratio | | 0.14 | | 0.25 | 0.25 | 0.25 | 0.27 | 0.27 | 0.27 | 0.20 | 0.20 | |
| Clearance Time (s) | | 3.7 | | 4.1 | 4.1 | 4.1 | 4.4 | 4.4 | 4.4 | 4.1 | 4.1 | |
| Vehicle Extension (s) | | 2.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | | 475 | | 386 | 811 | 372 | 473 | 493 | 427 | 328 | 677 | |
| v/s Ratio Prot | | c0.09 | | 0.14 | 0.13 | | 0.03 | c0.26 | | c0.17 | 0.17 | |
| v/s Ratio Perm | | | | | | c0.26 | | | 0.06 | | | |
| v/c Ratio | | 0.66 | | 0.55 | 0.54 | 1.06 | 0.11 | 0.95 | 0.23 | 0.84 | 0.84 | |
| Uniform Delay, d1 | | 48.3 | | 38.4 | 38.4 | 44.2 | 32.0 | 41.9 | 33.1 | 45.0 | 44.9 | |
| Progression Factor | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 2.7 | | 0.9 | 0.4 | 63.9 | 0.0 | 27.2 | 0.1 | 17.1 | 8.5 | |
| Delay (s) | | 51.0 | | 39.3 | 38.8 | 108.1 | 32.0 | 69.1 | 33.2 | 62.1 | 53.4 | |
| Level of Service | | D | | D | D | F | C | E | C | E | D | |
| Approach Delay (s) | | 51.0 | | | 74.1 | | | 54.8 | | | 56.2 | |
| Approach LOS | | D | | | E | | | D | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 62.6 | HCM 2000 Level of Service | E |
| HCM 2000 Volume to Capacity ratio | 0.91 | | |
| Actuated Cycle Length (s) | 117.6 | Sum of lost time (s) | 16.3 |
| Intersection Capacity Utilization | 86.4% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
14: Diablo Ave & Novato Blvd #2 02/16/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 24 | 254 | 22 | 284 | 327 | 633 | 49 | 439 | 238 | 448 | 334 | 12 |
| Future Volume (vph) | 24 | 254 | 22 | 284 | 327 | 633 | 49 | 439 | 238 | 448 | 334 | 12 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 11 | 11 | 11 | 11 | 11 | 12 | 11 | 11 | 12 | 10 | 12 | 12 |
| Total Lost time (s) | 4.0 | 4.1 | 4.1 | 4.0 | 4.0 | 4.0 | 4.0 | 4.1 | | 4.0 | 4.0 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | | 0.97 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.95 | | 1.00 | 0.99 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1728 | 1818 | 1512 | 1711 | 1818 | 1555 | 1728 | 3225 | | 3204 | 1852 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1728 | 1818 | 1512 | 1711 | 1818 | 1555 | 1728 | 3225 | | 3204 | 1852 | |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 26 | 270 | 23 | 302 | 348 | 673 | 52 | 467 | 253 | 477 | 355 | 13 |
| RTOR Reduction (vph) | 0 | 0 | 19 | 0 | 0 | 87 | 0 | 64 | 0 | 0 | 1 | 0 |
| Lane Group Flow (vph) | 26 | 270 | 4 | 302 | 348 | 586 | 52 | 656 | 0 | 477 | 367 | 0 |
| Confl. Peds. (#/hr) | | | 10 | | | 15 | | | 2 | | | 3 |
| Confl. Bikes (#/hr) | | | 1 | | | 1 | | | | | | 6 |
| Heavy Vehicles (%) | 1% | 1% | 1% | 2% | 1% | 2% | 1% | 2% | 2% | 2% | 2% | 1% |
| Turn Type | Prot | NA | Perm | Prot | NA | pm+ov | Prot | NA | | Prot | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | 1 | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | 4 | | | 8 | | | | | | |
| Actuated Green, G (s) | 4.8 | 19.5 | 19.5 | 22.1 | 36.9 | 54.2 | 6.4 | 24.8 | | 17.3 | 35.8 | |
| Effective Green, g (s) | 4.8 | 19.5 | 19.5 | 22.1 | 36.9 | 54.2 | 6.4 | 24.8 | | 17.3 | 35.8 | |
| Actuated g/C Ratio | 0.05 | 0.20 | 0.20 | 0.22 | 0.37 | 0.54 | 0.06 | 0.25 | | 0.17 | 0.36 | |
| Clearance Time (s) | 4.0 | 4.1 | 4.1 | 4.0 | 4.0 | 4.0 | 4.0 | 4.1 | | 4.0 | 4.0 | |
| Vehicle Extension (s) | 3.0 | 2.0 | 2.0 | 3.0 | 3.0 | 3.0 | 3.0 | 2.0 | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 83 | 354 | 295 | 378 | 671 | 843 | 110 | 800 | | 554 | 663 | |
| v/s Ratio Prot | 0.02 | c0.15 | | c0.18 | 0.19 | 0.12 | 0.03 | c0.20 | | c0.15 | 0.20 | |
| v/s Ratio Perm | | | 0.00 | | | 0.26 | | | | | | |
| v/c Ratio | 0.31 | 0.76 | 0.02 | 0.80 | 0.52 | 0.69 | 0.47 | 0.82 | | 0.86 | 0.55 | |
| Uniform Delay, d1 | 46.0 | 38.0 | 32.4 | 36.8 | 24.6 | 16.8 | 45.1 | 35.4 | | 40.1 | 25.6 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 2.2 | 8.5 | 0.0 | 11.2 | 0.7 | 2.5 | 3.2 | 6.4 | | 12.9 | 1.0 | |
| Delay (s) | 48.1 | 46.5 | 32.5 | 48.0 | 25.3 | 19.3 | 48.3 | 41.9 | | 53.1 | 26.7 | |
| Level of Service | D | D | C | D | C | B | D | D | | D | C | |
| Approach Delay (s) | | 45.6 | | | 27.4 | | | 42.3 | | | 41.6 | |
| Approach LOS | | D | | | C | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 36.4 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.81 | | |
| Actuated Cycle Length (s) | 99.9 | Sum of lost time (s) | 16.2 |
| Intersection Capacity Utilization | 79.7% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 15: Redwood Blvd & Diablo Ave/De Long Ave

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 284 | 578 | 107 | 107 | 966 | 418 | 138 | 317 | 87 | 335 | 230 | 228 |
| Future Volume (vph) | 284 | 578 | 107 | 107 | 966 | 418 | 138 | 317 | 87 | 335 | 230 | 228 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 9 |
| Total Lost time (s) | 4.0 | 3.7 | | 4.0 | 4.1 | | 3.5 | 4.8 | 4.8 | 3.5 | 3.5 | 3.5 |
| Lane Util. Factor | 0.97 | 0.95 | | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 | 0.97 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.97 |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.98 | | 1.00 | 0.95 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3467 | 3526 | | 1805 | 3335 | | 1805 | 3610 | 1508 | 3303 | 1900 | 1394 |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3467 | 3526 | | 1805 | 3335 | | 1805 | 3610 | 1508 | 3303 | 1900 | 1394 |
| Peak-hour factor, PHF | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Adj. Flow (vph) | 290 | 590 | 109 | 109 | 986 | 427 | 141 | 323 | 89 | 342 | 235 | 233 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 33 | 0 | 0 | 50 |
| Lane Group Flow (vph) | 290 | 699 | 0 | 109 | 1413 | 0 | 141 | 323 | 56 | 342 | 235 | 183 |
| Confl. Peds. (#/hr) | | | | | | 2 | | | 7 | | | 14 |
| Confl. Bikes (#/hr) | | | | | | | | | | | | 3 |
| Heavy Vehicles (%) | 1% | 0% | 0% | 0% | 2% | 5% | 0% | 0% | 5% | 6% | 0% | 1% |
| Turn Type | Prot | NA | | Prot | NA | | Prot | NA | Perm | Prot | NA | Perm |
| Protected Phases | 3 | 8 | | 7 | 4 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | | | | | | | 2 | | | 6 |
| Actuated Green, G (s) | 17.1 | 61.0 | | 17.0 | 60.5 | | 14.6 | 22.1 | 22.1 | 13.9 | 22.7 | 22.7 |
| Effective Green, g (s) | 17.1 | 61.0 | | 17.0 | 60.5 | | 14.6 | 22.1 | 22.1 | 13.9 | 22.7 | 22.7 |
| Actuated g/C Ratio | 0.13 | 0.47 | | 0.13 | 0.47 | | 0.11 | 0.17 | 0.17 | 0.11 | 0.17 | 0.17 |
| Clearance Time (s) | 4.0 | 3.7 | | 4.0 | 4.1 | | 3.5 | 4.8 | 4.8 | 3.5 | 3.5 | 3.5 |
| Vehicle Extension (s) | 2.5 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 456 | 1654 | | 236 | 1552 | | 202 | 613 | 256 | 353 | 331 | 243 |
| v/s Ratio Prot | c0.08 | 0.20 | | 0.06 | c0.42 | | 0.08 | 0.09 | | c0.10 | 0.12 | |
| v/s Ratio Perm | | | | | | | | | 0.04 | | | c0.13 |
| v/c Ratio | 0.64 | 0.42 | | 0.46 | 0.91 | | 0.70 | 0.53 | 0.22 | 0.97 | 0.71 | 0.76 |
| Uniform Delay, d1 | 53.5 | 22.8 | | 52.3 | 32.2 | | 55.6 | 49.2 | 46.5 | 57.8 | 50.5 | 51.0 |
| Progression Factor | 1.00 | 1.00 | | 1.43 | 0.53 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 2.5 | 0.8 | | 0.3 | 5.8 | | 8.2 | 0.4 | 0.2 | 38.9 | 5.6 | 11.2 |
| Delay (s) | 56.0 | 23.6 | | 75.2 | 23.0 | | 63.8 | 49.6 | 46.7 | 96.8 | 56.2 | 62.2 |
| Level of Service | E | C | | E | C | | E | D | D | F | E | E |
| Approach Delay (s) | | 33.1 | | | 26.7 | | | 52.7 | | | 75.0 | |
| Approach LOS | | C | | | C | | | D | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 42.2 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.85 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 16.4 |
| Intersection Capacity Utilization | 96.7% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 16: Reichert Ave & De Long Ave

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 87 | 877 | 18 | 95 | 1366 | 350 | 12 | 30 | 51 | 248 | 18 | 82 |
| Future Volume (vph) | 87 | 877 | 18 | 95 | 1366 | 350 | 12 | 30 | 51 | 248 | 18 | 82 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 0.95 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 0.99 | | 1.00 | 1.00 | 0.98 | 1.00 | 0.98 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 0.99 | 1.00 | 1.00 | 0.99 | 1.00 | |
| Frt | 1.00 | 1.00 | | 1.00 | 0.97 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.88 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1805 | 3527 | | 1805 | 3428 | | 1794 | 1900 | 1577 | 1763 | 1634 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.62 | 1.00 | 1.00 | 0.74 | 1.00 | |
| Satd. Flow (perm) | 1805 | 3527 | | 1805 | 3428 | | 1173 | 1900 | 1577 | 1366 | 1634 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 92 | 923 | 19 | 100 | 1438 | 368 | 13 | 32 | 54 | 261 | 19 | 86 |
| RTOR Reduction (vph) | 0 | 1 | 0 | 0 | 14 | 0 | 0 | 0 | 15 | 0 | 28 | 0 |
| Lane Group Flow (vph) | 92 | 941 | 0 | 100 | 1792 | 0 | 13 | 32 | 39 | 261 | 77 | 0 |
| Confl. Peds. (#/hr) | | | 5 | | | 11 | 5 | | 5 | 11 | | 5 |
| Confl. Bikes (#/hr) | | | 5 | | | 5 | | | 5 | | | 5 |
| Heavy Vehicles (%) | 0% | 2% | 0% | 0% | 1% | 1% | 0% | 0% | 0% | 1% | 0% | 0% |
| Turn Type | Prot | NA | | Prot | NA | | Perm | NA | Perm | Perm | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | | | | | 8 | | 8 | 4 | | |
| Actuated Green, G (s) | 11.0 | 80.3 | | 10.8 | 80.1 | | 28.3 | 28.3 | 28.3 | 28.3 | 28.3 | |
| Effective Green, g (s) | 11.0 | 80.3 | | 10.8 | 80.1 | | 28.3 | 28.3 | 28.3 | 28.3 | 28.3 | |
| Actuated g/C Ratio | 0.08 | 0.62 | | 0.08 | 0.62 | | 0.22 | 0.22 | 0.22 | 0.22 | 0.22 | |
| Clearance Time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | |
| Vehicle Extension (s) | 2.0 | 3.0 | | 2.0 | 3.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 152 | 2178 | | 149 | 2112 | | 255 | 413 | 343 | 297 | 355 | |
| v/s Ratio Prot | 0.05 | 0.27 | | c0.06 | c0.52 | | | 0.02 | | | 0.05 | |
| v/s Ratio Perm | | | | | | | 0.01 | | 0.02 | c0.19 | | |
| v/c Ratio | 0.61 | 0.43 | | 0.67 | 0.85 | | 0.05 | 0.08 | 0.11 | 0.88 | 0.22 | |
| Uniform Delay, d1 | 57.4 | 13.0 | | 57.9 | 20.1 | | 40.2 | 40.5 | 40.8 | 49.2 | 41.7 | |
| Progression Factor | 0.75 | 1.15 | | 0.99 | 0.72 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 3.8 | 0.5 | | 7.1 | 3.5 | | 0.0 | 0.0 | 0.1 | 23.5 | 0.1 | |
| Delay (s) | 46.8 | 15.4 | | 64.2 | 17.9 | | 40.3 | 40.5 | 40.8 | 72.7 | 41.9 | |
| Level of Service | D | B | | E | B | | D | D | D | E | D | |
| Approach Delay (s) | | 18.2 | | | 20.4 | | | 40.7 | | | 63.9 | |
| Approach LOS | | B | | | C | | | D | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 25.0 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.84 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 87.5% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
## 17: US 101 SB Ramps & De Long Ave

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 211 | 1005 | 27 | 1758 | 0 | 0 | 0 | 0 | 10 | 7 | 177 |
| Future Volume (vph) | 0 | 211 | 1005 | 27 | 1758 | 0 | 0 | 0 | 0 | 10 | 7 | 177 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.6 | 3.6 | 3.0 | 3.6 | | | | | 4.0 | 4.0 | |
| Lane Util. Factor | | 0.95 | 1.00 | 1.00 | 0.95 | | | | | 0.95 | 0.95 | |
| Frt | | 1.00 | 0.85 | 1.00 | 1.00 | | | | | 1.00 | 0.86 | |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 3574 | 1599 | 1770 | 3539 | | | | | 1681 | 1515 | |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | 0.95 | 1.00 | |
| Satd. Flow (perm) | | 3574 | 1599 | 1770 | 3539 | | | | | 1681 | 1515 | |
| Peak-hour factor, PHF | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Adj. Flow (vph) | 0 | 215 | 1026 | 28 | 1794 | 0 | 0 | 0 | 0 | 10 | 7 | 181 |
| RTOR Reduction (vph) | 0 | 0 | 283 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 41 | 0 |
| Lane Group Flow (vph) | 0 | 215 | 743 | 28 | 1794 | 0 | 0 | 0 | 0 | 9 | 148 | 0 |
| Heavy Vehicles (%) | 0% | 1% | 1% | 2% | 2% | 2% | 2% | 2% | 2% | 2% | 2% | 2% |
| Turn Type | | NA | Perm | Prot | NA | | | | | Split | NA | |
| Protected Phases | | 6 | | 5 | 2 | | | | | 4 | 4 | |
| Permitted Phases | | | 6 | | | | | | | | | |
| Actuated Green, G (s) | | 91.1 | 91.1 | 11.0 | 105.1 | | | | | 17.3 | 17.3 | |
| Effective Green, g (s) | | 91.1 | 91.1 | 11.0 | 105.1 | | | | | 17.3 | 17.3 | |
| Actuated g/C Ratio | | 0.70 | 0.70 | 0.08 | 0.81 | | | | | 0.13 | 0.13 | |
| Clearance Time (s) | | 3.6 | 3.6 | 3.0 | 3.6 | | | | | 4.0 | 4.0 | |
| Vehicle Extension (s) | | 4.0 | 4.0 | 2.0 | 4.0 | | | | | 2.5 | 2.5 | |
| Lane Grp Cap (vph) | | 2504 | 1120 | 149 | 2861 | | | | | 223 | 201 | |
| v/s Ratio Prot | | 0.06 | | 0.02 | c0.51 | | | | | 0.01 | c0.10 | |
| v/s Ratio Perm | | | c0.46 | | | | | | | | | |
| v/c Ratio | | 0.09 | 0.66 | 0.19 | 0.63 | | | | | 0.04 | 0.74 | |
| Uniform Delay, d1 | | 6.2 | 10.9 | 55.3 | 4.8 | | | | | 49.1 | 54.2 | |
| Progression Factor | | 0.84 | 5.78 | 0.79 | 0.44 | | | | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 0.1 | 2.8 | 0.1 | 0.7 | | | | | 0.1 | 12.5 | |
| Delay (s) | | 5.3 | 65.6 | 44.0 | 2.9 | | | | | 49.2 | 66.6 | |
| Level of Service | | A | E | D | A | | | | | D | E | |
| Approach Delay (s) | | 55.2 | | | 3.5 | | | 0.0 | | | 65.8 | |
| Approach LOS | | E | | | A | | | A | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 26.9 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.68 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 128.8% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
## 18: US 101 NB Ramps & De Long Ave

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 178 | 45 | 0 | 0 | 61 | 28 | 1711 | 24 | 33 | 0 | 0 | 0 |
| Future Volume (vph) | 178 | 45 | 0 | 0 | 61 | 28 | 1711 | 24 | 33 | 0 | 0 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 3.6 | | | 3.6 | | 4.5 | 4.5 | | | | |
| Lane Util. Factor | 1.00 | 0.95 | | | 0.95 | | 0.95 | 0.95 | | | | |
| Frpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | | | | |
| Flpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | | | | |
| Frt | 1.00 | 1.00 | | | 0.95 | | 1.00 | 0.99 | | | | |
| Flt Protected | 0.95 | 1.00 | | | 1.00 | | 0.95 | 0.96 | | | | |
| Satd. Flow (prot) | 1770 | 3610 | | | 3353 | | 1698 | 1695 | | | | |
| Flt Permitted | 0.95 | 1.00 | | | 1.00 | | 0.95 | 0.96 | | | | |
| Satd. Flow (perm) | 1770 | 3610 | | | 3353 | | 1698 | 1695 | | | | |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 185 | 47 | 0 | 0 | 64 | 29 | 1782 | 25 | 34 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 27 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 185 | 47 | 0 | 0 | 66 | 0 | 927 | 913 | 0 | 0 | 0 | 0 |
| Confl. Peds. (#/hr) | | | | | | 1 | | | | | | |
| Heavy Vehicles (%) | 2% | 0% | 0% | 0% | 0% | 7% | 1% | 0% | 6% | 0% | 0% | 0% |
| Turn Type | Prot | NA | | | NA | | Split | NA | | | | |
| Protected Phases | 1 | 6 | | | 2 | | 4 | 4 | | | | |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | 15.8 | 27.6 | | | 8.3 | | 94.3 | 94.3 | | | | |
| Effective Green, g (s) | 15.8 | 27.6 | | | 8.3 | | 94.3 | 94.3 | | | | |
| Actuated g/C Ratio | 0.12 | 0.21 | | | 0.06 | | 0.73 | 0.73 | | | | |
| Clearance Time (s) | 3.5 | 3.6 | | | 3.6 | | 4.5 | 4.5 | | | | |
| Vehicle Extension (s) | 2.5 | 2.0 | | | 2.0 | | 3.0 | 3.0 | | | | |
| Lane Grp Cap (vph) | 215 | 766 | | | 214 | | 1231 | 1229 | | | | |
| v/s Ratio Prot | c0.10 | 0.01 | | | c0.02 | | c0.55 | 0.54 | | | | |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | 0.86 | 0.06 | | | 0.31 | | 0.75 | 0.74 | | | | |
| Uniform Delay, d1 | 56.0 | 40.9 | | | 58.1 | | 10.8 | 10.6 | | | | |
| Progression Factor | 1.13 | 1.10 | | | 1.00 | | 1.00 | 1.00 | | | | |
| Incremental Delay, d2 | 27.5 | 0.0 | | | 0.3 | | 4.3 | 4.1 | | | | |
| Delay (s) | 91.1 | 44.9 | | | 58.4 | | 15.1 | 14.7 | | | | |
| Level of Service | F | D | | | E | | B | B | | | | |
| Approach Delay (s) | | 81.7 | | | 58.4 | | | 14.9 | | | 0.0 | |
| Approach LOS | | F | | | E | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 23.9 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.74 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 11.6 |
| Intersection Capacity Utilization | 128.8% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 19: Redwood Blvd & Lamont Ave

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 31 | 4 | 23 | 48 | 3 | 57 | 21 | 509 | 60 | 72 | 430 | 15 |
| Future Volume (vph) | 31 | 4 | 23 | 48 | 3 | 57 | 21 | 509 | 60 | 72 | 430 | 15 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.5 | 3.5 | | 3.5 | 3.5 | 3.5 | 4.8 | | 3.5 | 4.8 | 4.8 |
| Lane Util. Factor | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 |
| Frpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | 0.99 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Flpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | | 1.00 | 0.85 | | 1.00 | 0.85 | 1.00 | 0.98 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | | 0.96 | 1.00 | | 0.95 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | | 1818 | 1615 | | 1814 | 1595 | 1805 | 3545 | | 1805 | 3610 | 1615 |
| Flt Permitted | | 0.80 | 1.00 | | 0.77 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | | 1511 | 1615 | | 1462 | 1595 | 1805 | 3545 | | 1805 | 3610 | 1615 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 33 | 4 | 24 | 51 | 3 | 60 | 22 | 536 | 63 | 76 | 453 | 16 |
| RTOR Reduction (vph) | 0 | 0 | 18 | 0 | 0 | 46 | 0 | 8 | 0 | 0 | 0 | 8 |
| Lane Group Flow (vph) | 0 | 37 | 6 | 0 | 54 | 14 | 22 | 591 | 0 | 76 | 453 | 8 |
| Confl. Peds. (#/hr) | 1 | | | | | 1 | | | 2 | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Perm | NA | Perm | Perm | NA | Perm | Prot | NA | | Prot | NA | Perm |
| Protected Phases | | 8 | | | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | 8 | | 8 | 4 | | 4 | | | | | | 2 |
| Actuated Green, G (s) | | 12.1 | 12.1 | | 12.1 | 12.1 | 1.0 | 22.7 | | 5.4 | 27.1 | 27.1 |
| Effective Green, g (s) | | 12.1 | 12.1 | | 12.1 | 12.1 | 1.0 | 22.7 | | 5.4 | 27.1 | 27.1 |
| Actuated g/C Ratio | | 0.23 | 0.23 | | 0.23 | 0.23 | 0.02 | 0.44 | | 0.10 | 0.52 | 0.52 |
| Clearance Time (s) | | 3.5 | 3.5 | | 3.5 | 3.5 | 3.5 | 4.8 | | 3.5 | 4.8 | 4.8 |
| Vehicle Extension (s) | | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 | 3.0 | | 2.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | 351 | 375 | | 340 | 371 | 34 | 1547 | | 187 | 1881 | 841 |
| v/s Ratio Prot | | | | | | | 0.01 | c0.17 | | c0.04 | 0.13 | |
| v/s Ratio Perm | | 0.02 | 0.00 | | c0.04 | 0.01 | | | | | | 0.01 |
| v/c Ratio | | 0.11 | 0.01 | | 0.16 | 0.04 | 0.65 | 0.38 | | 0.41 | 0.24 | 0.01 |
| Uniform Delay, d1 | | 15.7 | 15.4 | | 15.9 | 15.4 | 25.3 | 9.9 | | 21.8 | 6.8 | 6.0 |
| Progression Factor | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.0 | 0.0 | | 0.1 | 0.0 | 27.5 | 0.2 | | 0.5 | 0.1 | 0.0 |
| Delay (s) | | 15.7 | 15.4 | | 16.0 | 15.5 | 52.8 | 10.1 | | 22.3 | 6.9 | 6.0 |
| Level of Service | | B | B | | B | B | D | B | | C | A | A |
| Approach Delay (s) | | 15.6 | | | 15.7 | | | 11.6 | | | 9.0 | |
| Approach LOS | | B | | | B | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 11.1 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.32 | | |
| Actuated Cycle Length (s) | 52.0 | Sum of lost time (s) | 11.8 |
| Intersection Capacity Utilization | 46.2% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 20: Redwood Blvd & Landing Ct

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 0 | 3 | 30 | 0 | 27 | 1 | 577 | 27 | 18 | 550 | 1 |
| Future Volume (vph) | 0 | 0 | 3 | 30 | 0 | 27 | 1 | 577 | 27 | 18 | 550 | 1 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.5 | | 3.5 | | 3.5 | | 4.8 | 4.8 | 3.5 | 4.8 | 4.8 |
| Lane Util. Factor | | 1.00 | | 1.00 | | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |
| Frpb, ped/bikes | | 0.99 | | 1.00 | | 1.00 | | 1.00 | 0.98 | 1.00 | 1.00 | 0.97 |
| Flpb, ped/bikes | | 1.00 | | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.86 | | 1.00 | | 0.85 | | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | | 1.00 | | 0.95 | | 1.00 | | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | | 1622 | | 1803 | | 1615 | | 3610 | 1579 | 1805 | 3610 | 1571 |
| Flt Permitted | | 1.00 | | 0.76 | | 1.00 | | 0.95 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | | 1622 | | 1434 | | 1615 | | 3446 | 1579 | 1805 | 3610 | 1571 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 0 | 0 | 3 | 32 | 0 | 28 | 1 | 607 | 28 | 19 | 579 | 1 |
| RTOR Reduction (vph) | 0 | 3 | 0 | 0 | 0 | 24 | 0 | 0 | 12 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 32 | 0 | 4 | 0 | 608 | 16 | 19 | 579 | 1 |
| Confl. Peds. (#/hr) | | | 4 | 4 | | | | | 3 | | | 6 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | | NA | | Perm | | Perm | Perm | NA | Perm | Prot | NA | Perm |
| Protected Phases | | 4 | | | | | | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | 2 | | | 6 |
| Actuated Green, G (s) | | 7.0 | | 7.0 | | 7.0 | | 27.9 | 27.9 | 0.8 | 32.2 | 32.2 |
| Effective Green, g (s) | | 7.0 | | 7.0 | | 7.0 | | 27.9 | 27.9 | 0.8 | 32.2 | 32.2 |
| Actuated g/C Ratio | | 0.15 | | 0.15 | | 0.15 | | 0.59 | 0.59 | 0.02 | 0.68 | 0.68 |
| Clearance Time (s) | | 3.5 | | 3.5 | | 3.5 | | 4.8 | 4.8 | 3.5 | 4.8 | 4.8 |
| Vehicle Extension (s) | | 3.0 | | 2.0 | | 2.0 | | 4.0 | 4.0 | 2.0 | 4.0 | 4.0 |
| Lane Grp Cap (vph) | | 239 | | 211 | | 238 | | 2024 | 927 | 30 | 2447 | 1064 |
| v/s Ratio Prot | | 0.00 | | | | | | | | c0.01 | 0.16 | |
| v/s Ratio Perm | | | | c0.02 | | 0.00 | | c0.18 | 0.01 | | | 0.00 |
| v/c Ratio | | 0.00 | | 0.15 | | 0.02 | | 0.30 | 0.02 | 0.63 | 0.24 | 0.00 |
| Uniform Delay, d1 | | 17.3 | | 17.7 | | 17.3 | | 4.9 | 4.1 | 23.2 | 2.9 | 2.5 |
| Progression Factor | | 1.00 | | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.0 | | 0.1 | | 0.0 | | 0.1 | 0.0 | 27.8 | 0.1 | 0.0 |
| Delay (s) | | 17.3 | | 17.8 | | 17.3 | | 5.0 | 4.1 | 51.0 | 3.0 | 2.5 |
| Level of Service | | B | | B | | B | | A | A | D | A | A |
| Approach Delay (s) | | 17.3 | | | 17.6 | | | 5.0 | | | 4.5 | |
| Approach LOS | | B | | | B | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 5.4 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.28 | | |
| Actuated Cycle Length (s) | 47.5 | Sum of lost time (s) | 11.8 |
| Intersection Capacity Utilization | 42.1% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis
## 21: Novato Blvd #3 & Center Rd/Garden Ct

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 149 | 1 | 199 | 4 | 2 | 2 | 203 | 572 | 5 | 2 | 556 | 97 |
| Future Volume (vph) | 149 | 1 | 199 | 4 | 2 | 2 | 203 | 572 | 5 | 2 | 556 | 97 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.2 | 3.2 | | | 3.0 | | 3.0 | 4.4 | | 3.0 | 4.4 | |
| Lane Util. Factor | 1.00 | 1.00 | | | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.85 | | | 0.97 | | 1.00 | 1.00 | | 1.00 | 0.98 | |
| Flt Protected | 0.95 | 1.00 | | | 0.98 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1805 | 1616 | | | 1791 | | 1805 | 3604 | | 1805 | 3483 | |
| Flt Permitted | 0.75 | 1.00 | | | 0.90 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1430 | 1616 | | | 1655 | | 1805 | 3604 | | 1805 | 3483 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 157 | 1 | 209 | 4 | 2 | 2 | 214 | 602 | 5 | 2 | 585 | 102 |
| RTOR Reduction (vph) | 0 | 174 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 10 | 0 |
| Lane Group Flow (vph) | 157 | 36 | 0 | 0 | 6 | 0 | 214 | 607 | 0 | 2 | 677 | 0 |
| Confl. Peds. (#/hr) | | | | | | | | | 9 | | | 6 |
| Confl. Bikes (#/hr) | | | | | | | | | 2 | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 1% | 0% |
| Turn Type | Perm | NA | | Perm | NA | | Prot | NA | | Prot | NA | |
| Protected Phases | | 8 | | | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | 8 | | | 4 | | | | | | | | |
| Actuated Green, G (s) | 16.6 | 16.6 | | | 16.8 | | 16.2 | 70.6 | | 2.2 | 56.6 | |
| Effective Green, g (s) | 16.6 | 16.6 | | | 16.8 | | 16.2 | 70.6 | | 2.2 | 56.6 | |
| Actuated g/C Ratio | 0.17 | 0.17 | | | 0.17 | | 0.16 | 0.71 | | 0.02 | 0.57 | |
| Clearance Time (s) | 3.2 | 3.2 | | | 3.0 | | 3.0 | 4.4 | | 3.0 | 4.4 | |
| Vehicle Extension (s) | 3.0 | 3.0 | | | 2.0 | | 2.0 | 4.0 | | 2.0 | 4.0 | |
| Lane Grp Cap (vph) | 237 | 268 | | | 278 | | 292 | 2544 | | 39 | 1971 | |
| v/s Ratio Prot | | 0.02 | | | | | c0.12 | 0.17 | | 0.00 | c0.19 | |
| v/s Ratio Perm | c0.11 | | | | 0.00 | | | | | | | |
| v/c Ratio | 0.66 | 0.13 | | | 0.02 | | 0.73 | 0.24 | | 0.05 | 0.34 | |
| Uniform Delay, d1 | 39.1 | 35.6 | | | 34.7 | | 39.8 | 5.2 | | 47.9 | 11.7 | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | | 0.95 | 1.47 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 6.8 | 0.2 | | | 0.0 | | 7.7 | 0.2 | | 0.2 | 0.5 | |
| Delay (s) | 45.9 | 35.8 | | | 34.8 | | 45.5 | 7.9 | | 48.1 | 12.2 | |
| Level of Service | D | D | | | C | | D | A | | D | B | |
| Approach Delay (s) | | 40.1 | | | 34.8 | | | 17.7 | | | 12.3 | |
| Approach LOS | | D | | | C | | | B | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 20.1 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.47 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 55.3% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



# HCM Signalized Intersection Capacity Analysis
## 22: Novato Blvd #3 & Arthur Street

02/15/2018

| Movement | EBL | EBR | NBL | NBT | SBU | SBT | SBR |
|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | |
| Traffic Volume (vph) | 93 | 124 | 153 | 842 | 7 | 725 | 87 |
| Future Volume (vph) | 93 | 124 | 153 | 842 | 7 | 725 | 87 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 3.5 | 3.5 | 4.9 | 3.5 | 4.9 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 0.98 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 0.85 | 1.00 | 1.00 | 1.00 | 0.98 | |
| Flt Protected | 0.95 | 1.00 | 0.95 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1797 | 1589 | 1805 | 3574 | 1805 | 3552 | |
| Flt Permitted | 0.95 | 1.00 | 0.95 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1797 | 1589 | 1805 | 3574 | 1805 | 3552 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 98 | 131 | 161 | 886 | 7 | 763 | 92 |
| RTOR Reduction (vph) | 0 | 115 | 0 | 0 | 0 | 5 | 0 |
| Lane Group Flow (vph) | 98 | 16 | 161 | 886 | 7 | 850 | 0 |
| Confl. Peds. (#/hr) | 4 | 2 | | | | | |
| Confl. Bikes (#/hr) | | 1 | | | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 1% | 0% | 0% | 0% |
| Turn Type | Perm | Perm | Prot | NA | Prot | NA | |
| Protected Phases | | | 1 | 6 | 5 | 2 | |
| Permitted Phases | 4 | 4 | | | | | |
| Actuated Green, G (s) | 12.5 | 12.5 | 13.5 | 74.4 | 1.2 | 62.1 | |
| Effective Green, g (s) | 12.5 | 12.5 | 13.5 | 74.4 | 1.2 | 62.1 | |
| Actuated g/C Ratio | 0.12 | 0.12 | 0.14 | 0.74 | 0.01 | 0.62 | |
| Clearance Time (s) | 3.5 | 3.5 | 3.5 | 4.9 | 3.5 | 4.9 | |
| Vehicle Extension (s) | 2.0 | 2.0 | 2.0 | 4.0 | 2.0 | 4.0 | |
| Lane Grp Cap (vph) | 224 | 198 | 243 | 2659 | 21 | 2205 | |
| v/s Ratio Prot | | | c0.09 | 0.25 | 0.00 | c0.24 | |
| v/s Ratio Perm | c0.05 | 0.01 | | | | | |
| v/c Ratio | 0.44 | 0.08 | 0.66 | 0.33 | 0.33 | 0.39 | |
| Uniform Delay, d1 | 40.5 | 38.7 | 41.1 | 4.4 | 49.0 | 9.4 | |
| Progression Factor | 1.00 | 1.00 | 0.85 | 1.43 | 0.87 | 0.83 | |
| Incremental Delay, d2 | 0.5 | 0.1 | 3.5 | 0.2 | 3.3 | 0.5 | |
| Delay (s) | 41.0 | 38.7 | 38.4 | 6.5 | 45.9 | 8.3 | |
| Level of Service | D | D | D | A | D | A | |
| Approach Delay (s) | 39.7 | | | 11.4 | | 8.6 | |
| Approach LOS | D | | | B | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 13.3 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.43 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 11.9 |
| Intersection Capacity Utilization | 48.3% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | EBR | WBU | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 40 | 126 | 15 | 28 | 226 | 196 | 581 | 27 | 359 | 182 | 430 | 381 |
| Future Volume (vph) | 40 | 126 | 15 | 28 | 226 | 196 | 581 | 27 | 359 | 182 | 430 | 381 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 3.5 | | | 3.5 | 4.1 | 4.1 | 3.5 | 4.1 | | 3.5 | 4.4 |
| Lane Util. Factor | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 0.97 | 1.00 |
| Frpb, ped/bikes | 1.00 | 0.99 | | | 1.00 | 1.00 | 0.99 | 1.00 | 0.99 | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 0.98 | | | 1.00 | 1.00 | 0.85 | 1.00 | 0.95 | | 1.00 | 0.98 |
| Flt Protected | 0.95 | 1.00 | | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 1860 | | | 1789 | 1900 | 1592 | 1805 | 1775 | | 3502 | 1851 |
| Flt Permitted | 0.95 | 1.00 | | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | 1805 | 1860 | | | 1789 | 1900 | 1592 | 1805 | 1775 | | 3502 | 1851 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 42 | 133 | 16 | 29 | 238 | 206 | 612 | 28 | 378 | 192 | 453 | 401 |
| RTOR Reduction (vph) | 0 | 5 | 0 | 0 | 0 | 0 | 397 | 0 | 16 | 0 | 0 | 5 |
| Lane Group Flow (vph) | 42 | 144 | 0 | 0 | 267 | 206 | 215 | 28 | 554 | 0 | 453 | 462 |
| Confl. Peds. (#/hr) | | | 13 | | | | 2 | | | 5 | | |
| Confl. Bikes (#/hr) | | | 1 | | | | | | | 1 | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 1% | 0% | 0% | 0% | 1% | 1% | 0% | 0% |
| Turn Type | Prot | NA | | Prot | Prot | NA | Perm | Prot | NA | | Prot | NA |
| Protected Phases | 3 | 8 | | 7 | 7 | 4 | | 1 | 6 | | 5 | 2 |
| Permitted Phases | | | | | | | 4 | | | | | |
| Actuated Green, G (s) | 6.0 | 15.6 | | | 15.5 | 24.5 | 24.5 | 6.0 | 38.0 | | 16.3 | 48.0 |
| Effective Green, g (s) | 6.0 | 15.6 | | | 15.5 | 24.5 | 24.5 | 6.0 | 38.0 | | 16.3 | 48.0 |
| Actuated g/C Ratio | 0.06 | 0.16 | | | 0.16 | 0.24 | 0.24 | 0.06 | 0.38 | | 0.16 | 0.48 |
| Clearance Time (s) | 3.5 | 3.5 | | | 3.5 | 4.1 | 4.1 | 3.5 | 4.1 | | 3.5 | 4.4 |
| Vehicle Extension (s) | 2.0 | 2.0 | | | 2.0 | 2.0 | 2.0 | 2.0 | 3.0 | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 108 | 290 | | | 277 | 465 | 390 | 108 | 674 | | 570 | 888 |
| v/s Ratio Prot | 0.02 | c0.08 | | | c0.15 | 0.11 | | 0.02 | c0.31 | | c0.13 | 0.25 |
| v/s Ratio Perm | | | | | | | c0.13 | | | | | |
| v/c Ratio | 0.39 | 0.50 | | | 0.96 | 0.44 | 0.55 | 0.26 | 0.82 | | 0.79 | 0.52 |
| Uniform Delay, d1 | 45.2 | 38.6 | | | 42.0 | 32.0 | 32.9 | 44.9 | 27.9 | | 40.2 | 18.0 |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 0.70 | 0.51 |
| Incremental Delay, d2 | 0.8 | 0.5 | | | 43.7 | 0.2 | 1.0 | 0.5 | 8.0 | | 10.5 | 2.1 |
| Delay (s) | 46.1 | 39.1 | | | 85.6 | 32.2 | 33.9 | 45.3 | 35.9 | | 38.5 | 11.3 |
| Level of Service | D | D | | | F | C | C | D | D | | D | B |
| Approach Delay (s) | | 40.6 | | | | 46.3 | | | 36.4 | | | 24.7 |
| Approach LOS | | D | | | | D | | | D | | | C |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 36.7 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.80 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 15.5 |
| Intersection Capacity Utilization | 84.0% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



HCM Signalized Intersection Capacity Analysis
23: Novato Blvd #3 & Rowland Boulevard 02/15/2018

| Movement | SBR |
|---|---|
| Lane Configurations | |
| Traffic Volume (vph) | 63 |
| Future Volume (vph) | 63 |
| Ideal Flow (vphpl) | 1900 |
| Total Lost time (s) | |
| Lane Util. Factor | |
| Frpb, ped/bikes | |
| Flpb, ped/bikes | |
| Frt | |
| Flt Protected | |
| Satd. Flow (prot) | |
| Flt Permitted | |
| Satd. Flow (perm) | |
| Peak-hour factor, PHF | 0.95 |
| Adj. Flow (vph) | 66 |
| RTOR Reduction (vph) | 0 |
| Lane Group Flow (vph) | 0 |
| Confl. Peds. (#/hr) | 6 |
| Confl. Bikes (#/hr) | |
| Heavy Vehicles (%) | 0% |
| Turn Type | |
| Protected Phases | |
| Permitted Phases | |
| Actuated Green, G (s) | |
| Effective Green, g (s) | |
| Actuated g/C Ratio | |
| Clearance Time (s) | |
| Vehicle Extension (s) | |
| Lane Grp Cap (vph) | |
| v/s Ratio Prot | |
| v/s Ratio Perm | |
| v/c Ratio | |
| Uniform Delay, d1 | |
| Progression Factor | |
| Incremental Delay, d2 | |
| Delay (s) | |
| Level of Service | |
| Approach Delay (s) | |
| Approach LOS | |

Intersection Summary

## HCM Signalized Intersection Capacity Analysis
## 24: Rowland Boulevard & Redwood Blvd

02/15/2018

| Movement | EBL | EBT | EBR | WBU | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 113 | 632 | 47 | 1 | 135 | 930 | 434 | 23 | 29 | 61 | 396 | 26 |
| Future Volume (vph) | 113 | 632 | 47 | 1 | 135 | 930 | 434 | 23 | 29 | 61 | 396 | 26 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.5 | 4.5 | | 3.5 | 4.5 | | 3.5 | 4.1 | | 3.5 | 4.8 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | | 0.97 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.98 | | 1.00 | 1.00 | | 1.00 | 0.99 | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | | 1.00 | 0.95 | | 1.00 | 0.90 | | 1.00 | 1.00 |
| Flt Protected | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 3574 | 1590 | | 1805 | 3421 | | 1805 | 3211 | | 3502 | 1900 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | 1805 | 3574 | 1590 | | 1805 | 3421 | | 1805 | 3211 | | 3502 | 1900 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 119 | 665 | 49 | 1 | 142 | 979 | 457 | 24 | 31 | 64 | 417 | 27 |
| RTOR Reduction (vph) | 0 | 0 | 29 | 0 | 0 | 41 | 0 | 0 | 54 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 119 | 665 | 20 | 0 | 143 | 1395 | 0 | 24 | 41 | 0 | 417 | 27 |
| Confl. Peds. (#/hr) | | | 4 | | | | 4 | | | 3 | | |
| Confl. Bikes (#/hr) | | | | | | | | | | 1 | | |
| Heavy Vehicles (%) | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Prot | NA | Perm | Prot | Prot | NA | | Prot | NA | | Prot | NA |
| Protected Phases | 5 | 2 | | 1 | 1 | 6 | | 3 | 8 | | 7 | 4 |
| Permitted Phases | | | 2 | | | | | | | | | |
| Actuated Green, G (s) | 11.2 | 38.2 | 38.2 | | 12.7 | 39.7 | | 4.0 | 13.9 | | 12.8 | 22.0 |
| Effective Green, g (s) | 11.2 | 38.2 | 38.2 | | 12.7 | 39.7 | | 4.0 | 13.9 | | 12.8 | 22.0 |
| Actuated g/C Ratio | 0.12 | 0.41 | 0.41 | | 0.14 | 0.43 | | 0.04 | 0.15 | | 0.14 | 0.24 |
| Clearance Time (s) | 3.5 | 4.5 | 4.5 | | 3.5 | 4.5 | | 3.5 | 4.1 | | 3.5 | 4.8 |
| Vehicle Extension (s) | 2.0 | 4.0 | 4.0 | | 2.0 | 4.0 | | 2.0 | 2.5 | | 2.5 | 2.5 |
| Lane Grp Cap (vph) | 216 | 1464 | 651 | | 245 | 1457 | | 77 | 478 | | 480 | 448 |
| v/s Ratio Prot | 0.07 | 0.19 | | | c0.08 | c0.41 | | 0.01 | 0.01 | | c0.12 | 0.01 |
| v/s Ratio Perm | | | 0.01 | | | | | | | | | |
| v/c Ratio | 0.55 | 0.45 | 0.03 | | 0.58 | 0.96 | | 0.31 | 0.08 | | 0.87 | 0.06 |
| Uniform Delay, d1 | 38.6 | 19.9 | 16.4 | | 37.8 | 25.9 | | 43.3 | 34.2 | | 39.4 | 27.6 |
| Progression Factor | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 1.7 | 0.3 | 0.0 | | 2.3 | 14.6 | | 0.8 | 0.1 | | 15.2 | 0.0 |
| Delay (s) | 40.4 | 20.2 | 16.5 | | 40.0 | 40.5 | | 44.1 | 34.2 | | 54.5 | 27.6 |
| Level of Service | D | C | B | | D | D | | D | C | | D | C |
| Approach Delay (s) | | 22.9 | | | | 40.5 | | | 36.2 | | | 46.5 |
| Approach LOS | | C | | | | D | | | D | | | D |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 36.8 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.75 | | |
| Actuated Cycle Length (s) | 93.2 | Sum of lost time (s) | 16.3 |
| Intersection Capacity Utilization | 78.6% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
## 24: Rowland Boulevard & Redwood Blvd

02/15/2018

| Movement | SBR |
|---|---|
| Lane Configurations | |
| Traffic Volume (vph) | 144 |
| Future Volume (vph) | 144 |
| Ideal Flow (vphpl) | 1900 |
| Total Lost time (s) | 4.8 |
| Lane Util. Factor | 1.00 |
| Frpb, ped/bikes | 0.99 |
| Flpb, ped/bikes | 1.00 |
| Frt | 0.85 |
| Flt Protected | 1.00 |
| Satd. Flow (prot) | 1593 |
| Flt Permitted | 1.00 |
| Satd. Flow (perm) | 1593 |
| Peak-hour factor, PHF | 0.95 |
| Adj. Flow (vph) | 152 |
| RTOR Reduction (vph) | 116 |
| Lane Group Flow (vph) | 36 |
| Confl. Peds. (#/hr) | 2 |
| Confl. Bikes (#/hr) | |
| Heavy Vehicles (%) | 0% |
| Turn Type | Perm |
| Protected Phases | |
| Permitted Phases | 4 |
| Actuated Green, G (s) | 22.0 |
| Effective Green, g (s) | 22.0 |
| Actuated g/C Ratio | 0.24 |
| Clearance Time (s) | 4.8 |
| Vehicle Extension (s) | 2.5 |
| Lane Grp Cap (vph) | 376 |
| v/s Ratio Prot | |
| v/s Ratio Perm | c0.02 |
| v/c Ratio | 0.10 |
| Uniform Delay, d1 | 27.8 |
| Progression Factor | 1.00 |
| Incremental Delay, d2 | 0.1 |
| Delay (s) | 27.9 |
| Level of Service | C |
| Approach Delay (s) | |
| Approach LOS | |

Intersection Summary

## HCM Signalized Intersection Capacity Analysis
### 25: Rowland Boulevard & Highway 101 SB Ramps

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 516 | 585 | 737 | 1305 | 0 | 0 | 0 | 0 | 309 | 6 | 173 |
| Future Volume (vph) | 0 | 516 | 585 | 737 | 1305 | 0 | 0 | 0 | 0 | 309 | 6 | 173 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.0 | 4.0 | 3.0 | 4.0 | | | | | 3.0 | 3.0 | |
| Lane Util. Factor | | 0.91 | 0.91 | 0.97 | 0.95 | | | | | 0.91 | 0.91 | |
| Frpb, ped/bikes | | 1.00 | 0.99 | 1.00 | 1.00 | | | | | 1.00 | 0.99 | |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | | | | 1.00 | 1.00 | |
| Frt | | 0.95 | 0.85 | 1.00 | 1.00 | | | | | 1.00 | 0.92 | |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | 0.95 | 0.98 | |
| Satd. Flow (prot) | | 3254 | 1450 | 3502 | 3610 | | | | | 1643 | 3062 | |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | 0.95 | 0.98 | |
| Satd. Flow (perm) | | 3254 | 1450 | 3502 | 3610 | | | | | 1643 | 3062 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 0 | 543 | 616 | 776 | 1374 | 0 | 0 | 0 | 0 | 325 | 6 | 182 |
| RTOR Reduction (vph) | 0 | 56 | 231 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 0 |
| Lane Group Flow (vph) | 0 | 746 | 126 | 776 | 1374 | 0 | 0 | 0 | 0 | 179 | 319 | 0 |
| Confl. Peds. (#/hr) | | | 2 | | | | | | | | | 7 |
| Confl. Bikes (#/hr) | | | | | | | | | | | | 1 |
| Heavy Vehicles (%) | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 33% | 0% |
| Turn Type | | NA | Perm | Prot | NA | | | | | Split | NA | |
| Protected Phases | | 2 | | 1 | 6 | | | | | 4 | 4 | |
| Permitted Phases | | | 2 | | | | | | | | | |
| Actuated Green, G (s) | | 20.1 | 20.1 | 13.5 | 36.6 | | | | | 13.4 | 13.4 | |
| Effective Green, g (s) | | 20.1 | 20.1 | 13.5 | 36.6 | | | | | 13.4 | 13.4 | |
| Actuated g/C Ratio | | 0.35 | 0.35 | 0.24 | 0.64 | | | | | 0.24 | 0.24 | |
| Clearance Time (s) | | 4.0 | 4.0 | 3.0 | 4.0 | | | | | 3.0 | 3.0 | |
| Vehicle Extension (s) | | 4.0 | 4.0 | 2.0 | 2.5 | | | | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | | 1147 | 511 | 829 | 2318 | | | | | 386 | 719 | |
| v/s Ratio Prot | | 0.23 | | c0.22 | c0.38 | | | | | c0.11 | 0.10 | |
| v/s Ratio Perm | | | 0.09 | | | | | | | | | |
| v/c Ratio | | 0.65 | 0.25 | 0.94 | 0.59 | | | | | 0.46 | 0.44 | |
| Uniform Delay, d1 | | 15.5 | 13.1 | 21.3 | 5.9 | | | | | 18.7 | 18.6 | |
| Progression Factor | | 1.00 | 1.00 | 1.00 | 1.00 | | | | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 1.5 | 0.3 | 17.3 | 0.3 | | | | | 0.3 | 0.2 | |
| Delay (s) | | 17.0 | 13.4 | 38.7 | 6.2 | | | | | 19.0 | 18.8 | |
| Level of Service | | B | B | D | A | | | | | B | B | |
| Approach Delay (s) | | 15.9 | | | 17.9 | | | 0.0 | | | 18.9 | |
| Approach LOS | | B | | | B | | | A | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 17.4 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.69 | | |
| Actuated Cycle Length (s) | 57.0 | Sum of lost time (s) | 10.0 |
| Intersection Capacity Utilization | 69.6% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 26: Highway 101 NB Ramps & Rowland Boulevard

02/15/2018

| Movement | EBL2 | EBL | EBT | WBT | WBR | WBR2 | NBL2 | NBL | NBT | NBR | NEL2 | NEL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 3 | 93 | 740 | 1215 | 1 | 499 | 801 | 11 | 1 | 778 | 18 | 18 |
| Future Volume (vph) | 3 | 93 | 740 | 1215 | 1 | 499 | 801 | 11 | 1 | 778 | 18 | 18 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | 4.0 | 4.0 | | 4.0 | 3.5 | | 3.5 | 3.0 | | 3.5 |
| Lane Util. Factor | | 1.00 | 0.95 | 0.86 | | 0.86 | 0.95 | | 0.95 | 0.88 | | 1.00 |
| Frpb, ped/bikes | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Frt | | 1.00 | 1.00 | 0.99 | | 0.85 | 1.00 | | 1.00 | 0.85 | | 0.98 |
| Flt Protected | | 0.95 | 1.00 | 1.00 | | 1.00 | 0.95 | | 0.95 | 1.00 | | 0.96 |
| Satd. Flow (prot) | | 1804 | 3574 | 4640 | | 1323 | 1715 | | 1718 | 2842 | | 1745 |
| Flt Permitted | | 0.95 | 1.00 | 1.00 | | 1.00 | 0.95 | | 0.95 | 1.00 | | 0.96 |
| Satd. Flow (perm) | | 1804 | 3574 | 4640 | | 1323 | 1715 | | 1718 | 2842 | | 1745 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 3 | 98 | 779 | 1279 | 1 | 525 | 843 | 12 | 1 | 819 | 19 | 19 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 8 | 0 | 213 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 101 | 779 | 1393 | 0 | 191 | 430 | 0 | 426 | 819 | 0 | 43 |
| Confl. Peds. (#/hr) | | | | | 1 | | | | | 8 | | |
| Heavy Vehicles (%) | 2% | 0% | 1% | 4% | 0% | 5% | 0% | 2% | 13% | 0% | 2% | 0% |
| Turn Type | Prot | Prot | NA | NA | | Perm | Split | Split | NA | custom | Perm | Prot |
| Protected Phases | 5 | 5 | 2 | 6 | | | 8 | 8 | 8 | 1 8 | | 7 |
| Permitted Phases | | | | | | 6 | | | | | 7 | |
| Actuated Green, G (s) | | 10.1 | 49.4 | 50.7 | | 50.7 | 36.4 | | 36.4 | 47.8 | | 8.8 |
| Effective Green, g (s) | | 10.1 | 49.4 | 50.7 | | 50.7 | 36.4 | | 36.4 | 47.8 | | 8.8 |
| Actuated g/C Ratio | | 0.08 | 0.41 | 0.42 | | 0.42 | 0.30 | | 0.30 | 0.40 | | 0.07 |
| Clearance Time (s) | | 3.0 | 4.0 | 4.0 | | 4.0 | 3.5 | | 3.5 | | | 3.5 |
| Vehicle Extension (s) | | 2.0 | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | | | 2.0 |
| Lane Grp Cap (vph) | | 151 | 1471 | 1960 | | 558 | 520 | | 521 | 1132 | | 127 |
| v/s Ratio Prot | | 0.06 | 0.22 | c0.30 | | | c0.25 | | 0.25 | c0.29 | | |
| v/s Ratio Perm | | | | | | 0.14 | | | | | | 0.02 |
| v/c Ratio | | 0.67 | 0.53 | 0.71 | | 0.34 | 0.83 | | 0.82 | 0.72 | | 0.34 |
| Uniform Delay, d1 | | 53.3 | 26.6 | 28.6 | | 23.4 | 38.9 | | 38.7 | 30.5 | | 52.8 |
| Progression Factor | | 1.00 | 1.00 | 0.90 | | 1.38 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Incremental Delay, d2 | | 8.4 | 1.4 | 1.9 | | 1.5 | 9.9 | | 9.2 | 2.0 | | 0.6 |
| Delay (s) | | 61.7 | 27.9 | 27.6 | | 33.7 | 48.8 | | 47.9 | 32.5 | | 53.4 |
| Level of Service | | E | C | C | | C | D | | D | C | | D |
| Approach Delay (s) | | | 31.8 | 29.0 | | | | | 40.6 | | | 53.4 |
| Approach LOS | | | C | C | | | | | D | | | D |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 34.2 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.72 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 14.0 |
| Intersection Capacity Utilization | 79.7% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
26: Highway 101 NB Ramps & Rowland Boulevard 02/15/2018

| Movement | NER |
|---|---|
| Lane Configurations | |
| Traffic Volume (vph) | 5 |
| Future Volume (vph) | 5 |
| Ideal Flow (vphpl) | 1900 |
| Total Lost time (s) | |
| Lane Util. Factor | |
| Frpb, ped/bikes | |
| Flpb, ped/bikes | |
| Frt | |
| Flt Protected | |
| Satd. Flow (prot) | |
| Flt Permitted | |
| Satd. Flow (perm) | |
| Peak-hour factor, PHF | 0.95 |
| Adj. Flow (vph) | 5 |
| RTOR Reduction (vph) | 0 |
| Lane Group Flow (vph) | 0 |
| Confl. Peds. (#/hr) | |
| Heavy Vehicles (%) | 15% |
| Turn Type | |
| Protected Phases | |
| Permitted Phases | |
| Actuated Green, G (s) | |
| Effective Green, g (s) | |
| Actuated g/C Ratio | |
| Clearance Time (s) | |
| Vehicle Extension (s) | |
| Lane Grp Cap (vph) | |
| v/s Ratio Prot | |
| v/s Ratio Perm | |
| v/c Ratio | |
| Uniform Delay, d1 | |
| Progression Factor | |
| Incremental Delay, d2 | |
| Delay (s) | |
| Level of Service | |
| Approach Delay (s) | |
| Approach LOS | |

Intersection Summary



HCM Signalized Intersection Capacity Analysis
27: Rowland Boulevard & Rowland Way 02/15/2018

| Movement | EBU | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | |
| Traffic Volume (vph) | 6 | 225 | 1289 | 1372 | 26 | 36 | 339 |
| Future Volume (vph) | 6 | 225 | 1289 | 1372 | 26 | 36 | 339 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.5 | 4.0 | 4.0 | | 3.2 | 3.2 |
| Lane Util. Factor | | 0.97 | 0.91 | 0.95 | | 1.00 | 0.95 |
| Frpb, ped/bikes | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | | 1.00 | 1.00 | 1.00 | | 0.88 | 0.85 |
| Flt Protected | | 0.95 | 1.00 | 1.00 | | 0.99 | 1.00 |
| Satd. Flow (prot) | | 3468 | 5187 | 3593 | | 1634 | 1519 |
| Flt Permitted | | 0.95 | 1.00 | 1.00 | | 0.99 | 1.00 |
| Satd. Flow (perm) | | 3468 | 5187 | 3593 | | 1634 | 1519 |
| Peak-hour factor, PHF | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| Adj. Flow (vph) | 6 | 232 | 1329 | 1414 | 27 | 37 | 349 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 1 | 0 | 140 | 171 |
| Lane Group Flow (vph) | 0 | 238 | 1329 | 1440 | 0 | 54 | 21 |
| Confl. Peds. (#/hr) | | | | | 12 | 2 | |
| Heavy Vehicles (%) | 0% | 1% | 0% | 0% | 7% | 2% | 1% |
| Turn Type | Prot | Prot | NA | NA | | Prot | Perm |
| Protected Phases | 5 | 5 | 2 | 6 | | 4 | |
| Permitted Phases | | | | | | | 4 |
| Actuated Green, G (s) | | 12.8 | 99.8 | 83.5 | | 13.0 | 13.0 |
| Effective Green, g (s) | | 12.8 | 99.8 | 83.5 | | 13.0 | 13.0 |
| Actuated g/C Ratio | | 0.11 | 0.83 | 0.70 | | 0.11 | 0.11 |
| Clearance Time (s) | | 3.5 | 4.0 | 4.0 | | 3.2 | 3.2 |
| Vehicle Extension (s) | | 2.0 | 4.0 | 4.0 | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | | 369 | 4313 | 2500 | | 177 | 164 |
| v/s Ratio Prot | | c0.07 | 0.26 | c0.40 | | c0.03 | |
| v/s Ratio Perm | | | | | | | 0.01 |
| v/c Ratio | | 0.64 | 0.31 | 0.58 | | 0.31 | 0.13 |
| Uniform Delay, d1 | | 51.4 | 2.3 | 9.3 | | 49.3 | 48.4 |
| Progression Factor | | 1.02 | 1.20 | 0.99 | | 1.00 | 1.00 |
| Incremental Delay, d2 | | 2.4 | 0.2 | 0.9 | | 0.4 | 0.1 |
| Delay (s) | | 54.7 | 2.9 | 10.0 | | 49.7 | 48.5 |
| Level of Service | | D | A | A | | D | D |
| Approach Delay (s) | | | 10.8 | 10.0 | | 49.1 | |
| Approach LOS | | | B | A | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 14.8 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.55 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 10.7 |
| Intersection Capacity Utilization | 71.1% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 28: Rowland Boulevard & Vintage Way

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 17 | 489 | 811 | 2 | 576 | 6 | 822 | 3 | 2 | 4 | 3 | 0 |
| Future Volume (vph) | 17 | 489 | 811 | 2 | 576 | 6 | 822 | 3 | 2 | 4 | 3 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 4.0 | 4.0 | 3.0 | 4.0 | | 3.6 | 3.6 | | | 3.2 | |
| Lane Util. Factor | 1.00 | 0.95 | 0.88 | 1.00 | 0.95 | | 0.97 | 1.00 | | | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 0.99 | | | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | | 1.00 | 0.94 | | | 1.00 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | | 0.97 | |
| Satd. Flow (prot) | 1805 | 3539 | 2842 | 1805 | 3567 | | 3502 | 1768 | | | 1847 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | | 0.97 | |
| Satd. Flow (perm) | 1805 | 3539 | 2842 | 1805 | 3567 | | 3502 | 1768 | | | 1847 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 18 | 515 | 854 | 2 | 606 | 6 | 865 | 3 | 2 | 4 | 3 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 18 | 515 | 854 | 2 | 611 | 0 | 865 | 4 | 0 | 0 | 7 | 0 |
| Confl. Peds. (#/hr) | | | 9 | 9 | | 13 | | | 11 | | | |
| Confl. Bikes (#/hr) | | | 2 | | | 2 | | | | | | |
| Heavy Vehicles (%) | 0% | 2% | 0% | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Prot | NA | pt+ov | Prot | NA | | Split | NA | | Split | NA | |
| Protected Phases | 5 | 2 | 2 3 | 1 | 6 | | 3 | 3 | | 4 | 4 | |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | 5.4 | 49.6 | 105.0 | 2.8 | 47.0 | | 51.4 | 51.4 | | | 2.4 | |
| Effective Green, g (s) | 5.4 | 49.6 | 105.0 | 2.8 | 47.0 | | 51.4 | 51.4 | | | 2.4 | |
| Actuated g/C Ratio | 0.05 | 0.41 | 0.88 | 0.02 | 0.39 | | 0.43 | 0.43 | | | 0.02 | |
| Clearance Time (s) | 3.0 | 4.0 | | 3.0 | 4.0 | | 3.6 | 3.6 | | | 3.2 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | | 3.0 | 3.0 | | | 2.0 | |
| Lane Grp Cap (vph) | 81 | 1462 | 2486 | 42 | 1397 | | 1500 | 757 | | | 36 | |
| v/s Ratio Prot | 0.01 | 0.15 | c0.30 | 0.00 | c0.17 | | c0.25 | 0.00 | | | c0.00 | |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | 0.22 | 0.35 | 0.34 | 0.05 | 0.44 | | 0.58 | 0.01 | | | 0.19 | |
| Uniform Delay, d1 | 55.3 | 24.2 | 1.3 | 57.3 | 26.8 | | 26.0 | 19.7 | | | 57.8 | |
| Progression Factor | 1.19 | 1.20 | 0.93 | 1.00 | 1.00 | | 1.00 | 1.00 | | | 1.00 | |
| Incremental Delay, d2 | 0.5 | 0.6 | 0.4 | 0.2 | 1.0 | | 1.6 | 0.0 | | | 1.0 | |
| Delay (s) | 66.5 | 29.6 | 1.6 | 57.5 | 27.8 | | 27.7 | 19.7 | | | 58.8 | |
| Level of Service | E | C | A | E | C | | C | B | | | E | |
| Approach Delay (s) | | 12.8 | | | 27.9 | | | 27.6 | | | 58.8 | |
| Approach LOS | | B | | | C | | | C | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 20.6 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.50 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 13.8 |
| Intersection Capacity Utilization | 60.1% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 29: Novato Blvd #3 & Sunset Parkway

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 206 | 18 | 33 | 30 | 11 | 36 | 44 | 291 | 51 | 34 | 322 | 217 |
| Future Volume (vph) | 206 | 18 | 33 | 30 | 11 | 36 | 44 | 291 | 51 | 34 | 322 | 217 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.0 | | 3.5 | 3.5 | | 3.5 | 4.9 | | 3.5 | 4.6 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 0.98 | | 1.00 | 0.98 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.90 | | 1.00 | 0.89 | | 1.00 | 0.98 | | 1.00 | 0.94 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1787 | 1674 | | 1805 | 1642 | | 1805 | 1835 | | 1805 | 1778 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1787 | 1674 | | 1805 | 1642 | | 1805 | 1835 | | 1805 | 1778 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 217 | 19 | 35 | 32 | 12 | 38 | 46 | 306 | 54 | 36 | 339 | 228 |
| RTOR Reduction (vph) | 0 | 27 | 0 | 0 | 34 | 0 | 0 | 5 | 0 | 0 | 19 | 0 |
| Lane Group Flow (vph) | 217 | 27 | 0 | 32 | 16 | 0 | 46 | 355 | 0 | 36 | 548 | 0 |
| Confl. Peds. (#/hr) | | | 11 | | | 6 | | | 3 | | | |
| Confl. Bikes (#/hr) | | | | | | 1 | | | | | | |
| Heavy Vehicles (%) | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 1% | 0% | 0% | 0% | 1% |
| Turn Type | Prot | NA | | Prot | NA | | Prot | NA | | Prot | NA | |
| Protected Phases | 3 | 8 | | 7 | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | 12.9 | 17.8 | | 3.4 | 8.8 | | 5.2 | 38.5 | | 5.2 | 38.8 | |
| Effective Green, g (s) | 12.9 | 17.8 | | 3.4 | 8.8 | | 5.2 | 38.5 | | 5.2 | 38.8 | |
| Actuated g/C Ratio | 0.16 | 0.22 | | 0.04 | 0.11 | | 0.06 | 0.48 | | 0.06 | 0.48 | |
| Clearance Time (s) | 3.5 | 4.0 | | 3.5 | 3.5 | | 3.5 | 4.9 | | 3.5 | 4.6 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 285 | 368 | | 75 | 178 | | 116 | 874 | | 116 | 853 | |
| v/s Ratio Prot | c0.12 | 0.02 | | 0.02 | c0.01 | | c0.03 | 0.19 | | 0.02 | c0.31 | |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | 0.76 | 0.07 | | 0.43 | 0.09 | | 0.40 | 0.41 | | 0.31 | 0.64 | |
| Uniform Delay, d1 | 32.5 | 25.0 | | 37.7 | 32.4 | | 36.3 | 13.7 | | 36.1 | 15.8 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 10.3 | 0.0 | | 1.4 | 0.1 | | 0.8 | 1.4 | | 0.6 | 3.7 | |
| Delay (s) | 42.8 | 25.0 | | 39.2 | 32.5 | | 37.1 | 15.1 | | 36.6 | 19.5 | |
| Level of Service | D | C | | D | C | | D | B | | D | B | |
| Approach Delay (s) | | 39.2 | | | 35.1 | | | 17.6 | | | 20.5 | |
| Approach LOS | | D | | | D | | | B | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 24.3 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.58 | | |
| Actuated Cycle Length (s) | 80.8 | Sum of lost time (s) | 15.9 |
| Intersection Capacity Utilization | 63.2% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM 2010 AWSC
## 30: Redwood Blvd & Novato Blvd #3



| Intersection | |
|---|---|
| Intersection Delay, s/veh | 41.1 |
| Intersection LOS | E |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 44 | 263 | 69 | 72 | 357 | 109 | 117 | 13 | 139 | 84 | 10 | 46 |
| Future Vol, veh/h | 44 | 263 | 69 | 72 | 357 | 109 | 117 | 13 | 139 | 84 | 10 | 46 |
| Peak Hour Factor | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Heavy Vehicles, % | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Mvmt Flow | 46 | 277 | 73 | 76 | 376 | 115 | 123 | 14 | 146 | 88 | 11 | 48 |
| Number of Lanes | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Opposing Approach | WB | EB | SB | NB |
| Opposing Lanes | 2 | 2 | 2 | 3 |
| Conflicting Approach Left | SB | NB | EB | WB |
| Conflicting Lanes Left | 2 | 3 | 2 | 2 |
| Conflicting Approach Right | NB | SB | WB | EB |
| Conflicting Lanes Right | 3 | 2 | 2 | 2 |
| HCM Control Delay | 31.1 | 67.8 | 15.3 | 14.5 |
| HCM LOS | D | F | C | B |

| Lane | NBLn1 | NBLn2 | NBLn3 | EBLn1 | EBLn2 | WBLn1 | WBLn2 | SBLn1 | SBLn2 |
|---|---|---|---|---|---|---|---|---|---|
| Vol Left, % | 100% | 0% | 0% | 100% | 0% | 100% | 0% | 100% | 0% |
| Vol Thru, % | 0% | 100% | 0% | 0% | 79% | 0% | 77% | 0% | 18% |
| Vol Right, % | 0% | 0% | 100% | 0% | 21% | 0% | 23% | 0% | 82% |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 117 | 13 | 139 | 44 | 332 | 72 | 466 | 84 | 56 |
| LT Vol | 117 | 0 | 0 | 44 | 0 | 72 | 0 | 84 | 0 |
| Through Vol | 0 | 13 | 0 | 0 | 263 | 0 | 357 | 0 | 10 |
| RT Vol | 0 | 0 | 139 | 0 | 69 | 0 | 109 | 0 | 46 |
| Lane Flow Rate | 123 | 14 | 146 | 46 | 349 | 76 | 491 | 88 | 59 |
| Geometry Grp | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Degree of Util (X) | 0.313 | 0.033 | 0.326 | 0.111 | 0.776 | 0.175 | 1.028 | 0.235 | 0.139 |
| Departure Headway (Hd) | 9.375 | 8.857 | 8.132 | 8.635 | 7.991 | 8.303 | 7.543 | 9.888 | 8.764 |
| Convergence, Y/N | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Cap | 385 | 407 | 445 | 413 | 451 | 436 | 481 | 365 | 411 |
| Service Time | 7.075 | 6.557 | 5.832 | 6.428 | 5.784 | 5.985 | 5.325 | 7.588 | 6.464 |
| HCM Lane V/C Ratio | 0.319 | 0.034 | 0.328 | 0.111 | 0.774 | 0.174 | 1.021 | 0.241 | 0.144 |
| HCM Control Delay | 16.3 | 11.9 | 14.7 | 12.5 | 33.6 | 12.7 | 76.3 | 15.6 | 12.9 |
| HCM Lane LOS | C | B | B | B | D | B | F | C | B |
| HCM 95th-tile Q | 1.3 | 0.1 | 1.4 | 0.4 | 6.7 | 0.6 | 14.3 | 0.9 | 0.5 |



## HCM Signalized Intersection Capacity Analysis
## 30: Redwood Blvd & Novato Blvd #3



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 44 | 263 | 69 | 72 | 357 | 109 | 117 | 13 | 139 | 84 | 10 | 46 |
| Future Volume (vph) | 44 | 263 | 69 | 72 | 357 | 109 | 117 | 13 | 139 | 84 | 10 | 46 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 16 | 16 | 12 | 16 | 16 | 12 | 12 | 12 | 12 | 12 | 12 |
| Total Lost time (s) | 3.5 | 4.0 | | 3.5 | 4.0 | | 3.5 | 4.0 | 4.0 | 3.5 | 4.0 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 0.97 | | 1.00 | 0.96 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.88 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1787 | 2049 | | 1787 | 2042 | | 1787 | 1881 | 1599 | 1787 | 1652 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1787 | 2049 | | 1787 | 2042 | | 1787 | 1881 | 1599 | 1787 | 1652 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 46 | 277 | 73 | 76 | 376 | 115 | 123 | 14 | 146 | 88 | 11 | 48 |
| RTOR Reduction (vph) | 0 | 9 | 0 | 0 | 11 | 0 | 0 | 0 | 123 | 0 | 44 | 0 |
| Lane Group Flow (vph) | 46 | 341 | 0 | 76 | 480 | 0 | 123 | 14 | 23 | 88 | 16 | 0 |
| Heavy Vehicles (%) | 1% | 2% | 1% | 1% | 2% | 1% | 1% | 1% | 1% | 1% | 1% | 1% |
| Turn Type | Prot | NA | | Prot | NA | | Prot | NA | Perm | Prot | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | | | | | | | 2 | | | |
| Actuated Green, G (s) | 3.0 | 20.4 | | 4.1 | 21.5 | | 9.8 | 8.6 | 8.6 | 6.3 | 5.1 | |
| Effective Green, g (s) | 3.0 | 20.4 | | 4.1 | 21.5 | | 9.8 | 8.6 | 8.6 | 6.3 | 5.1 | |
| Actuated g/C Ratio | 0.06 | 0.37 | | 0.08 | 0.40 | | 0.18 | 0.16 | 0.16 | 0.12 | 0.09 | |
| Clearance Time (s) | 3.5 | 4.0 | | 3.5 | 4.0 | | 3.5 | 4.0 | 4.0 | 3.5 | 4.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 98 | 768 | | 134 | 807 | | 321 | 297 | 252 | 206 | 154 | |
| v/s Ratio Prot | 0.03 | 0.17 | | c0.04 | c0.23 | | c0.07 | 0.01 | | 0.05 | 0.01 | |
| v/s Ratio Perm | | | | | | | | | c0.01 | | | |
| v/c Ratio | 0.47 | 0.44 | | 0.57 | 0.59 | | 0.38 | 0.05 | 0.09 | 0.43 | 0.10 | |
| Uniform Delay, d1 | 24.9 | 12.7 | | 24.3 | 13.0 | | 19.6 | 19.4 | 19.6 | 22.4 | 22.6 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 3.5 | 0.4 | | 5.4 | 1.2 | | 0.8 | 0.1 | 0.2 | 1.4 | 0.3 | |
| Delay (s) | 28.5 | 13.2 | | 29.7 | 14.2 | | 20.4 | 19.5 | 19.7 | 23.8 | 22.8 | |
| Level of Service | C | B | | C | B | | C | B | B | C | C | |
| Approach Delay (s) | | 14.9 | | | 16.3 | | | 20.0 | | | 23.4 | |
| Approach LOS | | B | | | B | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 17.4 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.47 | | |
| Actuated Cycle Length (s) | 54.4 | Sum of lost time (s) | 15.0 |
| Intersection Capacity Utilization | 51.9% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

# MOVEMENT SUMMARY

## Site: 30 [PM Existing + Project]

Novato Boulevard/Redwood Boulevard
PM Existing + Project

Roundabout

**Movement Performance - Vehicles**

| Mov ID | OD Mov | Demand Flows Total veh/h | Demand Flows HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance ft | Prop. Queued | Effective Stop Rate per veh | Average Speed mph |
|---|---|---|---|---|---|---|---|---|---|---|---|
| South: NB Redwood Boulevard | | | | | | | | | | | |
| 3 | L2 | 123 | 2.0 | 0.321 | 7.6 | LOS A | 1.6 | 39.6 | 0.58 | 0.52 | 32.5 |
| 8 | T1 | 14 | 2.0 | 0.321 | 7.6 | LOS A | 1.6 | 39.6 | 0.58 | 0.52 | 32.5 |
| 18 | R2 | 146 | 2.0 | 0.321 | 7.6 | LOS A | 1.6 | 39.6 | 0.58 | 0.52 | 31.6 |
| Approach | | 283 | 2.0 | 0.321 | 7.6 | LOS A | 1.6 | 39.6 | 0.58 | 0.52 | 32.0 |
| East: WB Novato Blvd | | | | | | | | | | | |
| 1 | L2 | 76 | 2.0 | 0.506 | 9.0 | LOS A | 3.4 | 87.3 | 0.52 | 0.37 | 32.6 |
| 6 | T1 | 376 | 2.0 | 0.506 | 9.0 | LOS A | 3.4 | 87.3 | 0.52 | 0.37 | 32.6 |
| 16 | R2 | 115 | 2.0 | 0.506 | 9.0 | LOS A | 3.4 | 87.3 | 0.52 | 0.37 | 31.7 |
| Approach | | 566 | 2.0 | 0.506 | 9.0 | LOS A | 3.4 | 87.3 | 0.52 | 0.37 | 32.4 |
| North: SB Redwood Boulevard | | | | | | | | | | | |
| 7 | L2 | 88 | 2.0 | 0.198 | 7.0 | LOS A | 0.8 | 21.2 | 0.60 | 0.57 | 32.4 |
| 4 | T1 | 11 | 2.0 | 0.198 | 7.0 | LOS A | 0.8 | 21.2 | 0.60 | 0.57 | 32.4 |
| 14 | R2 | 48 | 2.0 | 0.198 | 7.0 | LOS A | 0.8 | 21.2 | 0.60 | 0.57 | 31.5 |
| Approach | | 147 | 2.0 | 0.198 | 7.0 | LOS A | 0.8 | 21.2 | 0.60 | 0.57 | 32.1 |
| West: EB Novato Blvd | | | | | | | | | | | |
| 5 | L2 | 46 | 2.0 | 0.273 | 5.5 | LOS A | 1.3 | 33.3 | 0.36 | 0.23 | 34.3 |
| 2 | T1 | 277 | 2.0 | 0.273 | 5.5 | LOS A | 1.3 | 33.3 | 0.36 | 0.23 | 34.3 |
| 12 | R2 | 73 | 2.0 | 0.061 | 3.5 | LOS A | 0.2 | 6.1 | 0.29 | 0.16 | 34.5 |
| Approach | | 396 | 2.0 | 0.273 | 5.2 | LOS A | 1.3 | 33.3 | 0.34 | 0.22 | 34.3 |
| All Vehicles | | 1393 | 2.0 | 0.506 | 7.4 | LOS A | 3.4 | 87.3 | 0.49 | 0.38 | 32.8 |

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.


Organisation: W-TRANS | Processed: Tuesday, February 27, 2018 4:01:26 PM
Project: N:\AAA\MAX\NOV\126NOV\SIDRA\Novato-Redwood.sip7

## HCM Signalized Intersection Capacity Analysis
31: Alameda Del Prado & Ignacio Blvd

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 10 | 447 | 78 | 332 | 736 | 34 | 98 | 4 | 162 | 28 | 5 | 1 |
| Future Volume (vph) | 10 | 447 | 78 | 332 | 736 | 34 | 98 | 4 | 162 | 28 | 5 | 1 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.6 | 3.6 | 3.0 | 3.6 | | | 3.5 | 3.5 | | 3.7 | |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | | 1.00 | 1.00 | | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.97 | 1.00 | 1.00 | | | 1.00 | 0.98 | | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.99 | 1.00 | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | | | 1.00 | 0.85 | | 1.00 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 0.95 | 1.00 | | 0.96 | |
| Satd. Flow (prot) | 1770 | 3610 | 1573 | 1900 | 3586 | | | 1784 | 1589 | | 1812 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 0.76 | 1.00 | | 0.76 | |
| Satd. Flow (perm) | 1770 | 3610 | 1573 | 1805 | 3586 | | | 1421 | 1589 | | 1431 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 11 | 471 | 82 | 349 | 775 | 36 | 103 | 4 | 171 | 29 | 5 | 1 |
| RTOR Reduction (vph) | 0 | 0 | 30 | 0 | 2 | 0 | 0 | 0 | 146 | 0 | 1 | 0 |
| Lane Group Flow (vph) | 11 | 471 | 52 | 349 | 809 | 0 | 0 | 107 | 25 | 0 | 34 | 0 |
| Confl. Peds. (#/hr) | | | 4 | | | | 7 | | 4 | 4 | | 7 |
| Heavy Vehicles (%) | 2% | 0% | 0% | 0% | 0% | 0% | 1% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Prot | NA | Perm | Prot | NA | | Perm | NA | Perm | Perm | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | 2 | | | | 8 | | 8 | 4 | | |
| Actuated Green, G (s) | 1.2 | 47.6 | 47.6 | 27.4 | 73.8 | | | 14.9 | 14.9 | | 14.7 | |
| Effective Green, g (s) | 1.2 | 47.6 | 47.6 | 27.4 | 73.8 | | | 14.9 | 14.9 | | 14.7 | |
| Actuated g/C Ratio | 0.01 | 0.48 | 0.48 | 0.27 | 0.74 | | | 0.15 | 0.15 | | 0.15 | |
| Clearance Time (s) | 3.0 | 3.6 | 3.6 | 3.0 | 3.6 | | | 3.5 | 3.5 | | 3.7 | |
| Vehicle Extension (s) | 2.0 | 3.0 | 3.0 | 2.0 | 3.0 | | | 2.0 | 2.0 | | 2.0 | |
| Lane Grp Cap (vph) | 21 | 1718 | 748 | 520 | 2646 | | | 211 | 236 | | 210 | |
| v/s Ratio Prot | c0.01 | 0.13 | | c0.18 | c0.23 | | | | | | | |
| v/s Ratio Perm | | | 0.03 | | | | | c0.08 | 0.02 | | 0.02 | |
| v/c Ratio | 0.52 | 0.27 | 0.07 | 0.67 | 0.31 | | | 0.51 | 0.11 | | 0.16 | |
| Uniform Delay, d1 | 49.1 | 15.8 | 14.2 | 32.3 | 4.4 | | | 39.2 | 36.8 | | 37.3 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 0.73 | 0.74 | | | 1.00 | 1.00 | | 1.00 | |
| Incremental Delay, d2 | 10.4 | 0.4 | 0.2 | 2.4 | 0.3 | | | 0.7 | 0.1 | | 0.1 | |
| Delay (s) | 59.5 | 16.2 | 14.4 | 26.1 | 3.6 | | | 39.9 | 36.9 | | 37.4 | |
| Level of Service | E | B | B | C | A | | | D | D | | D | |
| Approach Delay (s) | | 16.8 | | | 10.3 | | | 38.0 | | | 37.4 | |
| Approach LOS | | B | | | B | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 16.4 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.45 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 10.3 |
| Intersection Capacity Utilization | 68.1% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 32: US 101 SB Off Ramp/Enfrente Rd & Ignacio Blvd/Ignacio Blvd #3

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 33 | 394 | 264 | 664 | 817 | 139 | 0 | 0 | 783 | 189 | 89 | 296 |
| Future Volume (vph) | 33 | 394 | 264 | 664 | 817 | 139 | 0 | 0 | 783 | 189 | 89 | 296 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Grade (%) | | 0% | | | 0% | | | 2% | | | 0% | |
| Total Lost time (s) | 3.0 | 8.0 | 8.0 | 4.0 | 5.0 | | | | 4.0 | | 4.0 | 4.0 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | | | 0.88 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.96 | 1.00 | 0.99 | | | | 1.00 | | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.98 | | | | 0.85 | | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | | 1.00 | | 0.97 | 1.00 |
| Satd. Flow (prot) | 1805 | 3610 | 1550 | 1787 | 3504 | | | | 2814 | | 1809 | 1578 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | | 1.00 | | 0.97 | 1.00 |
| Satd. Flow (perm) | 1805 | 3610 | 1550 | 1787 | 3504 | | | | 2814 | | 1809 | 1578 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 34 | 410 | 275 | 692 | 851 | 145 | 0 | 0 | 816 | 197 | 93 | 308 |
| RTOR Reduction (vph) | 0 | 0 | 201 | 0 | 10 | 0 | 0 | 0 | 409 | 0 | 0 | 241 |
| Lane Group Flow (vph) | 34 | 410 | 74 | 692 | 986 | 0 | 0 | 0 | 407 | 0 | 290 | 67 |
| Confl. Peds. (#/hr) | | | 7 | | | 20 | | | | | | 1 |
| Confl. Bikes (#/hr) | | | | | | 3 | | | | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 5% | 1% |
| Turn Type | Prot | NA | Perm | Prot | NA | | | | Over | Split | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | | | 1 | 7 | 7 | |
| Permitted Phases | | | 2 | | | | | | | | | 7 |
| Actuated Green, G (s) | 6.6 | 26.9 | 26.9 | 35.2 | 59.5 | | | | 35.2 | | 21.9 | 21.9 |
| Effective Green, g (s) | 6.6 | 26.9 | 26.9 | 35.2 | 59.5 | | | | 35.2 | | 21.9 | 21.9 |
| Actuated g/C Ratio | 0.07 | 0.27 | 0.27 | 0.35 | 0.60 | | | | 0.35 | | 0.22 | 0.22 |
| Clearance Time (s) | 3.0 | 8.0 | 8.0 | 4.0 | 5.0 | | | | 4.0 | | 4.0 | 4.0 |
| Vehicle Extension (s) | 2.0 | 2.5 | 2.5 | 3.0 | 4.0 | | | | 3.0 | | 2.5 | 2.5 |
| Lane Grp Cap (vph) | 119 | 971 | 416 | 629 | 2084 | | | | 990 | | 396 | 345 |
| v/s Ratio Prot | 0.02 | c0.11 | | c0.39 | c0.28 | | | | 0.14 | | c0.16 | |
| v/s Ratio Perm | | | 0.05 | | | | | | | | | 0.04 |
| v/c Ratio | 0.29 | 0.42 | 0.18 | 1.10 | 0.47 | | | | 0.41 | | 0.73 | 0.20 |
| Uniform Delay, d1 | 44.5 | 30.1 | 28.1 | 32.4 | 11.4 | | | | 24.5 | | 36.3 | 31.9 |
| Progression Factor | 0.98 | 0.68 | 0.41 | 0.81 | 0.73 | | | | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.5 | 1.3 | 0.9 | 56.9 | 0.4 | | | | 0.3 | | 6.5 | 0.2 |
| Delay (s) | 44.1 | 21.9 | 12.3 | 83.1 | 8.7 | | | | 24.8 | | 42.8 | 32.1 |
| Level of Service | D | C | B | F | A | | | | C | | D | C |
| Approach Delay (s) | | 19.3 | | | 39.2 | | | 24.8 | | | 37.3 | |
| Approach LOS | | B | | | D | | | C | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 32.1 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.82 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 82.7% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 32: US 101 SB Off Ramp/Enfrente Rd & Ignacio Blvd/Ignacio Blvd #3

02/16/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 33 | 394 | 264 | 664 | 817 | 139 | 0 | 0 | 783 | 189 | 89 | 296 |
| Future Volume (vph) | 33 | 394 | 264 | 664 | 817 | 139 | 0 | 0 | 783 | 189 | 89 | 296 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Grade (%) | | 0% | | | 0% | | | 2% | | | 0% | |
| Total Lost time (s) | 3.0 | 8.0 | 8.0 | 4.0 | 5.0 | | | | 4.0 | | 4.0 | 4.0 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | | | 0.88 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.96 | 1.00 | 0.99 | | | | 1.00 | | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.98 | | | | 0.85 | | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | | 1.00 | | 0.97 | 1.00 |
| Satd. Flow (prot) | 1805 | 3610 | 1550 | 1787 | 3504 | | | | 2814 | | 1809 | 1578 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | | 1.00 | | 0.97 | 1.00 |
| Satd. Flow (perm) | 1805 | 3610 | 1550 | 1787 | 3504 | | | | 2814 | | 1809 | 1578 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 34 | 410 | 275 | 692 | 851 | 145 | 0 | 0 | 816 | 197 | 93 | 308 |
| RTOR Reduction (vph) | 0 | 0 | 201 | 0 | 10 | 0 | 0 | 0 | 409 | 0 | 0 | 241 |
| Lane Group Flow (vph) | 34 | 410 | 74 | 692 | 986 | 0 | 0 | 0 | 407 | 0 | 290 | 67 |
| Confl. Peds. (#/hr) | | | 7 | | | 20 | | | | | | 1 |
| Confl. Bikes (#/hr) | | | | | | 3 | | | | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 5% | 1% |
| Turn Type | Prot | NA | Perm | Prot | NA | | | | Over | Split | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | | | 1 | 7 | 7 | |
| Permitted Phases | | | 2 | | | | | | | | | 7 |
| Actuated Green, G (s) | 6.6 | 26.9 | 26.9 | 35.2 | 59.5 | | | | 35.2 | | 21.9 | 21.9 |
| Effective Green, g (s) | 6.6 | 26.9 | 26.9 | 35.2 | 59.5 | | | | 35.2 | | 21.9 | 21.9 |
| Actuated g/C Ratio | 0.07 | 0.27 | 0.27 | 0.35 | 0.60 | | | | 0.35 | | 0.22 | 0.22 |
| Clearance Time (s) | 3.0 | 8.0 | 8.0 | 4.0 | 5.0 | | | | 4.0 | | 4.0 | 4.0 |
| Vehicle Extension (s) | 2.0 | 2.5 | 2.5 | 3.0 | 4.0 | | | | 3.0 | | 2.5 | 2.5 |
| Lane Grp Cap (vph) | 119 | 971 | 416 | 629 | 2084 | | | | 990 | | 396 | 345 |
| v/s Ratio Prot | 0.02 | c0.11 | | c0.39 | c0.28 | | | | 0.14 | | c0.16 | |
| v/s Ratio Perm | | | 0.05 | | | | | | | | | 0.04 |
| v/c Ratio | 0.29 | 0.42 | 0.18 | 1.10 | 0.47 | | | | 0.41 | | 0.73 | 0.20 |
| Uniform Delay, d1 | 44.5 | 30.1 | 28.1 | 32.4 | 11.4 | | | | 24.5 | | 36.3 | 31.9 |
| Progression Factor | 0.93 | 0.65 | 0.36 | 0.82 | 0.72 | | | | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.5 | 1.3 | 0.9 | 56.9 | 0.4 | | | | 0.3 | | 6.5 | 0.2 |
| Delay (s) | 41.9 | 20.8 | 11.0 | 83.5 | 8.6 | | | | 24.8 | | 42.8 | 32.1 |
| Level of Service | D | C | B | F | A | | | | C | | D | C |
| Approach Delay (s) | | 18.1 | | | 39.3 | | | 24.8 | | | 37.3 | |
| Approach LOS | | B | | | D | | | C | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 31.9 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.82 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 82.7% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 33: Nave Dr & Ignacio Blvd #3/Bel Marin Keys Blvd #3

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 359 | 1013 | 134 | 739 | 768 | 868 | 749 | 271 | 0 | 0 | 0 |
| Future Volume (vph) | 0 | 359 | 1013 | 134 | 739 | 768 | 868 | 749 | 271 | 0 | 0 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.0 | 4.6 | 3.0 | 4.0 | | 4.6 | 4.6 | 3.0 | | | |
| Lane Util. Factor | | 0.95 | 1.00 | 1.00 | 0.95 | | 0.91 | 0.91 | 1.00 | | | |
| Frpb, ped/bikes | | 1.00 | 0.99 | 1.00 | 0.99 | | 1.00 | 1.00 | 0.99 | | | |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | | |
| Frt | | 1.00 | 0.85 | 1.00 | 0.92 | | 1.00 | 1.00 | 0.85 | | | |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 0.98 | 1.00 | | | |
| Satd. Flow (prot) | | 3610 | 1605 | 1805 | 3278 | | 1643 | 3382 | 1600 | | | |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 0.98 | 1.00 | | | |
| Satd. Flow (perm) | | 3610 | 1605 | 1805 | 3278 | | 1643 | 3382 | 1600 | | | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 0 | 378 | 1066 | 141 | 778 | 808 | 914 | 788 | 285 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 72 | 0 | 42 | 0 | 0 | 0 | 115 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 378 | 994 | 141 | 1544 | 0 | 558 | 1144 | 170 | 0 | 0 | 0 |
| Confl. Peds. (#/hr) | | | 1 | | | 1 | | | 1 | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 2% | 0% | 1% | 0% | 0% | 0% | 0% |
| Turn Type | | NA | pm+ov | Prot | NA | | Split | NA | pm+ov | | | |
| Protected Phases | | 2 | 3 | 1 | 6 | | 3 | 3 | 1 | | | |
| Permitted Phases | | | 2 | | | | | | 3 | | | |
| Actuated Green, G (s) | | 35.8 | 75.6 | 12.8 | 51.6 | | 39.8 | 39.8 | 52.6 | | | |
| Effective Green, g (s) | | 35.8 | 75.6 | 12.8 | 51.6 | | 39.8 | 39.8 | 52.6 | | | |
| Actuated g/C Ratio | | 0.36 | 0.76 | 0.13 | 0.52 | | 0.40 | 0.40 | 0.53 | | | |
| Clearance Time (s) | | 4.0 | 4.6 | 3.0 | 4.0 | | 4.6 | 4.6 | 3.0 | | | |
| Vehicle Extension (s) | | 4.0 | 2.0 | 2.0 | 4.0 | | 2.0 | 2.0 | 2.0 | | | |
| Lane Grp Cap (vph) | | 1292 | 1213 | 231 | 1691 | | 653 | 1346 | 841 | | | |
| v/s Ratio Prot | | 0.10 | 0.33 | 0.08 | c0.47 | | c0.34 | 0.34 | 0.03 | | | |
| v/s Ratio Perm | | | 0.29 | | | | | | 0.08 | | | |
| v/c Ratio | | 0.29 | 0.82 | 0.61 | 0.95dr | | 0.85 | 0.85 | 0.20 | | | |
| Uniform Delay, d1 | | 23.0 | 7.8 | 41.2 | 22.2 | | 27.5 | 27.4 | 12.6 | | | |
| Progression Factor | | 1.08 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | | |
| Incremental Delay, d2 | | 0.5 | 3.7 | 3.3 | 9.1 | | 10.2 | 5.0 | 0.0 | | | |
| Delay (s) | | 25.4 | 11.5 | 44.6 | 31.2 | | 37.7 | 32.4 | 12.6 | | | |
| Level of Service | | C | B | D | C | | D | C | B | | | |
| Approach Delay (s) | | 15.1 | | | 32.3 | | | 31.0 | | | 0.0 | |
| Approach LOS | | B | | | C | | | C | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 27.0 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.92 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 11.6 |
| Intersection Capacity Utilization | 82.9% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |

dr Defacto Right Lane. Recode with 1 though lane as a right lane.
c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 34: Bel Marin Keys Blvd #3 & Commercial Blvd

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 3 | 0 | 38 | 278 | 1 | 28 | 46 | 538 | 78 | 31 | 1429 | 7 |
| Future Volume (vph) | 3 | 0 | 38 | 278 | 1 | 28 | 46 | 538 | 78 | 31 | 1429 | 7 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.0 | | | 4.0 | 4.0 | 3.0 | 3.9 | | 3.0 | 3.5 | |
| Lane Util. Factor | | 1.00 | | | 1.00 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | | 0.99 | | | 1.00 | 0.99 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 0.87 | | | 1.00 | 0.85 | 1.00 | 0.98 | | 1.00 | 1.00 | |
| Flt Protected | | 1.00 | | | 0.95 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 1632 | | | 1807 | 1396 | 1805 | 3530 | | 1805 | 3572 | |
| Flt Permitted | | 0.98 | | | 0.69 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | | 1607 | | | 1316 | 1396 | 1805 | 3530 | | 1805 | 3572 | |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Adj. Flow (vph) | 3 | 0 | 42 | 309 | 1 | 31 | 51 | 598 | 87 | 34 | 1588 | 8 |
| RTOR Reduction (vph) | 0 | 32 | 0 | 0 | 0 | 22 | 0 | 12 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 13 | 0 | 0 | 310 | 9 | 51 | 673 | 0 | 34 | 1596 | 0 |
| Confl. Peds. (#/hr) | 3 | | 2 | 2 | | 3 | | | 3 | | | |
| Heavy Vehicles (%) | 2% | 0% | 0% | 0% | 0% | 14% | 0% | 0% | 0% | 0% | 1% | 0% |
| Turn Type | Perm | NA | | Perm | NA | Perm | Prot | NA | | Prot | NA | |
| Protected Phases | | 4 | | | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | | | | | | |
| Actuated Green, G (s) | | 22.1 | | | 22.1 | 22.1 | 4.2 | 38.4 | | 3.6 | 38.2 | |
| Effective Green, g (s) | | 22.1 | | | 22.1 | 22.1 | 4.2 | 38.4 | | 3.6 | 38.2 | |
| Actuated g/C Ratio | | 0.29 | | | 0.29 | 0.29 | 0.06 | 0.51 | | 0.05 | 0.51 | |
| Clearance Time (s) | | 4.0 | | | 4.0 | 4.0 | 3.0 | 3.9 | | 3.0 | 3.5 | |
| Vehicle Extension (s) | | 3.0 | | | 3.0 | 3.0 | 2.5 | 3.0 | | 2.5 | 4.0 | |
| Lane Grp Cap (vph) | | 473 | | | 387 | 411 | 101 | 1807 | | 86 | 1819 | |
| v/s Ratio Prot | | | | | | | c0.03 | 0.19 | | 0.02 | c0.45 | |
| v/s Ratio Perm | | 0.01 | | | c0.24 | 0.01 | | | | | | |
| v/c Ratio | | 0.03 | | | 0.80 | 0.02 | 0.50 | 0.37 | | 0.40 | 0.88 | |
| Uniform Delay, d1 | | 18.8 | | | 24.4 | 18.8 | 34.4 | 11.0 | | 34.6 | 16.3 | |
| Progression Factor | | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | 0.91 | 0.79 | |
| Incremental Delay, d2 | | 0.0 | | | 11.3 | 0.0 | 2.9 | 0.6 | | 1.4 | 4.2 | |
| Delay (s) | | 18.8 | | | 35.7 | 18.8 | 37.3 | 11.6 | | 32.9 | 17.1 | |
| Level of Service | | B | | | D | B | D | B | | C | B | |
| Approach Delay (s) | | 18.8 | | | 34.2 | | | 13.4 | | | 17.5 | |
| Approach LOS | | B | | | C | | | B | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 18.5 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.83 | | |
| Actuated Cycle Length (s) | 75.0 | Sum of lost time (s) | 10.9 |
| Intersection Capacity Utilization | 68.6% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## 35: Bel Marin Keys Blvd #3 & Hamilton Dr/Digital Dr



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 5 | 7 | 154 | 606 | 4 | 13 | 45 | 381 | 127 | 6 | 713 | 2 |
| Future Volume (vph) | 5 | 7 | 154 | 606 | 4 | 13 | 45 | 381 | 127 | 6 | 713 | 2 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.5 | 3.5 | 3.5 | 3.5 | | 3.0 | 4.0 | | 3.0 | 4.0 | |
| Lane Util. Factor | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | | 1.00 | 0.98 | 1.00 | 0.99 | | 1.00 | 0.99 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | 1.00 | 0.99 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 1.00 | 0.85 | 1.00 | 0.88 | | 1.00 | 0.96 | | 1.00 | 1.00 | |
| Flt Protected | | 0.98 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 1864 | 1522 | 1739 | 1662 | | 1770 | 3375 | | 1805 | 3538 | |
| Flt Permitted | | 0.96 | 1.00 | 0.75 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | | 1823 | 1522 | 1371 | 1662 | | 1770 | 3375 | | 1805 | 3538 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 5 | 8 | 167 | 659 | 4 | 14 | 49 | 414 | 138 | 7 | 775 | 2 |
| RTOR Reduction (vph) | 0 | 0 | 99 | 0 | 8 | 0 | 0 | 37 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 13 | 68 | 659 | 10 | 0 | 49 | 515 | 0 | 7 | 777 | 0 |
| Confl. Peds. (#/hr) | 1 | | 10 | 10 | | 1 | | | 2 | | | 8 |
| Confl. Bikes (#/hr) | | | | | | | | | 5 | | | 5 |
| Heavy Vehicles (%) | 0% | 0% | 4% | 3% | 0% | 0% | 2% | 2% | 3% | 0% | 2% | 0% |
| Turn Type | Perm | NA | Perm | Perm | NA | | Prot | NA | | Prot | NA | |
| Protected Phases | | 4 | | | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | 4 | 8 | | | | | | | | |
| Actuated Green, G (s) | | 30.5 | 30.5 | 30.5 | 30.5 | | 5.4 | 32.2 | | 1.8 | 28.6 | |
| Effective Green, g (s) | | 30.5 | 30.5 | 30.5 | 30.5 | | 5.4 | 32.2 | | 1.8 | 28.6 | |
| Actuated g/C Ratio | | 0.41 | 0.41 | 0.41 | 0.41 | | 0.07 | 0.43 | | 0.02 | 0.38 | |
| Clearance Time (s) | | 3.5 | 3.5 | 3.5 | 3.5 | | 3.0 | 4.0 | | 3.0 | 4.0 | |
| Vehicle Extension (s) | | 2.0 | 2.0 | 2.5 | 2.5 | | 2.0 | 4.0 | | 2.0 | 4.0 | |
| Lane Grp Cap (vph) | | 741 | 618 | 557 | 675 | | 127 | 1449 | | 43 | 1349 | |
| v/s Ratio Prot | | | | | 0.01 | | c0.03 | 0.15 | | 0.00 | c0.22 | |
| v/s Ratio Perm | | 0.01 | 0.04 | c0.48 | | | | | | | | |
| v/c Ratio | | 0.02 | 0.11 | 1.18 | 0.01 | | 0.39 | 0.36 | | 0.16 | 0.58 | |
| Uniform Delay, d1 | | 13.3 | 13.8 | 22.2 | 13.3 | | 33.2 | 14.4 | | 35.9 | 18.4 | |
| Progression Factor | | 1.00 | 1.00 | 1.00 | 1.00 | | 0.80 | 1.60 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 0.0 | 0.0 | 99.7 | 0.0 | | 0.7 | 0.7 | | 0.7 | 1.8 | |
| Delay (s) | | 13.3 | 13.8 | 121.9 | 13.3 | | 27.2 | 23.7 | | 36.5 | 20.2 | |
| Level of Service | | B | B | F | B | | C | C | | D | C | |
| Approach Delay (s) | | 13.8 | | | 119.0 | | | 24.0 | | | 20.3 | |
| Approach LOS | | B | | | F | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 50.6 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.85 | | |
| Actuated Cycle Length (s) | 75.0 | Sum of lost time (s) | 10.5 |
| Intersection Capacity Utilization | 78.6% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



HCM Signalized Intersection Capacity Analysis

## 36: Nave Dr & US 101 NB Off Ramp



| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 720 | 233 | 0 | 1177 | 894 | 238 |
| Future Volume (vph) | 720 | 233 | 0 | 1177 | 894 | 238 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | | 5.0 | 5.0 | |
| Lane Util. Factor | 0.97 | 1.00 | | 0.95 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 0.99 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.85 | | 1.00 | 0.97 | |
| Flt Protected | 0.95 | 1.00 | | 1.00 | 1.00 | |
| Satd. Flow (prot) | 3467 | 1563 | | 3574 | 3469 | |
| Flt Permitted | 0.95 | 1.00 | | 1.00 | 1.00 | |
| Satd. Flow (perm) | 3467 | 1563 | | 3574 | 3469 | |
| Peak-hour factor, PHF | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Adj. Flow (vph) | 735 | 238 | 0 | 1201 | 912 | 243 |
| RTOR Reduction (vph) | 0 | 39 | 0 | 0 | 34 | 0 |
| Lane Group Flow (vph) | 735 | 199 | 0 | 1201 | 1121 | 0 |
| Confl. Peds. (#/hr) | | 1 | | | | |
| Heavy Vehicles (%) | 1% | 2% | 0% | 1% | 1% | 0% |
| Turn Type | Prot | Perm | | NA | NA | |
| Protected Phases | 4 | | | 2 | 6 | |
| Permitted Phases | | 4 | | | | |
| Actuated Green, G (s) | 31.0 | 31.0 | | 31.0 | 31.0 | |
| Effective Green, g (s) | 31.0 | 31.0 | | 31.0 | 31.0 | |
| Actuated g/C Ratio | 0.44 | 0.44 | | 0.44 | 0.44 | |
| Clearance Time (s) | 3.0 | 3.0 | | 5.0 | 5.0 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 1535 | 692 | | 1582 | 1536 | |
| v/s Ratio Prot | c0.21 | | | c0.34 | 0.32 | |
| v/s Ratio Perm | | 0.13 | | | | |
| v/c Ratio | 0.48 | 0.29 | | 0.76 | 0.73 | |
| Uniform Delay, d1 | 13.8 | 12.4 | | 16.4 | 16.1 | |
| Progression Factor | 1.00 | 1.00 | | 0.50 | 1.00 | |
| Incremental Delay, d2 | 1.1 | 1.0 | | 2.6 | 3.1 | |
| Delay (s) | 14.9 | 13.5 | | 10.7 | 19.1 | |
| Level of Service | B | B | | B | B | |
| Approach Delay (s) | 14.5 | | | 10.7 | 19.1 | |
| Approach LOS | B | | | B | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 14.7 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.62 | | |
| Actuated Cycle Length (s) | 70.0 | Sum of lost time (s) | 8.0 |
| Intersection Capacity Utilization | 62.5% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 37: Nave Dr & Hamilton Center

02/15/2018

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 114 | 43 | 901 | 127 | 140 | 785 |
| Future Volume (vph) | 114 | 43 | 901 | 127 | 140 | 785 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.2 | 3.2 | 4.4 | | 3.0 | 4.4 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 0.85 | 0.98 | | 1.00 | 1.00 |
| Flt Protected | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 1615 | 1863 | | 1770 | 1881 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | 1805 | 1615 | 1863 | | 1770 | 1881 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 119 | 45 | 939 | 132 | 146 | 818 |
| RTOR Reduction (vph) | 0 | 41 | 6 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 119 | 4 | 1065 | 0 | 146 | 818 |
| Confl. Peds. (#/hr) | | | | 2 | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 2% | 1% |
| Turn Type | Prot | Perm | NA | | Prot | NA |
| Protected Phases | 8 | | 2 | | 1 | 6 |
| Permitted Phases | | 8 | | | | |
| Actuated Green, G (s) | 6.4 | 6.4 | 45.0 | | 8.0 | 56.0 |
| Effective Green, g (s) | 6.4 | 6.4 | 45.0 | | 8.0 | 56.0 |
| Actuated g/C Ratio | 0.09 | 0.09 | 0.64 | | 0.11 | 0.80 |
| Clearance Time (s) | 3.2 | 3.2 | 4.4 | | 3.0 | 4.4 |
| Vehicle Extension (s) | 1.0 | 1.0 | 1.0 | | 1.0 | 1.0 |
| Lane Grp Cap (vph) | 165 | 147 | 1197 | | 202 | 1504 |
| v/s Ratio Prot | c0.07 | | c0.57 | | c0.08 | 0.43 |
| v/s Ratio Perm | | 0.00 | | | | |
| v/c Ratio | 0.72 | 0.03 | 0.89 | | 0.72 | 0.54 |
| Uniform Delay, d1 | 30.9 | 29.0 | 10.4 | | 29.9 | 2.5 |
| Progression Factor | 1.00 | 1.00 | 0.81 | | 1.08 | 0.89 |
| Incremental Delay, d2 | 12.3 | 0.0 | 8.6 | | 7.9 | 1.1 |
| Delay (s) | 43.3 | 29.0 | 17.0 | | 40.1 | 3.3 |
| Level of Service | D | C | B | | D | A |
| Approach Delay (s) | 39.4 | | 17.0 | | | 8.8 |
| Approach LOS | D | | B | | | A |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 15.1 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.85 | | |
| Actuated Cycle Length (s) | 70.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 79.6% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 38: Nave Dr & Hamilton Pkwy

02/15/2018

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 90 | 384 | 525 | 54 | 325 | 439 |
| Future Volume (vph) | 90 | 384 | 525 | 54 | 325 | 439 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.2 | 3.2 | 4.4 | 4.4 | 3.0 | 4.4 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.85 | 1.00 | 0.85 | 1.00 | 1.00 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (prot) | 1770 | 1599 | 1900 | 1578 | 1787 | 1850 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (perm) | 1770 | 1599 | 1900 | 1578 | 1787 | 1900 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 95 | 404 | 553 | 57 | 342 | 462 |
| RTOR Reduction (vph) | 0 | 351 | 0 | 15 | 0 | 0 |
| Lane Group Flow (vph) | 95 | 53 | 553 | 42 | 342 | 462 |
| Confl. Peds. (#/hr) | | | | 2 | | |
| Heavy Vehicles (%) | 2% | 1% | 0% | 0% | 1% | 0% |
| Turn Type | Prot | Perm | NA | Perm | Prot | NA |
| Protected Phases | 8 | | 2 | | 1 | 6 |
| Permitted Phases | | 8 | | 2 | | |
| Actuated Green, G (s) | 9.1 | 9.1 | 27.9 | 27.9 | 22.4 | 53.3 |
| Effective Green, g (s) | 9.1 | 9.1 | 27.9 | 27.9 | 22.4 | 53.3 |
| Actuated g/C Ratio | 0.13 | 0.13 | 0.40 | 0.40 | 0.32 | 0.76 |
| Clearance Time (s) | 3.2 | 3.2 | 4.4 | 4.4 | 3.0 | 4.4 |
| Vehicle Extension (s) | 2.0 | 2.0 | 3.0 | 3.0 | 2.0 | 3.0 |
| Lane Grp Cap (vph) | 230 | 207 | 757 | 628 | 571 | 1408 |
| v/s Ratio Prot | c0.05 | | c0.29 | | c0.19 | 0.25 |
| v/s Ratio Perm | | 0.03 | | 0.03 | | |
| v/c Ratio | 0.41 | 0.25 | 0.73 | 0.07 | 0.60 | 0.33 |
| Uniform Delay, d1 | 28.0 | 27.4 | 17.9 | 13.0 | 20.0 | 2.7 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.23 |
| Incremental Delay, d2 | 0.4 | 0.2 | 6.1 | 0.2 | 1.0 | 0.5 |
| Delay (s) | 28.4 | 27.6 | 24.0 | 13.2 | 21.0 | 1.1 |
| Level of Service | C | C | C | B | C | A |
| Approach Delay (s) | 27.8 | | 23.0 | | | 9.6 |
| Approach LOS | C | | C | | | A |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 18.6 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.63 | | |
| Actuated Cycle Length (s) | 70.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 61.0% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 39: Nave Dr & Main Gate Dr

02/15/2018

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 352 | 273 | 293 | 317 | 272 | 272 |
| Future Volume (vph) | 352 | 273 | 293 | 317 | 272 | 272 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | 4.1 | 4.1 | 3.0 | 4.4 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.85 | 1.00 | 0.85 | 1.00 | 1.00 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 1615 | 1900 | 1615 | 1805 | 1881 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (perm) | 1805 | 1615 | 1900 | 1615 | 1805 | 1881 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 371 | 287 | 308 | 334 | 286 | 286 |
| RTOR Reduction (vph) | 0 | 203 | 0 | 247 | 0 | 0 |
| Lane Group Flow (vph) | 371 | 84 | 308 | 87 | 286 | 286 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 1% |
| Turn Type | Prot | Perm | NA | Perm | Prot | NA |
| Protected Phases | 8 | | 2 | | 1 | 6 |
| Permitted Phases | | 8 | | 2 | | |
| Actuated Green, G (s) | 14.7 | 14.7 | 13.2 | 13.2 | 12.4 | 28.3 |
| Effective Green, g (s) | 14.7 | 14.7 | 13.2 | 13.2 | 12.4 | 28.3 |
| Actuated g/C Ratio | 0.29 | 0.29 | 0.26 | 0.26 | 0.25 | 0.56 |
| Clearance Time (s) | 3.0 | 3.0 | 4.1 | 4.1 | 3.0 | 4.4 |
| Vehicle Extension (s) | 2.0 | 2.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| Lane Grp Cap (vph) | 526 | 471 | 497 | 422 | 444 | 1056 |
| v/s Ratio Prot | c0.21 | | c0.16 | | c0.16 | 0.15 |
| v/s Ratio Perm | | 0.05 | | 0.05 | | |
| v/c Ratio | 0.71 | 0.18 | 0.62 | 0.21 | 0.64 | 0.27 |
| Uniform Delay, d1 | 15.9 | 13.3 | 16.4 | 14.5 | 17.0 | 5.7 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 3.5 | 0.1 | 1.6 | 0.1 | 2.4 | 0.1 |
| Delay (s) | 19.4 | 13.4 | 18.0 | 14.6 | 19.4 | 5.8 |
| Level of Service | B | B | B | B | B | A |
| Approach Delay (s) | 16.8 | | 16.2 | | | 12.6 |
| Approach LOS | B | | B | | | B |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 15.3 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.66 | | |
| Actuated Cycle Length (s) | 50.4 | Sum of lost time (s) | 10.1 |
| Intersection Capacity Utilization | 60.1% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 40: Nave Dr & Bolling Dr

02/15/2018

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 219 | 62 | 560 | 345 | 98 | 571 |
| Future Volume (vph) | 219 | 62 | 560 | 345 | 98 | 571 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | 4.1 | | 3.0 | 3.5 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 0.97 | 1.00 | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 0.85 | 0.95 | | 1.00 | 1.00 |
| Flt Protected | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | 1787 | 1569 | 1791 | | 1805 | 1881 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | 1787 | 1569 | 1791 | | 1805 | 1881 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 228 | 65 | 583 | 359 | 102 | 595 |
| RTOR Reduction (vph) | 0 | 52 | 23 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 228 | 13 | 919 | 0 | 102 | 595 |
| Confl. Peds. (#/hr) | | 6 | | | | |
| Heavy Vehicles (%) | 1% | 0% | 1% | 0% | 0% | 1% |
| Turn Type | Prot | Perm | NA | | Prot | NA |
| Protected Phases | 4 | | 6 | | 5 | 2 |
| Permitted Phases | | 4 | | | | |
| Actuated Green, G (s) | 14.1 | 14.1 | 37.6 | | 6.9 | 48.1 |
| Effective Green, g (s) | 14.1 | 14.1 | 37.6 | | 6.9 | 48.1 |
| Actuated g/C Ratio | 0.21 | 0.21 | 0.55 | | 0.10 | 0.70 |
| Clearance Time (s) | 3.0 | 3.0 | 4.1 | | 3.0 | 3.5 |
| Vehicle Extension (s) | 2.0 | 2.0 | 2.0 | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 366 | 322 | 980 | | 181 | 1316 |
| v/s Ratio Prot | c0.13 | | c0.51 | | c0.06 | 0.32 |
| v/s Ratio Perm | | 0.01 | | | | |
| v/c Ratio | 0.62 | 0.04 | 0.94 | | 0.56 | 0.45 |
| Uniform Delay, d1 | 24.9 | 21.9 | 14.5 | | 29.5 | 4.5 |
| Progression Factor | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 2.4 | 0.0 | 15.5 | | 2.4 | 0.1 |
| Delay (s) | 27.2 | 21.9 | 30.0 | | 31.8 | 4.6 |
| Level of Service | C | C | C | | C | A |
| Approach Delay (s) | 26.1 | | 30.0 | | | 8.6 |
| Approach LOS | C | | C | | | A |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 21.7 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.82 | | |
| Actuated Cycle Length (s) | 68.7 | Sum of lost time (s) | 10.1 |
| Intersection Capacity Utilization | 81.7% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Intersection | |
|---|---|
| Intersection Delay, s/veh | 19.3 |
| Intersection LOS | C |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 8 | 10 | 1 | 103 | 20 | 754 | 0 | 68 | 37 | 273 | 70 | 12 |
| Future Vol, veh/h | 8 | 10 | 1 | 103 | 20 | 754 | 0 | 68 | 37 | 273 | 70 | 12 |
| Peak Hour Factor | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 8 | 10 | 1 | 106 | 21 | 777 | 0 | 70 | 38 | 281 | 72 | 12 |
| Number of Lanes | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Opposing Approach | WB | EB | SB | NB |
| Opposing Lanes | 2 | 1 | 2 | 1 |
| Conflicting Approach Left | SB | NB | EB | WB |
| Conflicting Lanes Left | 2 | 1 | 1 | 2 |
| Conflicting Approach Right | NB | SB | WB | EB |
| Conflicting Lanes Right | 1 | 2 | 2 | 1 |
| HCM Control Delay | 10.7 | 21 | 11.9 | 17.9 |
| HCM LOS | B | C | B | C |

| Lane | NBLn1 | EBLn1 | WBLn1 | WBLn2 | SBLn1 | SBLn2 |
|---|---|---|---|---|---|---|
| Vol Left, % | 0% | 42% | 23% | 0% | 100% | 0% |
| Vol Thru, % | 65% | 53% | 4% | 0% | 0% | 85% |
| Vol Right, % | 35% | 5% | 72% | 100% | 0% | 15% |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 105 | 19 | 447 | 430 | 273 | 82 |
| LT Vol | 0 | 8 | 103 | 0 | 273 | 0 |
| Through Vol | 68 | 10 | 20 | 0 | 0 | 70 |
| RT Vol | 37 | 1 | 324 | 430 | 0 | 12 |
| Lane Flow Rate | 108 | 20 | 461 | 443 | 281 | 85 |
| Geometry Grp | 6 | 6 | 7 | 7 | 7 | 7 |
| Degree of Util (X) | 0.209 | 0.04 | 0.739 | 0.672 | 0.58 | 0.16 |
| Departure Headway (Hd) | 6.957 | 7.339 | 5.773 | 5.462 | 7.416 | 6.804 |
| Convergence, Y/N | Yes | Yes | Yes | Yes | Yes | Yes |
| Cap | 515 | 486 | 627 | 660 | 487 | 527 |
| Service Time | 5.008 | 5.414 | 3.522 | 3.21 | 5.163 | 4.55 |
| HCM Lane V/C Ratio | 0.21 | 0.041 | 0.735 | 0.671 | 0.577 | 0.161 |
| HCM Control Delay | 11.9 | 10.7 | 23.2 | 18.7 | 20 | 10.9 |
| HCM Lane LOS | B | B | C | C | C | B |
| HCM 95th-tile Q | 0.8 | 0.1 | 6.4 | 5.2 | 3.6 | 0.6 |

| Intersection | |
|---|---|
| Intersection Delay, s/veh | 64.6 |
| Intersection LOS | F |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 16 | 596 | 129 | 201 | 489 | 9 | 113 | 12 | 333 | 29 | 13 | 15 |
| Future Vol, veh/h | 16 | 596 | 129 | 201 | 489 | 9 | 113 | 12 | 333 | 29 | 13 | 15 |
| Peak Hour Factor | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| Heavy Vehicles, % | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Mvmt Flow | 17 | 641 | 139 | 216 | 526 | 10 | 122 | 13 | 358 | 31 | 14 | 16 |
| Number of Lanes | 1 | 2 | 0 | 1 | 2 | 0 | 0 | 1 | 1 | 0 | 1 | 0 |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Opposing Approach | WB | EB | SB | NB |
| Opposing Lanes | 3 | 3 | 1 | 2 |
| Conflicting Approach Left | SB | NB | EB | WB |
| Conflicting Lanes Left | 1 | 2 | 3 | 3 |
| Conflicting Approach Right | NB | SB | WB | EB |
| Conflicting Lanes Right | 2 | 1 | 3 | 3 |
| HCM Control Delay | 95.9 | 41.3 | 55.1 | 18.1 |
| HCM LOS | F | E | F | C |

| Lane | NBLn1 | NBLn2 | EBLn1 | EBLn2 | EBLn3 | WBLn1 | WBLn2 | WBLn3 | SBLn1 |
|---|---|---|---|---|---|---|---|---|---|
| Vol Left, % | 90% | 0% | 100% | 0% | 0% | 100% | 0% | 0% | 51% |
| Vol Thru, % | 10% | 0% | 0% | 100% | 61% | 0% | 100% | 95% | 23% |
| Vol Right, % | 0% | 100% | 0% | 0% | 39% | 0% | 0% | 5% | 26% |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 125 | 333 | 16 | 397 | 328 | 201 | 326 | 172 | 57 |
| LT Vol | 113 | 0 | 16 | 0 | 0 | 201 | 0 | 0 | 29 |
| Through Vol | 12 | 0 | 0 | 397 | 199 | 0 | 326 | 163 | 13 |
| RT Vol | 0 | 333 | 0 | 0 | 129 | 0 | 0 | 9 | 15 |
| Lane Flow Rate | 134 | 358 | 17 | 427 | 352 | 216 | 351 | 185 | 61 |
| Geometry Grp | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Degree of Util (X) | 0.4 | 0.952 | 0.049 | 1.158 | 0.927 | 0.597 | 0.92 | 0.483 | 0.203 |
| Departure Headway (Hd) | 11.112 | 9.932 | 10.284 | 9.761 | 9.474 | 10.32 | 9.797 | 9.759 | 12.307 |
| Convergence, Y/N | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Cap | 327 | 369 | 348 | 372 | 384 | 352 | 372 | 372 | 294 |
| Service Time | 8.812 | 7.632 | 8.047 | 7.524 | 7.236 | 8.02 | 7.497 | 7.459 | 10.007 |
| HCM Lane V/C Ratio | 0.41 | 0.97 | 0.049 | 1.148 | 0.917 | 0.614 | 0.944 | 0.497 | 0.207 |
| HCM Control Delay | 21 | 67.9 | 13.6 | 128 | 61 | 27.2 | 60.7 | 21.2 | 18.1 |
| HCM Lane LOS | C | F | B | F | F | D | F | C | C |
| HCM 95th-tile Q | 1.9 | 10.3 | 0.2 | 16.7 | 9.9 | 3.7 | 9.6 | 2.5 | 0.7 |





| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 16 | 596 | 129 | 201 | 489 | 9 | 113 | 12 | 333 | 29 | 13 | 15 |
| Future Volume (vph) | 16 | 596 | 129 | 201 | 489 | 9 | 113 | 12 | 333 | 29 | 13 | 15 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | | 4.0 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | | 1.00 | 0.85 | | 0.96 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 0.96 | 1.00 | | 0.98 | |
| Satd. Flow (prot) | 1787 | 1881 | 1599 | 1787 | 1881 | 1599 | | 1800 | 1599 | | 1770 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 0.77 | 1.00 | | 0.82 | |
| Satd. Flow (perm) | 1787 | 1881 | 1599 | 1787 | 1881 | 1599 | | 1456 | 1599 | | 1494 | |
| Peak-hour factor, PHF | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| Adj. Flow (vph) | 17 | 641 | 139 | 216 | 526 | 10 | 122 | 13 | 358 | 31 | 14 | 16 |
| RTOR Reduction (vph) | 0 | 0 | 59 | 0 | 0 | 4 | 0 | 0 | 88 | 0 | 13 | 0 |
| Lane Group Flow (vph) | 17 | 641 | 80 | 216 | 526 | 6 | 0 | 135 | 270 | 0 | 48 | 0 |
| Heavy Vehicles (%) | 1% | 1% | 1% | 1% | 1% | 1% | 1% | 1% | 1% | 1% | 1% | 1% |
| Turn Type | Prot | NA | Perm | Prot | NA | Perm | Perm | NA | pm+ov | Perm | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | | 2 | 3 | | 6 | |
| Permitted Phases | | | 4 | | | 8 | 2 | | 2 | 6 | | |
| Actuated Green, G (s) | 0.6 | 32.2 | 32.2 | 13.2 | 44.8 | 44.8 | | 13.3 | 26.5 | | 13.3 | |
| Effective Green, g (s) | 0.6 | 32.2 | 32.2 | 13.2 | 44.8 | 44.8 | | 13.3 | 26.5 | | 13.3 | |
| Actuated g/C Ratio | 0.01 | 0.46 | 0.46 | 0.19 | 0.63 | 0.63 | | 0.19 | 0.37 | | 0.19 | |
| Clearance Time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | | 4.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | |
| Lane Grp Cap (vph) | 15 | 856 | 728 | 333 | 1191 | 1013 | | 273 | 689 | | 281 | |
| v/s Ratio Prot | 0.01 | c0.34 | | c0.12 | 0.28 | | | | c0.07 | | | |
| v/s Ratio Perm | | | 0.05 | | | 0.00 | | c0.09 | 0.10 | | 0.03 | |
| v/c Ratio | 1.13 | 0.75 | 0.11 | 0.65 | 0.44 | 0.01 | | 0.49 | 0.39 | | 0.17 | |
| Uniform Delay, d1 | 35.1 | 15.9 | 11.0 | 26.6 | 6.6 | 4.8 | | 25.7 | 16.2 | | 24.1 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | |
| Incremental Delay, d2 | 279.2 | 3.6 | 0.1 | 4.3 | 0.3 | 0.0 | | 1.4 | 0.4 | | 0.3 | |
| Delay (s) | 314.2 | 19.5 | 11.1 | 30.9 | 6.9 | 4.8 | | 27.1 | 16.6 | | 24.4 | |
| Level of Service | F | B | B | C | A | A | | C | B | | C | |
| Approach Delay (s) | | 24.3 | | | 13.7 | | | 19.5 | | | 24.4 | |
| Approach LOS | | C | | | B | | | B | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 19.4 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.68 | | |
| Actuated Cycle Length (s) | 70.7 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 65.3% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## MOVEMENT SUMMARY

### Site: 1 [AM Cumulative]

Simmons Lane/San Marin Drive
AM Cumulative with Project

Roundabout

**Movement Performance - Vehicles**

| Mov ID | OD Mov | Demand Flows Total veh/h | Demand Flows HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance ft | Prop. Queued | Effective Stop Rate per veh | Average Speed mph |
|---|---|---|---|---|---|---|---|---|---|---|---|
| South: NB Simmons Ln | | | | | | | | | | | |
| 3 | L2 | 119 | 2.0 | 0.719 | 21.5 | LOS C | 7.3 | 186.0 | 0.87 | 1.17 | 27.3 |
| 8 | T1 | 13 | 2.0 | 0.719 | 21.5 | LOS C | 7.3 | 186.0 | 0.87 | 1.17 | 27.3 |
| 18 | R2 | 351 | 2.0 | 0.719 | 21.5 | LOS C | 7.3 | 186.0 | 0.87 | 1.17 | 26.7 |
| Approach | | 482 | 2.0 | 0.719 | 21.5 | LOS C | 7.3 | 186.0 | 0.87 | 1.17 | 26.9 |
| East: WB San Marin Drive | | | | | | | | | | | |
| 1 | L2 | 212 | 2.0 | 0.174 | 4.5 | LOS A | 0.8 | 19.4 | 0.29 | 0.17 | 32.6 |
| 6 | T1 | 515 | 2.0 | 0.432 | 7.4 | LOS A | 2.5 | 64.7 | 0.40 | 0.25 | 33.6 |
| 16 | R2 | 9 | 2.0 | 0.432 | 7.4 | LOS A | 2.5 | 64.7 | 0.40 | 0.25 | 32.7 |
| Approach | | 736 | 2.0 | 0.432 | 6.5 | LOS A | 2.5 | 64.7 | 0.37 | 0.23 | 33.3 |
| North: SB Simmons Ln | | | | | | | | | | | |
| 7 | L2 | 31 | 2.0 | 0.090 | 6.4 | LOS A | 0.3 | 7.8 | 0.57 | 0.57 | 32.8 |
| 4 | T1 | 14 | 2.0 | 0.090 | 6.4 | LOS A | 0.3 | 7.8 | 0.57 | 0.57 | 32.8 |
| 14 | R2 | 16 | 2.0 | 0.090 | 6.4 | LOS A | 0.3 | 7.8 | 0.57 | 0.57 | 32.0 |
| Approach | | 60 | 2.0 | 0.090 | 6.4 | LOS A | 0.3 | 7.8 | 0.57 | 0.57 | 32.6 |
| West: EB San Marin Drive | | | | | | | | | | | |
| 5 | L2 | 17 | 2.0 | 0.752 | 16.9 | LOS B | 14.9 | 377.3 | 0.85 | 1.00 | 29.5 |
| 2 | T1 | 627 | 2.0 | 0.752 | 16.9 | LOS B | 14.9 | 377.3 | 0.85 | 1.00 | 29.5 |
| 12 | R2 | 136 | 2.0 | 0.752 | 16.9 | LOS B | 14.9 | 377.3 | 0.85 | 1.00 | 28.8 |
| Approach | | 780 | 2.0 | 0.752 | 16.9 | LOS B | 14.9 | 377.3 | 0.85 | 1.00 | 29.3 |
| All Vehicles | | 2058 | 2.0 | 0.752 | 14.0 | LOS B | 14.9 | 377.3 | 0.67 | 0.75 | 30.1 |

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.


Organisation: W-TRANS | Processed: Tuesday, February 27, 2018 3:50:36 PM
Project: N:\AAA\MAX\NOV\126NOV\SIDRA\Simmons-San Marin.sip7



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 37 | 953 | 2 | 2 | 711 | 204 | 1 | 0 | 4 | 25 | 0 | 1 |
| Future Volume (vph) | 37 | 953 | 2 | 2 | 711 | 204 | 1 | 0 | 4 | 25 | 0 | 1 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.8 | | 4.0 | 4.8 | 4.8 | | 4.0 | | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 | | 1.00 | | 0.95 | 0.95 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | | 1.00 | 1.00 | 0.85 | | 0.89 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | | 0.99 | | 0.95 | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 3573 | | 1805 | 3574 | 1615 | | 1678 | | 1715 | 1715 | 1615 |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1805 | 3573 | | 1805 | 3574 | 1615 | | 1695 | | 1805 | 1805 | 1615 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 40 | 1036 | 2 | 2 | 773 | 222 | 1 | 0 | 4 | 27 | 0 | 1 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 102 | 0 | 5 | 0 | 0 | 0 | 1 |
| Lane Group Flow (vph) | 40 | 1038 | 0 | 2 | 773 | 120 | 0 | 0 | 0 | 13 | 14 | 0 |
| Confl. Peds. (#/hr) | | | 2 | | | | | | | | | |
| Heavy Vehicles (%) | 0% | 1% | 0% | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Prot | NA | | Prot | NA | Perm | Perm | NA | | Perm | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | | | | 6 | 8 | | | 4 | | 4 |
| Actuated Green, G (s) | 2.3 | 21.6 | | 1.0 | 20.3 | 20.3 | | 2.3 | | 2.3 | 2.3 | 2.3 |
| Effective Green, g (s) | 2.3 | 21.6 | | 1.0 | 20.3 | 20.3 | | 2.3 | | 2.3 | 2.3 | 2.3 |
| Actuated g/C Ratio | 0.06 | 0.57 | | 0.03 | 0.54 | 0.54 | | 0.06 | | 0.06 | 0.06 | 0.06 |
| Clearance Time (s) | 4.0 | 4.8 | | 4.0 | 4.8 | 4.8 | | 4.0 | | 4.0 | 4.0 | 4.0 |
| Vehicle Extension (s) | 2.0 | 4.0 | | 2.0 | 4.0 | 4.0 | | 2.0 | | 2.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 110 | 2047 | | 47 | 1924 | 869 | | 103 | | 110 | 110 | 98 |
| v/s Ratio Prot | c0.02 | c0.29 | | 0.00 | 0.22 | | | | | | | |
| v/s Ratio Perm | | | | | | 0.07 | | 0.00 | | 0.01 | c0.01 | 0.00 |
| v/c Ratio | 0.36 | 0.51 | | 0.04 | 0.40 | 0.14 | | 0.00 | | 0.12 | 0.13 | 0.00 |
| Uniform Delay, d1 | 17.0 | 4.8 | | 17.9 | 5.1 | 4.3 | | 16.6 | | 16.7 | 16.8 | 16.6 |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.7 | 0.3 | | 0.1 | 0.2 | 0.1 | | 0.0 | | 0.2 | 0.2 | 0.0 |
| Delay (s) | 17.7 | 5.1 | | 18.0 | 5.3 | 4.4 | | 16.6 | | 16.9 | 16.9 | 16.6 |
| Level of Service | B | A | | B | A | A | | B | | B | B | B |
| Approach Delay (s) | | 5.6 | | | 5.1 | | | 16.6 | | | 16.9 | |
| Approach LOS | | A | | | A | | | B | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 5.6 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.49 | | |
| Actuated Cycle Length (s) | 37.7 | Sum of lost time (s) | 12.8 |
| Intersection Capacity Utilization | 47.0% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 3: San Marin Dr & E Campus Drive

02/15/2018

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 71 | 975 | 915 | 400 | 64 | 48 |
| Future Volume (vph) | 71 | 975 | 915 | 400 | 64 | 48 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 4.3 | 4.3 | 4.3 | 3.0 | 3.0 |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | 1.00 | 0.97 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 1.00 | 0.85 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 3574 | 3574 | 1615 | 3502 | 1594 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (perm) | 1805 | 3574 | 3574 | 1615 | 3502 | 1594 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 77 | 1060 | 995 | 435 | 70 | 52 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 103 | 0 | 48 |
| Lane Group Flow (vph) | 77 | 1060 | 995 | 332 | 70 | 4 |
| Confl. Peds. (#/hr) | | | | | | 1 |
| Heavy Vehicles (%) | 0% | 1% | 1% | 0% | 0% | 0% |
| Turn Type | Prot | NA | NA | Perm | Perm | Perm |
| Protected Phases | 5 | 2 | 6 | | | |
| Permitted Phases | | | | 6 | 4 | 4 |
| Actuated Green, G (s) | 10.0 | 112.1 | 99.1 | 99.1 | 10.6 | 10.6 |
| Effective Green, g (s) | 10.0 | 112.1 | 99.1 | 99.1 | 10.6 | 10.6 |
| Actuated g/C Ratio | 0.08 | 0.86 | 0.76 | 0.76 | 0.08 | 0.08 |
| Clearance Time (s) | 3.0 | 4.3 | 4.3 | 4.3 | 3.0 | 3.0 |
| Vehicle Extension (s) | 2.0 | 4.0 | 4.0 | 4.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 138 | 3081 | 2724 | 1231 | 285 | 129 |
| v/s Ratio Prot | c0.04 | 0.30 | c0.28 | | | |
| v/s Ratio Perm | | | | 0.21 | c0.02 | 0.00 |
| v/c Ratio | 0.56 | 0.34 | 0.37 | 0.27 | 0.25 | 0.03 |
| Uniform Delay, d1 | 57.9 | 1.8 | 5.1 | 4.6 | 56.0 | 55.0 |
| Progression Factor | 1.00 | 1.00 | 0.54 | 0.36 | 1.00 | 1.00 |
| Incremental Delay, d2 | 2.8 | 0.3 | 0.1 | 0.1 | 0.2 | 0.0 |
| Delay (s) | 60.6 | 2.1 | 2.8 | 1.8 | 56.1 | 55.0 |
| Level of Service | E | A | A | A | E | E |
| Approach Delay (s) | | 6.0 | 2.5 | | 55.6 | |
| Approach LOS | | A | A | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 6.4 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.37 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 10.3 |
| Intersection Capacity Utilization | 51.3% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 4: Redwood Blvd & San Marin Dr

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 71 | 800 | 171 | 378 | 1087 | 738 | 179 | 143 | 314 | 183 | 60 | 48 |
| Future Volume (vph) | 71 | 800 | 171 | 378 | 1087 | 738 | 179 | 143 | 314 | 183 | 60 | 48 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.6 | | 3.0 | 4.0 | | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 | |
| Lane Util. Factor | 1.00 | 0.91 | | 1.00 | 0.91 | | 0.97 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 0.99 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 0.97 | | 1.00 | 0.94 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.93 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1787 | 4986 | | 1752 | 4824 | | 3467 | 1881 | 1568 | 1787 | 1741 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1787 | 4986 | | 1752 | 4824 | | 3467 | 1881 | 1568 | 1787 | 1741 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 75 | 842 | 180 | 398 | 1144 | 777 | 188 | 151 | 331 | 193 | 63 | 51 |
| RTOR Reduction (vph) | 0 | 26 | 0 | 0 | 71 | 0 | 0 | 0 | 293 | 0 | 25 | 0 |
| Lane Group Flow (vph) | 75 | 996 | 0 | 398 | 1850 | 0 | 188 | 151 | 38 | 193 | 89 | 0 |
| Confl. Peds. (#/hr) | | | 4 | | | | | | | | | 5 |
| Confl. Bikes (#/hr) | | | | | | | | | | | | 1 |
| Heavy Vehicles (%) | 1% | 1% | 1% | 3% | 1% | 1% | 1% | 1% | 3% | 1% | 1% | 1% |
| Turn Type | Prot | NA | | Prot | NA | | Split | NA | Perm | Split | NA | |
| Protected Phases | 1 | 6 | | 5 | 2 | | 7 | 7 | | 8 | 8 | |
| Permitted Phases | | | | | 2 | | | | 7 | | | |
| Actuated Green, G (s) | 8.3 | 44.8 | | 35.1 | 71.2 | | 14.8 | 14.8 | 14.8 | 20.1 | 20.1 | |
| Effective Green, g (s) | 8.3 | 44.8 | | 35.1 | 71.2 | | 14.8 | 14.8 | 14.8 | 20.1 | 20.1 | |
| Actuated g/C Ratio | 0.06 | 0.34 | | 0.27 | 0.55 | | 0.11 | 0.11 | 0.11 | 0.15 | 0.15 | |
| Clearance Time (s) | 3.0 | 3.6 | | 3.0 | 4.0 | | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 | |
| Vehicle Extension (s) | 2.0 | 4.0 | | 5.0 | 4.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 114 | 1718 | | 473 | 2642 | | 394 | 214 | 178 | 276 | 269 | |
| v/s Ratio Prot | 0.04 | 0.20 | | c0.23 | c0.38 | | 0.05 | c0.08 | | c0.11 | 0.05 | |
| v/s Ratio Perm | | | | | | | | | 0.02 | | | |
| v/c Ratio | 0.66 | 0.58 | | 0.84 | 0.70 | | 0.48 | 0.71 | 0.21 | 0.70 | 0.33 | |
| Uniform Delay, d1 | 59.5 | 34.9 | | 44.8 | 21.6 | | 54.0 | 55.5 | 52.3 | 52.1 | 48.9 | |
| Progression Factor | 1.17 | 0.95 | | 1.03 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 9.6 | 1.4 | | 8.2 | 0.9 | | 0.3 | 8.3 | 0.2 | 6.1 | 0.3 | |
| Delay (s) | 79.0 | 34.4 | | 54.3 | 22.4 | | 54.3 | 63.8 | 52.5 | 58.2 | 49.2 | |
| Level of Service | E | C | | D | C | | D | E | D | E | D | |
| Approach Delay (s) | | 37.5 | | | 27.8 | | | 55.6 | | | 54.9 | |
| Approach LOS | | D | | | C | | | E | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 36.4 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.76 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 15.6 |
| Intersection Capacity Utilization | 92.3% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 4: Redwood Blvd & San Marin Dr

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 71 | 800 | 171 | 378 | 1087 | 738 | 179 | 143 | 314 | 183 | 60 | 48 |
| Future Volume (vph) | 71 | 800 | 171 | 378 | 1087 | 738 | 179 | 143 | 314 | 183 | 60 | 48 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.6 | | 3.0 | 4.0 | 4.3 | 4.3 | 4.3 | 3.0 | 4.3 | 4.3 | |
| Lane Util. Factor | 1.00 | 0.91 | | 0.97 | 0.95 | 1.00 | 0.95 | 0.95 | 0.88 | 0.91 | 0.91 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 0.97 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.96 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 0.99 | 1.00 | 0.95 | 0.98 | |
| Satd. Flow (prot) | 1787 | 4986 | | 3400 | 3574 | 1599 | 1698 | 1775 | 2760 | 1626 | 3210 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 0.99 | 1.00 | 0.95 | 0.98 | |
| Satd. Flow (perm) | 1787 | 4986 | | 3400 | 3574 | 1599 | 1698 | 1775 | 2760 | 1626 | 3210 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 75 | 842 | 180 | 398 | 1144 | 777 | 188 | 151 | 331 | 193 | 63 | 51 |
| RTOR Reduction (vph) | 0 | 25 | 0 | 0 | 0 | 72 | 0 | 0 | 220 | 0 | 29 | 0 |
| Lane Group Flow (vph) | 75 | 997 | 0 | 398 | 1144 | 705 | 165 | 174 | 111 | 104 | 174 | 0 |
| Confl. Peds. (#/hr) | | | 4 | | | | | | | | | 5 |
| Confl. Bikes (#/hr) | | | | | | | | | | | | 1 |
| Heavy Vehicles (%) | 1% | 1% | 1% | 3% | 1% | 1% | 1% | 1% | 3% | 1% | 1% | 1% |
| Turn Type | Prot | NA | | Prot | NA | pm+ov | Split | NA | pm+ov | Split | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | 4 | 8 | 8 | 1 | 4 | 4 | |
| Permitted Phases | | | | | | 6 | | | 8 | | | |
| Actuated Green, G (s) | 8.0 | 48.7 | | 26.2 | 66.5 | 87.6 | 16.8 | 16.8 | 43.0 | 21.1 | 21.1 | |
| Effective Green, g (s) | 8.0 | 48.7 | | 26.2 | 66.5 | 87.6 | 16.8 | 16.8 | 43.0 | 21.1 | 21.1 | |
| Actuated g/C Ratio | 0.06 | 0.38 | | 0.20 | 0.52 | 0.68 | 0.13 | 0.13 | 0.34 | 0.16 | 0.16 | |
| Clearance Time (s) | 3.0 | 3.6 | | 3.0 | 4.0 | 4.3 | 4.3 | 4.3 | 3.0 | 4.3 | 4.3 | |
| Vehicle Extension (s) | 2.0 | 4.0 | | 5.0 | 4.0 | 2.0 | 2.0 | 2.0 | 5.0 | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 111 | 1897 | | 695 | 1856 | 1094 | 222 | 232 | 927 | 268 | 529 | |
| v/s Ratio Prot | c0.04 | 0.20 | | 0.12 | 0.32 | c0.11 | 0.10 | c0.10 | 0.02 | 0.06 | 0.05 | |
| v/s Ratio Perm | | | | | | 0.33 | | | 0.02 | | | |
| v/c Ratio | 0.68 | 0.53 | | 0.57 | 0.62 | 0.64 | 0.74 | 0.75 | 0.12 | 0.39 | 0.33 | |
| Uniform Delay, d1 | 58.7 | 30.7 | | 45.9 | 21.7 | 11.4 | 53.5 | 53.6 | 29.4 | 47.7 | 47.2 | |
| Progression Factor | 1.00 | 1.00 | | 0.99 | 0.76 | 1.19 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 12.0 | 1.0 | | 1.2 | 1.0 | 0.6 | 11.1 | 11.4 | 0.1 | 0.3 | 0.1 | |
| Delay (s) | 70.8 | 31.8 | | 46.8 | 17.5 | 14.2 | 64.7 | 65.0 | 29.5 | 48.0 | 47.3 | |
| Level of Service | E | C | | D | B | B | E | E | C | D | D | |
| Approach Delay (s) | | 34.4 | | | 21.5 | | | 47.4 | | | 47.6 | |
| Approach LOS | | C | | | C | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 30.5 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.66 | | |
| Actuated Cycle Length (s) | 128.0 | Sum of lost time (s) | 15.6 |
| Intersection Capacity Utilization | 82.6% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 5: US 101 SB Ramps & San Marin Dr

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 744 | 555 | 192 | 1452 | 0 | 0 | 0 | 0 | 101 | 1 | 750 |
| Future Volume (vph) | 0 | 744 | 555 | 192 | 1452 | 0 | 0 | 0 | 0 | 101 | 1 | 750 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.9 | 4.9 | 3.0 | 5.3 | | | | | | 4.0 | 4.0 |
| Lane Util. Factor | | 0.95 | 1.00 | 1.00 | 0.95 | | | | | | 1.00 | 0.88 |
| Frpb, ped/bikes | | 1.00 | 0.99 | 1.00 | 1.00 | | | | | | 1.00 | 1.00 |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | | | | | 1.00 | 1.00 |
| Frt | | 1.00 | 0.85 | 1.00 | 1.00 | | | | | | 1.00 | 0.85 |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | | 0.95 | 1.00 |
| Satd. Flow (prot) | | 3574 | 1575 | 1805 | 3574 | | | | | | 1810 | 2814 |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | | 0.95 | 1.00 |
| Satd. Flow (perm) | | 3574 | 1575 | 1805 | 3574 | | | | | | 1810 | 2814 |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 0 | 791 | 590 | 204 | 1545 | 0 | 0 | 0 | 0 | 107 | 1 | 798 |
| RTOR Reduction (vph) | 0 | 0 | 335 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 66 |
| Lane Group Flow (vph) | 0 | 791 | 255 | 204 | 1545 | 0 | 0 | 0 | 0 | 0 | 108 | 732 |
| Confl. Peds. (#/hr) | | | 4 | | | | | | | | | |
| Heavy Vehicles (%) | 0% | 1% | 1% | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 1% |
| Turn Type | | NA | Perm | Prot | NA | | | | | Split | NA | Perm |
| Protected Phases | | 2 | | 1 | 6 | | | | | 4 | 4 | |
| Permitted Phases | | | 2 | | | | | | | | | 4 |
| Actuated Green, G (s) | | 28.1 | 28.1 | 8.0 | 38.7 | | | | | | 17.0 | 17.0 |
| Effective Green, g (s) | | 28.1 | 28.1 | 8.0 | 38.7 | | | | | | 17.0 | 17.0 |
| Actuated g/C Ratio | | 0.43 | 0.43 | 0.12 | 0.60 | | | | | | 0.26 | 0.26 |
| Clearance Time (s) | | 4.9 | 4.9 | 3.0 | 5.3 | | | | | | 4.0 | 4.0 |
| Vehicle Extension (s) | | 4.0 | 4.0 | 2.0 | 4.0 | | | | | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | | 1545 | 680 | 222 | 2127 | | | | | | 473 | 735 |
| v/s Ratio Prot | | 0.22 | | c0.11 | c0.43 | | | | | | 0.06 | |
| v/s Ratio Perm | | | 0.16 | | | | | | | | | c0.26 |
| v/c Ratio | | 0.51 | 0.38 | 0.92 | 0.73 | | | | | | 0.23 | 1.00 |
| Uniform Delay, d1 | | 13.5 | 12.5 | 28.2 | 9.4 | | | | | | 18.8 | 24.0 |
| Progression Factor | | 0.43 | 2.82 | 1.00 | 1.00 | | | | | | 1.00 | 1.00 |
| Incremental Delay, d2 | | 1.0 | 1.3 | 37.8 | 2.2 | | | | | | 0.1 | 32.0 |
| Delay (s) | | 6.8 | 36.5 | 66.0 | 11.6 | | | | | | 18.9 | 56.0 |
| Level of Service | | A | D | E | B | | | | | | B | E |
| Approach Delay (s) | | 19.5 | | | 17.9 | | | 0.0 | | | 51.6 | |
| Approach LOS | | B | | | B | | | A | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 26.0 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.87 | | |
| Actuated Cycle Length (s) | 65.0 | Sum of lost time (s) | 11.9 |
| Intersection Capacity Utilization | 113.7% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 5: US 101 SB Ramps & San Marin Dr

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 744 | 555 | 192 | 1452 | 0 | 0 | 0 | 0 | 101 | 1 | 750 |
| Future Volume (vph) | 0 | 744 | 555 | 192 | 1452 | 0 | 0 | 0 | 0 | 101 | 1 | 750 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.9 | 4.9 | 3.0 | 5.3 | | | | | | 4.0 | 4.0 |
| Lane Util. Factor | | 0.91 | 0.91 | 1.00 | 0.95 | | | | | | 1.00 | 0.88 |
| Frpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | | | | | 1.00 | 1.00 |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | | | | | 1.00 | 1.00 |
| Frt | | 0.97 | 0.85 | 1.00 | 1.00 | | | | | | 1.00 | 0.85 |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | | 0.95 | 1.00 |
| Satd. Flow (prot) | | 3324 | 1455 | 1805 | 3574 | | | | | | 1810 | 2814 |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | | 0.95 | 1.00 |
| Satd. Flow (perm) | | 3324 | 1455 | 1805 | 3574 | | | | | | 1810 | 2814 |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 0 | 791 | 590 | 204 | 1545 | 0 | 0 | 0 | 0 | 107 | 1 | 798 |
| RTOR Reduction (vph) | 0 | 11 | 228 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 63 |
| Lane Group Flow (vph) | 0 | 951 | 191 | 204 | 1545 | 0 | 0 | 0 | 0 | 0 | 108 | 735 |
| Confl. Peds. (#/hr) | | | 4 | | | | | | | | | |
| Heavy Vehicles (%) | 0% | 1% | 1% | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 1% |
| Turn Type | | NA | Prot | Prot | NA | | | | | Split | NA | Perm |
| Protected Phases | | 2 | 2 | 1 | 6 | | | | | 4 | 4 | |
| Permitted Phases | | | | | | | | | | | | 4 |
| Actuated Green, G (s) | | 58.2 | 58.2 | 16.7 | 82.9 | | | | | | 35.8 | 35.8 |
| Effective Green, g (s) | | 58.2 | 58.2 | 16.7 | 82.9 | | | | | | 35.8 | 35.8 |
| Actuated g/C Ratio | | 0.45 | 0.45 | 0.13 | 0.65 | | | | | | 0.28 | 0.28 |
| Clearance Time (s) | | 4.9 | 4.9 | 3.0 | 5.3 | | | | | | 4.0 | 4.0 |
| Vehicle Extension (s) | | 4.0 | 4.0 | 2.0 | 4.0 | | | | | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | | 1511 | 661 | 235 | 2314 | | | | | | 506 | 787 |
| v/s Ratio Prot | | 0.29 | 0.13 | c0.11 | c0.43 | | | | | | 0.06 | |
| v/s Ratio Perm | | | | | | | | | | | | c0.26 |
| v/c Ratio | | 0.63 | 0.29 | 0.87 | 0.67 | | | | | | 0.21 | 0.93 |
| Uniform Delay, d1 | | 26.7 | 21.9 | 54.6 | 14.0 | | | | | | 35.3 | 45.0 |
| Progression Factor | | 0.59 | 0.39 | 1.00 | 0.69 | | | | | | 1.00 | 1.00 |
| Incremental Delay, d2 | | 1.9 | 1.0 | 21.6 | 1.2 | | | | | | 0.1 | 17.8 |
| Delay (s) | | 17.7 | 9.6 | 75.9 | 10.8 | | | | | | 35.4 | 62.7 |
| Level of Service | | B | A | E | B | | | | | | D | E |
| Approach Delay (s) | | 15.2 | | | 18.4 | | | 0.0 | | | 59.5 | |
| Approach LOS | | B | | | B | | | A | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 26.5 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.81 | | |
| Actuated Cycle Length (s) | 128.0 | Sum of lost time (s) | 14.9 |
| Intersection Capacity Utilization | 100.7% | ICU Level of Service | G |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 6: US 101 NB Ramps & San Marin Dr

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 411 | 432 | 0 | 0 | 763 | 96 | 875 | 0 | 181 | 0 | 0 | 0 |
| Future Volume (vph) | 411 | 432 | 0 | 0 | 763 | 96 | 875 | 0 | 181 | 0 | 0 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.6 | | | 4.9 | 4.9 | 3.5 | 3.5 | | | | |
| Lane Util. Factor | 0.97 | 1.00 | | | 0.95 | 1.00 | 0.95 | 0.95 | | | | |
| Frpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | 0.99 | 1.00 | 0.99 | | | | |
| Flpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | | | |
| Frt | 1.00 | 1.00 | | | 1.00 | 0.85 | 1.00 | 0.95 | | | | |
| Flt Protected | 0.95 | 1.00 | | | 1.00 | 1.00 | 0.95 | 0.97 | | | | |
| Satd. Flow (prot) | 3467 | 1881 | | | 3574 | 1594 | 1681 | 1606 | | | | |
| Flt Permitted | 0.95 | 1.00 | | | 1.00 | 1.00 | 0.95 | 0.97 | | | | |
| Satd. Flow (perm) | 3467 | 1881 | | | 3574 | 1594 | 1681 | 1606 | | | | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 433 | 455 | 0 | 0 | 803 | 101 | 921 | 0 | 191 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 73 | 0 | 57 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 433 | 455 | 0 | 0 | 803 | 28 | 571 | 484 | 0 | 0 | 0 | 0 |
| Confl. Peds. (#/hr) | | | 3 | | | 1 | | | 1 | 1 | | |
| Heavy Vehicles (%) | 1% | 1% | 0% | 0% | 1% | 0% | 2% | 0% | 3% | 0% | 0% | 0% |
| Turn Type | Prot | NA | | | NA | Perm | Split | NA | | | | |
| Protected Phases | 5 | 2 | | | 6 | | 8 | 8 | | | | |
| Permitted Phases | | | | | | 6 | | | | | | |
| Actuated Green, G (s) | 9.4 | 30.5 | | | 17.3 | 17.3 | 23.5 | 23.5 | | | | |
| Effective Green, g (s) | 9.4 | 30.5 | | | 17.3 | 17.3 | 23.5 | 23.5 | | | | |
| Actuated g/C Ratio | 0.15 | 0.49 | | | 0.28 | 0.28 | 0.38 | 0.38 | | | | |
| Clearance Time (s) | 3.5 | 4.6 | | | 4.9 | 4.9 | 3.5 | 3.5 | | | | |
| Vehicle Extension (s) | 2.0 | 4.0 | | | 4.0 | 4.0 | 2.5 | 2.5 | | | | |
| Lane Grp Cap (vph) | 524 | 923 | | | 995 | 444 | 636 | 607 | | | | |
| v/s Ratio Prot | c0.12 | 0.24 | | | c0.22 | | c0.34 | 0.30 | | | | |
| v/s Ratio Perm | | | | | | 0.02 | | | | | | |
| v/c Ratio | 0.83 | 0.49 | | | 0.81 | 0.06 | 0.90 | 0.80 | | | | |
| Uniform Delay, d1 | 25.6 | 10.6 | | | 20.8 | 16.5 | 18.2 | 17.2 | | | | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | | | |
| Incremental Delay, d2 | 9.8 | 0.6 | | | 5.1 | 0.1 | 15.3 | 7.0 | | | | |
| Delay (s) | 35.4 | 11.2 | | | 26.0 | 16.5 | 33.5 | 24.2 | | | | |
| Level of Service | D | B | | | C | B | C | C | | | | |
| Approach Delay (s) | | 23.0 | | | 24.9 | | | 29.0 | | | 0.0 | |
| Approach LOS | | C | | | C | | | C | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 25.9 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.85 | | |
| Actuated Cycle Length (s) | 62.1 | Sum of lost time (s) | 11.9 |
| Intersection Capacity Utilization | 113.7% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 6: US 101 NB Ramps & San Marin Dr

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 411 | 432 | 0 | 0 | 763 | 96 | 875 | 0 | 181 | 0 | 0 | 0 |
| Future Volume (vph) | 411 | 432 | 0 | 0 | 763 | 96 | 875 | 0 | 181 | 0 | 0 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.6 | | | 4.9 | 4.9 | 3.5 | 3.5 | | | | |
| Lane Util. Factor | 0.97 | 1.00 | | | 0.95 | 1.00 | 0.97 | 1.00 | | | | |
| Frpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | 0.99 | 1.00 | 0.98 | | | | |
| Flpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | | | |
| Frt | 1.00 | 1.00 | | | 1.00 | 0.85 | 1.00 | 0.85 | | | | |
| Flt Protected | 0.95 | 1.00 | | | 1.00 | 1.00 | 0.95 | 1.00 | | | | |
| Satd. Flow (prot) | 3467 | 1881 | | | 3574 | 1594 | 3433 | 1535 | | | | |
| Flt Permitted | 0.95 | 1.00 | | | 1.00 | 1.00 | 0.95 | 1.00 | | | | |
| Satd. Flow (perm) | 3467 | 1881 | | | 3574 | 1594 | 3433 | 1535 | | | | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 433 | 455 | 0 | 0 | 803 | 101 | 921 | 0 | 191 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 50 | 0 | 102 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 433 | 455 | 0 | 0 | 803 | 51 | 921 | 89 | 0 | 0 | 0 | 0 |
| Confl. Peds. (#/hr) | | | 3 | | | 1 | | | 1 | 1 | | |
| Heavy Vehicles (%) | 1% | 1% | 0% | 0% | 1% | 0% | 2% | 0% | 3% | 0% | 0% | 0% |
| Turn Type | Prot | NA | | | NA | Perm | Split | NA | | | | |
| Protected Phases | 5 | 2 | | | 6 | | 8 | 8 | | | | |
| Permitted Phases | | | | | | 6 | | | | | | |
| Actuated Green, G (s) | 20.3 | 60.0 | | | 35.9 | 35.9 | 59.9 | 59.9 | | | | |
| Effective Green, g (s) | 20.3 | 60.0 | | | 35.9 | 35.9 | 59.9 | 59.9 | | | | |
| Actuated g/C Ratio | 0.16 | 0.47 | | | 0.28 | 0.28 | 0.47 | 0.47 | | | | |
| Clearance Time (s) | 3.5 | 4.6 | | | 4.9 | 4.9 | 3.5 | 3.5 | | | | |
| Vehicle Extension (s) | 2.0 | 4.0 | | | 4.0 | 4.0 | 2.5 | 2.5 | | | | |
| Lane Grp Cap (vph) | 549 | 881 | | | 1002 | 447 | 1606 | 718 | | | | |
| v/s Ratio Prot | c0.12 | 0.24 | | | c0.22 | | c0.27 | 0.06 | | | | |
| v/s Ratio Perm | | | | | | 0.03 | | | | | | |
| v/c Ratio | 0.79 | 0.52 | | | 0.80 | 0.11 | 0.57 | 0.12 | | | | |
| Uniform Delay, d1 | 51.8 | 23.8 | | | 42.7 | 34.2 | 24.8 | 19.2 | | | | |
| Progression Factor | 0.73 | 0.38 | | | 1.00 | 1.00 | 1.00 | 1.00 | | | | |
| Incremental Delay, d2 | 5.8 | 0.6 | | | 4.9 | 0.2 | 1.5 | 0.4 | | | | |
| Delay (s) | 43.6 | 9.7 | | | 47.7 | 34.4 | 26.3 | 19.6 | | | | |
| Level of Service | D | A | | | D | C | C | B | | | | |
| Approach Delay (s) | | 26.2 | | | 46.2 | | | 25.1 | | | 0.0 | |
| Approach LOS | | C | | | D | | | C | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 32.0 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.68 | | |
| Actuated Cycle Length (s) | 128.0 | Sum of lost time (s) | 11.9 |
| Intersection Capacity Utilization | 100.7% | ICU Level of Service | G |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 7: Redwood Blvd & Olive St

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 111 | 98 | 36 | 148 | 130 | 116 | 18 | 452 | 140 | 151 | 409 | 87 |
| Future Volume (vph) | 111 | 98 | 36 | 148 | 130 | 116 | 18 | 452 | 140 | 151 | 409 | 87 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 5.1 | 5.1 | | | 5.1 | | 4.0 | 3.9 | 3.9 | 4.0 | 3.9 | |
| Lane Util. Factor | 1.00 | 1.00 | | | 1.00 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | |
| Frt | 1.00 | 0.96 | | | 0.96 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.97 | |
| Flt Protected | 0.95 | 1.00 | | | 0.98 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1770 | 1788 | | | 1756 | | 1770 | 3539 | 1583 | 1770 | 3446 | |
| Flt Permitted | 0.95 | 1.00 | | | 0.98 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1770 | 1788 | | | 1756 | | 1770 | 3539 | 1583 | 1770 | 3446 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 121 | 107 | 39 | 161 | 141 | 126 | 20 | 491 | 152 | 164 | 445 | 95 |
| RTOR Reduction (vph) | 0 | 14 | 0 | 0 | 13 | 0 | 0 | 0 | 102 | 0 | 16 | 0 |
| Lane Group Flow (vph) | 121 | 132 | 0 | 0 | 415 | 0 | 20 | 491 | 50 | 164 | 524 | 0 |
| Turn Type | Split | NA | | Split | NA | | Prot | NA | Perm | Prot | NA | |
| Protected Phases | 4 | 4 | | 8 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | | | | | | | 2 | | | |
| Actuated Green, G (s) | 11.8 | 11.8 | | | 25.4 | | 3.5 | 18.1 | 18.1 | 11.7 | 26.3 | |
| Effective Green, g (s) | 11.8 | 11.8 | | | 25.4 | | 3.5 | 18.1 | 18.1 | 11.7 | 26.3 | |
| Actuated g/C Ratio | 0.14 | 0.14 | | | 0.30 | | 0.04 | 0.21 | 0.21 | 0.14 | 0.31 | |
| Clearance Time (s) | 5.1 | 5.1 | | | 5.1 | | 4.0 | 3.9 | 3.9 | 4.0 | 3.9 | |
| Vehicle Extension (s) | 1.0 | 1.0 | | | 1.0 | | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | |
| Lane Grp Cap (vph) | 245 | 247 | | | 524 | | 72 | 752 | 336 | 243 | 1064 | |
| v/s Ratio Prot | 0.07 | c0.07 | | | c0.24 | | 0.01 | c0.14 | | c0.09 | 0.15 | |
| v/s Ratio Perm | | | | | | | | | 0.03 | | | |
| v/c Ratio | 0.49 | 0.54 | | | 0.79 | | 0.28 | 0.65 | 0.15 | 0.67 | 0.49 | |
| Uniform Delay, d1 | 33.9 | 34.1 | | | 27.4 | | 39.6 | 30.6 | 27.2 | 34.9 | 24.0 | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 0.6 | 1.1 | | | 7.5 | | 0.8 | 1.6 | 0.1 | 5.7 | 0.1 | |
| Delay (s) | 34.5 | 35.2 | | | 35.0 | | 40.3 | 32.2 | 27.3 | 40.6 | 24.1 | |
| Level of Service | C | D | | | C | | D | C | C | D | C | |
| Approach Delay (s) | | 34.9 | | | 35.0 | | | 31.3 | | | 27.9 | |
| Approach LOS | | C | | | C | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 31.4 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.69 | | |
| Actuated Cycle Length (s) | 85.1 | Sum of lost time (s) | 18.1 |
| Intersection Capacity Utilization | 67.0% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis
## 8: Redwood Blvd & Grant Ave

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 100 | 99 | 205 | 25 | 76 | 45 | 225 | 391 | 48 | 35 | 444 | 87 |
| Future Volume (vph) | 100 | 99 | 205 | 25 | 76 | 45 | 225 | 391 | 48 | 35 | 444 | 87 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.5 | 3.5 | | 3.5 | 3.7 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | | 1.00 | 0.99 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.98 | | 1.00 | 0.98 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1763 | 1900 | 1564 | 1803 | 1900 | 1588 | 1805 | 3474 | | 1805 | 3440 | |
| Flt Permitted | 0.70 | 1.00 | 1.00 | 0.69 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1304 | 1900 | 1564 | 1305 | 1900 | 1588 | 1805 | 3474 | | 1805 | 3440 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 109 | 108 | 223 | 27 | 83 | 49 | 245 | 425 | 52 | 38 | 483 | 95 |
| RTOR Reduction (vph) | 0 | 0 | 162 | 0 | 0 | 36 | 0 | 8 | 0 | 0 | 16 | 0 |
| Lane Group Flow (vph) | 109 | 108 | 61 | 27 | 83 | 13 | 245 | 469 | 0 | 38 | 562 | 0 |
| Confl. Peds. (#/hr) | 9 | | 11 | 2 | | 1 | | | 10 | | | 9 |
| Confl. Bikes (#/hr) | | | 5 | | | 5 | | | 5 | | | 5 |
| Heavy Vehicles (%) | 2% | 0% | 1% | 0% | 0% | 0% | 0% | 2% | 0% | 0% | 2% | 0% |
| Turn Type | Perm | NA | Perm | Perm | NA | Perm | Prot | NA | | Prot | NA | |
| Protected Phases | | 8 | | | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | 8 | | 8 | 4 | | 4 | | | | | | |
| Actuated Green, G (s) | 17.7 | 17.7 | 17.7 | 17.7 | 17.7 | 17.7 | 15.6 | 28.9 | | 6.7 | 19.8 | |
| Effective Green, g (s) | 17.7 | 17.7 | 17.7 | 17.7 | 17.7 | 17.7 | 15.6 | 28.9 | | 6.7 | 19.8 | |
| Actuated g/C Ratio | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.24 | 0.45 | | 0.10 | 0.31 | |
| Clearance Time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.5 | 3.5 | | 3.5 | 3.7 | |
| Vehicle Extension (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 2.5 | 3.0 | | 2.5 | 3.0 | |
| Lane Grp Cap (vph) | 358 | 523 | 430 | 359 | 523 | 437 | 437 | 1561 | | 188 | 1059 | |
| v/s Ratio Prot | | 0.06 | | | 0.04 | | c0.14 | 0.13 | | 0.02 | c0.16 | |
| v/s Ratio Perm | c0.08 | | 0.04 | 0.02 | | 0.01 | | | | | | |
| v/c Ratio | 0.30 | 0.21 | 0.14 | 0.08 | 0.16 | 0.03 | 0.56 | 0.30 | | 0.20 | 0.53 | |
| Uniform Delay, d1 | 18.4 | 17.9 | 17.6 | 17.2 | 17.7 | 17.0 | 21.3 | 11.3 | | 26.4 | 18.4 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 0.7 | 0.3 | 0.2 | 0.1 | 0.2 | 0.0 | 1.3 | 0.1 | | 0.4 | 0.5 | |
| Delay (s) | 19.1 | 18.2 | 17.8 | 17.4 | 17.9 | 17.1 | 22.7 | 11.4 | | 26.7 | 18.9 | |
| Level of Service | B | B | B | B | B | B | C | B | | C | B | |
| Approach Delay (s) | | 18.2 | | | 17.5 | | | 15.2 | | | 19.4 | |
| Approach LOS | | B | | | B | | | B | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 17.4 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.46 | | |
| Actuated Cycle Length (s) | 64.3 | Sum of lost time (s) | 11.2 |
| Intersection Capacity Utilization | 56.0% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



# HCM 2010 AWSC
## 9: San Marin Dr/Sutro Ave & Novato Blvd

02/15/2018

| Intersection | |
|---|---|
| Intersection Delay, s/veh | 39.9 |
| Intersection LOS | E |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 108 | 199 | 63 | 21 | 181 | 177 | 116 | 161 | 51 | 197 | 98 | 102 |
| Future Vol, veh/h | 108 | 199 | 63 | 21 | 181 | 177 | 116 | 161 | 51 | 197 | 98 | 102 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 117 | 216 | 68 | 23 | 197 | 192 | 126 | 175 | 55 | 214 | 107 | 111 |
| Number of Lanes | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Opposing Approach | WB | EB | SB | NB |
| Opposing Lanes | 2 | 2 | 3 | 2 |
| Conflicting Approach Left | SB | NB | EB | WB |
| Conflicting Lanes Left | 3 | 2 | 2 | 2 |
| Conflicting Approach Right | NB | SB | WB | EB |
| Conflicting Lanes Right | 2 | 3 | 2 | 2 |
| HCM Control Delay | 31.7 | 79.2 | 25.1 | 22.3 |
| HCM LOS | D | F | D | C |

| Lane | NBLn1 | NBLn2 | EBLn1 | EBLn2 | WBLn1 | WBLn2 | SBLn1 | SBLn2 | SBLn3 |
|---|---|---|---|---|---|---|---|---|---|
| Vol Left, % | 100% | 0% | 100% | 0% | 100% | 0% | 100% | 0% | 0% |
| Vol Thru, % | 0% | 76% | 0% | 76% | 0% | 51% | 0% | 100% | 0% |
| Vol Right, % | 0% | 24% | 0% | 24% | 0% | 49% | 0% | 0% | 100% |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 116 | 212 | 108 | 262 | 21 | 358 | 197 | 98 | 102 |
| LT Vol | 116 | 0 | 108 | 0 | 21 | 0 | 197 | 0 | 0 |
| Through Vol | 0 | 161 | 0 | 199 | 0 | 181 | 0 | 98 | 0 |
| RT Vol | 0 | 51 | 0 | 63 | 0 | 177 | 0 | 0 | 102 |
| Lane Flow Rate | 126 | 230 | 117 | 285 | 23 | 389 | 214 | 107 | 111 |
| Geometry Grp | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Degree of Util (X) | 0.365 | 0.624 | 0.335 | 0.756 | 0.066 | 1.022 | 0.612 | 0.29 | 0.279 |
| Departure Headway (Hd) | 10.76 | 10.056 | 10.475 | 9.779 | 10.336 | 9.458 | 10.542 | 10.019 | 9.286 |
| Convergence, Y/N | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Cap | 337 | 362 | 345 | 373 | 351 | 389 | 345 | 361 | 389 |
| Service Time | 8.46 | 7.756 | 8.175 | 7.479 | 7.969 | 7.092 | 8.242 | 7.719 | 6.986 |
| HCM Lane V/C Ratio | 0.374 | 0.635 | 0.339 | 0.764 | 0.066 | 1 | 0.62 | 0.296 | 0.285 |
| HCM Control Delay | 19.5 | 28.1 | 18.4 | 37.2 | 13.7 | 83 | 28.5 | 16.8 | 15.5 |
| HCM Lane LOS | C | D | C | E | B | F | D | C | C |
| HCM 95th-tile Q | 1.6 | 4 | 1.4 | 6 | 0.2 | 12.7 | 3.8 | 1.2 | 1.1 |

HCM Signalized Intersection Capacity Analysis
9: San Marin Dr/Sutro Ave & Novato Blvd #1 02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 108 | 199 | 63 | 21 | 181 | 177 | 116 | 161 | 51 | 197 | 98 | 102 |
| Future Volume (vph) | 108 | 199 | 63 | 21 | 181 | 177 | 116 | 161 | 51 | 197 | 98 | 102 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 4.0 | | 3.0 | 4.0 | | 3.0 | 4.0 | | 3.0 | 4.0 | 4.0 |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.96 | | 1.00 | 0.93 | | 1.00 | 0.96 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1770 | 1796 | | 1770 | 1725 | | 1770 | 1796 | | 1770 | 1863 | 1583 |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1770 | 1796 | | 1770 | 1725 | | 1770 | 1796 | | 1770 | 1863 | 1583 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 117 | 216 | 68 | 23 | 197 | 192 | 126 | 175 | 55 | 214 | 107 | 111 |
| RTOR Reduction (vph) | 0 | 12 | 0 | 0 | 38 | 0 | 0 | 13 | 0 | 0 | 0 | 77 |
| Lane Group Flow (vph) | 117 | 272 | 0 | 23 | 351 | 0 | 126 | 217 | 0 | 214 | 107 | 34 |
| Turn Type | Prot | NA | | Prot | NA | | Prot | NA | | Prot | NA | Perm |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | | | | | | | | | | 6 |
| Actuated Green, G (s) | 7.0 | 26.0 | | 1.6 | 20.6 | | 7.8 | 15.7 | | 13.5 | 21.4 | 21.4 |
| Effective Green, g (s) | 7.0 | 26.0 | | 1.6 | 20.6 | | 7.8 | 15.7 | | 13.5 | 21.4 | 21.4 |
| Actuated g/C Ratio | 0.10 | 0.37 | | 0.02 | 0.29 | | 0.11 | 0.22 | | 0.19 | 0.30 | 0.30 |
| Clearance Time (s) | 3.0 | 4.0 | | 3.0 | 4.0 | | 3.0 | 4.0 | | 3.0 | 4.0 | 4.0 |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | 175 | 659 | | 40 | 501 | | 195 | 398 | | 337 | 563 | 478 |
| v/s Ratio Prot | c0.07 | 0.15 | | 0.01 | c0.20 | | 0.07 | c0.12 | | c0.12 | 0.06 | |
| v/s Ratio Perm | | | | | | | | | | | | 0.02 |
| v/c Ratio | 0.67 | 0.41 | | 0.57 | 0.70 | | 0.65 | 0.54 | | 0.64 | 0.19 | 0.07 |
| Uniform Delay, d1 | 30.8 | 16.7 | | 34.3 | 22.3 | | 30.2 | 24.4 | | 26.4 | 18.3 | 17.6 |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 9.3 | 0.4 | | 18.4 | 4.4 | | 7.2 | 1.5 | | 3.9 | 0.2 | 0.1 |
| Delay (s) | 40.1 | 17.1 | | 52.7 | 26.7 | | 37.3 | 25.9 | | 30.3 | 18.4 | 17.7 |
| Level of Service | D | B | | D | C | | D | C | | C | B | B |
| Approach Delay (s) | | 23.8 | | | 28.2 | | | 30.0 | | | 24.1 | |
| Approach LOS | | C | | | C | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 26.4 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.64 | | |
| Actuated Cycle Length (s) | 70.8 | Sum of lost time (s) | 14.0 |
| Intersection Capacity Utilization | 62.2% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



# MOVEMENT SUMMARY

## Site: 9 [AM Cumulative]

Novato Boulevard/San Marin Dr-Sutro Ave
AM Cumulative with Project

Roundabout

**Movement Performance - Vehicles**

| Mov ID | OD Mov | Demand Flows Total veh/h | Demand Flows HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance ft | Prop. Queued | Effective Stop Rate per veh | Average Speed mph |
|---|---|---|---|---|---|---|---|---|---|---|---|
| South: NB Sutro Ave | | | | | | | | | | | |
| 3 | L2 | 126 | 2.0 | 0.466 | 11.1 | LOS B | 3.0 | 75.3 | 0.71 | 0.79 | 31.2 |
| 8 | T1 | 175 | 2.0 | 0.466 | 11.1 | LOS B | 3.0 | 75.3 | 0.71 | 0.79 | 31.2 |
| 18 | R2 | 55 | 2.0 | 0.466 | 11.1 | LOS B | 3.0 | 75.3 | 0.71 | 0.79 | 30.4 |
| Approach | | 357 | 2.0 | 0.466 | 11.1 | LOS B | 3.0 | 75.3 | 0.71 | 0.79 | 31.0 |
| East: WB Novato Blvd | | | | | | | | | | | |
| 1 | L2 | 23 | 2.0 | 0.471 | 10.1 | LOS B | 3.1 | 79.3 | 0.66 | 0.68 | 32.3 |
| 6 | T1 | 197 | 2.0 | 0.471 | 10.1 | LOS B | 3.1 | 79.3 | 0.66 | 0.68 | 32.3 |
| 16 | R2 | 192 | 2.0 | 0.471 | 10.1 | LOS B | 3.1 | 79.3 | 0.66 | 0.68 | 31.4 |
| Approach | | 412 | 2.0 | 0.471 | 10.1 | LOS B | 3.1 | 79.3 | 0.66 | 0.68 | 31.9 |
| North: SB San Marin Drive | | | | | | | | | | | |
| 7 | L2 | 214 | 2.0 | 0.317 | 6.8 | LOS A | 1.5 | 37.8 | 0.51 | 0.42 | 32.3 |
| 4 | T1 | 107 | 2.0 | 0.317 | 6.8 | LOS A | 1.5 | 37.8 | 0.51 | 0.42 | 32.3 |
| 14 | R2 | 111 | 2.0 | 0.110 | 4.6 | LOS A | 0.4 | 11.0 | 0.42 | 0.32 | 34.0 |
| Approach | | 432 | 2.0 | 0.317 | 6.2 | LOS A | 1.5 | 37.8 | 0.49 | 0.40 | 32.7 |
| West: EB Novato Blvd | | | | | | | | | | | |
| 5 | L2 | 117 | 2.0 | 0.425 | 8.7 | LOS A | 2.3 | 59.4 | 0.60 | 0.52 | 32.4 |
| 2 | T1 | 216 | 2.0 | 0.425 | 8.7 | LOS A | 2.3 | 59.4 | 0.60 | 0.52 | 32.3 |
| 12 | R2 | 68 | 2.0 | 0.425 | 8.7 | LOS A | 2.3 | 59.4 | 0.60 | 0.52 | 31.5 |
| Approach | | 402 | 2.0 | 0.425 | 8.7 | LOS A | 2.3 | 59.4 | 0.60 | 0.52 | 32.2 |
| All Vehicles | | 1602 | 2.0 | 0.471 | 8.9 | LOS A | 3.1 | 79.3 | 0.61 | 0.59 | 32.0 |

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 735 | 17 | 270 | 480 | 30 | 466 |
| Future Volume (vph) | 735 | 17 | 270 | 480 | 30 | 466 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.9 | | 3.0 | 3.6 | 3.6 | 3.6 |
| Lane Util. Factor | 0.95 | | 1.00 | 0.95 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | | 1.00 | 1.00 | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | | 1.00 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 1.00 | | 0.95 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (prot) | 3561 | | 1787 | 3610 | 1805 | 1593 |
| Flt Permitted | 1.00 | | 0.95 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (perm) | 3561 | | 1787 | 3610 | 1805 | 1593 |
| Peak-hour factor, PHF | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 |
| Adj. Flow (vph) | 865 | 20 | 318 | 565 | 35 | 548 |
| RTOR Reduction (vph) | 1 | 0 | 0 | 0 | 0 | 348 |
| Lane Group Flow (vph) | 884 | 0 | 318 | 565 | 35 | 200 |
| Confl. Peds. (#/hr) | | 3 | | | 6 | 2 |
| Heavy Vehicles (%) | 1% | 0% | 1% | 0% | 0% | 0% |
| Turn Type | NA | | Prot | NA | Prot | Perm |
| Protected Phases | 2 | | 1 | 6 | 4 | |
| Permitted Phases | | | | | | 4 |
| Actuated Green, G (s) | 45.8 | | 18.0 | 46.1 | 15.7 | 15.7 |
| Effective Green, g (s) | 45.8 | | 18.0 | 46.1 | 15.7 | 15.7 |
| Actuated g/C Ratio | 0.51 | | 0.20 | 0.51 | 0.17 | 0.17 |
| Clearance Time (s) | 3.9 | | 3.0 | 3.6 | 3.6 | 3.6 |
| Vehicle Extension (s) | 3.0 | | 2.0 | 3.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 1812 | | 357 | 1849 | 314 | 277 |
| v/s Ratio Prot | c0.25 | | c0.18 | 0.16 | 0.02 | |
| v/s Ratio Perm | | | | | | c0.13 |
| v/c Ratio | 0.49 | | 0.89 | 0.31 | 0.11 | 0.72 |
| Uniform Delay, d1 | 14.4 | | 35.0 | 12.7 | 31.3 | 35.1 |
| Progression Factor | 1.00 | | 1.03 | 0.49 | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.9 | | 21.4 | 0.4 | 0.1 | 7.7 |
| Delay (s) | 15.4 | | 57.4 | 6.6 | 31.3 | 42.8 |
| Level of Service | B | | E | A | C | D |
| Approach Delay (s) | 15.4 | | | 24.9 | 42.1 | |
| Approach LOS | B | | | C | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 25.6 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.62 | | |
| Actuated Cycle Length (s) | 90.0 | Sum of lost time (s) | 10.5 |
| Intersection Capacity Utilization | 56.6% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group





| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 291 | 890 | 493 | 96 | 87 | 277 |
| Future Volume (vph) | 291 | 890 | 493 | 96 | 87 | 277 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.9 | 3.6 | | 3.0 | 3.0 |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.98 | | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 3574 | 3510 | | 1805 | 1599 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | 1805 | 3574 | 3510 | | 1805 | 1599 |
| Peak-hour factor, PHF | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 |
| Adj. Flow (vph) | 342 | 1047 | 580 | 113 | 102 | 326 |
| RTOR Reduction (vph) | 0 | 0 | 14 | 0 | 0 | 267 |
| Lane Group Flow (vph) | 342 | 1047 | 679 | 0 | 102 | 59 |
| Confl. Peds. (#/hr) | | | | | 2 | |
| Confl. Bikes (#/hr) | | | | 1 | | |
| Heavy Vehicles (%) | 0% | 1% | 0% | 0% | 0% | 1% |
| Turn Type | Prot | NA | NA | | Prot | Perm |
| Protected Phases | 5 | 2 | 6 | | 8 | |
| Permitted Phases | | | | | | 8 |
| Actuated Green, G (s) | 18.0 | 45.8 | 46.1 | | 16.3 | 16.3 |
| Effective Green, g (s) | 18.0 | 45.8 | 46.1 | | 16.3 | 16.3 |
| Actuated g/C Ratio | 0.20 | 0.51 | 0.51 | | 0.18 | 0.18 |
| Clearance Time (s) | 3.0 | 3.9 | 3.6 | | 3.0 | 3.0 |
| Vehicle Extension (s) | 2.0 | 3.0 | 3.0 | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 361 | 1818 | 1797 | | 326 | 289 |
| v/s Ratio Prot | c0.19 | c0.29 | 0.19 | | c0.06 | |
| v/s Ratio Perm | | | | | | 0.04 |
| v/c Ratio | 0.95 | 0.58 | 0.38 | | 0.31 | 0.20 |
| Uniform Delay, d1 | 35.5 | 15.4 | 13.3 | | 32.0 | 31.3 |
| Progression Factor | 1.05 | 0.49 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 31.9 | 1.1 | 0.6 | | 0.2 | 0.1 |
| Delay (s) | 69.3 | 8.6 | 13.9 | | 32.2 | 31.5 |
| Level of Service | E | A | B | | C | C |
| Approach Delay (s) | | 23.6 | 13.9 | | 31.6 | |
| Approach LOS | | C | B | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 22.3 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.61 | | |
| Actuated Cycle Length (s) | 90.0 | Sum of lost time (s) | 10.5 |
| Intersection Capacity Utilization | 47.8% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 12: Novato Blvd & Grant Ave

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 200 | 887 | 3 | 4 | 439 | 60 | 1 | 0 | 2 | 37 | 1 | 186 |
| Future Volume (vph) | 200 | 887 | 3 | 4 | 439 | 60 | 1 | 0 | 2 | 37 | 1 | 186 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.5 | 4.5 | 3.5 | 4.9 | 4.9 | | 4.0 | | 3.5 | 3.5 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 | | 1.00 | | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.96 | | 0.97 | | 1.00 | 0.98 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | | 0.98 | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | | 0.91 | | 1.00 | 0.85 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 0.98 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1787 | 1863 | 1576 | 1805 | 3539 | 1534 | | 1644 | | 1748 | 1569 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 0.70 | | 0.76 | 1.00 | |
| Satd. Flow (perm) | 1787 | 1863 | 1576 | 1805 | 3539 | 1534 | | 1168 | | 1390 | 1569 | |
| Peak-hour factor, PHF | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 |
| Adj. Flow (vph) | 235 | 1044 | 4 | 5 | 516 | 71 | 1 | 0 | 2 | 44 | 1 | 219 |
| RTOR Reduction (vph) | 0 | 0 | 1 | 0 | 0 | 28 | 0 | 3 | 0 | 0 | 194 | 0 |
| Lane Group Flow (vph) | 235 | 1044 | 3 | 5 | 516 | 43 | 0 | 0 | 0 | 44 | 26 | 0 |
| Confl. Peds. (#/hr) | | | 1 | | | 8 | 5 | | 12 | 12 | | 5 |
| Confl. Bikes (#/hr) | | | 4 | | | 2 | | | 2 | | | 1 |
| Heavy Vehicles (%) | 1% | 2% | 0% | 0% | 2% | 1% | 0% | 0% | 0% | 1% | 0% | 1% |
| Turn Type | Prot | NA | Perm | Prot | NA | Perm | Perm | NA | | Perm | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | 2 | | | 6 | 8 | | | 4 | | |
| Actuated Green, G (s) | 16.7 | 75.9 | 75.9 | 1.2 | 60.0 | 60.0 | | 10.9 | | 11.4 | 11.4 | |
| Effective Green, g (s) | 16.7 | 75.9 | 75.9 | 1.2 | 60.0 | 60.0 | | 10.9 | | 11.4 | 11.4 | |
| Actuated g/C Ratio | 0.17 | 0.76 | 0.76 | 0.01 | 0.60 | 0.60 | | 0.11 | | 0.11 | 0.11 | |
| Clearance Time (s) | 3.5 | 4.5 | 4.5 | 3.5 | 4.9 | 4.9 | | 4.0 | | 3.5 | 3.5 | |
| Vehicle Extension (s) | 2.0 | 3.0 | 3.0 | 2.0 | 3.0 | 3.0 | | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 298 | 1414 | 1196 | 21 | 2123 | 920 | | 127 | | 158 | 178 | |
| v/s Ratio Prot | c0.13 | c0.56 | | 0.00 | 0.15 | | | | | | 0.02 | |
| v/s Ratio Perm | | | 0.00 | | | 0.03 | | 0.00 | | c0.03 | | |
| v/c Ratio | 0.79 | 0.74 | 0.00 | 0.24 | 0.24 | 0.05 | | 0.00 | | 0.28 | 0.15 | |
| Uniform Delay, d1 | 40.0 | 6.6 | 2.9 | 48.9 | 9.4 | 8.2 | | 39.7 | | 40.5 | 39.9 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 0.87 | 1.01 | 1.52 | | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 12.0 | 2.1 | 0.0 | 2.0 | 0.3 | 0.1 | | 0.0 | | 0.4 | 0.1 | |
| Delay (s) | 52.0 | 8.7 | 2.9 | 44.8 | 9.7 | 12.6 | | 39.7 | | 40.9 | 40.1 | |
| Level of Service | D | A | A | D | A | B | | D | | D | D | |
| Approach Delay (s) | | 16.6 | | | 10.3 | | | 39.7 | | | 40.2 | |
| Approach LOS | | B | | | B | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 17.8 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.72 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 12.4 |
| Intersection Capacity Utilization | 75.8% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 13: Tamalpais Ave/7th St & Novato Blvd

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 96 | 795 | 37 | 62 | 462 | 122 | 39 | 102 | 38 | 72 | 109 | 46 |
| Future Volume (vph) | 96 | 795 | 37 | 62 | 462 | 122 | 39 | 102 | 38 | 72 | 109 | 46 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 5.0 | | 3.5 | 5.0 | 5.0 | 3.5 | 3.5 | | 3.5 | 3.5 | 3.5 |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 0.95 | 1.00 | 0.99 | | 1.00 | 1.00 | 0.96 |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 0.99 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.99 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.96 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1787 | 1847 | | 1787 | 1863 | 1523 | 1770 | 1794 | | 1784 | 1881 | 1531 |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.56 | 1.00 | | 0.46 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1787 | 1847 | | 1787 | 1863 | 1523 | 1049 | 1794 | | 862 | 1881 | 1531 |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 102 | 846 | 39 | 66 | 491 | 130 | 41 | 109 | 40 | 77 | 116 | 49 |
| RTOR Reduction (vph) | 0 | 1 | 0 | 0 | 0 | 19 | 0 | 15 | 0 | 0 | 0 | 42 |
| Lane Group Flow (vph) | 102 | 884 | 0 | 66 | 491 | 111 | 41 | 134 | 0 | 77 | 116 | 7 |
| Confl. Peds. (#/hr) | | | 11 | | | 17 | 6 | | 1 | 1 | | 6 |
| Confl. Bikes (#/hr) | | | 9 | | | 1 | | | 1 | | | 4 |
| Heavy Vehicles (%) | 1% | 2% | 1% | 1% | 2% | 1% | 1% | 1% | 1% | 1% | 1% | 1% |
| Turn Type | Prot | NA | | Prot | NA | Perm | Perm | NA | | Perm | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | | | | 6 | 8 | | | 4 | | 4 |
| Actuated Green, G (s) | 9.2 | 66.3 | | 7.8 | 64.9 | 64.9 | 13.9 | 13.9 | | 13.9 | 13.9 | 13.9 |
| Effective Green, g (s) | 9.2 | 66.3 | | 7.8 | 64.9 | 64.9 | 13.9 | 13.9 | | 13.9 | 13.9 | 13.9 |
| Actuated g/C Ratio | 0.09 | 0.66 | | 0.08 | 0.65 | 0.65 | 0.14 | 0.14 | | 0.14 | 0.14 | 0.14 |
| Clearance Time (s) | 3.5 | 5.0 | | 3.5 | 5.0 | 5.0 | 3.5 | 3.5 | | 3.5 | 3.5 | 3.5 |
| Vehicle Extension (s) | 2.0 | 5.0 | | 2.0 | 5.0 | 5.0 | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 164 | 1224 | | 139 | 1209 | 988 | 145 | 249 | | 119 | 261 | 212 |
| v/s Ratio Prot | c0.06 | c0.48 | | 0.04 | 0.26 | | | 0.07 | | | 0.06 | |
| v/s Ratio Perm | | | | | | 0.07 | 0.04 | | | c0.09 | | 0.00 |
| v/c Ratio | 0.62 | 0.72 | | 0.47 | 0.41 | 0.11 | 0.28 | 0.54 | | 0.65 | 0.44 | 0.03 |
| Uniform Delay, d1 | 43.7 | 10.9 | | 44.1 | 8.4 | 6.6 | 38.6 | 40.1 | | 40.7 | 39.5 | 37.2 |
| Progression Factor | 0.87 | 1.05 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 3.7 | 2.7 | | 0.9 | 1.0 | 0.2 | 0.4 | 1.1 | | 8.7 | 0.4 | 0.0 |
| Delay (s) | 41.8 | 14.1 | | 45.1 | 9.4 | 6.9 | 39.0 | 41.2 | | 49.5 | 39.9 | 37.3 |
| Level of Service | D | B | | D | A | A | D | D | | D | D | D |
| Approach Delay (s) | | 17.0 | | | 12.3 | | | 40.7 | | | 42.4 | |
| Approach LOS | | B | | | B | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 20.5 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.71 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 82.5% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 14: Novato Blvd & Diablo Ave

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 22 | 244 | 37 | 200 | 245 | 325 | 36 | 308 | 212 | 482 | 423 | 28 |
| Future Volume (vph) | 22 | 244 | 37 | 200 | 245 | 325 | 36 | 308 | 212 | 482 | 423 | 28 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 12 | 12 | 11 | 11 | 12 | 11 | 11 | 12 | 12 | 12 | 12 |
| Total Lost time (s) | | 3.7 | | 4.1 | 4.1 | 4.1 | 4.4 | 4.4 | 4.4 | 4.1 | 4.1 | |
| Lane Util. Factor | | 0.95 | | 0.91 | 0.91 | 1.00 | 1.00 | 1.00 | 1.00 | 0.91 | 0.91 | |
| Frpb, ped/bikes | | 1.00 | | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | | 0.98 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | |
| Flt Protected | | 1.00 | | 0.95 | 0.99 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.99 | |
| Satd. Flow (prot) | | 3487 | | 1557 | 3273 | 1510 | 1728 | 1801 | 1556 | 1610 | 3319 | |
| Flt Permitted | | 1.00 | | 0.95 | 0.99 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.99 | |
| Satd. Flow (perm) | | 3487 | | 1557 | 3273 | 1510 | 1728 | 1801 | 1556 | 1610 | 3319 | |
| Peak-hour factor, PHF | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Adj. Flow (vph) | 22 | 249 | 38 | 204 | 250 | 332 | 37 | 314 | 216 | 492 | 432 | 29 |
| RTOR Reduction (vph) | 0 | 8 | 0 | 0 | 0 | 217 | 0 | 0 | 166 | 0 | 2 | 0 |
| Lane Group Flow (vph) | 0 | 301 | 0 | 147 | 307 | 115 | 37 | 314 | 50 | 310 | 641 | 0 |
| Confl. Peds. (#/hr) | | | 7 | | | 15 | | | 2 | | | 4 |
| Confl. Bikes (#/hr) | | | 1 | | | 1 | | | 3 | | | 5 |
| Heavy Vehicles (%) | 1% | 1% | 1% | 2% | 1% | 2% | 1% | 2% | 2% | 2% | 2% | 1% |
| Turn Type | Split | NA | | Split | NA | Perm | Split | NA | Perm | Split | NA | |
| Protected Phases | 3 | 3 | | 4 | 4 | | 1 | 1 | | 2 | 2 | |
| Permitted Phases | | | | | | 4 | | | 1 | | 2 | |
| Actuated Green, G (s) | | 14.6 | | 15.3 | 15.3 | 15.3 | 21.1 | 21.1 | 21.1 | 24.5 | 24.5 | |
| Effective Green, g (s) | | 14.6 | | 15.3 | 15.3 | 15.3 | 21.1 | 21.1 | 21.1 | 24.5 | 24.5 | |
| Actuated g/C Ratio | | 0.16 | | 0.17 | 0.17 | 0.17 | 0.23 | 0.23 | 0.23 | 0.27 | 0.27 | |
| Clearance Time (s) | | 3.7 | | 4.1 | 4.1 | 4.1 | 4.4 | 4.4 | 4.4 | 4.1 | 4.1 | |
| Vehicle Extension (s) | | 2.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | | 554 | | 259 | 545 | 251 | 397 | 413 | 357 | 429 | 885 | |
| v/s Ratio Prot | | c0.09 | | c0.09 | 0.09 | | 0.02 | c0.17 | | 0.19 | c0.19 | |
| v/s Ratio Perm | | | | | | 0.08 | | | 0.03 | | | |
| v/c Ratio | | 0.54 | | 0.57 | 0.56 | 0.46 | 0.09 | 0.76 | 0.14 | 0.72 | 0.72 | |
| Uniform Delay, d1 | | 35.5 | | 35.2 | 35.2 | 34.5 | 27.8 | 33.0 | 28.1 | 30.6 | 30.6 | |
| Progression Factor | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 0.6 | | 1.7 | 0.8 | 0.5 | 0.0 | 7.3 | 0.1 | 5.0 | 2.5 | |
| Delay (s) | | 36.1 | | 36.9 | 36.0 | 35.0 | 27.9 | 40.2 | 28.2 | 35.6 | 33.1 | |
| Level of Service | | D | | D | D | D | C | D | C | D | C | |
| Approach Delay (s) | | 36.1 | | | 35.7 | | | 34.8 | | | 33.9 | |
| Approach LOS | | D | | | D | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 34.9 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.67 | | |
| Actuated Cycle Length (s) | 91.8 | Sum of lost time (s) | 16.3 |
| Intersection Capacity Utilization | 73.8% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 14: Diablo Ave & Novato Blvd

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 22 | 244 | 37 | 200 | 245 | 325 | 36 | 308 | 212 | 482 | 423 | 28 |
| Future Volume (vph) | 22 | 244 | 37 | 200 | 245 | 325 | 36 | 308 | 212 | 482 | 423 | 28 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 11 | 11 | 11 | 11 | 11 | 12 | 11 | 11 | 12 | 10 | 12 | 12 |
| Total Lost time (s) | 4.0 | 4.1 | 4.1 | 4.0 | 4.0 | 4.0 | 4.0 | 4.1 | | 4.0 | 4.0 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | | 0.97 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.98 | 1.00 | 0.99 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.94 | | 1.00 | 0.99 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1728 | 1818 | 1518 | 1711 | 1818 | 1558 | 1728 | 3190 | | 3204 | 1843 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1728 | 1818 | 1518 | 1711 | 1818 | 1558 | 1728 | 3190 | | 3204 | 1843 | |
| Peak-hour factor, PHF | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Adj. Flow (vph) | 22 | 249 | 38 | 204 | 250 | 332 | 37 | 314 | 216 | 492 | 432 | 29 |
| RTOR Reduction (vph) | 0 | 0 | 29 | 0 | 0 | 135 | 0 | 124 | 0 | 0 | 2 | 0 |
| Lane Group Flow (vph) | 22 | 249 | 9 | 204 | 250 | 197 | 37 | 406 | 0 | 492 | 459 | 0 |
| Confl. Peds. (#/hr) | | | 7 | | | 15 | | | 2 | | | 4 |
| Confl. Bikes (#/hr) | | | 1 | | | 1 | | | 3 | | | 5 |
| Heavy Vehicles (%) | 1% | 1% | 1% | 2% | 1% | 2% | 1% | 2% | 2% | 2% | 2% | 1% |
| Turn Type | Prot | NA | Perm | Prot | NA | pm+ov | Prot | NA | | Prot | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | 1 | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | 4 | | | 8 | | | | | | |
| Actuated Green, G (s) | 1.7 | 19.5 | 19.5 | 13.5 | 31.4 | 48.0 | 3.3 | 18.3 | | 16.6 | 31.7 | |
| Effective Green, g (s) | 1.7 | 19.5 | 19.5 | 13.5 | 31.4 | 48.0 | 3.3 | 18.3 | | 16.6 | 31.7 | |
| Actuated g/C Ratio | 0.02 | 0.23 | 0.23 | 0.16 | 0.37 | 0.57 | 0.04 | 0.22 | | 0.20 | 0.38 | |
| Clearance Time (s) | 4.0 | 4.1 | 4.1 | 4.0 | 4.0 | 4.0 | 4.0 | 4.1 | | 4.0 | 4.0 | |
| Vehicle Extension (s) | 3.0 | 2.0 | 2.0 | 3.0 | 3.0 | 3.0 | 3.0 | 2.0 | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 34 | 421 | 351 | 274 | 678 | 963 | 67 | 694 | | 632 | 694 | |
| v/s Ratio Prot | 0.01 | c0.14 | | c0.12 | 0.14 | 0.04 | 0.02 | 0.13 | | c0.15 | c0.25 | |
| v/s Ratio Perm | | | 0.01 | | | 0.09 | | | | | | |
| v/c Ratio | 0.65 | 0.59 | 0.03 | 0.74 | 0.37 | 0.20 | 0.55 | 0.59 | | 0.78 | 0.66 | |
| Uniform Delay, d1 | 40.9 | 28.8 | 25.0 | 33.7 | 19.1 | 8.8 | 39.7 | 29.5 | | 32.0 | 21.7 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 35.3 | 1.5 | 0.0 | 10.5 | 0.3 | 0.1 | 9.5 | 0.8 | | 6.0 | 2.4 | |
| Delay (s) | 76.2 | 30.2 | 25.0 | 44.1 | 19.5 | 8.9 | 49.2 | 30.3 | | 38.0 | 24.1 | |
| Level of Service | E | C | C | D | B | A | D | C | | D | C | |
| Approach Delay (s) | | 32.9 | | | 21.4 | | | 31.5 | | | 31.3 | |
| Approach LOS | | C | | | C | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 28.6 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.71 | | |
| Actuated Cycle Length (s) | 84.1 | Sum of lost time (s) | 16.2 |
| Intersection Capacity Utilization | 70.4% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
## 15: Redwood Blvd & Diablo Ave/De Long Ave



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 234 | 497 | 168 | 156 | 575 | 216 | 54 | 143 | 31 | 222 | 276 | 171 |
| Future Volume (vph) | 234 | 497 | 168 | 156 | 575 | 216 | 54 | 143 | 31 | 222 | 276 | 171 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 9 |
| Total Lost time (s) | 5.0 | 4.0 | | 5.0 | 4.1 | | 4.0 | 4.8 | 4.8 | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 0.95 | | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 | 0.97 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 0.99 | | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.98 |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.96 | | 1.00 | 0.96 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3467 | 3456 | | 1805 | 3349 | | 1805 | 3610 | 1505 | 3303 | 1900 | 1408 |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3467 | 3456 | | 1805 | 3349 | | 1805 | 3610 | 1505 | 3303 | 1900 | 1408 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 254 | 540 | 183 | 170 | 625 | 235 | 59 | 155 | 34 | 241 | 300 | 186 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 0 | 0 | 58 |
| Lane Group Flow (vph) | 254 | 723 | 0 | 170 | 860 | 0 | 59 | 155 | 19 | 241 | 300 | 128 |
| Confl. Peds. (#/hr) | | | 5 | | | 5 | | | 5 | | | 5 |
| Confl. Bikes (#/hr) | | | 5 | | | 5 | | | 5 | | | 5 |
| Heavy Vehicles (%) | 1% | 0% | 0% | 0% | 2% | 5% | 0% | 0% | 5% | 6% | 0% | 1% |
| Turn Type | Prot | NA | | Prot | NA | | Prot | NA | Perm | Prot | NA | Perm |
| Protected Phases | 3 | 8 | | 7 | 4 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | | | | | | | 2 | | | 6 |
| Actuated Green, G (s) | 17.0 | 48.2 | | 17.0 | 48.1 | | 10.4 | 36.0 | 36.0 | 11.0 | 37.4 | 37.4 |
| Effective Green, g (s) | 17.0 | 48.2 | | 17.0 | 48.1 | | 10.4 | 36.0 | 36.0 | 11.0 | 37.4 | 37.4 |
| Actuated g/C Ratio | 0.13 | 0.37 | | 0.13 | 0.37 | | 0.08 | 0.28 | 0.28 | 0.08 | 0.29 | 0.29 |
| Clearance Time (s) | 5.0 | 4.0 | | 5.0 | 4.1 | | 4.0 | 4.8 | 4.8 | 4.0 | 4.0 | 4.0 |
| Vehicle Extension (s) | 2.5 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 453 | 1281 | | 236 | 1239 | | 144 | 999 | 416 | 279 | 546 | 405 |
| v/s Ratio Prot | 0.07 | 0.21 | | c0.09 | c0.26 | | 0.03 | 0.04 | | c0.07 | c0.16 | |
| v/s Ratio Perm | | | | | | | | | 0.01 | | | 0.09 |
| v/c Ratio | 0.56 | 0.56 | | 0.72 | 0.69 | | 0.41 | 0.16 | 0.05 | 0.86 | 0.55 | 0.32 |
| Uniform Delay, d1 | 53.0 | 32.5 | | 54.2 | 34.7 | | 56.9 | 35.5 | 34.4 | 58.8 | 39.2 | 36.3 |
| Progression Factor | 1.00 | 1.00 | | 1.12 | 0.89 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 1.3 | 1.8 | | 7.6 | 2.8 | | 0.7 | 0.3 | 0.2 | 22.4 | 3.9 | 2.0 |
| Delay (s) | 54.3 | 34.4 | | 68.3 | 33.6 | | 57.6 | 35.8 | 34.6 | 81.2 | 43.1 | 38.3 |
| Level of Service | D | C | | E | C | | E | D | C | F | D | D |
| Approach Delay (s) | | 39.5 | | | 39.3 | | | 40.8 | | | 54.5 | |
| Approach LOS | | D | | | D | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 43.2 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.67 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 17.9 |
| Intersection Capacity Utilization | 103.4% | ICU Level of Service | G |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
## 16: Reichert Ave & De Long Ave



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 71 | 690 | 14 | 66 | 954 | 208 | 13 | 22 | 40 | 192 | 37 | 78 |
| Future Volume (vph) | 71 | 690 | 14 | 66 | 954 | 208 | 13 | 22 | 40 | 192 | 37 | 78 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 0.95 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 0.99 | | 1.00 | 1.00 | 0.98 | 1.00 | 0.98 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 0.99 | 1.00 | 1.00 | 0.99 | 1.00 | |
| Frt | 1.00 | 1.00 | | 1.00 | 0.97 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.90 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1805 | 3527 | | 1805 | 3459 | | 1793 | 1900 | 1578 | 1778 | 1676 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.55 | 1.00 | 1.00 | 0.74 | 1.00 | |
| Satd. Flow (perm) | 1805 | 3527 | | 1805 | 3459 | | 1041 | 1900 | 1578 | 1388 | 1676 | |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Adj. Flow (vph) | 79 | 767 | 16 | 73 | 1060 | 231 | 14 | 24 | 44 | 213 | 41 | 87 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 9 | 0 | 27 | 0 |
| Lane Group Flow (vph) | 79 | 783 | 0 | 73 | 1285 | 0 | 14 | 24 | 35 | 213 | 101 | 0 |
| Confl. Peds. (#/hr) | | | 6 | | | 3 | 6 | | 4 | 4 | | 6 |
| Confl. Bikes (#/hr) | | | 5 | | | 5 | | | 5 | | | 5 |
| Heavy Vehicles (%) | 0% | 2% | 0% | 0% | 1% | 1% | 0% | 0% | 0% | 1% | 0% | 0% |
| Turn Type | Prot | NA | | Prot | NA | | Perm | NA | Perm | Perm | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | | | | | 8 | | 8 | 4 | | |
| Actuated Green, G (s) | 9.0 | 85.8 | | 8.7 | 85.5 | | 24.9 | 24.9 | 24.9 | 24.9 | 24.9 | |
| Effective Green, g (s) | 9.0 | 85.8 | | 8.7 | 85.5 | | 24.9 | 24.9 | 24.9 | 24.9 | 24.9 | |
| Actuated g/C Ratio | 0.07 | 0.66 | | 0.07 | 0.66 | | 0.19 | 0.19 | 0.19 | 0.19 | 0.19 | |
| Clearance Time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | |
| Vehicle Extension (s) | 2.0 | 3.0 | | 2.0 | 3.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 124 | 2327 | | 120 | 2274 | | 199 | 363 | 302 | 265 | 321 | |
| v/s Ratio Prot | c0.04 | 0.22 | | 0.04 | c0.37 | | | 0.01 | | | 0.06 | |
| v/s Ratio Perm | | | | | | | 0.01 | | 0.02 | c0.15 | | |
| v/c Ratio | 0.64 | 0.34 | | 0.61 | 0.57 | | 0.07 | 0.07 | 0.12 | 0.80 | 0.31 | |
| Uniform Delay, d1 | 58.9 | 9.7 | | 59.0 | 12.1 | | 43.1 | 43.0 | 43.5 | 50.2 | 45.2 | |
| Progression Factor | 1.00 | 1.15 | | 1.09 | 0.97 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 6.2 | 0.3 | | 5.5 | 1.0 | | 0.1 | 0.0 | 0.1 | 15.2 | 0.2 | |
| Delay (s) | 65.2 | 11.5 | | 70.1 | 12.7 | | 43.1 | 43.1 | 43.5 | 65.4 | 45.4 | |
| Level of Service | E | B | | E | B | | D | D | D | E | D | |
| Approach Delay (s) | | 16.4 | | | 15.8 | | | 43.3 | | | 57.9 | |
| Approach LOS | | B | | | B | | | D | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 22.3 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.62 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 68.9% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 17: US 101 SB Ramps & De Long Ave

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 194 | 696 | 20 | 845 | 0 | 0 | 0 | 0 | 12 | 2 | 313 |
| Future Volume (vph) | 0 | 194 | 696 | 20 | 845 | 0 | 0 | 0 | 0 | 12 | 2 | 313 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.6 | 3.6 | 3.0 | 3.6 | | | | | 4.0 | 4.0 | |
| Lane Util. Factor | | 0.95 | 1.00 | 1.00 | 0.95 | | | | | 0.95 | 0.95 | |
| Frt | | 1.00 | 0.85 | 1.00 | 1.00 | | | | | 1.00 | 0.85 | |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 3574 | 1599 | 1770 | 3539 | | | | | 1681 | 1506 | |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | 0.95 | 1.00 | |
| Satd. Flow (perm) | | 3574 | 1599 | 1770 | 3539 | | | | | 1681 | 1506 | |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 0 | 206 | 740 | 21 | 899 | 0 | 0 | 0 | 0 | 13 | 2 | 333 |
| RTOR Reduction (vph) | 0 | 0 | 293 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 110 | 0 |
| Lane Group Flow (vph) | 0 | 206 | 447 | 21 | 899 | 0 | 0 | 0 | 0 | 12 | 226 | 0 |
| Heavy Vehicles (%) | 0% | 1% | 1% | 2% | 2% | 2% | 2% | 2% | 2% | 2% | 2% | 2% |
| Turn Type | | NA | Perm | Prot | NA | | | | | Split | NA | |
| Protected Phases | | 6 | | 5 | 2 | | | | | 4 | 4 | |
| Permitted Phases | | | 6 | | | | | | | | | |
| Actuated Green, G (s) | | 39.3 | 39.3 | 1.4 | 43.7 | | | | | 13.7 | 13.7 | |
| Effective Green, g (s) | | 39.3 | 39.3 | 1.4 | 43.7 | | | | | 13.7 | 13.7 | |
| Actuated g/C Ratio | | 0.60 | 0.60 | 0.02 | 0.67 | | | | | 0.21 | 0.21 | |
| Clearance Time (s) | | 3.6 | 3.6 | 3.0 | 3.6 | | | | | 4.0 | 4.0 | |
| Vehicle Extension (s) | | 4.0 | 4.0 | 2.0 | 4.0 | | | | | 2.5 | 2.5 | |
| Lane Grp Cap (vph) | | 2160 | 966 | 38 | 2379 | | | | | 354 | 317 | |
| v/s Ratio Prot | | 0.06 | | c0.01 | 0.25 | | | | | 0.01 | c0.15 | |
| v/s Ratio Perm | | | c0.28 | | | | | | | | | |
| v/c Ratio | | 0.10 | 0.46 | 0.55 | 0.38 | | | | | 0.03 | 0.71 | |
| Uniform Delay, d1 | | 5.4 | 7.1 | 31.5 | 4.7 | | | | | 20.4 | 23.8 | |
| Progression Factor | | 1.01 | 7.02 | 1.00 | 1.00 | | | | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 0.1 | 1.5 | 9.5 | 0.5 | | | | | 0.0 | 6.9 | |
| Delay (s) | | 5.5 | 51.0 | 41.0 | 5.1 | | | | | 20.4 | 30.8 | |
| Level of Service | | A | D | D | A | | | | | C | C | |
| Approach Delay (s) | | 41.1 | | | 6.0 | | | 0.0 | | | 30.4 | |
| Approach LOS | | D | | | A | | | A | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 24.8 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.53 | | |
| Actuated Cycle Length (s) | 65.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 66.5% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 18: US 101 NB Ramps & De Long Ave

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 173 | 34 | 0 | 1 | 58 | 9 | 808 | 2 | 18 | 0 | 0 | 0 |
| Future Volume (vph) | 173 | 34 | 0 | 1 | 58 | 9 | 808 | 2 | 18 | 0 | 0 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 3.6 | | | 3.6 | | 4.5 | 4.5 | | | | |
| Lane Util. Factor | 1.00 | 0.95 | | | 0.95 | | 0.95 | 0.95 | | | | |
| Frt | 1.00 | 1.00 | | | 0.98 | | 1.00 | 0.99 | | | | |
| Flt Protected | 0.95 | 1.00 | | | 1.00 | | 0.95 | 0.95 | | | | |
| Satd. Flow (prot) | 1770 | 3610 | | | 3478 | | 1698 | 1690 | | | | |
| Flt Permitted | 0.95 | 1.00 | | | 0.95 | | 0.95 | 0.95 | | | | |
| Satd. Flow (perm) | 1770 | 3610 | | | 3310 | | 1698 | 1690 | | | | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 188 | 37 | 0 | 1 | 63 | 10 | 878 | 2 | 20 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 188 | 37 | 0 | 0 | 65 | 0 | 448 | 450 | 0 | 0 | 0 | 0 |
| Heavy Vehicles (%) | 2% | 0% | 0% | 0% | 0% | 12% | 1% | 0% | 8% | 0% | 0% | 0% |
| Turn Type | Prot | NA | | | NA | | Split | NA | | | | |
| Protected Phases | 1 | 6 | | | 2 | | 4 | 4 | | | | |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | 8.8 | 16.8 | | | 4.5 | | 20.5 | 20.5 | | | | |
| Effective Green, g (s) | 8.8 | 16.8 | | | 4.5 | | 20.5 | 20.5 | | | | |
| Actuated g/C Ratio | 0.19 | 0.37 | | | 0.10 | | 0.45 | 0.45 | | | | |
| Clearance Time (s) | 3.5 | 3.6 | | | 3.6 | | 4.5 | 4.5 | | | | |
| Vehicle Extension (s) | 2.5 | 2.0 | | | 2.0 | | 3.0 | 3.0 | | | | |
| Lane Grp Cap (vph) | 343 | 1335 | | | 328 | | 766 | 763 | | | | |
| v/s Ratio Prot | c0.11 | 0.01 | | | | | 0.26 | c0.27 | | | | |
| v/s Ratio Perm | | | | | c0.02 | | | | | | | |
| v/c Ratio | 0.55 | 0.03 | | | 1.00dr | | 0.58 | 0.59 | | | | |
| Uniform Delay, d1 | 16.5 | 9.1 | | | 18.8 | | 9.3 | 9.3 | | | | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | | | | |
| Incremental Delay, d2 | 1.4 | 0.0 | | | 0.1 | | 1.1 | 1.2 | | | | |
| Delay (s) | 17.9 | 9.1 | | | 18.9 | | 10.4 | 10.5 | | | | |
| Level of Service | B | A | | | B | | B | B | | | | |
| Approach Delay (s) | | 16.5 | | | 18.9 | | | 10.5 | | | 0.0 | |
| Approach LOS | | B | | | B | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 12.1 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.53 | | |
| Actuated Cycle Length (s) | 45.4 | Sum of lost time (s) | 11.6 |
| Intersection Capacity Utilization | 46.3% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| dr Defacto Right Lane. Recode with 1 though lane as a right lane. | | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 19: Redwood Blvd & Lamont Ave

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 11 | 2 | 8 | 105 | 2 | 51 | 17 | 269 | 41 | 65 | 496 | 29 |
| Future Volume (vph) | 11 | 2 | 8 | 105 | 2 | 51 | 17 | 269 | 41 | 65 | 496 | 29 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.5 | 3.5 | | 3.5 | 3.5 | 3.5 | 4.8 | | 3.5 | 4.8 | 4.8 |
| Lane Util. Factor | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 |
| Frpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | 0.99 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Flpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | | 1.00 | 0.85 | | 1.00 | 0.85 | 1.00 | 0.98 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | | 0.96 | 1.00 | | 0.95 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | | 1821 | 1615 | | 1811 | 1595 | 1805 | 3527 | | 1805 | 3610 | 1615 |
| Flt Permitted | | 0.84 | 1.00 | | 0.74 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | | 1588 | 1615 | | 1399 | 1595 | 1805 | 3527 | | 1805 | 3610 | 1615 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 12 | 2 | 9 | 114 | 2 | 55 | 18 | 292 | 45 | 71 | 539 | 32 |
| RTOR Reduction (vph) | 0 | 0 | 7 | 0 | 0 | 40 | 0 | 12 | 0 | 0 | 0 | 18 |
| Lane Group Flow (vph) | 0 | 14 | 2 | 0 | 116 | 15 | 18 | 325 | 0 | 71 | 539 | 14 |
| Confl. Peds. (#/hr) | 1 | | | | | 1 | | | 2 | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Perm | NA | Perm | Perm | NA | Perm | Prot | NA | | Prot | NA | Perm |
| Protected Phases | | 8 | | | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | 8 | | 8 | 4 | | 4 | | | | | | 2 |
| Actuated Green, G (s) | | 12.7 | 12.7 | | 12.7 | 12.7 | 0.9 | 18.8 | | 3.1 | 21.0 | 21.0 |
| Effective Green, g (s) | | 12.7 | 12.7 | | 12.7 | 12.7 | 0.9 | 18.8 | | 3.1 | 21.0 | 21.0 |
| Actuated g/C Ratio | | 0.27 | 0.27 | | 0.27 | 0.27 | 0.02 | 0.41 | | 0.07 | 0.45 | 0.45 |
| Clearance Time (s) | | 3.5 | 3.5 | | 3.5 | 3.5 | 3.5 | 4.8 | | 3.5 | 4.8 | 4.8 |
| Vehicle Extension (s) | | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 | 3.0 | | 2.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | 434 | 442 | | 382 | 436 | 35 | 1429 | | 120 | 1633 | 730 |
| v/s Ratio Prot | | | | | | | 0.01 | 0.09 | | c0.04 | c0.15 | |
| v/s Ratio Perm | | 0.01 | 0.00 | | c0.08 | 0.01 | | | | | | 0.01 |
| v/c Ratio | | 0.03 | 0.01 | | 0.30 | 0.03 | 0.51 | 0.23 | | 0.59 | 0.33 | 0.02 |
| Uniform Delay, d1 | | 12.3 | 12.3 | | 13.3 | 12.4 | 22.5 | 9.0 | | 21.0 | 8.2 | 7.0 |
| Progression Factor | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.0 | 0.0 | | 0.2 | 0.0 | 5.2 | 0.1 | | 5.1 | 0.1 | 0.0 |
| Delay (s) | | 12.4 | 12.3 | | 13.5 | 12.4 | 27.7 | 9.1 | | 26.2 | 8.3 | 7.0 |
| Level of Service | | B | B | | B | B | C | A | | C | A | A |
| Approach Delay (s) | | 12.3 | | | 13.1 | | | 10.1 | | | 10.2 | |
| Approach LOS | | B | | | B | | | B | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 10.6 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.34 | | |
| Actuated Cycle Length (s) | 46.4 | Sum of lost time (s) | 11.8 |
| Intersection Capacity Utilization | 45.1% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 20: Redwood Blvd & Landing Ct

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 2 | 0 | 1 | 25 | 0 | 12 | 1 | 312 | 32 | 25 | 485 | 1 |
| Future Volume (vph) | 2 | 0 | 1 | 25 | 0 | 12 | 1 | 312 | 32 | 25 | 485 | 1 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.5 | | 3.5 | | 3.5 | | 4.8 | 4.8 | 3.5 | 4.8 | 4.8 |
| Lane Util. Factor | | 1.00 | | 1.00 | | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |
| Frpb, ped/bikes | | 1.00 | | 1.00 | | 1.00 | | 1.00 | 0.98 | 1.00 | 1.00 | 0.97 |
| Flpb, ped/bikes | | 1.00 | | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.95 | | 1.00 | | 0.85 | | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | | 0.97 | | 0.95 | | 1.00 | | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | | 1748 | | 1803 | | 1615 | | 3609 | 1579 | 1805 | 3610 | 1572 |
| Flt Permitted | | 0.97 | | 0.76 | | 1.00 | | 0.95 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | | 1748 | | 1434 | | 1615 | | 3444 | 1579 | 1805 | 3610 | 1572 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 2 | 0 | 1 | 27 | 0 | 13 | 1 | 339 | 35 | 27 | 527 | 1 |
| RTOR Reduction (vph) | 0 | 3 | 0 | 0 | 0 | 11 | 0 | 0 | 14 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 27 | 0 | 2 | 0 | 340 | 21 | 27 | 527 | 1 |
| Confl. Peds. (#/hr) | | | 4 | 4 | | | | | 3 | | | 6 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Perm | NA | | Perm | | Perm | Perm | NA | Perm | Prot | NA | Perm |
| Protected Phases | | 4 | | | | | | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | 2 | | | 6 |
| Actuated Green, G (s) | | 5.5 | | 5.5 | | 5.5 | | 26.1 | 26.1 | 0.8 | 30.4 | 30.4 |
| Effective Green, g (s) | | 5.5 | | 5.5 | | 5.5 | | 26.1 | 26.1 | 0.8 | 30.4 | 30.4 |
| Actuated g/C Ratio | | 0.12 | | 0.12 | | 0.12 | | 0.59 | 0.59 | 0.02 | 0.69 | 0.69 |
| Clearance Time (s) | | 3.5 | | 3.5 | | 3.5 | | 4.8 | 4.8 | 3.5 | 4.8 | 4.8 |
| Vehicle Extension (s) | | 3.0 | | 2.0 | | 2.0 | | 4.0 | 4.0 | 2.0 | 4.0 | 4.0 |
| Lane Grp Cap (vph) | | 217 | | 178 | | 200 | | 2033 | 932 | 32 | 2482 | 1081 |
| v/s Ratio Prot | | | | | | | | | | c0.01 | c0.15 | |
| v/s Ratio Perm | | 0.00 | | c0.02 | | 0.00 | | 0.10 | 0.01 | | | 0.00 |
| v/c Ratio | | 0.00 | | 0.15 | | 0.01 | | 0.17 | 0.02 | 0.84 | 0.21 | 0.00 |
| Uniform Delay, d1 | | 16.9 | | 17.3 | | 17.0 | | 4.1 | 3.8 | 21.6 | 2.5 | 2.2 |
| Progression Factor | | 1.00 | | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.0 | | 0.1 | | 0.0 | | 0.1 | 0.0 | 93.1 | 0.1 | 0.0 |
| Delay (s) | | 16.9 | | 17.4 | | 17.0 | | 4.2 | 3.8 | 114.7 | 2.6 | 2.2 |
| Level of Service | | B | | B | | B | | A | A | F | A | A |
| Approach Delay (s) | | 16.9 | | | 17.3 | | | 4.1 | | | 8.0 | |
| Approach LOS | | B | | | B | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 6.9 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.23 | | |
| Actuated Cycle Length (s) | 44.2 | Sum of lost time (s) | 11.8 |
| Intersection Capacity Utilization | 40.6% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 57 | 0 | 305 | 3 | 0 | 3 | 124 | 473 | 4 | 1 | 696 | 69 |
| Future Volume (vph) | 57 | 0 | 305 | 3 | 0 | 3 | 124 | 473 | 4 | 1 | 696 | 69 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.2 | 3.2 | | | 3.0 | | 3.0 | 4.4 | | 3.0 | 4.4 | |
| Lane Util. Factor | 1.00 | 1.00 | | | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.85 | | | 0.93 | | 1.00 | 1.00 | | 1.00 | 0.99 | |
| Flt Protected | 0.95 | 1.00 | | | 0.98 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1805 | 1615 | | | 1729 | | 1805 | 3605 | | 1805 | 3519 | |
| Flt Permitted | 0.75 | 1.00 | | | 0.59 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1432 | 1615 | | | 1053 | | 1805 | 3605 | | 1805 | 3519 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 62 | 0 | 332 | 3 | 0 | 3 | 135 | 514 | 4 | 1 | 757 | 75 |
| RTOR Reduction (vph) | 0 | 293 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 4 | 0 |
| Lane Group Flow (vph) | 62 | 39 | 0 | 0 | 1 | 0 | 135 | 518 | 0 | 1 | 828 | 0 |
| Confl. Peds. (#/hr) | | | | | | | | | 9 | | | 6 |
| Confl. Bikes (#/hr) | | | | | | | | | 2 | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 1% | 0% |
| Turn Type | Perm | NA | | Perm | NA | | Prot | NA | | Prot | NA | |
| Protected Phases | | 8 | | | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | 8 | | | 4 | | | | | | | | |
| Actuated Green, G (s) | 11.7 | 11.7 | | | 11.9 | | 12.4 | 75.5 | | 2.2 | 65.3 | |
| Effective Green, g (s) | 11.7 | 11.7 | | | 11.9 | | 12.4 | 75.5 | | 2.2 | 65.3 | |
| Actuated g/C Ratio | 0.12 | 0.12 | | | 0.12 | | 0.12 | 0.76 | | 0.02 | 0.65 | |
| Clearance Time (s) | 3.2 | 3.2 | | | 3.0 | | 3.0 | 4.4 | | 3.0 | 4.4 | |
| Vehicle Extension (s) | 3.0 | 3.0 | | | 2.0 | | 2.0 | 4.0 | | 2.0 | 4.0 | |
| Lane Grp Cap (vph) | 167 | 188 | | | 125 | | 223 | 2721 | | 39 | 2297 | |
| v/s Ratio Prot | | 0.02 | | | | | c0.07 | 0.14 | | 0.00 | c0.24 | |
| v/s Ratio Perm | c0.04 | | | | 0.00 | | | | | | | |
| v/c Ratio | 0.37 | 0.21 | | | 0.01 | | 0.61 | 0.19 | | 0.03 | 0.36 | |
| Uniform Delay, d1 | 40.8 | 40.0 | | | 38.8 | | 41.5 | 3.5 | | 47.9 | 7.9 | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | | 0.68 | 1.38 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 1.4 | 0.5 | | | 0.0 | | 3.1 | 0.2 | | 0.1 | 0.4 | |
| Delay (s) | 42.1 | 40.5 | | | 38.8 | | 31.3 | 5.0 | | 47.9 | 8.3 | |
| Level of Service | D | D | | | D | | C | A | | D | A | |
| Approach Delay (s) | | 40.8 | | | 38.8 | | | 10.4 | | | 8.4 | |
| Approach LOS | | D | | | D | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 15.9 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.40 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 59.0% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |





| Movement | EBL | EBR | NBL | NBT | SBU | SBT | SBR |
|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | |
| Traffic Volume (vph) | 162 | 129 | 229 | 513 | 19 | 878 | 186 |
| Future Volume (vph) | 162 | 129 | 229 | 513 | 19 | 878 | 186 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 3.5 | 3.5 | 4.9 | 3.5 | 4.9 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 0.98 | 1.00 | 1.00 | 1.00 | 0.99 | |
| Flpb, ped/bikes | 0.99 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 0.85 | 1.00 | 1.00 | 1.00 | 0.97 | |
| Flt Protected | 0.95 | 1.00 | 0.95 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1785 | 1579 | 1805 | 3610 | 1805 | 3468 | |
| Flt Permitted | 0.95 | 1.00 | 0.95 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1785 | 1579 | 1805 | 3610 | 1805 | 3468 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 176 | 140 | 249 | 558 | 21 | 954 | 202 |
| RTOR Reduction (vph) | 0 | 118 | 0 | 0 | 0 | 13 | 0 |
| Lane Group Flow (vph) | 176 | 22 | 249 | 558 | 21 | 1143 | 0 |
| Confl. Peds. (#/hr) | 10 | 8 | | | | | 5 |
| Confl. Bikes (#/hr) | | 1 | | | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 1% | 0% |
| Turn Type | Perm | Perm | Prot | NA | Prot | NA | |
| Protected Phases | | | 1 | 6 | 5 | 2 | |
| Permitted Phases | 4 | 4 | | | | | |
| Actuated Green, G (s) | 15.7 | 15.7 | 17.8 | 69.7 | 2.7 | 54.6 | |
| Effective Green, g (s) | 15.7 | 15.7 | 17.8 | 69.7 | 2.7 | 54.6 | |
| Actuated g/C Ratio | 0.16 | 0.16 | 0.18 | 0.70 | 0.03 | 0.55 | |
| Clearance Time (s) | 3.5 | 3.5 | 3.5 | 4.9 | 3.5 | 4.9 | |
| Vehicle Extension (s) | 2.0 | 2.0 | 2.0 | 4.0 | 2.0 | 4.0 | |
| Lane Grp Cap (vph) | 280 | 247 | 321 | 2516 | 48 | 1893 | |
| v/s Ratio Prot | | | c0.14 | 0.15 | 0.01 | c0.33 | |
| v/s Ratio Perm | c0.10 | 0.01 | | | | | |
| v/c Ratio | 0.63 | 0.09 | 0.78 | 0.22 | 0.44 | 0.60 | |
| Uniform Delay, d1 | 39.4 | 36.0 | 39.2 | 5.4 | 47.9 | 15.4 | |
| Progression Factor | 1.00 | 1.00 | 0.80 | 1.11 | 1.37 | 0.74 | |
| Incremental Delay, d2 | 3.2 | 0.1 | 8.4 | 0.2 | 2.2 | 1.4 | |
| Delay (s) | 42.6 | 36.1 | 39.9 | 6.2 | 67.8 | 12.8 | |
| Level of Service | D | D | D | A | E | B | |
| Approach Delay (s) | 39.7 | | | 16.6 | | 13.7 | |
| Approach LOS | D | | | B | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 18.3 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.64 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 11.9 |
| Intersection Capacity Utilization | 65.9% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 23: Novato Blvd & Rowland Blvd



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 45 | 140 | 16 | 355 | 321 | 348 | 45 | 306 | 221 | 410 | 426 | 187 |
| Future Volume (vph) | 45 | 140 | 16 | 355 | 321 | 348 | 45 | 306 | 221 | 410 | 426 | 187 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 3.5 | | 3.5 | 4.1 | 4.1 | 3.5 | 4.1 | | 3.5 | 4.4 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 0.97 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 0.99 | | 1.00 | 1.00 | 0.99 | 1.00 | 0.99 | | 1.00 | 0.99 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.98 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.94 | | 1.00 | 0.95 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1805 | 1857 | | 1770 | 1900 | 1576 | 1805 | 1746 | | 3502 | 1791 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1805 | 1857 | | 1770 | 1900 | 1576 | 1805 | 1746 | | 3502 | 1791 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 47 | 147 | 17 | 374 | 338 | 366 | 47 | 322 | 233 | 432 | 448 | 197 |
| RTOR Reduction (vph) | 0 | 5 | 0 | 0 | 0 | 254 | 0 | 25 | 0 | 0 | 13 | 0 |
| Lane Group Flow (vph) | 47 | 159 | 0 | 374 | 338 | 112 | 47 | 530 | 0 | 432 | 632 | 0 |
| Confl. Peds. (#/hr) | | | 24 | | | 2 | | | 13 | | | 10 |
| Confl. Bikes (#/hr) | | | 1 | | | | | | 1 | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 2% | 0% | 1% | 0% | 0% | 2% | 0% | 0% | 0% |
| Turn Type | Prot | NA | | Prot | NA | Perm | Prot | NA | | Prot | NA | |
| Protected Phases | 3 | 8 | | 7 | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | | | | | | 4 | | | | | | |
| Actuated Green, G (s) | 5.4 | 18.0 | | 18.5 | 30.5 | 30.5 | 6.0 | 32.7 | | 16.2 | 42.6 | |
| Effective Green, g (s) | 5.4 | 18.0 | | 18.5 | 30.5 | 30.5 | 6.0 | 32.7 | | 16.2 | 42.6 | |
| Actuated g/C Ratio | 0.05 | 0.18 | | 0.18 | 0.30 | 0.30 | 0.06 | 0.33 | | 0.16 | 0.43 | |
| Clearance Time (s) | 3.5 | 3.5 | | 3.5 | 4.1 | 4.1 | 3.5 | 4.1 | | 3.5 | 4.4 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 3.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 97 | 334 | | 327 | 579 | 480 | 108 | 570 | | 567 | 762 | |
| v/s Ratio Prot | 0.03 | 0.09 | | c0.21 | c0.18 | | 0.03 | c0.30 | | c0.12 | 0.35 | |
| v/s Ratio Perm | | | | | | 0.07 | | | | | | |
| v/c Ratio | 0.48 | 0.48 | | 1.14 | 0.58 | 0.23 | 0.44 | 0.93 | | 0.76 | 0.83 | |
| Uniform Delay, d1 | 45.9 | 36.8 | | 40.8 | 29.4 | 26.0 | 45.4 | 32.5 | | 40.1 | 25.5 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.38 | 0.61 | |
| Incremental Delay, d2 | 1.4 | 0.4 | | 94.6 | 1.0 | 0.1 | 1.0 | 23.9 | | 4.6 | 8.6 | |
| Delay (s) | 47.3 | 37.2 | | 135.4 | 30.4 | 26.1 | 46.4 | 56.4 | | 60.0 | 24.2 | |
| Level of Service | D | D | | F | C | C | D | E | | E | C | |
| Approach Delay (s) | | 39.4 | | | 65.3 | | | 55.6 | | | 38.5 | |
| Approach LOS | | D | | | E | | | E | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 51.8 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.89 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 15.5 |
| Intersection Capacity Utilization | 91.1% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 24: Redwood Blvd & Rowland Blvd



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 115 | 699 | 49 | 21 | 795 | 288 | 72 | 23 | 81 | 302 | 19 | 301 |
| Future Volume (vph) | 115 | 699 | 49 | 21 | 795 | 288 | 72 | 23 | 81 | 302 | 19 | 301 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.4 | 4.4 | 3.5 | 3.7 | 3.7 | 3.5 | 4.1 | | 3.5 | 4.8 | 4.8 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | 0.97 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.99 | 1.00 | 0.99 | | 1.00 | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.88 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1805 | 3574 | 1589 | 1805 | 3574 | 1578 | 1805 | 3150 | | 3502 | 1900 | 1593 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1805 | 3574 | 1589 | 1805 | 3574 | 1578 | 1805 | 3150 | | 3502 | 1900 | 1593 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 125 | 760 | 53 | 23 | 864 | 313 | 78 | 25 | 88 | 328 | 21 | 327 |
| RTOR Reduction (vph) | 0 | 0 | 28 | 0 | 0 | 77 | 0 | 76 | 0 | 0 | 0 | 245 |
| Lane Group Flow (vph) | 125 | 760 | 25 | 23 | 864 | 236 | 78 | 37 | 0 | 328 | 21 | 82 |
| Confl. Peds. (#/hr) | | | 6 | | | 2 | | | 3 | | | 2 |
| Confl. Bikes (#/hr) | | | | | | | | | 1 | | | |
| Heavy Vehicles (%) | 0% | 1% | 0% | 0% | 1% | 1% | 0% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Prot | NA | Perm | Prot | NA | Perm | Prot | NA | | Prot | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | 3 | 8 | | 7 | 4 | |
| Permitted Phases | | | 2 | | | 6 | | | | | | 4 |
| Actuated Green, G (s) | 11.2 | 38.4 | 38.4 | 3.0 | 30.9 | 30.9 | 8.0 | 10.7 | | 12.6 | 14.6 | 14.6 |
| Effective Green, g (s) | 11.2 | 38.4 | 38.4 | 3.0 | 30.9 | 30.9 | 8.0 | 10.7 | | 12.6 | 14.6 | 14.6 |
| Actuated g/C Ratio | 0.14 | 0.48 | 0.48 | 0.04 | 0.39 | 0.39 | 0.10 | 0.13 | | 0.16 | 0.18 | 0.18 |
| Clearance Time (s) | 3.5 | 4.4 | 4.4 | 3.5 | 3.7 | 3.7 | 3.5 | 4.1 | | 3.5 | 4.8 | 4.8 |
| Vehicle Extension (s) | 2.0 | 4.0 | 4.0 | 2.0 | 4.0 | 4.0 | 2.0 | 2.5 | | 2.5 | 2.5 | 2.5 |
| Lane Grp Cap (vph) | 252 | 1711 | 760 | 67 | 1377 | 607 | 180 | 420 | | 550 | 345 | 289 |
| v/s Ratio Prot | c0.07 | 0.21 | | 0.01 | c0.24 | | 0.04 | 0.01 | | c0.09 | 0.01 | |
| v/s Ratio Perm | | | 0.02 | | | 0.15 | | | | | | c0.05 |
| v/c Ratio | 0.50 | 0.44 | 0.03 | 0.34 | 0.63 | 0.39 | 0.43 | 0.09 | | 0.60 | 0.06 | 0.29 |
| Uniform Delay, d1 | 31.9 | 13.8 | 11.1 | 37.6 | 20.0 | 17.8 | 34.0 | 30.5 | | 31.4 | 27.1 | 28.3 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.6 | 0.3 | 0.0 | 1.1 | 1.0 | 0.6 | 0.6 | 0.1 | | 1.5 | 0.1 | 0.4 |
| Delay (s) | 32.5 | 14.1 | 11.1 | 38.8 | 21.0 | 18.4 | 34.6 | 30.5 | | 32.9 | 27.2 | 28.7 |
| Level of Service | C | B | B | D | C | B | C | C | | C | C | C |
| Approach Delay (s) | | 16.4 | | | 20.7 | | | 32.2 | | | 30.7 | |
| Approach LOS | | B | | | C | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 22.3 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.56 | | |
| Actuated Cycle Length (s) | 80.2 | Sum of lost time (s) | 16.2 |
| Intersection Capacity Utilization | 60.9% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 25: US 101 SB Ramps & Rowland Blvd

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 576 | 475 | 136 | 653 | 0 | 0 | 0 | 0 | 273 | 49 | 489 |
| Future Volume (vph) | 0 | 576 | 475 | 136 | 653 | 0 | 0 | 0 | 0 | 273 | 49 | 489 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.6 | 3.6 | 3.0 | 3.6 | | | | | 3.0 | 3.0 | |
| Lane Util. Factor | | 0.91 | 0.91 | 0.97 | 0.95 | | | | | 0.91 | 0.91 | |
| Frpb, ped/bikes | | 1.00 | 0.99 | 1.00 | 1.00 | | | | | 1.00 | 0.99 | |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | | | | 1.00 | 1.00 | |
| Frt | | 0.97 | 0.85 | 1.00 | 1.00 | | | | | 1.00 | 0.87 | |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 3314 | 1450 | 3367 | 3574 | | | | | 1643 | 2844 | |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | 0.95 | 1.00 | |
| Satd. Flow (perm) | | 3314 | 1450 | 3367 | 3574 | | | | | 1643 | 2844 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 0 | 626 | 516 | 148 | 710 | 0 | 0 | 0 | 0 | 297 | 53 | 532 |
| RTOR Reduction (vph) | 0 | 27 | 213 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 73 | 0 |
| Lane Group Flow (vph) | 0 | 764 | 138 | 148 | 710 | 0 | 0 | 0 | 0 | 267 | 542 | 0 |
| Confl. Peds. (#/hr) | | | 2 | | | | | | | | | 2 |
| Confl. Bikes (#/hr) | | | | | | | | | | | | 1 |
| Heavy Vehicles (%) | 0% | 1% | 0% | 4% | 1% | 0% | 0% | 0% | 0% | 0% | 40% | 1% |
| Turn Type | | NA | Perm | Prot | NA | | | | | Split | NA | |
| Protected Phases | | 2 | | 1 | 6 | | | | | 4 | 4 | |
| Permitted Phases | | | 2 | | | | | | | | | |
| Actuated Green, G (s) | | 19.0 | 19.0 | 3.8 | 25.8 | | | | | 15.8 | 15.8 | |
| Effective Green, g (s) | | 19.0 | 19.0 | 3.8 | 25.8 | | | | | 15.8 | 15.8 | |
| Actuated g/C Ratio | | 0.39 | 0.39 | 0.08 | 0.54 | | | | | 0.33 | 0.33 | |
| Clearance Time (s) | | 3.6 | 3.6 | 3.0 | 3.6 | | | | | 3.0 | 3.0 | |
| Vehicle Extension (s) | | 4.0 | 4.0 | 2.0 | 2.5 | | | | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | | 1306 | 571 | 265 | 1913 | | | | | 538 | 932 | |
| v/s Ratio Prot | | c0.23 | | c0.04 | 0.20 | | | | | 0.16 | c0.19 | |
| v/s Ratio Perm | | | 0.10 | | | | | | | | | |
| v/c Ratio | | 0.59 | 0.24 | 0.56 | 0.37 | | | | | 0.50 | 0.94dr | |
| Uniform Delay, d1 | | 11.5 | 9.8 | 21.4 | 6.5 | | | | | 13.0 | 13.5 | |
| Progression Factor | | 1.00 | 1.00 | 1.00 | 1.00 | | | | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 0.8 | 0.3 | 1.5 | 0.1 | | | | | 0.3 | 0.6 | |
| Delay (s) | | 12.3 | 10.1 | 22.8 | 6.6 | | | | | 13.3 | 14.1 | |
| Level of Service | | B | B | C | A | | | | | B | B | |
| Approach Delay (s) | | 11.6 | | | 9.4 | | | 0.0 | | | 13.8 | |
| Approach LOS | | B | | | A | | | A | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 11.6 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.58 | | |
| Actuated Cycle Length (s) | 48.2 | Sum of lost time (s) | 9.6 |
| Intersection Capacity Utilization | 52.5% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

dr Defacto Right Lane. Recode with 1 though lane as a right lane.
c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 26: US 101 NB Ramps & Rowland Blvd

02/15/2018

| Movement | EBL2 | EBL | EBT | WBT | WBR | WBR2 | NBL2 | NBL | NBT | NBR | NEL2 | NEL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 28 | 243 | 607 | 312 | 2 | 144 | 486 | 8 | 9 | 426 | 13 | 4 |
| Future Volume (vph) | 28 | 243 | 607 | 312 | 2 | 144 | 486 | 8 | 9 | 426 | 13 | 4 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | 3.6 | 3.6 | | 3.6 | 3.5 | | 3.5 | 3.0 | | 3.5 |
| Lane Util. Factor | | 1.00 | 0.95 | 0.86 | | 0.86 | 0.95 | | 0.95 | 0.88 | | 1.00 |
| Frpb, ped/bikes | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Frt | | 1.00 | 1.00 | 0.98 | | 0.85 | 1.00 | | 1.00 | 0.85 | | 0.99 |
| Flt Protected | | 0.95 | 1.00 | 1.00 | | 1.00 | 0.95 | | 0.95 | 1.00 | | 0.96 |
| Satd. Flow (prot) | | 1805 | 3574 | 4621 | | 1323 | 1715 | | 1681 | 2787 | | 1794 |
| Flt Permitted | | 0.95 | 1.00 | 1.00 | | 1.00 | 0.95 | | 0.95 | 1.00 | | 0.96 |
| Satd. Flow (perm) | | 1805 | 3574 | 4621 | | 1323 | 1715 | | 1681 | 2787 | | 1794 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 30 | 264 | 660 | 339 | 2 | 157 | 528 | 9 | 10 | 463 | 14 | 4 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 14 | 0 | 87 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 294 | 660 | 373 | 0 | 24 | 275 | 0 | 272 | 463 | 0 | 20 |
| Confl. Peds. (#/hr) | | | | | | | | | | 2 | | |
| Heavy Vehicles (%) | 0% | 0% | 1% | 4% | 0% | 5% | 0% | 0% | 67% | 2% | 0% | 0% |
| Turn Type | Prot | Prot | NA | NA | | Perm | Split | Split | NA | custom | Perm | Prot |
| Protected Phases | 5 | 5 | 2 | 6 | | | 8 | 8 | 8 | 1 8 | | 7 |
| Permitted Phases | | | | | | 6 | | | | | 7 | |
| Actuated Green, G (s) | | 16.4 | 18.0 | 14.1 | | 14.1 | 16.9 | | 16.9 | 32.9 | | 3.1 |
| Effective Green, g (s) | | 16.4 | 18.0 | 14.1 | | 14.1 | 16.9 | | 16.9 | 29.4 | | 3.1 |
| Actuated g/C Ratio | | 0.26 | 0.28 | 0.22 | | 0.22 | 0.26 | | 0.26 | 0.46 | | 0.05 |
| Clearance Time (s) | | 3.0 | 3.6 | 3.6 | | 3.6 | 3.5 | | 3.5 | | | 3.5 |
| Vehicle Extension (s) | | 2.0 | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | | | 2.0 |
| Lane Grp Cap (vph) | | 461 | 1003 | 1016 | | 291 | 452 | | 443 | 1278 | | 86 |
| v/s Ratio Prot | | 0.16 | c0.18 | c0.08 | | | 0.16 | | c0.16 | 0.17 | | |
| v/s Ratio Perm | | | | | | 0.02 | | | | | | 0.01 |
| v/c Ratio | | 0.64 | 0.66 | 0.37 | | 0.08 | 0.61 | | 0.61 | 0.36 | | 0.23 |
| Uniform Delay, d1 | | 21.2 | 20.3 | 21.2 | | 19.9 | 20.7 | | 20.7 | 11.3 | | 29.4 |
| Progression Factor | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Incremental Delay, d2 | | 2.1 | 1.2 | 0.1 | | 0.0 | 1.6 | | 1.8 | 0.1 | | 0.5 |
| Delay (s) | | 23.3 | 21.5 | 21.3 | | 19.9 | 22.3 | | 22.5 | 11.3 | | 29.9 |
| Level of Service | | C | C | C | | B | C | | C | B | | C |
| Approach Delay (s) | | | 22.1 | 21.0 | | | | | 17.3 | | | 29.9 |
| Approach LOS | | | C | C | | | | | B | | | C |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 20.0 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.55 | | |
| Actuated Cycle Length (s) | 64.1 | Sum of lost time (s) | 13.6 |
| Intersection Capacity Utilization | 62.4% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 26: US 101 NB Ramps & Rowland Blvd

02/15/2018

| Movement | NER |
|---|---|
| Lane Configurations | |
| Traffic Volume (vph) | 2 |
| Future Volume (vph) | 2 |
| Ideal Flow (vphpl) | 1900 |
| Total Lost time (s) | |
| Lane Util. Factor | |
| Frpb, ped/bikes | |
| Flpb, ped/bikes | |
| Frt | |
| Flt Protected | |
| Satd. Flow (prot) | |
| Flt Permitted | |
| Satd. Flow (perm) | |
| Peak-hour factor, PHF | 0.92 |
| Adj. Flow (vph) | 2 |
| RTOR Reduction (vph) | 0 |
| Lane Group Flow (vph) | 0 |
| Confl. Peds. (#/hr) | |
| Heavy Vehicles (%) | 0% |
| Turn Type | |
| Protected Phases | |
| Permitted Phases | |
| Actuated Green, G (s) | |
| Effective Green, g (s) | |
| Actuated g/C Ratio | |
| Clearance Time (s) | |
| Vehicle Extension (s) | |
| Lane Grp Cap (vph) | |
| v/s Ratio Prot | |
| v/s Ratio Perm | |
| v/c Ratio | |
| Uniform Delay, d1 | |
| Progression Factor | |
| Incremental Delay, d2 | |
| Delay (s) | |
| Level of Service | |
| Approach Delay (s) | |
| Approach LOS | |
| Intersection Summary | |



## HCM Signalized Intersection Capacity Analysis
### 27: Rowland Blvd & Rowland Way

02/15/2018

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 421 | 626 | 366 | 23 | 13 | 86 |
| Future Volume (vph) | 421 | 626 | 366 | 23 | 13 | 86 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 3.6 | 3.2 | | 3.2 | 3.2 |
| Lane Util. Factor | 0.97 | 0.91 | 0.95 | | 1.00 | 0.95 |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.99 | | 0.89 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | | 0.99 | 1.00 |
| Satd. Flow (prot) | 3467 | 5085 | 3397 | | 1607 | 1490 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | | 0.99 | 1.00 |
| Satd. Flow (perm) | 3467 | 5085 | 3397 | | 1607 | 1490 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 458 | 680 | 398 | 25 | 14 | 93 |
| RTOR Reduction (vph) | 0 | 0 | 5 | 0 | 34 | 46 |
| Lane Group Flow (vph) | 458 | 680 | 418 | 0 | 20 | 7 |
| Confl. Peds. (#/hr) | | | | 1 | 2 | |
| Heavy Vehicles (%) | 1% | 2% | 5% | 9% | 6% | 3% |
| Turn Type | Prot | NA | NA | | Prot | Perm |
| Protected Phases | 5 | 2 | 6 | | 4 | |
| Permitted Phases | | | | | | 4 |
| Actuated Green, G (s) | 13.0 | 32.0 | 15.9 | | 6.2 | 6.2 |
| Effective Green, g (s) | 13.0 | 32.0 | 15.9 | | 6.2 | 6.2 |
| Actuated g/C Ratio | 0.29 | 0.71 | 0.35 | | 0.14 | 0.14 |
| Clearance Time (s) | 3.5 | 3.6 | 3.2 | | 3.2 | 3.2 |
| Vehicle Extension (s) | 2.0 | 4.0 | 4.0 | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 1001 | 3616 | 1200 | | 221 | 205 |
| v/s Ratio Prot | c0.13 | 0.13 | c0.12 | | c0.01 | |
| v/s Ratio Perm | | | | | | 0.00 |
| v/c Ratio | 0.46 | 0.19 | 0.35 | | 0.09 | 0.04 |
| Uniform Delay, d1 | 13.1 | 2.2 | 10.7 | | 16.9 | 16.8 |
| Progression Factor | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.1 | 0.0 | 0.2 | | 0.1 | 0.0 |
| Delay (s) | 13.2 | 2.2 | 11.0 | | 17.0 | 16.8 |
| Level of Service | B | A | B | | B | B |
| Approach Delay (s) | | 6.6 | 11.0 | | 16.9 | |
| Approach LOS | | A | B | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 8.4 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.34 | | |
| Actuated Cycle Length (s) | 45.0 | Sum of lost time (s) | 9.9 |
| Intersection Capacity Utilization | 38.4% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 28: Vintage Way & Rowland Blvd
02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 7 | 335 | 300 | 2 | 242 | 3 | 130 | 3 | 0 | 1 | 2 | 1 |
| Future Volume (vph) | 7 | 335 | 300 | 2 | 242 | 3 | 130 | 3 | 0 | 1 | 2 | 1 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.6 | 3.6 | 3.0 | 3.6 | | 3.6 | 3.6 | | | 3.2 | |
| Lane Util. Factor | 1.00 | 0.95 | 0.88 | 1.00 | 0.95 | | 0.97 | 1.00 | | | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | | 1.00 | 1.00 | | | 0.97 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | | 0.99 | |
| Satd. Flow (prot) | 1805 | 3195 | 2814 | 1805 | 3249 | | 3367 | 1900 | | | 1813 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | | 0.99 | |
| Satd. Flow (perm) | 1805 | 3195 | 2814 | 1805 | 3249 | | 3367 | 1900 | | | 1813 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 8 | 364 | 326 | 2 | 263 | 3 | 141 | 3 | 0 | 1 | 2 | 1 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| Lane Group Flow (vph) | 8 | 364 | 326 | 2 | 265 | 0 | 141 | 3 | 0 | 0 | 3 | 0 |
| Confl. Peds. (#/hr) | | | 1 | | | 3 | | | 1 | | | |
| Confl. Bikes (#/hr) | | | 2 | | | 2 | | | | | | |
| Heavy Vehicles (%) | 0% | 13% | 1% | 0% | 11% | 0% | 4% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Prot | NA | pt+ov | Prot | NA | | Split | NA | | Split | NA | |
| Protected Phases | 5 | 2 | 2 3 | 1 | 6 | | 3 | 3 | | 4 | 4 | |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | 1.1 | 10.8 | 30.9 | 0.5 | 10.2 | | 16.5 | 16.5 | | | 1.1 | |
| Effective Green, g (s) | 1.1 | 10.8 | 30.9 | 0.5 | 10.2 | | 16.5 | 16.5 | | | 1.1 | |
| Actuated g/C Ratio | 0.03 | 0.26 | 0.73 | 0.01 | 0.24 | | 0.39 | 0.39 | | | 0.03 | |
| Clearance Time (s) | 3.0 | 3.6 | | 3.0 | 3.6 | | 3.6 | 3.6 | | | 3.2 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | | 3.0 | 3.0 | | | 2.0 | |
| Lane Grp Cap (vph) | 46 | 815 | 2055 | 21 | 783 | | 1313 | 741 | | | 47 | |
| v/s Ratio Prot | c0.00 | c0.11 | c0.12 | 0.00 | 0.08 | | 0.04 | 0.00 | | | c0.00 | |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | 0.17 | 0.45 | 0.16 | 0.10 | 0.34 | | 0.11 | 0.00 | | | 0.06 | |
| Uniform Delay, d1 | 20.2 | 13.2 | 1.7 | 20.7 | 13.3 | | 8.2 | 7.9 | | | 20.1 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | | 1.00 | |
| Incremental Delay, d2 | 0.7 | 0.1 | 0.0 | 0.7 | 0.1 | | 0.0 | 0.0 | | | 0.2 | |
| Delay (s) | 20.8 | 13.4 | 1.8 | 21.4 | 13.4 | | 8.2 | 7.9 | | | 20.3 | |
| Level of Service | C | B | A | C | B | | A | A | | | C | |
| Approach Delay (s) | | 8.0 | | | 13.4 | | | 8.2 | | | 20.3 | |
| Approach LOS | | A | | | B | | | A | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 9.4 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.28 | | |
| Actuated Cycle Length (s) | 42.3 | Sum of lost time (s) | 13.4 |
| Intersection Capacity Utilization | 36.0% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 29: Novato Blvd & Sunset Pkwy
02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 242 | 68 | 26 | 39 | 102 | 101 | 25 | 256 | 56 | 54 | 342 | 312 |
| Future Volume (vph) | 242 | 68 | 26 | 39 | 102 | 101 | 25 | 256 | 56 | 54 | 342 | 312 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.0 | | 3.5 | 3.5 | | 3.5 | 4.9 | | 3.5 | 4.6 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 0.99 | | 1.00 | 0.97 | | 1.00 | 1.00 | | 1.00 | 0.99 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.96 | | 1.00 | 0.93 | | 1.00 | 0.97 | | 1.00 | 0.93 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1787 | 1809 | | 1805 | 1711 | | 1805 | 1841 | | 1770 | 1716 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1787 | 1809 | | 1805 | 1711 | | 1805 | 1841 | | 1770 | 1716 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 263 | 74 | 28 | 42 | 111 | 110 | 27 | 278 | 61 | 59 | 372 | 339 |
| RTOR Reduction (vph) | 0 | 14 | 0 | 0 | 39 | 0 | 0 | 7 | 0 | 0 | 29 | 0 |
| Lane Group Flow (vph) | 263 | 88 | 0 | 42 | 182 | 0 | 27 | 332 | 0 | 59 | 682 | 0 |
| Confl. Peds. (#/hr) | | | 4 | | | 21 | | | 3 | | | 5 |
| Confl. Bikes (#/hr) | | | | | | 1 | | | | | | |
| Heavy Vehicles (%) | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 2% | 1% | 2% |
| Turn Type | Prot | NA | | Prot | NA | | Prot | NA | | Prot | NA | |
| Protected Phases | 3 | 8 | | 7 | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | 12.8 | 23.0 | | 5.7 | 16.4 | | 3.4 | 32.6 | | 5.7 | 35.2 | |
| Effective Green, g (s) | 12.8 | 23.0 | | 5.7 | 16.4 | | 3.4 | 32.6 | | 5.7 | 35.2 | |
| Actuated g/C Ratio | 0.15 | 0.28 | | 0.07 | 0.20 | | 0.04 | 0.39 | | 0.07 | 0.42 | |
| Clearance Time (s) | 3.5 | 4.0 | | 3.5 | 3.5 | | 3.5 | 4.9 | | 3.5 | 4.6 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 275 | 501 | | 124 | 338 | | 74 | 723 | | 121 | 728 | |
| v/s Ratio Prot | c0.15 | 0.05 | | 0.02 | c0.11 | | 0.01 | 0.18 | | c0.03 | c0.40 | |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | 0.96 | 0.18 | | 0.34 | 0.54 | | 0.36 | 0.46 | | 0.49 | 0.94 | |
| Uniform Delay, d1 | 34.8 | 22.8 | | 36.8 | 29.8 | | 38.7 | 18.6 | | 37.2 | 22.8 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 41.8 | 0.1 | | 0.6 | 0.8 | | 1.1 | 0.2 | | 1.1 | 19.2 | |
| Delay (s) | 76.5 | 22.8 | | 37.4 | 30.7 | | 39.8 | 18.8 | | 38.3 | 42.0 | |
| Level of Service | E | C | | D | C | | D | B | | D | D | |
| Approach Delay (s) | | 61.5 | | | 31.7 | | | 20.3 | | | 41.7 | |
| Approach LOS | | E | | | C | | | C | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 39.9 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.84 | | |
| Actuated Cycle Length (s) | 82.9 | Sum of lost time (s) | 15.9 |
| Intersection Capacity Utilization | 86.3% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM 2010 AWSC
30: Redwood Blvd & Novato Blvd 

| Intersection | |
|---|---|
| Intersection Delay, s/veh | 237.3 |
| Intersection LOS | F |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 49 | 486 | 392 | 327 | 180 | 28 | 95 | 6 | 71 | 99 | 22 | 67 |
| Future Vol, veh/h | 49 | 486 | 392 | 327 | 180 | 28 | 95 | 6 | 71 | 99 | 22 | 67 |
| Peak Hour Factor | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Heavy Vehicles, % | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Mvmt Flow | 52 | 512 | 413 | 344 | 189 | 29 | 100 | 6 | 75 | 104 | 23 | 71 |
| Number of Lanes | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Opposing Approach | WB | EB | SB | NB |
| Opposing Lanes | 2 | 2 | 2 | 3 |
| Conflicting Approach Left | SB | NB | EB | WB |
| Conflicting Lanes Left | 2 | 3 | 2 | 2 |
| Conflicting Approach Right | NB | SB | WB | EB |
| Conflicting Lanes Right | 3 | 2 | 2 | 2 |
| HCM Control Delay | 440.3 | 33.6 | 17 | 17.3 |
| HCM LOS | F | D | C | C |

| Lane | NBLn1 | NBLn2 | NBLn3 | EBLn1 | EBLn2 | WBLn1 | WBLn2 | SBLn1 | SBLn2 |
|---|---|---|---|---|---|---|---|---|---|
| Vol Left, % | 100% | 0% | 0% | 100% | 0% | 100% | 0% | 100% | 0% |
| Vol Thru, % | 0% | 100% | 0% | 0% | 55% | 0% | 87% | 0% | 25% |
| Vol Right, % | 0% | 0% | 100% | 0% | 45% | 0% | 13% | 0% | 75% |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 95 | 6 | 71 | 49 | 878 | 327 | 208 | 99 | 89 |
| LT Vol | 95 | 0 | 0 | 49 | 0 | 327 | 0 | 99 | 0 |
| Through Vol | 0 | 6 | 0 | 0 | 486 | 0 | 180 | 0 | 22 |
| RT Vol | 0 | 0 | 71 | 0 | 392 | 0 | 28 | 0 | 67 |
| Lane Flow Rate | 100 | 6 | 75 | 52 | 924 | 344 | 219 | 104 | 94 |
| Geometry Grp | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Degree of Util (X) | 0.266 | 0.016 | 0.174 | 0.122 | 1.975 | 0.795 | 0.471 | 0.274 | 0.22 |
| Departure Headway (Hd) | 11.599 | 11.07 | 10.329 | 8.505 | 7.692 | 10.01 | 9.411 | 11.498 | 10.407 |
| Convergence, Y/N | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Cap | 312 | 325 | 350 | 424 | 481 | 365 | 385 | 315 | 348 |
| Service Time | 9.299 | 8.77 | 8.029 | 6.205 | 5.392 | 7.71 | 7.111 | 9.198 | 8.107 |
| HCM Lane V/C Ratio | 0.321 | 0.018 | 0.214 | 0.123 | 1.921 | 0.942 | 0.569 | 0.33 | 0.27 |
| HCM Control Delay | 18.5 | 13.9 | 15.2 | 12.4 | 464.2 | 42.1 | 20.2 | 18.5 | 16 |
| HCM Lane LOS | C | B | C | B | F | E | C | C | C |
| HCM 95th-tile Q | 1 | 0 | 0.6 | 0.4 | 62.6 | 6.7 | 2.4 | 1.1 | 0.8 |



## HCM Signalized Intersection Capacity Analysis
30: Redwood Blvd & Novato Blvd 

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 49 | 486 | 392 | 327 | 180 | 28 | 95 | 6 | 71 | 99 | 22 | 67 |
| Future Volume (vph) | 49 | 486 | 392 | 327 | 180 | 28 | 95 | 6 | 71 | 99 | 22 | 67 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 16 | 16 | 12 | 16 | 16 | 12 | 12 | 12 | 12 | 12 | 12 |
| Total Lost time (s) | 3.5 | 4.0 | | 3.5 | 4.0 | | 3.5 | 4.0 | 4.0 | 3.5 | 4.0 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 0.93 | | 1.00 | 0.98 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.89 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1787 | 1978 | | 1787 | 2072 | | 1787 | 1881 | 1599 | 1787 | 1668 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1787 | 1978 | | 1787 | 2072 | | 1787 | 1881 | 1599 | 1787 | 1668 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 52 | 512 | 413 | 344 | 189 | 29 | 100 | 6 | 75 | 104 | 23 | 71 |
| RTOR Reduction (vph) | 0 | 20 | 0 | 0 | 3 | 0 | 0 | 0 | 69 | 0 | 64 | 0 |
| Lane Group Flow (vph) | 52 | 905 | 0 | 344 | 215 | 0 | 100 | 6 | 6 | 104 | 30 | 0 |
| Heavy Vehicles (%) | 1% | 2% | 1% | 1% | 2% | 1% | 1% | 1% | 1% | 1% | 1% | 1% |
| Turn Type | Prot | NA | | Prot | NA | | Prot | NA | Perm | Prot | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | | | | | | | 2 | | | |
| Actuated Green, G (s) | 6.9 | 56.0 | | 25.6 | 74.7 | | 8.5 | 8.8 | 8.8 | 10.5 | 10.8 | |
| Effective Green, g (s) | 6.9 | 56.0 | | 25.6 | 74.7 | | 8.5 | 8.8 | 8.8 | 10.5 | 10.8 | |
| Actuated g/C Ratio | 0.06 | 0.48 | | 0.22 | 0.64 | | 0.07 | 0.08 | 0.08 | 0.09 | 0.09 | |
| Clearance Time (s) | 3.5 | 4.0 | | 3.5 | 4.0 | | 3.5 | 4.0 | 4.0 | 3.5 | 4.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 106 | 955 | | 394 | 1335 | | 131 | 142 | 121 | 161 | 155 | |
| v/s Ratio Prot | 0.03 | c0.46 | | c0.19 | 0.10 | | c0.06 | 0.00 | | 0.06 | c0.02 | |
| v/s Ratio Perm | | | | | | | | | 0.00 | | | |
| v/c Ratio | 0.49 | 0.95 | | 0.87 | 0.16 | | 0.76 | 0.04 | 0.05 | 0.65 | 0.19 | |
| Uniform Delay, d1 | 52.8 | 28.5 | | 43.6 | 8.2 | | 52.7 | 49.6 | 49.7 | 50.9 | 48.5 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 3.5 | 17.6 | | 18.7 | 0.1 | | 22.8 | 0.1 | 0.2 | 8.6 | 0.6 | |
| Delay (s) | 56.3 | 46.2 | | 62.3 | 8.2 | | 75.5 | 49.8 | 49.8 | 59.5 | 49.1 | |
| Level of Service | E | D | | E | A | | E | D | D | E | D | |
| Approach Delay (s) | | 46.7 | | | 41.3 | | | 64.0 | | | 54.6 | |
| Approach LOS | | D | | | D | | | E | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 47.6 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.83 | | |
| Actuated Cycle Length (s) | 115.9 | Sum of lost time (s) | 15.0 |
| Intersection Capacity Utilization | 89.8% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## MOVEMENT SUMMARY

### Site: 30 [AM Cumulative]

Novato Boulevard/Redwood Boulevard
AM Cumulative with Project

Roundabout

**Movement Performance - Vehicles**

| Mov ID | OD Mov | Demand Flows Total veh/h | Demand Flows HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance ft | Prop. Queued | Effective Stop Rate per veh | Average Speed mph |
|---|---|---|---|---|---|---|---|---|---|---|---|
| South: NB Redwood Boulevard | | | | | | | | | | | |
| 3 | L2 | 102 | 2.0 | 0.278 | 8.9 | LOS A | 1.2 | 30.1 | 0.66 | 0.66 | 31.6 |
| 8 | T1 | 6 | 2.0 | 0.278 | 8.9 | LOS A | 1.2 | 30.1 | 0.66 | 0.66 | 31.6 |
| 18 | R2 | 76 | 2.0 | 0.278 | 8.9 | LOS A | 1.2 | 30.1 | 0.66 | 0.66 | 30.8 |
| Approach | | 185 | 2.0 | 0.278 | 8.9 | LOS A | 1.2 | 30.1 | 0.66 | 0.66 | 31.3 |
| East: WB Novato Blvd | | | | | | | | | | | |
| 1 | L2 | 352 | 2.0 | 0.503 | 8.8 | LOS A | 3.5 | 87.9 | 0.50 | 0.33 | 31.6 |
| 6 | T1 | 194 | 2.0 | 0.503 | 8.8 | LOS A | 3.5 | 87.9 | 0.50 | 0.33 | 31.6 |
| 16 | R2 | 30 | 2.0 | 0.503 | 8.8 | LOS A | 3.5 | 87.9 | 0.50 | 0.33 | 30.8 |
| Approach | | 575 | 2.0 | 0.503 | 8.8 | LOS A | 3.5 | 87.9 | 0.50 | 0.33 | 31.5 |
| North: SB Redwood Boulevard | | | | | | | | | | | |
| 7 | L2 | 106 | 2.0 | 0.293 | 8.8 | LOS A | 1.3 | 32.4 | 0.66 | 0.66 | 31.7 |
| 4 | T1 | 24 | 2.0 | 0.293 | 8.8 | LOS A | 1.3 | 32.4 | 0.66 | 0.66 | 31.7 |
| 14 | R2 | 72 | 2.0 | 0.293 | 8.8 | LOS A | 1.3 | 32.4 | 0.66 | 0.66 | 30.9 |
| Approach | | 202 | 2.0 | 0.293 | 8.8 | LOS A | 1.3 | 32.4 | 0.66 | 0.66 | 31.4 |
| West: EB Novato Blvd | | | | | | | | | | | |
| 5 | L2 | 53 | 2.0 | 0.756 | 20.9 | LOS C | 8.6 | 218.9 | 0.77 | 1.13 | 27.9 |
| 2 | T1 | 523 | 2.0 | 0.756 | 20.9 | LOS C | 8.6 | 218.9 | 0.77 | 1.13 | 27.9 |
| 12 | R2 | 422 | 2.0 | 0.473 | 10.0 | LOS A | 3.0 | 77.2 | 0.65 | 0.71 | 31.4 |
| Approach | | 997 | 2.0 | 0.756 | 16.3 | LOS B | 8.6 | 218.9 | 0.72 | 0.95 | 29.3 |
| All Vehicles | | 1959 | 2.0 | 0.756 | 12.6 | LOS B | 8.6 | 218.9 | 0.64 | 0.71 | 30.3 |

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.





| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 13 | 890 | 469 | 268 | 373 | 19 | 69 | 4 | 240 | 7 | 2 | 0 |
| Future Volume (vph) | 13 | 890 | 469 | 268 | 373 | 19 | 69 | 4 | 240 | 7 | 2 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.6 | 3.6 | 3.0 | 3.6 | | | 3.5 | 3.5 | | 3.7 | |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | | 1.00 | 1.00 | | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.97 | 1.00 | 1.00 | | | 1.00 | 0.98 | | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.99 | 1.00 | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | | | 1.00 | 0.85 | | 1.00 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 0.95 | 1.00 | | 0.96 | |
| Satd. Flow (prot) | 1770 | 3610 | 1573 | 1900 | 3584 | | | 1786 | 1589 | | 1824 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 0.73 | 1.00 | | 0.85 | |
| Satd. Flow (perm) | 1770 | 3610 | 1573 | 1805 | 3584 | | | 1368 | 1589 | | 1608 | |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 14 | 927 | 489 | 279 | 389 | 20 | 72 | 4 | 250 | 7 | 2 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 88 | 0 | 2 | 0 | 0 | 0 | 217 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 14 | 927 | 401 | 279 | 407 | 0 | 0 | 76 | 33 | 0 | 9 | 0 |
| Confl. Peds. (#/hr) | | | 4 | | | | 7 | | 4 | 4 | | 7 |
| Heavy Vehicles (%) | 2% | 0% | 0% | 0% | 0% | 0% | 1% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Prot | NA | Perm | Prot | NA | | Perm | NA | Perm | Perm | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | 2 | | | | 8 | | 8 | 4 | | |
| Actuated Green, G (s) | 1.4 | 49.2 | 49.2 | 27.4 | 75.2 | | | 13.3 | 13.3 | | 13.1 | |
| Effective Green, g (s) | 1.4 | 49.2 | 49.2 | 27.4 | 75.2 | | | 13.3 | 13.3 | | 13.1 | |
| Actuated g/C Ratio | 0.01 | 0.49 | 0.49 | 0.27 | 0.75 | | | 0.13 | 0.13 | | 0.13 | |
| Clearance Time (s) | 3.0 | 3.6 | 3.6 | 3.0 | 3.6 | | | 3.5 | 3.5 | | 3.7 | |
| Vehicle Extension (s) | 2.0 | 3.0 | 3.0 | 2.0 | 3.0 | | | 2.0 | 2.0 | | 2.0 | |
| Lane Grp Cap (vph) | 24 | 1776 | 773 | 520 | 2695 | | | 181 | 211 | | 210 | |
| v/s Ratio Prot | 0.01 | c0.26 | | c0.15 | 0.11 | | | | | | | |
| v/s Ratio Perm | | | 0.25 | | | | | c0.06 | 0.02 | | 0.01 | |
| v/c Ratio | 0.58 | 0.52 | 0.52 | 0.54 | 0.15 | | | 0.42 | 0.16 | | 0.04 | |
| Uniform Delay, d1 | 49.0 | 17.4 | 17.3 | 30.9 | 3.5 | | | 39.8 | 38.4 | | 38.0 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 0.66 | 0.48 | | | 1.00 | 1.00 | | 1.00 | |
| Incremental Delay, d2 | 21.1 | 1.1 | 2.5 | 0.5 | 0.1 | | | 0.6 | 0.1 | | 0.0 | |
| Delay (s) | 70.1 | 18.5 | 19.8 | 20.9 | 1.8 | | | 40.4 | 38.5 | | 38.0 | |
| Level of Service | E | B | B | C | A | | | D | D | | D | |
| Approach Delay (s) | | 19.4 | | | 9.5 | | | 39.0 | | | 38.0 | |
| Approach LOS | | B | | | A | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 19.3 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.51 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 10.3 |
| Intersection Capacity Utilization | 63.7% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 32: US 101 SB Off Ramp/Enfrente Rd & Ignacio Blvd



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 36 | 864 | 314 | 203 | 438 | 43 | 0 | 0 | 1163 | 265 | 143 | 218 |
| Future Volume (vph) | 36 | 864 | 314 | 203 | 438 | 43 | 0 | 0 | 1163 | 265 | 143 | 218 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Grade (%) | | 0% | | | 0% | | | 2% | | | 0% | |
| Total Lost time (s) | 3.0 | 8.0 | 8.0 | 4.0 | 5.0 | | | | 4.0 | | 4.0 | 4.0 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | | | 0.88 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.96 | 1.00 | 1.00 | | | | 1.00 | | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | | | | 0.85 | | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | | 1.00 | | 0.97 | 1.00 |
| Satd. Flow (prot) | 1805 | 3610 | 1550 | 1770 | 3544 | | | | 2759 | | 1809 | 1578 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | | 1.00 | | 0.97 | 1.00 |
| Satd. Flow (perm) | 1805 | 3610 | 1550 | 1770 | 3544 | | | | 2759 | | 1809 | 1578 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 38 | 900 | 327 | 211 | 456 | 45 | 0 | 0 | 1211 | 276 | 149 | 227 |
| RTOR Reduction (vph) | 0 | 0 | 134 | 0 | 6 | 0 | 0 | 0 | 323 | 0 | 0 | 163 |
| Lane Group Flow (vph) | 38 | 900 | 193 | 211 | 495 | 0 | 0 | 0 | 888 | 0 | 425 | 64 |
| Confl. Peds. (#/hr) | | | 7 | | | 20 | | | | | | 1 |
| Confl. Bikes (#/hr) | | | | | | 3 | | | | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 2% | 0% | 0% | 0% | 0% | 2% | 0% | 5% | 1% |
| Turn Type | Prot | NA | Perm | Prot | NA | | | | Over | Split | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | | | 1 | 7 | 7 | |
| Permitted Phases | | | 2 | | | | | | | | | 7 |
| Actuated Green, G (s) | 6.6 | 28.5 | 28.5 | 27.2 | 53.1 | | | | 27.2 | | 28.3 | 28.3 |
| Effective Green, g (s) | 6.6 | 28.5 | 28.5 | 27.2 | 53.1 | | | | 27.2 | | 28.3 | 28.3 |
| Actuated g/C Ratio | 0.07 | 0.28 | 0.28 | 0.27 | 0.53 | | | | 0.27 | | 0.28 | 0.28 |
| Clearance Time (s) | 3.0 | 8.0 | 8.0 | 4.0 | 5.0 | | | | 4.0 | | 4.0 | 4.0 |
| Vehicle Extension (s) | 2.0 | 2.5 | 2.5 | 3.0 | 4.0 | | | | 3.0 | | 2.5 | 2.5 |
| Lane Grp Cap (vph) | 119 | 1028 | 441 | 481 | 1881 | | | | 750 | | 511 | 446 |
| v/s Ratio Prot | 0.02 | c0.25 | | 0.12 | 0.14 | | | | c0.32 | | c0.23 | |
| v/s Ratio Perm | | | 0.12 | | | | | | | | | 0.04 |
| v/c Ratio | 0.32 | 0.88 | 0.44 | 0.44 | 0.26 | | | | 1.18 | | 0.83 | 0.14 |
| Uniform Delay, d1 | 44.6 | 34.1 | 29.2 | 30.1 | 12.8 | | | | 36.4 | | 33.6 | 26.8 |
| Progression Factor | 0.98 | 0.73 | 0.55 | 1.55 | 1.83 | | | | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.5 | 9.6 | 2.9 | 0.6 | 0.3 | | | | 96.0 | | 10.9 | 0.1 |
| Delay (s) | 44.1 | 34.3 | 18.9 | 47.2 | 23.7 | | | | 132.4 | | 44.5 | 26.9 |
| Level of Service | D | C | B | D | C | | | | F | | D | C |
| Approach Delay (s) | | 30.6 | | | 30.7 | | | 132.4 | | | 38.4 | |
| Approach LOS | | C | | | C | | | F | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 64.0 | HCM 2000 Level of Service | E |
| HCM 2000 Volume to Capacity ratio | 0.96 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 100.2% | ICU Level of Service | G |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 32: US 101 SB Off Ramp/Enfrente Rd & Ignacio Blvd



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 36 | 864 | 314 | 203 | 438 | 43 | 0 | 0 | 1163 | 265 | 143 | 218 |
| Future Volume (vph) | 36 | 864 | 314 | 203 | 438 | 43 | 0 | 0 | 1163 | 265 | 143 | 218 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Grade (%) | | 0% | | | 0% | | | 2% | | | 0% | |
| Total Lost time (s) | 3.0 | 8.0 | 8.0 | 4.0 | 5.0 | | | | 4.0 | | 4.0 | 4.0 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | | | 0.88 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.96 | 1.00 | 0.99 | | | | 1.00 | | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | | | | 0.85 | | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | | 1.00 | | 0.97 | 1.00 |
| Satd. Flow (prot) | 1805 | 3610 | 1546 | 1787 | 3543 | | | | 2814 | | 1809 | 1578 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | | 1.00 | | 0.97 | 1.00 |
| Satd. Flow (perm) | 1805 | 3610 | 1546 | 1787 | 3543 | | | | 2814 | | 1809 | 1578 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 38 | 900 | 327 | 211 | 456 | 45 | 0 | 0 | 1211 | 276 | 149 | 227 |
| RTOR Reduction (vph) | 0 | 0 | 128 | 0 | 6 | 0 | 0 | 0 | 183 | 0 | 0 | 168 |
| Lane Group Flow (vph) | 38 | 900 | 199 | 211 | 495 | 0 | 0 | 0 | 1028 | 0 | 425 | 59 |
| Confl. Peds. (#/hr) | | | 7 | | | 20 | | | | | | 1 |
| Confl. Bikes (#/hr) | | | | | | 3 | | | | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 5% | 1% |
| Turn Type | Prot | NA | Perm | Prot | NA | | | | Over | Split | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | | | 1 | 7 | 7 | |
| Permitted Phases | | | 2 | | | | | | | | | 7 |
| Actuated Green, G (s) | 3.6 | 28.0 | 28.0 | 39.1 | 67.5 | | | | 39.1 | | 28.9 | 28.9 |
| Effective Green, g (s) | 3.6 | 28.0 | 28.0 | 39.1 | 67.5 | | | | 39.1 | | 28.9 | 28.9 |
| Actuated g/C Ratio | 0.03 | 0.25 | 0.25 | 0.35 | 0.60 | | | | 0.35 | | 0.26 | 0.26 |
| Clearance Time (s) | 3.0 | 8.0 | 8.0 | 4.0 | 5.0 | | | | 4.0 | | 4.0 | 4.0 |
| Vehicle Extension (s) | 2.0 | 4.0 | 4.0 | 3.0 | 4.0 | | | | 3.0 | | 2.5 | 2.5 |
| Lane Grp Cap (vph) | 58 | 902 | 386 | 623 | 2135 | | | | 982 | | 466 | 407 |
| v/s Ratio Prot | 0.02 | c0.25 | | 0.12 | 0.14 | | | | c0.37 | | c0.23 | |
| v/s Ratio Perm | | | 0.13 | | | | | | | | | 0.04 |
| v/c Ratio | 0.66 | 1.00 | 0.51 | 0.34 | 0.23 | | | | 1.05 | | 0.91 | 0.14 |
| Uniform Delay, d1 | 53.6 | 42.0 | 36.2 | 26.9 | 10.3 | | | | 36.5 | | 40.3 | 32.0 |
| Progression Factor | 1.28 | 0.75 | 0.63 | 0.71 | 0.39 | | | | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 17.4 | 28.5 | 4.5 | 0.3 | 0.2 | | | | 41.8 | | 22.0 | 0.1 |
| Delay (s) | 85.9 | 60.1 | 27.1 | 19.5 | 4.2 | | | | 78.2 | | 62.3 | 32.1 |
| Level of Service | F | E | C | B | A | | | | E | | E | C |
| Approach Delay (s) | | 52.4 | | | 8.7 | | | 78.2 | | | 51.8 | |
| Approach LOS | | D | | | A | | | E | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 52.3 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.99 | | |
| Actuated Cycle Length (s) | 112.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 100.2% | ICU Level of Service | G |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 33: Nave Dr & Ignacio Blvd/Bel Marin Keys Blvd



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 969 | 1311 | 101 | 238 | 237 | 447 | 543 | 708 | 0 | 0 | 0 |
| Future Volume (vph) | 0 | 969 | 1311 | 101 | 238 | 237 | 447 | 543 | 708 | 0 | 0 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.0 | 4.6 | 3.0 | 4.0 | | 4.6 | 4.6 | 3.0 | | | |
| Lane Util. Factor | | 0.95 | 1.00 | 1.00 | 0.95 | | 0.91 | 0.91 | 1.00 | | | |
| Frpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 0.99 | | 1.00 | 1.00 | 0.99 | | | |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | | |
| Frt | | 1.00 | 0.85 | 1.00 | 0.93 | | 1.00 | 1.00 | 0.85 | | | |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 0.99 | 1.00 | | | |
| Satd. Flow (prot) | | 3539 | 1607 | 1805 | 3252 | | 1643 | 3398 | 1583 | | | |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 0.99 | 1.00 | | | |
| Satd. Flow (perm) | | 3539 | 1607 | 1805 | 3252 | | 1643 | 3398 | 1583 | | | |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 0 | 1031 | 1395 | 107 | 253 | 252 | 476 | 578 | 753 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 81 | 0 | 127 | 0 | 0 | 0 | 4 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 1031 | 1314 | 107 | 378 | 0 | 343 | 711 | 749 | 0 | 0 | 0 |
| Confl. Peds. (#/hr) | | | 1 | | | 1 | | | 1 | | | |
| Heavy Vehicles (%) | 0% | 2% | 0% | 0% | 2% | 2% | 0% | 1% | 1% | 0% | 0% | 0% |
| Turn Type | | NA | pm+ov | Prot | NA | | Split | NA | pm+ov | | | |
| Protected Phases | | 2 | 3 | 1 | 6 | | 3 | 3 | 1 | | | |
| Permitted Phases | | | 2 | | | | | | 3 | | | |
| Actuated Green, G (s) | | 28.4 | 76.4 | 12.0 | 43.4 | | 48.0 | 48.0 | 60.0 | | | |
| Effective Green, g (s) | | 28.4 | 76.4 | 12.0 | 43.4 | | 48.0 | 48.0 | 60.0 | | | |
| Actuated g/C Ratio | | 0.28 | 0.76 | 0.12 | 0.43 | | 0.48 | 0.48 | 0.60 | | | |
| Clearance Time (s) | | 4.0 | 4.6 | 3.0 | 4.0 | | 4.6 | 4.6 | 3.0 | | | |
| Vehicle Extension (s) | | 4.0 | 2.0 | 2.0 | 4.0 | | 2.0 | 2.0 | 2.0 | | | |
| Lane Grp Cap (vph) | | 1005 | 1227 | 216 | 1411 | | 788 | 1631 | 949 | | | |
| v/s Ratio Prot | | 0.29 | c0.51 | 0.06 | 0.12 | | 0.21 | 0.21 | c0.09 | | | |
| v/s Ratio Perm | | | 0.30 | | | | | | 0.38 | | | |
| v/c Ratio | | 1.03 | 1.07 | 0.50 | 0.27 | | 0.44 | 0.44 | 0.79 | | | |
| Uniform Delay, d1 | | 35.8 | 11.8 | 41.2 | 18.1 | | 17.1 | 17.1 | 15.2 | | | |
| Progression Factor | | 0.98 | 1.28 | 1.16 | 0.89 | | 1.00 | 1.00 | 1.00 | | | |
| Incremental Delay, d2 | | 22.4 | 37.4 | 0.6 | 0.5 | | 0.1 | 0.1 | 4.1 | | | |
| Delay (s) | | 57.4 | 52.6 | 48.2 | 16.6 | | 17.2 | 17.2 | 19.3 | | | |
| Level of Service | | E | D | D | B | | B | B | B | | | |
| Approach Delay (s) | | 54.6 | | | 22.1 | | | 18.1 | | | 0.0 | |
| Approach LOS | | D | | | C | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 36.9 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 1.03 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 11.6 |
| Intersection Capacity Utilization | 98.5% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 34: Bel Marin Keys Blvd & Commercial Blvd



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 0 | 12 | 77 | 0 | 9 | 48 | 1395 | 242 | 13 | 484 | 1 |
| Future Volume (vph) | 0 | 0 | 12 | 77 | 0 | 9 | 48 | 1395 | 242 | 13 | 484 | 1 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.0 | | | 4.0 | 4.0 | 3.0 | 3.9 | | 3.0 | 3.5 | |
| Lane Util. Factor | | 1.00 | | | 1.00 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | | 0.99 | | | 1.00 | 0.98 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 0.86 | | | 1.00 | 0.85 | 1.00 | 0.98 | | 1.00 | 1.00 | |
| Flt Protected | | 1.00 | | | 0.95 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 1620 | | | 1766 | 1395 | 1805 | 3447 | | 1805 | 3538 | |
| Flt Permitted | | 1.00 | | | 0.75 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | | 1620 | | | 1392 | 1395 | 1805 | 3447 | | 1805 | 3538 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 0 | 0 | 13 | 81 | 0 | 9 | 51 | 1468 | 255 | 14 | 509 | 1 |
| RTOR Reduction (vph) | 0 | 11 | 0 | 0 | 0 | 8 | 0 | 7 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 2 | 0 | 0 | 81 | 1 | 51 | 1716 | 0 | 14 | 510 | 0 |
| Confl. Peds. (#/hr) | 3 | | 2 | 2 | | 3 | | | 3 | | | |
| Heavy Vehicles (%) | 2% | 0% | 0% | 2% | 0% | 14% | 0% | 2% | 2% | 0% | 2% | 0% |
| Turn Type | | NA | | Perm | NA | Perm | Prot | NA | | Prot | NA | |
| Protected Phases | | 4 | | | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | | | | | | |
| Actuated Green, G (s) | | 12.3 | | | 12.3 | 12.3 | 6.8 | 75.0 | | 1.8 | 70.4 | |
| Effective Green, g (s) | | 12.3 | | | 12.3 | 12.3 | 6.8 | 75.0 | | 1.8 | 70.4 | |
| Actuated g/C Ratio | | 0.12 | | | 0.12 | 0.12 | 0.07 | 0.75 | | 0.02 | 0.70 | |
| Clearance Time (s) | | 4.0 | | | 4.0 | 4.0 | 3.0 | 3.9 | | 3.0 | 3.5 | |
| Vehicle Extension (s) | | 3.0 | | | 3.0 | 3.0 | 2.5 | 3.0 | | 2.5 | 4.0 | |
| Lane Grp Cap (vph) | | 199 | | | 171 | 171 | 122 | 2585 | | 32 | 2490 | |
| v/s Ratio Prot | | 0.00 | | | | | c0.03 | c0.50 | | 0.01 | 0.14 | |
| v/s Ratio Perm | | | | | c0.06 | 0.00 | | | | | | |
| v/c Ratio | | 0.01 | | | 0.47 | 0.01 | 0.42 | 0.66 | | 0.44 | 0.20 | |
| Uniform Delay, d1 | | 38.5 | | | 40.8 | 38.5 | 44.7 | 6.2 | | 48.6 | 5.1 | |
| Progression Factor | | 1.00 | | | 1.00 | 1.00 | 0.96 | 0.69 | | 0.93 | 1.27 | |
| Incremental Delay, d2 | | 0.0 | | | 2.1 | 0.0 | 0.6 | 0.5 | | 6.8 | 0.2 | |
| Delay (s) | | 38.5 | | | 42.9 | 38.5 | 43.5 | 4.8 | | 51.8 | 6.7 | |
| Level of Service | | D | | | D | D | D | A | | D | A | |
| Approach Delay (s) | | 38.5 | | | 42.5 | | | 6.0 | | | 7.9 | |
| Approach LOS | | D | | | D | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 7.9 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.64 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 10.9 |
| Intersection Capacity Utilization | 69.2% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 35: Bel Marin Keys Blvd & Hamilton Dr/Digital Dr

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 1 | 48 | 102 | 2 | 9 | 109 | 690 | 618 | 9 | 353 | 3 |
| Future Volume (vph) | 0 | 1 | 48 | 102 | 2 | 9 | 109 | 690 | 618 | 9 | 353 | 3 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.5 | 3.5 | 3.5 | 3.5 | | 3.0 | 4.0 | | 3.0 | 4.0 | |
| Lane Util. Factor | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | | 1.00 | 0.99 | 1.00 | 0.99 | | 1.00 | 0.99 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 1.00 | 0.85 | 1.00 | 0.88 | | 1.00 | 0.93 | | 1.00 | 1.00 | |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 1900 | 1533 | 1768 | 1649 | | 1770 | 3251 | | 1805 | 3534 | |
| Flt Permitted | | 1.00 | 1.00 | 0.76 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | | 1900 | 1533 | 1409 | 1649 | | 1770 | 3251 | | 1805 | 3534 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 0 | 1 | 51 | 107 | 2 | 9 | 115 | 726 | 651 | 9 | 372 | 3 |
| RTOR Reduction (vph) | 0 | 0 | 43 | 0 | 8 | 0 | 0 | 85 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 1 | 8 | 107 | 3 | 0 | 115 | 1292 | 0 | 9 | 375 | 0 |
| Confl. Peds. (#/hr) | 1 | | 1 | 1 | | 1 | | | 2 | | | 8 |
| Heavy Vehicles (%) | 0% | 0% | 4% | 2% | 0% | 0% | 2% | 2% | 2% | 0% | 2% | 0% |
| Turn Type | | NA | Perm | Perm | NA | | Prot | NA | | Prot | NA | |
| Protected Phases | | 4 | | | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | 4 | 8 | | | | | | | | |
| Actuated Green, G (s) | | 15.1 | 15.1 | 15.1 | 15.1 | | 11.5 | 72.6 | | 1.8 | 62.9 | |
| Effective Green, g (s) | | 15.1 | 15.1 | 15.1 | 15.1 | | 11.5 | 72.6 | | 1.8 | 62.9 | |
| Actuated g/C Ratio | | 0.15 | 0.15 | 0.15 | 0.15 | | 0.12 | 0.73 | | 0.02 | 0.63 | |
| Clearance Time (s) | | 3.5 | 3.5 | 3.5 | 3.5 | | 3.0 | 4.0 | | 3.0 | 4.0 | |
| Vehicle Extension (s) | | 2.0 | 2.0 | 2.5 | 2.5 | | 2.0 | 4.0 | | 2.0 | 4.0 | |
| Lane Grp Cap (vph) | | 286 | 231 | 212 | 248 | | 203 | 2360 | | 32 | 2222 | |
| v/s Ratio Prot | | 0.00 | | | 0.00 | | c0.06 | c0.40 | | 0.00 | 0.11 | |
| v/s Ratio Perm | | | 0.01 | c0.08 | | | | | | | | |
| v/c Ratio | | 0.00 | 0.03 | 0.50 | 0.01 | | 0.57 | 0.55 | | 0.28 | 0.17 | |
| Uniform Delay, d1 | | 36.1 | 36.2 | 39.0 | 36.1 | | 41.9 | 6.2 | | 48.5 | 7.7 | |
| Progression Factor | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.05 | 1.29 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 0.0 | 0.0 | 1.4 | 0.0 | | 1.7 | 0.7 | | 1.8 | 0.2 | |
| Delay (s) | | 36.1 | 36.2 | 40.4 | 36.1 | | 45.6 | 8.8 | | 50.2 | 7.9 | |
| Level of Service | | D | D | D | D | | D | A | | D | A | |
| Approach Delay (s) | | 36.2 | | | 40.0 | | | 11.6 | | | 8.9 | |
| Approach LOS | | D | | | D | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 13.4 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.56 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 10.5 |
| Intersection Capacity Utilization | 69.1% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 35: Bel Marin Keys Blvd #3 & Hamilton Dr/Digital Dr

02/23/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 1 | 48 | 102 | 2 | 9 | 109 | 690 | 618 | 9 | 353 | 3 |
| Future Volume (vph) | 0 | 1 | 48 | 102 | 2 | 9 | 109 | 690 | 618 | 9 | 353 | 3 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.5 | 3.5 | 3.5 | 3.5 | | 3.0 | 4.5 | | 3.0 | 4.5 | |
| Lane Util. Factor | | 1.00 | 1.00 | 0.95 | 0.95 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | | 1.00 | 0.99 | 1.00 | 1.00 | | 1.00 | 0.99 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 1.00 | 0.85 | 1.00 | 0.98 | | 1.00 | 0.93 | | 1.00 | 1.00 | |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 0.96 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 1900 | 1533 | 1715 | 1691 | | 1770 | 3316 | | 1805 | 3569 | |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 0.96 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | | 1900 | 1533 | 1715 | 1691 | | 1770 | 3316 | | 1805 | 3569 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 0 | 1 | 51 | 107 | 2 | 9 | 115 | 726 | 651 | 9 | 372 | 3 |
| RTOR Reduction (vph) | 0 | 0 | 46 | 0 | 8 | 0 | 0 | 81 | 0 | 0 | 1 | 0 |
| Lane Group Flow (vph) | 0 | 1 | 5 | 60 | 50 | 0 | 115 | 1296 | 0 | 9 | 374 | 0 |
| Confl. Peds. (#/hr) | 1 | | 1 | 1 | | 1 | | | 2 | | | 8 |
| Heavy Vehicles (%) | 0% | 0% | 4% | 0% | 0% | 0% | 2% | 0% | 0% | 0% | 1% | 0% |
| Turn Type | | NA | Perm | Split | NA | | Prot | NA | | Prot | NA | |
| Protected Phases | 4 | 4 | | 8 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | 4 | | | | | | | | | |
| Actuated Green, G (s) | | 10.0 | 10.0 | 11.0 | 11.0 | | 15.4 | 63.7 | | 0.8 | 49.1 | |
| Effective Green, g (s) | | 10.0 | 10.0 | 11.0 | 11.0 | | 15.4 | 63.7 | | 0.8 | 49.1 | |
| Actuated g/C Ratio | | 0.10 | 0.10 | 0.11 | 0.11 | | 0.15 | 0.64 | | 0.01 | 0.49 | |
| Clearance Time (s) | | 3.5 | 3.5 | 3.5 | 3.5 | | 3.0 | 4.5 | | 3.0 | 4.5 | |
| Vehicle Extension (s) | | 2.0 | 2.0 | 2.5 | 2.5 | | 2.0 | 4.0 | | 2.0 | 4.0 | |
| Lane Grp Cap (vph) | | 190 | 153 | 188 | 186 | | 272 | 2112 | | 14 | 1752 | |
| v/s Ratio Prot | | 0.00 | | c0.03 | 0.03 | | 0.06 | c0.39 | | c0.00 | 0.10 | |
| v/s Ratio Perm | | | c0.00 | | | | | | | | | |
| v/c Ratio | | 0.01 | 0.03 | 0.32 | 0.27 | | 0.42 | 0.61 | | 0.64 | 0.21 | |
| Uniform Delay, d1 | | 40.5 | 40.6 | 41.0 | 40.8 | | 38.3 | 10.8 | | 49.5 | 14.5 | |
| Progression Factor | | 1.00 | 1.00 | 1.00 | 1.00 | | 0.78 | 0.36 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 0.0 | 0.0 | 0.7 | 0.6 | | 0.3 | 1.1 | | 56.8 | 0.3 | |
| Delay (s) | | 40.5 | 40.7 | 41.8 | 41.4 | | 30.2 | 4.9 | | 106.2 | 14.8 | |
| Level of Service | | D | D | D | D | | C | A | | F | B | |
| Approach Delay (s) | | 40.7 | | | 41.6 | | | 6.9 | | | 16.9 | |
| Approach LOS | | D | | | D | | | A | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 11.6 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.51 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 14.5 |
| Intersection Capacity Utilization | 63.0% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 786 | 174 | 0 | 893 | 1203 | 195 |
| Future Volume (vph) | 786 | 174 | 0 | 893 | 1203 | 195 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | | 5.0 | 5.0 | |
| Lane Util. Factor | 0.97 | 1.00 | | 0.95 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 0.99 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.85 | | 1.00 | 0.98 | |
| Flt Protected | 0.95 | 1.00 | | 1.00 | 1.00 | |
| Satd. Flow (prot) | 3467 | 1563 | | 3574 | 3504 | |
| Flt Permitted | 0.95 | 1.00 | | 1.00 | 1.00 | |
| Satd. Flow (perm) | 3467 | 1563 | | 3574 | 3504 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 854 | 189 | 0 | 971 | 1308 | 212 |
| RTOR Reduction (vph) | 0 | 20 | 0 | 0 | 19 | 0 |
| Lane Group Flow (vph) | 854 | 169 | 0 | 971 | 1502 | 0 |
| Confl. Peds. (#/hr) | | 1 | | | | |
| Heavy Vehicles (%) | 1% | 2% | 0% | 1% | 1% | 0% |
| Turn Type | Prot | Perm | | NA | NA | |
| Protected Phases | 4 | | | 2 | 6 | |
| Permitted Phases | | 4 | | | | |
| Actuated Green, G (s) | 27.0 | 27.0 | | 35.0 | 35.0 | |
| Effective Green, g (s) | 27.0 | 27.0 | | 35.0 | 35.0 | |
| Actuated g/C Ratio | 0.39 | 0.39 | | 0.50 | 0.50 | |
| Clearance Time (s) | 3.0 | 3.0 | | 5.0 | 5.0 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 1337 | 602 | | 1787 | 1752 | |
| v/s Ratio Prot | c0.25 | | | 0.27 | c0.43 | |
| v/s Ratio Perm | | 0.11 | | | | |
| v/c Ratio | 0.64 | 0.28 | | 0.54 | 0.86 | |
| Uniform Delay, d1 | 17.5 | 14.8 | | 12.0 | 15.3 | |
| Progression Factor | 1.00 | 1.00 | | 0.37 | 1.00 | |
| Incremental Delay, d2 | 2.3 | 1.2 | | 1.0 | 5.7 | |
| Delay (s) | 19.9 | 16.0 | | 5.5 | 21.0 | |
| Level of Service | B | B | | A | C | |
| Approach Delay (s) | 19.2 | | | 5.5 | 21.0 | |
| Approach LOS | B | | | A | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 16.2 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.76 | | |
| Actuated Cycle Length (s) | 70.0 | Sum of lost time (s) | 8.0 |
| Intersection Capacity Utilization | 69.5% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group





| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 40 | 21 | 730 | 86 | 102 | 1128 |
| Future Volume (vph) | 40 | 21 | 730 | 86 | 102 | 1128 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.2 | 3.2 | 4.4 | | 3.0 | 4.4 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 0.85 | 0.99 | | 1.00 | 1.00 |
| Flt Protected | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 1615 | 1868 | | 1770 | 1881 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | 1805 | 1615 | 1868 | | 1770 | 1881 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 43 | 23 | 793 | 93 | 111 | 1226 |
| RTOR Reduction (vph) | 0 | 22 | 5 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 43 | 1 | 881 | 0 | 111 | 1226 |
| Confl. Peds. (#/hr) | | | | 2 | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 2% | 1% |
| Turn Type | Prot | Perm | NA | | Prot | NA |
| Protected Phases | 8 | | 2 | | 1 | 6 |
| Permitted Phases | | 8 | | | | |
| Actuated Green, G (s) | 3.6 | 3.6 | 48.6 | | 7.2 | 58.8 |
| Effective Green, g (s) | 3.6 | 3.6 | 48.6 | | 7.2 | 58.8 |
| Actuated g/C Ratio | 0.05 | 0.05 | 0.69 | | 0.10 | 0.84 |
| Clearance Time (s) | 3.2 | 3.2 | 4.4 | | 3.0 | 4.4 |
| Vehicle Extension (s) | 1.0 | 1.0 | 1.0 | | 1.0 | 1.0 |
| Lane Grp Cap (vph) | 92 | 83 | 1296 | | 182 | 1580 |
| v/s Ratio Prot | c0.02 | | 0.47 | | 0.06 | c0.65 |
| v/s Ratio Perm | | 0.00 | | | | |
| v/c Ratio | 0.47 | 0.01 | 0.68 | | 0.61 | 0.78 |
| Uniform Delay, d1 | 32.3 | 31.5 | 6.2 | | 30.1 | 2.6 |
| Progression Factor | 1.00 | 1.00 | 0.76 | | 1.29 | 1.55 |
| Incremental Delay, d2 | 1.4 | 0.0 | 2.3 | | 2.3 | 2.3 |
| Delay (s) | 33.6 | 31.5 | 7.0 | | 41.0 | 6.3 |
| Level of Service | C | C | A | | D | A |
| Approach Delay (s) | 32.9 | | 7.0 | | | 9.1 |
| Approach LOS | C | | A | | | A |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 9.0 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.80 | | |
| Actuated Cycle Length (s) | 70.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 71.4% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## 38: Nave Dr & Hamilton Pkwy



| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 119 | 283 | 498 | 42 | 360 | 773 |
| Future Volume (vph) | 119 | 283 | 498 | 42 | 360 | 773 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.2 | 3.2 | 4.4 | 4.4 | 3.0 | 4.4 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.85 | 1.00 | 0.85 | 1.00 | 1.00 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (prot) | 1770 | 1599 | 1900 | 1578 | 1787 | 1850 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (perm) | 1770 | 1599 | 1900 | 1578 | 1787 | 1900 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 129 | 308 | 541 | 46 | 391 | 840 |
| RTOR Reduction (vph) | 0 | 266 | 0 | 13 | 0 | 0 |
| Lane Group Flow (vph) | 129 | 42 | 541 | 33 | 391 | 840 |
| Confl. Peds. (#/hr) | | | | 2 | | |
| Heavy Vehicles (%) | 2% | 1% | 0% | 0% | 1% | 0% |
| Turn Type | Prot | Perm | NA | Perm | Prot | NA |
| Protected Phases | 8 | | 2 | | 1 | 6 |
| Permitted Phases | | 8 | | 2 | | |
| Actuated Green, G (s) | 9.6 | 9.6 | 25.4 | 25.4 | 24.4 | 52.8 |
| Effective Green, g (s) | 9.6 | 9.6 | 25.4 | 25.4 | 24.4 | 52.8 |
| Actuated g/C Ratio | 0.14 | 0.14 | 0.36 | 0.36 | 0.35 | 0.75 |
| Clearance Time (s) | 3.2 | 3.2 | 4.4 | 4.4 | 3.0 | 4.4 |
| Vehicle Extension (s) | 2.0 | 2.0 | 3.0 | 3.0 | 2.0 | 3.0 |
| Lane Grp Cap (vph) | 242 | 219 | 689 | 572 | 622 | 1395 |
| v/s Ratio Prot | c0.07 | | c0.28 | | c0.22 | 0.45 |
| v/s Ratio Perm | | 0.03 | | 0.02 | | |
| v/c Ratio | 0.53 | 0.19 | 0.79 | 0.06 | 0.63 | 0.60 |
| Uniform Delay, d1 | 28.1 | 26.8 | 19.9 | 14.5 | 19.0 | 3.9 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.25 | 0.67 |
| Incremental Delay, d2 | 1.1 | 0.2 | 8.8 | 0.2 | 1.0 | 1.3 |
| Delay (s) | 29.2 | 26.9 | 28.6 | 14.7 | 24.7 | 3.9 |
| Level of Service | C | C | C | B | C | A |
| Approach Delay (s) | 27.6 | | 27.5 | | | 10.5 |
| Approach LOS | C | | C | | | B |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 18.3 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.68 | | |
| Actuated Cycle Length (s) | 70.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 63.1% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group





## 39: Nave Dr & Main Gate Dr



| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 264 | 185 | 231 | 460 | 301 | 337 |
| Future Volume (vph) | 264 | 185 | 231 | 460 | 301 | 337 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | 4.1 | 4.1 | 3.0 | 4.4 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.85 | 1.00 | 0.85 | 1.00 | 1.00 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 1615 | 1900 | 1615 | 1805 | 1881 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (perm) | 1805 | 1615 | 1900 | 1615 | 1805 | 1881 |
| Peak-hour factor, PHF | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| Adj. Flow (vph) | 284 | 199 | 248 | 495 | 324 | 362 |
| RTOR Reduction (vph) | 0 | 149 | 0 | 369 | 0 | 0 |
| Lane Group Flow (vph) | 284 | 50 | 248 | 126 | 324 | 362 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 1% |
| Turn Type | Prot | Perm | NA | Perm | Prot | NA |
| Protected Phases | 8 | | 2 | | 1 | 6 |
| Permitted Phases | | 8 | | 2 | | |
| Actuated Green, G (s) | 11.4 | 11.4 | 11.5 | 11.5 | 12.2 | 26.4 |
| Effective Green, g (s) | 11.4 | 11.4 | 11.5 | 11.5 | 12.2 | 26.4 |
| Actuated g/C Ratio | 0.25 | 0.25 | 0.25 | 0.25 | 0.27 | 0.58 |
| Clearance Time (s) | 3.0 | 3.0 | 4.1 | 4.1 | 3.0 | 4.4 |
| Vehicle Extension (s) | 2.0 | 2.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| Lane Grp Cap (vph) | 455 | 407 | 483 | 410 | 487 | 1098 |
| v/s Ratio Prot | c0.16 | | c0.13 | | c0.18 | 0.19 |
| v/s Ratio Perm | | 0.03 | | 0.08 | | |
| v/c Ratio | 0.62 | 0.12 | 0.51 | 0.31 | 0.67 | 0.33 |
| Uniform Delay, d1 | 15.0 | 13.0 | 14.5 | 13.6 | 14.7 | 4.8 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 1.9 | 0.0 | 0.4 | 0.2 | 2.7 | 0.1 |
| Delay (s) | 16.9 | 13.1 | 14.8 | 13.8 | 17.3 | 4.9 |
| Level of Service | B | B | B | B | B | A |
| Approach Delay (s) | 15.3 | | 14.1 | | | 10.8 |
| Approach LOS | B | | B | | | B |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 13.2 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.60 | | |
| Actuated Cycle Length (s) | 45.2 | Sum of lost time (s) | 10.1 |
| Intersection Capacity Utilization | 53.5% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 40: Nave Dr & Bolling Dr

02/15/2018

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 338 | 110 | 523 | 98 | 83 | 532 |
| Future Volume (vph) | 338 | 110 | 523 | 98 | 83 | 532 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | 4.1 | | 3.0 | 3.5 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 0.97 | 1.00 | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 0.85 | 0.98 | | 1.00 | 1.00 |
| Flt Protected | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | 1787 | 1571 | 1844 | | 1805 | 1881 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | 1787 | 1571 | 1844 | | 1805 | 1881 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 367 | 120 | 568 | 107 | 90 | 578 |
| RTOR Reduction (vph) | 0 | 85 | 9 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 367 | 35 | 666 | 0 | 90 | 578 |
| Confl. Peds. (#/hr) | | 6 | | | | |
| Heavy Vehicles (%) | 1% | 0% | 1% | 0% | 0% | 1% |
| Turn Type | Prot | Perm | NA | | Prot | NA |
| Protected Phases | 4 | | 6 | | 5 | 2 |
| Permitted Phases | | 4 | | | | |
| Actuated Green, G (s) | 17.5 | 17.5 | 25.5 | | 6.5 | 35.6 |
| Effective Green, g (s) | 17.5 | 17.5 | 25.5 | | 6.5 | 35.6 |
| Actuated g/C Ratio | 0.29 | 0.29 | 0.43 | | 0.11 | 0.60 |
| Clearance Time (s) | 3.0 | 3.0 | 4.1 | | 3.0 | 3.5 |
| Vehicle Extension (s) | 2.0 | 2.0 | 2.0 | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 524 | 461 | 788 | | 196 | 1123 |
| v/s Ratio Prot | c0.21 | | c0.36 | | 0.05 | c0.31 |
| v/s Ratio Perm | | 0.02 | | | | |
| v/c Ratio | 0.70 | 0.08 | 0.84 | | 0.46 | 0.51 |
| Uniform Delay, d1 | 18.7 | 15.2 | 15.3 | | 24.9 | 7.0 |
| Progression Factor | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 3.4 | 0.0 | 8.0 | | 0.6 | 0.2 |
| Delay (s) | 22.2 | 15.2 | 23.2 | | 25.5 | 7.1 |
| Level of Service | C | B | C | | C | A |
| Approach Delay (s) | 20.5 | | 23.2 | | | 9.6 |
| Approach LOS | C | | C | | | A |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 17.5 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.75 | | |
| Actuated Cycle Length (s) | 59.6 | Sum of lost time (s) | 10.1 |
| Intersection Capacity Utilization | 70.0% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM 2010 AWSC
### 41: Alameda Del Prado & Clay Ct/Nave Dr

02/15/2018

| Intersection | |
|---|---|
| Intersection Delay, s/veh | 33.9 |
| Intersection LOS | D |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 131 | 12 | 0 | 66 | 123 | 620 | 2 | 164 | 45 | 109 | 21 | 6 |
| Future Vol, veh/h | 131 | 12 | 0 | 66 | 123 | 620 | 2 | 164 | 45 | 109 | 21 | 6 |
| Peak Hour Factor | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 138 | 13 | 0 | 69 | 129 | 653 | 2 | 173 | 47 | 115 | 22 | 6 |
| Number of Lanes | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Opposing Approach | WB | EB | SB | NB |
| Opposing Lanes | 2 | 1 | 2 | 1 |
| Conflicting Approach Left | SB | NB | EB | WB |
| Conflicting Lanes Left | 2 | 1 | 1 | 2 |
| Conflicting Approach Right | NB | SB | WB | EB |
| Conflicting Lanes Right | 1 | 2 | 2 | 1 |
| HCM Control Delay | 13.7 | 45.6 | 16.1 | 13.2 |
| HCM LOS | B | E | C | B |

| Lane | NBLn1 | EBLn1 | WBLn1 | WBLn2 | SBLn1 | SBLn2 |
|---|---|---|---|---|---|---|
| Vol Left, % | 1% | 92% | 35% | 0% | 100% | 0% |
| Vol Thru, % | 78% | 8% | 65% | 0% | 0% | 78% |
| Vol Right, % | 21% | 0% | 0% | 100% | 0% | 22% |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 211 | 143 | 189 | 620 | 109 | 27 |
| LT Vol | 2 | 131 | 66 | 0 | 109 | 0 |
| Through Vol | 164 | 12 | 123 | 0 | 0 | 21 |
| RT Vol | 45 | 0 | 0 | 620 | 0 | 6 |
| Lane Flow Rate | 222 | 151 | 199 | 653 | 115 | 28 |
| Geometry Grp | 6 | 6 | 7 | 7 | 7 | 7 |
| Degree of Util (X) | 0.449 | 0.309 | 0.35 | 0.989 | 0.262 | 0.059 |
| Departure Headway (Hd) | 7.278 | 7.381 | 6.445 | 5.557 | 8.207 | 7.534 |
| Convergence, Y/N | Yes | Yes | Yes | Yes | Yes | Yes |
| Cap | 498 | 488 | 561 | 659 | 439 | 477 |
| Service Time | 5.278 | 5.408 | 4.145 | 3.257 | 5.925 | 5.251 |
| HCM Lane V/C Ratio | 0.446 | 0.309 | 0.355 | 0.991 | 0.262 | 0.059 |
| HCM Control Delay | 16.1 | 13.7 | 12.6 | 55.6 | 13.8 | 10.7 |
| HCM Lane LOS | C | B | B | F | B | B |
| HCM 95th-tile Q | 2.3 | 1.3 | 1.6 | 15.1 | 1 | 0.2 |

## HCM 2010 AWSC
### 1: Simmons Ln & San Marin Dr

02/15/2018

| Intersection | |
|---|---|
| Intersection Delay, s/veh | 131.2 |
| Intersection LOS | F |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 12 | 482 | 96 | 342 | 1012 | 32 | 112 | 16 | 169 | 19 | 12 | 13 |
| Future Vol, veh/h | 12 | 482 | 96 | 342 | 1012 | 32 | 112 | 16 | 169 | 19 | 12 | 13 |
| Peak Hour Factor | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 13 | 507 | 101 | 360 | 1065 | 34 | 118 | 17 | 178 | 20 | 13 | 14 |
| Number of Lanes | 1 | 2 | 0 | 1 | 2 | 0 | 0 | 1 | 1 | 0 | 1 | 0 |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Opposing Approach | WB | EB | SB | NB |
| Opposing Lanes | 3 | 3 | 1 | 2 |
| Conflicting Approach Left | SB | NB | EB | WB |
| Conflicting Lanes Left | 1 | 2 | 3 | 3 |
| Conflicting Approach Right | NB | SB | WB | EB |
| Conflicting Lanes Right | 2 | 1 | 3 | 3 |
| HCM Control Delay | 47.9 | 192.9 | 25.6 | 18 |
| HCM LOS | E | F | D | C |

| Lane | NBLn1 | NBLn2 | EBLn1 | EBLn2 | EBLn3 | WBLn1 | WBLn2 | WBLn3 | SBLn1 |
|---|---|---|---|---|---|---|---|---|---|
| Vol Left, % | 88% | 0% | 100% | 0% | 0% | 100% | 0% | 0% | 43% |
| Vol Thru, % | 12% | 0% | 0% | 100% | 63% | 0% | 100% | 91% | 27% |
| Vol Right, % | 0% | 100% | 0% | 0% | 37% | 0% | 0% | 9% | 30% |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 128 | 169 | 12 | 321 | 257 | 342 | 675 | 369 | 44 |
| LT Vol | 112 | 0 | 12 | 0 | 0 | 342 | 0 | 0 | 19 |
| Through Vol | 16 | 0 | 0 | 321 | 161 | 0 | 675 | 337 | 12 |
| RT Vol | 0 | 169 | 0 | 0 | 96 | 0 | 0 | 32 | 13 |
| Lane Flow Rate | 135 | 178 | 13 | 338 | 270 | 360 | 710 | 389 | 46 |
| Geometry Grp | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Degree of Util (X) | 0.431 | 0.514 | 0.035 | 0.902 | 0.701 | 0.905 | 1.683 | 0.914 | 0.154 |
| Departure Headway (Hd) | 12.819 | 11.656 | 11.097 | 10.58 | 10.309 | 9.046 | 8.529 | 8.466 | 12.996 |
| Convergence, Y/N | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Cap | 283 | 311 | 325 | 345 | 354 | 400 | 426 | 428 | 278 |
| Service Time | 10.519 | 9.356 | 8.797 | 8.28 | 8.009 | 6.824 | 6.307 | 6.244 | 10.696 |
| HCM Lane V/C Ratio | 0.477 | 0.572 | 0.04 | 0.98 | 0.763 | 0.9 | 1.667 | 0.909 | 0.165 |
| HCM Control Delay | 24.9 | 26.1 | 14.2 | 60.4 | 33.9 | 55 | 338.6 | 54.3 | 18 |
| HCM Lane LOS | C | D | B | F | D | F | F | F | C |
| HCM 95th-tile Q | 2.1 | 2.8 | 0.1 | 8.8 | 5.1 | 9.5 | 42 | 10 | 0.5 |



## HCM Signalized Intersection Capacity Analysis
### 1: Simmons Ln & San Marin Dr

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 12 | 482 | 96 | 342 | 1012 | 32 | 112 | 16 | 169 | 19 | 12 | 13 |
| Future Volume (vph) | 12 | 482 | 96 | 342 | 1012 | 32 | 112 | 16 | 169 | 19 | 12 | 13 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | | 4.0 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | | 1.00 | 0.85 | | 0.96 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 0.96 | 1.00 | | 0.98 | |
| Satd. Flow (prot) | 1770 | 1863 | 1583 | 1770 | 1863 | 1583 | | 1785 | 1583 | | 1751 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 0.75 | 1.00 | | 0.86 | |
| Satd. Flow (perm) | 1770 | 1863 | 1583 | 1770 | 1863 | 1583 | | 1401 | 1583 | | 1540 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 13 | 507 | 101 | 360 | 1065 | 34 | 118 | 17 | 178 | 20 | 13 | 14 |
| RTOR Reduction (vph) | 0 | 0 | 58 | 0 | 0 | 11 | 0 | 0 | 85 | 0 | 12 | 0 |
| Lane Group Flow (vph) | 13 | 507 | 43 | 360 | 1065 | 23 | 0 | 135 | 93 | 0 | 35 | 0 |
| Turn Type | Prot | NA | Perm | Prot | NA | Perm | Perm | NA | pm+ov | Perm | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | | 2 | 3 | | 6 | |
| Permitted Phases | | | 4 | | | 8 | 2 | | 2 | 6 | | |
| Actuated Green, G (s) | 0.7 | 33.2 | 33.2 | 19.2 | 51.7 | 51.7 | | 13.6 | 32.8 | | 13.6 | |
| Effective Green, g (s) | 0.7 | 33.2 | 33.2 | 19.2 | 51.7 | 51.7 | | 13.6 | 32.8 | | 13.6 | |
| Actuated g/C Ratio | 0.01 | 0.43 | 0.43 | 0.25 | 0.66 | 0.66 | | 0.17 | 0.42 | | 0.17 | |
| Clearance Time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | | 4.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | |
| Lane Grp Cap (vph) | 15 | 792 | 673 | 435 | 1234 | 1049 | | 244 | 746 | | 268 | |
| v/s Ratio Prot | 0.01 | 0.27 | | c0.20 | c0.57 | | | | 0.03 | | | |
| v/s Ratio Perm | | | 0.03 | | | 0.01 | | c0.10 | 0.03 | | 0.02 | |
| v/c Ratio | 0.87 | 0.64 | 0.06 | 0.83 | 0.86 | 0.02 | | 0.55 | 0.12 | | 0.13 | |
| Uniform Delay, d1 | 38.6 | 17.7 | 13.2 | 27.8 | 10.4 | 4.5 | | 29.4 | 13.8 | | 27.2 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | |
| Incremental Delay, d2 | 162.9 | 1.8 | 0.0 | 12.2 | 6.5 | 0.0 | | 2.7 | 0.1 | | 0.2 | |
| Delay (s) | 201.5 | 19.5 | 13.3 | 40.1 | 16.8 | 4.5 | | 32.1 | 13.9 | | 27.4 | |
| Level of Service | F | B | B | D | B | A | | C | B | | C | |
| Approach Delay (s) | | 22.3 | | | 22.3 | | | 21.8 | | | 27.4 | |
| Approach LOS | | C | | | C | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 22.3 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.82 | | |
| Actuated Cycle Length (s) | 78.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 79.6% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

# MOVEMENT SUMMARY

## Site: 1 [PM Cumulative]

Simmons Lane/San Marin Drive
PM Cumulative with Project

Roundabout

**Movement Performance - Vehicles**

| Mov ID | OD Mov | Demand Flows Total veh/h | Demand Flows HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance ft | Prop. Queued | Effective Stop Rate per veh | Average Speed mph |
|---|---|---|---|---|---|---|---|---|---|---|---|
| South: NB Simmons Ln | | | | | | | | | | | |
| 3 | L2 | 117 | 2.0 | 0.399 | 9.7 | LOS A | 2.2 | 54.6 | 0.67 | 0.70 | 31.6 |
| 8 | T1 | 17 | 2.0 | 0.399 | 9.7 | LOS A | 2.2 | 54.6 | 0.67 | 0.70 | 31.6 |
| 18 | R2 | 176 | 2.0 | 0.399 | 9.7 | LOS A | 2.2 | 54.6 | 0.67 | 0.70 | 30.8 |
| Approach | | 309 | 2.0 | 0.399 | 9.7 | LOS A | 2.2 | 54.6 | 0.67 | 0.70 | 31.2 |
| East: WB San Marin Drive | | | | | | | | | | | |
| 1 | L2 | 356 | 2.0 | 0.293 | 5.6 | LOS A | 1.5 | 36.9 | 0.33 | 0.20 | 32.1 |
| 6 | T1 | 1054 | 2.0 | 1.011 | 49.6 | LOS F | 72.4 | 1838.6 | 1.00 | 1.69 | 20.7 |
| 16 | R2 | 33 | 2.0 | 1.011 | 49.6 | LOS F | 72.4 | 1838.6 | 1.00 | 1.69 | 20.3 |
| Approach | | 1444 | 2.0 | 1.011 | 38.8 | LOS D | 72.4 | 1838.6 | 0.84 | 1.32 | 22.7 |
| North: SB Simmons Ln | | | | | | | | | | | |
| 7 | L2 | 20 | 2.0 | 0.122 | 11.6 | LOS B | 0.4 | 9.8 | 0.76 | 0.76 | 30.7 |
| 4 | T1 | 13 | 2.0 | 0.122 | 11.6 | LOS B | 0.4 | 9.8 | 0.76 | 0.76 | 30.7 |
| 14 | R2 | 14 | 2.0 | 0.122 | 11.6 | LOS B | 0.4 | 9.8 | 0.76 | 0.76 | 30.0 |
| Approach | | 46 | 2.0 | 0.122 | 11.6 | LOS B | 0.4 | 9.8 | 0.76 | 0.76 | 30.5 |
| West: EB San Marin Drive | | | | | | | | | | | |
| 5 | L2 | 13 | 2.0 | 0.681 | 15.4 | LOS B | 8.8 | 222.3 | 0.81 | 1.02 | 30.1 |
| 2 | T1 | 502 | 2.0 | 0.681 | 15.4 | LOS B | 8.8 | 222.3 | 0.81 | 1.02 | 30.1 |
| 12 | R2 | 100 | 2.0 | 0.681 | 15.4 | LOS B | 8.8 | 222.3 | 0.81 | 1.02 | 29.3 |
| Approach | | 615 | 2.0 | 0.681 | 15.4 | LOS B | 8.8 | 222.3 | 0.81 | 1.02 | 29.9 |
| All Vehicles | | 2414 | 2.0 | 1.011 | 28.6 | LOS C | 72.4 | 1838.6 | 0.81 | 1.15 | 25.2 |

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.


Organisation: W-TRANS | Processed: Tuesday, February 27, 2018 3:51:48 PM
Project: N:\AAA\MAX\NOV\126NOV\SIDRA\Simmons-San Marin.sip7

# HCM Signalized Intersection Capacity Analysis

## 2: W Campus Dr & San Marin Dr

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 8 | 708 | 0 | 3 | 1384 | 45 | 0 | 0 | 0 | 207 | 0 | 36 |
| Future Volume (vph) | 8 | 708 | 0 | 3 | 1384 | 45 | 0 | 0 | 0 | 207 | 0 | 36 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.8 | | 4.0 | 4.8 | 4.8 | | | | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 | | | | 0.95 | 0.95 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | | | 1.00 | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | | 1.00 | 1.00 | 0.85 | | | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | | | | 0.95 | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 3574 | | 1805 | 3574 | 1615 | | | | 1715 | 1715 | 1615 |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | | | | 0.76 | 0.76 | 1.00 |
| Satd. Flow (perm) | 1805 | 3574 | | 1805 | 3574 | 1615 | | | | 1367 | 1367 | 1615 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 8 | 745 | 0 | 3 | 1457 | 47 | 0 | 0 | 0 | 218 | 0 | 38 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 18 | 0 | 0 | 0 | 0 | 0 | 33 |
| Lane Group Flow (vph) | 8 | 745 | 0 | 3 | 1457 | 29 | 0 | 0 | 0 | 109 | 109 | 5 |
| Confl. Peds. (#/hr) | | | 2 | | | | | | | | | |
| Heavy Vehicles (%) | 0% | 1% | 0% | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Prot | NA | | Prot | NA | Perm | | | | Perm | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | | | | 6 | 8 | | | 4 | | 4 |
| Actuated Green, G (s) | 1.5 | 36.7 | | 1.3 | 36.5 | 36.5 | | | | 8.4 | 8.4 | 8.4 |
| Effective Green, g (s) | 1.5 | 36.7 | | 1.3 | 36.5 | 36.5 | | | | 8.4 | 8.4 | 8.4 |
| Actuated g/C Ratio | 0.03 | 0.62 | | 0.02 | 0.62 | 0.62 | | | | 0.14 | 0.14 | 0.14 |
| Clearance Time (s) | 4.0 | 4.8 | | 4.0 | 4.8 | 4.8 | | | | 4.0 | 4.0 | 4.0 |
| Vehicle Extension (s) | 2.0 | 4.0 | | 2.0 | 4.0 | 4.0 | | | | 2.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 45 | 2215 | | 39 | 2203 | 995 | | | | 193 | 193 | 229 |
| v/s Ratio Prot | c0.00 | 0.21 | | 0.00 | c0.41 | | | | | | | |
| v/s Ratio Perm | | | | | | 0.02 | | | | c0.08 | 0.08 | 0.00 |
| v/c Ratio | 0.18 | 0.34 | | 0.08 | 0.66 | 0.03 | | | | 0.56 | 0.56 | 0.02 |
| Uniform Delay, d1 | 28.2 | 5.4 | | 28.4 | 7.3 | 4.4 | | | | 23.7 | 23.7 | 21.9 |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.7 | 0.1 | | 0.3 | 0.8 | 0.0 | | | | 2.2 | 2.2 | 0.0 |
| Delay (s) | 28.9 | 5.5 | | 28.7 | 8.2 | 4.4 | | | | 25.9 | 25.9 | 21.9 |
| Level of Service | C | A | | C | A | A | | | | C | C | C |
| Approach Delay (s) | | 5.8 | | | 8.1 | | | 0.0 | | | 25.3 | |
| Approach LOS | | A | | | A | | | A | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 9.2 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.63 | | |
| Actuated Cycle Length (s) | 59.2 | Sum of lost time (s) | 12.8 |
| Intersection Capacity Utilization | 53.9% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 3: San Marin Dr & E Campus Drive

02/15/2018

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 3 | 919 | 1427 | 136 | 493 | 12 |
| Future Volume (vph) | 3 | 919 | 1427 | 136 | 493 | 12 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 4.3 | 4.3 | 4.3 | 3.0 | 3.0 |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | 1.00 | 0.97 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 1.00 | 0.85 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 3574 | 3574 | 1615 | 3502 | 1595 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (perm) | 1805 | 3574 | 3574 | 1615 | 3502 | 1595 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 3 | 957 | 1486 | 142 | 514 | 12 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 53 | 0 | 10 |
| Lane Group Flow (vph) | 3 | 957 | 1486 | 89 | 514 | 3 |
| Confl. Peds. (#/hr) | | | | | | 1 |
| Heavy Vehicles (%) | 0% | 1% | 1% | 0% | 0% | 0% |
| Turn Type | Prot | NA | NA | Perm | Prot | Perm |
| Protected Phases | 5 | 2 | 6 | | 4 | |
| Permitted Phases | | | | 6 | | 4 |
| Actuated Green, G (s) | 1.3 | 48.8 | 44.5 | 44.5 | 18.2 | 18.2 |
| Effective Green, g (s) | 1.3 | 48.8 | 44.5 | 44.5 | 18.2 | 18.2 |
| Actuated g/C Ratio | 0.02 | 0.66 | 0.60 | 0.60 | 0.24 | 0.24 |
| Clearance Time (s) | 3.0 | 4.3 | 4.3 | 4.3 | 3.0 | 3.0 |
| Vehicle Extension (s) | 2.0 | 4.0 | 4.0 | 4.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 31 | 2347 | 2140 | 967 | 857 | 390 |
| v/s Ratio Prot | 0.00 | c0.27 | c0.42 | | c0.15 | |
| v/s Ratio Perm | | | | 0.06 | | 0.00 |
| v/c Ratio | 0.10 | 0.41 | 0.69 | 0.09 | 0.60 | 0.01 |
| Uniform Delay, d1 | 35.9 | 6.0 | 10.2 | 6.3 | 24.8 | 21.2 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.5 | 0.2 | 1.1 | 0.1 | 0.8 | 0.0 |
| Delay (s) | 36.4 | 6.1 | 11.3 | 6.4 | 25.6 | 21.2 |
| Level of Service | D | A | B | A | C | C |
| Approach Delay (s) | | 6.2 | 10.9 | | 25.5 | |
| Approach LOS | | A | B | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 11.9 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.66 | | |
| Actuated Cycle Length (s) | 74.3 | Sum of lost time (s) | 10.3 |
| Intersection Capacity Utilization | 60.8% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 4: Redwood Blvd & San Marin Dr

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 36 | 1168 | 229 | 417 | 1113 | 235 | 302 | 100 | 562 | 731 | 165 | 107 |
| Future Volume (vph) | 36 | 1168 | 229 | 417 | 1113 | 235 | 302 | 100 | 562 | 731 | 165 | 107 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.6 | | 3.0 | 4.0 | | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 | |
| Lane Util. Factor | 1.00 | 0.91 | | 1.00 | 0.91 | | 0.97 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 0.99 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 0.98 | | 1.00 | 0.97 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.94 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1787 | 4997 | | 1752 | 5002 | | 3467 | 1881 | 1568 | 1787 | 1758 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1787 | 4997 | | 1752 | 5002 | | 3467 | 1881 | 1568 | 1787 | 1758 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 38 | 1229 | 241 | 439 | 1172 | 247 | 318 | 105 | 592 | 769 | 174 | 113 |
| RTOR Reduction (vph) | 0 | 22 | 0 | 0 | 24 | 0 | 0 | 0 | 177 | 0 | 18 | 0 |
| Lane Group Flow (vph) | 38 | 1448 | 0 | 439 | 1395 | 0 | 318 | 105 | 415 | 769 | 269 | 0 |
| Confl. Peds. (#/hr) | | | 4 | | | | | | | | | 5 |
| Confl. Bikes (#/hr) | | | | | | | | | | | | 1 |
| Heavy Vehicles (%) | 1% | 1% | 1% | 3% | 1% | 1% | 1% | 1% | 3% | 1% | 1% | 1% |
| Turn Type | Prot | NA | | Prot | NA | | Split | NA | Perm | Split | NA | |
| Protected Phases | 1 | 6 | | 5 | 2 | | 7 | 7 | | 8 | 8 | |
| Permitted Phases | | | | | 2 | | | | 7 | | | |
| Actuated Green, G (s) | 8.0 | 44.1 | | 14.8 | 50.5 | | 12.2 | 12.2 | 12.2 | 43.7 | 43.7 | |
| Effective Green, g (s) | 8.0 | 44.1 | | 14.8 | 50.5 | | 12.2 | 12.2 | 12.2 | 43.7 | 43.7 | |
| Actuated g/C Ratio | 0.06 | 0.34 | | 0.11 | 0.39 | | 0.09 | 0.09 | 0.09 | 0.34 | 0.34 | |
| Clearance Time (s) | 3.0 | 3.6 | | 3.0 | 4.0 | | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 | |
| Vehicle Extension (s) | 2.0 | 4.0 | | 5.0 | 4.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 109 | 1695 | | 199 | 1943 | | 325 | 176 | 147 | 600 | 590 | |
| v/s Ratio Prot | 0.02 | c0.29 | | c0.25 | 0.28 | | 0.09 | 0.06 | | c0.43 | 0.15 | |
| v/s Ratio Perm | | | | | | | | | c0.26 | | | |
| v/c Ratio | 0.35 | 0.85 | | 2.21 | 0.72 | | 0.98 | 0.60 | 2.83 | 1.28 | 0.46 | |
| Uniform Delay, d1 | 58.5 | 40.0 | | 57.6 | 33.7 | | 58.8 | 56.5 | 58.9 | 43.1 | 33.8 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 0.7 | 4.6 | | 558.8 | 2.3 | | 43.4 | 3.6 | 839.9 | 139.2 | 0.2 | |
| Delay (s) | 59.2 | 44.5 | | 616.4 | 36.0 | | 102.2 | 60.1 | 898.8 | 182.3 | 34.0 | |
| Level of Service | E | D | | F | D | | F | E | F | F | C | |
| Approach Delay (s) | | 44.9 | | | 173.1 | | | 562.4 | | | 142.0 | |
| Approach LOS | | D | | | F | | | F | | | F | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 204.2 | HCM 2000 Level of Service | F |
| HCM 2000 Volume to Capacity ratio | 1.40 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 15.6 |
| Intersection Capacity Utilization | 114.7% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 4: Redwood Blvd & San Marin Dr

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 36 | 1168 | 229 | 417 | 1113 | 235 | 302 | 100 | 562 | 731 | 165 | 107 |
| Future Volume (vph) | 36 | 1168 | 229 | 417 | 1113 | 235 | 302 | 100 | 562 | 731 | 165 | 107 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.6 | | 3.0 | 4.0 | 4.3 | 4.3 | 4.3 | 3.0 | 4.3 | 4.3 | |
| Lane Util. Factor | 1.00 | 0.91 | | 0.97 | 0.95 | 1.00 | 0.95 | 0.95 | 0.88 | 0.91 | 0.91 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 0.98 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.97 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 0.98 | 1.00 | 0.95 | 0.97 | |
| Satd. Flow (prot) | 1787 | 4996 | | 3400 | 3574 | 1599 | 1698 | 1743 | 2760 | 1626 | 3235 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 0.98 | 1.00 | 0.95 | 0.97 | |
| Satd. Flow (perm) | 1787 | 4996 | | 3400 | 3574 | 1599 | 1698 | 1743 | 2760 | 1626 | 3235 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 38 | 1229 | 241 | 439 | 1172 | 247 | 318 | 105 | 592 | 769 | 174 | 113 |
| RTOR Reduction (vph) | 0 | 21 | 0 | 0 | 0 | 77 | 0 | 0 | 49 | 0 | 12 | 0 |
| Lane Group Flow (vph) | 38 | 1449 | 0 | 439 | 1172 | 170 | 210 | 213 | 543 | 384 | 660 | 0 |
| Confl. Peds. (#/hr) | | | 4 | | | | | | | | | 5 |
| Confl. Bikes (#/hr) | | | | | | | | | | | | 1 |
| Heavy Vehicles (%) | 1% | 1% | 1% | 3% | 1% | 1% | 1% | 1% | 3% | 1% | 1% | 1% |
| Turn Type | Prot | NA | | Prot | NA | pm+ov | Split | NA | pm+ov | Split | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | 4 | 8 | 8 | 1 | 4 | 4 | |
| Permitted Phases | | | | | | 6 | | | 8 | | | |
| Actuated Green, G (s) | 8.0 | 46.6 | | 20.6 | 58.8 | 96.3 | 20.1 | 20.1 | 40.7 | 37.5 | 37.5 | |
| Effective Green, g (s) | 8.0 | 46.6 | | 20.6 | 58.8 | 96.3 | 20.1 | 20.1 | 40.7 | 37.5 | 37.5 | |
| Actuated g/C Ratio | 0.06 | 0.33 | | 0.15 | 0.42 | 0.69 | 0.14 | 0.14 | 0.29 | 0.27 | 0.27 | |
| Clearance Time (s) | 3.0 | 3.6 | | 3.0 | 4.0 | 4.3 | 4.3 | 4.3 | 3.0 | 4.3 | 4.3 | |
| Vehicle Extension (s) | 2.0 | 4.0 | | 5.0 | 4.0 | 2.0 | 2.0 | 2.0 | 5.0 | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 102 | 1662 | | 500 | 1501 | 1099 | 243 | 250 | 802 | 435 | 866 | |
| v/s Ratio Prot | 0.02 | c0.29 | | c0.13 | 0.33 | 0.04 | c0.12 | 0.12 | 0.10 | c0.24 | 0.20 | |
| v/s Ratio Perm | | | | | | 0.06 | | | 0.10 | | | |
| v/c Ratio | 0.37 | 0.87 | | 0.88 | 0.78 | 0.15 | 0.86 | 0.85 | 0.68 | 0.88 | 0.76 | |
| Uniform Delay, d1 | 63.6 | 43.9 | | 58.5 | 35.0 | 7.6 | 58.6 | 58.5 | 43.8 | 49.1 | 47.2 | |
| Progression Factor | 1.00 | 1.00 | | 0.83 | 0.57 | 3.40 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 0.8 | 6.6 | | 14.5 | 3.4 | 0.0 | 25.0 | 22.6 | 3.0 | 18.2 | 3.6 | |
| Delay (s) | 64.4 | 50.5 | | 62.9 | 23.5 | 25.9 | 83.6 | 81.1 | 46.8 | 67.3 | 50.8 | |
| Level of Service | E | D | | E | C | C | F | F | D | E | D | |
| Approach Delay (s) | | 50.9 | | | 33.1 | | | 61.6 | | | 56.8 | |
| Approach LOS | | D | | | C | | | E | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 48.0 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.88 | | |
| Actuated Cycle Length (s) | 140.0 | Sum of lost time (s) | 15.6 |
| Intersection Capacity Utilization | 96.0% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 5: US 101 SB Ramps & San Marin Dr

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 1302 | 1123 | 200 | 1433 | 0 | 0 | 0 | 0 | 67 | 2 | 386 |
| Future Volume (vph) | 0 | 1302 | 1123 | 200 | 1433 | 0 | 0 | 0 | 0 | 67 | 2 | 386 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.9 | 4.9 | 3.0 | 5.3 | | | | | | 4.0 | 4.0 |
| Lane Util. Factor | | 0.95 | 1.00 | 1.00 | 0.95 | | | | | | 1.00 | 0.88 |
| Frpb, ped/bikes | | 1.00 | 0.98 | 1.00 | 1.00 | | | | | | 1.00 | 1.00 |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | | | | | 1.00 | 1.00 |
| Frt | | 1.00 | 0.85 | 1.00 | 1.00 | | | | | | 1.00 | 0.85 |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | | 0.95 | 1.00 |
| Satd. Flow (prot) | | 3574 | 1575 | 1805 | 3574 | | | | | | 1812 | 2814 |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | | 0.95 | 1.00 |
| Satd. Flow (perm) | | 3574 | 1575 | 1805 | 3574 | | | | | | 1812 | 2814 |
| Peak-hour factor, PHF | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| Adj. Flow (vph) | 0 | 1342 | 1158 | 206 | 1477 | 0 | 0 | 0 | 0 | 69 | 2 | 398 |
| RTOR Reduction (vph) | 0 | 0 | 264 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 125 |
| Lane Group Flow (vph) | 0 | 1342 | 894 | 206 | 1477 | 0 | 0 | 0 | 0 | 0 | 71 | 273 |
| Confl. Peds. (#/hr) | | | 4 | | | | | | | | | |
| Heavy Vehicles (%) | 0% | 1% | 1% | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 1% |
| Turn Type | | NA | Perm | Prot | NA | | | | | Split | NA | Perm |
| Protected Phases | | 2 | | 1 | 6 | | | | | 4 | 4 | |
| Permitted Phases | | | 2 | | | | | | | | | 4 |
| Actuated Green, G (s) | | 41.1 | 41.1 | 9.0 | 52.7 | | | | | | 8.0 | 8.0 |
| Effective Green, g (s) | | 41.1 | 41.1 | 9.0 | 52.7 | | | | | | 8.0 | 8.0 |
| Actuated g/C Ratio | | 0.59 | 0.59 | 0.13 | 0.75 | | | | | | 0.11 | 0.11 |
| Clearance Time (s) | | 4.9 | 4.9 | 3.0 | 5.3 | | | | | | 4.0 | 4.0 |
| Vehicle Extension (s) | | 4.0 | 4.0 | 2.0 | 4.0 | | | | | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | | 2098 | 924 | 232 | 2690 | | | | | | 207 | 321 |
| v/s Ratio Prot | | 0.38 | | c0.11 | 0.41 | | | | | | 0.04 | |
| v/s Ratio Perm | | | c0.57 | | | | | | | | | c0.10 |
| v/c Ratio | | 0.64 | 0.97 | 0.89 | 0.55 | | | | | | 0.34 | 0.85 |
| Uniform Delay, d1 | | 9.6 | 13.8 | 30.0 | 3.6 | | | | | | 28.6 | 30.4 |
| Progression Factor | | 1.00 | 1.00 | 1.00 | 1.00 | | | | | | 1.00 | 1.00 |
| Incremental Delay, d2 | | 1.5 | 22.7 | 30.2 | 0.8 | | | | | | 0.4 | 18.3 |
| Delay (s) | | 11.1 | 36.5 | 60.2 | 4.5 | | | | | | 28.9 | 48.8 |
| Level of Service | | B | D | E | A | | | | | | C | D |
| Approach Delay (s) | | 22.8 | | | 11.3 | | | 0.0 | | | 45.8 | |
| Approach LOS | | C | | | B | | | A | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 21.0 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.94 | | |
| Actuated Cycle Length (s) | 70.0 | Sum of lost time (s) | 11.9 |
| Intersection Capacity Utilization | 144.4% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 5: US 101 SB Ramps & San Marin Dr

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 1302 | 1123 | 200 | 1433 | 0 | 0 | 0 | 0 | 67 | 2 | 386 |
| Future Volume (vph) | 0 | 1302 | 1123 | 200 | 1433 | 0 | 0 | 0 | 0 | 67 | 2 | 386 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.9 | 4.9 | 3.0 | 5.3 | | | | | | 4.0 | 4.0 |
| Lane Util. Factor | | 0.91 | 0.91 | 1.00 | 0.95 | | | | | | 1.00 | 0.88 |
| Frpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | | | | | 1.00 | 1.00 |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | | | | | 1.00 | 1.00 |
| Frt | | 0.97 | 0.85 | 1.00 | 1.00 | | | | | | 1.00 | 0.85 |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | | 0.95 | 1.00 |
| Satd. Flow (prot) | | 3297 | 1455 | 1805 | 3574 | | | | | | 1812 | 2814 |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | | 0.95 | 1.00 |
| Satd. Flow (perm) | | 3297 | 1455 | 1805 | 3574 | | | | | | 1812 | 2814 |
| Peak-hour factor, PHF | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| Adj. Flow (vph) | 0 | 1342 | 1158 | 206 | 1477 | 0 | 0 | 0 | 0 | 69 | 2 | 398 |
| RTOR Reduction (vph) | 0 | 15 | 229 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 167 |
| Lane Group Flow (vph) | 0 | 1721 | 535 | 206 | 1477 | 0 | 0 | 0 | 0 | 0 | 71 | 231 |
| Confl. Peds. (#/hr) | | | 4 | | | | | | | | | |
| Heavy Vehicles (%) | 0% | 1% | 1% | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 1% |
| Turn Type | | NA | Prot | Prot | NA | | | | | Split | NA | Perm |
| Protected Phases | | 2 | 2 | 1 | 6 | | | | | 4 | 4 | |
| Permitted Phases | | | | | | | | | | | | 4 |
| Actuated Green, G (s) | | 92.0 | 92.0 | 17.4 | 117.4 | | | | | | 13.3 | 13.3 |
| Effective Green, g (s) | | 92.0 | 92.0 | 17.4 | 117.4 | | | | | | 13.3 | 13.3 |
| Actuated g/C Ratio | | 0.66 | 0.66 | 0.12 | 0.84 | | | | | | 0.10 | 0.10 |
| Clearance Time (s) | | 4.9 | 4.9 | 3.0 | 5.3 | | | | | | 4.0 | 4.0 |
| Vehicle Extension (s) | | 4.0 | 4.0 | 2.0 | 4.0 | | | | | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | | 2166 | 956 | 224 | 2997 | | | | | | 172 | 267 |
| v/s Ratio Prot | | c0.52 | 0.37 | c0.11 | c0.41 | | | | | | 0.04 | |
| v/s Ratio Perm | | | | | | | | | | | | c0.08 |
| v/c Ratio | | 0.79 | 0.56 | 0.92 | 0.49 | | | | | | 0.41 | 0.87 |
| Uniform Delay, d1 | | 17.2 | 13.0 | 60.6 | 3.1 | | | | | | 59.7 | 62.5 |
| Progression Factor | | 0.80 | 0.87 | 0.95 | 2.27 | | | | | | 1.00 | 1.00 |
| Incremental Delay, d2 | | 1.9 | 1.5 | 28.9 | 0.4 | | | | | | 0.6 | 23.6 |
| Delay (s) | | 15.6 | 12.8 | 86.3 | 7.4 | | | | | | 60.3 | 86.1 |
| Level of Service | | B | B | F | A | | | | | | E | F |
| Approach Delay (s) | | 14.8 | | | 17.1 | | | 0.0 | | | 82.1 | |
| Approach LOS | | B | | | B | | | A | | | F | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 22.4 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.81 | | |
| Actuated Cycle Length (s) | 140.0 | Sum of lost time (s) | 14.9 |
| Intersection Capacity Utilization | 112.3% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 6: US 101 NB Ramps & San Marin Dr

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 629 | 690 | 0 | 0 | 569 | 63 | 1163 | 113 | 269 | 0 | 0 | 0 |
| Future Volume (vph) | 629 | 690 | 0 | 0 | 569 | 63 | 1163 | 113 | 269 | 0 | 0 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.6 | | | 4.9 | 4.9 | 3.5 | 3.5 | | | | |
| Lane Util. Factor | 0.97 | 1.00 | | | 0.95 | 1.00 | 0.95 | 0.95 | | | | |
| Frpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | 0.99 | 1.00 | 0.99 | | | | |
| Flpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | | | |
| Frt | 1.00 | 1.00 | | | 1.00 | 0.85 | 1.00 | 0.95 | | | | |
| Flt Protected | 0.95 | 1.00 | | | 1.00 | 1.00 | 0.95 | 0.98 | | | | |
| Satd. Flow (prot) | 3467 | 1881 | | | 3574 | 1593 | 1681 | 1622 | | | | |
| Flt Permitted | 0.95 | 1.00 | | | 1.00 | 1.00 | 0.95 | 0.98 | | | | |
| Satd. Flow (perm) | 3467 | 1881 | | | 3574 | 1593 | 1681 | 1622 | | | | |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 655 | 719 | 0 | 0 | 593 | 66 | 1211 | 118 | 280 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 55 | 0 | 29 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 655 | 719 | 0 | 0 | 593 | 11 | 823 | 757 | 0 | 0 | 0 | 0 |
| Confl. Peds. (#/hr) | | | 3 | | | 1 | | | 1 | 1 | | |
| Heavy Vehicles (%) | 1% | 1% | 0% | 0% | 1% | 0% | 2% | 0% | 3% | 0% | 0% | 0% |
| Turn Type | Prot | NA | | | NA | Perm | Split | NA | | | | |
| Protected Phases | 5 | 2 | | | 6 | | 8 | 8 | | | | |
| Permitted Phases | | | | | | 6 | | | | | | |
| Actuated Green, G (s) | 10.3 | 26.0 | | | 11.9 | 11.9 | 35.1 | 35.1 | | | | |
| Effective Green, g (s) | 10.3 | 26.0 | | | 11.9 | 11.9 | 35.1 | 35.1 | | | | |
| Actuated g/C Ratio | 0.15 | 0.38 | | | 0.17 | 0.17 | 0.51 | 0.51 | | | | |
| Clearance Time (s) | 3.5 | 4.6 | | | 4.9 | 4.9 | 3.5 | 3.5 | | | | |
| Vehicle Extension (s) | 2.0 | 4.0 | | | 4.0 | 4.0 | 2.5 | 2.5 | | | | |
| Lane Grp Cap (vph) | 516 | 706 | | | 614 | 273 | 852 | 822 | | | | |
| v/s Ratio Prot | c0.19 | c0.38 | | | 0.17 | | c0.49 | 0.47 | | | | |
| v/s Ratio Perm | | | | | | 0.01 | | | | | | |
| v/c Ratio | 1.27 | 1.02 | | | 0.97 | 0.04 | 0.97 | 0.92 | | | | |
| Uniform Delay, d1 | 29.5 | 21.6 | | | 28.4 | 23.9 | 16.5 | 15.8 | | | | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | | | |
| Incremental Delay, d2 | 135.9 | 38.6 | | | 27.8 | 0.1 | 22.6 | 15.6 | | | | |
| Delay (s) | 165.3 | 60.2 | | | 56.3 | 24.0 | 39.1 | 31.3 | | | | |
| Level of Service | F | E | | | E | C | D | C | | | | |
| Approach Delay (s) | | 110.3 | | | 53.0 | | | 35.3 | | | 0.0 | |
| Approach LOS | | F | | | D | | | D | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 66.8 | HCM 2000 Level of Service | E |
| HCM 2000 Volume to Capacity ratio | 1.08 | | |
| Actuated Cycle Length (s) | 69.2 | Sum of lost time (s) | 11.9 |
| Intersection Capacity Utilization | 144.4% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 6: US 101 NB Ramps & San Marin Dr

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 629 | 690 | 0 | 0 | 569 | 63 | 1163 | 113 | 269 | 0 | 0 | 0 |
| Future Volume (vph) | 629 | 690 | 0 | 0 | 569 | 63 | 1163 | 113 | 269 | 0 | 0 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.6 | | | 4.9 | 4.9 | 3.5 | 3.5 | | | | |
| Lane Util. Factor | 0.97 | 1.00 | | | 0.95 | 1.00 | 0.97 | 1.00 | | | | |
| Frpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | 0.99 | 1.00 | 0.99 | | | | |
| Flpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | | | |
| Frt | 1.00 | 1.00 | | | 1.00 | 0.85 | 1.00 | 0.89 | | | | |
| Flt Protected | 0.95 | 1.00 | | | 1.00 | 1.00 | 0.95 | 1.00 | | | | |
| Satd. Flow (prot) | 3467 | 1881 | | | 3574 | 1593 | 3433 | 1640 | | | | |
| Flt Permitted | 0.95 | 1.00 | | | 1.00 | 1.00 | 0.95 | 1.00 | | | | |
| Satd. Flow (perm) | 3467 | 1881 | | | 3574 | 1593 | 3433 | 1640 | | | | |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 655 | 719 | 0 | 0 | 593 | 66 | 1211 | 118 | 280 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 39 | 0 | 56 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 655 | 719 | 0 | 0 | 593 | 27 | 1211 | 342 | 0 | 0 | 0 | 0 |
| Confl. Peds. (#/hr) | | | 3 | | | 1 | | | 1 | 1 | | |
| Heavy Vehicles (%) | 1% | 1% | 0% | 0% | 1% | 0% | 2% | 0% | 3% | 0% | 0% | 0% |
| Turn Type | Prot | NA | | | NA | Perm | Split | NA | | | | |
| Protected Phases | 5 | 2 | | | 6 | | 8 | 8 | | | | |
| Permitted Phases | | | | | | 6 | | | | | | |
| Actuated Green, G (s) | 30.2 | 62.6 | | | 28.6 | 28.6 | 69.3 | 69.3 | | | | |
| Effective Green, g (s) | 30.2 | 62.6 | | | 28.6 | 28.6 | 69.3 | 69.3 | | | | |
| Actuated g/C Ratio | 0.22 | 0.45 | | | 0.20 | 0.20 | 0.49 | 0.49 | | | | |
| Clearance Time (s) | 3.5 | 4.6 | | | 4.9 | 4.9 | 3.5 | 3.5 | | | | |
| Vehicle Extension (s) | 2.0 | 4.0 | | | 4.0 | 4.0 | 2.5 | 2.5 | | | | |
| Lane Grp Cap (vph) | 747 | 841 | | | 730 | 325 | 1699 | 811 | | | | |
| v/s Ratio Prot | 0.19 | c0.38 | | | 0.17 | | c0.35 | 0.21 | | | | |
| v/s Ratio Perm | | | | | | 0.02 | | | | | | |
| v/c Ratio | 0.88 | 0.85 | | | 0.81 | 0.08 | 0.71 | 0.42 | | | | |
| Uniform Delay, d1 | 53.1 | 34.6 | | | 53.1 | 45.1 | 27.6 | 22.6 | | | | |
| Progression Factor | 0.72 | 0.55 | | | 1.00 | 1.00 | 1.00 | 1.00 | | | | |
| Incremental Delay, d2 | 7.3 | 5.8 | | | 7.2 | 0.2 | 2.6 | 1.6 | | | | |
| Delay (s) | 45.5 | 24.8 | | | 60.4 | 45.2 | 30.2 | 24.2 | | | | |
| Level of Service | D | C | | | E | D | C | C | | | | |
| Approach Delay (s) | | 34.6 | | | 58.8 | | | 28.7 | | | 0.0 | |
| Approach LOS | | C | | | E | | | C | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 36.4 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.80 | | |
| Actuated Cycle Length (s) | 140.0 | Sum of lost time (s) | 11.9 |
| Intersection Capacity Utilization | 112.3% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 7: Redwood Blvd & Olive St

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 166 | 74 | 37 | 189 | 107 | 112 | 77 | 835 | 216 | 137 | 539 | 157 |
| Future Volume (vph) | 166 | 74 | 37 | 189 | 107 | 112 | 77 | 835 | 216 | 137 | 539 | 157 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 5.1 | 5.1 | | | 5.1 | | 4.0 | 3.9 | 3.9 | 4.0 | 3.9 | |
| Lane Util. Factor | 1.00 | 1.00 | | | 1.00 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | |
| Frt | 1.00 | 0.95 | | | 0.96 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.97 | |
| Flt Protected | 0.95 | 1.00 | | | 0.98 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1770 | 1770 | | | 1753 | | 1770 | 3539 | 1583 | 1770 | 3420 | |
| Flt Permitted | 0.95 | 1.00 | | | 0.98 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1770 | 1770 | | | 1753 | | 1770 | 3539 | 1583 | 1770 | 3420 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 175 | 78 | 39 | 199 | 113 | 118 | 81 | 879 | 227 | 144 | 567 | 165 |
| RTOR Reduction (vph) | 0 | 18 | 0 | 0 | 12 | 0 | 0 | 0 | 78 | 0 | 23 | 0 |
| Lane Group Flow (vph) | 175 | 99 | 0 | 0 | 418 | 0 | 81 | 879 | 149 | 144 | 709 | 0 |
| Turn Type | Split | NA | | Split | NA | | Prot | NA | Perm | Prot | NA | |
| Protected Phases | 4 | 4 | | 8 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | | | | | | | 2 | | | |
| Actuated Green, G (s) | 14.0 | 14.0 | | | 26.1 | | 7.8 | 28.4 | 28.4 | 10.1 | 30.7 | |
| Effective Green, g (s) | 14.0 | 14.0 | | | 26.1 | | 7.8 | 28.4 | 28.4 | 10.1 | 30.7 | |
| Actuated g/C Ratio | 0.14 | 0.14 | | | 0.27 | | 0.08 | 0.29 | 0.29 | 0.10 | 0.32 | |
| Clearance Time (s) | 5.1 | 5.1 | | | 5.1 | | 4.0 | 3.9 | 3.9 | 4.0 | 3.9 | |
| Vehicle Extension (s) | 1.0 | 1.0 | | | 1.0 | | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | |
| Lane Grp Cap (vph) | 256 | 256 | | | 473 | | 142 | 1039 | 464 | 184 | 1085 | |
| v/s Ratio Prot | c0.10 | 0.06 | | | c0.24 | | 0.05 | c0.25 | | c0.08 | 0.21 | |
| v/s Ratio Perm | | | | | | | | | 0.09 | | | |
| v/c Ratio | 0.68 | 0.39 | | | 0.88 | | 0.57 | 0.85 | 0.32 | 0.78 | 0.65 | |
| Uniform Delay, d1 | 39.2 | 37.5 | | | 33.9 | | 42.8 | 32.1 | 26.6 | 42.2 | 28.4 | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 5.9 | 0.4 | | | 17.2 | | 3.4 | 6.2 | 0.1 | 17.9 | 1.1 | |
| Delay (s) | 45.1 | 37.8 | | | 51.0 | | 46.2 | 38.3 | 26.8 | 60.1 | 29.5 | |
| Level of Service | D | D | | | D | | D | D | C | E | C | |
| Approach Delay (s) | | 42.2 | | | 51.0 | | | 36.6 | | | 34.5 | |
| Approach LOS | | D | | | D | | | D | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 38.8 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.81 | | |
| Actuated Cycle Length (s) | 96.7 | Sum of lost time (s) | 18.1 |
| Intersection Capacity Utilization | 71.9% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 141 | 142 | 330 | 49 | 178 | 88 | 420 | 661 | 74 | 62 | 558 | 181 |
| Future Volume (vph) | 141 | 142 | 330 | 49 | 178 | 88 | 420 | 661 | 74 | 62 | 558 | 181 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.5 | 3.5 | | 3.5 | 3.7 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.96 | 1.00 | 0.99 | | 1.00 | 0.99 | |
| Flpb, ped/bikes | 0.99 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.98 | | 1.00 | 0.96 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1751 | 1900 | 1526 | 1803 | 1900 | 1555 | 1805 | 3460 | | 1805 | 3387 | |
| Flt Permitted | 0.55 | 1.00 | 1.00 | 0.62 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1017 | 1900 | 1526 | 1174 | 1900 | 1555 | 1805 | 3460 | | 1805 | 3387 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 148 | 149 | 347 | 52 | 187 | 93 | 442 | 696 | 78 | 65 | 587 | 191 |
| RTOR Reduction (vph) | 0 | 0 | 256 | 0 | 0 | 68 | 0 | 8 | 0 | 0 | 29 | 0 |
| Lane Group Flow (vph) | 148 | 149 | 91 | 52 | 187 | 25 | 442 | 766 | 0 | 65 | 749 | 0 |
| Confl. Peds. (#/hr) | 22 | | 46 | 2 | | 34 | | | 36 | | | 10 |
| Confl. Bikes (#/hr) | | | 5 | | | 5 | | | 5 | | | 5 |
| Heavy Vehicles (%) | 2% | 0% | 1% | 0% | 0% | 0% | 0% | 2% | 0% | 0% | 2% | 0% |
| Turn Type | Perm | NA | Perm | Perm | NA | Perm | Prot | NA | | Prot | NA | |
| Protected Phases | | 8 | | | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | 8 | | 8 | 4 | | 4 | | | | | | |
| Actuated Green, G (s) | 21.5 | 21.5 | 21.5 | 21.5 | 21.5 | 21.5 | 24.6 | 37.2 | | 11.9 | 24.3 | |
| Effective Green, g (s) | 21.5 | 21.5 | 21.5 | 21.5 | 21.5 | 21.5 | 24.6 | 37.2 | | 11.9 | 24.3 | |
| Actuated g/C Ratio | 0.26 | 0.26 | 0.26 | 0.26 | 0.26 | 0.26 | 0.30 | 0.46 | | 0.15 | 0.30 | |
| Clearance Time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.5 | 3.5 | | 3.5 | 3.7 | |
| Vehicle Extension (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 2.5 | 3.0 | | 2.5 | 3.0 | |
| Lane Grp Cap (vph) | 267 | 500 | 402 | 309 | 500 | 409 | 544 | 1577 | | 263 | 1008 | |
| v/s Ratio Prot | | 0.08 | | | 0.10 | | c0.24 | 0.22 | | 0.04 | c0.22 | |
| v/s Ratio Perm | c0.15 | | 0.06 | 0.04 | | 0.02 | | | | | | |
| v/c Ratio | 0.55 | 0.30 | 0.23 | 0.17 | 0.37 | 0.06 | 0.81 | 0.49 | | 0.25 | 0.74 | |
| Uniform Delay, d1 | 25.9 | 24.0 | 23.5 | 23.2 | 24.6 | 22.5 | 26.4 | 15.5 | | 30.9 | 25.8 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 3.1 | 0.5 | 0.4 | 0.4 | 0.6 | 0.1 | 8.8 | 0.2 | | 0.4 | 3.0 | |
| Delay (s) | 29.0 | 24.5 | 23.9 | 23.5 | 25.2 | 22.6 | 35.2 | 15.8 | | 31.2 | 28.8 | |
| Level of Service | C | C | C | C | C | C | D | B | | C | C | |
| Approach Delay (s) | | 25.2 | | | 24.2 | | | 22.8 | | | 29.0 | |
| Approach LOS | | C | | | C | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 25.2 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.71 | | |
| Actuated Cycle Length (s) | 81.6 | Sum of lost time (s) | 11.2 |
| Intersection Capacity Utilization | 95.2% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |





| Intersection | |
|---|---|
| Intersection Delay, s/veh | 129.9 |
| Intersection LOS | F |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 105 | 173 | 56 | 77 | 351 | 198 | 69 | 132 | 61 | 185 | 235 | 460 |
| Future Vol, veh/h | 105 | 173 | 56 | 77 | 351 | 198 | 69 | 132 | 61 | 185 | 235 | 460 |
| Peak Hour Factor | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 111 | 182 | 59 | 81 | 369 | 208 | 73 | 139 | 64 | 195 | 247 | 484 |
| Number of Lanes | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Opposing Approach | WB | EB | SB | NB |
| Opposing Lanes | 2 | 2 | 3 | 2 |
| Conflicting Approach Left | SB | NB | EB | WB |
| Conflicting Lanes Left | 3 | 2 | 2 | 2 |
| Conflicting Approach Right | NB | SB | WB | EB |
| Conflicting Lanes Right | 2 | 3 | 2 | 2 |
| HCM Control Delay | 34.1 | 281.1 | 29.7 | 88.6 |
| HCM LOS | D | F | D | F |

| Lane | NBLn1 | NBLn2 | EBLn1 | EBLn2 | WBLn1 | WBLn2 | SBLn1 | SBLn2 | SBLn3 |
|---|---|---|---|---|---|---|---|---|---|
| Vol Left, % | 100% | 0% | 100% | 0% | 100% | 0% | 100% | 0% | 0% |
| Vol Thru, % | 0% | 68% | 0% | 76% | 0% | 64% | 0% | 100% | 0% |
| Vol Right, % | 0% | 32% | 0% | 24% | 0% | 36% | 0% | 0% | 100% |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 69 | 193 | 105 | 229 | 77 | 549 | 185 | 235 | 460 |
| LT Vol | 69 | 0 | 105 | 0 | 77 | 0 | 185 | 0 | 0 |
| Through Vol | 0 | 132 | 0 | 173 | 0 | 351 | 0 | 235 | 0 |
| RT Vol | 0 | 61 | 0 | 56 | 0 | 198 | 0 | 0 | 460 |
| Lane Flow Rate | 73 | 203 | 111 | 241 | 81 | 578 | 195 | 247 | 484 |
| Geometry Grp | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Degree of Util (X) | 0.233 | 0.611 | 0.345 | 0.707 | 0.244 | 1.621 | 0.544 | 0.657 | 1.193 |
| Departure Headway (Hd) | 13.315 | 12.54 | 12.867 | 12.158 | 11.354 | 10.572 | 11.456 | 10.929 | 10.191 |
| Convergence, Y/N | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Cap | 272 | 291 | 282 | 299 | 319 | 347 | 317 | 334 | 358 |
| Service Time | 11.015 | 10.24 | 10.567 | 9.858 | 9.054 | 8.272 | 9.156 | 8.629 | 7.891 |
| HCM Lane V/C Ratio | 0.268 | 0.698 | 0.394 | 0.806 | 0.254 | 1.666 | 0.615 | 0.74 | 1.352 |
| HCM Control Delay | 20 | 33.1 | 22.2 | 39.6 | 17.7 | 318 | 27 | 32.3 | 142.1 |
| HCM Lane LOS | C | D | C | E | C | F | D | D | F |
| HCM 95th-tile Q | 0.9 | 3.7 | 1.5 | 5 | 0.9 | 32.8 | 3.1 | 4.4 | 17.5 |

HCM Signalized Intersection Capacity Analysis
9: San Marin Dr/Sutro Ave & Novato Blvd #1 02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 105 | 173 | 56 | 77 | 351 | 198 | 69 | 132 | 61 | 185 | 235 | 460 |
| Future Volume (vph) | 105 | 173 | 56 | 77 | 351 | 198 | 69 | 132 | 61 | 185 | 235 | 460 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 4.0 | | 3.0 | 4.0 | | 3.0 | 4.0 | | 3.0 | 4.0 | 4.0 |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.96 | | 1.00 | 0.95 | | 1.00 | 0.95 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1770 | 1794 | | 1770 | 1762 | | 1770 | 1775 | | 1770 | 1863 | 1583 |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1770 | 1794 | | 1770 | 1762 | | 1770 | 1775 | | 1770 | 1863 | 1583 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 111 | 182 | 59 | 81 | 369 | 208 | 73 | 139 | 64 | 195 | 247 | 484 |
| RTOR Reduction (vph) | 0 | 12 | 0 | 0 | 21 | 0 | 0 | 21 | 0 | 0 | 0 | 291 |
| Lane Group Flow (vph) | 111 | 229 | 0 | 81 | 556 | 0 | 73 | 182 | 0 | 195 | 247 | 193 |
| Turn Type | Prot | NA | | Prot | NA | | Prot | NA | | Prot | NA | Perm |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | | | | | | | | | | 6 |
| Actuated Green, G (s) | 7.1 | 29.2 | | 6.5 | 28.6 | | 4.6 | 14.4 | | 11.6 | 21.4 | 21.4 |
| Effective Green, g (s) | 7.1 | 29.2 | | 6.5 | 28.6 | | 4.6 | 14.4 | | 11.6 | 21.4 | 21.4 |
| Actuated g/C Ratio | 0.09 | 0.39 | | 0.09 | 0.38 | | 0.06 | 0.19 | | 0.15 | 0.28 | 0.28 |
| Clearance Time (s) | 3.0 | 4.0 | | 3.0 | 4.0 | | 3.0 | 4.0 | | 3.0 | 4.0 | 4.0 |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | 166 | 692 | | 151 | 665 | | 107 | 337 | | 271 | 526 | 447 |
| v/s Ratio Prot | c0.06 | 0.13 | | 0.05 | c0.32 | | 0.04 | 0.10 | | c0.11 | c0.13 | |
| v/s Ratio Perm | | | | | | | | | | | | 0.12 |
| v/c Ratio | 0.67 | 0.33 | | 0.54 | 0.84 | | 0.68 | 0.54 | | 0.72 | 0.47 | 0.43 |
| Uniform Delay, d1 | 33.2 | 16.4 | | 33.2 | 21.4 | | 34.8 | 27.7 | | 30.5 | 22.5 | 22.2 |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 9.8 | 0.3 | | 3.6 | 9.0 | | 16.5 | 1.7 | | 8.8 | 0.7 | 0.7 |
| Delay (s) | 42.9 | 16.7 | | 36.8 | 30.4 | | 51.3 | 29.3 | | 39.3 | 23.1 | 22.8 |
| Level of Service | D | B | | D | C | | D | C | | D | C | C |
| Approach Delay (s) | | 24.9 | | | 31.2 | | | 35.1 | | | 26.4 | |
| Approach LOS | | C | | | C | | | D | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 28.7 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.73 | | |
| Actuated Cycle Length (s) | 75.7 | Sum of lost time (s) | 14.0 |
| Intersection Capacity Utilization | 72.9% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



# MOVEMENT SUMMARY

## Site: 9 [PM Cumulative]

Novato Boulevard/San Marin Dr-Sutro Ave
PM Cumulative with Project
Roundabout

**Movement Performance - Vehicles**

| Mov ID | OD Mov | Demand Flows Total veh/h | Demand Flows HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance ft | Prop. Queued | Effective Stop Rate per veh | Average Speed mph |
|---|---|---|---|---|---|---|---|---|---|---|---|
| South: NB Sutro Ave | | | | | | | | | | | |
| 3 | L2 | 73 | 2.0 | 0.338 | 8.4 | LOS A | 1.6 | 40.9 | 0.62 | 0.60 | 32.6 |
| 8 | T1 | 139 | 2.0 | 0.338 | 8.4 | LOS A | 1.6 | 40.9 | 0.62 | 0.60 | 32.6 |
| 18 | R2 | 64 | 2.0 | 0.338 | 8.4 | LOS A | 1.6 | 40.9 | 0.62 | 0.60 | 31.7 |
| Approach | | 276 | 2.0 | 0.338 | 8.4 | LOS A | 1.6 | 40.9 | 0.62 | 0.60 | 32.4 |
| East: WB Novato Blvd | | | | | | | | | | | |
| 1 | L2 | 81 | 2.0 | 0.681 | 14.7 | LOS B | 9.5 | 240.4 | 0.79 | 0.93 | 30.1 |
| 6 | T1 | 369 | 2.0 | 0.681 | 14.7 | LOS B | 9.5 | 240.4 | 0.79 | 0.93 | 30.1 |
| 16 | R2 | 208 | 2.0 | 0.681 | 14.7 | LOS B | 9.5 | 240.4 | 0.79 | 0.93 | 29.4 |
| Approach | | 659 | 2.0 | 0.681 | 14.7 | LOS B | 9.5 | 240.4 | 0.79 | 0.93 | 29.9 |
| North: SB San Marin Drive | | | | | | | | | | | |
| 7 | L2 | 195 | 2.0 | 0.516 | 11.2 | LOS B | 3.7 | 93.2 | 0.69 | 0.80 | 31.0 |
| 4 | T1 | 247 | 2.0 | 0.516 | 11.2 | LOS B | 3.7 | 93.2 | 0.69 | 0.80 | 30.9 |
| 14 | R2 | 484 | 2.0 | 0.565 | 12.3 | LOS B | 4.6 | 116.0 | 0.72 | 0.87 | 30.4 |
| Approach | | 926 | 2.0 | 0.565 | 11.8 | LOS B | 4.6 | 116.0 | 0.71 | 0.84 | 30.6 |
| West: EB Novato Blvd | | | | | | | | | | | |
| 5 | L2 | 111 | 2.0 | 0.448 | 10.5 | LOS B | 2.7 | 69.8 | 0.69 | 0.76 | 31.5 |
| 2 | T1 | 182 | 2.0 | 0.448 | 10.5 | LOS B | 2.7 | 69.8 | 0.69 | 0.76 | 31.5 |
| 12 | R2 | 59 | 2.0 | 0.448 | 10.5 | LOS B | 2.7 | 69.8 | 0.69 | 0.76 | 30.7 |
| Approach | | 352 | 2.0 | 0.448 | 10.5 | LOS B | 2.7 | 69.8 | 0.69 | 0.76 | 31.4 |
| All Vehicles | | 2213 | 2.0 | 0.681 | 12.0 | LOS B | 9.5 | 240.4 | 0.72 | 0.82 | 30.7 |

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

## HCM Signalized Intersection Capacity Analysis
### 10: Wilson Ave & Novato Blvd #2

02/15/2018

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 559 | 42 | 452 | 871 | 46 | 295 |
| Future Volume (vph) | 559 | 42 | 452 | 871 | 46 | 295 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.9 | | 3.0 | 3.6 | 3.6 | 3.6 |
| Lane Util. Factor | 0.95 | | 1.00 | 0.95 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | | 1.00 | 1.00 | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 0.99 | | 1.00 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 1.00 | | 0.95 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (prot) | 3533 | | 1787 | 3610 | 1805 | 1593 |
| Flt Permitted | 1.00 | | 0.95 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (perm) | 3533 | | 1787 | 3610 | 1805 | 1593 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 588 | 44 | 476 | 917 | 48 | 311 |
| RTOR Reduction (vph) | 5 | 0 | 0 | 0 | 0 | 262 |
| Lane Group Flow (vph) | 627 | 0 | 476 | 917 | 48 | 49 |
| Confl. Peds. (#/hr) | | 3 | | | 6 | 2 |
| Heavy Vehicles (%) | 1% | 0% | 1% | 0% | 0% | 0% |
| Turn Type | NA | | Prot | NA | Prot | Perm |
| Protected Phases | 2 | | 1 | 6 | 4 | |
| Permitted Phases | | | | | | 4 |
| Actuated Green, G (s) | 30.9 | | 19.3 | 38.3 | 11.3 | 11.3 |
| Effective Green, g (s) | 30.9 | | 19.3 | 38.3 | 11.3 | 11.3 |
| Actuated g/C Ratio | 0.43 | | 0.27 | 0.53 | 0.16 | 0.16 |
| Clearance Time (s) | 3.9 | | 3.0 | 3.6 | 3.6 | 3.6 |
| Vehicle Extension (s) | 3.0 | | 2.0 | 3.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 1516 | | 479 | 1920 | 283 | 250 |
| v/s Ratio Prot | c0.18 | | c0.27 | c0.25 | 0.03 | |
| v/s Ratio Perm | | | | | | c0.03 |
| v/c Ratio | 0.41 | | 0.99 | 0.48 | 0.17 | 0.20 |
| Uniform Delay, d1 | 14.3 | | 26.3 | 10.6 | 26.3 | 26.4 |
| Progression Factor | 1.00 | | 0.93 | 0.47 | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.8 | | 35.3 | 0.7 | 0.1 | 0.1 |
| Delay (s) | 15.1 | | 59.9 | 5.7 | 26.4 | 26.5 |
| Level of Service | B | | E | A | C | C |
| Approach Delay (s) | 15.1 | | | 24.2 | 26.5 | |
| Approach LOS | B | | | C | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 22.1 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.58 | | |
| Actuated Cycle Length (s) | 72.0 | Sum of lost time (s) | 10.5 |
| Intersection Capacity Utilization | 59.7% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 11: Novato Blvd #2 & Simmons Ln

02/15/2018

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 137 | 717 | 1037 | 106 | 113 | 296 |
| Future Volume (vph) | 137 | 717 | 1037 | 106 | 113 | 296 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.9 | 3.6 | | 3.0 | 3.0 |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.99 | | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 3574 | 3553 | | 1805 | 1599 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | 1805 | 3574 | 3553 | | 1805 | 1599 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 144 | 755 | 1092 | 112 | 119 | 312 |
| RTOR Reduction (vph) | 0 | 0 | 7 | 0 | 0 | 240 |
| Lane Group Flow (vph) | 144 | 755 | 1197 | 0 | 119 | 72 |
| Confl. Peds. (#/hr) | | | | | 2 | |
| Confl. Bikes (#/hr) | | | | 1 | | |
| Heavy Vehicles (%) | 0% | 1% | 0% | 0% | 0% | 1% |
| Turn Type | Prot | NA | NA | | Prot | Perm |
| Protected Phases | 5 | 2 | 6 | | 8 | |
| Permitted Phases | | | | | | 8 |
| Actuated Green, G (s) | 12.2 | 30.9 | 38.3 | | 11.9 | 11.9 |
| Effective Green, g (s) | 12.2 | 30.9 | 38.3 | | 11.9 | 11.9 |
| Actuated g/C Ratio | 0.17 | 0.43 | 0.53 | | 0.17 | 0.17 |
| Clearance Time (s) | 3.0 | 3.9 | 3.6 | | 3.0 | 3.0 |
| Vehicle Extension (s) | 2.0 | 3.0 | 3.0 | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 305 | 1533 | 1889 | | 298 | 264 |
| v/s Ratio Prot | 0.08 | c0.21 | c0.34 | | c0.07 | |
| v/s Ratio Perm | | | | | | 0.04 |
| v/c Ratio | 0.47 | 0.49 | 0.63 | | 0.40 | 0.27 |
| Uniform Delay, d1 | 27.0 | 14.9 | 11.9 | | 26.9 | 26.3 |
| Progression Factor | 0.68 | 0.51 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 4.8 | 1.1 | 1.6 | | 0.3 | 0.2 |
| Delay (s) | 23.2 | 8.6 | 13.5 | | 27.2 | 26.5 |
| Level of Service | C | A | B | | C | C |
| Approach Delay (s) | | 11.0 | 13.5 | | 26.7 | |
| Approach LOS | | B | B | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 14.8 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.58 | | |
| Actuated Cycle Length (s) | 72.0 | Sum of lost time (s) | 10.5 |
| Intersection Capacity Utilization | 57.0% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 12: Grant Ave & Novato Blvd #2

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 160 | 677 | 1 | 2 | 952 | 54 | 1 | 6 | 4 | 25 | 1 | 288 |
| Future Volume (vph) | 160 | 677 | 1 | 2 | 952 | 54 | 1 | 6 | 4 | 25 | 1 | 288 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.5 | 4.5 | 3.5 | 4.9 | 4.9 | | 4.0 | | 3.5 | 3.5 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 | | 1.00 | | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.96 | | 0.98 | | 1.00 | 0.98 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | | 0.97 | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | | 0.95 | | 1.00 | 0.85 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1787 | 1863 | 1534 | 1805 | 3539 | 1529 | | 1762 | | 1737 | 1591 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 0.53 | | 0.75 | 1.00 | |
| Satd. Flow (perm) | 1787 | 1863 | 1534 | 1805 | 3539 | 1529 | | 947 | | 1372 | 1591 | |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 167 | 705 | 1 | 2 | 992 | 56 | 1 | 6 | 4 | 26 | 1 | 300 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 19 | 0 | 4 | 0 | 0 | 269 | 0 |
| Lane Group Flow (vph) | 167 | 705 | 1 | 2 | 992 | 37 | 0 | 7 | 0 | 26 | 32 | 0 |
| Confl. Peds. (#/hr) | | | 11 | | | 8 | 1 | | 14 | 14 | | 1 |
| Confl. Bikes (#/hr) | | | 1 | | | 4 | | | 2 | | | 1 |
| Heavy Vehicles (%) | 1% | 2% | 0% | 0% | 2% | 1% | 0% | 0% | 0% | 1% | 0% | 0% |
| Turn Type | Prot | NA | Perm | Prot | NA | Perm | Perm | NA | | Perm | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | 2 | | | 6 | 8 | | | 4 | | |
| Actuated Green, G (s) | 14.6 | 86.1 | 86.1 | 1.2 | 72.3 | 72.3 | | 10.7 | | 11.2 | 11.2 | |
| Effective Green, g (s) | 14.6 | 86.1 | 86.1 | 1.2 | 72.3 | 72.3 | | 10.7 | | 11.2 | 11.2 | |
| Actuated g/C Ratio | 0.13 | 0.78 | 0.78 | 0.01 | 0.66 | 0.66 | | 0.10 | | 0.10 | 0.10 | |
| Clearance Time (s) | 3.5 | 4.5 | 4.5 | 3.5 | 4.9 | 4.9 | | 4.0 | | 3.5 | 3.5 | |
| Vehicle Extension (s) | 2.0 | 3.0 | 3.0 | 2.0 | 3.0 | 3.0 | | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 237 | 1458 | 1200 | 19 | 2326 | 1004 | | 92 | | 139 | 161 | |
| v/s Ratio Prot | c0.09 | c0.38 | | 0.00 | 0.28 | | | | | | c0.02 | |
| v/s Ratio Perm | | | 0.00 | | | 0.02 | | 0.01 | | 0.02 | | |
| v/c Ratio | 0.70 | 0.48 | 0.00 | 0.11 | 0.43 | 0.04 | | 0.08 | | 0.19 | 0.20 | |
| Uniform Delay, d1 | 45.6 | 4.2 | 2.6 | 53.9 | 9.0 | 6.6 | | 45.2 | | 45.2 | 45.3 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.41 | 0.23 | 0.20 | | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 7.5 | 1.2 | 0.0 | 0.6 | 0.4 | 0.0 | | 0.1 | | 0.2 | 0.2 | |
| Delay (s) | 53.2 | 5.3 | 2.6 | 76.4 | 2.4 | 1.4 | | 45.3 | | 45.5 | 45.5 | |
| Level of Service | D | A | A | E | A | A | | D | | D | D | |
| Approach Delay (s) | | 14.5 | | | 2.5 | | | 45.3 | | | 45.5 | |
| Approach LOS | | B | | | A | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 13.5 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.50 | | |
| Actuated Cycle Length (s) | 110.0 | Sum of lost time (s) | 12.4 |
| Intersection Capacity Utilization | 69.2% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 13: Tamalpais Ave/7th St & Novato Blvd #2

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 135 | 593 | 43 | 72 | 857 | 215 | 44 | 124 | 46 | 185 | 112 | 125 |
| Future Volume (vph) | 135 | 593 | 43 | 72 | 857 | 215 | 44 | 124 | 46 | 185 | 112 | 125 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 5.0 | | 3.5 | 5.0 | 5.0 | 3.5 | 3.5 | | 3.5 | 3.5 | 3.5 |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 0.96 | 1.00 | 0.99 | | 1.00 | 1.00 | 0.97 |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 0.99 | 1.00 | | 0.99 | 1.00 | 1.00 |
| Frt | 1.00 | 0.99 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.96 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1787 | 1839 | | 1787 | 1863 | 1542 | 1768 | 1782 | | 1765 | 1881 | 1547 |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.61 | 1.00 | | 0.49 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1787 | 1839 | | 1787 | 1863 | 1542 | 1144 | 1782 | | 918 | 1881 | 1547 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 141 | 618 | 45 | 75 | 893 | 224 | 46 | 129 | 48 | 193 | 117 | 130 |
| RTOR Reduction (vph) | 0 | 2 | 0 | 0 | 0 | 33 | 0 | 13 | 0 | 0 | 0 | 101 |
| Lane Group Flow (vph) | 141 | 661 | 0 | 75 | 893 | 191 | 46 | 164 | 0 | 193 | 117 | 29 |
| Confl. Peds. (#/hr) | | | 10 | | | 6 | 5 | | 7 | 7 | | 5 |
| Confl. Bikes (#/hr) | | | 3 | | | 2 | | | 5 | | | |
| Heavy Vehicles (%) | 1% | 2% | 1% | 1% | 2% | 1% | 1% | 1% | 1% | 1% | 1% | 1% |
| Turn Type | Prot | NA | | Prot | NA | Perm | Perm | NA | | Perm | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | | | | 6 | 8 | | | 4 | | 4 |
| Actuated Green, G (s) | 12.7 | 65.9 | | 7.4 | 60.6 | 60.6 | 24.7 | 24.7 | | 24.7 | 24.7 | 24.7 |
| Effective Green, g (s) | 12.7 | 65.9 | | 7.4 | 60.6 | 60.6 | 24.7 | 24.7 | | 24.7 | 24.7 | 24.7 |
| Actuated g/C Ratio | 0.12 | 0.60 | | 0.07 | 0.55 | 0.55 | 0.22 | 0.22 | | 0.22 | 0.22 | 0.22 |
| Clearance Time (s) | 3.5 | 5.0 | | 3.5 | 5.0 | 5.0 | 3.5 | 3.5 | | 3.5 | 3.5 | 3.5 |
| Vehicle Extension (s) | 2.0 | 5.0 | | 2.0 | 5.0 | 5.0 | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 206 | 1101 | | 120 | 1026 | 849 | 256 | 400 | | 206 | 422 | 347 |
| v/s Ratio Prot | c0.08 | 0.36 | | 0.04 | c0.48 | | | 0.09 | | | 0.06 | |
| v/s Ratio Perm | | | | | | 0.12 | 0.04 | | | c0.21 | | 0.02 |
| v/c Ratio | 0.68 | 0.60 | | 0.62 | 0.87 | 0.22 | 0.18 | 0.41 | | 0.94 | 0.28 | 0.08 |
| Uniform Delay, d1 | 46.7 | 13.8 | | 49.9 | 21.3 | 12.7 | 34.5 | 36.4 | | 41.9 | 35.3 | 33.7 |
| Progression Factor | 0.90 | 1.13 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 6.8 | 2.3 | | 7.1 | 10.0 | 0.6 | 0.1 | 0.2 | | 44.3 | 0.1 | 0.0 |
| Delay (s) | 48.7 | 17.8 | | 57.1 | 31.4 | 13.3 | 34.6 | 36.7 | | 86.2 | 35.4 | 33.7 |
| Level of Service | D | B | | E | C | B | C | D | | F | D | C |
| Approach Delay (s) | | 23.3 | | | 29.6 | | | 36.2 | | | 57.2 | |
| Approach LOS | | C | | | C | | | D | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 32.8 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.86 | | |
| Actuated Cycle Length (s) | 110.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 89.0% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 14: Diablo Ave & Novato Blvd #2

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 24 | 258 | 23 | 290 | 337 | 670 | 51 | 472 | 239 | 469 | 354 | 12 |
| Future Volume (vph) | 24 | 258 | 23 | 290 | 337 | 670 | 51 | 472 | 239 | 469 | 354 | 12 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 12 | 12 | 11 | 11 | 12 | 11 | 11 | 12 | 12 | 12 | 12 |
| Total Lost time (s) | | 3.7 | | 4.1 | 4.1 | 4.1 | 4.4 | 4.4 | 4.4 | 4.1 | 4.1 | |
| Lane Util. Factor | | 0.95 | | 0.91 | 0.91 | 1.00 | 1.00 | 1.00 | 1.00 | 0.91 | 0.91 | |
| Frpb, ped/bikes | | 1.00 | | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | | 0.99 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | |
| Flt Protected | | 1.00 | | 0.95 | 0.99 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.98 | |
| Satd. Flow (prot) | | 3513 | | 1557 | 3269 | 1500 | 1728 | 1801 | 1560 | 1610 | 3320 | |
| Flt Permitted | | 1.00 | | 0.95 | 0.99 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.98 | |
| Satd. Flow (perm) | | 3513 | | 1557 | 3269 | 1500 | 1728 | 1801 | 1560 | 1610 | 3320 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 25 | 272 | 24 | 305 | 355 | 705 | 54 | 497 | 252 | 494 | 373 | 13 |
| RTOR Reduction (vph) | 0 | 5 | 0 | 0 | 0 | 287 | 0 | 0 | 146 | 0 | 1 | 0 |
| Lane Group Flow (vph) | 0 | 316 | 0 | 213 | 447 | 418 | 54 | 497 | 106 | 287 | 592 | 0 |
| Confl. Peds. (#/hr) | | | 10 | | | 15 | | | 2 | | | 3 |
| Confl. Bikes (#/hr) | | | 1 | | | 1 | | | | | | 6 |
| Heavy Vehicles (%) | 1% | 1% | 1% | 2% | 1% | 2% | 1% | 2% | 2% | 2% | 2% | 1% |
| Turn Type | Split | NA | | Split | NA | Perm | Split | NA | Perm | Split | NA | |
| Protected Phases | 3 | 3 | | 4 | 4 | | 1 | 1 | | 2 | 2 | |
| Permitted Phases | | | | | | 4 | | | 1 | | 2 | |
| Actuated Green, G (s) | | 16.0 | | 29.1 | 29.1 | 29.1 | 32.2 | 32.2 | 32.2 | 25.1 | 25.1 | |
| Effective Green, g (s) | | 16.0 | | 29.1 | 29.1 | 29.1 | 32.2 | 32.2 | 32.2 | 25.1 | 25.1 | |
| Actuated g/C Ratio | | 0.13 | | 0.25 | 0.25 | 0.25 | 0.27 | 0.27 | 0.27 | 0.21 | 0.21 | |
| Clearance Time (s) | | 3.7 | | 4.1 | 4.1 | 4.1 | 4.4 | 4.4 | 4.4 | 4.1 | 4.1 | |
| Vehicle Extension (s) | | 2.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | | 473 | | 381 | 801 | 367 | 468 | 488 | 423 | 340 | 702 | |
| v/s Ratio Prot | | c0.09 | | 0.14 | 0.14 | | 0.03 | c0.28 | | 0.18 | c0.18 | |
| v/s Ratio Perm | | | | | | c0.28 | | | 0.07 | | | |
| v/c Ratio | | 0.67 | | 0.56 | 0.56 | 1.14 | 0.12 | 1.02 | 0.25 | 0.84 | 0.84 | |
| Uniform Delay, d1 | | 48.8 | | 39.2 | 39.2 | 44.8 | 32.5 | 43.2 | 33.8 | 44.9 | 44.9 | |
| Progression Factor | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 2.8 | | 1.0 | 0.5 | 90.5 | 0.0 | 45.5 | 0.1 | 16.5 | 8.8 | |
| Delay (s) | | 51.6 | | 40.2 | 39.7 | 135.3 | 32.6 | 88.7 | 33.9 | 61.4 | 53.7 | |
| Level of Service | | D | | D | D | F | C | F | C | E | D | |
| Approach Delay (s) | | 51.6 | | | 89.1 | | | 67.8 | | | 56.2 | |
| Approach LOS | | D | | | F | | | E | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 71.9 | HCM 2000 Level of Service | E |
| HCM 2000 Volume to Capacity ratio | 0.95 | | |
| Actuated Cycle Length (s) | 118.7 | Sum of lost time (s) | 16.3 |
| Intersection Capacity Utilization | 90.6% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 14: Diablo Ave & Novato Blvd #2

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 24 | 258 | 23 | 290 | 337 | 670 | 51 | 472 | 239 | 469 | 354 | 12 |
| Future Volume (vph) | 24 | 258 | 23 | 290 | 337 | 670 | 51 | 472 | 239 | 469 | 354 | 12 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 11 | 11 | 11 | 11 | 11 | 12 | 11 | 11 | 12 | 10 | 12 | 12 |
| Total Lost time (s) | 4.0 | 4.1 | 4.1 | 4.0 | 4.0 | 4.0 | 4.0 | 4.1 | | 4.0 | 4.0 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | | 0.97 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.95 | | 1.00 | 0.99 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1728 | 1818 | 1511 | 1711 | 1818 | 1554 | 1728 | 3233 | | 3204 | 1852 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1728 | 1818 | 1511 | 1711 | 1818 | 1554 | 1728 | 3233 | | 3204 | 1852 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 25 | 272 | 24 | 305 | 355 | 705 | 54 | 497 | 252 | 494 | 373 | 13 |
| RTOR Reduction (vph) | 0 | 0 | 19 | 0 | 0 | 79 | 0 | 54 | 0 | 0 | 1 | 0 |
| Lane Group Flow (vph) | 25 | 272 | 5 | 305 | 355 | 626 | 54 | 695 | 0 | 494 | 385 | 0 |
| Confl. Peds. (#/hr) | | | 10 | | | 15 | | | 2 | | | 3 |
| Confl. Bikes (#/hr) | | | 1 | | | 1 | | | | | | 6 |
| Heavy Vehicles (%) | 1% | 1% | 1% | 2% | 1% | 2% | 1% | 2% | 2% | 2% | 2% | 1% |
| Turn Type | Prot | NA | Perm | Prot | NA | pm+ov | Prot | NA | | Prot | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | 1 | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | 4 | | | 8 | | | | | | |
| Actuated Green, G (s) | 4.9 | 20.2 | 20.2 | 23.0 | 38.4 | 56.7 | 6.5 | 26.4 | | 18.3 | 38.3 | |
| Effective Green, g (s) | 4.9 | 20.2 | 20.2 | 23.0 | 38.4 | 56.7 | 6.5 | 26.4 | | 18.3 | 38.3 | |
| Actuated g/C Ratio | 0.05 | 0.19 | 0.19 | 0.22 | 0.37 | 0.54 | 0.06 | 0.25 | | 0.18 | 0.37 | |
| Clearance Time (s) | 4.0 | 4.1 | 4.1 | 4.0 | 4.0 | 4.0 | 4.0 | 4.1 | | 4.0 | 4.0 | |
| Vehicle Extension (s) | 3.0 | 2.0 | 2.0 | 3.0 | 3.0 | 3.0 | 3.0 | 2.0 | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 81 | 352 | 293 | 378 | 670 | 846 | 107 | 819 | | 563 | 681 | |
| v/s Ratio Prot | 0.01 | 0.15 | | c0.18 | 0.20 | c0.13 | 0.03 | c0.21 | | c0.15 | 0.21 | |
| v/s Ratio Perm | | | 0.00 | | | 0.27 | | | | | | |
| v/c Ratio | 0.31 | 0.77 | 0.02 | 0.81 | 0.53 | 0.74 | 0.50 | 0.85 | | 0.88 | 0.56 | |
| Uniform Delay, d1 | 48.0 | 39.8 | 33.9 | 38.4 | 25.8 | 18.1 | 47.2 | 36.9 | | 41.8 | 26.3 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 2.2 | 9.2 | 0.0 | 11.9 | 0.8 | 3.4 | 3.7 | 7.8 | | 14.4 | 1.1 | |
| Delay (s) | 50.1 | 49.0 | 33.9 | 50.3 | 26.5 | 21.5 | 51.0 | 44.8 | | 56.2 | 27.3 | |
| Level of Service | D | D | C | D | C | C | D | D | | E | C | |
| Approach Delay (s) | | 48.0 | | | 29.2 | | | 45.2 | | | 43.5 | |
| Approach LOS | | D | | | C | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 38.6 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.83 | | |
| Actuated Cycle Length (s) | 104.1 | Sum of lost time (s) | 16.2 |
| Intersection Capacity Utilization | 81.7% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 15: Redwood Blvd & Diablo Ave/De Long Ave

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 293 | 592 | 111 | 109 | 991 | 437 | 142 | 328 | 87 | 362 | 248 | 252 |
| Future Volume (vph) | 293 | 592 | 111 | 109 | 991 | 437 | 142 | 328 | 87 | 362 | 248 | 252 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 9 |
| Total Lost time (s) | 4.0 | 3.7 | | 4.0 | 4.1 | | 3.5 | 4.8 | 4.8 | 3.5 | 3.5 | 3.5 |
| Lane Util. Factor | 0.97 | 0.95 | | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 | 0.97 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.97 |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.98 | | 1.00 | 0.95 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3467 | 3525 | | 1805 | 3332 | | 1805 | 3610 | 1508 | 3303 | 1900 | 1394 |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3467 | 3525 | | 1805 | 3332 | | 1805 | 3610 | 1508 | 3303 | 1900 | 1394 |
| Peak-hour factor, PHF | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Adj. Flow (vph) | 299 | 604 | 113 | 111 | 1011 | 446 | 145 | 335 | 89 | 369 | 253 | 257 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 33 | 0 | 0 | 49 |
| Lane Group Flow (vph) | 299 | 717 | 0 | 111 | 1457 | 0 | 145 | 335 | 56 | 369 | 253 | 208 |
| Confl. Peds. (#/hr) | | | | | | 2 | | | 7 | | | 14 |
| Confl. Bikes (#/hr) | | | | | | | | | | | | 3 |
| Heavy Vehicles (%) | 1% | 0% | 0% | 0% | 2% | 5% | 0% | 0% | 5% | 6% | 0% | 1% |
| Turn Type | Prot | NA | | Prot | NA | | Prot | NA | Perm | Prot | NA | Perm |
| Protected Phases | 3 | 8 | | 7 | 4 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | | | | | | | 2 | | | 6 |
| Actuated Green, G (s) | 17.1 | 59.7 | | 17.0 | 59.2 | | 14.6 | 23.4 | 23.4 | 13.9 | 24.0 | 24.0 |
| Effective Green, g (s) | 17.1 | 59.7 | | 17.0 | 59.2 | | 14.6 | 23.4 | 23.4 | 13.9 | 24.0 | 24.0 |
| Actuated g/C Ratio | 0.13 | 0.46 | | 0.13 | 0.46 | | 0.11 | 0.18 | 0.18 | 0.11 | 0.18 | 0.18 |
| Clearance Time (s) | 4.0 | 3.7 | | 4.0 | 4.1 | | 3.5 | 4.8 | 4.8 | 3.5 | 3.5 | 3.5 |
| Vehicle Extension (s) | 2.5 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 456 | 1618 | | 236 | 1517 | | 202 | 649 | 271 | 353 | 350 | 257 |
| v/s Ratio Prot | c0.09 | 0.20 | | 0.06 | c0.44 | | 0.08 | 0.09 | | c0.11 | 0.13 | |
| v/s Ratio Perm | | | | | | | | | 0.04 | | | c0.15 |
| v/c Ratio | 0.66 | 0.44 | | 0.47 | 0.96 | | 0.72 | 0.52 | 0.21 | 1.05 | 0.72 | 0.81 |
| Uniform Delay, d1 | 53.7 | 23.9 | | 52.3 | 34.3 | | 55.7 | 48.2 | 45.4 | 58.0 | 49.9 | 50.8 |
| Progression Factor | 1.00 | 1.00 | | 1.44 | 0.57 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 3.0 | 0.9 | | 0.3 | 9.7 | | 9.7 | 0.3 | 0.1 | 60.2 | 6.1 | 16.1 |
| Delay (s) | 56.7 | 24.7 | | 75.4 | 29.2 | | 65.4 | 48.5 | 45.5 | 118.3 | 56.0 | 66.9 |
| Level of Service | E | C | | E | C | | E | D | D | F | E | E |
| Approach Delay (s) | | 34.1 | | | 32.5 | | | 52.3 | | | 85.3 | |
| Approach LOS | | C | | | C | | | D | | | F | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 47.2 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.90 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 16.4 |
| Intersection Capacity Utilization | 98.6% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 16: Reichert Ave & De Long Ave

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 87 | 912 | 23 | 100 | 1405 | 359 | 19 | 32 | 60 | 257 | 19 | 83 |
| Future Volume (vph) | 87 | 912 | 23 | 100 | 1405 | 359 | 19 | 32 | 60 | 257 | 19 | 83 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 0.95 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 0.99 | | 1.00 | 1.00 | 0.98 | 1.00 | 0.98 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 0.99 | 1.00 | 1.00 | 0.99 | 1.00 | |
| Frt | 1.00 | 1.00 | | 1.00 | 0.97 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.88 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1805 | 3525 | | 1805 | 3428 | | 1794 | 1900 | 1577 | 1763 | 1636 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.62 | 1.00 | 1.00 | 0.73 | 1.00 | |
| Satd. Flow (perm) | 1805 | 3525 | | 1805 | 3428 | | 1170 | 1900 | 1577 | 1364 | 1636 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 92 | 960 | 24 | 105 | 1479 | 378 | 20 | 34 | 63 | 271 | 20 | 87 |
| RTOR Reduction (vph) | 0 | 1 | 0 | 0 | 14 | 0 | 0 | 0 | 15 | 0 | 28 | 0 |
| Lane Group Flow (vph) | 92 | 983 | 0 | 105 | 1843 | 0 | 20 | 34 | 48 | 271 | 79 | 0 |
| Confl. Peds. (#/hr) | | | 5 | | | 11 | 5 | | 5 | 11 | | 5 |
| Confl. Bikes (#/hr) | | | 5 | | | 5 | | | 5 | | | 5 |
| Heavy Vehicles (%) | 0% | 2% | 0% | 0% | 1% | 1% | 0% | 0% | 0% | 1% | 0% | 0% |
| Turn Type | Prot | NA | | Prot | NA | | Perm | NA | Perm | Perm | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | | | | | 8 | | 8 | 4 | | |
| Actuated Green, G (s) | 11.0 | 79.4 | | 11.0 | 79.4 | | 29.0 | 29.0 | 29.0 | 29.0 | 29.0 | |
| Effective Green, g (s) | 11.0 | 79.4 | | 11.0 | 79.4 | | 29.0 | 29.0 | 29.0 | 29.0 | 29.0 | |
| Actuated g/C Ratio | 0.08 | 0.61 | | 0.08 | 0.61 | | 0.22 | 0.22 | 0.22 | 0.22 | 0.22 | |
| Clearance Time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | |
| Vehicle Extension (s) | 2.0 | 3.0 | | 2.0 | 3.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 152 | 2152 | | 152 | 2093 | | 261 | 423 | 351 | 304 | 364 | |
| v/s Ratio Prot | 0.05 | 0.28 | | c0.06 | c0.54 | | | 0.02 | | | 0.05 | |
| v/s Ratio Perm | | | | | | | 0.02 | | 0.03 | c0.20 | | |
| v/c Ratio | 0.61 | 0.46 | | 0.69 | 0.88 | | 0.08 | 0.08 | 0.14 | 0.89 | 0.22 | |
| Uniform Delay, d1 | 57.4 | 13.7 | | 57.8 | 21.3 | | 39.9 | 40.0 | 40.5 | 49.0 | 41.2 | |
| Progression Factor | 0.72 | 1.19 | | 1.01 | 0.69 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 3.6 | 0.5 | | 8.0 | 4.5 | | 0.0 | 0.0 | 0.1 | 25.6 | 0.1 | |
| Delay (s) | 44.9 | 16.8 | | 66.3 | 19.2 | | 40.0 | 40.0 | 40.5 | 74.6 | 41.3 | |
| Level of Service | D | B | | E | B | | D | D | D | E | D | |
| Approach Delay (s) | | 19.2 | | | 21.7 | | | 40.3 | | | 65.2 | |
| Approach LOS | | B | | | C | | | D | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 26.2 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.87 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 89.3% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 17: US 101 SB Ramps & De Long Ave

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 223 | 1047 | 28 | 1802 | 0 | 0 | 0 | 0 | 10 | 7 | 187 |
| Future Volume (vph) | 0 | 223 | 1047 | 28 | 1802 | 0 | 0 | 0 | 0 | 10 | 7 | 187 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.6 | 3.6 | 3.0 | 3.6 | | | | | 4.0 | 4.0 | |
| Lane Util. Factor | | 0.95 | 1.00 | 1.00 | 0.95 | | | | | 0.95 | 0.95 | |
| Frt | | 1.00 | 0.85 | 1.00 | 1.00 | | | | | 1.00 | 0.86 | |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 3574 | 1599 | 1770 | 3539 | | | | | 1681 | 1514 | |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | 0.95 | 1.00 | |
| Satd. Flow (perm) | | 3574 | 1599 | 1770 | 3539 | | | | | 1681 | 1514 | |
| Peak-hour factor, PHF | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Adj. Flow (vph) | 0 | 228 | 1068 | 29 | 1839 | 0 | 0 | 0 | 0 | 10 | 7 | 191 |
| RTOR Reduction (vph) | 0 | 0 | 280 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 37 | 0 |
| Lane Group Flow (vph) | 0 | 228 | 788 | 29 | 1839 | 0 | 0 | 0 | 0 | 9 | 162 | 0 |
| Heavy Vehicles (%) | 0% | 1% | 1% | 2% | 2% | 2% | 2% | 2% | 2% | 2% | 2% | 2% |
| Turn Type | | NA | Perm | Prot | NA | | | | | Split | NA | |
| Protected Phases | | 6 | | 5 | 2 | | | | | 4 | 4 | |
| Permitted Phases | | | 6 | | | | | | | | | |
| Actuated Green, G (s) | | 91.5 | 91.5 | 9.4 | 103.9 | | | | | 18.5 | 18.5 | |
| Effective Green, g (s) | | 91.5 | 91.5 | 9.4 | 103.9 | | | | | 18.5 | 18.5 | |
| Actuated g/C Ratio | | 0.70 | 0.70 | 0.07 | 0.80 | | | | | 0.14 | 0.14 | |
| Clearance Time (s) | | 3.6 | 3.6 | 3.0 | 3.6 | | | | | 4.0 | 4.0 | |
| Vehicle Extension (s) | | 4.0 | 4.0 | 2.0 | 4.0 | | | | | 2.5 | 2.5 | |
| Lane Grp Cap (vph) | | 2515 | 1125 | 127 | 2828 | | | | | 239 | 215 | |
| v/s Ratio Prot | | 0.06 | | 0.02 | c0.52 | | | | | 0.01 | c0.11 | |
| v/s Ratio Perm | | | c0.49 | | | | | | | | | |
| v/c Ratio | | 0.09 | 0.70 | 0.23 | 0.65 | | | | | 0.04 | 0.75 | |
| Uniform Delay, d1 | | 6.1 | 11.3 | 56.9 | 5.5 | | | | | 48.1 | 53.6 | |
| Progression Factor | | 0.75 | 4.38 | 0.88 | 0.61 | | | | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 0.1 | 3.2 | 0.2 | 0.8 | | | | | 0.0 | 13.3 | |
| Delay (s) | | 4.6 | 52.5 | 50.5 | 4.1 | | | | | 48.1 | 66.9 | |
| Level of Service | | A | D | D | A | | | | | D | E | |
| Approach Delay (s) | | 44.1 | | | 4.8 | | | 0.0 | | | 66.0 | |
| Approach LOS | | D | | | A | | | A | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 23.7 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.71 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 132.6% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 18: US 101 NB Ramps & De Long Ave

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 190 | 45 | 0 | 0 | 63 | 29 | 1754 | 25 | 33 | 0 | 0 | 0 |
| Future Volume (vph) | 190 | 45 | 0 | 0 | 63 | 29 | 1754 | 25 | 33 | 0 | 0 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 3.6 | | | 3.6 | | 4.5 | 4.5 | | | | |
| Lane Util. Factor | 1.00 | 0.95 | | | 0.95 | | 0.95 | 0.95 | | | | |
| Frpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | | | | |
| Flpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | | | | |
| Frt | 1.00 | 1.00 | | | 0.95 | | 1.00 | 0.99 | | | | |
| Flt Protected | 0.95 | 1.00 | | | 1.00 | | 0.95 | 0.96 | | | | |
| Satd. Flow (prot) | 1770 | 3610 | | | 3353 | | 1698 | 1695 | | | | |
| Flt Permitted | 0.95 | 1.00 | | | 1.00 | | 0.95 | 0.96 | | | | |
| Satd. Flow (perm) | 1770 | 3610 | | | 3353 | | 1698 | 1695 | | | | |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 198 | 47 | 0 | 0 | 66 | 30 | 1827 | 26 | 34 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 28 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 198 | 47 | 0 | 0 | 68 | 0 | 950 | 936 | 0 | 0 | 0 | 0 |
| Confl. Peds. (#/hr) | | | | | | 1 | | | | | | |
| Heavy Vehicles (%) | 2% | 0% | 0% | 0% | 0% | 7% | 1% | 0% | 6% | 0% | 0% | 0% |
| Turn Type | Prot | NA | | | NA | | Split | NA | | | | |
| Protected Phases | 1 | 6 | | | 2 | | 4 | 4 | | | | |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | 16.1 | 27.9 | | | 8.3 | | 94.0 | 94.0 | | | | |
| Effective Green, g (s) | 16.1 | 27.9 | | | 8.3 | | 94.0 | 94.0 | | | | |
| Actuated g/C Ratio | 0.12 | 0.21 | | | 0.06 | | 0.72 | 0.72 | | | | |
| Clearance Time (s) | 3.5 | 3.6 | | | 3.6 | | 4.5 | 4.5 | | | | |
| Vehicle Extension (s) | 2.5 | 2.0 | | | 2.0 | | 3.0 | 3.0 | | | | |
| Lane Grp Cap (vph) | 219 | 774 | | | 214 | | 1227 | 1225 | | | | |
| v/s Ratio Prot | c0.11 | 0.01 | | | c0.02 | | c0.56 | 0.55 | | | | |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | 0.90 | 0.06 | | | 0.32 | | 0.77 | 0.76 | | | | |
| Uniform Delay, d1 | 56.2 | 40.6 | | | 58.1 | | 11.3 | 11.1 | | | | |
| Progression Factor | 1.05 | 1.13 | | | 1.00 | | 1.00 | 1.00 | | | | |
| Incremental Delay, d2 | 35.6 | 0.0 | | | 0.3 | | 4.8 | 4.6 | | | | |
| Delay (s) | 94.6 | 45.8 | | | 58.5 | | 16.1 | 15.7 | | | | |
| Level of Service | F | D | | | E | | B | B | | | | |
| Approach Delay (s) | | 85.2 | | | 58.5 | | | 15.9 | | | 0.0 | |
| Approach LOS | | F | | | E | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 25.4 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.76 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 11.6 |
| Intersection Capacity Utilization | 132.6% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 19: Redwood Blvd & Lamont Ave

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 33 | 4 | 24 | 48 | 3 | 57 | 22 | 525 | 63 | 74 | 453 | 16 |
| Future Volume (vph) | 33 | 4 | 24 | 48 | 3 | 57 | 22 | 525 | 63 | 74 | 453 | 16 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.5 | 3.5 | | 3.5 | 3.5 | 3.5 | 4.8 | | 3.5 | 4.8 | 4.8 |
| Lane Util. Factor | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 |
| Frpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | 0.99 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Flpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | | 1.00 | 0.85 | | 1.00 | 0.85 | 1.00 | 0.98 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | | 0.96 | 1.00 | | 0.95 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | | 1818 | 1615 | | 1814 | 1595 | 1805 | 3544 | | 1805 | 3610 | 1615 |
| Flt Permitted | | 0.79 | 1.00 | | 0.77 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | | 1504 | 1615 | | 1461 | 1595 | 1805 | 3544 | | 1805 | 3610 | 1615 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 35 | 4 | 25 | 51 | 3 | 60 | 23 | 553 | 66 | 78 | 477 | 17 |
| RTOR Reduction (vph) | 0 | 0 | 19 | 0 | 0 | 46 | 0 | 8 | 0 | 0 | 0 | 8 |
| Lane Group Flow (vph) | 0 | 39 | 6 | 0 | 54 | 14 | 23 | 611 | 0 | 78 | 477 | 9 |
| Confl. Peds. (#/hr) | 1 | | | | | 1 | | | 2 | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Perm | NA | Perm | Perm | NA | Perm | Prot | NA | | Prot | NA | Perm |
| Protected Phases | | 8 | | | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | 8 | | 8 | 4 | | 4 | | | | | | 2 |
| Actuated Green, G (s) | | 12.2 | 12.2 | | 12.2 | 12.2 | 1.0 | 22.7 | | 5.4 | 27.1 | 27.1 |
| Effective Green, g (s) | | 12.2 | 12.2 | | 12.2 | 12.2 | 1.0 | 22.7 | | 5.4 | 27.1 | 27.1 |
| Actuated g/C Ratio | | 0.23 | 0.23 | | 0.23 | 0.23 | 0.02 | 0.44 | | 0.10 | 0.52 | 0.52 |
| Clearance Time (s) | | 3.5 | 3.5 | | 3.5 | 3.5 | 3.5 | 4.8 | | 3.5 | 4.8 | 4.8 |
| Vehicle Extension (s) | | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 | 3.0 | | 2.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | 352 | 378 | | 342 | 373 | 34 | 1544 | | 187 | 1877 | 840 |
| v/s Ratio Prot | | | | | | | 0.01 | c0.17 | | c0.04 | 0.13 | |
| v/s Ratio Perm | | 0.03 | 0.00 | | c0.04 | 0.01 | | | | | | 0.01 |
| v/c Ratio | | 0.11 | 0.02 | | 0.16 | 0.04 | 0.68 | 0.40 | | 0.42 | 0.25 | 0.01 |
| Uniform Delay, d1 | | 15.7 | 15.3 | | 15.9 | 15.4 | 25.4 | 10.0 | | 21.9 | 6.9 | 6.0 |
| Progression Factor | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.1 | 0.0 | | 0.1 | 0.0 | 34.5 | 0.2 | | 0.5 | 0.1 | 0.0 |
| Delay (s) | | 15.7 | 15.3 | | 15.9 | 15.4 | 59.9 | 10.2 | | 22.4 | 7.0 | 6.0 |
| Level of Service | | B | B | | B | B | E | B | | C | A | A |
| Approach Delay (s) | | 15.6 | | | 15.7 | | | 12.0 | | | 9.1 | |
| Approach LOS | | B | | | B | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 11.2 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.33 | | |
| Actuated Cycle Length (s) | 52.1 | Sum of lost time (s) | 11.8 |
| Intersection Capacity Utilization | 46.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 20: Redwood Blvd & Landing Ct

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 0 | 3 | 30 | 0 | 27 | 1 | 592 | 27 | 18 | 572 | 1 |
| Future Volume (vph) | 0 | 0 | 3 | 30 | 0 | 27 | 1 | 592 | 27 | 18 | 572 | 1 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.5 | | 3.5 | | 3.5 | | 4.8 | 4.8 | 3.5 | 4.8 | 4.8 |
| Lane Util. Factor | | 1.00 | | 1.00 | | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |
| Frpb, ped/bikes | | 0.99 | | 1.00 | | 1.00 | | 1.00 | 0.98 | 1.00 | 1.00 | 0.97 |
| Flpb, ped/bikes | | 1.00 | | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.86 | | 1.00 | | 0.85 | | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | | 1.00 | | 0.95 | | 1.00 | | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | | 1622 | | 1802 | | 1615 | | 3610 | 1579 | 1805 | 3610 | 1571 |
| Flt Permitted | | 1.00 | | 0.76 | | 1.00 | | 0.95 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | | 1622 | | 1434 | | 1615 | | 3446 | 1579 | 1805 | 3610 | 1571 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 0 | 0 | 3 | 32 | 0 | 28 | 1 | 623 | 28 | 19 | 602 | 1 |
| RTOR Reduction (vph) | 0 | 3 | 0 | 0 | 0 | 24 | 0 | 0 | 12 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 32 | 0 | 4 | 0 | 624 | 16 | 19 | 602 | 1 |
| Confl. Peds. (#/hr) | | | 4 | 4 | | | | | 3 | | | 6 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | | NA | | Perm | | Perm | Perm | NA | Perm | Prot | NA | Perm |
| Protected Phases | | 4 | | | | | | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | 2 | | | 6 |
| Actuated Green, G (s) | | 7.0 | | 7.0 | | 7.0 | | 28.0 | 28.0 | 0.8 | 32.3 | 32.3 |
| Effective Green, g (s) | | 7.0 | | 7.0 | | 7.0 | | 28.0 | 28.0 | 0.8 | 32.3 | 32.3 |
| Actuated g/C Ratio | | 0.15 | | 0.15 | | 0.15 | | 0.59 | 0.59 | 0.02 | 0.68 | 0.68 |
| Clearance Time (s) | | 3.5 | | 3.5 | | 3.5 | | 4.8 | 4.8 | 3.5 | 4.8 | 4.8 |
| Vehicle Extension (s) | | 3.0 | | 2.0 | | 2.0 | | 4.0 | 4.0 | 2.0 | 4.0 | 4.0 |
| Lane Grp Cap (vph) | | 238 | | 210 | | 237 | | 2027 | 928 | 30 | 2449 | 1066 |
| v/s Ratio Prot | | 0.00 | | | | | | | | c0.01 | 0.17 | |
| v/s Ratio Perm | | | | c0.02 | | 0.00 | | c0.18 | 0.01 | | | 0.00 |
| v/c Ratio | | 0.00 | | 0.15 | | 0.02 | | 0.31 | 0.02 | 0.63 | 0.25 | 0.00 |
| Uniform Delay, d1 | | 17.3 | | 17.7 | | 17.4 | | 4.9 | 4.1 | 23.3 | 3.0 | 2.5 |
| Progression Factor | | 1.00 | | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.0 | | 0.1 | | 0.0 | | 0.1 | 0.0 | 27.8 | 0.1 | 0.0 |
| Delay (s) | | 17.3 | | 17.8 | | 17.4 | | 5.0 | 4.1 | 51.1 | 3.0 | 2.5 |
| Level of Service | | B | | B | | B | | A | A | D | A | A |
| Approach Delay (s) | | 17.3 | | | 17.6 | | | 5.0 | | | 4.5 | |
| Approach LOS | | B | | | B | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 5.4 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.28 | | |
| Actuated Cycle Length (s) | 47.6 | Sum of lost time (s) | 11.8 |
| Intersection Capacity Utilization | 42.6% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 21: Novato Blvd #3 & Center Rd/Garden Ct

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 155 | 1 | 206 | 4 | 2 | 2 | 210 | 607 | 5 | 2 | 582 | 102 |
| Future Volume (vph) | 155 | 1 | 206 | 4 | 2 | 2 | 210 | 607 | 5 | 2 | 582 | 102 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.2 | 3.2 | | | 3.0 | | 3.0 | 4.4 | | 3.0 | 4.4 | |
| Lane Util. Factor | 1.00 | 1.00 | | | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.85 | | | 0.97 | | 1.00 | 1.00 | | 1.00 | 0.98 | |
| Flt Protected | 0.95 | 1.00 | | | 0.98 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1805 | 1616 | | | 1791 | | 1805 | 3605 | | 1805 | 3483 | |
| Flt Permitted | 0.75 | 1.00 | | | 0.90 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1430 | 1616 | | | 1654 | | 1805 | 3605 | | 1805 | 3483 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 163 | 1 | 217 | 4 | 2 | 2 | 221 | 639 | 5 | 2 | 613 | 107 |
| RTOR Reduction (vph) | 0 | 180 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 10 | 0 |
| Lane Group Flow (vph) | 163 | 38 | 0 | 0 | 6 | 0 | 221 | 644 | 0 | 2 | 710 | 0 |
| Confl. Peds. (#/hr) | | | | | | | | | 9 | | | 6 |
| Confl. Bikes (#/hr) | | | | | | | | | 2 | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 1% | 0% |
| Turn Type | Perm | NA | | Perm | NA | | Prot | NA | | Prot | NA | |
| Protected Phases | | 8 | | | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | 8 | | | 4 | | | | | | | | |
| Actuated Green, G (s) | 16.9 | 16.9 | | | 17.1 | | 16.6 | 70.3 | | 2.2 | 55.9 | |
| Effective Green, g (s) | 16.9 | 16.9 | | | 17.1 | | 16.6 | 70.3 | | 2.2 | 55.9 | |
| Actuated g/C Ratio | 0.17 | 0.17 | | | 0.17 | | 0.17 | 0.70 | | 0.02 | 0.56 | |
| Clearance Time (s) | 3.2 | 3.2 | | | 3.0 | | 3.0 | 4.4 | | 3.0 | 4.4 | |
| Vehicle Extension (s) | 3.0 | 3.0 | | | 2.0 | | 2.0 | 4.0 | | 2.0 | 4.0 | |
| Lane Grp Cap (vph) | 241 | 273 | | | 282 | | 299 | 2534 | | 39 | 1946 | |
| v/s Ratio Prot | | 0.02 | | | | | c0.12 | 0.18 | | 0.00 | c0.20 | |
| v/s Ratio Perm | c0.11 | | | | 0.00 | | | | | | | |
| v/c Ratio | 0.68 | 0.14 | | | 0.02 | | 0.74 | 0.25 | | 0.05 | 0.37 | |
| Uniform Delay, d1 | 39.0 | 35.4 | | | 34.5 | | 39.6 | 5.4 | | 47.9 | 12.2 | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | | 0.91 | 1.45 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 7.3 | 0.2 | | | 0.0 | | 7.7 | 0.2 | | 0.2 | 0.5 | |
| Delay (s) | 46.3 | 35.6 | | | 34.5 | | 44.0 | 8.0 | | 48.1 | 12.7 | |
| Level of Service | D | D | | | C | | D | A | | D | B | |
| Approach Delay (s) | | 40.2 | | | 34.5 | | | 17.2 | | | 12.8 | |
| Approach LOS | | D | | | C | | | B | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 20.1 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.49 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 56.6% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 22: Novato Blvd #3 & Arthur Street

02/15/2018

| Movement | EBL | EBR | NBL | NBT | SBU | SBT | SBR |
|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | |
| Traffic Volume (vph) | 93 | 128 | 158 | 893 | 7 | 751 | 87 |
| Future Volume (vph) | 93 | 128 | 158 | 893 | 7 | 751 | 87 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 3.5 | 3.5 | 4.9 | 3.5 | 4.9 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 0.98 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 0.85 | 1.00 | 1.00 | 1.00 | 0.98 | |
| Flt Protected | 0.95 | 1.00 | 0.95 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1797 | 1589 | 1805 | 3574 | 1805 | 3554 | |
| Flt Permitted | 0.95 | 1.00 | 0.95 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1797 | 1589 | 1805 | 3574 | 1805 | 3554 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 98 | 135 | 166 | 940 | 7 | 791 | 92 |
| RTOR Reduction (vph) | 0 | 118 | 0 | 0 | 0 | 5 | 0 |
| Lane Group Flow (vph) | 98 | 17 | 166 | 940 | 7 | 878 | 0 |
| Confl. Peds. (#/hr) | 4 | 2 | | | | | |
| Confl. Bikes (#/hr) | | 1 | | | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 1% | 0% | 0% | 0% |
| Turn Type | Perm | Perm | Prot | NA | Prot | NA | |
| Protected Phases | | | 1 | 6 | 5 | 2 | |
| Permitted Phases | 4 | 4 | | | | | |
| Actuated Green, G (s) | 12.5 | 12.5 | 13.7 | 74.4 | 1.2 | 61.9 | |
| Effective Green, g (s) | 12.5 | 12.5 | 13.7 | 74.4 | 1.2 | 61.9 | |
| Actuated g/C Ratio | 0.12 | 0.12 | 0.14 | 0.74 | 0.01 | 0.62 | |
| Clearance Time (s) | 3.5 | 3.5 | 3.5 | 4.9 | 3.5 | 4.9 | |
| Vehicle Extension (s) | 2.0 | 2.0 | 2.0 | 4.0 | 2.0 | 4.0 | |
| Lane Grp Cap (vph) | 224 | 198 | 247 | 2659 | 21 | 2199 | |
| v/s Ratio Prot | | | c0.09 | 0.26 | 0.00 | c0.25 | |
| v/s Ratio Perm | c0.05 | 0.01 | | | | | |
| v/c Ratio | 0.44 | 0.09 | 0.67 | 0.35 | 0.33 | 0.40 | |
| Uniform Delay, d1 | 40.5 | 38.7 | 41.0 | 4.4 | 49.0 | 9.6 | |
| Progression Factor | 1.00 | 1.00 | 0.87 | 1.21 | 0.83 | 1.10 | |
| Incremental Delay, d2 | 0.5 | 0.1 | 3.6 | 0.2 | 3.3 | 0.5 | |
| Delay (s) | 41.0 | 38.8 | 39.1 | 5.6 | 43.8 | 11.1 | |
| Level of Service | D | D | D | A | D | B | |
| Approach Delay (s) | 39.7 | | | 10.7 | | 11.4 | |
| Approach LOS | D | | | B | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 14.0 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.45 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 11.9 |
| Intersection Capacity Utilization | 49.3% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 23: Novato Blvd #3 & Rowland Boulevard

02/15/2018

| Movement | EBL | EBT | EBR | WBU | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 40 | 128 | 16 | 28 | 240 | 203 | 621 | 28 | 369 | 188 | 449 | 389 |
| Future Volume (vph) | 40 | 128 | 16 | 28 | 240 | 203 | 621 | 28 | 369 | 188 | 449 | 389 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 3.5 | | | 3.5 | 4.1 | 4.1 | 3.5 | 4.1 | | 3.5 | 4.4 |
| Lane Util. Factor | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 0.97 | 1.00 |
| Frpb, ped/bikes | 1.00 | 0.99 | | | 1.00 | 1.00 | 0.99 | 1.00 | 0.99 | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 0.98 | | | 1.00 | 1.00 | 0.85 | 1.00 | 0.95 | | 1.00 | 0.98 |
| Flt Protected | 0.95 | 1.00 | | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 1858 | | | 1789 | 1900 | 1592 | 1805 | 1775 | | 3502 | 1852 |
| Flt Permitted | 0.95 | 1.00 | | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | 1805 | 1858 | | | 1789 | 1900 | 1592 | 1805 | 1775 | | 3502 | 1852 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 42 | 135 | 17 | 29 | 253 | 214 | 654 | 29 | 388 | 198 | 473 | 409 |
| RTOR Reduction (vph) | 0 | 5 | 0 | 0 | 0 | 0 | 386 | 0 | 16 | 0 | 0 | 5 |
| Lane Group Flow (vph) | 42 | 147 | 0 | 0 | 282 | 214 | 268 | 29 | 570 | 0 | 473 | 471 |
| Confl. Peds. (#/hr) | | | 13 | | | | 2 | | | 5 | | |
| Confl. Bikes (#/hr) | | | 1 | | | | | | | 1 | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 1% | 0% | 0% | 0% | 1% | 1% | 0% | 0% |
| Turn Type | Prot | NA | | Prot | Prot | NA | Perm | Prot | NA | | Prot | NA |
| Protected Phases | 3 | 8 | | 7 | 7 | 4 | | 1 | 6 | | 5 | 2 |
| Permitted Phases | | | | | | | 4 | | | | | |
| Actuated Green, G (s) | 5.5 | 16.6 | | | 15.5 | 26.0 | 26.0 | 6.0 | 39.1 | | 14.2 | 47.0 |
| Effective Green, g (s) | 5.5 | 16.6 | | | 15.5 | 26.0 | 26.0 | 6.0 | 39.1 | | 14.2 | 47.0 |
| Actuated g/C Ratio | 0.06 | 0.17 | | | 0.16 | 0.26 | 0.26 | 0.06 | 0.39 | | 0.14 | 0.47 |
| Clearance Time (s) | 3.5 | 3.5 | | | 3.5 | 4.1 | 4.1 | 3.5 | 4.1 | | 3.5 | 4.4 |
| Vehicle Extension (s) | 2.0 | 2.0 | | | 2.0 | 2.0 | 2.0 | 2.0 | 3.0 | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 99 | 308 | | | 277 | 494 | 413 | 108 | 694 | | 497 | 870 |
| v/s Ratio Prot | 0.02 | c0.08 | | | c0.16 | 0.11 | | 0.02 | c0.32 | | c0.14 | 0.25 |
| v/s Ratio Perm | | | | | | | c0.17 | | | | | |
| v/c Ratio | 0.42 | 0.48 | | | 1.02 | 0.43 | 0.65 | 0.27 | 0.82 | | 0.95 | 0.54 |
| Uniform Delay, d1 | 45.7 | 37.8 | | | 42.2 | 30.9 | 32.9 | 44.9 | 27.3 | | 42.6 | 18.8 |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 0.70 | 0.54 |
| Incremental Delay, d2 | 1.1 | 0.4 | | | 58.8 | 0.2 | 2.8 | 0.5 | 7.8 | | 29.0 | 2.3 |
| Delay (s) | 46.8 | 38.2 | | | 101.0 | 31.1 | 35.7 | 45.4 | 35.1 | | 58.7 | 12.5 |
| Level of Service | D | D | | | F | C | D | D | D | | E | B |
| Approach Delay (s) | | 40.1 | | | | 50.9 | | | 35.6 | | | 35.5 |
| Approach LOS | | D | | | | D | | | D | | | D |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 41.9 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.84 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 15.5 |
| Intersection Capacity Utilization | 87.4% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 23: Novato Blvd #3 & Rowland Boulevard

02/15/2018

| Movement | SBR |
|---|---|
| Lane Configurations | |
| Traffic Volume (vph) | 64 |
| Future Volume (vph) | 64 |
| Ideal Flow (vphpl) | 1900 |
| Total Lost time (s) | |
| Lane Util. Factor | |
| Frpb, ped/bikes | |
| Flpb, ped/bikes | |
| Frt | |
| Flt Protected | |
| Satd. Flow (prot) | |
| Flt Permitted | |
| Satd. Flow (perm) | |
| Peak-hour factor, PHF | 0.95 |
| Adj. Flow (vph) | 67 |
| RTOR Reduction (vph) | 0 |
| Lane Group Flow (vph) | 0 |
| Confl. Peds. (#/hr) | 6 |
| Confl. Bikes (#/hr) | |
| Heavy Vehicles (%) | 0% |
| Turn Type | |
| Protected Phases | |
| Permitted Phases | |
| Actuated Green, G (s) | |
| Effective Green, g (s) | |
| Actuated g/C Ratio | |
| Clearance Time (s) | |
| Vehicle Extension (s) | |
| Lane Grp Cap (vph) | |
| v/s Ratio Prot | |
| v/s Ratio Perm | |
| v/c Ratio | |
| Uniform Delay, d1 | |
| Progression Factor | |
| Incremental Delay, d2 | |
| Delay (s) | |
| Level of Service | |
| Approach Delay (s) | |
| Approach LOS | |

Intersection Summary

| Movement | EBL | EBT | EBR | WBU | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 116 | 655 | 49 | 1 | 142 | 982 | 456 | 24 | 30 | 64 | 433 | 27 |
| Future Volume (vph) | 116 | 655 | 49 | 1 | 142 | 982 | 456 | 24 | 30 | 64 | 433 | 27 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.5 | 4.5 | | 3.5 | 4.5 | | 3.5 | 4.1 | | 3.5 | 4.8 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | | 0.97 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.98 | | 1.00 | 1.00 | | 1.00 | 0.99 | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | | 1.00 | 0.95 | | 1.00 | 0.90 | | 1.00 | 1.00 |
| Flt Protected | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 3574 | 1590 | | 1805 | 3422 | | 1805 | 3209 | | 3502 | 1900 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | 1805 | 3574 | 1590 | | 1805 | 3422 | | 1805 | 3209 | | 3502 | 1900 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 122 | 689 | 52 | 1 | 149 | 1034 | 480 | 25 | 32 | 67 | 456 | 28 |
| RTOR Reduction (vph) | 0 | 0 | 31 | 0 | 0 | 41 | 0 | 0 | 57 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 122 | 689 | 21 | 0 | 150 | 1473 | 0 | 25 | 42 | 0 | 456 | 28 |
| Confl. Peds. (#/hr) | | | 4 | | | | 4 | | | 3 | | |
| Confl. Bikes (#/hr) | | | | | | | | | | 1 | | |
| Heavy Vehicles (%) | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Prot | NA | Perm | Prot | Prot | NA | | Prot | NA | | Prot | NA |
| Protected Phases | 5 | 2 | | 1 | 1 | 6 | | 3 | 8 | | 7 | 4 |
| Permitted Phases | | | 2 | | | | | | | | | |
| Actuated Green, G (s) | 11.2 | 38.2 | 38.2 | | 12.7 | 39.7 | | 4.0 | 13.9 | | 12.8 | 22.0 |
| Effective Green, g (s) | 11.2 | 38.2 | 38.2 | | 12.7 | 39.7 | | 4.0 | 13.9 | | 12.8 | 22.0 |
| Actuated g/C Ratio | 0.12 | 0.41 | 0.41 | | 0.14 | 0.43 | | 0.04 | 0.15 | | 0.14 | 0.24 |
| Clearance Time (s) | 3.5 | 4.5 | 4.5 | | 3.5 | 4.5 | | 3.5 | 4.1 | | 3.5 | 4.8 |
| Vehicle Extension (s) | 2.0 | 4.0 | 4.0 | | 2.0 | 4.0 | | 2.0 | 2.5 | | 2.5 | 2.5 |
| Lane Grp Cap (vph) | 216 | 1464 | 651 | | 245 | 1457 | | 77 | 478 | | 480 | 448 |
| v/s Ratio Prot | 0.07 | 0.19 | | | c0.08 | c0.43 | | 0.01 | 0.01 | | c0.13 | 0.01 |
| v/s Ratio Perm | | | 0.01 | | | | | | | | | |
| v/c Ratio | 0.56 | 0.47 | 0.03 | | 0.61 | 1.01 | | 0.32 | 0.09 | | 0.95 | 0.06 |
| Uniform Delay, d1 | 38.7 | 20.1 | 16.4 | | 37.9 | 26.8 | | 43.3 | 34.2 | | 39.9 | 27.6 |
| Progression Factor | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 2.0 | 0.3 | 0.0 | | 3.2 | 26.2 | | 0.9 | 0.1 | | 28.4 | 0.0 |
| Delay (s) | 40.7 | 20.4 | 16.5 | | 41.1 | 53.0 | | 44.2 | 34.2 | | 68.3 | 27.6 |
| Level of Service | D | C | B | | D | D | | D | C | | E | C |
| Approach Delay (s) | | 23.1 | | | | 51.9 | | | 36.2 | | | 56.7 |
| Approach LOS | | C | | | | D | | | D | | | E |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 44.7 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.80 | | |
| Actuated Cycle Length (s) | 93.2 | Sum of lost time (s) | 16.3 |
| Intersection Capacity Utilization | 81.7% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |





| Movement | SBR |
|---|---|
| Lane Configurations | |
| Traffic Volume (vph) | 148 |
| Future Volume (vph) | 148 |
| Ideal Flow (vphpl) | 1900 |
| Total Lost time (s) | 4.8 |
| Lane Util. Factor | 1.00 |
| Frpb, ped/bikes | 0.99 |
| Flpb, ped/bikes | 1.00 |
| Frt | 0.85 |
| Flt Protected | 1.00 |
| Satd. Flow (prot) | 1593 |
| Flt Permitted | 1.00 |
| Satd. Flow (perm) | 1593 |
| Peak-hour factor, PHF | 0.95 |
| Adj. Flow (vph) | 156 |
| RTOR Reduction (vph) | 119 |
| Lane Group Flow (vph) | 37 |
| Confl. Peds. (#/hr) | 2 |
| Confl. Bikes (#/hr) | |
| Heavy Vehicles (%) | 0% |
| Turn Type | Perm |
| Protected Phases | |
| Permitted Phases | 4 |
| Actuated Green, G (s) | 22.0 |
| Effective Green, g (s) | 22.0 |
| Actuated g/C Ratio | 0.24 |
| Clearance Time (s) | 4.8 |
| Vehicle Extension (s) | 2.5 |
| Lane Grp Cap (vph) | 376 |
| v/s Ratio Prot | |
| v/s Ratio Perm | c0.02 |
| v/c Ratio | 0.10 |
| Uniform Delay, d1 | 27.8 |
| Progression Factor | 1.00 |
| Incremental Delay, d2 | 0.1 |
| Delay (s) | 27.9 |
| Level of Service | C |
| Approach Delay (s) | |
| Approach LOS | |

Intersection Summary

## HCM Signalized Intersection Capacity Analysis
## 25: Rowland Boulevard & Highway 101 SB Ramps

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 545 | 615 | 765 | 1365 | 0 | 0 | 0 | 0 | 321 | 6 | 186 |
| Future Volume (vph) | 0 | 545 | 615 | 765 | 1365 | 0 | 0 | 0 | 0 | 321 | 6 | 186 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.0 | 4.0 | 3.0 | 4.0 | | | | | 3.0 | 3.0 | |
| Lane Util. Factor | | 0.91 | 0.91 | 0.97 | 0.95 | | | | | 0.91 | 0.91 | |
| Frpb, ped/bikes | | 1.00 | 0.99 | 1.00 | 1.00 | | | | | 1.00 | 0.99 | |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | | | | 1.00 | 1.00 | |
| Frt | | 0.95 | 0.85 | 1.00 | 1.00 | | | | | 1.00 | 0.92 | |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | 0.95 | 0.98 | |
| Satd. Flow (prot) | | 3255 | 1450 | 3502 | 3610 | | | | | 1643 | 3057 | |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | 0.95 | 0.98 | |
| Satd. Flow (perm) | | 3255 | 1450 | 3502 | 3610 | | | | | 1643 | 3057 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 0 | 574 | 647 | 805 | 1437 | 0 | 0 | 0 | 0 | 338 | 6 | 196 |
| RTOR Reduction (vph) | 0 | 55 | 241 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 0 |
| Lane Group Flow (vph) | 0 | 791 | 134 | 805 | 1437 | 0 | 0 | 0 | 0 | 189 | 339 | 0 |
| Confl. Peds. (#/hr) | | | 2 | | | | | | | | | 7 |
| Confl. Bikes (#/hr) | | | | | | | | | | | | 1 |
| Heavy Vehicles (%) | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 33% | 0% |
| Turn Type | | NA | Perm | Prot | NA | | | | | Split | NA | |
| Protected Phases | | 2 | | 1 | 6 | | | | | 4 | 4 | |
| Permitted Phases | | | 2 | | | | | | | | | |
| Actuated Green, G (s) | | 20.8 | 20.8 | 13.4 | 37.2 | | | | | 13.8 | 13.8 | |
| Effective Green, g (s) | | 20.8 | 20.8 | 13.4 | 37.2 | | | | | 13.8 | 13.8 | |
| Actuated g/C Ratio | | 0.36 | 0.36 | 0.23 | 0.64 | | | | | 0.24 | 0.24 | |
| Clearance Time (s) | | 4.0 | 4.0 | 3.0 | 4.0 | | | | | 3.0 | 3.0 | |
| Vehicle Extension (s) | | 4.0 | 4.0 | 2.0 | 2.5 | | | | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | | 1167 | 520 | 809 | 2315 | | | | | 390 | 727 | |
| v/s Ratio Prot | | 0.24 | | c0.23 | c0.40 | | | | | c0.12 | 0.11 | |
| v/s Ratio Perm | | | 0.09 | | | | | | | | | |
| v/c Ratio | | 0.68 | 0.26 | 1.00 | 0.62 | | | | | 0.48 | 0.47 | |
| Uniform Delay, d1 | | 15.8 | 13.1 | 22.3 | 6.2 | | | | | 19.0 | 18.9 | |
| Progression Factor | | 1.00 | 1.00 | 1.00 | 1.00 | | | | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 1.7 | 0.4 | 30.2 | 0.5 | | | | | 0.3 | 0.2 | |
| Delay (s) | | 17.5 | 13.5 | 52.5 | 6.6 | | | | | 19.4 | 19.1 | |
| Level of Service | | B | B | D | A | | | | | B | B | |
| Approach Delay (s) | | 16.3 | | | 23.1 | | | 0.0 | | | 19.2 | |
| Approach LOS | | B | | | C | | | A | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 20.5 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.72 | | |
| Actuated Cycle Length (s) | 58.0 | Sum of lost time (s) | 10.0 |
| Intersection Capacity Utilization | 72.1% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
## 26: Highway 101 NB Ramps & Rowland Boulevard

02/15/2018

| Movement | EBL2 | EBL | EBT | WBT | WBR | WBR2 | NBL2 | NBL | NBT | NBR | NEL2 | NEL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 4 | 99 | 776 | 1266 | 2 | 517 | 838 | 15 | 2 | 801 | 20 | 20 |
| Future Volume (vph) | 4 | 99 | 776 | 1266 | 2 | 517 | 838 | 15 | 2 | 801 | 20 | 20 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | 4.0 | 4.0 | | 4.0 | 3.5 | | 3.5 | 3.0 | | 3.5 |
| Lane Util. Factor | | 1.00 | 0.95 | 0.86 | | 0.86 | 0.95 | | 0.95 | 0.88 | | 1.00 |
| Frpb, ped/bikes | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Frt | | 1.00 | 1.00 | 0.99 | | 0.85 | 1.00 | | 1.00 | 0.85 | | 0.98 |
| Flt Protected | | 0.95 | 1.00 | 1.00 | | 1.00 | 0.95 | | 0.95 | 1.00 | | 0.96 |
| Satd. Flow (prot) | | 1804 | 3574 | 4640 | | 1323 | 1715 | | 1717 | 2842 | | 1742 |
| Flt Permitted | | 0.95 | 1.00 | 1.00 | | 1.00 | 0.95 | | 0.95 | 1.00 | | 0.96 |
| Satd. Flow (perm) | | 1804 | 3574 | 4640 | | 1323 | 1715 | | 1717 | 2842 | | 1742 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 4 | 104 | 817 | 1333 | 2 | 544 | 882 | 16 | 2 | 843 | 21 | 21 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 8 | 0 | 214 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 108 | 817 | 1452 | 0 | 205 | 450 | 0 | 450 | 843 | 0 | 48 |
| Confl. Peds. (#/hr) | | | | | 1 | | | | | 8 | | |
| Heavy Vehicles (%) | 2% | 0% | 1% | 4% | 0% | 5% | 0% | 2% | 13% | 0% | 2% | 0% |
| Turn Type | Prot | Prot | NA | NA | | Perm | Split | Split | NA | custom | Perm | Prot |
| Protected Phases | 5 | 5 | 2 | 6 | | | 8 | 8 | 8 | 1 8 | | 7 |
| Permitted Phases | | | | | | 6 | | | | | 7 | |
| Actuated Green, G (s) | | 10.2 | 48.4 | 49.7 | | 49.7 | 37.3 | | 37.3 | 48.8 | | 8.8 |
| Effective Green, g (s) | | 10.2 | 48.4 | 49.7 | | 49.7 | 37.3 | | 37.3 | 48.8 | | 8.8 |
| Actuated g/C Ratio | | 0.08 | 0.40 | 0.41 | | 0.41 | 0.31 | | 0.31 | 0.41 | | 0.07 |
| Clearance Time (s) | | 3.0 | 4.0 | 4.0 | | 4.0 | 3.5 | | 3.5 | | | 3.5 |
| Vehicle Extension (s) | | 2.0 | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | | | 2.0 |
| Lane Grp Cap (vph) | | 153 | 1441 | 1921 | | 547 | 533 | | 533 | 1155 | | 127 |
| v/s Ratio Prot | | 0.06 | 0.23 | c0.31 | | | c0.26 | | 0.26 | c0.30 | | |
| v/s Ratio Perm | | | | | | 0.15 | | | | | | 0.03 |
| v/c Ratio | | 0.71 | 0.57 | 0.76 | | 0.37 | 0.84 | | 0.84 | 0.73 | | 0.38 |
| Uniform Delay, d1 | | 53.4 | 27.7 | 30.0 | | 24.4 | 38.6 | | 38.6 | 30.0 | | 53.0 |
| Progression Factor | | 1.00 | 1.00 | 0.90 | | 1.28 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Incremental Delay, d2 | | 11.4 | 1.6 | 2.4 | | 1.7 | 11.2 | | 11.2 | 2.0 | | 0.7 |
| Delay (s) | | 64.9 | 29.3 | 29.4 | | 32.8 | 49.9 | | 49.9 | 32.0 | | 53.7 |
| Level of Service | | E | C | C | | C | D | | D | C | | D |
| Approach Delay (s) | | | 33.5 | 30.2 | | | | | 41.2 | | | 53.7 |
| Approach LOS | | | C | C | | | | | D | | | D |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 35.3 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.76 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 14.0 |
| Intersection Capacity Utilization | 82.1% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 26: Highway 101 NB Ramps & Rowland Boulevard

02/15/2018

| Movement | NER |
|---|---|
| Lane Configurations | |
| Traffic Volume (vph) | 6 |
| Future Volume (vph) | 6 |
| Ideal Flow (vphpl) | 1900 |
| Total Lost time (s) | |
| Lane Util. Factor | |
| Frpb, ped/bikes | |
| Flpb, ped/bikes | |
| Frt | |
| Flt Protected | |
| Satd. Flow (prot) | |
| Flt Permitted | |
| Satd. Flow (perm) | |
| Peak-hour factor, PHF | 0.95 |
| Adj. Flow (vph) | 6 |
| RTOR Reduction (vph) | 0 |
| Lane Group Flow (vph) | 0 |
| Confl. Peds. (#/hr) | |
| Heavy Vehicles (%) | 15% |
| Turn Type | |
| Protected Phases | |
| Permitted Phases | |
| Actuated Green, G (s) | |
| Effective Green, g (s) | |
| Actuated g/C Ratio | |
| Clearance Time (s) | |
| Vehicle Extension (s) | |
| Lane Grp Cap (vph) | |
| v/s Ratio Prot | |
| v/s Ratio Perm | |
| v/c Ratio | |
| Uniform Delay, d1 | |
| Progression Factor | |
| Incremental Delay, d2 | |
| Delay (s) | |
| Level of Service | |
| Approach Delay (s) | |
| Approach LOS | |

Intersection Summary



## HCM Signalized Intersection Capacity Analysis
### 27: Rowland Boulevard & Rowland Way

02/15/2018

| Movement | EBU | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | |
| Traffic Volume (vph) | 6 | 236 | 1347 | 1441 | 27 | 38 | 356 |
| Future Volume (vph) | 6 | 236 | 1347 | 1441 | 27 | 38 | 356 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.5 | 4.0 | 4.0 | | 3.2 | 3.2 |
| Lane Util. Factor | | 0.97 | 0.91 | 0.95 | | 1.00 | 0.95 |
| Frpb, ped/bikes | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | | 1.00 | 1.00 | 1.00 | | 0.88 | 0.85 |
| Flt Protected | | 0.95 | 1.00 | 1.00 | | 0.99 | 1.00 |
| Satd. Flow (prot) | | 3468 | 5187 | 3594 | | 1634 | 1519 |
| Flt Permitted | | 0.95 | 1.00 | 1.00 | | 0.99 | 1.00 |
| Satd. Flow (perm) | | 3468 | 5187 | 3594 | | 1634 | 1519 |
| Peak-hour factor, PHF | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| Adj. Flow (vph) | 6 | 243 | 1389 | 1486 | 28 | 39 | 367 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 1 | 0 | 147 | 180 |
| Lane Group Flow (vph) | 0 | 249 | 1389 | 1513 | 0 | 57 | 22 |
| Confl. Peds. (#/hr) | | | | | 12 | 2 | |
| Heavy Vehicles (%) | 0% | 1% | 0% | 0% | 7% | 2% | 1% |
| Turn Type | Prot | Prot | NA | NA | | Prot | Perm |
| Protected Phases | 5 | 5 | 2 | 6 | | 4 | |
| Permitted Phases | | | | | | | 4 |
| Actuated Green, G (s) | | 13.1 | 99.7 | 83.1 | | 13.1 | 13.1 |
| Effective Green, g (s) | | 13.1 | 99.7 | 83.1 | | 13.1 | 13.1 |
| Actuated g/C Ratio | | 0.11 | 0.83 | 0.69 | | 0.11 | 0.11 |
| Clearance Time (s) | | 3.5 | 4.0 | 4.0 | | 3.2 | 3.2 |
| Vehicle Extension (s) | | 2.0 | 4.0 | 4.0 | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | | 378 | 4309 | 2488 | | 178 | 165 |
| v/s Ratio Prot | | c0.07 | 0.27 | c0.42 | | c0.03 | |
| v/s Ratio Perm | | | | | | | 0.01 |
| v/c Ratio | | 0.66 | 0.32 | 0.61 | | 0.32 | 0.13 |
| Uniform Delay, d1 | | 51.3 | 2.3 | 9.8 | | 49.3 | 48.3 |
| Progression Factor | | 1.02 | 1.17 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | | 2.5 | 0.2 | 1.0 | | 0.4 | 0.1 |
| Delay (s) | | 54.7 | 2.9 | 10.8 | | 49.7 | 48.5 |
| Level of Service | | D | A | B | | D | D |
| Approach Delay (s) | | | 10.8 | 10.8 | | 49.1 | |
| Approach LOS | | | B | B | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 15.1 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.58 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 10.7 |
| Intersection Capacity Utilization | 73.7% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 18 | 544 | 831 | 2 | 640 | 6 | 839 | 3 | 2 | 4 | 3 | 0 |
| Future Volume (vph) | 18 | 544 | 831 | 2 | 640 | 6 | 839 | 3 | 2 | 4 | 3 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 4.0 | 4.0 | 3.0 | 4.0 | | 3.6 | 3.6 | | | 3.2 | |
| Lane Util. Factor | 1.00 | 0.95 | 0.88 | 1.00 | 0.95 | | 0.97 | 1.00 | | | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 0.99 | | | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | | 1.00 | 0.94 | | | 1.00 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | | 0.97 | |
| Satd. Flow (prot) | 1805 | 3539 | 2842 | 1805 | 3568 | | 3502 | 1768 | | | 1847 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | | 0.97 | |
| Satd. Flow (perm) | 1805 | 3539 | 2842 | 1805 | 3568 | | 3502 | 1768 | | | 1847 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 19 | 573 | 875 | 2 | 674 | 6 | 883 | 3 | 2 | 4 | 3 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 19 | 573 | 875 | 2 | 679 | 0 | 883 | 4 | 0 | 0 | 7 | 0 |
| Confl. Peds. (#/hr) | | | 9 | 9 | | 13 | | | 11 | | | |
| Confl. Bikes (#/hr) | | | 2 | | | 2 | | | | | | |
| Heavy Vehicles (%) | 0% | 2% | 0% | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Prot | NA | pt+ov | Prot | NA | | Split | NA | | Split | NA | |
| Protected Phases | 5 | 2 | 2 3 | 1 | 6 | | 3 | 3 | | 4 | 4 | |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | 5.4 | 49.6 | 105.0 | 2.8 | 47.0 | | 51.4 | 51.4 | | | 2.4 | |
| Effective Green, g (s) | 5.4 | 49.6 | 105.0 | 2.8 | 47.0 | | 51.4 | 51.4 | | | 2.4 | |
| Actuated g/C Ratio | 0.05 | 0.41 | 0.88 | 0.02 | 0.39 | | 0.43 | 0.43 | | | 0.02 | |
| Clearance Time (s) | 3.0 | 4.0 | | 3.0 | 4.0 | | 3.6 | 3.6 | | | 3.2 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | | 3.0 | 3.0 | | | 2.0 | |
| Lane Grp Cap (vph) | 81 | 1462 | 2486 | 42 | 1397 | | 1500 | 757 | | | 36 | |
| v/s Ratio Prot | 0.01 | 0.16 | c0.31 | 0.00 | c0.19 | | c0.25 | 0.00 | | | c0.00 | |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | 0.23 | 0.39 | 0.35 | 0.05 | 0.49 | | 0.59 | 0.01 | | | 0.19 | |
| Uniform Delay, d1 | 55.3 | 24.6 | 1.4 | 57.3 | 27.4 | | 26.2 | 19.7 | | | 57.8 | |
| Progression Factor | 1.17 | 1.17 | 0.96 | 1.00 | 1.00 | | 1.00 | 1.00 | | | 1.00 | |
| Incremental Delay, d2 | 0.5 | 0.8 | 0.4 | 0.2 | 1.2 | | 1.7 | 0.0 | | | 1.0 | |
| Delay (s) | 65.4 | 29.6 | 1.7 | 57.5 | 28.6 | | 27.9 | 19.7 | | | 58.8 | |
| Level of Service | E | C | A | E | C | | C | B | | | E | |
| Approach Delay (s) | | 13.4 | | | 28.7 | | | 27.9 | | | 58.8 | |
| Approach LOS | | B | | | C | | | C | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 21.2 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.53 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 13.8 |
| Intersection Capacity Utilization | 60.6% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |





| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 210 | 19 | 35 | 32 | 12 | 38 | 46 | 304 | 54 | 36 | 333 | 228 |
| Future Volume (vph) | 210 | 19 | 35 | 32 | 12 | 38 | 46 | 304 | 54 | 36 | 333 | 228 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.0 | | 3.5 | 3.5 | | 3.5 | 4.9 | | 3.5 | 4.6 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 0.98 | | 1.00 | 0.98 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.90 | | 1.00 | 0.89 | | 1.00 | 0.98 | | 1.00 | 0.94 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1787 | 1674 | | 1805 | 1644 | | 1805 | 1835 | | 1805 | 1777 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1787 | 1674 | | 1805 | 1644 | | 1805 | 1835 | | 1805 | 1777 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 221 | 20 | 37 | 34 | 13 | 40 | 48 | 320 | 57 | 38 | 351 | 240 |
| RTOR Reduction (vph) | 0 | 30 | 0 | 0 | 36 | 0 | 0 | 5 | 0 | 0 | 19 | 0 |
| Lane Group Flow (vph) | 221 | 27 | 0 | 34 | 17 | 0 | 48 | 372 | 0 | 38 | 572 | 0 |
| Confl. Peds. (#/hr) | | | 11 | | | 6 | | | 3 | | | |
| Confl. Bikes (#/hr) | | | | | | 1 | | | | | | |
| Heavy Vehicles (%) | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 1% | 0% | 0% | 0% | 1% |
| Turn Type | Prot | NA | | Prot | NA | | Prot | NA | | Prot | NA | |
| Protected Phases | 3 | 8 | | 7 | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | 13.1 | 15.6 | | 5.2 | 8.2 | | 5.2 | 38.3 | | 5.2 | 38.6 | |
| Effective Green, g (s) | 13.1 | 15.6 | | 5.2 | 8.2 | | 5.2 | 38.3 | | 5.2 | 38.6 | |
| Actuated g/C Ratio | 0.16 | 0.19 | | 0.06 | 0.10 | | 0.06 | 0.48 | | 0.06 | 0.48 | |
| Clearance Time (s) | 3.5 | 4.0 | | 3.5 | 3.5 | | 3.5 | 4.9 | | 3.5 | 4.6 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 291 | 325 | | 117 | 168 | | 117 | 876 | | 117 | 855 | |
| v/s Ratio Prot | c0.12 | c0.02 | | 0.02 | 0.01 | | c0.03 | 0.20 | | 0.02 | c0.32 | |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | 0.76 | 0.08 | | 0.29 | 0.10 | | 0.41 | 0.42 | | 0.32 | 0.67 | |
| Uniform Delay, d1 | 32.0 | 26.4 | | 35.7 | 32.7 | | 36.0 | 13.7 | | 35.8 | 15.9 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 9.7 | 0.0 | | 0.5 | 0.1 | | 0.9 | 1.5 | | 0.6 | 4.1 | |
| Delay (s) | 41.7 | 26.5 | | 36.2 | 32.8 | | 36.9 | 15.2 | | 36.4 | 20.0 | |
| Level of Service | D | C | | D | C | | D | B | | D | C | |
| Approach Delay (s) | | 38.6 | | | 34.1 | | | 17.7 | | | 21.0 | |
| Approach LOS | | D | | | C | | | B | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 24.3 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.60 | | |
| Actuated Cycle Length (s) | 80.2 | Sum of lost time (s) | 15.9 |
| Intersection Capacity Utilization | 65.0% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM 2010 AWSC
### 30: Redwood Blvd & Novato Blvd #3

02/15/2018

| Intersection | |
|---|---|
| Intersection Delay, s/veh | 49.6 |
| Intersection LOS | E |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 46 | 274 | 74 | 74 | 370 | 114 | 121 | 14 | 141 | 88 | 11 | 48 |
| Future Vol, veh/h | 46 | 274 | 74 | 74 | 370 | 114 | 121 | 14 | 141 | 88 | 11 | 48 |
| Peak Hour Factor | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Heavy Vehicles, % | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Mvmt Flow | 48 | 288 | 78 | 78 | 389 | 120 | 127 | 15 | 148 | 93 | 12 | 51 |
| Number of Lanes | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Opposing Approach | WB | EB | SB | NB |
| Opposing Lanes | 2 | 2 | 2 | 3 |
| Conflicting Approach Left | SB | NB | EB | WB |
| Conflicting Lanes Left | 2 | 3 | 2 | 2 |
| Conflicting Approach Right | NB | SB | WB | EB |
| Conflicting Lanes Right | 3 | 2 | 2 | 2 |
| HCM Control Delay | 34.4 | 86.3 | 15.7 | 14.9 |
| HCM LOS | D | F | C | B |

| Lane | NBLn1 | NBLn2 | NBLn3 | EBLn1 | EBLn2 | WBLn1 | WBLn2 | SBLn1 | SBLn2 |
|---|---|---|---|---|---|---|---|---|---|
| Vol Left, % | 100% | 0% | 0% | 100% | 0% | 100% | 0% | 100% | 0% |
| Vol Thru, % | 0% | 100% | 0% | 0% | 79% | 0% | 76% | 0% | 19% |
| Vol Right, % | 0% | 0% | 100% | 0% | 21% | 0% | 24% | 0% | 81% |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 121 | 14 | 141 | 46 | 348 | 74 | 484 | 88 | 59 |
| LT Vol | 121 | 0 | 0 | 46 | 0 | 74 | 0 | 88 | 0 |
| Through Vol | 0 | 14 | 0 | 0 | 274 | 0 | 370 | 0 | 11 |
| RT Vol | 0 | 0 | 141 | 0 | 74 | 0 | 114 | 0 | 48 |
| Lane Flow Rate | 127 | 15 | 148 | 48 | 366 | 78 | 509 | 93 | 62 |
| Geometry Grp | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Degree of Util (X) | 0.326 | 0.036 | 0.328 | 0.115 | 0.805 | 0.182 | 1.096 | 0.249 | 0.148 |
| Departure Headway (Hd) | 9.586 | 9.067 | 8.341 | 8.909 | 8.261 | 8.406 | 7.744 | 10.096 | 8.975 |
| Convergence, Y/N | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Cap | 377 | 397 | 433 | 405 | 440 | 429 | 474 | 358 | 402 |
| Service Time | 7.286 | 6.767 | 6.041 | 6.609 | 5.961 | 6.106 | 5.444 | 7.796 | 6.675 |
| HCM Lane V/C Ratio | 0.337 | 0.038 | 0.342 | 0.119 | 0.832 | 0.182 | 1.074 | 0.26 | 0.154 |
| HCM Control Delay | 16.9 | 12.1 | 15.1 | 12.8 | 37.2 | 13 | 97.5 | 16.1 | 13.2 |
| HCM Lane LOS | C | B | C | B | E | B | F | C | B |
| HCM 95th-tile Q | 1.4 | 0.1 | 1.4 | 0.4 | 7.3 | 0.7 | 16.9 | 1 | 0.5 |



## HCM Signalized Intersection Capacity Analysis
### 30: Redwood Blvd & Novato Blvd #3

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 46 | 274 | 74 | 74 | 370 | 114 | 121 | 14 | 141 | 88 | 11 | 48 |
| Future Volume (vph) | 46 | 274 | 74 | 74 | 370 | 114 | 121 | 14 | 141 | 88 | 11 | 48 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 16 | 16 | 12 | 16 | 16 | 12 | 12 | 12 | 12 | 12 | 12 |
| Total Lost time (s) | 3.5 | 4.0 | | 3.5 | 4.0 | | 3.5 | 4.0 | 4.0 | 3.5 | 4.0 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 0.97 | | 1.00 | 0.96 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.88 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1787 | 2048 | | 1787 | 2041 | | 1787 | 1881 | 1599 | 1787 | 1653 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1787 | 2048 | | 1787 | 2041 | | 1787 | 1881 | 1599 | 1787 | 1653 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 48 | 288 | 78 | 78 | 389 | 120 | 127 | 15 | 148 | 93 | 12 | 51 |
| RTOR Reduction (vph) | 0 | 9 | 0 | 0 | 11 | 0 | 0 | 0 | 125 | 0 | 46 | 0 |
| Lane Group Flow (vph) | 48 | 357 | 0 | 78 | 498 | 0 | 127 | 15 | 23 | 93 | 17 | 0 |
| Heavy Vehicles (%) | 1% | 2% | 1% | 1% | 2% | 1% | 1% | 1% | 1% | 1% | 1% | 1% |
| Turn Type | Prot | NA | | Prot | NA | | Prot | NA | Perm | Prot | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | | | | | | | 2 | | | |
| Actuated Green, G (s) | 2.6 | 20.0 | | 4.2 | 21.6 | | 9.6 | 8.4 | 8.4 | 6.4 | 5.2 | |
| Effective Green, g (s) | 2.6 | 20.0 | | 4.2 | 21.6 | | 9.6 | 8.4 | 8.4 | 6.4 | 5.2 | |
| Actuated g/C Ratio | 0.05 | 0.37 | | 0.08 | 0.40 | | 0.18 | 0.16 | 0.16 | 0.12 | 0.10 | |
| Clearance Time (s) | 3.5 | 4.0 | | 3.5 | 4.0 | | 3.5 | 4.0 | 4.0 | 3.5 | 4.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 86 | 758 | | 138 | 816 | | 317 | 292 | 248 | 211 | 159 | |
| v/s Ratio Prot | 0.03 | 0.17 | | c0.04 | c0.24 | | c0.07 | 0.01 | | 0.05 | 0.01 | |
| v/s Ratio Perm | | | | | | | | | c0.01 | | | |
| v/c Ratio | 0.56 | 0.47 | | 0.57 | 0.61 | | 0.40 | 0.05 | 0.09 | 0.44 | 0.11 | |
| Uniform Delay, d1 | 25.1 | 13.0 | | 24.0 | 12.9 | | 19.7 | 19.4 | 19.5 | 22.1 | 22.3 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 7.6 | 0.5 | | 5.2 | 1.3 | | 0.8 | 0.1 | 0.2 | 1.5 | 0.3 | |
| Delay (s) | 32.8 | 13.4 | | 29.2 | 14.2 | | 20.5 | 19.5 | 19.7 | 23.6 | 22.6 | |
| Level of Service | C | B | | C | B | | C | B | B | C | C | |
| Approach Delay (s) | | 15.7 | | | 16.2 | | | 20.0 | | | 23.2 | |
| Approach LOS | | B | | | B | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 17.6 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.49 | | |
| Actuated Cycle Length (s) | 54.0 | Sum of lost time (s) | 15.0 |
| Intersection Capacity Utilization | 53.1% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## MOVEMENT SUMMARY

**Site: 30 [PM Cumulative]**

Novato Boulevard/Redwood Boulevard
PM Cumulative with Project

Roundabout

**Movement Performance - Vehicles**

| Mov ID | OD Mov | Demand Flows Total veh/h | Demand Flows HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance ft | Prop. Queued | Effective Stop Rate per veh | Average Speed mph |
|---|---|---|---|---|---|---|---|---|---|---|---|
| South: NB Redwood Boulevard | | | | | | | | | | | |
| 3 | L2 | 127 | 2.0 | 0.336 | 7.9 | LOS A | 1.6 | 41.5 | 0.60 | 0.55 | 32.3 |
| 8 | T1 | 15 | 2.0 | 0.336 | 7.9 | LOS A | 1.6 | 41.5 | 0.60 | 0.55 | 32.3 |
| 18 | R2 | 148 | 2.0 | 0.336 | 7.9 | LOS A | 1.6 | 41.5 | 0.60 | 0.55 | 31.5 |
| Approach | | 291 | 2.0 | 0.336 | 7.9 | LOS A | 1.6 | 41.5 | 0.60 | 0.55 | 31.9 |
| East: WB Novato Blvd | | | | | | | | | | | |
| 1 | L2 | 78 | 2.0 | 0.529 | 9.5 | LOS A | 3.7 | 93.5 | 0.55 | 0.39 | 32.4 |
| 6 | T1 | 389 | 2.0 | 0.529 | 9.5 | LOS A | 3.7 | 93.5 | 0.55 | 0.39 | 32.4 |
| 16 | R2 | 120 | 2.0 | 0.529 | 9.5 | LOS A | 3.7 | 93.5 | 0.55 | 0.39 | 31.5 |
| Approach | | 587 | 2.0 | 0.529 | 9.5 | LOS A | 3.7 | 93.5 | 0.55 | 0.39 | 32.2 |
| North: SB Redwood Boulevard | | | | | | | | | | | |
| 7 | L2 | 93 | 2.0 | 0.212 | 7.3 | LOS A | 0.9 | 22.7 | 0.61 | 0.60 | 32.2 |
| 4 | T1 | 12 | 2.0 | 0.212 | 7.3 | LOS A | 0.9 | 22.7 | 0.61 | 0.60 | 32.2 |
| 14 | R2 | 51 | 2.0 | 0.212 | 7.3 | LOS A | 0.9 | 22.7 | 0.61 | 0.60 | 31.4 |
| Approach | | 155 | 2.0 | 0.212 | 7.3 | LOS A | 0.9 | 22.7 | 0.61 | 0.60 | 32.0 |
| West: EB Novato Blvd | | | | | | | | | | | |
| 5 | L2 | 48 | 2.0 | 0.287 | 5.7 | LOS A | 1.4 | 35.3 | 0.37 | 0.24 | 34.2 |
| 2 | T1 | 288 | 2.0 | 0.287 | 5.7 | LOS A | 1.4 | 35.3 | 0.37 | 0.24 | 34.2 |
| 12 | R2 | 78 | 2.0 | 0.066 | 3.6 | LOS A | 0.3 | 6.6 | 0.30 | 0.17 | 34.5 |
| Approach | | 415 | 2.0 | 0.287 | 5.3 | LOS A | 1.4 | 35.3 | 0.35 | 0.23 | 34.2 |
| All Vehicles | | 1447 | 2.0 | 0.529 | 7.7 | LOS A | 3.7 | 93.5 | 0.51 | 0.40 | 32.7 |

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.


Organisation: W-TRANS | Processed: Tuesday, February 27, 2018 4:03:44 PM
Project: N:\AAA\MAX\NOV\126NOV\SIDRA\Novato-Redwood.sip7

## HCM Signalized Intersection Capacity Analysis
### 31: Alameda Del Prado & Ignacio Blvd

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 11 | 459 | 81 | 348 | 742 | 36 | 102 | 4 | 170 | 29 | 5 | 1 |
| Future Volume (vph) | 11 | 459 | 81 | 348 | 742 | 36 | 102 | 4 | 170 | 29 | 5 | 1 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.6 | 3.6 | 3.0 | 3.6 | | | 3.5 | 3.5 | | 3.7 | |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | | 1.00 | 1.00 | | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.97 | 1.00 | 1.00 | | | 1.00 | 0.98 | | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.99 | 1.00 | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | | | 1.00 | 0.85 | | 1.00 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 0.95 | 1.00 | | 0.96 | |
| Satd. Flow (prot) | 1770 | 3610 | 1573 | 1900 | 3585 | | | 1784 | 1589 | | 1811 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 0.76 | 1.00 | | 0.75 | |
| Satd. Flow (perm) | 1770 | 3610 | 1573 | 1805 | 3585 | | | 1413 | 1589 | | 1417 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 12 | 483 | 85 | 366 | 781 | 38 | 107 | 4 | 179 | 31 | 5 | 1 |
| RTOR Reduction (vph) | 0 | 0 | 31 | 0 | 2 | 0 | 0 | 0 | 152 | 0 | 1 | 0 |
| Lane Group Flow (vph) | 12 | 483 | 54 | 366 | 817 | 0 | 0 | 111 | 27 | 0 | 36 | 0 |
| Confl. Peds. (#/hr) | | | 4 | | | | 7 | | 4 | 4 | | 7 |
| Heavy Vehicles (%) | 2% | 0% | 0% | 0% | 0% | 0% | 1% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Prot | NA | Perm | Prot | NA | | Perm | NA | Perm | Perm | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | 2 | | | | 8 | | 8 | 4 | | |
| Actuated Green, G (s) | 1.2 | 47.4 | 47.4 | 27.4 | 73.6 | | | 15.1 | 15.1 | | 14.9 | |
| Effective Green, g (s) | 1.2 | 47.4 | 47.4 | 27.4 | 73.6 | | | 15.1 | 15.1 | | 14.9 | |
| Actuated g/C Ratio | 0.01 | 0.47 | 0.47 | 0.27 | 0.74 | | | 0.15 | 0.15 | | 0.15 | |
| Clearance Time (s) | 3.0 | 3.6 | 3.6 | 3.0 | 3.6 | | | 3.5 | 3.5 | | 3.7 | |
| Vehicle Extension (s) | 2.0 | 3.0 | 3.0 | 2.0 | 3.0 | | | 2.0 | 2.0 | | 2.0 | |
| Lane Grp Cap (vph) | 21 | 1711 | 745 | 520 | 2638 | | | 213 | 239 | | 211 | |
| v/s Ratio Prot | c0.01 | 0.13 | | c0.19 | c0.23 | | | | | | | |
| v/s Ratio Perm | | | 0.03 | | | | | c0.08 | 0.02 | | 0.03 | |
| v/c Ratio | 0.57 | 0.28 | 0.07 | 0.70 | 0.31 | | | 0.52 | 0.11 | | 0.17 | |
| Uniform Delay, d1 | 49.1 | 16.0 | 14.3 | 32.7 | 4.5 | | | 39.1 | 36.7 | | 37.2 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 0.74 | 0.74 | | | 1.00 | 1.00 | | 1.00 | |
| Incremental Delay, d2 | 21.2 | 0.4 | 0.2 | 3.2 | 0.3 | | | 1.1 | 0.1 | | 0.1 | |
| Delay (s) | 70.4 | 16.4 | 14.5 | 27.2 | 3.6 | | | 40.2 | 36.7 | | 37.3 | |
| Level of Service | E | B | B | C | A | | | D | D | | D | |
| Approach Delay (s) | | 17.2 | | | 10.9 | | | 38.1 | | | 37.3 | |
| Approach LOS | | B | | | B | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 16.9 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.46 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 10.3 |
| Intersection Capacity Utilization | 69.0% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 32: US 101 SB Off Ramp/Enfrente Rd & Ignacio Blvd/Ignacio Blvd #3

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 35 | 403 | 267 | 668 | 821 | 145 | 0 | 0 | 813 | 201 | 92 | 308 |
| Future Volume (vph) | 35 | 403 | 267 | 668 | 821 | 145 | 0 | 0 | 813 | 201 | 92 | 308 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Grade (%) | | 0% | | | 0% | | | 2% | | | 0% | |
| Total Lost time (s) | 3.0 | 8.0 | 8.0 | 4.0 | 5.0 | | | | 4.0 | | 4.0 | 4.0 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | | | 0.88 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.96 | 1.00 | 0.99 | | | | 1.00 | | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.98 | | | | 0.85 | | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | | 1.00 | | 0.97 | 1.00 |
| Satd. Flow (prot) | 1805 | 3610 | 1550 | 1770 | 3500 | | | | 2759 | | 1809 | 1578 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | | 1.00 | | 0.97 | 1.00 |
| Satd. Flow (perm) | 1805 | 3610 | 1550 | 1770 | 3500 | | | | 2759 | | 1809 | 1578 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 36 | 420 | 278 | 696 | 855 | 151 | 0 | 0 | 847 | 209 | 96 | 321 |
| RTOR Reduction (vph) | 0 | 0 | 205 | 0 | 11 | 0 | 0 | 0 | 389 | 0 | 0 | 240 |
| Lane Group Flow (vph) | 36 | 420 | 73 | 696 | 995 | 0 | 0 | 0 | 458 | 0 | 305 | 81 |
| Confl. Peds. (#/hr) | | | 7 | | | 20 | | | | | | 1 |
| Confl. Bikes (#/hr) | | | | | | 3 | | | | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 2% | 0% | 0% | 0% | 0% | 2% | 0% | 5% | 1% |
| Turn Type | Prot | NA | Perm | Prot | NA | | | | Over | Split | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | | | 1 | 7 | 7 | |
| Permitted Phases | | | 2 | | | | | | | | | 7 |
| Actuated Green, G (s) | 6.6 | 26.3 | 26.3 | 35.2 | 58.9 | | | | 35.2 | | 22.5 | 22.5 |
| Effective Green, g (s) | 6.6 | 26.3 | 26.3 | 35.2 | 58.9 | | | | 35.2 | | 22.5 | 22.5 |
| Actuated g/C Ratio | 0.07 | 0.26 | 0.26 | 0.35 | 0.59 | | | | 0.35 | | 0.22 | 0.22 |
| Clearance Time (s) | 3.0 | 8.0 | 8.0 | 4.0 | 5.0 | | | | 4.0 | | 4.0 | 4.0 |
| Vehicle Extension (s) | 2.0 | 2.5 | 2.5 | 3.0 | 4.0 | | | | 3.0 | | 2.5 | 2.5 |
| Lane Grp Cap (vph) | 119 | 949 | 407 | 623 | 2061 | | | | 971 | | 407 | 355 |
| v/s Ratio Prot | 0.02 | c0.12 | | c0.39 | c0.28 | | | | 0.17 | | c0.17 | |
| v/s Ratio Perm | | | 0.05 | | | | | | | | | 0.05 |
| v/c Ratio | 0.30 | 0.44 | 0.18 | 1.12 | 0.48 | | | | 0.47 | | 0.75 | 0.23 |
| Uniform Delay, d1 | 44.5 | 30.7 | 28.5 | 32.4 | 11.8 | | | | 25.2 | | 36.1 | 31.7 |
| Progression Factor | 0.98 | 0.69 | 0.44 | 0.82 | 0.74 | | | | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.5 | 1.5 | 0.9 | 62.8 | 0.4 | | | | 0.4 | | 7.0 | 0.2 |
| Delay (s) | 44.2 | 22.7 | 13.4 | 89.3 | 9.1 | | | | 25.5 | | 43.1 | 31.9 |
| Level of Service | D | C | B | F | A | | | | C | | D | C |
| Approach Delay (s) | | 20.3 | | | 41.9 | | | 25.5 | | | 37.4 | |
| Approach LOS | | C | | | D | | | C | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 33.5 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.83 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 83.9% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 32: US 101 SB Off Ramp/Enfrente Rd & Ignacio Blvd/Ignacio Blvd #3

02/16/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 35 | 403 | 267 | 668 | 821 | 145 | 0 | 0 | 813 | 201 | 92 | 308 |
| Future Volume (vph) | 35 | 403 | 267 | 668 | 821 | 145 | 0 | 0 | 813 | 201 | 92 | 308 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Grade (%) | | 0% | | | 0% | | | 2% | | | 0% | |
| Total Lost time (s) | 3.0 | 8.0 | 8.0 | 4.0 | 5.0 | | | | 4.0 | | 4.0 | 4.0 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | | | 0.88 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.96 | 1.00 | 0.99 | | | | 1.00 | | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.98 | | | | 0.85 | | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | | 1.00 | | 0.97 | 1.00 |
| Satd. Flow (prot) | 1805 | 3610 | 1550 | 1770 | 3500 | | | | 2759 | | 1809 | 1578 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | | 1.00 | | 0.97 | 1.00 |
| Satd. Flow (perm) | 1805 | 3610 | 1550 | 1770 | 3500 | | | | 2759 | | 1809 | 1578 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 36 | 420 | 278 | 696 | 855 | 151 | 0 | 0 | 847 | 209 | 96 | 321 |
| RTOR Reduction (vph) | 0 | 0 | 205 | 0 | 11 | 0 | 0 | 0 | 389 | 0 | 0 | 240 |
| Lane Group Flow (vph) | 36 | 420 | 73 | 696 | 995 | 0 | 0 | 0 | 458 | 0 | 305 | 81 |
| Confl. Peds. (#/hr) | | | 7 | | | 20 | | | | | | 1 |
| Confl. Bikes (#/hr) | | | | | | 3 | | | | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 2% | 0% | 0% | 0% | 0% | 2% | 0% | 5% | 1% |
| Turn Type | Prot | NA | Perm | Prot | NA | | | | Over | Split | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | | | 1 | 7 | 7 | |
| Permitted Phases | | | 2 | | | | | | | | | 7 |
| Actuated Green, G (s) | 6.6 | 26.3 | 26.3 | 35.2 | 58.9 | | | | 35.2 | | 22.5 | 22.5 |
| Effective Green, g (s) | 6.6 | 26.3 | 26.3 | 35.2 | 58.9 | | | | 35.2 | | 22.5 | 22.5 |
| Actuated g/C Ratio | 0.07 | 0.26 | 0.26 | 0.35 | 0.59 | | | | 0.35 | | 0.22 | 0.22 |
| Clearance Time (s) | 3.0 | 8.0 | 8.0 | 4.0 | 5.0 | | | | 4.0 | | 4.0 | 4.0 |
| Vehicle Extension (s) | 2.0 | 2.5 | 2.5 | 3.0 | 4.0 | | | | 3.0 | | 2.5 | 2.5 |
| Lane Grp Cap (vph) | 119 | 949 | 407 | 623 | 2061 | | | | 971 | | 407 | 355 |
| v/s Ratio Prot | 0.02 | c0.12 | | c0.39 | c0.28 | | | | 0.17 | | c0.17 | |
| v/s Ratio Perm | | | 0.05 | | | | | | | | | 0.05 |
| v/c Ratio | 0.30 | 0.44 | 0.18 | 1.12 | 0.48 | | | | 0.47 | | 0.75 | 0.23 |
| Uniform Delay, d1 | 44.5 | 30.7 | 28.5 | 32.4 | 11.8 | | | | 25.2 | | 36.1 | 31.7 |
| Progression Factor | 0.93 | 0.65 | 0.39 | 0.83 | 0.73 | | | | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.5 | 1.5 | 0.9 | 62.8 | 0.4 | | | | 0.4 | | 7.0 | 0.2 |
| Delay (s) | 42.1 | 21.6 | 12.2 | 89.6 | 8.9 | | | | 25.5 | | 43.1 | 31.9 |
| Level of Service | D | C | B | F | A | | | | C | | D | C |
| Approach Delay (s) | | 19.0 | | | 41.9 | | | 25.5 | | | 37.4 | |
| Approach LOS | | B | | | D | | | C | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 33.3 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.83 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 83.9% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 33: Nave Dr & Ignacio Blvd #3/Bel Marin Keys Blvd #3

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 379 | 1044 | 134 | 769 | 778 | 870 | 769 | 276 | 0 | 0 | 0 |
| Future Volume (vph) | 0 | 379 | 1044 | 134 | 769 | 778 | 870 | 769 | 276 | 0 | 0 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.0 | 4.6 | 3.0 | 4.0 | | 4.6 | 4.6 | 3.0 | | | |
| Lane Util. Factor | | 0.95 | 1.00 | 1.00 | 0.95 | | 0.91 | 0.91 | 1.00 | | | |
| Frpb, ped/bikes | | 1.00 | 0.99 | 1.00 | 0.99 | | 1.00 | 1.00 | 0.99 | | | |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | | |
| Frt | | 1.00 | 0.85 | 1.00 | 0.92 | | 1.00 | 1.00 | 0.85 | | | |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 0.98 | 1.00 | | | |
| Satd. Flow (prot) | | 3539 | 1605 | 1805 | 3250 | | 1643 | 3382 | 1584 | | | |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 0.98 | 1.00 | | | |
| Satd. Flow (perm) | | 3539 | 1605 | 1805 | 3250 | | 1643 | 3382 | 1584 | | | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 0 | 399 | 1099 | 141 | 809 | 819 | 916 | 809 | 291 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 72 | 0 | 39 | 0 | 0 | 0 | 105 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 399 | 1027 | 141 | 1589 | 0 | 559 | 1166 | 186 | 0 | 0 | 0 |
| Confl. Peds. (#/hr) | | | 1 | | | 1 | | | 1 | | | |
| Heavy Vehicles (%) | 0% | 2% | 0% | 0% | 2% | 2% | 0% | 1% | 1% | 0% | 0% | 0% |
| Turn Type | | NA | pm+ov | Prot | NA | | Split | NA | pm+ov | | | |
| Protected Phases | | 2 | 3 | 1 | 6 | | 3 | 3 | 1 | | | |
| Permitted Phases | | | 2 | | | | | | 3 | | | |
| Actuated Green, G (s) | | 35.4 | 75.6 | 12.8 | 51.2 | | 40.2 | 40.2 | 53.0 | | | |
| Effective Green, g (s) | | 35.4 | 75.6 | 12.8 | 51.2 | | 40.2 | 40.2 | 53.0 | | | |
| Actuated g/C Ratio | | 0.35 | 0.76 | 0.13 | 0.51 | | 0.40 | 0.40 | 0.53 | | | |
| Clearance Time (s) | | 4.0 | 4.6 | 3.0 | 4.0 | | 4.6 | 4.6 | 3.0 | | | |
| Vehicle Extension (s) | | 4.0 | 2.0 | 2.0 | 4.0 | | 2.0 | 2.0 | 2.0 | | | |
| Lane Grp Cap (vph) | | 1252 | 1213 | 231 | 1664 | | 660 | 1359 | 839 | | | |
| v/s Ratio Prot | | 0.11 | 0.34 | 0.08 | c0.49 | | 0.34 | c0.34 | 0.03 | | | |
| v/s Ratio Perm | | | 0.30 | | | | | | 0.09 | | | |
| v/c Ratio | | 0.32 | 0.85 | 0.61 | 0.95 | | 0.85 | 0.86 | 0.22 | | | |
| Uniform Delay, d1 | | 23.5 | 8.3 | 41.2 | 23.3 | | 27.1 | 27.3 | 12.5 | | | |
| Progression Factor | | 1.10 | 1.01 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | | |
| Incremental Delay, d2 | | 0.6 | 4.6 | 3.3 | 13.7 | | 9.5 | 5.4 | 0.0 | | | |
| Delay (s) | | 26.4 | 13.0 | 44.6 | 37.0 | | 36.6 | 32.7 | 12.6 | | | |
| Level of Service | | C | B | D | D | | D | C | B | | | |
| Approach Delay (s) | | 16.5 | | | 37.6 | | | 30.9 | | | 0.0 | |
| Approach LOS | | B | | | D | | | C | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 29.0 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.94 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 11.6 |
| Intersection Capacity Utilization | 84.5% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 34: Bel Marin Keys Blvd #3 & Commercial Blvd

02/16/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 3 | 0 | 40 | 292 | 1 | 29 | 48 | 562 | 82 | 33 | 1448 | 7 |
| Future Volume (vph) | 3 | 0 | 40 | 292 | 1 | 29 | 48 | 562 | 82 | 33 | 1448 | 7 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.0 | | | 4.0 | 4.0 | 3.0 | 3.9 | | 3.0 | 3.5 | |
| Lane Util. Factor | | 1.00 | | | 1.00 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | | 0.99 | | | 1.00 | 0.99 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 0.87 | | | 1.00 | 0.85 | 1.00 | 0.98 | | 1.00 | 1.00 | |
| Flt Protected | | 1.00 | | | 0.95 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 1631 | | | 1754 | 1396 | 1805 | 3456 | | 1805 | 3537 | |
| Flt Permitted | | 0.98 | | | 0.69 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | | 1608 | | | 1275 | 1396 | 1805 | 3456 | | 1805 | 3537 | |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Adj. Flow (vph) | 3 | 0 | 44 | 324 | 1 | 32 | 53 | 624 | 91 | 37 | 1609 | 8 |
| RTOR Reduction (vph) | 0 | 32 | 0 | 0 | 0 | 22 | 0 | 12 | 0 | 0 | 1 | 0 |
| Lane Group Flow (vph) | 0 | 15 | 0 | 0 | 325 | 10 | 53 | 703 | 0 | 37 | 1616 | 0 |
| Confl. Peds. (#/hr) | 3 | | 2 | 2 | | 3 | | | 3 | | | |
| Heavy Vehicles (%) | 2% | 0% | 0% | 3% | 0% | 14% | 0% | 2% | 3% | 0% | 2% | 0% |
| Turn Type | Perm | NA | | Perm | NA | Perm | Prot | NA | | Prot | NA | |
| Protected Phases | | 4 | | | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | | | | | | |
| Actuated Green, G (s) | | 23.2 | | | 23.2 | 23.2 | 3.9 | 37.3 | | 3.6 | 37.4 | |
| Effective Green, g (s) | | 23.2 | | | 23.2 | 23.2 | 3.9 | 37.3 | | 3.6 | 37.4 | |
| Actuated g/C Ratio | | 0.31 | | | 0.31 | 0.31 | 0.05 | 0.50 | | 0.05 | 0.50 | |
| Clearance Time (s) | | 4.0 | | | 4.0 | 4.0 | 3.0 | 3.9 | | 3.0 | 3.5 | |
| Vehicle Extension (s) | | 3.0 | | | 3.0 | 3.0 | 2.5 | 3.0 | | 2.5 | 4.0 | |
| Lane Grp Cap (vph) | | 497 | | | 394 | 431 | 93 | 1718 | | 86 | 1763 | |
| v/s Ratio Prot | | | | | | | c0.03 | 0.20 | | 0.02 | c0.46 | |
| v/s Ratio Perm | | 0.01 | | | c0.25 | 0.01 | | | | | | |
| v/c Ratio | | 0.03 | | | 0.82 | 0.02 | 0.57 | 0.41 | | 0.43 | 0.92 | |
| Uniform Delay, d1 | | 18.1 | | | 24.0 | 18.0 | 34.7 | 11.9 | | 34.7 | 17.4 | |
| Progression Factor | | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.09 | 1.02 | |
| Incremental Delay, d2 | | 0.0 | | | 13.1 | 0.0 | 6.4 | 0.7 | | 1.4 | 5.5 | |
| Delay (s) | | 18.1 | | | 37.1 | 18.0 | 41.1 | 12.6 | | 39.3 | 23.2 | |
| Level of Service | | B | | | D | B | D | B | | D | C | |
| Approach Delay (s) | | 18.1 | | | 35.4 | | | 14.6 | | | 23.6 | |
| Approach LOS | | B | | | D | | | B | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 22.5 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.87 | | |
| Actuated Cycle Length (s) | 75.0 | Sum of lost time (s) | 10.9 |
| Intersection Capacity Utilization | 69.9% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 35: Bel Marin Keys Blvd #3 & Hamilton Dr/Digital Dr

02/16/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 5 | 7 | 162 | 630 | 4 | 14 | 47 | 404 | 132 | 6 | 732 | 2 |
| Future Volume (vph) | 5 | 7 | 162 | 630 | 4 | 14 | 47 | 404 | 132 | 6 | 732 | 2 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.5 | 3.5 | 3.5 | 3.5 | | 3.0 | 4.0 | | 3.0 | 4.0 | |
| Lane Util. Factor | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | | 1.00 | 0.98 | 1.00 | 0.99 | | 1.00 | 0.99 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | 1.00 | 0.99 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 1.00 | 0.85 | 1.00 | 0.88 | | 1.00 | 0.96 | | 1.00 | 1.00 | |
| Flt Protected | | 0.98 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 1864 | 1522 | 1739 | 1658 | | 1770 | 3378 | | 1805 | 3538 | |
| Flt Permitted | | 0.96 | 1.00 | 0.75 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | | 1822 | 1522 | 1371 | 1658 | | 1770 | 3378 | | 1805 | 3538 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 5 | 8 | 176 | 685 | 4 | 15 | 51 | 439 | 143 | 7 | 796 | 2 |
| RTOR Reduction (vph) | 0 | 0 | 104 | 0 | 9 | 0 | 0 | 36 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 13 | 72 | 685 | 10 | 0 | 51 | 546 | 0 | 7 | 798 | 0 |
| Confl. Peds. (#/hr) | 1 | | 10 | 10 | | 1 | | | 2 | | | 8 |
| Confl. Bikes (#/hr) | | | | | | | | | 5 | | | 5 |
| Heavy Vehicles (%) | 0% | 0% | 4% | 3% | 0% | 0% | 2% | 2% | 3% | 0% | 2% | 0% |
| Turn Type | Perm | NA | Perm | Perm | NA | | Prot | NA | | Prot | NA | |
| Protected Phases | | 4 | | | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | 4 | 8 | | | | | | | | |
| Actuated Green, G (s) | | 30.5 | 30.5 | 30.5 | 30.5 | | 5.4 | 32.2 | | 1.8 | 28.6 | |
| Effective Green, g (s) | | 30.5 | 30.5 | 30.5 | 30.5 | | 5.4 | 32.2 | | 1.8 | 28.6 | |
| Actuated g/C Ratio | | 0.41 | 0.41 | 0.41 | 0.41 | | 0.07 | 0.43 | | 0.02 | 0.38 | |
| Clearance Time (s) | | 3.5 | 3.5 | 3.5 | 3.5 | | 3.0 | 4.0 | | 3.0 | 4.0 | |
| Vehicle Extension (s) | | 2.0 | 2.0 | 2.5 | 2.5 | | 2.0 | 4.0 | | 2.0 | 4.0 | |
| Lane Grp Cap (vph) | | 740 | 618 | 557 | 674 | | 127 | 1450 | | 43 | 1349 | |
| v/s Ratio Prot | | | | | 0.01 | | c0.03 | 0.16 | | 0.00 | c0.23 | |
| v/s Ratio Perm | | 0.01 | 0.05 | c0.50 | | | | | | | | |
| v/c Ratio | | 0.02 | 0.12 | 1.23 | 0.01 | | 0.40 | 0.38 | | 0.16 | 0.59 | |
| Uniform Delay, d1 | | 13.3 | 13.9 | 22.2 | 13.3 | | 33.3 | 14.6 | | 35.9 | 18.5 | |
| Progression Factor | | 1.00 | 1.00 | 1.00 | 1.00 | | 0.77 | 1.63 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 0.0 | 0.0 | 118.5 | 0.0 | | 0.7 | 0.7 | | 0.7 | 1.9 | |
| Delay (s) | | 13.3 | 13.9 | 140.8 | 13.3 | | 26.3 | 24.5 | | 36.5 | 20.4 | |
| Level of Service | | B | B | F | B | | C | C | | D | C | |
| Approach Delay (s) | | 13.8 | | | 137.3 | | | 24.7 | | | 20.6 | |
| Approach LOS | | B | | | F | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 56.4 | HCM 2000 Level of Service | E |
| HCM 2000 Volume to Capacity ratio | 0.88 | | |
| Actuated Cycle Length (s) | 75.0 | Sum of lost time (s) | 10.5 |
| Intersection Capacity Utilization | 80.0% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 35: Bel Marin Keys Blvd #3 & Hamilton Dr/Digital Dr

02/16/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 5 | 7 | 162 | 630 | 4 | 14 | 47 | 404 | 132 | 6 | 732 | 2 |
| Future Volume (vph) | 5 | 7 | 162 | 630 | 4 | 14 | 47 | 404 | 132 | 6 | 732 | 2 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.5 | 3.5 | 3.5 | 3.5 | | 3.0 | 4.5 | | 3.0 | 4.5 | |
| Lane Util. Factor | | 1.00 | 1.00 | 0.95 | 0.95 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | | 1.00 | 0.99 | 1.00 | 1.00 | | 1.00 | 0.99 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 1.00 | 0.85 | 1.00 | 0.99 | | 1.00 | 0.96 | | 1.00 | 1.00 | |
| Flt Protected | | 0.98 | 1.00 | 0.95 | 0.95 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 1864 | 1533 | 1665 | 1664 | | 1770 | 3381 | | 1805 | 3538 | |
| Flt Permitted | | 0.98 | 1.00 | 0.95 | 0.95 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | | 1864 | 1533 | 1665 | 1664 | | 1770 | 3381 | | 1805 | 3538 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 5 | 8 | 176 | 685 | 4 | 15 | 51 | 439 | 143 | 7 | 796 | 2 |
| RTOR Reduction (vph) | 0 | 0 | 120 | 0 | 1 | 0 | 0 | 23 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 13 | 56 | 356 | 347 | 0 | 51 | 559 | 0 | 7 | 798 | 0 |
| Confl. Peds. (#/hr) | | | 1 | | | 1 | | | 2 | | | 8 |
| Heavy Vehicles (%) | 0% | 0% | 4% | 3% | 0% | 0% | 2% | 2% | 3% | 0% | 2% | 0% |
| Turn Type | Split | NA | Perm | Split | NA | | Prot | NA | | Prot | NA | |
| Protected Phases | 4 | 4 | | 8 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | 4 | | | | | | | | | |
| Actuated Green, G (s) | | 12.1 | 12.1 | 25.6 | 25.6 | | 5.0 | 47.0 | | 0.8 | 42.8 | |
| Effective Green, g (s) | | 12.1 | 12.1 | 25.6 | 25.6 | | 5.0 | 47.0 | | 0.8 | 42.8 | |
| Actuated g/C Ratio | | 0.12 | 0.12 | 0.26 | 0.26 | | 0.05 | 0.47 | | 0.01 | 0.43 | |
| Clearance Time (s) | | 3.5 | 3.5 | 3.5 | 3.5 | | 3.0 | 4.5 | | 3.0 | 4.5 | |
| Vehicle Extension (s) | | 2.0 | 2.0 | 2.5 | 2.5 | | 2.0 | 4.0 | | 2.0 | 4.0 | |
| Lane Grp Cap (vph) | | 225 | 185 | 426 | 425 | | 88 | 1589 | | 14 | 1514 | |
| v/s Ratio Prot | | 0.01 | | c0.21 | 0.21 | | c0.03 | 0.17 | | 0.00 | c0.23 | |
| v/s Ratio Perm | | | c0.04 | | | | | | | | | |
| v/c Ratio | | 0.06 | 0.31 | 0.84 | 0.82 | | 0.58 | 0.35 | | 0.50 | 0.53 | |
| Uniform Delay, d1 | | 38.9 | 40.1 | 35.2 | 35.0 | | 46.5 | 16.8 | | 49.4 | 21.1 | |
| Progression Factor | | 1.00 | 1.00 | 1.00 | 1.00 | | 0.59 | 0.28 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 0.0 | 0.3 | 13.0 | 11.2 | | 5.4 | 0.6 | | 9.9 | 1.3 | |
| Delay (s) | | 38.9 | 40.5 | 48.3 | 46.2 | | 32.6 | 5.3 | | 59.3 | 22.4 | |
| Level of Service | | D | D | D | D | | C | A | | E | C | |
| Approach Delay (s) | | 40.4 | | | 47.2 | | | 7.5 | | | 22.8 | |
| Approach LOS | | D | | | D | | | A | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 27.4 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.59 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 14.5 |
| Intersection Capacity Utilization | 59.4% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## 36: Nave Dr & US 101 NB Off Ramp


| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 730 | 233 | 0 | 1197 | 922 | 246 |
| Future Volume (vph) | 730 | 233 | 0 | 1197 | 922 | 246 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | | 5.0 | 5.0 | |
| Lane Util. Factor | 0.97 | 1.00 | | 0.95 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 0.99 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.85 | | 1.00 | 0.97 | |
| Flt Protected | 0.95 | 1.00 | | 1.00 | 1.00 | |
| Satd. Flow (prot) | 3467 | 1563 | | 3574 | 3469 | |
| Flt Permitted | 0.95 | 1.00 | | 1.00 | 1.00 | |
| Satd. Flow (perm) | 3467 | 1563 | | 3574 | 3469 | |
| Peak-hour factor, PHF | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Adj. Flow (vph) | 745 | 238 | 0 | 1221 | 941 | 251 |
| RTOR Reduction (vph) | 0 | 36 | 0 | 0 | 35 | 0 |
| Lane Group Flow (vph) | 745 | 202 | 0 | 1221 | 1157 | 0 |
| Confl. Peds. (#/hr) | | 1 | | | | |
| Heavy Vehicles (%) | 1% | 2% | 0% | 1% | 1% | 0% |
| Turn Type | Prot | Perm | | NA | NA | |
| Protected Phases | 4 | | | 2 | 6 | |
| Permitted Phases | | 4 | | | | |
| Actuated Green, G (s) | 31.0 | 31.0 | | 31.0 | 31.0 | |
| Effective Green, g (s) | 31.0 | 31.0 | | 31.0 | 31.0 | |
| Actuated g/C Ratio | 0.44 | 0.44 | | 0.44 | 0.44 | |
| Clearance Time (s) | 3.0 | 3.0 | | 5.0 | 5.0 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 1535 | 692 | | 1582 | 1536 | |
| v/s Ratio Prot | c0.21 | | | c0.34 | 0.33 | |
| v/s Ratio Perm | | 0.13 | | | | |
| v/c Ratio | 0.49 | 0.29 | | 0.77 | 0.75 | |
| Uniform Delay, d1 | 13.8 | 12.5 | | 16.5 | 16.3 | |
| Progression Factor | 1.00 | 1.00 | | 0.51 | 1.00 | |
| Incremental Delay, d2 | 1.1 | 1.1 | | 2.7 | 3.5 | |
| Delay (s) | 14.9 | 13.6 | | 11.0 | 19.8 | |
| Level of Service | B | B | | B | B | |
| Approach Delay (s) | 14.6 | | | 11.0 | 19.8 | |
| Approach LOS | B | | | B | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 15.1 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.63 | | |
| Actuated Cycle Length (s) | 70.0 | Sum of lost time (s) | 8.0 |
| Intersection Capacity Utilization | 63.3% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group




## 37: Nave Dr & Hamilton Center


| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 120 | 45 | 921 | 133 | 147 | 813 |
| Future Volume (vph) | 120 | 45 | 921 | 133 | 147 | 813 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.2 | 3.2 | 4.4 | | 3.0 | 4.4 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 0.85 | 0.98 | | 1.00 | 1.00 |
| Flt Protected | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 1615 | 1862 | | 1770 | 1881 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | 1805 | 1615 | 1862 | | 1770 | 1881 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 125 | 47 | 959 | 139 | 153 | 847 |
| RTOR Reduction (vph) | 0 | 43 | 6 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 125 | 4 | 1092 | 0 | 153 | 847 |
| Confl. Peds. (#/hr) | | | | 2 | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 2% | 1% |
| Turn Type | Prot | Perm | NA | | Prot | NA |
| Protected Phases | 8 | | 2 | | 1 | 6 |
| Permitted Phases | | 8 | | | | |
| Actuated Green, G (s) | 6.5 | 6.5 | 44.8 | | 8.1 | 55.9 |
| Effective Green, g (s) | 6.5 | 6.5 | 44.8 | | 8.1 | 55.9 |
| Actuated g/C Ratio | 0.09 | 0.09 | 0.64 | | 0.12 | 0.80 |
| Clearance Time (s) | 3.2 | 3.2 | 4.4 | | 3.0 | 4.4 |
| Vehicle Extension (s) | 1.0 | 1.0 | 1.0 | | 1.0 | 1.0 |
| Lane Grp Cap (vph) | 167 | 149 | 1191 | | 204 | 1502 |
| v/s Ratio Prot | c0.07 | | c0.59 | | c0.09 | 0.45 |
| v/s Ratio Perm | | 0.00 | | | | |
| v/c Ratio | 0.75 | 0.03 | 0.92 | | 0.75 | 0.56 |
| Uniform Delay, d1 | 31.0 | 28.9 | 11.0 | | 30.0 | 2.6 |
| Progression Factor | 1.00 | 1.00 | 0.86 | | 1.08 | 0.91 |
| Incremental Delay, d2 | 14.8 | 0.0 | 10.5 | | 9.6 | 1.1 |
| Delay (s) | 45.7 | 28.9 | 20.0 | | 42.1 | 3.5 |
| Level of Service | D | C | C | | D | A |
| Approach Delay (s) | 41.1 | | 20.0 | | | 9.4 |
| Approach LOS | D | | C | | | A |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 16.9 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.87 | | |
| Actuated Cycle Length (s) | 70.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 81.7% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 92 | 393 | 536 | 55 | 339 | 453 |
| Future Volume (vph) | 92 | 393 | 536 | 55 | 339 | 453 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.2 | 3.2 | 4.4 | 4.4 | 3.0 | 4.4 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.85 | 1.00 | 0.85 | 1.00 | 1.00 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (prot) | 1770 | 1599 | 1900 | 1578 | 1787 | 1850 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (perm) | 1770 | 1599 | 1900 | 1578 | 1787 | 1900 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 97 | 414 | 564 | 58 | 357 | 477 |
| RTOR Reduction (vph) | 0 | 360 | 0 | 15 | 0 | 0 |
| Lane Group Flow (vph) | 97 | 54 | 564 | 43 | 357 | 477 |
| Confl. Peds. (#/hr) | | | | 2 | | |
| Heavy Vehicles (%) | 2% | 1% | 0% | 0% | 1% | 0% |
| Turn Type | Prot | Perm | NA | Perm | Prot | NA |
| Protected Phases | 8 | | 2 | | 1 | 6 |
| Permitted Phases | | 8 | | 2 | | |
| Actuated Green, G (s) | 9.2 | 9.2 | 27.1 | 27.1 | 23.1 | 53.2 |
| Effective Green, g (s) | 9.2 | 9.2 | 27.1 | 27.1 | 23.1 | 53.2 |
| Actuated g/C Ratio | 0.13 | 0.13 | 0.39 | 0.39 | 0.33 | 0.76 |
| Clearance Time (s) | 3.2 | 3.2 | 4.4 | 4.4 | 3.0 | 4.4 |
| Vehicle Extension (s) | 2.0 | 2.0 | 3.0 | 3.0 | 2.0 | 3.0 |
| Lane Grp Cap (vph) | 232 | 210 | 735 | 610 | 589 | 1406 |
| v/s Ratio Prot | c0.05 | | c0.30 | | c0.20 | 0.26 |
| v/s Ratio Perm | | 0.03 | | 0.03 | | |
| v/c Ratio | 0.42 | 0.26 | 0.77 | 0.07 | 0.61 | 0.34 |
| Uniform Delay, d1 | 27.9 | 27.3 | 18.7 | 13.5 | 19.6 | 2.7 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.23 |
| Incremental Delay, d2 | 0.4 | 0.2 | 7.5 | 0.2 | 1.0 | 0.6 |
| Delay (s) | 28.4 | 27.6 | 26.2 | 13.7 | 20.6 | 1.2 |
| Level of Service | C | C | C | B | C | A |
| Approach Delay (s) | 27.7 | | 25.1 | | | 9.5 |
| Approach LOS | C | | C | | | A |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 19.2 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.65 | | |
| Actuated Cycle Length (s) | 70.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 62.4% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group





| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 354 | 283 | 294 | 319 | 285 | 274 |
| Future Volume (vph) | 354 | 283 | 294 | 319 | 285 | 274 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | 4.1 | 4.1 | 3.0 | 4.4 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.85 | 1.00 | 0.85 | 1.00 | 1.00 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 1615 | 1900 | 1615 | 1805 | 1881 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (perm) | 1805 | 1615 | 1900 | 1615 | 1805 | 1881 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 373 | 298 | 309 | 336 | 300 | 288 |
| RTOR Reduction (vph) | 0 | 211 | 0 | 248 | 0 | 0 |
| Lane Group Flow (vph) | 373 | 87 | 309 | 88 | 300 | 288 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 1% |
| Turn Type | Prot | Perm | NA | Perm | Prot | NA |
| Protected Phases | 8 | | 2 | | 1 | 6 |
| Permitted Phases | | 8 | | 2 | | |
| Actuated Green, G (s) | 14.8 | 14.8 | 13.2 | 13.2 | 12.4 | 28.3 |
| Effective Green, g (s) | 14.8 | 14.8 | 13.2 | 13.2 | 12.4 | 28.3 |
| Actuated g/C Ratio | 0.29 | 0.29 | 0.26 | 0.26 | 0.25 | 0.56 |
| Clearance Time (s) | 3.0 | 3.0 | 4.1 | 4.1 | 3.0 | 4.4 |
| Vehicle Extension (s) | 2.0 | 2.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| Lane Grp Cap (vph) | 528 | 473 | 496 | 422 | 443 | 1054 |
| v/s Ratio Prot | c0.21 | | c0.16 | | c0.17 | 0.15 |
| v/s Ratio Perm | | 0.05 | | 0.05 | | |
| v/c Ratio | 0.71 | 0.18 | 0.62 | 0.21 | 0.68 | 0.27 |
| Uniform Delay, d1 | 15.9 | 13.3 | 16.5 | 14.6 | 17.2 | 5.8 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 3.5 | 0.1 | 1.8 | 0.1 | 3.2 | 0.1 |
| Delay (s) | 19.4 | 13.4 | 18.2 | 14.7 | 20.5 | 5.8 |
| Level of Service | B | B | B | B | C | A |
| Approach Delay (s) | 16.8 | | 16.4 | | | 13.3 |
| Approach LOS | B | | B | | | B |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 15.5 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.67 | | |
| Actuated Cycle Length (s) | 50.5 | Sum of lost time (s) | 10.1 |
| Intersection Capacity Utilization | 61.0% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 40: Nave Dr & Bolling Dr



| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 220 | 63 | 563 | 346 | 98 | 575 |
| Future Volume (vph) | 220 | 63 | 563 | 346 | 98 | 575 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | 4.1 | | 3.0 | 3.5 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 0.97 | 1.00 | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 0.85 | 0.95 | | 1.00 | 1.00 |
| Flt Protected | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | 1787 | 1569 | 1791 | | 1805 | 1881 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | 1787 | 1569 | 1791 | | 1805 | 1881 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 229 | 66 | 586 | 360 | 102 | 599 |
| RTOR Reduction (vph) | 0 | 52 | 23 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 229 | 14 | 923 | 0 | 102 | 599 |
| Confl. Peds. (#/hr) | | 6 | | | | |
| Heavy Vehicles (%) | 1% | 0% | 1% | 0% | 0% | 1% |
| Turn Type | Prot | Perm | NA | | Prot | NA |
| Protected Phases | 4 | | 6 | | 5 | 2 |
| Permitted Phases | | 4 | | | | |
| Actuated Green, G (s) | 14.1 | 14.1 | 37.6 | | 6.9 | 48.1 |
| Effective Green, g (s) | 14.1 | 14.1 | 37.6 | | 6.9 | 48.1 |
| Actuated g/C Ratio | 0.21 | 0.21 | 0.55 | | 0.10 | 0.70 |
| Clearance Time (s) | 3.0 | 3.0 | 4.1 | | 3.0 | 3.5 |
| Vehicle Extension (s) | 2.0 | 2.0 | 2.0 | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 366 | 322 | 980 | | 181 | 1316 |
| v/s Ratio Prot | c0.13 | | c0.52 | | c0.06 | 0.32 |
| v/s Ratio Perm | | 0.01 | | | | |
| v/c Ratio | 0.63 | 0.04 | 0.94 | | 0.56 | 0.46 |
| Uniform Delay, d1 | 24.9 | 21.9 | 14.5 | | 29.5 | 4.5 |
| Progression Factor | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 2.4 | 0.0 | 16.3 | | 2.4 | 0.1 |
| Delay (s) | 27.3 | 21.9 | 30.8 | | 31.8 | 4.6 |
| Level of Service | C | C | C | | C | A |
| Approach Delay (s) | 26.1 | | 30.8 | | | 8.6 |
| Approach LOS | C | | C | | | A |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 22.1 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.82 | | |
| Actuated Cycle Length (s) | 68.7 | Sum of lost time (s) | 10.1 |
| Intersection Capacity Utilization | 81.9% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM 2010 AWSC
### 41: Alameda Del Prado & Clay Ct/Nave Dr



| Intersection | |
|---|---|
| Intersection Delay, s/veh | 19.9 |
| Intersection LOS | C |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 8 | 11 | 1 | 107 | 21 | 759 | 0 | 70 | 39 | 273 | 71 | 13 |
| Future Vol, veh/h | 8 | 11 | 1 | 107 | 21 | 759 | 0 | 70 | 39 | 273 | 71 | 13 |
| Peak Hour Factor | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 8 | 11 | 1 | 110 | 22 | 782 | 0 | 72 | 40 | 281 | 73 | 13 |
| Number of Lanes | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Opposing Approach | WB | EB | SB | NB |
| Opposing Lanes | 2 | 1 | 2 | 1 |
| Conflicting Approach Left | SB | NB | EB | WB |
| Conflicting Lanes Left | 2 | 1 | 1 | 2 |
| Conflicting Approach Right | NB | SB | WB | EB |
| Conflicting Lanes Right | 1 | 2 | 2 | 1 |
| HCM Control Delay | 10.8 | 21.8 | 12 | 18 |
| HCM LOS | B | C | B | C |

| Lane | NBLn1 | EBLn1 | WBLn1 | WBLn2 | SBLn1 | SBLn2 |
|---|---|---|---|---|---|---|
| Vol Left, % | 0% | 40% | 24% | 0% | 100% | 0% |
| Vol Thru, % | 64% | 55% | 5% | 0% | 0% | 85% |
| Vol Right, % | 36% | 5% | 72% | 100% | 0% | 15% |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 109 | 20 | 454 | 433 | 273 | 84 |
| LT Vol | 0 | 8 | 107 | 0 | 273 | 0 |
| Through Vol | 70 | 11 | 21 | 0 | 0 | 71 |
| RT Vol | 39 | 1 | 326 | 433 | 0 | 13 |
| Lane Flow Rate | 112 | 21 | 468 | 446 | 281 | 87 |
| Geometry Grp | 6 | 6 | 7 | 7 | 7 | 7 |
| Degree of Util (X) | 0.218 | 0.042 | 0.755 | 0.68 | 0.583 | 0.164 |
| Departure Headway (Hd) | 6.98 | 7.378 | 5.806 | 5.487 | 7.451 | 6.833 |
| Convergence, Y/N | Yes | Yes | Yes | Yes | Yes | Yes |
| Cap | 514 | 483 | 623 | 656 | 484 | 525 |
| Service Time | 5.031 | 5.454 | 3.555 | 3.236 | 5.2 | 4.582 |
| HCM Lane V/C Ratio | 0.218 | 0.043 | 0.751 | 0.68 | 0.581 | 0.166 |
| HCM Control Delay | 12 | 10.8 | 24.3 | 19.2 | 20.2 | 10.9 |
| HCM Lane LOS | B | B | C | C | C | B |
| HCM 95th-tile Q | 0.8 | 0.1 | 6.8 | 5.3 | 3.7 | 0.6 |

# Roadway Segment Level of Service Calculations

## Arterial Level of Service: EB Novato Blvd #1

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| San Marin Dr | 9 | 10.1 | 24.3 | 0.1 | 18 |
| Eucalyptus | 132 | 10.1 | 46.0 | 0.4 | 34 |
| Total | | 20.2 | 70.3 | 0.6 | 28 |

## Arterial Level of Service: WB Novato Blvd #1

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| Sutro Ave | 9 | 16.7 | 52.6 | 0.4 | 29 |
| | 131 | 3.0 | 16.9 | 0.1 | 26 |
| Total | | 19.6 | 69.5 | 0.6 | 29 |

## Arterial Level of Service: EB Novato Blvd #2

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| | 135 | 3.9 | 45.5 | 0.4 | 34 |
| Raposa Vista | 134 | 10.1 | 25.6 | 0.2 | 24 |
| Wilson Ave | 10 | 15.5 | 28.3 | 0.1 | 17 |
| Simmons Ln | 11 | 5.9 | 12.3 | 0.1 | 19 |
| Grant Ave | 12 | 8.9 | 43.8 | 0.4 | 34 |
| Tamalpais Ave | 13 | 19.6 | 49.4 | 0.3 | 20 |
| Diablo Ave | 14 | 49.1 | 88.9 | 0.4 | 15 |
| Total | | 113.0 | 293.9 | 1.9 | 23 |

## Arterial Level of Service: WB Novato Blvd #2

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| 7th St | 13 | 22.8 | 58.2 | 0.4 | 23 |
| Grant Ave | 12 | 5.0 | 37.5 | 0.3 | 27 |
| Simmons Ln | 11 | 15.9 | 49.6 | 0.4 | 30 |
| Wilson Ave | 10 | 6.0 | 12.6 | 0.1 | 18 |
| Raposa Vista | 134 | 12.7 | 26.1 | 0.1 | 19 |
| | 135 | 4.0 | 21.1 | 0.2 | 29 |
| Eucalyptus | 132 | 11.1 | 49.6 | 0.4 | 31 |
| Total | | 77.5 | 254.6 | 1.9 | 26 |





## Arterial Level of Service: NB Novato Blvd #3

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| Redwood Blvd | 30 | 12.3 | 28.2 | 0.2 | 21 |
| | 92 | 4.6 | 55.6 | 0.5 | 34 |
| Sunset Parkway | 29 | 8.7 | 36.3 | 0.3 | 32 |
| Rowland Boulevard | 23 | 39.5 | 62.1 | 0.3 | 15 |
| Arthur Street | 22 | 6.4 | 33.2 | 0.3 | 36 |
| Garden Ct | 21 | 6.7 | 41.6 | 0.4 | 38 |
| Diablo Ave | 14 | 61.0 | 90.0 | 0.4 | 15 |
| Total | | 139.1 | 347.0 | 2.4 | 25 |

## Arterial Level of Service: SB Novato Blvd #3

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| Center Rd | 21 | 10.9 | 40.6 | 0.4 | 32 |
| Arthur Street | 22 | 10.1 | 46.8 | 0.4 | 34 |
| | 23 | 16.1 | 43.9 | 0.3 | 27 |
| Sunset Parkway | 29 | 15.6 | 40.1 | 0.3 | 24 |
| | 92 | 3.3 | 35.7 | 0.3 | 33 |
| Redwood Blvd | 30 | 12.5 | 62.4 | 0.5 | 30 |
| Total | | 68.6 | 269.6 | 2.3 | 30 |

## Arterial Level of Service: NB #3

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| Nave Dr | 33 | 27.4 | 39.6 | 0.1 | 12 |
| Commercial Blvd | 34 | 10.1 | 23.1 | 0.1 | 23 |
| Digital Dr | 35 | 8.7 | 19.8 | 0.1 | 24 |
| Total | | 46.3 | 82.5 | 0.4 | 18 |

## Arterial Level of Service: WB #3

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| Hamilton Dr | 35 | 12.4 | 24.1 | 0.1 | 20 |
| Commercial Blvd | 34 | 8.2 | 19.0 | 0.1 | 25 |
| US 101 NB On Ramp | 33 | 15.7 | 27.7 | 0.1 | 19 |
| Enfrente Rd | 32 | 17.3 | 30.4 | 0.1 | 15 |
| Total | | 53.7 | 101.2 | 0.5 | 19 |

## Arterial Level of Service: EB Novato Blvd #1

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| San Marin Dr | 9 | 12.6 | 25.6 | 0.1 | 18 |
| Eucalyptus | 135 | 11.1 | 45.5 | 0.4 | 33 |
| Total | | 23.7 | 71.1 | 0.5 | 28 |

## Arterial Level of Service: WB Novato Blvd #1

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| Sutro Ave | 9 | 28.1 | 63.2 | 0.4 | 24 |
| | 134 | 3.8 | 16.5 | 0.1 | 28 |
| Total | | 31.9 | 79.8 | 0.5 | 25 |

## Arterial Level of Service: EB Novato Blvd #2

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| | 138 | 4.0 | 45.6 | 0.4 | 33 |
| Raposa Vista | 137 | 11.8 | 27.1 | 0.2 | 22 |
| Wilson Ave | 10 | 15.8 | 28.3 | 0.1 | 17 |
| Simmons Ln | 11 | 5.6 | 12.3 | 0.1 | 19 |
| Grant Ave | 12 | 11.4 | 51.6 | 0.4 | 29 |
| Tamalpais Ave | 13 | 25.5 | 55.3 | 0.3 | 18 |
| Diablo Ave | 14 | 76.4 | 114.3 | 0.4 | 12 |
| Total | | 150.5 | 334.5 | 1.9 | 20 |

## Arterial Level of Service: WB Novato Blvd #2

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| 7th St | 13 | 23.4 | 60.2 | 0.4 | 23 |
| Grant Ave | 12 | 6.6 | 38.5 | 0.3 | 26 |
| Simmons Ln | 11 | 14.7 | 52.2 | 0.4 | 28 |
| Wilson Ave | 10 | 6.1 | 12.7 | 0.1 | 18 |
| Raposa Vista | 137 | 13.9 | 27.1 | 0.1 | 18 |
| | 138 | 4.0 | 21.2 | 0.2 | 28 |
| Eucalyptus | 135 | 11.0 | 48.8 | 0.4 | 31 |
| Total | | 79.8 | 260.6 | 1.9 | 26 |





## Arterial Level of Service: NB Novato Blvd #3

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| Redwood Blvd | 30 | 12.6 | 28.5 | 0.2 | 21 |
| | 92 | 4.6 | 71.5 | 0.5 | 26 |
| Sunset Parkway | 29 | 11.0 | 39.0 | 0.3 | 30 |
| Rowland Boulevard | 23 | 57.9 | 79.3 | 0.3 | 12 |
| Arthur Street | 22 | 11.9 | 39.5 | 0.3 | 30 |
| Garden Ct | 21 | 8.2 | 46.3 | 0.4 | 35 |
| Diablo Ave | 14 | 77.6 | 109.3 | 0.4 | 12 |
| Total | | 183.8 | 413.4 | 2.4 | 21 |

## Arterial Level of Service: SB Novato Blvd #3

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| Center Rd | 21 | 13.1 | 46.1 | 0.4 | 29 |
| Arthur Street | 22 | 11.0 | 45.7 | 0.4 | 35 |
| | 23 | 13.0 | 44.6 | 0.3 | 27 |
| Sunset Parkway | 29 | 17.0 | 40.3 | 0.3 | 24 |
| | 92 | 3.5 | 36.1 | 0.3 | 33 |
| Redwood Blvd | 30 | 15.2 | 66.0 | 0.5 | 29 |
| Total | | 72.8 | 278.9 | 2.3 | 29 |

## Arterial Level of Service: NB #3

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| Nave Dr | 33 | 28.6 | 39.5 | 0.1 | 12 |
| Commercial Blvd | 34 | 12.4 | 25.7 | 0.1 | 21 |
| Digital Dr | 35 | 8.8 | 19.9 | 0.1 | 24 |
| Total | | 49.7 | 85.0 | 0.4 | 17 |

## Arterial Level of Service: WB #3

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| Hamilton Dr | 35 | 16.7 | 28.3 | 0.1 | 17 |
| Commercial Blvd | 34 | 26.5 | 37.4 | 0.1 | 13 |
| US 101 NB On Ramp | 33 | 29.3 | 40.8 | 0.1 | 13 |
| Enfrente Rd | 32 | 16.6 | 29.6 | 0.1 | 16 |
| Total | | 89.2 | 136.1 | 0.5 | 14 |

## Arterial Level of Service: EB Novato Blvd #2

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| | 138 | 4.1 | 45.9 | 0.4 | 33 |
| Raposa Vista | 137 | 12.1 | 27.6 | 0.2 | 22 |
| Wilson Ave | 10 | 16.5 | 29.1 | 0.1 | 17 |
| Simmons Ln | 11 | 6.1 | 12.8 | 0.1 | 18 |
| Grant Ave | 12 | 10.6 | 50.2 | 0.4 | 29 |
| Tamalpais Ave | 13 | 25.2 | 55.2 | 0.3 | 18 |
| | 45 | 5.1 | 41.6 | 0.3 | 27 |
| Diablo Ave | 14 | 19.3 | 26.6 | 0.1 | 9 |
| Center Rd | 21 | 14.2 | 48.0 | 0.4 | 27 |
| Total | | 113.4 | 337.1 | 2.2 | 24 |

## Arterial Level of Service: WB Novato Blvd #2

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| Diablo Ave | 14 | 46.0 | 74.1 | 0.4 | 18 |
| | 45 | 5.5 | 13.7 | 0.1 | 17 |
| 7th St | 13 | 42.2 | 77.6 | 0.3 | 15 |
| Grant Ave | 12 | 6.7 | 38.5 | 0.3 | 26 |
| Simmons Ln | 11 | 14.2 | 51.7 | 0.4 | 29 |
| Wilson Ave | 10 | 6.2 | 12.8 | 0.1 | 18 |
| Raposa Vista | 137 | 14.3 | 27.4 | 0.1 | 18 |
| | 138 | 4.3 | 21.4 | 0.2 | 28 |
| Eucalyptus | 135 | 12.5 | 50.8 | 0.4 | 30 |
| Total | | 151.9 | 368.0 | 2.2 | 22 |

## Arterial Level of Service: NB Novato Blvd #3

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| Redwood Blvd | 30 | 16.2 | 32.1 | 0.2 | 18 |
| | 92 | 5.6 | 72.1 | 0.5 | 26 |
| Sunset Parkway | 29 | 9.9 | 38.7 | 0.3 | 30 |
| Rowland Boulevard | 23 | 68.7 | 90.7 | 0.3 | 11 |
| Arthur Street | 22 | 9.6 | 40.8 | 0.3 | 29 |
| Garden Ct | 21 | 7.8 | 46.0 | 0.4 | 35 |
| Diablo Ave | 14 | 46.0 | 74.1 | 0.4 | 18 |
| Total | | 163.7 | 394.5 | 2.4 | 22 |





## Arterial Level of Service: SB Novato Blvd #3

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| Center Rd | 21 | 14.2 | 48.0 | 0.4 | 27 |
| Arthur Street | 22 | 13.4 | 53.7 | 0.4 | 30 |
| | 23 | 15.0 | 46.6 | 0.3 | 26 |
| Sunset Parkway | 29 | 14.7 | 38.2 | 0.3 | 25 |
| | 92 | 3.4 | 35.9 | 0.3 | 33 |
| Redwood Blvd | 30 | 18.9 | 68.2 | 0.5 | 28 |
| Total | | 79.6 | 290.5 | 2.3 | 28 |

## Arterial Level of Service: NB #3

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| Nave Dr | 33 | 33.3 | 45.9 | 0.1 | 10 |
| Commercial Blvd | 34 | 8.9 | 22.7 | 0.1 | 23 |
| Digital Dr | 35 | 8.1 | 19.1 | 0.1 | 25 |
| Total | | 50.3 | 87.8 | 0.4 | 17 |

## Arterial Level of Service: WB #3

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| Hamilton Dr | 35 | 16.1 | 29.1 | 0.1 | 17 |
| Commercial Blvd | 34 | 19.8 | 31.7 | 0.1 | 15 |
| US 101 NB On Ramp | 33 | 24.0 | 37.3 | 0.1 | 14 |
| Enfrente Rd | 32 | 16.1 | 29.0 | 0.1 | 16 |
| Total | | 76.1 | 127.2 | 0.5 | 15 |

## Arterial Level of Service: EB Novato Blvd #1

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| San Marin Dr | 9 | 14.5 | 27.8 | 0.1 | 17 |
| Eucalyptus | 136 | 11.1 | 45.1 | 0.4 | 33 |
| Total | | 25.6 | 72.9 | 0.5 | 27 |

## Arterial Level of Service: WB Novato Blvd #1

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| Sutro Ave | 9 | 35.7 | 71.3 | 0.4 | 21 |
| | 135 | 3.8 | 16.7 | 0.1 | 28 |
| Total | | 39.4 | 88.0 | 0.5 | 22 |

## Arterial Level of Service: EB Novato Blvd #2

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| | 139 | 4.0 | 45.8 | 0.4 | 33 |
| Raposa Vista | 138 | 12.2 | 27.8 | 0.2 | 22 |
| Wilson Ave | 10 | 19.8 | 32.2 | 0.1 | 15 |
| Simmons Ln | 11 | 7.4 | 14.2 | 0.1 | 16 |
| Grant Ave | 12 | 12.7 | 53.1 | 0.4 | 28 |
| Tamalpais Ave | 13 | 28.5 | 58.5 | 0.3 | 17 |
| Diablo Ave | 14 | 63.5 | 101.8 | 0.4 | 13 |
| Total | | 148.2 | 333.3 | 1.9 | 20 |

## Arterial Level of Service: WB Novato Blvd #2

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| 7th St | 13 | 29.0 | 65.1 | 0.4 | 21 |
| Grant Ave | 12 | 6.0 | 38.4 | 0.3 | 26 |
| Simmons Ln | 11 | 18.3 | 55.5 | 0.4 | 27 |
| Wilson Ave | 10 | 7.6 | 14.2 | 0.1 | 16 |
| Raposa Vista | 138 | 14.5 | 27.8 | 0.1 | 17 |
| | 139 | 4.3 | 21.4 | 0.2 | 28 |
| Eucalyptus | 136 | 11.9 | 50.1 | 0.4 | 30 |
| Total | | 91.7 | 272.4 | 1.9 | 25 |





## Arterial Level of Service: NB Novato Blvd #3

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| Redwood Blvd | 30 | 15.5 | 31.6 | 0.2 | 19 |
| | 114 | 5.1 | 74.0 | 0.5 | 26 |
| Sunset Parkway | 29 | 11.7 | 40.3 | 0.3 | 29 |
| Rowland Boulevard | 23 | 60.9 | 82.6 | 0.3 | 12 |
| Arthur Street | 22 | 9.9 | 41.7 | 0.3 | 29 |
| Garden Ct | 21 | 7.2 | 45.6 | 0.4 | 35 |
| Diablo Ave | 14 | 80.1 | 112.3 | 0.4 | 12 |
| Total | | 190.4 | 428.0 | 2.4 | 20 |

## Arterial Level of Service: SB Novato Blvd #3

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| Center Rd | 21 | 12.5 | 46.3 | 0.4 | 28 |
| Arthur Street | 22 | 12.4 | 52.3 | 0.4 | 31 |
| | 23 | 13.1 | 44.9 | 0.3 | 27 |
| Sunset Parkway | 29 | 15.3 | 38.7 | 0.3 | 25 |
| | 114 | 3.3 | 35.4 | 0.3 | 33 |
| Redwood Blvd | 30 | 14.7 | 65.1 | 0.5 | 29 |
| Total | | 71.4 | 282.7 | 2.3 | 29 |

## Arterial Level of Service: NB #3

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| Nave Dr | 33 | 30.9 | 40.9 | 0.1 | 11 |
| Commercial Blvd | 34 | 13.7 | 27.1 | 0.1 | 20 |
| Digital Dr | 35 | 18.3 | 29.6 | 0.1 | 16 |
| Total | | 62.9 | 97.7 | 0.4 | 15 |

## Arterial Level of Service: WB #3

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| Hamilton Dr | 35 | 16.7 | 28.6 | 0.1 | 17 |
| Commercial Blvd | 34 | 28.4 | 38.8 | 0.1 | 12 |
| US 101 NB On Ramp | 33 | 30.5 | 41.9 | 0.1 | 13 |
| Enfrente Rd | 32 | 17.4 | 30.2 | 0.1 | 15 |
| Total | | 93.0 | 139.4 | 0.5 | 14 |

## Arterial Level of Service: EB Novato Blvd #2

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| | 139 | 4.3 | 46.4 | 0.4 | 33 |
| Raposa Vista | 138 | 13.1 | 28.3 | 0.2 | 21 |
| Wilson Ave | 10 | 19.6 | 32.1 | 0.1 | 15 |
| Simmons Ln | 11 | 6.2 | 12.9 | 0.1 | 18 |
| Grant Ave | 12 | 11.4 | 51.0 | 0.4 | 29 |
| Tamalpais Ave | 13 | 26.0 | 55.7 | 0.3 | 18 |
| | 200 | 4.3 | 37.8 | 0.3 | 28 |
| Diablo Ave | 14 | 21.8 | 31.9 | 0.1 | 10 |
| Center Rd | 21 | 15.5 | 50.1 | 0.4 | 26 |
| Total | | 122.3 | 346.1 | 2.2 | 23 |

## Arterial Level of Service: WB Novato Blvd #2

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| Diablo Ave | 14 | 41.4 | 70.6 | 0.4 | 19 |
| | 200 | 6.2 | 17.3 | 0.1 | 18 |
| 7th St | 13 | 42.7 | 75.0 | 0.3 | 14 |
| Grant Ave | 12 | 5.7 | 37.9 | 0.3 | 27 |
| Simmons Ln | 11 | 16.2 | 53.7 | 0.4 | 28 |
| Wilson Ave | 10 | 6.8 | 13.4 | 0.1 | 17 |
| Raposa Vista | 138 | 14.9 | 28.1 | 0.1 | 17 |
| | 139 | 4.1 | 21.1 | 0.2 | 29 |
| Eucalyptus | 136 | 11.6 | 49.8 | 0.4 | 31 |
| Total | | 149.5 | 366.9 | 2.2 | 22 |

## Arterial Level of Service: NB Novato Blvd #3

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| Redwood Blvd | 30 | 16.1 | 32.2 | 0.2 | 18 |
| | 114 | 5.7 | 73.0 | 0.5 | 26 |
| Sunset Parkway | 29 | 11.6 | 39.8 | 0.3 | 29 |
| Rowland Boulevard | 23 | 62.9 | 83.4 | 0.3 | 11 |
| Arthur Street | 22 | 10.9 | 42.3 | 0.3 | 28 |
| Garden Ct | 21 | 8.3 | 46.3 | 0.4 | 35 |
| Diablo Ave | 14 | 41.4 | 70.6 | 0.4 | 19 |
| Total | | 157.0 | 387.8 | 2.4 | 23 |





## Arterial Level of Service: SB Novato Blvd #3

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| Center Rd | 21 | 15.5 | 50.1 | 0.4 | 26 |
| Arthur Street | 22 | 13.3 | 53.2 | 0.4 | 30 |
| | 23 | 13.4 | 45.1 | 0.3 | 26 |
| Sunset Parkway | 29 | 19.7 | 43.4 | 0.3 | 22 |
| | 114 | 3.6 | 36.2 | 0.3 | 32 |
| Redwood Blvd | 30 | 16.0 | 65.1 | 0.5 | 29 |
| Total | | 81.6 | 293.1 | 2.3 | 28 |

## Arterial Level of Service: NB #3

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| Nave Dr | 33 | 34.0 | 44.1 | 0.1 | 10 |
| Commercial Blvd | 34 | 7.5 | 20.7 | 0.1 | 26 |
| Digital Dr | 35 | 8.5 | 19.8 | 0.1 | 24 |
| Total | | 50.0 | 84.5 | 0.4 | 17 |

## Arterial Level of Service: WB #3

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| Hamilton Dr | 35 | 14.8 | 26.4 | 0.1 | 19 |
| Commercial Blvd | 34 | 22.6 | 33.1 | 0.1 | 14 |
| US 101 NB On Ramp | 33 | 26.1 | 37.7 | 0.1 | 14 |
| Enfrente Rd | 32 | 18.3 | 31.3 | 0.1 | 15 |
| Total | | 81.8 | 128.4 | 0.5 | 15 |

# Freeway Level of Service Calculations

# HCS7 Freeway Facilities Report

## Project Information

| | | | |
|---|---|---|---|
| Analyst | W-Trans | Agency | |
| Jurisdiction | City of Novato | Time Period Analyzed | AM Peak Hour - Northbound |
| Analysis Year | 2016 | Date | 4/18/2017 |
| Project Description | City of Novato General Plan Update EIR | | |

## Facility Global Input

| | | | |
|---|---|---|---|
| Jam Density, pc/mi/ln | 190.0 | Density at Capacity, pc/mi/ln | 45.0 |
| Queue Discharge Capacity Drop, % | 7 | Total Segments | 24 |
| Total Time Periods | 1 | Time Period Duration, min | 15 |

## Segment Geometric Data

| No. | Coded | Analyzed | Name | Length, ft | Lanes |
|---|---|---|---|---|---|
| 1 | Basic | Basic | Novato S City Limits->Alameda del Prado | 2000 | 5 |
| 2 | Diverge | Basic | Alameda del Prado Off-> | 1500 | 5 |
| 3 | Basic | Basic | Alameda del Prado Off->Alameda del Prado On | 2000 | 4 |
| 4 | Merge | Merge | Alameda del Prado On-> | 1000 | 4 |
| 5 | Basic | Basic | Alameda del Prado On->Nave Off | 2600 | 4 |
| 6 | Diverge | Diverge | Nave Off-> | 1000 | 4 |
| 7 | Basic | Basic | Nave Off->Nave On | 2000 | 4 |
| 8 | Merge | Basic | Nave On-> | 500 | 5 |
| 9 | Merge | Merge | Ignacio On-> | 1500 | 5 |
| 10 | Diverge | Basic | SR37 Off-> | 1500 | 5 |
| 11 | Diverge | Diverge | Novato Blvd Off-> | 1500 | 4 |
| 12 | Basic | Basic | Novato Blvd Off->SR 37 On | 2650 | 4 |
| 13 | Weaving | Weaving | SR37->Rowland Blvd | 2050 | 5 |
| 14 | Basic | Basic | Rowland Blvd Off->Rowland Blvd On | 2900 | 4 |
| 15 | Merge | Merge | Rowland Blvd On-> | 1200 | 4 |
| 16 | Diverge | Diverge | De Long Off-> | 1200 | 4 |
| 17 | Basic | Basic | De Long Off->De Long On | 2000 | 4 |
| 18 | Merge | Merge | De Long Ave On-> | 1200 | 4 |
| 19 | Diverge | Diverge | Atherton Ave Off-> | 1200 | 4 |
| 20 | Basic | Basic | Atherton Ave Off->Atherton Ave On | 900 | 4 |
| 21 | Merge | Merge | Atherton Ave On-> | 1000 | 4 |
| 22 | Basic | Basic | Atherton On -> End HOV | 2300 | 3 |
| 23 | Basic | Basic | End HOV | 2000 | 2 |
| 24 | Basic | Basic | End HOV -> Begin 2 lane fwy | 2500 | 2 |

## Facility Segment Data

### Segment 1: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 4598 | 12000 | 0.38 | 75.4 | 12.2 | B |

### Segment 2: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 4598 | 363 | 12000 | 2000 | 0.38 | 0.18 | 75.4 | - | 12.2 | - | B |

### Segment 3: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 4237 | 9600 | 0.44 | 75.3 | 14.1 | B |

### Segment 4: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 4311 | 74 | 9600 | 2000 | 0.45 | 0.04 | 69.1 | 64.7 | 15.6 | 17.1 | B |

### Segment 5: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 4310 | 9600 | 0.45 | 75.3 | 14.3 | B |

### Segment 6: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 1.00 | 0.957 | 1.000 | 4310 | 810 | 9600 | 2000 | 0.45 | 0.40 | 67.7 | 58.7 | 15.9 | 22.5 | C |

### Segment 7: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 3464 | 9600 | 0.36 | 75.4 | 11.5 | B |

### Segment 8: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 3659 | 195 | 12000 | 2000 | 0.29 | 0.10 | 75.4 | - | 9.7 | - | A |

### Segment 9: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 4241 | 584 | 12000 | 2000 | 0.35 | 0.29 | 69.3 | 64.4 | 9.9 | 17.5 | B |

## Segment 10: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 4237 | 926 | 12000 | 4200 | 0.35 | 0.22 | 75.4 | - | 11.2 | - | B |

## Segment 11: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 3318 | 179 | 9600 | 2000 | 0.35 | 0.09 | 70.7 | 60.6 | 11.7 | 17.6 | B |

## Segment 12: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 3140 | 9600 | 0.33 | 75.4 | 10.4 | A |

## Segment 13: Weaving

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 3737 | 6630 | 0.57 | 65.9 | 11.4 | B |

## Segment 14: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 2931 | 9600 | 0.31 | 75.4 | 9.7 | A |

## Segment 15: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 3257 | 326 | 9600 | 2000 | 0.34 | 0.16 | 70.3 | 66.4 | 11.6 | 10.8 | B |

## Segment 16: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 3255 | 726 | 9600 | 2000 | 0.34 | 0.36 | 67.4 | 58.9 | 12.1 | 15.9 | B |

## Segment 17: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 2534 | 9600 | 0.26 | 75.4 | 8.4 | A |

## Segment 18: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 2713 | 179 | 9600 | 2000 | 0.28 | 0.09 | 70.8 | 66.6 | 9.6 | 8.5 | A |

## Segment 19: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 0.990 | 2712 | 590 | 9600 | 2000 | 0.28 | 0.30 | 67.8 | 59.3 | 10.0 | 13.2 | B |

## Segment 20: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 2132 | 9600 | 0.22 | 75.4 | 7.1 | A |

## Segment 21: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 2574 | 442 | 9014 | 1878 | 0.29 | 0.24 | 66.3 | 64.3 | 9.7 | 10.0 | A |

## Segment 22: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.94 | 1.000 | 2617 | 7200 | 0.36 | 71.7 | 12.2 | B |

## Segment 23: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 2571 | 4472 | 0.57 | 67.7 | 19.0 | C |

## Segment 24: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 2571 | 3628 | 0.71 | 51.8 | 24.8 | C |

## Facility Time Period Results

| T | Speed, mi/h | Density, pc/mi/ln | Density, veh/mi/ln | Travel Time, min | LOS |
|---|---|---|---|---|---|
| 1 | 71.1 | 12.0 | 11.6 | 6.4 | B |

## Facility Overall Results

| | | | |
|---|---|---|---|
| Space Mean Speed, mi/h | 71.1 | Density, veh/mi/ln | 11.6 |
| Average Travel Time, min | 6.4 | | |

# HCS7 Freeway Facilities Report

## Project Information

| | | | |
|---|---|---|---|
| Analyst | W-Trans | Agency | |
| Jurisdiction | City of Novato | Time Period Analyzed | AM Peak Hour - Southbound |
| Analysis Year | 2016 | Date | 4/21/2017 |
| Project Description | City of Novato General Plan EIR | | |

## Facility Global Input

| | | | |
|---|---|---|---|
| Jam Density, pc/mi/ln | 190.0 | Density at Capacity, pc/mi/ln | 45.0 |
| Queue Discharge Capacity Drop, % | 7 | Total Segments | 24 |
| Total Time Periods | 1 | Time Period Duration, min | 15 |

## Segment Geometric Data

| No. | Coded | Analyzed | Name | Length, ft | Lanes |
|---|---|---|---|---|---|
| 1 | Basic | Basic | N Novato City Limits->San Marin Dr | 3200 | 3 |
| 2 | Diverge | Diverge | San Marin Dr Off-> | 1500 | 3 |
| 3 | Basic | Basic | San Marin Dr Off->San Marin Dr On | 2100 | 3 |
| 4 | Merge | Merge | San Marin Dr On-> | 1175 | 3 |
| 5 | Diverge | Diverge | De Long Ave Off-> | 1175 | 3 |
| 6 | Basic | Basic | De Long Ave Off->De Long Ave On | 1975 | 3 |
| 7 | Merge | Merge | De Long Ave On-> | 1170 | 3 |
| 8 | Diverge | Diverge | BEGIN HOV | 200 | 3 |
| 9 | Diverge | Diverge | Rowland Blvd Off-> | 1170 | 3 |
| 10 | Basic | Basic | Rowland Blvd Off->Rowland Blvd On | 3150 | 3 |
| 11 | Merge | Merge | Rowland Blvd On-> | 1200 | 3 |
| 12 | Basic | Basic | Rowland Blvd->SR37-Novato Blvd | 770 | 3 |
| 13 | Diverge | Diverge | SR37-Novato Blvd Off-> | 1200 | 3 |
| 14 | Basic | Basic | SR37-Novato Blvd Off->SR37-Novato Blvd On | 3400 | 3 |
| 15 | Merge | Basic | SR37-Novato Blvd On-> | 1030 | 4 |
| 16 | Diverge | Diverge | Ignacio-Enfrente Off-> | 1000 | 4 |
| 17 | Diverge | Basic | BMK-Nave Off-> | 800 | 4 |
| 18 | Basic | Basic | Ignacio Blvd Off->Ignacio Blvd On | 1425 | 3 |
| 19 | Merge | Merge | Ignacio Blvd On-> | 1500 | 3 |
| 20 | Basic | Basic | Ignacio Blvd->Alameda Del Prado | 2250 | 3 |
| 21 | Diverge | Diverge | ADP Off-> | 1500 | 3 |
| 22 | Basic | Basic | ADP Off->ADP On | 1200 | 3 |
| 23 | Merge | Basic | ADP On-> | 1500 | 3 |
| 24 | Basic | Basic | Alameda Del Prado->S Novato City Limits | 1000 | 4 |

## Facility Segment Data

### Segment 1: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.957 | 6664 | 7200 | 0.93 | 58.6 | 37.9 | E |

### Segment 2: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.957 | 0.980 | 6664 | 575 | 7200 | 2000 | 0.93 | 0.29 | 66.6 | 61.5 | 33.4 | 37.5 | E |

### Segment 3: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.954 | 6089 | 7200 | 0.85 | 63.4 | 32.0 | D |

### Segment 4: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.960 | 0.980 | 6605 | 516 | 7200 | 2100 | 0.92 | 0.25 | 61.2 | 57.8 | 36.0 | 35.3 | E |

### Segment 5: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.960 | 0.980 | 6605 | 333 | 7200 | 2000 | 0.91 | 0.17 | 67.2 | 62.3 | 32.8 | 36.6 | E |

### Segment 6: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.958 | 6272 | 7200 | 0.87 | 61.9 | 33.8 | D |

### Segment 7: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.963 | 0.980 | 6798 | 526 | 7200 | 2000 | 0.94 | 0.26 | 60.3 | 56.8 | 37.6 | 36.2 | E |

### Segment 8: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 1.00 | 0.963 | 0.990 | 6798 | 1091 | 7200 | 2200 | 0.94 | 0.50 | 69.9 | 66.5 | 32.4 | 41.9 | E |

### Segment 9: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.95 | 0.963 | 0.980 | 5707 | 784 | 7200 | 2000 | 0.78 | 0.39 | 66.3 | 60.9 | 28.7 | 34.7 | D |

## Segment 10: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.960 | 4923 | 7200 | 0.67 | 70.6 | 23.2 | C |

## Segment 11: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.966 | 0.980 | 5406 | 483 | 7200 | 2000 | 0.74 | 0.24 | 64.6 | 61.7 | 27.9 | 29.7 | D |

## Segment 12: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.966 | 5406 | 7200 | 0.74 | 68.0 | 26.5 | D |

## Segment 13: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.966 | 0.962 | 5406 | 274 | 7200 | 2100 | 0.74 | 0.13 | 69.2 | 64.6 | 26.0 | 32.7 | D |

## Segment 14: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.967 | 5054 | 7200 | 0.70 | 70.0 | 24.1 | C |

## Segment 15: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.966 | 0.962 | 7647 | 2779 | 9600 | 4000 | 0.52 | 0.69 | 60.3 | - | 31.7 | - | D |

## Segment 16: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.966 | 0.980 | 7460 | 639 | 9600 | 2000 | 0.80 | 0.32 | 40.7 | 61.3 | 45.8 | 31.8 | F |

## Segment 17: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.964 | 0.980 | 6644 | 763 | 9600 | 2000 | 0.74 | 0.38 | 28.7 | - | 57.9 | - | F |

## Segment 18: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.962 | 5720 | 7200 | 0.88 | 30.2 | 63.0 | F |

## Segment 19: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.965 | 0.980 | 6262 | 650 | 7200 | 2000 | 0.97 | 0.32 | 34.2 | 55.2 | 61.0 | 37.4 | F |

## Segment 20: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.965 | 6112 | 7200 | 0.97 | 31.5 | 64.7 | F |

## Segment 21: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.932 | 0.980 | 5992 | 134 | 7200 | 2000 | 1.00 | 0.07 | 29.7 | 62.9 | 67.2 | 39.2 | F |

## Segment 22: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.931 | 5775 | 7200 | 0.99 | 26.4 | 72.9 | F |

## Segment 23: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.934 | 0.980 | 6704 | 929 | 7200 | 2000 | 0.98 | 0.46 | 60.4 | - | 37.0 | - | F |

## Segment 24: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.934 | 6704 | 9600 | 0.84 | 70.1 | 23.9 | C |

## Facility Time Period Results

| T | Speed, mi/h | Density, pc/mi/ln | Density, veh/mi/ln | Travel Time, min | LOS |
|---|---|---|---|---|---|
| 1 | 49.2 | 39.1 | 37.4 | 8.5 | F |

## Facility Overall Results

| | | | |
|---|---|---|---|
| Space Mean Speed, mi/h | 49.2 | Density, veh/mi/ln | 37.4 |
| Average Travel Time, min | 8.5 | | |

# HCS7 Freeway Facilities Report

## Project Information

| | | | |
|---|---|---|---|
| Analyst | W-Trans | Agency | |
| Jurisdiction | City of Novato | Time Period Analyzed | PM Peak Hour - Northbound |
| Analysis Year | 2016 | Date | 4/18/2017 |
| Project Description | City of Novato General Plan Update EIR | | |

## Facility Global Input

| | | | |
|---|---|---|---|
| Jam Density, pc/mi/ln | 190.0 | Density at Capacity, pc/mi/ln | 45.0 |
| Queue Discharge Capacity Drop, % | 7 | Total Segments | 23 |
| Total Time Periods | 1 | Time Period Duration, min | 15 |

## Segment Geometric Data

| No. | Coded | Analyzed | Name | Length, ft | Lanes |
|---|---|---|---|---|---|
| 1 | Basic | Basic | Novato S City Limits->Alameda del Prado | 2000 | 4 |
| 2 | Diverge | Basic | Alameda del Prado Off-> | 1500 | 4 |
| 3 | Basic | Basic | Alameda del Prado Off->Alameda del Prado On | 2000 | 3 |
| 4 | Merge | Merge | Alameda del Prado On-> | 1000 | 3 |
| 5 | Basic | Basic | Alameda del Prado On->Nave Off | 2600 | 3 |
| 6 | Diverge | Diverge | Nave Off-> | 1000 | 3 |
| 7 | Basic | Basic | Nave Off->Nave On | 2000 | 3 |
| 8 | Merge | Basic | Nave On-> | 500 | 4 |
| 9 | Merge | Merge | Ignacio On-> | 1500 | 4 |
| 10 | Diverge | Basic | SR37 Off-> | 1500 | 4 |
| 11 | Diverge | Diverge | Novato Blvd Off-> | 1500 | 3 |
| 12 | Basic | Basic | Novato Blvd Off->SR 37 On | 2650 | 3 |
| 13 | Weaving | Weaving | SR37->Rowland Blvd | 2050 | 4 |
| 14 | Basic | Basic | Rowland Blvd Off->Rowland Blvd On | 2900 | 3 |
| 15 | Merge | Merge | Rowland Blvd On-> | 1200 | 3 |
| 16 | Diverge | Diverge | De Long Off-> | 1200 | 3 |
| 17 | Basic | Basic | De Long Off->De Long On | 2000 | 3 |
| 18 | Merge | Merge | De Long Ave On-> | 1200 | 3 |
| 19 | Diverge | Diverge | Atherton Ave Off-> | 1200 | 3 |
| 20 | Basic | Basic | Atherton Ave Off->Atherton Ave On | 900 | 3 |
| 21 | Merge | Merge | Atherton Ave On-> | 1000 | 3 |
| 22 | Merge | Merge | End HOV | 1000 | 3 |
| 23 | Basic | Basic | End HOV -> Begin 2 lane fwy | 5100 | 2 |

## Facility Segment Data

### Segment 1: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 7638 | 9600 | 0.80 | 66.0 | 28.9 | D |

### Segment 2: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 7638 | 874 | 9600 | 2000 | 0.80 | 0.44 | 67.3 | - | 28.4 | - | D |

### Segment 3: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 6764 | 7200 | 0.94 | 57.6 | 39.1 | E |

### Segment 4: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 6964 | 200 | 7200 | 2000 | 0.97 | 0.10 | 59.8 | 56.2 | 38.8 | 36.5 | E |

### Segment 5: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 6964 | 7200 | 0.97 | 55.7 | 41.7 | E |

### Segment 6: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 1.00 | 0.957 | 1.000 | 6964 | 885 | 7200 | 2000 | 0.97 | 0.44 | 64.2 | 58.4 | 36.2 | 39.1 | E |

### Segment 7: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 6079 | 7200 | 0.84 | 63.4 | 31.9 | D |

### Segment 8: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 6326 | 247 | 9600 | 2000 | 0.63 | 0.12 | 67.6 | - | 23.4 | - | C |

### Segment 9: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 7421 | 1095 | 9600 | 2000 | 0.77 | 0.55 | 65.1 | 60.3 | 28.5 | 32.1 | D |

### Segment 10: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 7421 | 2453 | 9600 | 4200 | 0.77 | 0.58 | 67.0 | - | 27.7 | - | D |

### Segment 11: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 4968 | 384 | 7200 | 2000 | 0.69 | 0.19 | 65.7 | 59.9 | 25.2 | 31.9 | D |

### Segment 12: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 4584 | 7200 | 0.63 | 72.1 | 21.2 | C |

### Segment 13: Weaving

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 5477 | 5568 | 1.00 | 61.9 | 22.5 | C |

### Segment 14: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 4004 | 7200 | 0.55 | 74.0 | 18.0 | C |

### Segment 15: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 4525 | 521 | 7200 | 2000 | 0.63 | 0.26 | 66.8 | 64.5 | 22.6 | 22.0 | C |

### Segment 16: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 4525 | 1568 | 7200 | 2000 | 0.62 | 0.78 | 61.7 | 56.4 | 24.4 | 28.3 | D |

### Segment 17: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 2957 | 7200 | 0.41 | 74.4 | 13.1 | B |

### Segment 18: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 3257 | 300 | 7200 | 2000 | 0.45 | 0.15 | 68.3 | 65.9 | 15.9 | 15.5 | B |

### Segment 19: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 0.990 | 3257 | 946 | 7200 | 2000 | 0.45 | 0.47 | 63.1 | 58.3 | 17.2 | 21.0 | C |

### Segment 20: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 2286 | 7200 | 0.32 | 73.2 | 10.1 | A |

### Segment 21: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 2816 | 800 | 6761 | 1878 | 0.46 | 0.43 | 18.1 | 64.0 | 52.0 | 13.2 | F |

### Segment 22: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 3049 | 474 | 6761 | 1878 | 0.53 | 0.25 | 10.0 | 62.2 | 101.2 | 20.3 | F |

### Segment 23: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 3049 | 3274 | 1.09 | 55.6 | 21.1 | F |

### Facility Time Period Results

| T | Speed, mi/h | Density, pc/mi/ln | Density, veh/mi/ln | Travel Time, min | LOS |
|---|---|---|---|---|---|
| 1 | 55.6 | 28.2 | 27.0 | 8.1 | F |

### Facility Overall Results

| | | | |
|---|---|---|---|
| Space Mean Speed, mi/h | 55.6 | Density, veh/mi/ln | 27.0 |
| Average Travel Time, min | 8.1 | | |

# HCS7 Freeway Facilities Report

## Project Information

| | | | |
|---|---|---|---|
| Analyst | W-Trans | Agency | |
| Jurisdiction | City of Novato | Time Period Analyzed | PM Peak Hour - Southbound |
| Analysis Year | 2016 | Date | 4/21/2017 |
| Project Description | | | |

## Facility Global Input

| | | | |
|---|---|---|---|
| Jam Density, pc/mi/ln | 190.0 | Density at Capacity, pc/mi/ln | 45.0 |
| Queue Discharge Capacity Drop, % | 7 | Total Segments | 24 |
| Total Time Periods | 1 | Time Period Duration, min | 15 |

## Segment Geometric Data

| No. | Coded | Analyzed | Name | Length, ft | Lanes |
|---|---|---|---|---|---|
| 1 | Basic | Basic | N Novato City Limits->San Marin Dr | 3200 | 3 |
| 2 | Diverge | Diverge | San Marin Dr Off-> | 1500 | 3 |
| 3 | Basic | Basic | San Marin Dr Off->San Marin Dr On | 2100 | 3 |
| 4 | Merge | Merge | San Marin Dr On-> | 1175 | 3 |
| 5 | Diverge | Diverge | De Long Ave Off-> | 1175 | 3 |
| 6 | Basic | Basic | De Long Ave Off->De Long Ave On | 1975 | 3 |
| 7 | Merge | Basic | De Long Ave On-> | 1170 | 3 |
| 8 | Diverge | Diverge | BEGIN HOV | 200 | 4 |
| 9 | Diverge | Diverge | Rowland Blvd Off-> | 1170 | 4 |
| 10 | Basic | Basic | Rowland Blvd Off->Rowland Blvd On | 3150 | 4 |
| 11 | Merge | Merge | Rowland Blvd On-> | 1200 | 4 |
| 12 | Basic | Basic | Rowland Blvd->SR37-Novato Blvd | 770 | 4 |
| 13 | Diverge | Diverge | SR37-Novato Blvd Off-> | 1200 | 4 |
| 14 | Basic | Basic | SR37-Novato Blvd Off->SR37-Novato Blvd On | 3400 | 4 |
| 15 | Merge | Basic | SR37-Novato Blvd On-> | 1030 | 5 |
| 16 | Diverge | Diverge | Ignacio-Enfrente Off-> | 1000 | 5 |
| 17 | Diverge | Basic | BMK-Nave Off-> | 800 | 5 |
| 18 | Basic | Basic | Ignacio Blvd Off->Ignacio Blvd On | 1425 | 4 |
| 19 | Merge | Merge | Ignacio Blvd On-> | 1500 | 4 |
| 20 | Basic | Basic | Ignacio Blvd->Alameda Del Prado | 2250 | 4 |
| 21 | Diverge | Diverge | ADP Off-> | 1500 | 4 |
| 22 | Basic | Basic | ADP Off->ADP On | 1200 | 4 |
| 23 | Merge | Merge | ADP On-> | 1500 | 4 |
| 24 | Basic | Basic | Alameda Del Prado->S Novato City Limits | 1000 | 4 |

## Facility Segment Data

### Segment 1: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.957 | 3455 | 7200 | 0.48 | 75.1 | 15.3 | B |

### Segment 2: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.957 | 0.980 | 3455 | 338 | 7200 | 2000 | 0.48 | 0.17 | 64.2 | 58.4 | 17.9 | 23.4 | C |

### Segment 3: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.954 | 3129 | 7200 | 0.43 | 75.4 | 13.8 | B |

### Segment 4: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.960 | 0.980 | 3861 | 752 | 7200 | 2000 | 0.54 | 0.38 | 66.5 | 63.8 | 19.4 | 23.4 | C |

### Segment 5: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.960 | 0.980 | 3853 | 199 | 7200 | 2000 | 0.54 | 0.10 | 67.9 | 62.7 | 18.9 | 24.7 | C |

### Segment 6: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.958 | 3664 | 7200 | 0.51 | 74.8 | 16.3 | B |

### Segment 7: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.963 | 0.980 | 4537 | 892 | 7200 | 2000 | 0.51 | 0.45 | 72.3 | - | 20.9 | - | C |

### Segment 8: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 1.00 | 0.963 | 0.990 | 4525 | 0 | 9600 | 2200 | 0.47 | 0.00 | 75.7 | 69.8 | 14.9 | 22.9 | C |

### Segment 9: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.95 | 0.963 | 0.980 | 4525 | 419 | 9600 | 2000 | 0.47 | 0.21 | 70.9 | 62.0 | 16.0 | 22.3 | C |

## Segment 10: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.960 | 4124 | 9600 | 0.43 | 75.4 | 13.7 | B |

## Segment 11: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.966 | 0.980 | 5329 | 1230 | 9600 | 2000 | 0.56 | 0.62 | 67.3 | 63.2 | 19.8 | 25.5 | C |

## Segment 12: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.966 | 5308 | 9600 | 0.55 | 74.1 | 17.9 | B |

## Segment 13: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.966 | 0.962 | 5308 | 596 | 9600 | 2100 | 0.55 | 0.28 | 71.4 | 63.6 | 18.6 | 26.1 | C |

## Segment 14: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.967 | 4727 | 9600 | 0.49 | 75.0 | 15.8 | B |

## Segment 15: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.966 | 0.962 | 6127 | 1395 | 12000 | 4000 | 0.39 | 0.35 | 74.8 | - | 16.4 | - | B |

## Segment 16: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.966 | 0.980 | 6079 | 591 | 12000 | 2000 | 0.51 | 0.30 | 70.5 | 61.5 | 14.7 | 22.0 | C |

## Segment 17: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.964 | 0.980 | 5510 | 542 | 12000 | 2000 | 0.46 | 0.27 | 75.2 | - | 14.7 | - | B |

## Segment 18: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.962 | 4985 | 9600 | 0.52 | 74.6 | 16.7 | B |

## Segment 19: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.965 | 0.980 | 5921 | 951 | 9600 | 2000 | 0.62 | 0.48 | 67.1 | 63.0 | 22.1 | 26.2 | C |

## Segment 20: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.965 | 5906 | 9600 | 0.62 | 72.7 | 20.3 | C |

## Segment 21: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.932 | 0.980 | 6115 | 247 | 9600 | 2000 | 0.64 | 0.12 | 71.0 | 62.5 | 21.5 | 24.3 | C |

## Segment 22: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.931 | 5869 | 9600 | 0.61 | 72.8 | 20.2 | C |

## Segment 23: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.934 | 0.980 | 6473 | 623 | 9600 | 2000 | 0.67 | 0.31 | 68.7 | 66.2 | 23.6 | 19.0 | B |

## Segment 24: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.934 | 6484 | 9600 | 0.68 | 70.9 | 22.9 | C |

## Facility Time Period Results

| T | Speed, mi/h | Density, pc/mi/ln | Density, veh/mi/ln | Travel Time, min | LOS |
|---|---|---|---|---|---|
| 1 | 72.0 | 17.7 | 16.9 | 5.8 | B |

## Facility Overall Results

| | | | |
|---|---|---|---|
| Space Mean Speed, mi/h | 72.0 | Density, veh/mi/ln | 16.9 |
| Average Travel Time, min | 5.8 | | |

# HCS7 Freeway Facilities Report

## Project Information

| | | | |
|---|---|---|---|
| Analyst | W-Trans | Agency | |
| Jurisdiction | City of Novato | Time Period Analyzed | AM Peak Existing+Project - Northbound |
| Analysis Year | 2016 | Date | 6/8/17 |
| Project Description | City of Novato General Plan Update EIR | | |

## Facility Global Input

| | | | |
|---|---|---|---|
| Jam Density, pc/mi/ln | 190.0 | Density at Capacity, pc/mi/ln | 45.0 |
| Queue Discharge Capacity Drop, % | 7 | Total Segments | 24 |
| Total Time Periods | 1 | Time Period Duration, min | 15 |

## Segment Geometric Data

| No. | Coded | Analyzed | Name | Length, ft | Lanes |
|---|---|---|---|---|---|
| 1 | Basic | Basic | Novato S City Limits->Alameda del Prado | 2000 | 5 |
| 2 | Diverge | Basic | Alameda del Prado Off-> | 1500 | 5 |
| 3 | Basic | Basic | Alameda del Prado Off->Alameda del Prado On | 2000 | 4 |
| 4 | Merge | Merge | Alameda del Prado On-> | 1000 | 4 |
| 5 | Basic | Basic | Alameda del Prado On->Nave Off | 2600 | 4 |
| 6 | Diverge | Diverge | Nave Off-> | 1000 | 4 |
| 7 | Basic | Basic | Nave Off->Nave On | 2000 | 4 |
| 8 | Merge | Basic | Nave On-> | 500 | 5 |
| 9 | Merge | Merge | Ignacio On-> | 1500 | 5 |
| 10 | Diverge | Basic | SR37 Off-> | 1500 | 5 |
| 11 | Diverge | Diverge | Novato Blvd Off-> | 1500 | 4 |
| 12 | Basic | Basic | Novato Blvd Off->SR 37 On | 2650 | 4 |
| 13 | Weaving | Weaving | SR37->Rowland Blvd | 2050 | 5 |
| 14 | Basic | Basic | Rowland Blvd Off->Rowland Blvd On | 2900 | 4 |
| 15 | Merge | Merge | Rowland Blvd On-> | 1200 | 4 |
| 16 | Diverge | Diverge | De Long Off-> | 1200 | 4 |
| 17 | Basic | Basic | De Long Off->De Long On | 2000 | 4 |
| 18 | Merge | Merge | De Long Ave On-> | 1200 | 4 |
| 19 | Diverge | Diverge | Atherton Ave Off-> | 1200 | 4 |
| 20 | Basic | Basic | Atherton Ave Off->Atherton Ave On | 900 | 4 |
| 21 | Merge | Merge | Atherton Ave On-> | 1000 | 4 |
| 22 | Basic | Basic | Atherton On -> End HOV | 2300 | 3 |
| 23 | Basic | Basic | End HOV | 2000 | 2 |
| 24 | Basic | Basic | End HOV -> Begin 2 lane fwy | 2500 | 2 |

## Facility Segment Data

### Segment 1: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 5068 | 12000 | 0.42 | 75.4 | 13.4 | B |

### Segment 2: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 5068 | 374 | 12000 | 2000 | 0.42 | 0.19 | 75.4 | - | 13.4 | - | B |

### Segment 3: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 4697 | 9600 | 0.49 | 75.0 | 15.7 | B |

### Segment 4: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 4814 | 117 | 9600 | 2000 | 0.50 | 0.06 | 68.7 | 64.5 | 17.5 | 18.9 | B |

### Segment 5: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 4813 | 9600 | 0.50 | 74.9 | 16.1 | B |

### Segment 6: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 1.00 | 0.957 | 1.000 | 4813 | 949 | 9600 | 2000 | 0.50 | 0.47 | 67.2 | 58.3 | 17.9 | 25.1 | C |

### Segment 7: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 3821 | 9600 | 0.40 | 75.4 | 12.7 | B |

### Segment 8: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 4019 | 198 | 12000 | 2000 | 0.32 | 0.10 | 75.4 | - | 10.7 | - | A |

### Segment 9: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 4811 | 793 | 12000 | 2000 | 0.40 | 0.40 | 68.9 | 64.1 | 11.4 | 19.9 | B |

### Segment 10: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 4805 | 952 | 12000 | 4200 | 0.40 | 0.23 | 75.4 | - | 12.7 | - | B |

### Segment 11: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 3860 | 183 | 9600 | 2000 | 0.40 | 0.09 | 70.7 | 60.6 | 13.6 | 19.6 | B |

### Segment 12: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 3678 | 9600 | 0.38 | 75.4 | 12.2 | B |

### Segment 13: Weaving

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 4326 | 6576 | 0.66 | 65.1 | 13.4 | B |

### Segment 14: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 3344 | 9600 | 0.35 | 75.4 | 11.1 | B |

### Segment 15: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 3753 | 409 | 9600 | 2000 | 0.39 | 0.20 | 70.0 | 66.3 | 13.4 | 12.7 | B |

### Segment 16: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 3750 | 845 | 9600 | 2000 | 0.39 | 0.42 | 67.1 | 58.6 | 14.0 | 18.4 | B |

### Segment 17: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 2911 | 9600 | 0.30 | 75.4 | 9.7 | A |

### Segment 18: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 3096 | 185 | 9600 | 2000 | 0.32 | 0.09 | 70.6 | 66.5 | 11.0 | 9.7 | A |

### Segment 19: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 0.990 | 3095 | 876 | 9600 | 2000 | 0.32 | 0.44 | 66.4 | 58.5 | 11.7 | 16.1 | B |

### Segment 20: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 2234 | 9600 | 0.23 | 75.4 | 7.4 | A |

### Segment 21: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 2723 | 489 | 9014 | 1878 | 0.30 | 0.26 | 66.3 | 64.3 | 10.3 | 10.8 | B |

### Segment 22: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.94 | 1.000 | 2769 | 7200 | 0.38 | 71.7 | 12.9 | B |

### Segment 23: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 2720 | 4472 | 0.61 | 67.3 | 20.2 | C |

### Segment 24: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 2720 | 3628 | 0.75 | 51.0 | 26.7 | D |

### Facility Time Period Results

| T | Speed, mi/h | Density, pc/mi/ln | Density, veh/mi/ln | Travel Time, min | LOS |
|---|---|---|---|---|---|
| 1 | 70.9 | 13.5 | 13.0 | 6.4 | B |

### Facility Overall Results

| | | | |
|---|---|---|---|
| Space Mean Speed, mi/h | 70.9 | Density, veh/mi/ln | 13.0 |
| Average Travel Time, min | 6.4 | | |

# HCS7 Freeway Facilities Report

## Project Information

| | | | |
|---|---|---|---|
| Analyst | W-Trans | Agency | |
| Jurisdiction | City of Novato | Time Period Analyzed | AM Peak Existing + Project - Southbound |
| Analysis Year | 2016 | Date | 6/8/17 |
| Project Description | City of Novato General Plan EIR | | |

## Facility Global Input

| | | | |
|---|---|---|---|
| Jam Density, pc/mi/ln | 190.0 | Density at Capacity, pc/mi/ln | 45.0 |
| Queue Discharge Capacity Drop, % | 7 | Total Segments | 24 |
| Total Time Periods | 1 | Time Period Duration, min | 15 |

## Segment Geometric Data

| No. | Coded | Analyzed | Name | Length, ft | Lanes |
|---|---|---|---|---|---|
| 1 | Basic | Basic | N Novato City Limits->San Marin Dr | 3200 | 3 |
| 2 | Diverge | Diverge | San Marin Dr Off-> | 1500 | 3 |
| 3 | Basic | Basic | San Marin Dr Off->San Marin Dr On | 2100 | 3 |
| 4 | Merge | Merge | San Marin Dr On-> | 1175 | 3 |
| 5 | Diverge | Diverge | De Long Ave Off-> | 1175 | 3 |
| 6 | Basic | Basic | De Long Ave Off->De Long Ave On | 1975 | 3 |
| 7 | Merge | Merge | De Long Ave On-> | 1170 | 3 |
| 8 | Diverge | Diverge | BEGIN HOV | 200 | 3 |
| 9 | Diverge | Diverge | Rowland Blvd Off-> | 1170 | 3 |
| 10 | Basic | Basic | Rowland Blvd Off->Rowland Blvd On | 3150 | 3 |
| 11 | Merge | Merge | Rowland Blvd On-> | 1200 | 3 |
| 12 | Basic | Basic | Rowland Blvd->SR37-Novato Blvd | 770 | 3 |
| 13 | Diverge | Diverge | SR37-Novato Blvd Off-> | 1200 | 3 |
| 14 | Basic | Basic | SR37-Novato Blvd Off->SR37-Novato Blvd On | 3400 | 3 |
| 15 | Merge | Basic | SR37-Novato Blvd On-> | 1030 | 4 |
| 16 | Diverge | Diverge | Ignacio-Enfrente Off-> | 1000 | 4 |
| 17 | Diverge | Basic | BMK-Nave Off-> | 800 | 4 |
| 18 | Basic | Basic | Ignacio Blvd Off->Ignacio Blvd On | 1425 | 3 |
| 19 | Merge | Merge | Ignacio Blvd On-> | 1500 | 3 |
| 20 | Basic | Basic | Ignacio Blvd->Alameda Del Prado | 2250 | 3 |
| 21 | Diverge | Diverge | ADP Off-> | 1500 | 3 |
| 22 | Basic | Basic | ADP Off->ADP On | 1200 | 3 |
| 23 | Merge | Basic | ADP On-> | 1500 | 3 |
| 24 | Basic | Basic | Alameda Del Prado->S Novato City Limits | 1000 | 4 |

## Facility Segment Data

### Segment 1: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.957 | 6922 | 7200 | 0.97 | 56.1 | 41.1 | E |

### Segment 2: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.957 | 0.980 | 6828 | 723 | 7200 | 2000 | 0.97 | 0.36 | 66.3 | 61.1 | 34.3 | 38.4 | E |

### Segment 3: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.954 | 5899 | 7200 | 0.87 | 38.4 | 51.2 | F |

### Segment 4: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.960 | 0.980 | 6524 | 690 | 7200 | 2100 | 0.96 | 0.33 | 40.5 | 55.4 | 53.7 | 37.3 | F |

### Segment 5: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.960 | 0.980 | 6447 | 339 | 7200 | 2000 | 0.96 | 0.17 | 39.0 | 62.2 | 55.1 | 38.8 | F |

### Segment 6: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.958 | 5960 | 7200 | 0.92 | 30.0 | 66.3 | F |

### Segment 7: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.963 | 0.980 | 6704 | 744 | 7200 | 2000 | 1.02 | 0.37 | 60.2 | 56.5 | 37.1 | 36.4 | F |

### Segment 8: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 1.00 | 0.963 | 0.990 | 6704 | 1091 | 7200 | 2200 | 1.01 | 0.50 | 70.0 | 66.5 | 31.9 | 41.6 | F |

### Segment 9: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |

| 1 | 0.98 | 0.95 | 0.963 | 0.980 | 5613 | 857 | 7200 | 2000 | 0.86 | 0.43 | 66.1 | 60.7 | 28.3 | 34.4 | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

### Segment 10: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.960 | 4756 | 7200 | 0.74 | 71.4 | 22.2 | C |

### Segment 11: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.966 | 0.980 | 5417 | 661 | 7200 | 2000 | 0.83 | 0.33 | 64.3 | 61.4 | 28.1 | 30.3 | D |

### Segment 12: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.966 | 5417 | 7200 | 0.83 | 68.0 | 26.6 | D |

### Segment 13: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.966 | 0.962 | 5417 | 316 | 7200 | 2100 | 0.83 | 0.15 | 69.1 | 64.5 | 26.1 | 32.8 | D |

### Segment 14: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.967 | 5101 | 7200 | 0.78 | 69.8 | 24.4 | C |

### Segment 15: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.966 | 0.962 | 7988 | 2896 | 9600 | 4000 | 0.59 | 0.72 | 57.6 | - | 34.7 | - | D |

### Segment 16: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.966 | 0.980 | 7832 | 657 | 9600 | 2000 | 0.88 | 0.33 | 69.2 | 61.3 | 28.3 | 32.3 | D |

### Segment 17: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.964 | 0.980 | 7024 | 1232 | 9600 | 2000 | 0.81 | 0.62 | 36.5 | - | 48.1 | - | F |

### Segment 18: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.962 | 5640 | 7200 | 0.92 | 30.2 | 62.2 | F |

### Segment 19: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.965 | 0.980 | 6248 | 694 | 7200 | 2000 | 1.01 | 0.35 | 34.9 | 52.8 | 59.6 | 39.1 | F |

### Segment 20: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.965 | 6119 | 7200 | 1.01 | 32.5 | 62.7 | F |

### Segment 21: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.932 | 0.980 | 6032 | 215 | 7200 | 2000 | 1.05 | 0.11 | 30.3 | 62.6 | 66.4 | 41.7 | F |

### Segment 22: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.931 | 5736 | 7200 | 1.02 | 26.1 | 73.3 | F |

### Segment 23: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.934 | 0.980 | 6704 | 968 | 7200 | 2000 | 1.01 | 0.48 | 60.3 | - | 37.1 | - | F |

### Segment 24: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.934 | 6704 | 9600 | 0.86 | 70.1 | 23.9 | C |

## Facility Time Period Results

| T | Speed, mi/h | Density, pc/mi/ln | Density, veh/mi/ln | Travel Time, min | LOS |
|---|---|---|---|---|---|
| 1 | 45.8 | 42.3 | 40.5 | 9.1 | F |

## Facility Overall Results

| | | | |
|---|---|---|---|
| Space Mean Speed, mi/h | 45.8 | Density, veh/mi/ln | 40.5 |
| Average Travel Time, min | 9.1 | | |

# HCS7 Freeway Facilities Report

## Project Information

| | | | |
|---|---|---|---|
| Analyst | W-Trans | Agency | |
| Jurisdiction | City of Novato | Time Period Analyzed | PM Peak Existing + Project - Northbound |
| Analysis Year | 2016 | Date | 6/8/17 |
| Project Description | City of Novato General Plan Update EIR | | |

## Facility Global Input

| | | | |
|---|---|---|---|
| Jam Density, pc/mi/ln | 190.0 | Density at Capacity, pc/mi/ln | 45.0 |
| Queue Discharge Capacity Drop, % | 7 | Total Segments | 23 |
| Total Time Periods | 1 | Time Period Duration, min | 15 |

## Segment Geometric Data

| No. | Coded | Analyzed | Name | Length, ft | Lanes |
|---|---|---|---|---|---|
| 1 | Basic | Basic | Novato S City Limits->Alameda del Prado | 2000 | 4 |
| 2 | Diverge | Basic | Alameda del Prado Off-> | 1500 | 4 |
| 3 | Basic | Basic | Alameda del Prado Off->Alameda del Prado On | 2000 | 3 |
| 4 | Merge | Merge | Alameda del Prado On-> | 1000 | 3 |
| 5 | Basic | Basic | Alameda del Prado On->Nave Off | 2600 | 3 |
| 6 | Diverge | Diverge | Nave Off-> | 1000 | 3 |
| 7 | Basic | Basic | Nave Off->Nave On | 2000 | 3 |
| 8 | Merge | Basic | Nave On-> | 500 | 4 |
| 9 | Merge | Merge | Ignacio On-> | 1500 | 4 |
| 10 | Diverge | Basic | SR37 Off-> | 1500 | 4 |
| 11 | Diverge | Diverge | Novato Blvd Off-> | 1500 | 3 |
| 12 | Basic | Basic | Novato Blvd Off->SR 37 On | 2650 | 3 |
| 13 | Weaving | Weaving | SR37->Rowland Blvd | 2050 | 4 |
| 14 | Basic | Basic | Rowland Blvd Off->Rowland Blvd On | 2900 | 3 |
| 15 | Merge | Merge | Rowland Blvd On-> | 1200 | 3 |
| 16 | Diverge | Diverge | De Long Off-> | 1200 | 3 |
| 17 | Basic | Basic | De Long Off->De Long On | 2000 | 3 |
| 18 | Merge | Merge | De Long Ave On-> | 1200 | 3 |
| 19 | Diverge | Diverge | Atherton Ave Off-> | 1200 | 3 |
| 20 | Basic | Basic | Atherton Ave Off->Atherton Ave On | 900 | 3 |
| 21 | Merge | Merge | Atherton Ave On-> | 1000 | 3 |
| 22 | Merge | Merge | End HOV | 1000 | 3 |
| 23 | Basic | Basic | End HOV -> Begin 2 lane fwy | 5100 | 2 |

## Facility Segment Data

### Segment 1: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 7628 | 9600 | 0.83 | 39.6 | 48.2 | F |

### Segment 2: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 7409 | 929 | 9600 | 2000 | 0.83 | 0.46 | 28.2 | - | 65.6 | - | F |

### Segment 3: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 6397 | 7200 | 0.98 | 35.4 | 60.2 | F |

### Segment 4: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 6704 | 307 | 7200 | 2000 | 1.02 | 0.15 | 61.1 | 57.9 | 36.6 | 34.9 | F |

### Segment 5: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 6704 | 7200 | 1.02 | 58.2 | 38.4 | F |

### Segment 6: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 1.00 | 0.957 | 1.000 | 6704 | 953 | 7200 | 2000 | 1.02 | 0.48 | 64.1 | 58.2 | 34.9 | 37.8 | F |

### Segment 7: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 5751 | 7200 | 0.89 | 65.8 | 29.1 | D |

### Segment 8: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 6003 | 252 | 9600 | 2000 | 0.66 | 0.13 | 67.9 | - | 22.1 | - | C |

### Segment 9: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 7600 | 1597 | 9600 | 2000 | 0.86 | 0.80 | 63.4 | 58.0 | 30.0 | 34.7 | D |

### Segment 10: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 7600 | 2556 | 9600 | 4200 | 0.86 | 0.61 | 66.7 | - | 28.5 | - | D |

## Segment 11: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 5044 | 389 | 7200 | 2000 | 0.79 | 0.19 | 65.7 | 59.9 | 25.6 | 32.3 | D |

## Segment 12: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 4630 | 7200 | 0.74 | 72.0 | 21.4 | C |

## Segment 13: Weaving

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 4487 | 4819 | 1.12 | 26.8 | 45.0 | F |

## Segment 14: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 3617 | 7200 | 0.64 | 74.5 | 16.1 | B |

## Segment 15: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 4244 | 627 | 7200 | 2000 | 0.72 | 0.31 | 67.1 | 64.8 | 21.1 | 21.0 | C |

## Segment 16: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 4244 | 1861 | 7200 | 2000 | 0.72 | 0.93 | 60.3 | 55.5 | 23.5 | 27.9 | C |

## Segment 17: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 2383 | 7200 | 0.47 | 74.3 | 10.5 | A |

## Segment 18: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 2695 | 312 | 7200 | 2000 | 0.51 | 0.16 | 68.7 | 66.2 | 13.1 | 12.8 | B |

## Segment 19: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 0.990 | 2695 | 1222 | 7200 | 2000 | 0.51 | 0.61 | 61.1 | 57.4 | 14.7 | 18.8 | B |

## Segment 20: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 1473 | 7200 | 0.34 | 72.8 | 6.5 | A |

## Segment 21: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 2435 | 962 | 6761 | 1878 | 0.51 | 0.51 | 65.8 | 64.3 | 12.3 | 10.3 | B |

## Segment 22: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 2909 | 474 | 6761 | 1878 | 0.58 | 0.25 | 64.7 | 62.7 | 15.0 | 16.8 | B |

## Segment 23: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 2909 | 3274 | 1.19 | 55.9 | 19.9 | F |

## Facility Time Period Results

| T | Speed, mi/h | Density, pc/mi/ln | Density, veh/mi/ln | Travel Time, min | LOS |
|---|---|---|---|---|---|
| 1 | 52.3 | 29.8 | 28.5 | 8.6 | F |

## Facility Overall Results

| | | | |
|---|---|---|---|
| Space Mean Speed, mi/h | 52.3 | Density, veh/mi/ln | 28.5 |
| Average Travel Time, min | 8.6 | | |

# HCS7 Freeway Facilities Report

## Project Information

| | | | |
|---|---|---|---|
| Analyst | W-Trans | Agency | |
| Jurisdiction | City of Novato | Time Period Analyzed | PM Peak Existing + Project - Southbound |
| Analysis Year | 2016 | Date | 6/8/17 |
| Project Description | | | |

## Facility Global Input

| | | | |
|---|---|---|---|
| Jam Density, pc/mi/ln | 190.0 | Density at Capacity, pc/mi/ln | 45.0 |
| Queue Discharge Capacity Drop, % | 7 | Total Segments | 24 |
| Total Time Periods | 1 | Time Period Duration, min | 15 |

## Segment Geometric Data

| No. | Coded | Analyzed | Name | Length, ft | Lanes |
|---|---|---|---|---|---|
| 1 | Basic | Basic | N Novato City Limits->San Marin Dr | 3200 | 3 |
| 2 | Diverge | Diverge | San Marin Dr Off-> | 1500 | 3 |
| 3 | Basic | Basic | San Marin Dr Off->San Marin Dr On | 2100 | 3 |
| 4 | Merge | Merge | San Marin Dr On-> | 1175 | 3 |
| 5 | Diverge | Diverge | De Long Ave Off-> | 1175 | 3 |
| 6 | Basic | Basic | De Long Ave Off->De Long Ave On | 1975 | 3 |
| 7 | Merge | Basic | De Long Ave On-> | 1170 | 3 |
| 8 | Diverge | Diverge | BEGIN HOV | 200 | 4 |
| 9 | Diverge | Diverge | Rowland Blvd Off-> | 1170 | 4 |
| 10 | Basic | Basic | Rowland Blvd Off->Rowland Blvd On | 3150 | 4 |
| 11 | Merge | Merge | Rowland Blvd On-> | 1200 | 4 |
| 12 | Basic | Basic | Rowland Blvd->SR37-Novato Blvd | 770 | 4 |
| 13 | Diverge | Diverge | SR37-Novato Blvd Off-> | 1200 | 4 |
| 14 | Basic | Basic | SR37-Novato Blvd Off->SR37-Novato Blvd On | 3400 | 4 |
| 15 | Merge | Basic | SR37-Novato Blvd On-> | 1030 | 5 |
| 16 | Diverge | Diverge | Ignacio-Enfrente Off-> | 1000 | 5 |
| 17 | Diverge | Basic | BMK-Nave Off-> | 800 | 5 |
| 18 | Basic | Basic | Ignacio Blvd Off->Ignacio Blvd On | 1425 | 4 |
| 19 | Merge | Merge | Ignacio Blvd On-> | 1500 | 4 |
| 20 | Basic | Basic | Ignacio Blvd->Alameda Del Prado | 2250 | 4 |
| 21 | Diverge | Diverge | ADP Off-> | 1500 | 4 |
| 22 | Basic | Basic | ADP Off->ADP On | 1200 | 4 |
| 23 | Merge | Merge | ADP On-> | 1500 | 4 |
| 24 | Basic | Basic | Alameda Del Prado->S Novato City Limits | 1000 | 4 |

## Facility Segment Data

### Segment 1: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.957 | 3626 | 7200 | 0.50 | 74.8 | 16.2 | B |

### Segment 2: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.957 | 0.980 | 3626 | 423 | 7200 | 2000 | 0.50 | 0.21 | 63.9 | 58.1 | 18.9 | 24.4 | C |

### Segment 3: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.954 | 3216 | 7200 | 0.45 | 75.3 | 14.2 | B |

### Segment 4: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.960 | 0.980 | 4309 | 1113 | 7200 | 2000 | 0.60 | 0.56 | 65.5 | 62.9 | 21.9 | 26.4 | C |

### Segment 5: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.960 | 0.980 | 4297 | 212 | 7200 | 2000 | 0.60 | 0.11 | 67.8 | 62.6 | 21.1 | 26.9 | C |

### Segment 6: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.958 | 4097 | 7200 | 0.57 | 73.8 | 18.5 | C |

### Segment 7: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.963 | 0.980 | 5194 | 1119 | 7200 | 2000 | 0.57 | 0.56 | 69.3 | - | 25.0 | - | C |

### Segment 8: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 1.00 | 0.963 | 0.990 | 5179 | 0 | 9600 | 2200 | 0.54 | 0.00 | 75.4 | 69.8 | 17.2 | 25.6 | C |

### Segment 9: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.95 | 0.963 | 0.980 | 5179 | 524 | 9600 | 2000 | 0.54 | 0.26 | 70.4 | 61.7 | 18.4 | 25.3 | C |

## Segment 10: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.960 | 4677 | 9600 | 0.49 | 75.0 | 15.6 | B |

## Segment 11: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.966 | 0.980 | 6077 | 1429 | 9600 | 2000 | 0.63 | 0.71 | 66.3 | 62.0 | 22.9 | 28.7 | D |

## Segment 12: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.966 | 6053 | 9600 | 0.63 | 72.3 | 20.9 | C |

## Segment 13: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.966 | 0.962 | 6053 | 677 | 9600 | 2100 | 0.63 | 0.32 | 71.0 | 63.4 | 21.3 | 29.3 | D |

## Segment 14: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.967 | 5393 | 9600 | 0.56 | 73.9 | 18.2 | C |

## Segment 15: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.966 | 0.962 | 6835 | 1436 | 12000 | 4000 | 0.45 | 0.36 | 73.8 | - | 18.5 | - | C |

## Segment 16: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.966 | 0.980 | 6785 | 597 | 12000 | 2000 | 0.57 | 0.30 | 70.7 | 61.5 | 16.3 | 24.3 | C |

## Segment 17: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.964 | 0.980 | 6210 | 843 | 12000 | 2000 | 0.52 | 0.42 | 74.7 | - | 16.6 | - | B |

## Segment 18: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.962 | 5391 | 9600 | 0.56 | 73.9 | 18.2 | C |

## Segment 19: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.965 | 0.980 | 6465 | 1091 | 9600 | 2000 | 0.67 | 0.55 | 66.4 | 62.1 | 24.3 | 28.4 | D |

## Segment 20: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.965 | 6448 | 9600 | 0.67 | 71.1 | 22.7 | C |

## Segment 21: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.932 | 0.980 | 6676 | 347 | 9600 | 2000 | 0.70 | 0.17 | 70.5 | 62.2 | 23.7 | 26.9 | C |

## Segment 22: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.931 | 6330 | 9600 | 0.66 | 71.5 | 22.1 | C |

## Segment 23: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.934 | 0.980 | 7031 | 722 | 9600 | 2000 | 0.73 | 0.36 | 67.9 | 65.3 | 25.9 | 21.1 | C |

## Segment 24: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.934 | 7043 | 9600 | 0.73 | 68.8 | 25.6 | C |

## Facility Time Period Results

| T | Speed, mi/h | Density, pc/mi/ln | Density, veh/mi/ln | Travel Time, min | LOS |
|---|---|---|---|---|---|
| 1 | 71.2 | 19.7 | 18.9 | 5.8 | C |

## Facility Overall Results

| | | | |
|---|---|---|---|
| Space Mean Speed, mi/h | 71.2 | Density, veh/mi/ln | 18.9 |
| Average Travel Time, min | 5.8 | | |

# HCS7 Freeway Facilities Report

## Project Information

| | | | |
|---|---|---|---|
| Analyst | W-Trans | Agency | |
| Jurisdiction | City of Novato | Time Period Analyzed | AM Peak Cumulative with Project - Northbound |
| Analysis Year | 2016 | Date | 6/8/17 |
| Project Description | City of Novato General Plan Update EIR | | |

## Facility Global Input

| | | | |
|---|---|---|---|
| Jam Density, pc/mi/ln | 190.0 | Density at Capacity, pc/mi/ln | 45.0 |
| Queue Discharge Capacity Drop, % | 7 | Total Segments | 24 |
| Total Time Periods | 1 | Time Period Duration, min | 15 |

## Segment Geometric Data

| No. | Coded | Analyzed | Name | Length, ft | Lanes |
|---|---|---|---|---|---|
| 1 | Basic | Basic | Novato S City Limits->Alameda del Prado | 2000 | 5 |
| 2 | Diverge | Basic | Alameda del Prado Off-> | 1500 | 5 |
| 3 | Basic | Basic | Alameda del Prado Off->Alameda del Prado On | 2000 | 4 |
| 4 | Merge | Merge | Alameda del Prado On-> | 1000 | 4 |
| 5 | Basic | Basic | Alameda del Prado On->Nave Off | 2600 | 4 |
| 6 | Diverge | Diverge | Nave Off-> | 1000 | 4 |
| 7 | Basic | Basic | Nave Off->Nave On | 2000 | 4 |
| 8 | Merge | Basic | Nave On-> | 500 | 5 |
| 9 | Merge | Merge | Ignacio On-> | 1500 | 5 |
| 10 | Diverge | Basic | SR37 Off-> | 1500 | 5 |
| 11 | Diverge | Diverge | Novato Blvd Off-> | 1500 | 4 |
| 12 | Basic | Basic | Novato Blvd Off->SR 37 On | 2650 | 4 |
| 13 | Weaving | Weaving | SR37->Rowland Blvd | 2050 | 5 |
| 14 | Basic | Basic | Rowland Blvd Off->Rowland Blvd On | 2900 | 4 |
| 15 | Merge | Merge | Rowland Blvd On-> | 1200 | 4 |
| 16 | Diverge | Diverge | De Long Off-> | 1200 | 4 |
| 17 | Basic | Basic | De Long Off->De Long On | 2000 | 4 |
| 18 | Merge | Merge | De Long Ave On-> | 1200 | 4 |
| 19 | Diverge | Diverge | Atherton Ave Off-> | 1200 | 4 |
| 20 | Basic | Basic | Atherton Ave Off->Atherton Ave On | 900 | 4 |
| 21 | Merge | Merge | Atherton Ave On-> | 1000 | 4 |
| 22 | Basic | Basic | Atherton On -> End HOV | 2300 | 3 |
| 23 | Basic | Basic | End HOV | 2000 | 2 |
| 24 | Basic | Basic | End HOV -> Begin 2 lane fwy | 2500 | 2 |

## Facility Segment Data

### Segment 1: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 5426 | 12000 | 0.45 | 75.3 | 14.4 | B |

### Segment 2: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 5426 | 378 | 12000 | 2000 | 0.45 | 0.19 | 75.3 | - | 14.4 | - | B |

### Segment 3: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 5051 | 9600 | 0.53 | 74.5 | 17.0 | B |

### Segment 4: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 5168 | 117 | 9600 | 2000 | 0.54 | 0.06 | 68.5 | 64.4 | 18.9 | 20.0 | B |

### Segment 5: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 5167 | 9600 | 0.54 | 74.4 | 17.4 | B |

### Segment 6: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 1.00 | 0.957 | 1.000 | 5167 | 957 | 9600 | 2000 | 0.54 | 0.48 | 67.2 | 58.2 | 19.2 | 26.5 | C |

### Segment 7: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 4167 | 9600 | 0.43 | 75.4 | 13.8 | B |

### Segment 8: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 4367 | 200 | 12000 | 2000 | 0.35 | 0.10 | 75.4 | - | 11.6 | - | B |

### Segment 9: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 5165 | 799 | 12000 | 2000 | 0.43 | 0.40 | 68.8 | 64.0 | 12.2 | 20.8 | C |

## Segment 10: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 5159 | 1049 | 12000 | 4200 | 0.43 | 0.25 | 75.4 | - | 13.7 | - | B |

## Segment 11: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 4117 | 189 | 9600 | 2000 | 0.43 | 0.09 | 70.6 | 60.5 | 14.6 | 20.6 | C |

## Segment 12: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 3929 | 9600 | 0.41 | 75.4 | 13.0 | B |

## Segment 13: Weaving

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 4640 | 6685 | 0.70 | 64.5 | 14.5 | B |

## Segment 14: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 3635 | 9600 | 0.38 | 75.4 | 12.1 | B |

## Segment 15: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 4049 | 414 | 9600 | 2000 | 0.42 | 0.21 | 69.8 | 66.2 | 14.5 | 13.7 | B |

## Segment 16: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 4046 | 871 | 9600 | 2000 | 0.42 | 0.44 | 67.2 | 58.5 | 15.1 | 19.6 | B |

## Segment 17: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 3182 | 9600 | 0.33 | 75.4 | 10.6 | A |

## Segment 18: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 3374 | 192 | 9600 | 2000 | 0.35 | 0.10 | 70.4 | 66.4 | 12.0 | 10.6 | B |

## Segment 19: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 0.990 | 3372 | 925 | 9600 | 2000 | 0.35 | 0.46 | 66.3 | 58.3 | 12.7 | 17.3 | B |

## Segment 20: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 2463 | 9600 | 0.26 | 75.4 | 8.2 | A |

## Segment 21: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 2970 | 507 | 9014 | 1878 | 0.33 | 0.27 | 66.2 | 64.1 | 11.2 | 12.0 | B |

## Segment 22: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.94 | 1.000 | 3020 | 7200 | 0.42 | 71.7 | 14.0 | B |

## Segment 23: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 2967 | 4472 | 0.66 | 66.2 | 22.4 | C |

## Segment 24: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 2967 | 3628 | 0.82 | 49.0 | 30.3 | D |

## Facility Time Period Results

| T | Speed, mi/h | Density, pc/mi/ln | Density, veh/mi/ln | Travel Time, min | LOS |
|---|---|---|---|---|---|
| 1 | 70.5 | 14.7 | 14.1 | 6.5 | B |

## Facility Overall Results

| | | | |
|---|---|---|---|
| Space Mean Speed, mi/h | 70.5 | Density, veh/mi/ln | 14.1 |
| Average Travel Time, min | 6.5 | | |

# HCS7 Freeway Facilities Report

## Project Information

| | | | |
|---|---|---|---|
| Analyst | W-Trans | Agency | |
| Jurisdiction | City of Novato | Time Period Analyzed | AM Peak Cumulative with Project - Southbound |
| Analysis Year | 2016 | Date | 6/8/17 |
| Project Description | City of Novato General Plan EIR | | |

## Facility Global Input

| | | | |
|---|---|---|---|
| Jam Density, pc/mi/ln | 190.0 | Density at Capacity, pc/mi/ln | 45.0 |
| Queue Discharge Capacity Drop, % | 7 | Total Segments | 24 |
| Total Time Periods | 1 | Time Period Duration, min | 15 |

## Segment Geometric Data

| No. | Coded | Analyzed | Name | Length, ft | Lanes |
|---|---|---|---|---|---|
| 1 | Basic | Basic | N Novato City Limits->San Marin Dr | 3200 | 3 |
| 2 | Diverge | Diverge | San Marin Dr Off-> | 1500 | 3 |
| 3 | Basic | Basic | San Marin Dr Off->San Marin Dr On | 2100 | 3 |
| 4 | Merge | Merge | San Marin Dr On-> | 1175 | 3 |
| 5 | Diverge | Diverge | De Long Ave Off-> | 1175 | 3 |
| 6 | Basic | Basic | De Long Ave Off->De Long Ave On | 1975 | 3 |
| 7 | Merge | Merge | De Long Ave On-> | 1170 | 3 |
| 8 | Diverge | Diverge | BEGIN HOV | 200 | 3 |
| 9 | Diverge | Diverge | Rowland Blvd Off-> | 1170 | 3 |
| 10 | Basic | Basic | Rowland Blvd Off->Rowland Blvd On | 3150 | 3 |
| 11 | Merge | Merge | Rowland Blvd On-> | 1200 | 3 |
| 12 | Basic | Basic | Rowland Blvd->SR37-Novato Blvd | 770 | 3 |
| 13 | Diverge | Diverge | SR37-Novato Blvd Off-> | 1200 | 3 |
| 14 | Basic | Basic | SR37-Novato Blvd Off->SR37-Novato Blvd On | 3400 | 3 |
| 15 | Merge | Basic | SR37-Novato Blvd On-> | 1030 | 4 |
| 16 | Diverge | Diverge | Ignacio-Enfrente Off-> | 1000 | 4 |
| 17 | Diverge | Basic | BMK-Nave Off-> | 800 | 4 |
| 18 | Basic | Basic | Ignacio Blvd Off->Ignacio Blvd On | 1425 | 3 |
| 19 | Merge | Merge | Ignacio Blvd On-> | 1500 | 3 |
| 20 | Basic | Basic | Ignacio Blvd->Alameda Del Prado | 2250 | 3 |
| 21 | Diverge | Diverge | ADP Off-> | 1500 | 3 |
| 22 | Basic | Basic | ADP Off->ADP On | 1200 | 3 |
| 23 | Merge | Basic | ADP On-> | 1500 | 3 |
| 24 | Basic | Basic | Alameda Del Prado->S Novato City Limits | 1000 | 4 |

## Facility Segment Data

### Segment 1: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.957 | 6726 | 7200 | 1.02 | 41.1 | 54.6 | F |

### Segment 2: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.957 | 0.980 | 6659 | 729 | 7200 | 2000 | 1.02 | 0.36 | 45.5 | 61.1 | 48.8 | 42.7 | F |

### Segment 3: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.954 | 5730 | 7200 | 0.92 | 31.1 | 61.4 | F |

### Segment 4: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.960 | 0.980 | 6456 | 776 | 7200 | 2100 | 1.02 | 0.37 | 38.7 | 51.8 | 55.6 | 39.6 | F |

### Segment 5: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.960 | 0.980 | 6406 | 350 | 7200 | 2000 | 1.02 | 0.18 | 37.3 | 62.2 | 57.2 | 42.4 | F |

### Segment 6: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.958 | 5928 | 7200 | 0.97 | 29.6 | 66.8 | F |

### Segment 7: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.963 | 0.980 | 6704 | 776 | 7200 | 2000 | 1.08 | 0.39 | 60.1 | 56.4 | 37.2 | 36.5 | F |

### Segment 8: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 1.00 | 0.963 | 0.990 | 6704 | 1091 | 7200 | 2200 | 1.08 | 0.50 | 70.0 | 66.5 | 31.9 | 41.6 | F |

### Segment 9: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.95 | 0.963 | 0.980 | 5613 | 867 | 7200 | 2000 | 0.92 | 0.43 | 66.1 | 60.7 | 28.3 | 34.5 | D |

## Segment 10: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.960 | 4746 | 7200 | 0.80 | 71.5 | 22.1 | C |

## Segment 11: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.966 | 0.980 | 5451 | 705 | 7200 | 2000 | 0.89 | 0.35 | 64.1 | 61.2 | 28.3 | 30.5 | D |

## Segment 12: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.966 | 5451 | 7200 | 0.89 | 67.8 | 26.8 | D |

## Segment 13: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.966 | 0.962 | 5451 | 327 | 7200 | 2100 | 0.89 | 0.16 | 69.1 | 64.5 | 26.3 | 33.0 | D |

## Segment 14: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.967 | 5105 | 7200 | 0.85 | 69.7 | 24.4 | C |

## Segment 15: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.966 | 0.962 | 7960 | 3076 | 9600 | 4000 | 0.64 | 0.77 | 42.2 | - | 47.2 | - | F |

## Segment 16: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.966 | 0.980 | 7812 | 663 | 9600 | 2000 | 0.95 | 0.33 | 40.5 | 61.3 | 48.2 | 37.0 | F |

## Segment 17: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.964 | 0.980 | 7009 | 1247 | 9600 | 2000 | 0.88 | 0.62 | 27.4 | - | 63.9 | - | F |

## Segment 18: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.962 | 5635 | 7200 | 1.00 | 25.8 | 72.8 | F |

## Segment 19: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.965 | 0.980 | 6247 | 699 | 7200 | 2000 | 1.10 | 0.35 | 34.9 | 41.8 | 59.6 | 43.9 | F |

## Segment 20: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.965 | 6118 | 7200 | 1.10 | 32.5 | 62.7 | F |

## Segment 21: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.932 | 0.980 | 6031 | 215 | 7200 | 2000 | 1.14 | 0.11 | 30.3 | 62.6 | 66.4 | 47.3 | F |

## Segment 22: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.931 | 5735 | 7200 | 1.11 | 26.1 | 73.3 | F |

## Segment 23: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.934 | 0.980 | 6704 | 969 | 7200 | 2000 | 1.10 | 0.48 | 60.3 | - | 37.1 | - | F |

## Segment 24: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.934 | 6704 | 9600 | 0.93 | 70.1 | 23.9 | C |

## Facility Time Period Results

| T | Speed, mi/h | Density, pc/mi/ln | Density, veh/mi/ln | Travel Time, min | LOS |
|---|---|---|---|---|---|
| 1 | 41.5 | 46.7 | 44.7 | 10.0 | F |

## Facility Overall Results

| | | | |
|---|---|---|---|
| Space Mean Speed, mi/h | 41.5 | Density, veh/mi/ln | 44.7 |
| Average Travel Time, min | 10.0 | | |

# HCS7 Freeway Facilities Report

## Project Information

| | | | |
|---|---|---|---|
| Analyst | W-Trans | Agency | |
| Jurisdiction | City of Novato | Time Period Analyzed | PM Peak Cumulative with Project - Northbound |
| Analysis Year | 2016 | Date | 6/8/17 |
| Project Description | City of Novato General Plan Update EIR | | |

## Facility Global Input

| | | | |
|---|---|---|---|
| Jam Density, pc/mi/ln | 190.0 | Density at Capacity, pc/mi/ln | 45.0 |
| Queue Discharge Capacity Drop, % | 7 | Total Segments | 23 |
| Total Time Periods | 1 | Time Period Duration, min | 15 |

## Segment Geometric Data

| No. | Coded | Analyzed | Name | Length, ft | Lanes |
|---|---|---|---|---|---|
| 1 | Basic | Basic | Novato S City Limits->Alameda del Prado | 2000 | 4 |
| 2 | Diverge | Basic | Alameda del Prado Off-> | 1500 | 4 |
| 3 | Basic | Basic | Alameda del Prado Off->Alameda del Prado On | 2000 | 3 |
| 4 | Merge | Merge | Alameda del Prado On-> | 1000 | 3 |
| 5 | Basic | Basic | Alameda del Prado On->Nave Off | 2600 | 3 |
| 6 | Diverge | Diverge | Nave Off-> | 1000 | 3 |
| 7 | Basic | Basic | Nave Off->Nave On | 2000 | 3 |
| 8 | Merge | Basic | Nave On-> | 500 | 4 |
| 9 | Merge | Merge | Ignacio On-> | 1500 | 4 |
| 10 | Diverge | Basic | SR37 Off-> | 1500 | 4 |
| 11 | Diverge | Diverge | Novato Blvd Off-> | 1500 | 3 |
| 12 | Basic | Basic | Novato Blvd Off->SR 37 On | 2650 | 3 |
| 13 | Weaving | Weaving | SR37->Rowland Blvd | 2050 | 4 |
| 14 | Basic | Basic | Rowland Blvd Off->Rowland Blvd On | 2900 | 3 |
| 15 | Merge | Merge | Rowland Blvd On-> | 1200 | 3 |
| 16 | Diverge | Diverge | De Long Off-> | 1200 | 3 |
| 17 | Basic | Basic | De Long Off->De Long On | 2000 | 3 |
| 18 | Merge | Merge | De Long Ave On-> | 1200 | 3 |
| 19 | Diverge | Diverge | Atherton Ave Off-> | 1200 | 3 |
| 20 | Basic | Basic | Atherton Ave Off->Atherton Ave On | 900 | 3 |
| 21 | Merge | Merge | Atherton Ave On-> | 1000 | 3 |
| 22 | Merge | Merge | End HOV | 1000 | 3 |
| 23 | Basic | Basic | End HOV -> Begin 2 lane fwy | 5100 | 2 |

## Facility Segment Data

### Segment 1: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 7602 | 9600 | 0.90 | 25.3 | 75.2 | F |

### Segment 2: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 7405 | 933 | 9600 | 2000 | 0.90 | 0.47 | 25.0 | - | 74.1 | - | F |

### Segment 3: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 6397 | 7200 | 1.07 | 35.2 | 60.6 | F |

### Segment 4: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 6704 | 307 | 7200 | 2000 | 1.11 | 0.15 | 61.1 | 57.9 | 36.6 | 34.9 | F |

### Segment 5: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 6704 | 7200 | 1.11 | 58.2 | 38.4 | F |

### Segment 6: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 1.00 | 0.957 | 1.000 | 6704 | 959 | 7200 | 2000 | 1.11 | 0.48 | 64.1 | 58.2 | 34.9 | 37.8 | F |

### Segment 7: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 5745 | 7200 | 0.98 | 65.9 | 29.1 | D |

### Segment 8: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 6000 | 255 | 9600 | 2000 | 0.73 | 0.13 | 67.9 | - | 22.1 | - | C |

### Segment 9: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 7617 | 1617 | 9600 | 2000 | 0.93 | 0.81 | 63.3 | 57.9 | 30.1 | 34.9 | D |

### Segment 10: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 7617 | 2823 | 9600 | 4200 | 0.92 | 0.67 | 65.7 | - | 29.0 | - | D |

## Segment 11: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 4794 | 397 | 7200 | 2000 | 0.84 | 0.20 | 65.6 | 59.9 | 24.4 | 31.2 | D |

## Segment 12: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 4397 | 7200 | 0.79 | 72.8 | 20.1 | C |

## Segment 13: Weaving

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 4790 | 4790 | 1.14 | 26.6 | 45.0 | F |

## Segment 14: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 3655 | 7200 | 0.69 | 74.5 | 16.3 | B |

## Segment 15: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 4295 | 640 | 7200 | 2000 | 0.77 | 0.32 | 67.0 | 64.7 | 21.4 | 21.3 | C |

## Segment 16: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 4295 | 1905 | 7200 | 2000 | 0.77 | 0.95 | 60.2 | 55.4 | 23.8 | 28.2 | D |

## Segment 17: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 2390 | 7200 | 0.51 | 74.3 | 10.6 | A |

## Segment 18: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 2714 | 324 | 7200 | 2000 | 0.56 | 0.16 | 68.7 | 66.2 | 13.2 | 13.0 | B |

## Segment 19: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 0.990 | 2714 | 1315 | 7200 | 2000 | 0.56 | 0.66 | 60.8 | 57.2 | 14.9 | 19.1 | B |

## Segment 20: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 1399 | 7200 | 0.38 | 72.7 | 6.2 | A |

## Segment 21: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 2376 | 977 | 6761 | 1878 | 0.55 | 0.52 | 65.8 | 64.3 | 12.0 | 10.1 | B |

## Segment 22: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 3049 | 868 | 6761 | 1878 | 0.67 | 0.46 | 14.8 | 60.4 | 68.9 | 26.2 | F |

## Segment 23: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 3049 | 3274 | 1.39 | 55.6 | 21.1 | F |

## Facility Time Period Results

| T | Speed, mi/h | Density, pc/mi/ln | Density, veh/mi/ln | Travel Time, min | LOS |
|---|---|---|---|---|---|
| 1 | 46.5 | 33.3 | 31.9 | 9.7 | F |

## Facility Overall Results

| | | | |
|---|---|---|---|
| Space Mean Speed, mi/h | 46.5 | Density, veh/mi/ln | 31.9 |
| Average Travel Time, min | 9.7 | | |

# HCS7 Freeway Facilities Report

## Project Information

| | | | |
|---|---|---|---|
| Analyst | W-Trans | Agency | |
| Jurisdiction | City of Novato | Time Period Analyzed | PM Cumulative with Project - Southbound |
| Analysis Year | 2016 | Date | 6/8/17 |
| Project Description | | | |

## Facility Global Input

| | | | |
|---|---|---|---|
| Jam Density, pc/mi/ln | 190.0 | Density at Capacity, pc/mi/ln | 45.0 |
| Queue Discharge Capacity Drop, % | 7 | Total Segments | 24 |
| Total Time Periods | 1 | Time Period Duration, min | 15 |

## Segment Geometric Data

| No. | Coded | Analyzed | Name | Length, ft | Lanes |
|---|---|---|---|---|---|
| 1 | Basic | Basic | N Novato City Limits->San Marin Dr | 3771 | 3 |
| 2 | Diverge | Diverge | San Marin Dr Off-> | 1500 | 3 |
| 3 | Basic | Basic | San Marin Dr Off->San Marin Dr On | 2100 | 3 |
| 4 | Merge | Merge | San Marin Dr On-> | 1175 | 3 |
| 5 | Diverge | Diverge | De Long Ave Off-> | 1175 | 3 |
| 6 | Basic | Basic | De Long Ave Off->De Long Ave On | 1975 | 3 |
| 7 | Merge | Basic | De Long Ave On-> | 1170 | 3 |
| 8 | Diverge | Diverge | BEGIN HOV | 200 | 4 |
| 9 | Diverge | Diverge | Rowland Blvd Off-> | 1170 | 4 |
| 10 | Basic | Basic | Rowland Blvd Off->Rowland Blvd On | 3150 | 4 |
| 11 | Merge | Merge | Rowland Blvd On-> | 1200 | 4 |
| 12 | Basic | Basic | Rowland Blvd->SR37-Novato Blvd | 770 | 4 |
| 13 | Diverge | Diverge | SR37-Novato Blvd Off-> | 1200 | 4 |
| 14 | Basic | Basic | SR37-Novato Blvd Off->SR37-Novato Blvd On | 3400 | 4 |
| 15 | Merge | Basic | SR37-Novato Blvd On-> | 1030 | 5 |
| 16 | Diverge | Diverge | Ignacio-Enfrente Off-> | 1000 | 5 |
| 17 | Diverge | Basic | BMK-Nave Off-> | 800 | 5 |
| 18 | Basic | Basic | Ignacio Blvd Off->Ignacio Blvd On | 1425 | 4 |
| 19 | Merge | Merge | Ignacio Blvd On-> | 1500 | 4 |
| 20 | Basic | Basic | Ignacio Blvd->Alameda Del Prado | 2250 | 4 |
| 21 | Diverge | Diverge | ADP Off-> | 1500 | 4 |
| 22 | Basic | Basic | ADP Off->ADP On | 1200 | 4 |
| 23 | Merge | Merge | ADP On-> | 1500 | 4 |
| 24 | Basic | Basic | Alameda Del Prado->S Novato City Limits | 1000 | 4 |

## Facility Segment Data

### Segment 1: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.957 | 4016 | 7200 | 0.56 | 74.0 | 18.1 | C |

### Segment 2: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.957 | 0.980 | 4016 | 445 | 7200 | 2000 | 0.56 | 0.22 | 63.9 | 58.0 | 20.9 | 26.4 | C |

### Segment 3: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.954 | 3585 | 7200 | 0.50 | 74.9 | 16.0 | B |

### Segment 4: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.960 | 0.980 | 4743 | 1180 | 7200 | 2000 | 0.66 | 0.59 | 64.8 | 62.1 | 24.4 | 28.6 | D |

### Segment 5: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.960 | 0.980 | 4731 | 222 | 7200 | 2000 | 0.66 | 0.11 | 67.8 | 62.6 | 23.3 | 28.9 | D |

### Segment 6: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.958 | 4520 | 7200 | 0.63 | 72.4 | 20.8 | C |

### Segment 7: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.963 | 0.980 | 5660 | 1163 | 7200 | 2000 | 0.62 | 0.58 | 66.4 | - | 28.4 | - | D |

### Segment 8: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 1.00 | 0.963 | 0.990 | 5645 | 0 | 9600 | 2200 | 0.59 | 0.00 | 75.2 | 69.8 | 18.8 | 27.5 | C |

### Segment 9: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.95 | 0.963 | 0.980 | 5645 | 532 | 9600 | 2000 | 0.59 | 0.27 | 70.3 | 61.7 | 20.1 | 27.1 | C |

## Segment 10: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.960 | 5136 | 9600 | 0.54 | 74.4 | 17.3 | B |

## Segment 11: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.966 | 0.980 | 6573 | 1469 | 9600 | 2000 | 0.68 | 0.73 | 65.6 | 61.1 | 25.0 | 30.4 | D |

## Segment 12: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.966 | 6549 | 9600 | 0.68 | 70.7 | 23.2 | C |

## Segment 13: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.966 | 0.962 | 6549 | 754 | 9600 | 2100 | 0.68 | 0.36 | 70.7 | 63.2 | 23.2 | 31.6 | D |

## Segment 14: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.967 | 5815 | 9600 | 0.61 | 73.0 | 19.9 | C |

## Segment 15: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.966 | 0.962 | 7409 | 1588 | 12000 | 4000 | 0.49 | 0.40 | 72.7 | - | 20.4 | - | C |

## Segment 16: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.966 | 0.980 | 7354 | 613 | 12000 | 2000 | 0.61 | 0.31 | 70.6 | 61.4 | 16.7 | 24.8 | C |

## Segment 17: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.964 | 0.980 | 6765 | 857 | 12000 | 2000 | 0.56 | 0.43 | 73.9 | - | 18.3 | - | C |

## Segment 18: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.962 | 5933 | 9600 | 0.62 | 72.7 | 20.4 | C |

## Segment 19: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.965 | 0.980 | 7013 | 1099 | 9600 | 2000 | 0.73 | 0.55 | 65.8 | 61.3 | 26.6 | 30.2 | D |

## Segment 20: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.965 | 6996 | 9600 | 0.73 | 69.0 | 25.3 | C |

## Segment 21: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.932 | 0.980 | 7244 | 347 | 9600 | 2000 | 0.75 | 0.17 | 70.2 | 62.2 | 25.8 | 29.0 | D |

## Segment 22: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.931 | 6897 | 9600 | 0.72 | 69.4 | 24.8 | C |

## Segment 23: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.934 | 0.980 | 7603 | 728 | 9600 | 2000 | 0.79 | 0.36 | 67.3 | 64.5 | 28.2 | 22.9 | C |

## Segment 24: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.934 | 7616 | 9600 | 0.79 | 66.1 | 28.8 | D |

## Facility Time Period Results

| T | Speed, mi/h | Density, pc/mi/ln | Density, veh/mi/ln | Travel Time, min | LOS |
|---|---|---|---|---|---|
| 1 | 70.2 | 21.8 | 20.8 | 6.0 | C |

## Facility Overall Results

| | | | |
|---|---|---|---|
| Space Mean Speed, mi/h | 70.2 | Density, veh/mi/ln | 20.8 |
| Average Travel Time, min | 6.0 | | |

# HCS7 Basic Freeway Report

## Project Information

| | | | |
|---|---|---|---|
| Analyst | W-Trans | Date | 6/9/2017 |
| Agency | | Analysis Year | 2017 |
| Jurisdiction | City of Novato | Time Period Analyzed | AM Peak Hour - Eastbound |
| Project Description | | | |

## Geometric Data

| | | | |
|---|---|---|---|
| Number of Lanes (N), ln | 2 | Terrain Type | Level |
| Segment Length (L), ft | - | Percent Grade, % | - |
| Measured or Base Free-Flow Speed | Base | Grade Length, mi | - |
| Base Free-Flow Speed (BFFS), mi/h | 75.4 | Total Ramp Density (TRD), ramps/mi | 0.80 |
| Lane Width, ft | 12 | Free-Flow Speed (FFS), mi/h | 72.7 |
| Right-Side Lateral Clearance, ft | 6 | | |

## Adjustment Factors

| | | | |
|---|---|---|---|
| Driver Population | Mostly Familiar | Final Speed Adjustment Factor (SAF) | 0.975 |
| Weather Type | Non-Severe Weather | Final Capacity Adjustment Factor (CAF) | 0.968 |
| Incident Type | No Incident | Demand Adjustment Factor (DAF) | 1.000 |

## Demand and Capacity

| | | | |
|---|---|---|---|
| Volume (V), veh/h | 1030 | Heavy Vehicle Adjustment Factor ($f_{HV}$) | 0.971 |
| Peak Hour Factor (PHF) | 0.95 | Flow Rate ($v_p$), pc/h/ln | 558 |
| Total Trucks, % | 3.00 | Capacity (c), pc/h/ln | 2400 |
| Single-Unit Trucks (SUT), % | - | Adjusted Capacity ($c_{adj}$), pc/h/ln | 2323 |
| Tractor-Trailers (TT), % | - | Volume-to-Capacity Ratio (v/c) | 0.24 |
| Passenger Car Equivalent ($E_T$) | 2.000 | | |

## Speed and Density

| | | | |
|---|---|---|---|
| Lane Width Adjustment ($f_{LW}$) | 0.0 | Average Speed (S), mi/h | 70.9 |
| Right-Side Lateral Clearance Adj. ($f_{RLC}$) | 0.0 | Density (D), pc/mi/ln | 7.9 |
| Total Ramp Density Adjustment | 2.7 | Level of Service (LOS) | A |
| Adjusted Free-Flow Speed ($FFS_{adj}$), mi/h | 70.9 | | |




# HCS7 Basic Freeway Report

## Project Information

| | | | |
|---|---|---|---|
| Analyst | W-Trans | Date | 6/9/2017 |
| Agency | | Analysis Year | 2017 |
| Jurisdiction | City of Novato | Time Period Analyzed | AM Peak Hour - Westbound |
| Project Description | | | |

## Geometric Data

| | | | |
|---|---|---|---|
| Number of Lanes (N), ln | 2 | Terrain Type | Level |
| Segment Length (L), ft | - | Percent Grade, % | - |
| Measured or Base Free-Flow Speed | Base | Grade Length, mi | - |
| Base Free-Flow Speed (BFFS), mi/h | 75.4 | Total Ramp Density (TRD), ramps/mi | 0.80 |
| Lane Width, ft | 12 | Free-Flow Speed (FFS), mi/h | 72.7 |
| Right-Side Lateral Clearance, ft | 6 | | |

## Adjustment Factors

| | | | |
|---|---|---|---|
| Driver Population | Mostly Familiar | Final Speed Adjustment Factor (SAF) | 0.975 |
| Weather Type | Non-Severe Weather | Final Capacity Adjustment Factor (CAF) | 0.968 |
| Incident Type | No Incident | Demand Adjustment Factor (DAF) | 1.000 |

## Demand and Capacity

| | | | |
|---|---|---|---|
| Volume (V), veh/h | 2267 | Heavy Vehicle Adjustment Factor ($f_{HV}$) | 0.971 |
| Peak Hour Factor (PHF) | 0.95 | Flow Rate ($v_p$), pc/h/ln | 1229 |
| Total Trucks, % | 3.00 | Capacity (c), pc/h/ln | 2400 |
| Single-Unit Trucks (SUT), % | - | Adjusted Capacity ($c_{adj}$), pc/h/ln | 2323 |
| Tractor-Trailers (TT), % | - | Volume-to-Capacity Ratio (v/c) | 0.53 |
| Passenger Car Equivalent ($E_T$) | 2.000 | | |

## Speed and Density

| | | | |
|---|---|---|---|
| Lane Width Adjustment ($f_{LW}$) | 0.0 | Average Speed (S), mi/h | 70.7 |
| Right-Side Lateral Clearance Adj. ($f_{RLC}$) | 0.0 | Density (D), pc/mi/ln | 17.4 |
| Total Ramp Density Adjustment | 2.7 | Level of Service (LOS) | B |
| Adjusted Free-Flow Speed ($FFS_{adj}$), mi/h | 70.9 | | |

# HCS7 Basic Freeway Report

| Project Information | | | |
|---|---|---|---|
| Analyst | W-Trans | Date | 6/9/2017 |
| Agency | | Analysis Year | 2017 |
| Jurisdiction | City of Novato | Time Period Analyzed | PM Peak Hour - Eastbound |
| Project Description | | | |
| **Geometric Data** | | | |
| Number of Lanes (N), ln | 2 | Terrain Type | Level |
| Segment Length (L), ft | - | Percent Grade, % | - |
| Measured or Base Free-Flow Speed | Base | Grade Length, mi | - |
| Base Free-Flow Speed (BFFS), mi/h | 75.4 | Total Ramp Density (TRD), ramps/mi | 0.80 |
| Lane Width, ft | 12 | Free-Flow Speed (FFS), mi/h | 72.7 |
| Right-Side Lateral Clearance, ft | 6 | | |
| **Adjustment Factors** | | | |
| Driver Population | Mostly Familiar | Final Speed Adjustment Factor (SAF) | 0.975 |
| Weather Type | Non-Severe Weather | Final Capacity Adjustment Factor (CAF) | 0.968 |
| Incident Type | No Incident | Demand Adjustment Factor (DAF) | 1.000 |
| **Demand and Capacity** | | | |
| Volume (V), veh/h | 2370 | Heavy Vehicle Adjustment Factor ($f_{HV}$) | 0.971 |
| Peak Hour Factor (PHF) | 0.95 | Flow Rate ($v_p$), pc/h/ln | 1284 |
| Total Trucks, % | 3.00 | Capacity (c), pc/h/ln | 2400 |
| Single-Unit Trucks (SUT), % | - | Adjusted Capacity ($c_{adj}$), pc/h/ln | 2323 |
| Tractor-Trailers (TT), % | - | Volume-to-Capacity Ratio (v/c) | 0.55 |
| Passenger Car Equivalent ($E_T$) | 2.000 | | |
| **Speed and Density** | | | |
| Lane Width Adjustment ($f_{LW}$) | 0.0 | Average Speed (S), mi/h | 70.4 |
| Right-Side Lateral Clearance Adj. ($f_{RLC}$) | 0.0 | Density (D), pc/mi/ln | 18.2 |
| Total Ramp Density Adjustment | 2.7 | Level of Service (LOS) | C |
| Adjusted Free-Flow Speed ($FFS_{adj}$), mi/h | 70.9 | | |




# HCS7 Basic Freeway Report

| Project Information | | | |
|---|---|---|---|
| Analyst | W-Trans | Date | 6/9/2017 |
| Agency | | Analysis Year | 2017 |
| Jurisdiction | City of Novato | Time Period Analyzed | PM Peak Hour - Westbound |
| Project Description | | | |
| **Geometric Data** | | | |
| Number of Lanes (N), ln | 2 | Terrain Type | Level |
| Segment Length (L), ft | - | Percent Grade, % | - |
| Measured or Base Free-Flow Speed | Base | Grade Length, mi | - |
| Base Free-Flow Speed (BFFS), mi/h | 75.4 | Total Ramp Density (TRD), ramps/mi | 0.80 |
| Lane Width, ft | 12 | Free-Flow Speed (FFS), mi/h | 72.7 |
| Right-Side Lateral Clearance, ft | 6 | | |
| **Adjustment Factors** | | | |
| Driver Population | Mostly Familiar | Final Speed Adjustment Factor (SAF) | 0.975 |
| Weather Type | Non-Severe Weather | Final Capacity Adjustment Factor (CAF) | 0.968 |
| Incident Type | No Incident | Demand Adjustment Factor (DAF) | 1.000 |
| **Demand and Capacity** | | | |
| Volume (V), veh/h | 1288 | Heavy Vehicle Adjustment Factor ($f_{HV}$) | 0.971 |
| Peak Hour Factor (PHF) | 0.95 | Flow Rate ($v_p$), pc/h/ln | 698 |
| Total Trucks, % | 3.00 | Capacity (c), pc/h/ln | 2400 |
| Single-Unit Trucks (SUT), % | - | Adjusted Capacity ($c_{adj}$), pc/h/ln | 2323 |
| Tractor-Trailers (TT), % | - | Volume-to-Capacity Ratio (v/c) | 0.30 |
| Passenger Car Equivalent ($E_T$) | 2.000 | | |
| **Speed and Density** | | | |
| Lane Width Adjustment ($f_{LW}$) | 0.0 | Average Speed (S), mi/h | 70.9 |
| Right-Side Lateral Clearance Adj. ($f_{RLC}$) | 0.0 | Density (D), pc/mi/ln | 9.8 |
| Total Ramp Density Adjustment | 2.7 | Level of Service (LOS) | A |
| Adjusted Free-Flow Speed ($FFS_{adj}$), mi/h | 70.9 | | |

# HCS7 Basic Freeway Report

## Project Information

| | | | |
|---|---|---|---|
| Analyst | W-Trans | Date | 6/9/2017 |
| Agency | | Analysis Year | 2017 |
| Jurisdiction | City of Novato | Time Period Analyzed | AM Peak Existing+Project - Eastbound |
| Project Description | | | |

## Geometric Data

| | | | |
|---|---|---|---|
| Number of Lanes (N), ln | 2 | Terrain Type | Level |
| Segment Length (L), ft | - | Percent Grade, % | - |
| Measured or Base Free-Flow Speed | Base | Grade Length, mi | - |
| Base Free-Flow Speed (BFFS), mi/h | 75.4 | Total Ramp Density (TRD), ramps/mi | 0.80 |
| Lane Width, ft | 12 | Free-Flow Speed (FFS), mi/h | 72.7 |
| Right-Side Lateral Clearance, ft | 6 | | |

## Adjustment Factors

| | | | |
|---|---|---|---|
| Driver Population | Mostly Familiar | Final Speed Adjustment Factor (SAF) | 0.975 |
| Weather Type | Non-Severe Weather | Final Capacity Adjustment Factor (CAF) | 0.968 |
| Incident Type | No Incident | Demand Adjustment Factor (DAF) | 1.000 |

## Demand and Capacity

| | | | |
|---|---|---|---|
| Volume (V), veh/h | 1091 | Heavy Vehicle Adjustment Factor ($f_{HV}$) | 0.971 |
| Peak Hour Factor (PHF) | 0.95 | Flow Rate ($v_p$), pc/h/ln | 592 |
| Total Trucks, % | 3.00 | Capacity (c), pc/h/ln | 2400 |
| Single-Unit Trucks (SUT), % | - | Adjusted Capacity ($c_{adj}$), pc/h/ln | 2323 |
| Tractor-Trailers (TT), % | - | Volume-to-Capacity Ratio (v/c) | 0.25 |
| Passenger Car Equivalent ($E_T$) | 2.000 | | |

## Speed and Density

| | | | |
|---|---|---|---|
| Lane Width Adjustment ($f_{LW}$) | 0.0 | Average Speed (S), mi/h | 70.9 |
| Right-Side Lateral Clearance Adj. ($f_{RLC}$) | 0.0 | Density (D), pc/mi/ln | 8.3 |
| Total Ramp Density Adjustment | 2.7 | Level of Service (LOS) | A |
| Adjusted Free-Flow Speed ($FFS_{adj}$), mi/h | 70.9 | | |




# HCS7 Basic Freeway Report

## Project Information

| | | | |
|---|---|---|---|
| Analyst | W-Trans | Date | 6/9/2017 |
| Agency | | Analysis Year | 2017 |
| Jurisdiction | City of Novato | Time Period Analyzed | AM Peak Existing+Project - Westbound |
| Project Description | | | |

## Geometric Data

| | | | |
|---|---|---|---|
| Number of Lanes (N), ln | 2 | Terrain Type | Level |
| Segment Length (L), ft | - | Percent Grade, % | - |
| Measured or Base Free-Flow Speed | Base | Grade Length, mi | - |
| Base Free-Flow Speed (BFFS), mi/h | 75.4 | Total Ramp Density (TRD), ramps/mi | 0.80 |
| Lane Width, ft | 12 | Free-Flow Speed (FFS), mi/h | 72.7 |
| Right-Side Lateral Clearance, ft | 6 | | |

## Adjustment Factors

| | | | |
|---|---|---|---|
| Driver Population | Mostly Familiar | Final Speed Adjustment Factor (SAF) | 0.975 |
| Weather Type | Non-Severe Weather | Final Capacity Adjustment Factor (CAF) | 0.968 |
| Incident Type | No Incident | Demand Adjustment Factor (DAF) | 1.000 |

## Demand and Capacity

| | | | |
|---|---|---|---|
| Volume (V), veh/h | 2411 | Heavy Vehicle Adjustment Factor ($f_{HV}$) | 0.971 |
| Peak Hour Factor (PHF) | 0.95 | Flow Rate ($v_p$), pc/h/ln | 1307 |
| Total Trucks, % | 3.00 | Capacity (c), pc/h/ln | 2400 |
| Single-Unit Trucks (SUT), % | - | Adjusted Capacity ($c_{adj}$), pc/h/ln | 2323 |
| Tractor-Trailers (TT), % | - | Volume-to-Capacity Ratio (v/c) | 0.56 |
| Passenger Car Equivalent ($E_T$) | 2.000 | | |

## Speed and Density

| | | | |
|---|---|---|---|
| Lane Width Adjustment ($f_{LW}$) | 0.0 | Average Speed (S), mi/h | 70.3 |
| Right-Side Lateral Clearance Adj. ($f_{RLC}$) | 0.0 | Density (D), pc/mi/ln | 18.6 |
| Total Ramp Density Adjustment | 2.7 | Level of Service (LOS) | C |
| Adjusted Free-Flow Speed ($FFS_{adj}$), mi/h | 70.9 | | |

# HCS7 Basic Freeway Report

## Project Information

| | | | |
|---|---|---|---|
| Analyst | W-Trans | Date | 6/9/2017 |
| Agency | | Analysis Year | 2017 |
| Jurisdiction | City of Novato | Time Period Analyzed | PM Peak Existing+Project - Eastbound |
| Project Description | | | |

## Geometric Data

| | | | |
|---|---|---|---|
| Number of Lanes (N), ln | 2 | Terrain Type | Level |
| Segment Length (L), ft | - | Percent Grade, % | - |
| Measured or Base Free-Flow Speed | Base | Grade Length, mi | - |
| Base Free-Flow Speed (BFFS), mi/h | 75.4 | Total Ramp Density (TRD), ramps/mi | 0.80 |
| Lane Width, ft | 12 | Free-Flow Speed (FFS), mi/h | 72.7 |
| Right-Side Lateral Clearance, ft | 6 | | |

## Adjustment Factors

| | | | |
|---|---|---|---|
| Driver Population | Mostly Familiar | Final Speed Adjustment Factor (SAF) | 0.975 |
| Weather Type | Non-Severe Weather | Final Capacity Adjustment Factor (CAF) | 0.968 |
| Incident Type | No Incident | Demand Adjustment Factor (DAF) | 1.000 |

## Demand and Capacity

| | | | |
|---|---|---|---|
| Volume (V), veh/h | 2524 | Heavy Vehicle Adjustment Factor ($f_{HV}$) | 0.971 |
| Peak Hour Factor (PHF) | 0.95 | Flow Rate ($v_p$), pc/h/ln | 1368 |
| Total Trucks, % | 3.00 | Capacity (c), pc/h/ln | 2400 |
| Single-Unit Trucks (SUT), % | - | Adjusted Capacity ($c_{adj}$), pc/h/ln | 2323 |
| Tractor-Trailers (TT), % | - | Volume-to-Capacity Ratio (v/c) | 0.59 |
| Passenger Car Equivalent ($E_T$) | 2.000 | | |

## Speed and Density

| | | | |
|---|---|---|---|
| Lane Width Adjustment ($f_{LW}$) | 0.0 | Average Speed (S), mi/h | 69.9 |
| Right-Side Lateral Clearance Adj. ($f_{RLC}$) | 0.0 | Density (D), pc/mi/ln | 19.6 |
| Total Ramp Density Adjustment | 2.7 | Level of Service (LOS) | C |
| Adjusted Free-Flow Speed ($FFS_{adj}$), mi/h | 70.9 | | |




# HCS7 Basic Freeway Report

## Project Information

| | | | |
|---|---|---|---|
| Analyst | W-Trans | Date | 6/9/2017 |
| Agency | | Analysis Year | 2017 |
| Jurisdiction | City of Novato | Time Period Analyzed | PM Peak Existing+Project - Westbound |
| Project Description | | | |

## Geometric Data

| | | | |
|---|---|---|---|
| Number of Lanes (N), ln | 2 | Terrain Type | Level |
| Segment Length (L), ft | - | Percent Grade, % | - |
| Measured or Base Free-Flow Speed | Base | Grade Length, mi | - |
| Base Free-Flow Speed (BFFS), mi/h | 75.4 | Total Ramp Density (TRD), ramps/mi | 0.80 |
| Lane Width, ft | 12 | Free-Flow Speed (FFS), mi/h | 72.7 |
| Right-Side Lateral Clearance, ft | 6 | | |

## Adjustment Factors

| | | | |
|---|---|---|---|
| Driver Population | Mostly Familiar | Final Speed Adjustment Factor (SAF) | 0.975 |
| Weather Type | Non-Severe Weather | Final Capacity Adjustment Factor (CAF) | 0.968 |
| Incident Type | No Incident | Demand Adjustment Factor (DAF) | 1.000 |

## Demand and Capacity

| | | | |
|---|---|---|---|
| Volume (V), veh/h | 1375 | Heavy Vehicle Adjustment Factor ($f_{HV}$) | 0.971 |
| Peak Hour Factor (PHF) | 0.95 | Flow Rate ($v_p$), pc/h/ln | 746 |
| Total Trucks, % | 3.00 | Capacity (c), pc/h/ln | 2400 |
| Single-Unit Trucks (SUT), % | - | Adjusted Capacity ($c_{adj}$), pc/h/ln | 2323 |
| Tractor-Trailers (TT), % | - | Volume-to-Capacity Ratio (v/c) | 0.32 |
| Passenger Car Equivalent ($E_T$) | 2.000 | | |

## Speed and Density

| | | | |
|---|---|---|---|
| Lane Width Adjustment ($f_{LW}$) | 0.0 | Average Speed (S), mi/h | 70.9 |
| Right-Side Lateral Clearance Adj. ($f_{RLC}$) | 0.0 | Density (D), pc/mi/ln | 10.5 |
| Total Ramp Density Adjustment | 2.7 | Level of Service (LOS) | A |
| Adjusted Free-Flow Speed ($FFS_{adj}$), mi/h | 70.9 | | |

# HCS7 Basic Freeway Report

## Project Information

| | | | |
|---|---|---|---|
| Analyst | W-Trans | Date | 6/9/2017 |
| Agency | | Analysis Year | 2017 |
| Jurisdiction | City of Novato | Time Period Analyzed | AM Peak Cumulative with Project - Eastbound |
| Project Description | | | |

## Geometric Data

| | | | |
|---|---|---|---|
| Number of Lanes (N), ln | 2 | Terrain Type | Level |
| Segment Length (L), ft | - | Percent Grade, % | - |
| Measured or Base Free-Flow Speed | Base | Grade Length, mi | - |
| Base Free-Flow Speed (BFFS), mi/h | 75.4 | Total Ramp Density (TRD), ramps/mi | 0.80 |
| Lane Width, ft | 12 | Free-Flow Speed (FFS), mi/h | 72.7 |
| Right-Side Lateral Clearance, ft | 6 | | |

## Adjustment Factors

| | | | |
|---|---|---|---|
| Driver Population | Mostly Familiar | Final Speed Adjustment Factor (SAF) | 0.975 |
| Weather Type | Non-Severe Weather | Final Capacity Adjustment Factor (CAF) | 0.968 |
| Incident Type | No Incident | Demand Adjustment Factor (DAF) | 1.000 |

## Demand and Capacity

| | | | |
|---|---|---|---|
| Volume (V), veh/h | 1154 | Heavy Vehicle Adjustment Factor ($f_{HV}$) | 0.971 |
| Peak Hour Factor (PHF) | 0.95 | Flow Rate ($v_p$), pc/h/ln | 626 |
| Total Trucks, % | 3.00 | Capacity (c), pc/h/ln | 2400 |
| Single-Unit Trucks (SUT), % | - | Adjusted Capacity ($c_{adj}$), pc/h/ln | 2323 |
| Tractor-Trailers (TT), % | - | Volume-to-Capacity Ratio (v/c) | 0.27 |
| Passenger Car Equivalent ($E_T$) | 2.000 | | |

## Speed and Density

| | | | |
|---|---|---|---|
| Lane Width Adjustment ($f_{LW}$) | 0.0 | Average Speed (S), mi/h | 70.9 |
| Right-Side Lateral Clearance Adj. ($f_{RLC}$) | 0.0 | Density (D), pc/mi/ln | 8.8 |
| Total Ramp Density Adjustment | 2.7 | Level of Service (LOS) | A |
| Adjusted Free-Flow Speed ($FFS_{adj}$), mi/h | 70.9 | | |




# HCS7 Basic Freeway Report

## Project Information

| | | | |
|---|---|---|---|
| Analyst | W-Trans | Date | 6/9/2017 |
| Agency | | Analysis Year | 2017 |
| Jurisdiction | City of Novato | Time Period Analyzed | AM Peak Cumulative with Project - Westbound |
| Project Description | | | |

## Geometric Data

| | | | |
|---|---|---|---|
| Number of Lanes (N), ln | 2 | Terrain Type | Level |
| Segment Length (L), ft | - | Percent Grade, % | - |
| Measured or Base Free-Flow Speed | Base | Grade Length, mi | - |
| Base Free-Flow Speed (BFFS), mi/h | 75.4 | Total Ramp Density (TRD), ramps/mi | 0.80 |
| Lane Width, ft | 12 | Free-Flow Speed (FFS), mi/h | 72.7 |
| Right-Side Lateral Clearance, ft | 6 | | |

## Adjustment Factors

| | | | |
|---|---|---|---|
| Driver Population | Mostly Familiar | Final Speed Adjustment Factor (SAF) | 0.975 |
| Weather Type | Non-Severe Weather | Final Capacity Adjustment Factor (CAF) | 0.968 |
| Incident Type | No Incident | Demand Adjustment Factor (DAF) | 1.000 |

## Demand and Capacity

| | | | |
|---|---|---|---|
| Volume (V), veh/h | 2585 | Heavy Vehicle Adjustment Factor ($f_{HV}$) | 0.971 |
| Peak Hour Factor (PHF) | 0.95 | Flow Rate ($v_p$), pc/h/ln | 1401 |
| Total Trucks, % | 3.00 | Capacity (c), pc/h/ln | 2400 |
| Single-Unit Trucks (SUT), % | - | Adjusted Capacity ($c_{adj}$), pc/h/ln | 2323 |
| Tractor-Trailers (TT), % | - | Volume-to-Capacity Ratio (v/c) | 0.60 |
| Passenger Car Equivalent ($E_T$) | 2.000 | | |

## Speed and Density

| | | | |
|---|---|---|---|
| Lane Width Adjustment ($f_{LW}$) | 0.0 | Average Speed (S), mi/h | 69.7 |
| Right-Side Lateral Clearance Adj. ($f_{RLC}$) | 0.0 | Density (D), pc/mi/ln | 20.1 |
| Total Ramp Density Adjustment | 2.7 | Level of Service (LOS) | C |
| Adjusted Free-Flow Speed ($FFS_{adj}$), mi/h | 70.9 | | |

## HCS7 Basic Freeway Report

### Project Information

| | | | |
|---|---|---|---|
| Analyst | W-Trans | Date | 6/9/2017 |
| Agency | | Analysis Year | 2017 |
| Jurisdiction | City of Novato | Time Period Analyzed | PM Peak Cumulative with Project - Eastbound |
| Project Description | | | |

### Geometric Data

| | | | |
|---|---|---|---|
| Number of Lanes (N), ln | 2 | Terrain Type | Level |
| Segment Length (L), ft | - | Percent Grade, % | - |
| Measured or Base Free-Flow Speed | Base | Grade Length, mi | - |
| Base Free-Flow Speed (BFFS), mi/h | 75.4 | Total Ramp Density (TRD), ramps/mi | 0.80 |
| Lane Width, ft | 12 | Free-Flow Speed (FFS), mi/h | 72.7 |
| Right-Side Lateral Clearance, ft | 6 | | |

### Adjustment Factors

| | | | |
|---|---|---|---|
| Driver Population | Mostly Familiar | Final Speed Adjustment Factor (SAF) | 0.975 |
| Weather Type | Non-Severe Weather | Final Capacity Adjustment Factor (CAF) | 0.968 |
| Incident Type | No Incident | Demand Adjustment Factor (DAF) | 1.000 |

### Demand and Capacity

| | | | |
|---|---|---|---|
| Volume (V), veh/h | 2761 | Heavy Vehicle Adjustment Factor ($f_{HV}$) | 0.971 |
| Peak Hour Factor (PHF) | 0.95 | Flow Rate ($v_p$), pc/h/ln | 1496 |
| Total Trucks, % | 3.00 | Capacity (c), pc/h/ln | 2400 |
| Single-Unit Trucks (SUT), % | - | Adjusted Capacity ($c_{adj}$), pc/h/ln | 2323 |
| Tractor-Trailers (TT), % | - | Volume-to-Capacity Ratio (v/c) | 0.64 |
| Passenger Car Equivalent ($E_T$) | 2.000 | | |

### Speed and Density

| | | | |
|---|---|---|---|
| Lane Width Adjustment ($f_{LW}$) | 0.0 | Average Speed (S), mi/h | 68.8 |
| Right-Side Lateral Clearance Adj. ($f_{RLC}$) | 0.0 | Density (D), pc/mi/ln | 21.7 |
| Total Ramp Density Adjustment | 2.7 | Level of Service (LOS) | C |
| Adjusted Free-Flow Speed ($FFS_{adj}$), mi/h | 70.9 | | |

## HCS7 Basic Freeway Report

### Project Information

| | | | |
|---|---|---|---|
| Analyst | W-Trans | Date | 6/9/2017 |
| Agency | | Analysis Year | 2017 |
| Jurisdiction | City of Novato | Time Period Analyzed | PM Peak Cumulative with Project - Westbound |
| Project Description | | | |

### Geometric Data

| | | | |
|---|---|---|---|
| Number of Lanes (N), ln | 2 | Terrain Type | Level |
| Segment Length (L), ft | - | Percent Grade, % | - |
| Measured or Base Free-Flow Speed | Base | Grade Length, mi | - |
| Base Free-Flow Speed (BFFS), mi/h | 75.4 | Total Ramp Density (TRD), ramps/mi | 0.80 |
| Lane Width, ft | 12 | Free-Flow Speed (FFS), mi/h | 72.7 |
| Right-Side Lateral Clearance, ft | 6 | | |

### Adjustment Factors

| | | | |
|---|---|---|---|
| Driver Population | Mostly Familiar | Final Speed Adjustment Factor (SAF) | 0.975 |
| Weather Type | Non-Severe Weather | Final Capacity Adjustment Factor (CAF) | 0.968 |
| Incident Type | No Incident | Demand Adjustment Factor (DAF) | 1.000 |

### Demand and Capacity

| | | | |
|---|---|---|---|
| Volume (V), veh/h | 1479 | Heavy Vehicle Adjustment Factor ($f_{HV}$) | 0.971 |
| Peak Hour Factor (PHF) | 0.95 | Flow Rate ($v_p$), pc/h/ln | 802 |
| Total Trucks, % | 3.00 | Capacity (c), pc/h/ln | 2400 |
| Single-Unit Trucks (SUT), % | - | Adjusted Capacity ($c_{adj}$), pc/h/ln | 2323 |
| Tractor-Trailers (TT), % | - | Volume-to-Capacity Ratio (v/c) | 0.35 |
| Passenger Car Equivalent ($E_T$) | 2.000 | | |

### Speed and Density

| | | | |
|---|---|---|---|
| Lane Width Adjustment ($f_{LW}$) | 0.0 | Average Speed (S), mi/h | 70.9 |
| Right-Side Lateral Clearance Adj. ($f_{RLC}$) | 0.0 | Density (D), pc/mi/ln | 11.3 |
| Total Ramp Density Adjustment | 2.7 | Level of Service (LOS) | B |
| Adjusted Free-Flow Speed ($FFS_{adj}$), mi/h | 70.9 | | |

# Project Alternative Intersection Level of Service Calculations

| Intersection | |
|---|---|
| Intersection Delay, s/veh | 45.9 |
| Intersection LOS | E |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 15 | 527 | 129 | 191 | 458 | 9 | 113 | 12 | 315 | 29 | 13 | 15 |
| Future Vol, veh/h | 15 | 527 | 129 | 191 | 458 | 9 | 113 | 12 | 315 | 29 | 13 | 15 |
| Peak Hour Factor | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| Heavy Vehicles, % | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Mvmt Flow | 16 | 567 | 139 | 205 | 492 | 10 | 122 | 13 | 339 | 31 | 14 | 16 |
| Number of Lanes | 1 | 2 | 0 | 1 | 2 | 0 | 0 | 1 | 1 | 0 | 1 | 0 |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Opposing Approach | WB | EB | SB | NB |
| Opposing Lanes | 3 | 3 | 1 | 2 |
| Conflicting Approach Left | SB | NB | EB | WB |
| Conflicting Lanes Left | 1 | 2 | 3 | 3 |
| Conflicting Approach Right | NB | SB | WB | EB |
| Conflicting Lanes Right | 2 | 1 | 3 | 3 |
| HCM Control Delay | 61.5 | 34.4 | 42.9 | 17.2 |
| HCM LOS | F | D | E | C |

| Lane | NBLn1 | NBLn2 | EBLn1 | EBLn2 | EBLn3 | WBLn1 | WBLn2 | WBLn3 | SBLn1 |
|---|---|---|---|---|---|---|---|---|---|
| Vol Left, % | 90% | 0% | 100% | 0% | 0% | 100% | 0% | 0% | 51% |
| Vol Thru, % | 10% | 0% | 0% | 100% | 58% | 0% | 100% | 94% | 23% |
| Vol Right, % | 0% | 100% | 0% | 0% | 42% | 0% | 0% | 6% | 26% |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 125 | 315 | 15 | 351 | 305 | 191 | 305 | 162 | 57 |
| LT Vol | 113 | 0 | 15 | 0 | 0 | 191 | 0 | 0 | 29 |
| Through Vol | 12 | 0 | 0 | 351 | 176 | 0 | 305 | 153 | 13 |
| RT Vol | 0 | 315 | 0 | 0 | 129 | 0 | 0 | 9 | 15 |
| Lane Flow Rate | 134 | 339 | 16 | 378 | 328 | 205 | 328 | 174 | 61 |
| Geometry Grp | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Degree of Util (X) | 0.394 | 0.883 | 0.045 | 1 | 0.839 | 0.569 | 0.861 | 0.454 | 0.2 |
| Departure Headway (Hd) | 10.559 | 9.38 | 10.054 | 9.532 | 9.223 | 9.797 | 9.294 | 9.254 | 11.637 |
| Convergence, Y/N | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Cap | 345 | 390 | 357 | 382 | 393 | 370 | 391 | 391 | 310 |
| Service Time | 8.187 | 7.045 | 7.777 | 7.255 | 6.946 | 7.497 | 6.994 | 6.954 | 9.337 |
| HCM Lane V/C Ratio | 0.388 | 0.869 | 0.045 | 0.99 | 0.835 | 0.554 | 0.839 | 0.445 | 0.197 |
| HCM Control Delay | 19.8 | 52.1 | 13.3 | 77.8 | 45 | 24.7 | 48.4 | 19.4 | 17.2 |
| HCM Lane LOS | C | F | B | F | E | C | E | C | C |
| HCM 95th-tile Q | 1.8 | 8.8 | 0.1 | 11.9 | 7.8 | 3.4 | 8.3 | 2.3 | 0.7 |



# MOVEMENT SUMMARY

## Site: 1 [AM E+P Alt]

Simmons Lane/San Marin Drive
AM Existing plus Project Alternative

Roundabout

**Movement Performance - Vehicles**

| Mov ID | OD Mov | Demand Flows Total veh/h | Demand Flows HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance ft | Prop. Queued | Effective Stop Rate per veh | Average Speed mph |
|---|---|---|---|---|---|---|---|---|---|---|---|
| South: NB Simmons Ln | | | | | | | | | | | |
| 3 | L2 | 122 | 2.0 | 0.662 | 17.7 | LOS B | 5.1 | 129.3 | 0.83 | 0.96 | 28.6 |
| 8 | T1 | 13 | 2.0 | 0.662 | 17.7 | LOS B | 5.1 | 129.3 | 0.83 | 0.96 | 28.6 |
| 18 | R2 | 339 | 2.0 | 0.662 | 17.7 | LOS B | 5.1 | 129.3 | 0.83 | 0.96 | 28.0 |
| Approach | | 473 | 2.0 | 0.662 | 17.7 | LOS B | 5.1 | 129.3 | 0.83 | 0.96 | 28.2 |
| East: WB San Marin Drive | | | | | | | | | | | |
| 1 | L2 | 205 | 2.0 | 0.170 | 4.4 | LOS A | 0.7 | 18.7 | 0.30 | 0.17 | 32.6 |
| 6 | T1 | 492 | 2.0 | 0.415 | 7.1 | LOS A | 2.4 | 60.6 | 0.39 | 0.25 | 33.7 |
| 16 | R2 | 10 | 2.0 | 0.415 | 7.1 | LOS A | 2.4 | 60.6 | 0.39 | 0.25 | 32.8 |
| Approach | | 708 | 2.0 | 0.415 | 6.4 | LOS A | 2.4 | 60.6 | 0.36 | 0.23 | 33.4 |
| North: SB Simmons Ln | | | | | | | | | | | |
| 7 | L2 | 31 | 2.0 | 0.090 | 6.2 | LOS A | 0.3 | 7.8 | 0.57 | 0.56 | 32.9 |
| 4 | T1 | 14 | 2.0 | 0.090 | 6.2 | LOS A | 0.3 | 7.8 | 0.57 | 0.56 | 32.9 |
| 14 | R2 | 16 | 2.0 | 0.090 | 6.2 | LOS A | 0.3 | 7.8 | 0.57 | 0.56 | 32.1 |
| Approach | | 61 | 2.0 | 0.090 | 6.2 | LOS A | 0.3 | 7.8 | 0.57 | 0.56 | 32.7 |
| West: EB San Marin Drive | | | | | | | | | | | |
| 5 | L2 | 16 | 2.0 | 0.692 | 14.3 | LOS B | 7.1 | 179.4 | 0.76 | 0.68 | 30.5 |
| 2 | T1 | 567 | 2.0 | 0.692 | 14.3 | LOS B | 7.1 | 179.4 | 0.76 | 0.68 | 30.5 |
| 12 | R2 | 139 | 2.0 | 0.692 | 14.3 | LOS B | 7.1 | 179.4 | 0.76 | 0.68 | 29.8 |
| Approach | | 722 | 2.0 | 0.692 | 14.3 | LOS B | 7.1 | 179.4 | 0.76 | 0.68 | 30.4 |
| All Vehicles | | 1963 | 2.0 | 0.692 | 12.0 | LOS B | 7.1 | 179.4 | 0.63 | 0.58 | 30.9 |

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

## LANE SUMMARY

**Site: 1 [AM E+P Alt]**

Simmons Lane/San Marin Drive
AM Existing plus Project Alternative

Roundabout

**Lane Use and Performance**

| | Demand Flows Total veh/h | Demand Flows HV % | Cap. veh/h | Deg. Satn v/c | Lane Util. % | Average Delay sec | Level of Service | 95% Back of Queue Veh | 95% Back of Queue Dist ft | Lane Config | Lane Length ft | Cap. Adj. % | Prob. Block. % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| South: NB Simmons Ln | | | | | | | | | | | | | |
| Lane 1[d] | 473 | 2.0 | 714 | 0.662 | 100 | 17.7 | LOS B | 5.1 | 129.3 | Full | 1600 | 0.0 | 0.0 |
| Approach | 473 | 2.0 | | 0.662 | | 17.7 | LOS B | 5.1 | 129.3 | | | | |
| East: WB San Marin Drive | | | | | | | | | | | | | |
| Lane 1 | 205 | 2.0 | 1211 | 0.170 | 100 | 4.4 | LOS A | 0.7 | 18.7 | Short | 100 | 0.0 | NA |
| Lane 2[d] | 502 | 2.0 | 1211 | 0.415 | 100 | 7.1 | LOS A | 2.4 | 60.6 | Full | 1600 | 0.0 | 0.0 |
| Approach | 708 | 2.0 | | 0.415 | | 6.4 | LOS A | 2.4 | 60.6 | | | | |
| North: SB Simmons Ln | | | | | | | | | | | | | |
| Lane 1[d] | 61 | 2.0 | 684 | 0.090 | 100 | 6.2 | LOS A | 0.3 | 7.8 | Full | 1600 | 0.0 | 0.0 |
| Approach | 61 | 2.0 | | 0.090 | | 6.2 | LOS A | 0.3 | 7.8 | | | | |
| West: EB San Marin Drive | | | | | | | | | | | | | |
| Lane 1[d] | 722 | 2.0 | 1043 | 0.692 | 100 | 14.3 | LOS B | 7.1 | 179.4 | Full | 1600 | 0.0 | 0.0 |
| Approach | 722 | 2.0 | | 0.692 | | 14.3 | LOS B | 7.1 | 179.4 | | | | |
| Intersection | 1963 | 2.0 | | 0.692 | | 12.0 | LOS B | 7.1 | 179.4 | | | | |

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach


Organisation: W-TRANS | Processed: Tuesday, June 13, 2017 3:12:45 PM
Project: N:\AAA\MAX\NOV\126NOV\SIDRA\Simmons-San Marin.sip7



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 15 | 527 | 129 | 191 | 458 | 9 | 113 | 12 | 315 | 29 | 13 | 15 |
| Future Volume (vph) | 15 | 527 | 129 | 191 | 458 | 9 | 113 | 12 | 315 | 29 | 13 | 15 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | | 4.0 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | | 1.00 | 0.85 | | 0.96 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 0.96 | 1.00 | | 0.98 | |
| Satd. Flow (prot) | 1787 | 1881 | 1599 | 1787 | 1881 | 1599 | | 1800 | 1599 | | 1770 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 0.77 | 1.00 | | 0.83 | |
| Satd. Flow (perm) | 1787 | 1881 | 1599 | 1787 | 1881 | 1599 | | 1445 | 1599 | | 1498 | |
| Peak-hour factor, PHF | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| Adj. Flow (vph) | 16 | 567 | 139 | 205 | 492 | 10 | 122 | 13 | 339 | 31 | 14 | 16 |
| RTOR Reduction (vph) | 0 | 0 | 62 | 0 | 0 | 4 | 0 | 0 | 104 | 0 | 13 | 0 |
| Lane Group Flow (vph) | 16 | 567 | 77 | 205 | 492 | 6 | 0 | 135 | 235 | 0 | 48 | 0 |
| Heavy Vehicles (%) | 1% | 1% | 1% | 1% | 1% | 1% | 1% | 1% | 1% | 1% | 1% | 1% |
| Turn Type | Prot | NA | Perm | Prot | NA | Perm | Perm | NA | pm+ov | Perm | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | | 2 | 3 | | 6 | |
| Permitted Phases | | | 4 | | | 8 | 2 | | 2 | 6 | | |
| Actuated Green, G (s) | 0.6 | 28.4 | 28.4 | 12.7 | 40.5 | 40.5 | | 13.1 | 25.8 | | 13.1 | |
| Effective Green, g (s) | 0.6 | 28.4 | 28.4 | 12.7 | 40.5 | 40.5 | | 13.1 | 25.8 | | 13.1 | |
| Actuated g/C Ratio | 0.01 | 0.43 | 0.43 | 0.19 | 0.61 | 0.61 | | 0.20 | 0.39 | | 0.20 | |
| Clearance Time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | | 4.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | |
| Lane Grp Cap (vph) | 16 | 806 | 685 | 342 | 1150 | 978 | | 285 | 719 | | 296 | |
| v/s Ratio Prot | 0.01 | c0.30 | | c0.11 | 0.26 | | | | c0.06 | | | |
| v/s Ratio Perm | | | 0.05 | | | 0.00 | | c0.09 | 0.08 | | 0.03 | |
| v/c Ratio | 1.00 | 0.70 | 0.11 | 0.60 | 0.43 | 0.01 | | 0.47 | 0.33 | | 0.16 | |
| Uniform Delay, d1 | 32.8 | 15.5 | 11.3 | 24.4 | 6.8 | 5.0 | | 23.5 | 14.1 | | 22.0 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | |
| Incremental Delay, d2 | 225.0 | 2.8 | 0.1 | 2.8 | 0.3 | 0.0 | | 1.2 | 0.3 | | 0.3 | |
| Delay (s) | 257.8 | 18.3 | 11.4 | 27.2 | 7.0 | 5.0 | | 24.7 | 14.4 | | 22.3 | |
| Level of Service | F | B | B | C | A | A | | C | B | | C | |
| Approach Delay (s) | | 22.2 | | | 12.9 | | | 17.3 | | | 22.3 | |
| Approach LOS | | C | | | B | | | B | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 17.7 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.63 | | |
| Actuated Cycle Length (s) | 66.2 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 60.6% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 2: W Campus Dr & San Marin Dr

11/22/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 13 | 890 | 2 | 2 | 669 | 77 | 1 | 0 | 4 | 8 | 0 | 1 |
| Future Volume (vph) | 13 | 890 | 2 | 2 | 669 | 77 | 1 | 0 | 4 | 8 | 0 | 1 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.8 | | 4.0 | 4.8 | 4.8 | | 4.0 | | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 | | 1.00 | | 0.95 | 0.95 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | | 1.00 | 1.00 | 0.85 | | 0.89 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | | 0.99 | | 0.95 | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 3573 | | 1805 | 3574 | 1615 | | 1678 | | 1715 | 1715 | 1615 |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1805 | 3573 | | 1805 | 3574 | 1615 | | 1695 | | 1805 | 1805 | 1615 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 14 | 967 | 2 | 2 | 727 | 84 | 1 | 0 | 4 | 9 | 0 | 1 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 39 | 0 | 5 | 0 | 0 | 0 | 1 |
| Lane Group Flow (vph) | 14 | 969 | 0 | 2 | 727 | 45 | 0 | 0 | 0 | 4 | 5 | 0 |
| Confl. Peds. (#/hr) | | | 2 | | | | | | | | | |
| Heavy Vehicles (%) | 0% | 1% | 0% | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Prot | NA | | Prot | NA | Perm | Perm | NA | | Perm | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | | | | 6 | 8 | | | 4 | | 4 |
| Actuated Green, G (s) | 0.8 | 16.4 | | 0.7 | 16.3 | 16.3 | | 0.8 | | 0.8 | 0.8 | 0.8 |
| Effective Green, g (s) | 0.8 | 16.4 | | 0.7 | 16.3 | 16.3 | | 0.8 | | 0.8 | 0.8 | 0.8 |
| Actuated g/C Ratio | 0.03 | 0.53 | | 0.02 | 0.53 | 0.53 | | 0.03 | | 0.03 | 0.03 | 0.03 |
| Clearance Time (s) | 4.0 | 4.8 | | 4.0 | 4.8 | 4.8 | | 4.0 | | 4.0 | 4.0 | 4.0 |
| Vehicle Extension (s) | 2.0 | 4.0 | | 2.0 | 4.0 | 4.0 | | 2.0 | | 2.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 47 | 1908 | | 41 | 1897 | 857 | | 44 | | 47 | 47 | 42 |
| v/s Ratio Prot | c0.01 | c0.27 | | 0.00 | 0.20 | | | | | | | |
| v/s Ratio Perm | | | | | | 0.03 | | 0.00 | | 0.00 | c0.00 | 0.00 |
| v/c Ratio | 0.30 | 0.51 | | 0.05 | 0.38 | 0.05 | | 0.00 | | 0.09 | 0.11 | 0.00 |
| Uniform Delay, d1 | 14.7 | 4.6 | | 14.7 | 4.2 | 3.5 | | 14.6 | | 14.6 | 14.6 | 14.6 |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 1.3 | 0.3 | | 0.2 | 0.2 | 0.0 | | 0.0 | | 0.3 | 0.4 | 0.0 |
| Delay (s) | 16.0 | 4.9 | | 14.9 | 4.4 | 3.5 | | 14.6 | | 14.9 | 15.0 | 14.6 |
| Level of Service | B | A | | B | A | A | | B | | B | B | B |
| Approach Delay (s) | | 5.0 | | | 4.3 | | | 14.6 | | | 14.9 | |
| Approach LOS | | A | | | A | | | B | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 4.8 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.48 | | |
| Actuated Cycle Length (s) | 30.7 | Sum of lost time (s) | 12.8 |
| Intersection Capacity Utilization | 45.8% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 3: San Marin Dr & E Campus Drive

11/22/2017

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 0 | 903 | 747 | 20 | 11 | 0 |
| Future Volume (vph) | 0 | 903 | 747 | 20 | 11 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.3 | 4.3 | 4.3 | 3.0 | |
| Lane Util. Factor | | 0.95 | 0.95 | 1.00 | 0.97 | |
| Frpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | | 1.00 | 1.00 | 0.85 | 1.00 | |
| Flt Protected | | 1.00 | 1.00 | 1.00 | 0.95 | |
| Satd. Flow (prot) | | 3574 | 3574 | 1615 | 3502 | |
| Flt Permitted | | 1.00 | 1.00 | 1.00 | 0.95 | |
| Satd. Flow (perm) | | 3574 | 3574 | 1615 | 3502 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 0 | 982 | 812 | 22 | 12 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 3 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 982 | 812 | 19 | 12 | 0 |
| Confl. Peds. (#/hr) | | | | | | 1 |
| Heavy Vehicles (%) | 0% | 1% | 1% | 0% | 0% | 0% |
| Turn Type | Prot | NA | NA | Perm | Perm | Perm |
| Protected Phases | 5 | 2 | 6 | | | |
| Permitted Phases | | | | 6 | 4 | 4 |
| Actuated Green, G (s) | | 115.1 | 115.1 | 115.1 | 7.6 | |
| Effective Green, g (s) | | 115.1 | 115.1 | 115.1 | 7.6 | |
| Actuated g/C Ratio | | 0.89 | 0.89 | 0.89 | 0.06 | |
| Clearance Time (s) | | 4.3 | 4.3 | 4.3 | 3.0 | |
| Vehicle Extension (s) | | 4.0 | 4.0 | 4.0 | 2.0 | |
| Lane Grp Cap (vph) | | 3164 | 3164 | 1429 | 204 | |
| v/s Ratio Prot | | c0.27 | 0.23 | | | |
| v/s Ratio Perm | | | | 0.01 | c0.00 | |
| v/c Ratio | | 0.31 | 0.26 | 0.01 | 0.06 | |
| Uniform Delay, d1 | | 1.2 | 1.1 | 0.9 | 57.8 | |
| Progression Factor | | 1.00 | 0.91 | 1.09 | 1.00 | |
| Incremental Delay, d2 | | 0.3 | 0.1 | 0.0 | 0.0 | |
| Delay (s) | | 1.4 | 1.1 | 0.9 | 57.9 | |
| Level of Service | | A | A | A | E | |
| Approach Delay (s) | | 1.4 | 1.1 | | 57.9 | |
| Approach LOS | | A | A | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 1.6 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.30 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 10.3 |
| Intersection Capacity Utilization | 37.6% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 67 | 686 | 165 | 352 | 589 | 670 | 134 | 133 | 302 | 167 | 58 | 43 |
| Future Volume (vph) | 67 | 686 | 165 | 352 | 589 | 670 | 134 | 133 | 302 | 167 | 58 | 43 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.6 | | 3.0 | 4.0 | | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 | |
| Lane Util. Factor | 1.00 | 0.91 | | 1.00 | 0.91 | | 0.97 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 0.99 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 0.97 | | 1.00 | 0.92 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.94 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1787 | 4971 | | 1752 | 4726 | | 3467 | 1881 | 1568 | 1787 | 1748 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1787 | 4971 | | 1752 | 4726 | | 3467 | 1881 | 1568 | 1787 | 1748 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 71 | 722 | 174 | 371 | 620 | 705 | 141 | 140 | 318 | 176 | 61 | 45 |
| RTOR Reduction (vph) | 0 | 31 | 0 | 0 | 115 | 0 | 0 | 0 | 283 | 0 | 23 | 0 |
| Lane Group Flow (vph) | 71 | 865 | 0 | 371 | 1210 | 0 | 141 | 140 | 35 | 176 | 83 | 0 |
| Confl. Peds. (#/hr) | | | 4 | | | | | | | | | 5 |
| Confl. Bikes (#/hr) | | | | | | | | | | | | 1 |
| Heavy Vehicles (%) | 1% | 1% | 1% | 3% | 1% | 1% | 1% | 1% | 3% | 1% | 1% | 1% |
| Turn Type | Prot | NA | | Prot | NA | | Split | NA | Perm | Split | NA | |
| Protected Phases | 1 | 6 | | 5 | 2 | | 7 | 7 | | 8 | 8 | |
| Permitted Phases | | | | | 2 | | | | 7 | | | |
| Actuated Green, G (s) | 8.2 | 44.8 | | 36.5 | 72.7 | | 14.4 | 14.4 | 14.4 | 19.1 | 19.1 | |
| Effective Green, g (s) | 8.2 | 44.8 | | 36.5 | 72.7 | | 14.4 | 14.4 | 14.4 | 19.1 | 19.1 | |
| Actuated g/C Ratio | 0.06 | 0.34 | | 0.28 | 0.56 | | 0.11 | 0.11 | 0.11 | 0.15 | 0.15 | |
| Clearance Time (s) | 3.0 | 3.6 | | 3.0 | 4.0 | | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 | |
| Vehicle Extension (s) | 2.0 | 4.0 | | 5.0 | 4.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 112 | 1713 | | 491 | 2642 | | 384 | 208 | 173 | 262 | 256 | |
| v/s Ratio Prot | 0.04 | c0.17 | | c0.21 | 0.26 | | 0.04 | c0.07 | | c0.10 | 0.05 | |
| v/s Ratio Perm | | | | | | | | | 0.02 | | | |
| v/c Ratio | 0.63 | 0.50 | | 0.76 | 0.46 | | 0.37 | 0.67 | 0.20 | 0.67 | 0.32 | |
| Uniform Delay, d1 | 59.4 | 33.8 | | 42.7 | 17.0 | | 53.6 | 55.5 | 52.6 | 52.5 | 49.7 | |
| Progression Factor | 1.15 | 0.93 | | 1.05 | 1.07 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 8.1 | 1.0 | | 6.5 | 0.5 | | 0.2 | 6.6 | 0.2 | 5.2 | 0.3 | |
| Delay (s) | 76.6 | 32.5 | | 51.4 | 18.7 | | 53.8 | 62.1 | 52.8 | 57.7 | 49.9 | |
| Level of Service | E | C | | D | B | | D | E | D | E | D | |
| Approach Delay (s) | | 35.7 | | | 25.8 | | | 55.2 | | | 54.8 | |
| Approach LOS | | D | | | C | | | E | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 35.8 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.63 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 15.6 |
| Intersection Capacity Utilization | 90.9% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |





| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 67 | 686 | 165 | 352 | 589 | 670 | 134 | 133 | 302 | 167 | 58 | 43 |
| Future Volume (vph) | 67 | 686 | 165 | 352 | 589 | 670 | 134 | 133 | 302 | 167 | 58 | 43 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.6 | | 3.0 | 4.0 | 4.3 | 4.3 | 4.3 | 3.0 | 4.3 | 4.3 | |
| Lane Util. Factor | 1.00 | 0.91 | | 0.97 | 0.95 | 1.00 | 0.95 | 0.95 | 0.88 | 0.91 | 0.91 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 0.97 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.96 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.98 | |
| Satd. Flow (prot) | 1787 | 4971 | | 3400 | 3574 | 1599 | 1698 | 1779 | 2760 | 1626 | 3216 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.98 | |
| Satd. Flow (perm) | 1787 | 4971 | | 3400 | 3574 | 1599 | 1698 | 1779 | 2760 | 1626 | 3216 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 71 | 722 | 174 | 371 | 620 | 705 | 141 | 140 | 318 | 176 | 61 | 45 |
| RTOR Reduction (vph) | 0 | 27 | 0 | 0 | 0 | 83 | 0 | 0 | 222 | 0 | 28 | 0 |
| Lane Group Flow (vph) | 71 | 869 | 0 | 371 | 620 | 622 | 127 | 154 | 96 | 95 | 159 | 0 |
| Confl. Peds. (#/hr) | | | 4 | | | | | | | | | 5 |
| Confl. Bikes (#/hr) | | | | | | | | | | | | 1 |
| Heavy Vehicles (%) | 1% | 1% | 1% | 3% | 1% | 1% | 1% | 1% | 3% | 1% | 1% | 1% |
| Turn Type | Prot | NA | | Prot | NA | pm+ov | Split | NA | pm+ov | Split | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | 4 | 8 | 8 | 1 | 4 | 4 | |
| Permitted Phases | | | | | | 6 | | | 8 | | | |
| Actuated Green, G (s) | 8.8 | 55.1 | | 24.0 | 69.9 | 88.9 | 14.7 | 14.7 | 38.7 | 19.0 | 19.0 | |
| Effective Green, g (s) | 8.8 | 55.1 | | 24.0 | 69.9 | 88.9 | 14.7 | 14.7 | 38.7 | 19.0 | 19.0 | |
| Actuated g/C Ratio | 0.07 | 0.43 | | 0.19 | 0.55 | 0.69 | 0.11 | 0.11 | 0.30 | 0.15 | 0.15 | |
| Clearance Time (s) | 3.0 | 3.6 | | 3.0 | 4.0 | 4.3 | 4.3 | 4.3 | 3.0 | 4.3 | 4.3 | |
| Vehicle Extension (s) | 2.0 | 4.0 | | 5.0 | 4.0 | 2.0 | 2.0 | 2.0 | 5.0 | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 122 | 2139 | | 637 | 1951 | 1110 | 195 | 204 | 834 | 241 | 477 | |
| v/s Ratio Prot | c0.04 | 0.17 | | c0.11 | 0.17 | c0.08 | 0.07 | c0.09 | 0.02 | 0.06 | 0.05 | |
| v/s Ratio Perm | | | | | | 0.31 | | | 0.01 | | | |
| v/c Ratio | 0.58 | 0.41 | | 0.58 | 0.32 | 0.56 | 0.65 | 0.75 | 0.12 | 0.39 | 0.33 | |
| Uniform Delay, d1 | 57.8 | 25.2 | | 47.4 | 16.0 | 9.8 | 54.2 | 54.9 | 32.3 | 49.3 | 48.8 | |
| Progression Factor | 1.00 | 1.00 | | 1.03 | 0.58 | 0.70 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 4.5 | 0.6 | | 1.8 | 0.4 | 0.3 | 5.8 | 13.1 | 0.1 | 0.4 | 0.2 | |
| Delay (s) | 62.3 | 25.7 | | 50.7 | 9.6 | 7.1 | 60.0 | 68.0 | 32.4 | 49.7 | 49.0 | |
| Level of Service | E | C | | D | A | A | E | E | C | D | D | |
| Approach Delay (s) | | 28.4 | | | 17.6 | | | 47.4 | | | 49.2 | |
| Approach LOS | | C | | | B | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 28.1 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.59 | | |
| Actuated Cycle Length (s) | 128.0 | Sum of lost time (s) | 15.6 |
| Intersection Capacity Utilization | 81.4% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 5: US 101 SB Ramps & San Marin Dr


| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 655 | 502 | 126 | 1032 | 0 | 0 | 0 | 0 | 92 | 1 | 579 |
| Future Volume (vph) | 0 | 655 | 502 | 126 | 1032 | 0 | 0 | 0 | 0 | 92 | 1 | 579 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.9 | 4.9 | 3.0 | 5.3 | | | | | | 4.0 | 4.0 |
| Lane Util. Factor | | 0.95 | 1.00 | 1.00 | 0.95 | | | | | | 1.00 | 0.88 |
| Frpb, ped/bikes | | 1.00 | 0.99 | 1.00 | 1.00 | | | | | | 1.00 | 1.00 |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | | | | | 1.00 | 1.00 |
| Frt | | 1.00 | 0.85 | 1.00 | 1.00 | | | | | | 1.00 | 0.85 |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | | 0.95 | 1.00 |
| Satd. Flow (prot) | | 3574 | 1575 | 1805 | 3574 | | | | | | 1810 | 2814 |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | | 0.95 | 1.00 |
| Satd. Flow (perm) | | 3574 | 1575 | 1805 | 3574 | | | | | | 1810 | 2814 |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 0 | 697 | 534 | 134 | 1098 | 0 | 0 | 0 | 0 | 98 | 1 | 616 |
| RTOR Reduction (vph) | 0 | 0 | 270 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 129 |
| Lane Group Flow (vph) | 0 | 697 | 264 | 134 | 1098 | 0 | 0 | 0 | 0 | 0 | 99 | 487 |
| Confl. Peds. (#/hr) | | | 4 | | | | | | | | | |
| Heavy Vehicles (%) | 0% | 1% | 1% | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 1% |
| Turn Type | | NA | Perm | Prot | NA | | | | | Split | NA | Perm |
| Protected Phases | | 2 | | 1 | 6 | | | | | 4 | 4 | |
| Permitted Phases | | | 2 | | | | | | | | | 4 |
| Actuated Green, G (s) | | 32.1 | 32.1 | 6.6 | 41.3 | | | | | | 14.4 | 14.4 |
| Effective Green, g (s) | | 32.1 | 32.1 | 6.6 | 41.3 | | | | | | 14.4 | 14.4 |
| Actuated g/C Ratio | | 0.49 | 0.49 | 0.10 | 0.64 | | | | | | 0.22 | 0.22 |
| Clearance Time (s) | | 4.9 | 4.9 | 3.0 | 5.3 | | | | | | 4.0 | 4.0 |
| Vehicle Extension (s) | | 4.0 | 4.0 | 2.0 | 4.0 | | | | | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | | 1765 | 777 | 183 | 2270 | | | | | | 400 | 623 |
| v/s Ratio Prot | | 0.20 | | c0.07 | c0.31 | | | | | | 0.05 | |
| v/s Ratio Perm | | | 0.17 | | | | | | | | | c0.17 |
| v/c Ratio | | 0.39 | 0.34 | 0.73 | 0.48 | | | | | | 0.25 | 0.78 |
| Uniform Delay, d1 | | 10.3 | 10.0 | 28.3 | 6.2 | | | | | | 20.8 | 23.8 |
| Progression Factor | | 0.46 | 1.52 | 1.00 | 1.00 | | | | | | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.6 | 1.0 | 12.2 | 0.7 | | | | | | 0.1 | 5.8 |
| Delay (s) | | 5.3 | 16.2 | 40.6 | 7.0 | | | | | | 21.0 | 29.7 |
| Level of Service | | A | B | D | A | | | | | | C | C |
| Approach Delay (s) | | 10.1 | | | 10.6 | | | 0.0 | | | 28.5 | |
| Approach LOS | | B | | | B | | | A | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 14.4 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.61 | | |
| Actuated Cycle Length (s) | 65.0 | Sum of lost time (s) | 11.9 |
| Intersection Capacity Utilization | 58.2% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 6: US 101 NB Ramps & San Marin Dr


| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 380 | 364 | 0 | 0 | 485 | 86 | 668 | 0 | 152 | 0 | 0 | 0 |
| Future Volume (vph) | 380 | 364 | 0 | 0 | 485 | 86 | 668 | 0 | 152 | 0 | 0 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.6 | | | 4.9 | 4.9 | 3.5 | 3.5 | | | | |
| Lane Util. Factor | 0.97 | 1.00 | | | 0.95 | 1.00 | 0.95 | 0.95 | | | | |
| Frpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | 0.99 | 1.00 | 0.99 | | | | |
| Flpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | | | |
| Frt | 1.00 | 1.00 | | | 1.00 | 0.85 | 1.00 | 0.94 | | | | |
| Flt Protected | 0.95 | 1.00 | | | 1.00 | 1.00 | 0.95 | 0.97 | | | | |
| Satd. Flow (prot) | 3467 | 1881 | | | 3574 | 1594 | 1681 | 1599 | | | | |
| Flt Permitted | 0.95 | 1.00 | | | 1.00 | 1.00 | 0.95 | 0.97 | | | | |
| Satd. Flow (perm) | 3467 | 1881 | | | 3574 | 1594 | 1681 | 1599 | | | | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 400 | 383 | 0 | 0 | 511 | 91 | 703 | 0 | 160 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 68 | 0 | 60 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 400 | 383 | 0 | 0 | 511 | 23 | 443 | 361 | 0 | 0 | 0 | 0 |
| Confl. Peds. (#/hr) | | | 3 | | | 1 | | | 1 | 1 | | |
| Heavy Vehicles (%) | 1% | 1% | 0% | 0% | 1% | 0% | 2% | 0% | 3% | 0% | 0% | 0% |
| Turn Type | Prot | NA | | | NA | Perm | Split | NA | | | | |
| Protected Phases | 5 | 2 | | | 6 | | 8 | 8 | | | | |
| Permitted Phases | | | | | | 6 | | | | | | |
| Actuated Green, G (s) | 10.2 | 27.6 | | | 13.6 | 13.6 | 18.9 | 18.9 | | | | |
| Effective Green, g (s) | 10.2 | 27.6 | | | 13.6 | 13.6 | 18.9 | 18.9 | | | | |
| Actuated g/C Ratio | 0.19 | 0.51 | | | 0.25 | 0.25 | 0.35 | 0.35 | | | | |
| Clearance Time (s) | 3.5 | 4.6 | | | 4.9 | 4.9 | 3.5 | 3.5 | | | | |
| Vehicle Extension (s) | 2.0 | 4.0 | | | 4.0 | 4.0 | 2.5 | 2.5 | | | | |
| Lane Grp Cap (vph) | 647 | 950 | | | 890 | 397 | 581 | 553 | | | | |
| v/s Ratio Prot | c0.12 | 0.20 | | | c0.14 | | c0.26 | 0.23 | | | | |
| v/s Ratio Perm | | | | | | 0.01 | | | | | | |
| v/c Ratio | 0.62 | 0.40 | | | 0.57 | 0.06 | 0.76 | 0.65 | | | | |
| Uniform Delay, d1 | 20.4 | 8.4 | | | 18.0 | 15.6 | 15.9 | 15.1 | | | | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | | | |
| Incremental Delay, d2 | 1.2 | 0.4 | | | 1.1 | 0.1 | 5.6 | 2.5 | | | | |
| Delay (s) | 21.7 | 8.8 | | | 19.0 | 15.7 | 21.5 | 17.5 | | | | |
| Level of Service | C | A | | | B | B | C | B | | | | |
| Approach Delay (s) | | 15.4 | | | 18.5 | | | 19.6 | | | 0.0 | |
| Approach LOS | | B | | | B | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 17.8 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.67 | | |
| Actuated Cycle Length (s) | 54.6 | Sum of lost time (s) | 11.9 |
| Intersection Capacity Utilization | 58.2% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 7: Redwood Blvd & Olive St

11/22/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 102 | 95 | 32 | 137 | 126 | 107 | 17 | 408 | 132 | 149 | 390 | 77 |
| Future Volume (vph) | 102 | 95 | 32 | 137 | 126 | 107 | 17 | 408 | 132 | 149 | 390 | 77 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 5.1 | 5.1 | | | 5.1 | | 4.0 | 3.9 | 3.9 | 4.0 | 3.9 | |
| Lane Util. Factor | 1.00 | 1.00 | | | 1.00 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | |
| Frt | 1.00 | 0.96 | | | 0.96 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.98 | |
| Flt Protected | 0.95 | 1.00 | | | 0.98 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1770 | 1792 | | | 1758 | | 1770 | 3539 | 1583 | 1770 | 3451 | |
| Flt Permitted | 0.95 | 1.00 | | | 0.98 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1770 | 1792 | | | 1758 | | 1770 | 3539 | 1583 | 1770 | 3451 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 111 | 103 | 35 | 149 | 137 | 116 | 18 | 443 | 143 | 162 | 424 | 84 |
| RTOR Reduction (vph) | 0 | 13 | 0 | 0 | 12 | 0 | 0 | 0 | 106 | 0 | 14 | 0 |
| Lane Group Flow (vph) | 111 | 125 | 0 | 0 | 390 | 0 | 18 | 443 | 37 | 162 | 494 | 0 |
| Turn Type | Split | NA | | Split | NA | | Prot | NA | Perm | Prot | NA | |
| Protected Phases | 4 | 4 | | 8 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | | | | | | | 2 | | | |
| Actuated Green, G (s) | 11.6 | 11.6 | | | 23.8 | | 1.5 | 18.0 | 18.0 | 11.6 | 28.1 | |
| Effective Green, g (s) | 11.6 | 11.6 | | | 23.8 | | 1.5 | 18.0 | 18.0 | 11.6 | 28.1 | |
| Actuated g/C Ratio | 0.14 | 0.14 | | | 0.29 | | 0.02 | 0.22 | 0.22 | 0.14 | 0.34 | |
| Clearance Time (s) | 5.1 | 5.1 | | | 5.1 | | 4.0 | 3.9 | 3.9 | 4.0 | 3.9 | |
| Vehicle Extension (s) | 1.0 | 1.0 | | | 1.0 | | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | |
| Lane Grp Cap (vph) | 247 | 250 | | | 503 | | 31 | 766 | 342 | 247 | 1166 | |
| v/s Ratio Prot | 0.06 | c0.07 | | | c0.22 | | 0.01 | c0.13 | | c0.09 | 0.14 | |
| v/s Ratio Perm | | | | | | | | | 0.02 | | | |
| v/c Ratio | 0.45 | 0.50 | | | 0.78 | | 0.58 | 0.58 | 0.11 | 0.66 | 0.42 | |
| Uniform Delay, d1 | 32.8 | 33.1 | | | 27.2 | | 40.5 | 29.2 | 26.1 | 33.9 | 21.2 | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 0.5 | 0.6 | | | 6.7 | | 16.6 | 0.7 | 0.1 | 4.7 | 0.1 | |
| Delay (s) | 33.3 | 33.6 | | | 33.9 | | 57.0 | 29.8 | 26.2 | 38.6 | 21.3 | |
| Level of Service | C | C | | | C | | E | C | C | D | C | |
| Approach Delay (s) | | 33.5 | | | 33.9 | | | 29.8 | | | 25.5 | |
| Approach LOS | | C | | | C | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 29.6 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.65 | | |
| Actuated Cycle Length (s) | 83.1 | Sum of lost time (s) | 18.1 |
| Intersection Capacity Utilization | 64.4% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 8: Redwood Blvd & Grant Ave

11/22/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 84 | 99 | 195 | 22 | 76 | 40 | 214 | 363 | 46 | 34 | 420 | 77 |
| Future Volume (vph) | 84 | 99 | 195 | 22 | 76 | 40 | 214 | 363 | 46 | 34 | 420 | 77 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.5 | 3.5 | | 3.5 | 3.7 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | | 1.00 | 0.99 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.98 | | 1.00 | 0.98 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1763 | 1900 | 1564 | 1803 | 1900 | 1588 | 1805 | 3472 | | 1805 | 3446 | |
| Flt Permitted | 0.70 | 1.00 | 1.00 | 0.69 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1303 | 1900 | 1564 | 1304 | 1900 | 1588 | 1805 | 3472 | | 1805 | 3446 | |
| Peak-hour factor, PHF | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Adj. Flow (vph) | 92 | 109 | 214 | 24 | 84 | 44 | 235 | 399 | 51 | 37 | 462 | 85 |
| RTOR Reduction (vph) | 0 | 0 | 156 | 0 | 0 | 32 | 0 | 8 | 0 | 0 | 14 | 0 |
| Lane Group Flow (vph) | 92 | 109 | 58 | 24 | 84 | 12 | 235 | 442 | 0 | 37 | 533 | 0 |
| Confl. Peds. (#/hr) | 9 | | 11 | 2 | | 1 | | | 10 | | | 9 |
| Confl. Bikes (#/hr) | | | 5 | | | 5 | | | 5 | | | 5 |
| Heavy Vehicles (%) | 2% | 0% | 1% | 0% | 0% | 0% | 0% | 2% | 0% | 0% | 2% | 0% |
| Turn Type | Perm | NA | Perm | Perm | NA | Perm | Prot | NA | | Prot | NA | |
| Protected Phases | | 8 | | | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | 8 | | 8 | 4 | | 4 | | | | | | |
| Actuated Green, G (s) | 17.4 | 17.4 | 17.4 | 17.4 | 17.4 | 17.4 | 15.4 | 32.6 | | 3.2 | 20.2 | |
| Effective Green, g (s) | 17.4 | 17.4 | 17.4 | 17.4 | 17.4 | 17.4 | 15.4 | 32.6 | | 3.2 | 20.2 | |
| Actuated g/C Ratio | 0.27 | 0.27 | 0.27 | 0.27 | 0.27 | 0.27 | 0.24 | 0.51 | | 0.05 | 0.31 | |
| Clearance Time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.5 | 3.5 | | 3.5 | 3.7 | |
| Vehicle Extension (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 2.5 | 3.0 | | 2.5 | 3.0 | |
| Lane Grp Cap (vph) | 353 | 514 | 423 | 353 | 514 | 430 | 432 | 1763 | | 89 | 1084 | |
| v/s Ratio Prot | | 0.06 | | | 0.04 | | c0.13 | 0.13 | | 0.02 | c0.15 | |
| v/s Ratio Perm | c0.07 | | 0.04 | 0.02 | | 0.01 | | | | | | |
| v/c Ratio | 0.26 | 0.21 | 0.14 | 0.07 | 0.16 | 0.03 | 0.54 | 0.25 | | 0.42 | 0.49 | |
| Uniform Delay, d1 | 18.4 | 18.1 | 17.7 | 17.4 | 17.8 | 17.2 | 21.3 | 8.9 | | 29.6 | 17.8 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 0.5 | 0.3 | 0.2 | 0.1 | 0.2 | 0.0 | 1.1 | 0.1 | | 2.3 | 0.4 | |
| Delay (s) | 18.9 | 18.4 | 17.9 | 17.5 | 18.1 | 17.2 | 22.4 | 9.0 | | 31.9 | 18.2 | |
| Level of Service | B | B | B | B | B | B | C | A | | C | B | |
| Approach Delay (s) | | 18.3 | | | 17.7 | | | 13.6 | | | 19.1 | |
| Approach LOS | | B | | | B | | | B | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 16.7 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.43 | | |
| Actuated Cycle Length (s) | 64.2 | Sum of lost time (s) | 11.2 |
| Intersection Capacity Utilization | 54.3% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Intersection | |
|---|---|
| Intersection Delay, s/veh | 39.8 |
| Intersection LOS | E |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 62 | 147 | 60 | 20 | 176 | 170 | 111 | 160 | 50 | 194 | 95 | 97 |
| Future Vol, veh/h | 62 | 147 | 60 | 20 | 176 | 170 | 111 | 160 | 50 | 194 | 95 | 97 |
| Peak Hour Factor | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 73 | 173 | 71 | 24 | 207 | 200 | 131 | 188 | 59 | 228 | 112 | 114 |
| Number of Lanes | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Opposing Approach | WB | EB | SB | NB |
| Opposing Lanes | 2 | 2 | 3 | 2 |
| Conflicting Approach Left | SB | NB | EB | WB |
| Conflicting Lanes Left | 3 | 2 | 2 | 2 |
| Conflicting Approach Right | NB | SB | WB | EB |
| Conflicting Lanes Right | 2 | 3 | 2 | 2 |
| HCM Control Delay | 25.8 | 81 | 25.5 | 22.4 |
| HCM LOS | D | F | D | C |

| Lane | NBLn1 | NBLn2 | EBLn1 | EBLn2 | WBLn1 | WBLn2 | SBLn1 | SBLn2 | SBLn3 |
|---|---|---|---|---|---|---|---|---|---|
| Vol Left, % | 100% | 0% | 100% | 0% | 100% | 0% | 100% | 0% | 0% |
| Vol Thru, % | 0% | 76% | 0% | 71% | 0% | 51% | 0% | 100% | 0% |
| Vol Right, % | 0% | 24% | 0% | 29% | 0% | 49% | 0% | 0% | 100% |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 111 | 210 | 62 | 207 | 20 | 346 | 194 | 95 | 97 |
| LT Vol | 111 | 0 | 62 | 0 | 20 | 0 | 194 | 0 | 0 |
| Through Vol | 0 | 160 | 0 | 147 | 0 | 176 | 0 | 95 | 0 |
| RT Vol | 0 | 50 | 0 | 60 | 0 | 170 | 0 | 0 | 97 |
| Lane Flow Rate | 131 | 247 | 73 | 244 | 24 | 407 | 228 | 112 | 114 |
| Geometry Grp | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Degree of Util (X) | 0.369 | 0.649 | 0.208 | 0.645 | 0.065 | 1.033 | 0.632 | 0.293 | 0.276 |
| Departure Headway (Hd) | 10.464 | 9.763 | 10.573 | 9.841 | 10.01 | 9.137 | 10.269 | 9.746 | 9.015 |
| Convergence, Y/N | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Cap | 346 | 373 | 341 | 370 | 360 | 399 | 354 | 371 | 401 |
| Service Time | 8.164 | 7.463 | 8.273 | 7.541 | 7.71 | 6.837 | 7.969 | 7.446 | 6.715 |
| HCM Lane V/C Ratio | 0.379 | 0.662 | 0.214 | 0.659 | 0.067 | 1.02 | 0.644 | 0.302 | 0.284 |
| HCM Control Delay | 19.2 | 28.8 | 16 | 28.8 | 13.4 | 84.9 | 29 | 16.4 | 15.1 |
| HCM Lane LOS | C | D | C | D | B | F | D | C | C |
| HCM 95th-tile Q | 1.7 | 4.4 | 0.8 | 4.3 | 0.2 | 13.2 | 4.1 | 1.2 | 1.1 |



# MOVEMENT SUMMARY

## Site: 9 [AM Existing + Project Alt]

Novato Boulevard/San Marin Dr-Sutro Ave
AM Existing + Project Alternative

Roundabout

**Movement Performance - Vehicles**

| Mov ID | OD Mov | Demand Flows Total veh/h | Demand Flows HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance ft | Prop. Queued | Effective Stop Rate per veh | Average Speed mph |
|---|---|---|---|---|---|---|---|---|---|---|---|
| South: NB Sutro Ave | | | | | | | | | | | |
| 3 | L2 | 121 | 2.0 | 0.407 | 9.1 | LOS A | 2.1 | 54.3 | 0.64 | 0.61 | 32.1 |
| 8 | T1 | 174 | 2.0 | 0.407 | 9.1 | LOS A | 2.1 | 54.3 | 0.64 | 0.61 | 32.0 |
| 18 | R2 | 54 | 2.0 | 0.407 | 9.1 | LOS A | 2.1 | 54.3 | 0.64 | 0.61 | 31.2 |
| Approach | | 349 | 2.0 | 0.407 | 9.1 | LOS A | 2.1 | 54.3 | 0.64 | 0.61 | 31.9 |
| East: WB Novato Blvd | | | | | | | | | | | |
| 1 | L2 | 22 | 2.0 | 0.429 | 8.9 | LOS A | 2.3 | 59.5 | 0.61 | 0.54 | 32.8 |
| 6 | T1 | 191 | 2.0 | 0.429 | 8.9 | LOS A | 2.3 | 59.5 | 0.61 | 0.54 | 32.8 |
| 16 | R2 | 185 | 2.0 | 0.429 | 8.9 | LOS A | 2.3 | 59.5 | 0.61 | 0.54 | 32.0 |
| Approach | | 398 | 2.0 | 0.429 | 8.9 | LOS A | 2.3 | 59.5 | 0.61 | 0.54 | 32.4 |
| North: SB San Marin Drive | | | | | | | | | | | |
| 7 | L2 | 211 | 2.0 | 0.308 | 6.6 | LOS A | 1.4 | 36.5 | 0.49 | 0.41 | 32.4 |
| 4 | T1 | 103 | 2.0 | 0.308 | 6.6 | LOS A | 1.4 | 36.5 | 0.49 | 0.41 | 32.4 |
| 14 | R2 | 105 | 2.0 | 0.103 | 4.4 | LOS A | 0.4 | 10.3 | 0.42 | 0.31 | 34.1 |
| Approach | | 420 | 2.0 | 0.308 | 6.1 | LOS A | 1.4 | 36.5 | 0.47 | 0.38 | 32.8 |
| West: EB Novato Blvd | | | | | | | | | | | |
| 5 | L2 | 67 | 2.0 | 0.307 | 7.0 | LOS A | 1.5 | 38.6 | 0.53 | 0.45 | 33.3 |
| 2 | T1 | 160 | 2.0 | 0.307 | 7.0 | LOS A | 1.5 | 38.6 | 0.53 | 0.45 | 33.3 |
| 12 | R2 | 65 | 2.0 | 0.307 | 7.0 | LOS A | 1.5 | 38.6 | 0.53 | 0.45 | 32.4 |
| Approach | | 292 | 2.0 | 0.307 | 7.0 | LOS A | 1.5 | 38.6 | 0.53 | 0.45 | 33.1 |
| All Vehicles | | 1459 | 2.0 | 0.429 | 7.7 | LOS A | 2.3 | 59.5 | 0.56 | 0.49 | 32.5 |

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.


Organisation: W-TRANS | Processed: Tuesday, June 13, 2017 3:20:24 PM
Project: N:\AAA\MAX\NOV\126NOV\SIDRA\Novato-San Marin.sip7

# LANE SUMMARY

## Site: 9 [AM Existing + Project Alt]

Novato Boulevard/San Marin Dr-Sutro Ave
AM Existing + Project Alternative

Roundabout

**Lane Use and Performance**

| | Demand Flows Total veh/h | HV % | Cap. veh/h | Deg. Satn v/c | Lane Util. % | Average Delay sec | Level of Service | 95% Back of Queue Veh | 95% Back of Queue Dist ft | Lane Config | Lane Length ft | Cap. Adj. % | Prob. Block. % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| South: NB Sutro Ave | | | | | | | | | | | | | |
| Lane 1[d] | 349 | 2.0 | 858 | 0.407 | 100 | 9.1 | LOS A | 2.1 | 54.3 | Full | 1600 | 0.0 | 0.0 |
| Approach | 349 | 2.0 | | 0.407 | | 9.1 | LOS A | 2.1 | 54.3 | | | | |
| East: WB Novato Blvd | | | | | | | | | | | | | |
| Lane 1[d] | 398 | 2.0 | 928 | 0.429 | 100 | 8.9 | LOS A | 2.3 | 59.5 | Full | 1600 | 0.0 | 0.0 |
| Approach | 398 | 2.0 | | 0.429 | | 8.9 | LOS A | 2.3 | 59.5 | | | | |
| North: SB San Marin Drive | | | | | | | | | | | | | |
| Lane 1[d] | 314 | 2.0 | 1021 | 0.308 | 100 | 6.6 | LOS A | 1.4 | 36.5 | Full | 1600 | 0.0 | 0.0 |
| Lane 2 | 105 | 2.0 | 1021 | 0.103 | 100 | 4.4 | LOS A | 0.4 | 10.3 | Short | 30 | 0.0 | NA |
| Approach | 420 | 2.0 | | 0.308 | | 6.1 | LOS A | 1.4 | 36.5 | | | | |
| West: EB Novato Blvd | | | | | | | | | | | | | |
| Lane 1[d] | 292 | 2.0 | 954 | 0.307 | 100 | 7.0 | LOS A | 1.5 | 38.6 | Full | 1600 | 0.0 | 0.0 |
| Approach | 292 | 2.0 | | 0.307 | | 7.0 | LOS A | 1.5 | 38.6 | | | | |
| Intersection | 1459 | 2.0 | | 0.429 | | 7.7 | LOS A | 2.3 | 59.5 | | | | |

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach


Organisation: W-TRANS | Processed: Tuesday, June 13, 2017 3:20:24 PM
Project: N:\AAA\MAX\NOV\126NOV\SIDRA\Novato-San Marin.sip7



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 62 | 147 | 60 | 20 | 176 | 170 | 111 | 160 | 50 | 194 | 95 | 97 |
| Future Volume (vph) | 62 | 147 | 60 | 20 | 176 | 170 | 111 | 160 | 50 | 194 | 95 | 97 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 4.0 | | 3.0 | 4.0 | | 3.0 | 4.0 | | 3.0 | 4.0 | 4.0 |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.96 | | 1.00 | 0.93 | | 1.00 | 0.96 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1770 | 1781 | | 1770 | 1725 | | 1770 | 1796 | | 1770 | 1863 | 1583 |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1770 | 1781 | | 1770 | 1725 | | 1770 | 1796 | | 1770 | 1863 | 1583 |
| Peak-hour factor, PHF | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 |
| Adj. Flow (vph) | 73 | 173 | 71 | 24 | 207 | 200 | 131 | 188 | 59 | 228 | 112 | 114 |
| RTOR Reduction (vph) | 0 | 16 | 0 | 0 | 38 | 0 | 0 | 14 | 0 | 0 | 0 | 78 |
| Lane Group Flow (vph) | 73 | 228 | 0 | 24 | 369 | 0 | 131 | 233 | 0 | 228 | 112 | 36 |
| Turn Type | Prot | NA | | Prot | NA | | Prot | NA | | Prot | NA | Perm |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | | | | | | | | | | 6 |
| Actuated Green, G (s) | 5.1 | 24.4 | | 1.6 | 20.9 | | 8.2 | 16.1 | | 13.9 | 21.8 | 21.8 |
| Effective Green, g (s) | 5.1 | 24.4 | | 1.6 | 20.9 | | 8.2 | 16.1 | | 13.9 | 21.8 | 21.8 |
| Actuated g/C Ratio | 0.07 | 0.35 | | 0.02 | 0.30 | | 0.12 | 0.23 | | 0.20 | 0.31 | 0.31 |
| Clearance Time (s) | 3.0 | 4.0 | | 3.0 | 4.0 | | 3.0 | 4.0 | | 3.0 | 4.0 | 4.0 |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | 128 | 620 | | 40 | 515 | | 207 | 413 | | 351 | 580 | 492 |
| v/s Ratio Prot | c0.04 | 0.13 | | 0.01 | c0.21 | | 0.07 | c0.13 | | c0.13 | 0.06 | |
| v/s Ratio Perm | | | | | | | | | | | | 0.02 |
| v/c Ratio | 0.57 | 0.37 | | 0.60 | 0.72 | | 0.63 | 0.56 | | 0.65 | 0.19 | 0.07 |
| Uniform Delay, d1 | 31.4 | 17.0 | | 33.9 | 21.9 | | 29.5 | 23.8 | | 25.8 | 17.7 | 17.0 |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 6.0 | 0.4 | | 21.9 | 4.7 | | 6.2 | 1.8 | | 4.1 | 0.2 | 0.1 |
| Delay (s) | 37.4 | 17.4 | | 55.8 | 26.6 | | 35.6 | 25.6 | | 29.9 | 17.8 | 17.0 |
| Level of Service | D | B | | E | C | | D | C | | C | B | B |
| Approach Delay (s) | | 22.0 | | | 28.3 | | | 29.1 | | | 23.7 | |
| Approach LOS | | C | | | C | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 25.9 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.64 | | |
| Actuated Cycle Length (s) | 70.0 | Sum of lost time (s) | 14.0 |
| Intersection Capacity Utilization | 58.6% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 10: Wilson Ave & Novato Blvd

11/22/2017

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 671 | 17 | 262 | 464 | 28 | 458 |
| Future Volume (vph) | 671 | 17 | 262 | 464 | 28 | 458 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.9 | | 3.0 | 3.6 | 3.6 | 3.6 |
| Lane Util. Factor | 0.95 | | 1.00 | 0.95 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | | 1.00 | 1.00 | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | | 1.00 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 1.00 | | 0.95 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (prot) | 3560 | | 1787 | 3610 | 1805 | 1593 |
| Flt Permitted | 1.00 | | 0.95 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (perm) | 3560 | | 1787 | 3610 | 1805 | 1593 |
| Peak-hour factor, PHF | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 |
| Adj. Flow (vph) | 789 | 20 | 308 | 546 | 33 | 539 |
| RTOR Reduction (vph) | 2 | 0 | 0 | 0 | 0 | 209 |
| Lane Group Flow (vph) | 807 | 0 | 308 | 546 | 33 | 331 |
| Confl. Peds. (#/hr) | | 3 | | | 6 | 2 |
| Heavy Vehicles (%) | 1% | 0% | 1% | 0% | 0% | 0% |
| Turn Type | NA | | Prot | NA | Prot | Perm |
| Protected Phases | 2 | | 1 | 6 | 4 | |
| Permitted Phases | | | | | | 4 |
| Actuated Green, G (s) | 32.1 | | 17.4 | 39.8 | 20.0 | 20.0 |
| Effective Green, g (s) | 32.1 | | 17.4 | 39.8 | 20.0 | 20.0 |
| Actuated g/C Ratio | 0.40 | | 0.22 | 0.50 | 0.25 | 0.25 |
| Clearance Time (s) | 3.9 | | 3.0 | 3.6 | 3.6 | 3.6 |
| Vehicle Extension (s) | 3.0 | | 2.0 | 3.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 1428 | | 388 | 1795 | 451 | 398 |
| v/s Ratio Prot | c0.23 | | c0.17 | 0.15 | 0.02 | |
| v/s Ratio Perm | | | | | | c0.21 |
| v/c Ratio | 0.56 | | 0.79 | 0.30 | 0.07 | 0.83 |
| Uniform Delay, d1 | 18.5 | | 29.6 | 11.9 | 22.9 | 28.4 |
| Progression Factor | 1.00 | | 1.00 | 0.51 | 1.00 | 1.00 |
| Incremental Delay, d2 | 1.6 | | 9.5 | 0.4 | 0.0 | 13.1 |
| Delay (s) | 20.2 | | 39.0 | 6.5 | 22.9 | 41.5 |
| Level of Service | C | | D | A | C | D |
| Approach Delay (s) | 20.2 | | | 18.2 | 40.4 | |
| Approach LOS | C | | | B | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 24.6 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.70 | | |
| Actuated Cycle Length (s) | 80.0 | Sum of lost time (s) | 10.5 |
| Intersection Capacity Utilization | 54.3% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 11: Novato Blvd & Simmons Ln

11/22/2017

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 278 | 831 | 478 | 91 | 86 | 268 |
| Future Volume (vph) | 278 | 831 | 478 | 91 | 86 | 268 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.9 | 3.6 | | 3.0 | 3.0 |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.98 | | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 3574 | 3512 | | 1805 | 1599 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | 1805 | 3574 | 3512 | | 1805 | 1599 |
| Peak-hour factor, PHF | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 |
| Adj. Flow (vph) | 327 | 978 | 562 | 107 | 101 | 315 |
| RTOR Reduction (vph) | 0 | 0 | 16 | 0 | 0 | 234 |
| Lane Group Flow (vph) | 327 | 978 | 653 | 0 | 101 | 81 |
| Confl. Peds. (#/hr) | | | | | 2 | |
| Confl. Bikes (#/hr) | | | | 1 | | |
| Heavy Vehicles (%) | 0% | 1% | 0% | 0% | 0% | 1% |
| Turn Type | Prot | NA | NA | | Prot | Perm |
| Protected Phases | 5 | 2 | 6 | | 8 | |
| Permitted Phases | | | | | | 8 |
| Actuated Green, G (s) | 10.0 | 32.1 | 39.8 | | 20.6 | 20.6 |
| Effective Green, g (s) | 10.0 | 32.1 | 39.8 | | 20.6 | 20.6 |
| Actuated g/C Ratio | 0.12 | 0.40 | 0.50 | | 0.26 | 0.26 |
| Clearance Time (s) | 3.0 | 3.9 | 3.6 | | 3.0 | 3.0 |
| Vehicle Extension (s) | 2.0 | 3.0 | 3.0 | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 225 | 1434 | 1747 | | 464 | 411 |
| v/s Ratio Prot | c0.18 | c0.27 | c0.19 | | c0.06 | |
| v/s Ratio Perm | | | | | | 0.05 |
| v/c Ratio | 1.45 | 0.68 | 0.37 | | 0.22 | 0.20 |
| Uniform Delay, d1 | 35.0 | 19.7 | 12.4 | | 23.4 | 23.2 |
| Progression Factor | 0.79 | 0.64 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 222.5 | 2.1 | 0.6 | | 0.1 | 0.1 |
| Delay (s) | 250.3 | 14.6 | 13.0 | | 23.4 | 23.3 |
| Level of Service | F | B | B | | C | C |
| Approach Delay (s) | | 73.7 | 13.0 | | 23.4 | |
| Approach LOS | | E | B | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 47.9 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.57 | | |
| Actuated Cycle Length (s) | 80.0 | Sum of lost time (s) | 10.5 |
| Intersection Capacity Utilization | 46.5% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 12: Novato Blvd & Grant Ave

01/23/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 199 | 816 | 3 | 4 | 415 | 57 | 1 | 0 | 2 | 35 | 1 | 184 |
| Future Volume (vph) | 199 | 816 | 3 | 4 | 415 | 57 | 1 | 0 | 2 | 35 | 1 | 184 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.5 | 4.5 | 3.5 | 4.9 | 4.9 | | 4.0 | | 3.5 | 3.5 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 | | 1.00 | | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.96 | | 0.97 | | 1.00 | 0.98 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | | 0.98 | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | | 0.91 | | 1.00 | 0.85 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 0.98 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1787 | 1863 | 1576 | 1805 | 3539 | 1534 | | 1644 | | 1748 | 1569 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 0.70 | | 0.76 | 1.00 | |
| Satd. Flow (perm) | 1787 | 1863 | 1576 | 1805 | 3539 | 1534 | | 1175 | | 1390 | 1569 | |
| Peak-hour factor, PHF | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 |
| Adj. Flow (vph) | 234 | 960 | 4 | 5 | 488 | 67 | 1 | 0 | 2 | 41 | 1 | 216 |
| RTOR Reduction (vph) | 0 | 0 | 1 | 0 | 0 | 27 | 0 | 3 | 0 | 0 | 192 | 0 |
| Lane Group Flow (vph) | 234 | 960 | 3 | 5 | 488 | 40 | 0 | 0 | 0 | 41 | 25 | 0 |
| Confl. Peds. (#/hr) | | | 1 | | | 8 | 5 | | 12 | 12 | | 5 |
| Confl. Bikes (#/hr) | | | 4 | | | 2 | | | 2 | | | 1 |
| Heavy Vehicles (%) | 1% | 2% | 0% | 0% | 2% | 1% | 0% | 0% | 0% | 1% | 0% | 1% |
| Turn Type | Prot | NA | Perm | Prot | NA | Perm | Perm | NA | | Perm | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | 2 | | | 6 | 8 | | | 4 | | |
| Actuated Green, G (s) | 16.7 | 76.0 | 76.0 | 1.2 | 60.1 | 60.1 | | 10.8 | | 11.3 | 11.3 | |
| Effective Green, g (s) | 16.7 | 76.0 | 76.0 | 1.2 | 60.1 | 60.1 | | 10.8 | | 11.3 | 11.3 | |
| Actuated g/C Ratio | 0.17 | 0.76 | 0.76 | 0.01 | 0.60 | 0.60 | | 0.11 | | 0.11 | 0.11 | |
| Clearance Time (s) | 3.5 | 4.5 | 4.5 | 3.5 | 4.9 | 4.9 | | 4.0 | | 3.5 | 3.5 | |
| Vehicle Extension (s) | 2.0 | 3.0 | 3.0 | 2.0 | 3.0 | 3.0 | | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 298 | 1415 | 1197 | 21 | 2126 | 921 | | 126 | | 157 | 177 | |
| v/s Ratio Prot | c0.13 | c0.52 | | 0.00 | 0.14 | | | | | | 0.02 | |
| v/s Ratio Perm | | | 0.00 | | | 0.03 | | 0.00 | | c0.03 | | |
| v/c Ratio | 0.79 | 0.68 | 0.00 | 0.24 | 0.23 | 0.04 | | 0.00 | | 0.26 | 0.14 | |
| Uniform Delay, d1 | 39.9 | 5.9 | 2.9 | 48.9 | 9.2 | 8.2 | | 39.8 | | 40.5 | 40.0 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 0.88 | 0.99 | 1.45 | | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 11.8 | 1.3 | 0.0 | 2.0 | 0.2 | 0.1 | | 0.0 | | 0.3 | 0.1 | |
| Delay (s) | 51.7 | 7.3 | 2.9 | 45.2 | 9.3 | 11.9 | | 39.8 | | 40.9 | 40.1 | |
| Level of Service | D | A | A | D | A | B | | D | | D | D | |
| Approach Delay (s) | | 15.9 | | | 10.0 | | | 39.8 | | | 40.2 | |
| Approach LOS | | B | | | A | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 17.4 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.67 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 12.4 |
| Intersection Capacity Utilization | 72.0% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 13: Tamalpais Ave/7th St & Novato Blvd

01/23/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 96 | 727 | 36 | 60 | 440 | 121 | 37 | 99 | 34 | 72 | 105 | 45 |
| Future Volume (vph) | 96 | 727 | 36 | 60 | 440 | 121 | 37 | 99 | 34 | 72 | 105 | 45 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 5.0 | | 3.5 | 5.0 | 5.0 | 3.5 | 3.5 | | 3.5 | 3.5 | 3.5 |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 0.95 | 1.00 | 0.99 | | 1.00 | 1.00 | 0.96 |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 0.99 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.99 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.96 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1787 | 1846 | | 1787 | 1863 | 1523 | 1770 | 1798 | | 1784 | 1881 | 1531 |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.57 | 1.00 | | 0.48 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1787 | 1846 | | 1787 | 1863 | 1523 | 1068 | 1798 | | 902 | 1881 | 1531 |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 102 | 773 | 38 | 64 | 468 | 129 | 39 | 105 | 36 | 77 | 112 | 48 |
| RTOR Reduction (vph) | 0 | 1 | 0 | 0 | 0 | 20 | 0 | 15 | 0 | 0 | 0 | 41 |
| Lane Group Flow (vph) | 102 | 810 | 0 | 64 | 468 | 109 | 39 | 126 | 0 | 77 | 112 | 7 |
| Confl. Peds. (#/hr) | | | 11 | | | 17 | 6 | | 1 | 1 | | 6 |
| Confl. Bikes (#/hr) | | | 9 | | | 1 | | | 1 | | | 4 |
| Heavy Vehicles (%) | 1% | 2% | 1% | 1% | 2% | 1% | 1% | 1% | 1% | 1% | 1% | 1% |
| Turn Type | Prot | NA | | Prot | NA | Perm | Perm | NA | | Perm | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | | | | 6 | 8 | | | 4 | | 4 |
| Actuated Green, G (s) | 9.2 | 66.6 | | 7.7 | 65.1 | 65.1 | 13.7 | 13.7 | | 13.7 | 13.7 | 13.7 |
| Effective Green, g (s) | 9.2 | 66.6 | | 7.7 | 65.1 | 65.1 | 13.7 | 13.7 | | 13.7 | 13.7 | 13.7 |
| Actuated g/C Ratio | 0.09 | 0.67 | | 0.08 | 0.65 | 0.65 | 0.14 | 0.14 | | 0.14 | 0.14 | 0.14 |
| Clearance Time (s) | 3.5 | 5.0 | | 3.5 | 5.0 | 5.0 | 3.5 | 3.5 | | 3.5 | 3.5 | 3.5 |
| Vehicle Extension (s) | 2.0 | 5.0 | | 2.0 | 5.0 | 5.0 | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 164 | 1229 | | 137 | 1212 | 991 | 146 | 246 | | 123 | 257 | 209 |
| v/s Ratio Prot | c0.06 | c0.44 | | 0.04 | 0.25 | | | 0.07 | | | 0.06 | |
| v/s Ratio Perm | | | | | | 0.07 | 0.04 | | | c0.09 | | 0.00 |
| v/c Ratio | 0.62 | 0.66 | | 0.47 | 0.39 | 0.11 | 0.27 | 0.51 | | 0.63 | 0.44 | 0.03 |
| Uniform Delay, d1 | 43.7 | 9.9 | | 44.2 | 8.1 | 6.6 | 38.7 | 40.1 | | 40.7 | 39.6 | 37.4 |
| Progression Factor | 0.88 | 1.09 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 4.0 | 2.2 | | 0.9 | 0.9 | 0.2 | 0.4 | 0.8 | | 7.0 | 0.4 | 0.0 |
| Delay (s) | 42.3 | 13.0 | | 45.1 | 9.1 | 6.8 | 39.0 | 40.8 | | 47.7 | 40.0 | 37.4 |
| Level of Service | D | B | | D | A | A | D | D | | D | D | D |
| Approach Delay (s) | | 16.2 | | | 12.1 | | | 40.4 | | | 42.0 | |
| Approach LOS | | B | | | B | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 20.1 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.66 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 78.9% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 14: Novato Blvd & Diablo Ave

01/23/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 22 | 234 | 35 | 200 | 236 | 317 | 34 | 294 | 207 | 443 | 389 | 28 |
| Future Volume (vph) | 22 | 234 | 35 | 200 | 236 | 317 | 34 | 294 | 207 | 443 | 389 | 28 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 12 | 12 | 11 | 11 | 12 | 11 | 11 | 12 | 12 | 12 | 12 |
| Total Lost time (s) | | 3.7 | | 4.1 | 4.1 | 4.1 | 4.4 | 4.4 | 4.4 | 4.1 | 4.1 | |
| Lane Util. Factor | | 0.95 | | 0.91 | 0.91 | 1.00 | 1.00 | 1.00 | 1.00 | 0.91 | 0.91 | |
| Frpb, ped/bikes | | 1.00 | | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | | 0.98 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | |
| Flt Protected | | 1.00 | | 0.95 | 0.99 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.99 | |
| Satd. Flow (prot) | | 3488 | | 1557 | 3271 | 1512 | 1728 | 1801 | 1557 | 1610 | 3317 | |
| Flt Permitted | | 1.00 | | 0.95 | 0.99 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.99 | |
| Satd. Flow (perm) | | 3488 | | 1557 | 3271 | 1512 | 1728 | 1801 | 1557 | 1610 | 3317 | |
| Peak-hour factor, PHF | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Adj. Flow (vph) | 22 | 239 | 36 | 204 | 241 | 323 | 35 | 300 | 211 | 452 | 397 | 29 |
| RTOR Reduction (vph) | 0 | 8 | 0 | 0 | 0 | 215 | 0 | 0 | 163 | 0 | 2 | 0 |
| Lane Group Flow (vph) | 0 | 289 | 0 | 145 | 300 | 108 | 35 | 300 | 48 | 289 | 587 | 0 |
| Confl. Peds. (#/hr) | | | 7 | | | 15 | | | 2 | | | 4 |
| Confl. Bikes (#/hr) | | | 1 | | | 1 | | | 3 | | | 5 |
| Heavy Vehicles (%) | 1% | 1% | 1% | 2% | 1% | 2% | 1% | 2% | 2% | 2% | 2% | 1% |
| Turn Type | Split | NA | | Split | NA | Perm | Split | NA | Perm | Split | NA | |
| Protected Phases | 3 | 3 | | 4 | 4 | | 1 | 1 | | 2 | 2 | |
| Permitted Phases | | | | | | 4 | | | 1 | | 2 | |
| Actuated Green, G (s) | | 14.3 | | 15.0 | 15.0 | 15.0 | 20.2 | 20.2 | 20.2 | 22.5 | 22.5 | |
| Effective Green, g (s) | | 14.3 | | 15.0 | 15.0 | 15.0 | 20.2 | 20.2 | 20.2 | 22.5 | 22.5 | |
| Actuated g/C Ratio | | 0.16 | | 0.17 | 0.17 | 0.17 | 0.23 | 0.23 | 0.23 | 0.25 | 0.25 | |
| Clearance Time (s) | | 3.7 | | 4.1 | 4.1 | 4.1 | 4.4 | 4.4 | 4.4 | 4.1 | 4.1 | |
| Vehicle Extension (s) | | 2.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | | 564 | | 264 | 555 | 256 | 395 | 412 | 356 | 410 | 845 | |
| v/s Ratio Prot | | c0.08 | | c0.09 | 0.09 | | 0.02 | c0.17 | | c0.18 | 0.18 | |
| v/s Ratio Perm | | | | | | 0.07 | | | 0.03 | | | |
| v/c Ratio | | 0.51 | | 0.55 | 0.54 | 0.42 | 0.09 | 0.73 | 0.14 | 0.70 | 0.69 | |
| Uniform Delay, d1 | | 33.8 | | 33.6 | 33.5 | 32.8 | 26.8 | 31.5 | 27.1 | 29.9 | 29.8 | |
| Progression Factor | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 0.3 | | 1.3 | 0.6 | 0.4 | 0.0 | 5.4 | 0.1 | 4.5 | 2.0 | |
| Delay (s) | | 34.1 | | 34.8 | 34.1 | 33.2 | 26.8 | 36.9 | 27.2 | 34.3 | 31.8 | |
| Level of Service | | C | | C | C | C | C | D | C | C | C | |
| Approach Delay (s) | | 34.1 | | | 33.8 | | | 32.5 | | | 32.6 | |
| Approach LOS | | C | | | C | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 33.2 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.64 | | |
| Actuated Cycle Length (s) | 88.3 | Sum of lost time (s) | 16.3 |
| Intersection Capacity Utilization | 71.3% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 14: Novato Blvd #2/Novato Blvd & Diablo Ave

02/12/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 22 | 234 | 35 | 200 | 236 | 317 | 34 | 294 | 207 | 443 | 389 | 28 |
| Future Volume (vph) | 22 | 234 | 35 | 200 | 236 | 317 | 34 | 294 | 207 | 443 | 389 | 28 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 11 | 11 | 11 | 11 | 11 | 12 | 11 | 11 | 12 | 10 | 12 | 12 |
| Total Lost time (s) | 4.0 | 4.1 | 4.1 | 4.0 | 4.0 | 4.0 | 4.0 | 4.1 | | 4.0 | 4.0 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | | 0.97 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.98 | 1.00 | 0.99 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.94 | | 1.00 | 0.99 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1728 | 1818 | 1518 | 1711 | 1818 | 1558 | 1728 | 3187 | | 3204 | 1841 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1728 | 1818 | 1518 | 1711 | 1818 | 1558 | 1728 | 3187 | | 3204 | 1841 | |
| Peak-hour factor, PHF | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Adj. Flow (vph) | 22 | 239 | 36 | 204 | 241 | 323 | 35 | 300 | 211 | 452 | 397 | 29 |
| RTOR Reduction (vph) | 0 | 0 | 28 | 0 | 0 | 138 | 0 | 128 | 0 | 0 | 3 | 0 |
| Lane Group Flow (vph) | 22 | 239 | 8 | 204 | 241 | 185 | 35 | 383 | 0 | 452 | 423 | 0 |
| Confl. Peds. (#/hr) | | | 7 | | | 15 | | | 2 | | | 4 |
| Confl. Bikes (#/hr) | | | 1 | | | 1 | | | 3 | | | 5 |
| Heavy Vehicles (%) | 1% | 1% | 1% | 2% | 1% | 2% | 1% | 2% | 2% | 2% | 2% | 1% |
| Turn Type | Prot | NA | Perm | Prot | NA | pm+ov | Prot | NA | | Prot | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | 1 | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | 4 | | | 8 | | | | | | |
| Actuated Green, G (s) | 1.7 | 18.9 | 18.9 | 13.5 | 30.8 | 47.4 | 3.3 | 17.5 | | 16.6 | 30.9 | |
| Effective Green, g (s) | 1.7 | 18.9 | 18.9 | 13.5 | 30.8 | 47.4 | 3.3 | 17.5 | | 16.6 | 30.9 | |
| Actuated g/C Ratio | 0.02 | 0.23 | 0.23 | 0.16 | 0.37 | 0.57 | 0.04 | 0.21 | | 0.20 | 0.37 | |
| Clearance Time (s) | 4.0 | 4.1 | 4.1 | 4.0 | 4.0 | 4.0 | 4.0 | 4.1 | | 4.0 | 4.0 | |
| Vehicle Extension (s) | 3.0 | 2.0 | 2.0 | 3.0 | 3.0 | 3.0 | 3.0 | 2.0 | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 35 | 415 | 346 | 279 | 677 | 968 | 68 | 674 | | 643 | 687 | |
| v/s Ratio Prot | 0.01 | c0.13 | | c0.12 | 0.13 | 0.04 | 0.02 | 0.12 | | c0.14 | c0.23 | |
| v/s Ratio Perm | | | 0.01 | | | 0.08 | | | | | | |
| v/c Ratio | 0.63 | 0.58 | 0.02 | 0.73 | 0.36 | 0.19 | 0.51 | 0.57 | | 0.70 | 0.62 | |
| Uniform Delay, d1 | 40.2 | 28.3 | 24.7 | 32.9 | 18.8 | 8.5 | 38.9 | 29.2 | | 30.8 | 21.1 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 30.3 | 1.2 | 0.0 | 9.5 | 0.3 | 0.1 | 6.4 | 0.7 | | 3.5 | 1.7 | |
| Delay (s) | 70.5 | 29.5 | 24.8 | 42.3 | 19.1 | 8.6 | 45.4 | 29.9 | | 34.2 | 22.7 | |
| Level of Service | E | C | C | D | B | A | D | C | | C | C | |
| Approach Delay (s) | | 32.0 | | | 20.8 | | | 30.9 | | | 28.7 | |
| Approach LOS | | C | | | C | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 27.1 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.67 | | |
| Actuated Cycle Length (s) | 82.7 | Sum of lost time (s) | 16.2 |
| Intersection Capacity Utilization | 68.4% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 15: Redwood Blvd & Diablo Ave/De Long Ave



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 214 | 463 | 167 | 156 | 564 | 199 | 53 | 138 | 30 | 196 | 271 | 164 |
| Future Volume (vph) | 214 | 463 | 167 | 156 | 564 | 199 | 53 | 138 | 30 | 196 | 271 | 164 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 9 |
| Total Lost time (s) | 5.0 | 4.0 | | 5.0 | 4.1 | | 4.0 | 4.8 | 4.8 | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 0.95 | | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 | 0.97 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 0.99 | | 1.00 | 0.99 | | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.98 |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.96 | | 1.00 | 0.96 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3467 | 3448 | | 1805 | 3358 | | 1805 | 3610 | 1505 | 3303 | 1900 | 1408 |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3467 | 3448 | | 1805 | 3358 | | 1805 | 3610 | 1505 | 3303 | 1900 | 1408 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 233 | 503 | 182 | 170 | 613 | 216 | 58 | 150 | 33 | 213 | 295 | 178 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 0 | 0 | 58 |
| Lane Group Flow (vph) | 233 | 685 | 0 | 170 | 829 | 0 | 58 | 150 | 18 | 213 | 295 | 120 |
| Confl. Peds. (#/hr) | | | 5 | | | 5 | | | 5 | | | 5 |
| Confl. Bikes (#/hr) | | | 5 | | | 5 | | | 5 | | | 5 |
| Heavy Vehicles (%) | 1% | 0% | 0% | 0% | 2% | 5% | 0% | 0% | 5% | 6% | 0% | 1% |
| Turn Type | Prot | NA | | Prot | NA | | Prot | NA | Perm | Prot | NA | Perm |
| Protected Phases | 3 | 8 | | 7 | 4 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | | | | | | | 2 | | | 6 |
| Actuated Green, G (s) | 17.0 | 48.2 | | 17.0 | 48.1 | | 10.4 | 36.0 | 36.0 | 11.0 | 37.4 | 37.4 |
| Effective Green, g (s) | 17.0 | 48.2 | | 17.0 | 48.1 | | 10.4 | 36.0 | 36.0 | 11.0 | 37.4 | 37.4 |
| Actuated g/C Ratio | 0.13 | 0.37 | | 0.13 | 0.37 | | 0.08 | 0.28 | 0.28 | 0.08 | 0.29 | 0.29 |
| Clearance Time (s) | 5.0 | 4.0 | | 5.0 | 4.1 | | 4.0 | 4.8 | 4.8 | 4.0 | 4.0 | 4.0 |
| Vehicle Extension (s) | 2.5 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 453 | 1278 | | 236 | 1242 | | 144 | 999 | 416 | 279 | 546 | 405 |
| v/s Ratio Prot | 0.07 | 0.20 | | c0.09 | c0.25 | | 0.03 | 0.04 | | c0.06 | c0.16 | |
| v/s Ratio Perm | | | | | | | | | 0.01 | | | 0.09 |
| v/c Ratio | 0.51 | 0.54 | | 0.72 | 0.67 | | 0.40 | 0.15 | 0.04 | 0.76 | 0.54 | 0.30 |
| Uniform Delay, d1 | 52.7 | 32.1 | | 54.2 | 34.3 | | 56.8 | 35.5 | 34.4 | 58.2 | 39.0 | 36.1 |
| Progression Factor | 1.00 | 1.00 | | 1.13 | 0.87 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.7 | 1.6 | | 7.8 | 2.5 | | 0.7 | 0.3 | 0.2 | 10.6 | 3.8 | 1.9 |
| Delay (s) | 53.4 | 33.7 | | 69.1 | 32.3 | | 57.5 | 35.8 | 34.6 | 68.8 | 42.9 | 37.9 |
| Level of Service | D | C | | E | C | | E | D | C | E | D | D |
| Approach Delay (s) | | 38.7 | | | 38.5 | | | 40.8 | | | 49.6 | |
| Approach LOS | | D | | | D | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 41.5 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.65 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 17.9 |
| Intersection Capacity Utilization | 103.4% | ICU Level of Service | G |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 16: Reichert Ave & De Long Ave



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 68 | 634 | 11 | 61 | 927 | 201 | 12 | 21 | 38 | 188 | 35 | 75 |
| Future Volume (vph) | 68 | 634 | 11 | 61 | 927 | 201 | 12 | 21 | 38 | 188 | 35 | 75 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 0.95 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 0.99 | | 1.00 | 1.00 | 0.98 | 1.00 | 0.98 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 0.99 | 1.00 | 1.00 | 0.99 | 1.00 | |
| Frt | 1.00 | 1.00 | | 1.00 | 0.97 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.90 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1805 | 3529 | | 1805 | 3460 | | 1793 | 1900 | 1578 | 1778 | 1676 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.56 | 1.00 | 1.00 | 0.74 | 1.00 | |
| Satd. Flow (perm) | 1805 | 3529 | | 1805 | 3460 | | 1063 | 1900 | 1578 | 1389 | 1676 | |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Adj. Flow (vph) | 76 | 704 | 12 | 68 | 1030 | 223 | 13 | 23 | 42 | 209 | 39 | 83 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 9 | 0 | 28 | 0 |
| Lane Group Flow (vph) | 76 | 716 | 0 | 68 | 1247 | 0 | 13 | 23 | 33 | 209 | 94 | 0 |
| Confl. Peds. (#/hr) | | | 6 | | | 3 | 6 | | 4 | 4 | | 6 |
| Confl. Bikes (#/hr) | | | 5 | | | 5 | | | 5 | | | 5 |
| Heavy Vehicles (%) | 0% | 2% | 0% | 0% | 1% | 1% | 0% | 0% | 0% | 1% | 0% | 0% |
| Turn Type | Prot | NA | | Prot | NA | | Perm | NA | Perm | Perm | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | | | | | 8 | | 8 | 4 | | |
| Actuated Green, G (s) | 8.9 | 86.4 | | 8.5 | 86.0 | | 24.5 | 24.5 | 24.5 | 24.5 | 24.5 | |
| Effective Green, g (s) | 8.9 | 86.4 | | 8.5 | 86.0 | | 24.5 | 24.5 | 24.5 | 24.5 | 24.5 | |
| Actuated g/C Ratio | 0.07 | 0.66 | | 0.07 | 0.66 | | 0.19 | 0.19 | 0.19 | 0.19 | 0.19 | |
| Clearance Time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | |
| Vehicle Extension (s) | 2.0 | 3.0 | | 2.0 | 3.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 123 | 2345 | | 118 | 2288 | | 200 | 358 | 297 | 261 | 315 | |
| v/s Ratio Prot | c0.04 | 0.20 | | 0.04 | c0.36 | | | 0.01 | | | 0.06 | |
| v/s Ratio Perm | | | | | | | 0.01 | | 0.02 | c0.15 | | |
| v/c Ratio | 0.62 | 0.31 | | 0.58 | 0.54 | | 0.07 | 0.06 | 0.11 | 0.80 | 0.30 | |
| Uniform Delay, d1 | 58.9 | 9.2 | | 59.0 | 11.6 | | 43.3 | 43.3 | 43.7 | 50.4 | 45.4 | |
| Progression Factor | 1.00 | 1.15 | | 1.07 | 0.98 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 5.4 | 0.3 | | 4.0 | 0.9 | | 0.1 | 0.0 | 0.1 | 15.2 | 0.2 | |
| Delay (s) | 64.4 | 10.9 | | 67.3 | 12.3 | | 43.4 | 43.4 | 43.8 | 65.6 | 45.6 | |
| Level of Service | E | B | | E | B | | D | D | D | E | D | |
| Approach Delay (s) | | 16.0 | | | 15.1 | | | 43.6 | | | 58.2 | |
| Approach LOS | | B | | | B | | | D | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 21.9 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.60 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 67.7% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 17: US 101 SB Ramps & De Long Ave

11/22/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 188 | 642 | 20 | 815 | 0 | 0 | 0 | 0 | 11 | 2 | 303 |
| Future Volume (vph) | 0 | 188 | 642 | 20 | 815 | 0 | 0 | 0 | 0 | 11 | 2 | 303 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.6 | 3.6 | 3.0 | 3.6 | | | | | 4.0 | 4.0 | |
| Lane Util. Factor | | 0.95 | 1.00 | 1.00 | 0.95 | | | | | 0.95 | 0.95 | |
| Frt | | 1.00 | 0.85 | 1.00 | 1.00 | | | | | 1.00 | 0.85 | |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 3574 | 1599 | 1770 | 3539 | | | | | 1681 | 1506 | |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | 0.95 | 1.00 | |
| Satd. Flow (perm) | | 3574 | 1599 | 1770 | 3539 | | | | | 1681 | 1506 | |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 0 | 200 | 683 | 21 | 867 | 0 | 0 | 0 | 0 | 12 | 2 | 322 |
| RTOR Reduction (vph) | 0 | 0 | 264 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 120 | 0 |
| Lane Group Flow (vph) | 0 | 200 | 419 | 21 | 867 | 0 | 0 | 0 | 0 | 11 | 205 | 0 |
| Heavy Vehicles (%) | 0% | 1% | 1% | 2% | 2% | 2% | 2% | 2% | 2% | 2% | 2% | 2% |
| Turn Type | | NA | Perm | Prot | NA | | | | | Split | NA | |
| Protected Phases | | 6 | | 5 | 2 | | | | | 4 | 4 | |
| Permitted Phases | | | 6 | | | | | | | | | |
| Actuated Green, G (s) | | 39.9 | 39.9 | 1.4 | 44.3 | | | | | 13.1 | 13.1 | |
| Effective Green, g (s) | | 39.9 | 39.9 | 1.4 | 44.3 | | | | | 13.1 | 13.1 | |
| Actuated g/C Ratio | | 0.61 | 0.61 | 0.02 | 0.68 | | | | | 0.20 | 0.20 | |
| Clearance Time (s) | | 3.6 | 3.6 | 3.0 | 3.6 | | | | | 4.0 | 4.0 | |
| Vehicle Extension (s) | | 4.0 | 4.0 | 2.0 | 4.0 | | | | | 2.5 | 2.5 | |
| Lane Grp Cap (vph) | | 2193 | 981 | 38 | 2411 | | | | | 338 | 303 | |
| v/s Ratio Prot | | 0.06 | | c0.01 | 0.24 | | | | | 0.01 | c0.14 | |
| v/s Ratio Perm | | | c0.26 | | | | | | | | | |
| v/c Ratio | | 0.09 | 0.43 | 0.55 | 0.36 | | | | | 0.03 | 0.68 | |
| Uniform Delay, d1 | | 5.1 | 6.6 | 31.5 | 4.4 | | | | | 20.9 | 24.0 | |
| Progression Factor | | 1.03 | 5.87 | 1.00 | 1.00 | | | | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 0.1 | 1.3 | 9.5 | 0.4 | | | | | 0.0 | 5.4 | |
| Delay (s) | | 5.3 | 39.9 | 41.0 | 4.8 | | | | | 20.9 | 29.4 | |
| Level of Service | | A | D | D | A | | | | | C | C | |
| Approach Delay (s) | | 32.1 | | | 5.6 | | | 0.0 | | | 29.1 | |
| Approach LOS | | C | | | A | | | A | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 20.5 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.49 | | |
| Actuated Cycle Length (s) | 65.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 62.8% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 18: US 101 NB Ramps & De Long Ave

11/22/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 166 | 33 | 0 | 1 | 58 | 9 | 778 | 2 | 17 | 0 | 0 | 0 |
| Future Volume (vph) | 166 | 33 | 0 | 1 | 58 | 9 | 778 | 2 | 17 | 0 | 0 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 3.6 | | | 3.6 | | 4.5 | 4.5 | | | | |
| Lane Util. Factor | 1.00 | 0.95 | | | 0.95 | | 0.95 | 0.95 | | | | |
| Frt | 1.00 | 1.00 | | | 0.98 | | 1.00 | 0.99 | | | | |
| Flt Protected | 0.95 | 1.00 | | | 1.00 | | 0.95 | 0.95 | | | | |
| Satd. Flow (prot) | 1770 | 3610 | | | 3483 | | 1698 | 1690 | | | | |
| Flt Permitted | 0.95 | 1.00 | | | 0.95 | | 0.95 | 0.95 | | | | |
| Satd. Flow (perm) | 1770 | 3610 | | | 3316 | | 1698 | 1690 | | | | |
| Peak-hour factor, PHF | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 |
| Adj. Flow (vph) | 189 | 38 | 0 | 1 | 66 | 10 | 884 | 2 | 19 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 189 | 38 | 0 | 0 | 68 | 0 | 451 | 452 | 0 | 0 | 0 | 0 |
| Heavy Vehicles (%) | 2% | 0% | 0% | 0% | 0% | 12% | 1% | 0% | 8% | 0% | 0% | 0% |
| Turn Type | Prot | NA | | | NA | | Split | NA | | | | |
| Protected Phases | 1 | 6 | | | 2 | | 4 | 4 | | | | |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | 8.8 | 16.9 | | | 4.6 | | 20.6 | 20.6 | | | | |
| Effective Green, g (s) | 8.8 | 16.9 | | | 4.6 | | 20.6 | 20.6 | | | | |
| Actuated g/C Ratio | 0.19 | 0.37 | | | 0.10 | | 0.45 | 0.45 | | | | |
| Clearance Time (s) | 3.5 | 3.6 | | | 3.6 | | 4.5 | 4.5 | | | | |
| Vehicle Extension (s) | 2.5 | 2.0 | | | 2.0 | | 3.0 | 3.0 | | | | |
| Lane Grp Cap (vph) | 341 | 1337 | | | 334 | | 767 | 763 | | | | |
| v/s Ratio Prot | c0.11 | 0.01 | | | | | 0.27 | c0.27 | | | | |
| v/s Ratio Perm | | | | | c0.02 | | | | | | | |
| v/c Ratio | 0.55 | 0.03 | | | 1.00dr | | 0.59 | 0.59 | | | | |
| Uniform Delay, d1 | 16.6 | 9.1 | | | 18.8 | | 9.3 | 9.4 | | | | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | | | | |
| Incremental Delay, d2 | 1.6 | 0.0 | | | 0.1 | | 1.2 | 1.2 | | | | |
| Delay (s) | 18.2 | 9.1 | | | 18.9 | | 10.5 | 10.6 | | | | |
| Level of Service | B | A | | | B | | B | B | | | | |
| Approach Delay (s) | | 16.7 | | | 18.9 | | | 10.5 | | | 0.0 | |
| Approach LOS | | B | | | B | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 12.2 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.53 | | |
| Actuated Cycle Length (s) | 45.6 | Sum of lost time (s) | 11.6 |
| Intersection Capacity Utilization | 45.1% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| dr Defacto Right Lane. Recode with 1 though lane as a right lane. | | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 19: Redwood Blvd & Lamont Ave



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 10 | 2 | 8 | 100 | 2 | 50 | 16 | 263 | 41 | 65 | 490 | 28 |
| Future Volume (vph) | 10 | 2 | 8 | 100 | 2 | 50 | 16 | 263 | 41 | 65 | 490 | 28 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.5 | 3.5 | | 3.5 | 3.5 | 3.5 | 4.8 | | 3.5 | 4.8 | 4.8 |
| Lane Util. Factor | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 |
| Frpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | 0.99 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Flpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | | 1.00 | 0.85 | | 1.00 | 0.85 | 1.00 | 0.98 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | | 0.96 | 1.00 | | 0.95 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | | 1822 | 1615 | | 1811 | 1595 | 1805 | 3527 | | 1805 | 3610 | 1615 |
| Flt Permitted | | 0.84 | 1.00 | | 0.74 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | | 1599 | 1615 | | 1405 | 1595 | 1805 | 3527 | | 1805 | 3610 | 1615 |
| Peak-hour factor, PHF | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Adj. Flow (vph) | 11 | 2 | 9 | 110 | 2 | 55 | 18 | 289 | 45 | 71 | 538 | 31 |
| RTOR Reduction (vph) | 0 | 0 | 7 | 0 | 0 | 40 | 0 | 12 | 0 | 0 | 0 | 17 |
| Lane Group Flow (vph) | 0 | 13 | 2 | 0 | 112 | 15 | 18 | 322 | 0 | 71 | 538 | 14 |
| Confl. Peds. (#/hr) | 1 | | | | | 1 | | | 2 | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Perm | NA | Perm | Perm | NA | Perm | Prot | NA | | Prot | NA | Perm |
| Protected Phases | | 8 | | | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | 8 | | 8 | 4 | | 4 | | | | | | 2 |
| Actuated Green, G (s) | | 12.7 | 12.7 | | 12.7 | 12.7 | 0.9 | 18.9 | | 3.1 | 21.1 | 21.1 |
| Effective Green, g (s) | | 12.7 | 12.7 | | 12.7 | 12.7 | 0.9 | 18.9 | | 3.1 | 21.1 | 21.1 |
| Actuated g/C Ratio | | 0.27 | 0.27 | | 0.27 | 0.27 | 0.02 | 0.41 | | 0.07 | 0.45 | 0.45 |
| Clearance Time (s) | | 3.5 | 3.5 | | 3.5 | 3.5 | 3.5 | 4.8 | | 3.5 | 4.8 | 4.8 |
| Vehicle Extension (s) | | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 | 3.0 | | 2.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | 436 | 441 | | 383 | 435 | 34 | 1433 | | 120 | 1638 | 732 |
| v/s Ratio Prot | | | | | | | 0.01 | 0.09 | | c0.04 | c0.15 | |
| v/s Ratio Perm | | 0.01 | 0.00 | | c0.08 | 0.01 | | | | | | 0.01 |
| v/c Ratio | | 0.03 | 0.01 | | 0.29 | 0.03 | 0.53 | 0.22 | | 0.59 | 0.33 | 0.02 |
| Uniform Delay, d1 | | 12.4 | 12.3 | | 13.4 | 12.4 | 22.6 | 9.0 | | 21.1 | 8.2 | 7.0 |
| Progression Factor | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.0 | 0.0 | | 0.2 | 0.0 | 6.7 | 0.1 | | 5.1 | 0.1 | 0.0 |
| Delay (s) | | 12.4 | 12.3 | | 13.5 | 12.4 | 29.3 | 9.1 | | 26.2 | 8.3 | 7.0 |
| Level of Service | | B | B | | B | B | C | A | | C | A | A |
| Approach Delay (s) | | 12.4 | | | 13.1 | | | 10.1 | | | 10.2 | |
| Approach LOS | | B | | | B | | | B | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 10.6 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.34 | | |
| Actuated Cycle Length (s) | 46.5 | Sum of lost time (s) | 11.8 |
| Intersection Capacity Utilization | 44.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 20: Redwood Blvd & Landing Ct



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 2 | 0 | 1 | 25 | 0 | 12 | 1 | 306 | 32 | 25 | 479 | 1 |
| Future Volume (vph) | 2 | 0 | 1 | 25 | 0 | 12 | 1 | 306 | 32 | 25 | 479 | 1 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.5 | | 3.5 | | 3.5 | | 4.8 | 4.8 | 3.5 | 4.8 | 4.8 |
| Lane Util. Factor | | 1.00 | | 1.00 | | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |
| Frpb, ped/bikes | | 1.00 | | 1.00 | | 1.00 | | 1.00 | 0.98 | 1.00 | 1.00 | 0.97 |
| Flpb, ped/bikes | | 1.00 | | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.95 | | 1.00 | | 0.85 | | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | | 0.97 | | 0.95 | | 1.00 | | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | | 1748 | | 1803 | | 1615 | | 3609 | 1579 | 1805 | 3610 | 1572 |
| Flt Permitted | | 0.97 | | 1.00 | | 1.00 | | 0.95 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | | 1748 | | 1898 | | 1615 | | 3444 | 1579 | 1805 | 3610 | 1572 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 2 | 0 | 1 | 27 | 0 | 13 | 1 | 333 | 35 | 27 | 521 | 1 |
| RTOR Reduction (vph) | 0 | 3 | 0 | 0 | 0 | 12 | 0 | 0 | 13 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 27 | 0 | 1 | 0 | 334 | 22 | 27 | 521 | 1 |
| Confl. Peds. (#/hr) | | | 4 | 4 | | | | | 3 | | | 6 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Perm | NA | | Perm | | Perm | Perm | NA | Perm | Prot | NA | Perm |
| Protected Phases | | 4 | | | | | | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | 2 | | | 6 |
| Actuated Green, G (s) | | 4.0 | | 4.0 | | 4.0 | | 26.9 | 26.9 | 0.8 | 31.2 | 31.2 |
| Effective Green, g (s) | | 4.0 | | 4.0 | | 4.0 | | 26.9 | 26.9 | 0.8 | 31.2 | 31.2 |
| Actuated g/C Ratio | | 0.09 | | 0.09 | | 0.09 | | 0.62 | 0.62 | 0.02 | 0.72 | 0.72 |
| Clearance Time (s) | | 3.5 | | 3.5 | | 3.5 | | 4.8 | 4.8 | 3.5 | 4.8 | 4.8 |
| Vehicle Extension (s) | | 3.0 | | 2.0 | | 2.0 | | 4.0 | 4.0 | 2.0 | 4.0 | 4.0 |
| Lane Grp Cap (vph) | | 160 | | 174 | | 148 | | 2129 | 976 | 33 | 2589 | 1127 |
| v/s Ratio Prot | | | | | | | | | | c0.01 | c0.14 | |
| v/s Ratio Perm | | 0.00 | | c0.01 | | 0.00 | | 0.10 | 0.01 | | | 0.00 |
| v/c Ratio | | 0.00 | | 0.16 | | 0.01 | | 0.16 | 0.02 | 0.82 | 0.20 | 0.00 |
| Uniform Delay, d1 | | 17.9 | | 18.2 | | 17.9 | | 3.5 | 3.2 | 21.3 | 2.0 | 1.7 |
| Progression Factor | | 1.00 | | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.0 | | 0.2 | | 0.0 | | 0.0 | 0.0 | 81.1 | 0.1 | 0.0 |
| Delay (s) | | 17.9 | | 18.3 | | 18.0 | | 3.6 | 3.2 | 102.4 | 2.1 | 1.7 |
| Level of Service | | B | | B | | B | | A | A | F | A | A |
| Approach Delay (s) | | 17.9 | | | 18.2 | | | 3.5 | | | 7.0 | |
| Approach LOS | | B | | | B | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 6.2 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.23 | | |
| Actuated Cycle Length (s) | 43.5 | Sum of lost time (s) | 11.8 |
| Intersection Capacity Utilization | 40.5% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 21: Novato Blvd & Center Rd/Garden Ct

11/22/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 56 | 0 | 295 | 3 | 0 | 3 | 121 | 454 | 4 | 1 | 662 | 66 |
| Future Volume (vph) | 56 | 0 | 295 | 3 | 0 | 3 | 121 | 454 | 4 | 1 | 662 | 66 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.2 | 3.2 | | | 3.0 | | 3.0 | 4.4 | | 3.0 | 4.4 | |
| Lane Util. Factor | 1.00 | 1.00 | | | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.85 | | | 0.93 | | 1.00 | 1.00 | | 1.00 | 0.99 | |
| Flt Protected | 0.95 | 1.00 | | | 0.98 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1805 | 1615 | | | 1729 | | 1805 | 3604 | | 1805 | 3518 | |
| Flt Permitted | 0.75 | 1.00 | | | 0.58 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1432 | 1615 | | | 1035 | | 1805 | 3604 | | 1805 | 3518 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 61 | 0 | 321 | 3 | 0 | 3 | 132 | 493 | 4 | 1 | 720 | 72 |
| RTOR Reduction (vph) | 0 | 285 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 4 | 0 |
| Lane Group Flow (vph) | 61 | 36 | 0 | 0 | 1 | 0 | 132 | 497 | 0 | 1 | 788 | 0 |
| Confl. Peds. (#/hr) | | | | | | | | | 9 | | | 6 |
| Confl. Bikes (#/hr) | | | | | | | | | 2 | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 1% | 0% |
| Turn Type | Perm | NA | | Perm | NA | | Prot | NA | | Prot | NA | |
| Protected Phases | | 8 | | | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | 8 | | | 4 | | | | | | | | |
| Actuated Green, G (s) | 11.2 | 11.2 | | | 11.4 | | 12.3 | 76.0 | | 2.2 | 65.9 | |
| Effective Green, g (s) | 11.2 | 11.2 | | | 11.4 | | 12.3 | 76.0 | | 2.2 | 65.9 | |
| Actuated g/C Ratio | 0.11 | 0.11 | | | 0.11 | | 0.12 | 0.76 | | 0.02 | 0.66 | |
| Clearance Time (s) | 3.2 | 3.2 | | | 3.0 | | 3.0 | 4.4 | | 3.0 | 4.4 | |
| Vehicle Extension (s) | 3.0 | 3.0 | | | 2.0 | | 2.0 | 4.0 | | 2.0 | 4.0 | |
| Lane Grp Cap (vph) | 160 | 180 | | | 117 | | 222 | 2739 | | 39 | 2318 | |
| v/s Ratio Prot | | 0.02 | | | | | c0.07 | 0.14 | | 0.00 | c0.22 | |
| v/s Ratio Perm | c0.04 | | | | 0.00 | | | | | | | |
| v/c Ratio | 0.38 | 0.20 | | | 0.01 | | 0.59 | 0.18 | | 0.03 | 0.34 | |
| Uniform Delay, d1 | 41.2 | 40.3 | | | 39.3 | | 41.5 | 3.3 | | 47.9 | 7.5 | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | | 0.74 | 1.23 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 1.5 | 0.5 | | | 0.0 | | 2.8 | 0.1 | | 0.1 | 0.4 | |
| Delay (s) | 42.7 | 40.9 | | | 39.3 | | 33.3 | 4.3 | | 47.9 | 7.9 | |
| Level of Service | D | D | | | D | | C | A | | D | A | |
| Approach Delay (s) | | 41.2 | | | 39.3 | | | 10.4 | | | 7.9 | |
| Approach LOS | | D | | | D | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 15.9 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.38 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 57.4% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 22: Novato Blvd & Arthur St

11/22/2017

| Movement | EBL | EBR | NBL | NBT | SBU | SBT | SBR |
|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | |
| Traffic Volume (vph) | 157 | 124 | 220 | 490 | 18 | 823 | 180 |
| Future Volume (vph) | 157 | 124 | 220 | 490 | 18 | 823 | 180 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 3.5 | 3.5 | 4.9 | 3.5 | 4.9 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 0.98 | 1.00 | 1.00 | 1.00 | 0.99 | |
| Flpb, ped/bikes | 0.99 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 0.85 | 1.00 | 1.00 | 1.00 | 0.97 | |
| Flt Protected | 0.95 | 1.00 | 0.95 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1785 | 1579 | 1805 | 3610 | 1805 | 3465 | |
| Flt Permitted | 0.95 | 1.00 | 0.95 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1785 | 1579 | 1805 | 3610 | 1805 | 3465 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 171 | 135 | 239 | 533 | 20 | 895 | 196 |
| RTOR Reduction (vph) | 0 | 114 | 0 | 0 | 0 | 13 | 0 |
| Lane Group Flow (vph) | 171 | 21 | 239 | 533 | 20 | 1078 | 0 |
| Confl. Peds. (#/hr) | 10 | 8 | | | | | 5 |
| Confl. Bikes (#/hr) | | 1 | | | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 1% | 0% |
| Turn Type | Perm | Perm | Prot | NA | Prot | NA | |
| Protected Phases | | | 1 | 6 | 5 | 2 | |
| Permitted Phases | 4 | 4 | | | | | |
| Actuated Green, G (s) | 15.5 | 15.5 | 17.3 | 69.9 | 2.7 | 55.3 | |
| Effective Green, g (s) | 15.5 | 15.5 | 17.3 | 69.9 | 2.7 | 55.3 | |
| Actuated g/C Ratio | 0.16 | 0.16 | 0.17 | 0.70 | 0.03 | 0.55 | |
| Clearance Time (s) | 3.5 | 3.5 | 3.5 | 4.9 | 3.5 | 4.9 | |
| Vehicle Extension (s) | 2.0 | 2.0 | 2.0 | 4.0 | 2.0 | 4.0 | |
| Lane Grp Cap (vph) | 276 | 244 | 312 | 2523 | 48 | 1916 | |
| v/s Ratio Prot | | | c0.13 | 0.15 | 0.01 | c0.31 | |
| v/s Ratio Perm | c0.10 | 0.01 | | | | | |
| v/c Ratio | 0.62 | 0.09 | 0.77 | 0.21 | 0.42 | 0.56 | |
| Uniform Delay, d1 | 39.5 | 36.2 | 39.4 | 5.3 | 47.9 | 14.5 | |
| Progression Factor | 1.00 | 1.00 | 0.88 | 0.76 | 1.38 | 0.74 | |
| Incremental Delay, d2 | 2.9 | 0.1 | 8.3 | 0.2 | 2.0 | 1.1 | |
| Delay (s) | 42.4 | 36.2 | 43.0 | 4.2 | 68.0 | 11.9 | |
| Level of Service | D | D | D | A | E | B | |
| Approach Delay (s) | 39.7 | | | 16.2 | | 12.9 | |
| Approach LOS | D | | | B | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 17.8 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.61 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 11.9 |
| Intersection Capacity Utilization | 63.5% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 23: Novato Blvd & Rowland Blvd

11/22/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 44 | 135 | 15 | 353 | 308 | 336 | 43 | 294 | 216 | 367 | 413 | 179 |
| Future Volume (vph) | 44 | 135 | 15 | 353 | 308 | 336 | 43 | 294 | 216 | 367 | 413 | 179 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 3.5 | | 3.5 | 4.1 | 4.1 | 3.5 | 4.1 | | 3.5 | 4.4 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 0.97 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 0.99 | | 1.00 | 1.00 | 0.99 | 1.00 | 0.99 | | 1.00 | 0.99 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.98 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.94 | | 1.00 | 0.95 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1805 | 1858 | | 1770 | 1900 | 1576 | 1805 | 1744 | | 3502 | 1793 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1805 | 1858 | | 1770 | 1900 | 1576 | 1805 | 1744 | | 3502 | 1793 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 46 | 142 | 16 | 372 | 324 | 354 | 45 | 309 | 227 | 386 | 435 | 188 |
| RTOR Reduction (vph) | 0 | 4 | 0 | 0 | 0 | 250 | 0 | 24 | 0 | 0 | 13 | 0 |
| Lane Group Flow (vph) | 46 | 154 | 0 | 372 | 324 | 104 | 45 | 512 | 0 | 386 | 610 | 0 |
| Confl. Peds. (#/hr) | | | 24 | | | 2 | | | 13 | | | 10 |
| Confl. Bikes (#/hr) | | | 1 | | | | | | 1 | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 2% | 0% | 1% | 0% | 0% | 2% | 0% | 0% | 0% |
| Turn Type | Prot | NA | | Prot | NA | Perm | Prot | NA | | Prot | NA | |
| Protected Phases | 3 | 8 | | 7 | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | | | | | | 4 | | | | | | |
| Actuated Green, G (s) | 5.6 | 18.1 | | 17.5 | 29.4 | 29.4 | 5.7 | 35.7 | | 14.1 | 43.8 | |
| Effective Green, g (s) | 5.6 | 18.1 | | 17.5 | 29.4 | 29.4 | 5.7 | 35.7 | | 14.1 | 43.8 | |
| Actuated g/C Ratio | 0.06 | 0.18 | | 0.18 | 0.29 | 0.29 | 0.06 | 0.36 | | 0.14 | 0.44 | |
| Clearance Time (s) | 3.5 | 3.5 | | 3.5 | 4.1 | 4.1 | 3.5 | 4.1 | | 3.5 | 4.4 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 3.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 101 | 336 | | 309 | 558 | 463 | 102 | 622 | | 493 | 785 | |
| v/s Ratio Prot | 0.03 | 0.08 | | c0.21 | c0.17 | | 0.02 | c0.29 | | 0.11 | c0.34 | |
| v/s Ratio Perm | | | | | | 0.07 | | | | | | |
| v/c Ratio | 0.46 | 0.46 | | 1.20 | 0.58 | 0.22 | 0.44 | 0.82 | | 0.78 | 0.78 | |
| Uniform Delay, d1 | 45.7 | 36.6 | | 41.2 | 30.1 | 26.7 | 45.6 | 29.3 | | 41.5 | 23.9 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.19 | 0.64 | |
| Incremental Delay, d2 | 1.2 | 0.4 | | 118.4 | 1.0 | 0.1 | 1.1 | 11.8 | | 6.4 | 6.5 | |
| Delay (s) | 46.9 | 36.9 | | 159.7 | 31.0 | 26.8 | 46.7 | 41.0 | | 55.8 | 21.7 | |
| Level of Service | D | D | | F | C | C | D | D | | E | C | |
| Approach Delay (s) | | 39.2 | | | 75.2 | | | 41.5 | | | 34.7 | |
| Approach LOS | | D | | | E | | | D | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 51.4 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.87 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 15.5 |
| Intersection Capacity Utilization | 88.0% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 24: Redwood Blvd & Rowland Blvd

11/22/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 112 | 654 | 47 | 20 | 782 | 268 | 69 | 22 | 77 | 285 | 18 | 294 |
| Future Volume (vph) | 112 | 654 | 47 | 20 | 782 | 268 | 69 | 22 | 77 | 285 | 18 | 294 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.4 | 4.4 | 3.5 | 3.7 | 3.7 | 3.5 | 4.1 | | 3.5 | 4.8 | 4.8 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | 0.97 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.99 | 1.00 | 0.99 | | 1.00 | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.88 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1805 | 3574 | 1589 | 1805 | 3574 | 1578 | 1805 | 3151 | | 3502 | 1900 | 1593 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1805 | 3574 | 1589 | 1805 | 3574 | 1578 | 1805 | 3151 | | 3502 | 1900 | 1593 |
| Peak-hour factor, PHF | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 |
| Adj. Flow (vph) | 126 | 735 | 53 | 22 | 879 | 301 | 78 | 25 | 87 | 320 | 20 | 330 |
| RTOR Reduction (vph) | 0 | 0 | 27 | 0 | 0 | 73 | 0 | 75 | 0 | 0 | 0 | 244 |
| Lane Group Flow (vph) | 126 | 735 | 26 | 22 | 879 | 228 | 78 | 37 | 0 | 320 | 20 | 86 |
| Confl. Peds. (#/hr) | | | 6 | | | 2 | | | 3 | | | 2 |
| Confl. Bikes (#/hr) | | | | | | | | | 1 | | | |
| Heavy Vehicles (%) | 0% | 1% | 0% | 0% | 1% | 1% | 0% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Prot | NA | Perm | Prot | NA | Perm | Prot | NA | | Prot | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | 3 | 8 | | 7 | 4 | |
| Permitted Phases | | | 2 | | | 6 | | | | | | 4 |
| Actuated Green, G (s) | 11.1 | 38.9 | 38.9 | 3.0 | 31.5 | 31.5 | 8.0 | 10.7 | | 12.5 | 14.5 | 14.5 |
| Effective Green, g (s) | 11.1 | 38.9 | 38.9 | 3.0 | 31.5 | 31.5 | 8.0 | 10.7 | | 12.5 | 14.5 | 14.5 |
| Actuated g/C Ratio | 0.14 | 0.48 | 0.48 | 0.04 | 0.39 | 0.39 | 0.10 | 0.13 | | 0.16 | 0.18 | 0.18 |
| Clearance Time (s) | 3.5 | 4.4 | 4.4 | 3.5 | 3.7 | 3.7 | 3.5 | 4.1 | | 3.5 | 4.8 | 4.8 |
| Vehicle Extension (s) | 2.0 | 4.0 | 4.0 | 2.0 | 4.0 | 4.0 | 2.0 | 2.5 | | 2.5 | 2.5 | 2.5 |
| Lane Grp Cap (vph) | 248 | 1724 | 766 | 67 | 1396 | 616 | 179 | 418 | | 543 | 341 | 286 |
| v/s Ratio Prot | c0.07 | 0.21 | | 0.01 | c0.25 | | 0.04 | 0.01 | | c0.09 | 0.01 | |
| v/s Ratio Perm | | | 0.02 | | | 0.14 | | | | | | c0.05 |
| v/c Ratio | 0.51 | 0.43 | 0.03 | 0.33 | 0.63 | 0.37 | 0.44 | 0.09 | | 0.59 | 0.06 | 0.30 |
| Uniform Delay, d1 | 32.2 | 13.6 | 11.0 | 37.8 | 19.8 | 17.5 | 34.2 | 30.7 | | 31.7 | 27.4 | 28.6 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.6 | 0.2 | 0.0 | 1.0 | 1.0 | 0.5 | 0.6 | 0.1 | | 1.4 | 0.1 | 0.4 |
| Delay (s) | 32.8 | 13.8 | 11.0 | 38.9 | 20.9 | 18.0 | 34.8 | 30.7 | | 33.0 | 27.4 | 29.1 |
| Level of Service | C | B | B | D | C | B | C | C | | C | C | C |
| Approach Delay (s) | | 16.3 | | | 20.5 | | | 32.4 | | | 30.9 | |
| Approach LOS | | B | | | C | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 22.3 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.57 | | |
| Actuated Cycle Length (s) | 80.6 | Sum of lost time (s) | 16.2 |
| Intersection Capacity Utilization | 60.2% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
## 25: US 101 SB Ramps & Rowland Blvd

11/22/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 563 | 427 | 132 | 630 | 0 | 0 | 0 | 0 | 269 | 47 | 480 |
| Future Volume (vph) | 0 | 563 | 427 | 132 | 630 | 0 | 0 | 0 | 0 | 269 | 47 | 480 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.6 | 3.6 | 3.0 | 3.6 | | | | | 3.0 | 3.0 | |
| Lane Util. Factor | | 0.91 | 0.91 | 0.97 | 0.95 | | | | | 0.91 | 0.91 | |
| Frpb, ped/bikes | | 1.00 | 0.99 | 1.00 | 1.00 | | | | | 1.00 | 0.99 | |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | | | | 1.00 | 1.00 | |
| Frt | | 0.97 | 0.85 | 1.00 | 1.00 | | | | | 1.00 | 0.87 | |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 3329 | 1450 | 3367 | 3574 | | | | | 1643 | 2845 | |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | 0.95 | 1.00 | |
| Satd. Flow (perm) | | 3329 | 1450 | 3367 | 3574 | | | | | 1643 | 2845 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 0 | 612 | 464 | 143 | 685 | 0 | 0 | 0 | 0 | 292 | 51 | 522 |
| RTOR Reduction (vph) | 0 | 22 | 203 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 79 | 0 |
| Lane Group Flow (vph) | 0 | 725 | 126 | 143 | 685 | 0 | 0 | 0 | 0 | 263 | 523 | 0 |
| Confl. Peds. (#/hr) | | | 2 | | | | | | | | | 2 |
| Confl. Bikes (#/hr) | | | | | | | | | | | | 1 |
| Heavy Vehicles (%) | 0% | 1% | 0% | 4% | 1% | 0% | 0% | 0% | 0% | 0% | 40% | 1% |
| Turn Type | | NA | Perm | Prot | NA | | | | | Split | NA | |
| Protected Phases | | 2 | | 1 | 6 | | | | | 4 | 4 | |
| Permitted Phases | | | 2 | | | | | | | | | |
| Actuated Green, G (s) | | 17.7 | 17.7 | 3.7 | 24.4 | | | | | 15.2 | 15.2 | |
| Effective Green, g (s) | | 17.7 | 17.7 | 3.7 | 24.4 | | | | | 15.2 | 15.2 | |
| Actuated g/C Ratio | | 0.38 | 0.38 | 0.08 | 0.53 | | | | | 0.33 | 0.33 | |
| Clearance Time (s) | | 3.6 | 3.6 | 3.0 | 3.6 | | | | | 3.0 | 3.0 | |
| Vehicle Extension (s) | | 4.0 | 4.0 | 2.0 | 2.5 | | | | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | | 1275 | 555 | 269 | 1887 | | | | | 540 | 936 | |
| v/s Ratio Prot | | c0.22 | | c0.04 | 0.19 | | | | | 0.16 | c0.18 | |
| v/s Ratio Perm | | | 0.09 | | | | | | | | | |
| v/c Ratio | | 0.57 | 0.23 | 0.53 | 0.36 | | | | | 0.49 | 0.92dr | |
| Uniform Delay, d1 | | 11.2 | 9.6 | 20.4 | 6.4 | | | | | 12.4 | 12.7 | |
| Progression Factor | | 1.00 | 1.00 | 1.00 | 1.00 | | | | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 0.7 | 0.3 | 1.0 | 0.1 | | | | | 0.3 | 0.4 | |
| Delay (s) | | 11.9 | 9.9 | 21.4 | 6.5 | | | | | 12.6 | 13.2 | |
| Level of Service | | B | A | C | A | | | | | B | B | |
| Approach Delay (s) | | 11.3 | | | 9.0 | | | 0.0 | | | 13.0 | |
| Approach LOS | | B | | | A | | | A | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 11.2 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.56 | | |
| Actuated Cycle Length (s) | 46.2 | Sum of lost time (s) | 9.6 |
| Intersection Capacity Utilization | 51.3% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

dr Defacto Right Lane. Recode with 1 though lane as a right lane.
c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
## 26: US 101 NB Ramps & Rowland Blvd

11/22/2017

| Movement | EBL2 | EBL | EBT | WBT | WBR | WBR2 | NBL2 | NBL | NBT | NBR | NEL2 | NEL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 26 | 237 | 596 | 305 | 1 | 142 | 466 | 7 | 8 | 418 | 12 | 3 |
| Future Volume (vph) | 26 | 237 | 596 | 305 | 1 | 142 | 466 | 7 | 8 | 418 | 12 | 3 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | 3.6 | 3.6 | | 3.6 | 3.5 | | 3.5 | 3.0 | | 3.5 |
| Lane Util. Factor | | 1.00 | 0.95 | 0.86 | | 0.86 | 0.95 | | 0.95 | 0.88 | | 1.00 |
| Frpb, ped/bikes | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Frt | | 1.00 | 1.00 | 0.98 | | 0.85 | 1.00 | | 1.00 | 0.85 | | 0.99 |
| Flt Protected | | 0.95 | 1.00 | 1.00 | | 1.00 | 0.95 | | 0.95 | 1.00 | | 0.96 |
| Satd. Flow (prot) | | 1805 | 3574 | 4623 | | 1323 | 1715 | | 1683 | 2787 | | 1800 |
| Flt Permitted | | 0.95 | 1.00 | 1.00 | | 1.00 | 0.95 | | 0.95 | 1.00 | | 0.96 |
| Satd. Flow (perm) | | 1805 | 3574 | 4623 | | 1323 | 1715 | | 1683 | 2787 | | 1800 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 28 | 258 | 648 | 332 | 1 | 154 | 507 | 8 | 9 | 454 | 13 | 3 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 14 | 0 | 84 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 286 | 648 | 364 | 0 | 25 | 264 | 0 | 260 | 454 | 0 | 17 |
| Confl. Peds. (#/hr) | | | | | | | | | | 2 | | |
| Heavy Vehicles (%) | 0% | 0% | 1% | 4% | 0% | 5% | 0% | 0% | 67% | 2% | 0% | 0% |
| Turn Type | Prot | Prot | NA | NA | | Perm | Split | Split | NA | custom | Perm | Prot |
| Protected Phases | 5 | 5 | 2 | 6 | | | 8 | 8 | 8 | 1 8 | | 7 |
| Permitted Phases | | | | | | 6 | | | | | 7 | |
| Actuated Green, G (s) | | 16.0 | 17.5 | 13.9 | | 13.9 | 16.4 | | 16.4 | 32.3 | | 1.3 |
| Effective Green, g (s) | | 16.0 | 17.5 | 13.9 | | 13.9 | 16.4 | | 16.4 | 28.8 | | 1.3 |
| Actuated g/C Ratio | | 0.26 | 0.29 | 0.23 | | 0.23 | 0.27 | | 0.27 | 0.47 | | 0.02 |
| Clearance Time (s) | | 3.0 | 3.6 | 3.6 | | 3.6 | 3.5 | | 3.5 | | | 3.5 |
| Vehicle Extension (s) | | 2.0 | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | | | 2.0 |
| Lane Grp Cap (vph) | | 471 | 1021 | 1049 | | 300 | 459 | | 451 | 1311 | | 38 |
| v/s Ratio Prot | | 0.16 | c0.18 | c0.08 | | | 0.15 | | c0.15 | 0.16 | | |
| v/s Ratio Perm | | | | | | 0.02 | | | | | | 0.01 |
| v/c Ratio | | 0.61 | 0.63 | 0.35 | | 0.08 | 0.58 | | 0.58 | 0.35 | | 0.45 |
| Uniform Delay, d1 | | 19.8 | 19.1 | 19.8 | | 18.6 | 19.4 | | 19.4 | 10.2 | | 29.6 |
| Progression Factor | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Incremental Delay, d2 | | 1.5 | 1.0 | 0.1 | | 0.0 | 1.1 | | 1.1 | 0.1 | | 3.0 |
| Delay (s) | | 21.4 | 20.0 | 19.9 | | 18.7 | 20.5 | | 20.5 | 10.3 | | 32.6 |
| Level of Service | | C | C | B | | B | C | | C | B | | C |
| Approach Delay (s) | | | 20.4 | 19.6 | | | | | 15.8 | | | 32.6 |
| Approach LOS | | | C | B | | | | | B | | | C |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 18.5 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.54 | | |
| Actuated Cycle Length (s) | 61.2 | Sum of lost time (s) | 13.6 |
| Intersection Capacity Utilization | 61.4% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | NER |
|---|---|
| Lane Configurations | |
| Traffic Volume (vph) | 1 |
| Future Volume (vph) | 1 |
| Ideal Flow (vphpl) | 1900 |
| Total Lost time (s) | |
| Lane Util. Factor | |
| Frpb, ped/bikes | |
| Flpb, ped/bikes | |
| Frt | |
| Flt Protected | |
| Satd. Flow (prot) | |
| Flt Permitted | |
| Satd. Flow (perm) | |
| Peak-hour factor, PHF | 0.92 |
| Adj. Flow (vph) | 1 |
| RTOR Reduction (vph) | 0 |
| Lane Group Flow (vph) | 0 |
| Confl. Peds. (#/hr) | |
| Heavy Vehicles (%) | 0% |
| Turn Type | |
| Protected Phases | |
| Permitted Phases | |
| Actuated Green, G (s) | |
| Effective Green, g (s) | |
| Actuated g/C Ratio | |
| Clearance Time (s) | |
| Vehicle Extension (s) | |
| Lane Grp Cap (vph) | |
| v/s Ratio Prot | |
| v/s Ratio Perm | |
| v/c Ratio | |
| Uniform Delay, d1 | |
| Progression Factor | |
| Incremental Delay, d2 | |
| Delay (s) | |
| Level of Service | |
| Approach Delay (s) | |
| Approach LOS | |

Intersection Summary





| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 401 | 608 | 356 | 22 | 12 | 82 |
| Future Volume (vph) | 401 | 608 | 356 | 22 | 12 | 82 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 3.6 | 3.2 | | 3.2 | 3.2 |
| Lane Util. Factor | 0.97 | 0.91 | 0.95 | | 1.00 | 0.95 |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.99 | | 0.89 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | | 0.99 | 1.00 |
| Satd. Flow (prot) | 3467 | 5085 | 3398 | | 1605 | 1490 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | | 0.99 | 1.00 |
| Satd. Flow (perm) | 3467 | 5085 | 3398 | | 1605 | 1490 |
| Peak-hour factor, PHF | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 |
| Adj. Flow (vph) | 451 | 683 | 400 | 25 | 13 | 92 |
| RTOR Reduction (vph) | 0 | 0 | 5 | 0 | 34 | 45 |
| Lane Group Flow (vph) | 451 | 683 | 420 | 0 | 19 | 7 |
| Confl. Peds. (#/hr) | | | | 1 | 2 | |
| Heavy Vehicles (%) | 1% | 2% | 5% | 9% | 6% | 3% |
| Turn Type | Prot | NA | NA | | Prot | Perm |
| Protected Phases | 5 | 2 | 6 | | 4 | |
| Permitted Phases | | | | | | 4 |
| Actuated Green, G (s) | 12.9 | 31.9 | 15.9 | | 6.2 | 6.2 |
| Effective Green, g (s) | 12.9 | 31.9 | 15.9 | | 6.2 | 6.2 |
| Actuated g/C Ratio | 0.29 | 0.71 | 0.35 | | 0.14 | 0.14 |
| Clearance Time (s) | 3.5 | 3.6 | 3.2 | | 3.2 | 3.2 |
| Vehicle Extension (s) | 2.0 | 4.0 | 4.0 | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 996 | 3612 | 1203 | | 221 | 205 |
| v/s Ratio Prot | c0.13 | 0.13 | c0.12 | | c0.01 | |
| v/s Ratio Perm | | | | | | 0.00 |
| v/c Ratio | 0.45 | 0.19 | 0.35 | | 0.08 | 0.04 |
| Uniform Delay, d1 | 13.1 | 2.2 | 10.7 | | 16.9 | 16.8 |
| Progression Factor | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.1 | 0.0 | 0.2 | | 0.1 | 0.0 |
| Delay (s) | 13.2 | 2.2 | 10.9 | | 16.9 | 16.8 |
| Level of Service | B | A | B | | B | B |
| Approach Delay (s) | | 6.6 | 10.9 | | 16.9 | |
| Approach LOS | | A | B | | B | |

Intersection Summary

| | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 8.3 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.34 | | |
| Actuated Cycle Length (s) | 44.9 | Sum of lost time (s) | 9.9 |
| Intersection Capacity Utilization | 37.5% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 28: Vintage Way & Rowland Blvd

11/22/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 7 | 318 | 299 | 2 | 232 | 3 | 129 | 3 | 0 | 1 | 2 | 1 |
| Future Volume (vph) | 7 | 318 | 299 | 2 | 232 | 3 | 129 | 3 | 0 | 1 | 2 | 1 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.6 | 3.6 | 3.0 | 3.6 | | 3.6 | 3.6 | | | 3.2 | |
| Lane Util. Factor | 1.00 | 0.95 | 0.88 | 1.00 | 0.95 | | 0.97 | 1.00 | | | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | | 1.00 | 1.00 | | | 0.97 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | | 0.99 | |
| Satd. Flow (prot) | 1805 | 3195 | 2814 | 1805 | 3249 | | 3367 | 1900 | | | 1813 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | | 0.99 | |
| Satd. Flow (perm) | 1805 | 3195 | 2814 | 1805 | 3249 | | 3367 | 1900 | | | 1813 | |
| Peak-hour factor, PHF | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 |
| Adj. Flow (vph) | 8 | 374 | 352 | 2 | 273 | 4 | 152 | 4 | 0 | 1 | 2 | 1 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| Lane Group Flow (vph) | 8 | 374 | 352 | 2 | 275 | 0 | 152 | 4 | 0 | 0 | 3 | 0 |
| Confl. Peds. (#/hr) | | | 1 | | | 3 | | | 1 | | | |
| Confl. Bikes (#/hr) | | | 2 | | | 2 | | | | | | |
| Heavy Vehicles (%) | 0% | 13% | 1% | 0% | 11% | 0% | 4% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Prot | NA | pt+ov | Prot | NA | | Split | NA | | Split | NA | |
| Protected Phases | 5 | 2 | 2 3 | 1 | 6 | | 3 | 3 | | 4 | 4 | |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | 1.1 | 11.0 | 31.1 | 0.5 | 10.4 | | 16.5 | 16.5 | | | 1.1 | |
| Effective Green, g (s) | 1.1 | 11.0 | 31.1 | 0.5 | 10.4 | | 16.5 | 16.5 | | | 1.1 | |
| Actuated g/C Ratio | 0.03 | 0.26 | 0.73 | 0.01 | 0.24 | | 0.39 | 0.39 | | | 0.03 | |
| Clearance Time (s) | 3.0 | 3.6 | | 3.0 | 3.6 | | 3.6 | 3.6 | | | 3.2 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | | 3.0 | 3.0 | | | 2.0 | |
| Lane Grp Cap (vph) | 46 | 826 | 2059 | 21 | 795 | | 1307 | 737 | | | 46 | |
| v/s Ratio Prot | c0.00 | c0.12 | c0.13 | 0.00 | 0.08 | | 0.05 | 0.00 | | | c0.00 | |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | 0.17 | 0.45 | 0.17 | 0.10 | 0.35 | | 0.12 | 0.01 | | | 0.07 | |
| Uniform Delay, d1 | 20.3 | 13.2 | 1.7 | 20.8 | 13.2 | | 8.3 | 8.0 | | | 20.2 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | | 1.00 | |
| Incremental Delay, d2 | 0.7 | 0.1 | 0.0 | 0.7 | 0.1 | | 0.0 | 0.0 | | | 0.2 | |
| Delay (s) | 20.9 | 13.4 | 1.8 | 21.5 | 13.3 | | 8.4 | 8.0 | | | 20.4 | |
| Level of Service | C | B | A | C | B | | A | A | | | C | |
| Approach Delay (s) | | 7.9 | | | 13.4 | | | 8.4 | | | 20.4 | |
| Approach LOS | | A | | | B | | | A | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 9.3 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.29 | | |
| Actuated Cycle Length (s) | 42.5 | Sum of lost time (s) | 13.4 |
| Intersection Capacity Utilization | 36.0% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 29: Novato Blvd & Sunset Pkwy

11/22/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 239 | 65 | 25 | 37 | 97 | 96 | 24 | 242 | 53 | 51 | 329 | 310 |
| Future Volume (vph) | 239 | 65 | 25 | 37 | 97 | 96 | 24 | 242 | 53 | 51 | 329 | 310 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.0 | | 3.5 | 3.5 | | 3.5 | 4.9 | | 3.5 | 4.6 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 0.99 | | 1.00 | 0.97 | | 1.00 | 1.00 | | 1.00 | 0.99 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.96 | | 1.00 | 0.93 | | 1.00 | 0.97 | | 1.00 | 0.93 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1787 | 1808 | | 1805 | 1712 | | 1805 | 1841 | | 1770 | 1713 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1787 | 1808 | | 1805 | 1712 | | 1805 | 1841 | | 1770 | 1713 | |
| Peak-hour factor, PHF | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Adj. Flow (vph) | 263 | 71 | 27 | 41 | 107 | 105 | 26 | 266 | 58 | 56 | 362 | 341 |
| RTOR Reduction (vph) | 0 | 14 | 0 | 0 | 39 | 0 | 0 | 7 | 0 | 0 | 30 | 0 |
| Lane Group Flow (vph) | 263 | 84 | 0 | 41 | 173 | 0 | 26 | 317 | 0 | 56 | 673 | 0 |
| Confl. Peds. (#/hr) | | | 4 | | | 21 | | | 3 | | | 5 |
| Confl. Bikes (#/hr) | | | | | | 1 | | | | | | |
| Heavy Vehicles (%) | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 2% | 1% | 2% |
| Turn Type | Prot | NA | | Prot | NA | | Prot | NA | | Prot | NA | |
| Protected Phases | 3 | 8 | | 7 | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | 12.8 | 22.8 | | 5.7 | 16.2 | | 3.4 | 32.5 | | 5.8 | 35.2 | |
| Effective Green, g (s) | 12.8 | 22.8 | | 5.7 | 16.2 | | 3.4 | 32.5 | | 5.8 | 35.2 | |
| Actuated g/C Ratio | 0.15 | 0.28 | | 0.07 | 0.20 | | 0.04 | 0.39 | | 0.07 | 0.43 | |
| Clearance Time (s) | 3.5 | 4.0 | | 3.5 | 3.5 | | 3.5 | 4.9 | | 3.5 | 4.6 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 276 | 498 | | 124 | 335 | | 74 | 723 | | 124 | 729 | |
| v/s Ratio Prot | c0.15 | 0.05 | | 0.02 | c0.10 | | 0.01 | 0.17 | | c0.03 | c0.39 | |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | 0.95 | 0.17 | | 0.33 | 0.52 | | 0.35 | 0.44 | | 0.45 | 0.92 | |
| Uniform Delay, d1 | 34.7 | 22.8 | | 36.7 | 29.7 | | 38.6 | 18.4 | | 36.9 | 22.5 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 40.9 | 0.1 | | 0.6 | 0.6 | | 1.1 | 0.2 | | 1.0 | 17.0 | |
| Delay (s) | 75.6 | 22.8 | | 37.3 | 30.3 | | 39.6 | 18.6 | | 37.9 | 39.5 | |
| Level of Service | E | C | | D | C | | D | B | | D | D | |
| Approach Delay (s) | | 61.3 | | | 31.4 | | | 20.1 | | | 39.4 | |
| Approach LOS | | E | | | C | | | C | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 38.9 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.82 | | |
| Actuated Cycle Length (s) | 82.7 | Sum of lost time (s) | 15.9 |
| Intersection Capacity Utilization | 83.4% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Intersection | |
|---|---|
| Intersection Delay, s/veh | 229.2 |
| Intersection LOS | F |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 47 | 467 | 382 | 324 | 172 | 27 | 90 | 6 | 70 | 94 | 21 | 64 |
| Future Vol, veh/h | 47 | 467 | 382 | 324 | 172 | 27 | 90 | 6 | 70 | 94 | 21 | 64 |
| Peak Hour Factor | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| Heavy Vehicles, % | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Mvmt Flow | 51 | 502 | 411 | 348 | 185 | 29 | 97 | 6 | 75 | 101 | 23 | 69 |
| Number of Lanes | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Opposing Approach | WB | EB | SB | NB |
| Opposing Lanes | 2 | 2 | 2 | 3 |
| Conflicting Approach Left | SB | NB | EB | WB |
| Conflicting Lanes Left | 2 | 3 | 2 | 2 |
| Conflicting Approach Right | NB | SB | WB | EB |
| Conflicting Lanes Right | 3 | 2 | 2 | 2 |
| HCM Control Delay | 424.9 | 33.8 | 16.7 | 17.1 |
| HCM LOS | F | D | C | C |

| Lane | NBLn1 | NBLn2 | NBLn3 | EBLn1 | EBLn2 | WBLn1 | WBLn2 | SBLn1 | SBLn2 |
|---|---|---|---|---|---|---|---|---|---|
| Vol Left, % | 100% | 0% | 0% | 100% | 0% | 100% | 0% | 100% | 0% |
| Vol Thru, % | 0% | 100% | 0% | 0% | 55% | 0% | 86% | 0% | 25% |
| Vol Right, % | 0% | 0% | 100% | 0% | 45% | 0% | 14% | 0% | 75% |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 90 | 6 | 70 | 47 | 849 | 324 | 199 | 94 | 85 |
| LT Vol | 90 | 0 | 0 | 47 | 0 | 324 | 0 | 94 | 0 |
| Through Vol | 0 | 6 | 0 | 0 | 467 | 0 | 172 | 0 | 21 |
| RT Vol | 0 | 0 | 70 | 0 | 382 | 0 | 27 | 0 | 64 |
| Lane Flow Rate | 97 | 6 | 75 | 51 | 913 | 348 | 214 | 101 | 91 |
| Geometry Grp | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Degree of Util (X) | 0.257 | 0.016 | 0.175 | 0.119 | 1.938 | 0.801 | 0.458 | 0.265 | 0.214 |
| Departure Headway (Hd) | 11.496 | 10.967 | 10.228 | 8.458 | 7.643 | 9.906 | 9.307 | 11.411 | 10.321 |
| Convergence, Y/N | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Cap | 315 | 328 | 353 | 427 | 484 | 369 | 389 | 317 | 350 |
| Service Time | 9.196 | 8.667 | 7.928 | 6.158 | 5.343 | 7.606 | 7.007 | 9.111 | 8.021 |
| HCM Lane V/C Ratio | 0.308 | 0.018 | 0.212 | 0.119 | 1.886 | 0.943 | 0.55 | 0.319 | 0.26 |
| HCM Control Delay | 18.1 | 13.8 | 15.1 | 12.3 | 447.7 | 42.5 | 19.6 | 18.2 | 15.8 |
| HCM Lane LOS | C | B | C | B | F | E | C | C | C |
| HCM 95th-tile Q | 1 | 0 | 0.6 | 0.4 | 60.9 | 6.9 | 2.3 | 1 | 0.8 |



# MOVEMENT SUMMARY

## Site: 30 [AM Existing + Project Alt]

Novato Boulevard/Redwood Boulevard
AM Existing + Project Alternative

Roundabout

**Movement Performance - Vehicles**

| Mov ID | OD Mov | Demand Flows Total veh/h | Demand Flows HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance ft | Prop. Queued | Effective Stop Rate per veh | Average Speed mph |
|---|---|---|---|---|---|---|---|---|---|---|---|
| South: NB Redwood Boulevard | | | | | | | | | | | |
| 3 | L2 | 97 | 2.0 | 0.260 | 8.4 | LOS A | 1.1 | 28.2 | 0.64 | 0.64 | 31.9 |
| 8 | T1 | 6 | 2.0 | 0.260 | 8.4 | LOS A | 1.1 | 28.2 | 0.64 | 0.64 | 31.9 |
| 18 | R2 | 75 | 2.0 | 0.260 | 8.4 | LOS A | 1.1 | 28.2 | 0.64 | 0.64 | 31.1 |
| Approach | | 178 | 2.0 | 0.260 | 8.4 | LOS A | 1.1 | 28.2 | 0.64 | 0.64 | 31.5 |
| East: WB Novato Blvd | | | | | | | | | | | |
| 1 | L2 | 348 | 2.0 | 0.488 | 8.5 | LOS A | 3.3 | 84.1 | 0.47 | 0.31 | 31.7 |
| 6 | T1 | 185 | 2.0 | 0.488 | 8.5 | LOS A | 3.3 | 84.1 | 0.47 | 0.31 | 31.7 |
| 16 | R2 | 29 | 2.0 | 0.488 | 8.5 | LOS A | 3.3 | 84.1 | 0.47 | 0.31 | 30.9 |
| Approach | | 562 | 2.0 | 0.488 | 8.5 | LOS A | 3.3 | 84.1 | 0.47 | 0.31 | 31.6 |
| North: SB Redwood Boulevard | | | | | | | | | | | |
| 7 | L2 | 101 | 2.0 | 0.274 | 8.4 | LOS A | 1.2 | 30.1 | 0.64 | 0.64 | 31.9 |
| 4 | T1 | 23 | 2.0 | 0.274 | 8.4 | LOS A | 1.2 | 30.1 | 0.64 | 0.64 | 31.9 |
| 14 | R2 | 69 | 2.0 | 0.274 | 8.4 | LOS A | 1.2 | 30.1 | 0.64 | 0.64 | 31.1 |
| Approach | | 192 | 2.0 | 0.274 | 8.4 | LOS A | 1.2 | 30.1 | 0.64 | 0.64 | 31.6 |
| West: EB Novato Blvd | | | | | | | | | | | |
| 5 | L2 | 51 | 2.0 | 0.668 | 16.0 | LOS B | 4.8 | 121.2 | 0.74 | 0.83 | 29.7 |
| 2 | T1 | 502 | 2.0 | 0.668 | 16.0 | LOS B | 4.8 | 121.2 | 0.74 | 0.83 | 29.7 |
| 12 | R2 | 411 | 2.0 | 0.457 | 9.6 | LOS A | 2.5 | 63.3 | 0.64 | 0.64 | 31.5 |
| Approach | | 963 | 2.0 | 0.668 | 13.3 | LOS B | 4.8 | 121.2 | 0.70 | 0.75 | 30.5 |
| All Vehicles | | 1897 | 2.0 | 0.668 | 10.9 | LOS B | 4.8 | 121.2 | 0.62 | 0.60 | 31.0 |

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.


Organisation: W-TRANS | Processed: Tuesday, June 13, 2017 3:16:40 PM
Project: N:\AAA\MAX\NOV\126NOV\SIDRA\Novato-Redwood.sip7

# LANE SUMMARY

## Site: 30 [AM Existing + Project Alt]

Novato Boulevard/Redwood Boulevard
AM Existing + Project Alternative

Roundabout

**Lane Use and Performance**

| | Demand Flows Total veh/h | HV % | Cap. veh/h | Deg. Satn v/c | Lane Util. % | Average Delay sec | Level of Service | 95% Back of Queue Veh | 95% Back of Queue Dist ft | Lane Config | Lane Length ft | Cap. Adj. % | Prob. Block. % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| South: NB Redwood Boulevard | | | | | | | | | | | | | |
| Lane 1[d] | 178 | 2.0 | 685 | 0.260 | 100 | 8.4 | LOS A | 1.1 | 28.2 | Full | 1600 | 0.0 | 0.0 |
| Approach | 178 | 2.0 | | 0.260 | | 8.4 | LOS A | 1.1 | 28.2 | | | | |
| East: WB Novato Blvd | | | | | | | | | | | | | |
| Lane 1[d] | 562 | 2.0 | 1153 | 0.488 | 100 | 8.5 | LOS A | 3.3 | 84.1 | Full | 1600 | 0.0 | 0.0 |
| Approach | 562 | 2.0 | | 0.488 | | 8.5 | LOS A | 3.3 | 84.1 | | | | |
| North: SB Redwood Boulevard | | | | | | | | | | | | | |
| Lane 1[d] | 192 | 2.0 | 702 | 0.274 | 100 | 8.4 | LOS A | 1.2 | 30.1 | Full | 1600 | 0.0 | 0.0 |
| Approach | 192 | 2.0 | | 0.274 | | 8.4 | LOS A | 1.2 | 30.1 | | | | |
| West: EB Novato Blvd | | | | | | | | | | | | | |
| Lane 1[d] | 553 | 2.0 | 828[1] | 0.668 | 100 | 16.0 | LOS B | 4.8 | 121.2 | Full | 1600 | 0.0 | 0.0 |
| Lane 2 | 411 | 2.0 | 898 | 0.457 | 100 | 9.6 | LOS A | 2.5 | 63.3 | Short | 30 | 0.0 | NA |
| Approach | 963 | 2.0 | | 0.668 | | 13.3 | LOS B | 4.8 | 121.2 | | | | |
| Intersection | 1897 | 2.0 | | 0.668 | | 10.9 | LOS B | 4.8 | 121.2 | | | | |

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.
d Dominant lane on roundabout approach


Organisation: W-TRANS | Processed: Tuesday, June 13, 2017 3:16:40 PM
Project: N:\AAA\MAX\NOV\126NOV\SIDRA\Novato-Redwood.sip7



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 47 | 467 | 382 | 324 | 172 | 27 | 90 | 6 | 70 | 94 | 21 | 64 |
| Future Volume (vph) | 47 | 467 | 382 | 324 | 172 | 27 | 90 | 6 | 70 | 94 | 21 | 64 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 16 | 16 | 12 | 16 | 16 | 12 | 12 | 12 | 12 | 12 | 12 |
| Total Lost time (s) | 3.5 | 4.0 | | 3.5 | 4.0 | | 3.5 | 4.0 | 4.0 | 3.5 | 4.0 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 0.93 | | 1.00 | 0.98 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.89 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1787 | 1977 | | 1787 | 2071 | | 1787 | 1881 | 1599 | 1787 | 1670 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1787 | 1977 | | 1787 | 2071 | | 1787 | 1881 | 1599 | 1787 | 1670 | |
| Peak-hour factor, PHF | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| Adj. Flow (vph) | 51 | 502 | 411 | 348 | 185 | 29 | 97 | 6 | 75 | 101 | 23 | 69 |
| RTOR Reduction (vph) | 0 | 20 | 0 | 0 | 4 | 0 | 0 | 0 | 69 | 0 | 63 | 0 |
| Lane Group Flow (vph) | 51 | 893 | 0 | 348 | 210 | 0 | 97 | 6 | 6 | 101 | 29 | 0 |
| Heavy Vehicles (%) | 1% | 2% | 1% | 1% | 2% | 1% | 1% | 1% | 1% | 1% | 1% | 1% |
| Turn Type | Prot | NA | | Prot | NA | | Prot | NA | Perm | Prot | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | | | | | | | 2 | | | |
| Actuated Green, G (s) | 6.8 | 56.0 | | 25.9 | 75.1 | | 8.3 | 8.8 | 8.8 | 10.3 | 10.8 | |
| Effective Green, g (s) | 6.8 | 56.0 | | 25.9 | 75.1 | | 8.3 | 8.8 | 8.8 | 10.3 | 10.8 | |
| Actuated g/C Ratio | 0.06 | 0.48 | | 0.22 | 0.65 | | 0.07 | 0.08 | 0.08 | 0.09 | 0.09 | |
| Clearance Time (s) | 3.5 | 4.0 | | 3.5 | 4.0 | | 3.5 | 4.0 | 4.0 | 3.5 | 4.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 104 | 954 | | 398 | 1340 | | 127 | 142 | 121 | 158 | 155 | |
| v/s Ratio Prot | 0.03 | c0.45 | | c0.19 | 0.10 | | c0.05 | 0.00 | | 0.06 | c0.02 | |
| v/s Ratio Perm | | | | | | | | | 0.00 | | | |
| v/c Ratio | 0.49 | 0.94 | | 0.87 | 0.16 | | 0.76 | 0.04 | 0.05 | 0.64 | 0.19 | |
| Uniform Delay, d1 | 52.9 | 28.3 | | 43.5 | 8.0 | | 52.9 | 49.7 | 49.7 | 51.1 | 48.6 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 3.6 | 15.8 | | 18.7 | 0.1 | | 23.4 | 0.1 | 0.2 | 8.2 | 0.6 | |
| Delay (s) | 56.5 | 44.1 | | 62.2 | 8.1 | | 76.3 | 49.8 | 49.9 | 59.3 | 49.2 | |
| Level of Service | E | D | | E | A | | E | D | D | E | D | |
| Approach Delay (s) | | 44.8 | | | 41.6 | | | 64.3 | | | 54.5 | |
| Approach LOS | | D | | | D | | | E | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 46.6 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.82 | | |
| Actuated Cycle Length (s) | 116.0 | Sum of lost time (s) | 15.0 |
| Intersection Capacity Utilization | 87.7% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 31: Alameda Del Prado & Ignacio Blvd

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 12 | 864 | 448 | 255 | 356 | 18 | 67 | 4 | 230 | 7 | 2 | 0 |
| Future Volume (vph) | 12 | 864 | 448 | 255 | 356 | 18 | 67 | 4 | 230 | 7 | 2 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.6 | 3.6 | 3.0 | 3.6 | | | 3.5 | 3.5 | | 3.7 | |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | | 1.00 | 1.00 | | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.97 | 1.00 | 1.00 | | | 1.00 | 0.98 | | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.99 | 1.00 | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | | | 1.00 | 0.85 | | 1.00 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 0.95 | 1.00 | | 0.96 | |
| Satd. Flow (prot) | 1770 | 3610 | 1573 | 1900 | 3584 | | | 1786 | 1589 | | 1824 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 0.73 | 1.00 | | 0.85 | |
| Satd. Flow (perm) | 1770 | 3610 | 1573 | 1805 | 3584 | | | 1371 | 1589 | | 1609 | |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 12 | 900 | 467 | 266 | 371 | 19 | 70 | 4 | 240 | 7 | 2 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 87 | 0 | 2 | 0 | 0 | 0 | 208 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 13 | 900 | 380 | 266 | 388 | 0 | 0 | 74 | 32 | 0 | 9 | 0 |
| Confl. Peds. (#/hr) | | | 4 | | | | 7 | | 4 | 4 | | 7 |
| Heavy Vehicles (%) | 2% | 0% | 0% | 0% | 0% | 0% | 1% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Prot | NA | Perm | Prot | NA | | Perm | NA | Perm | Perm | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | 2 | | | | 8 | | 8 | 4 | | |
| Actuated Green, G (s) | 1.3 | 49.3 | 49.3 | 27.4 | 75.4 | | | 13.2 | 13.2 | | 13.0 | |
| Effective Green, g (s) | 1.3 | 49.3 | 49.3 | 27.4 | 75.4 | | | 13.2 | 13.2 | | 13.0 | |
| Actuated g/C Ratio | 0.01 | 0.49 | 0.49 | 0.27 | 0.75 | | | 0.13 | 0.13 | | 0.13 | |
| Clearance Time (s) | 3.0 | 3.6 | 3.6 | 3.0 | 3.6 | | | 3.5 | 3.5 | | 3.7 | |
| Vehicle Extension (s) | 2.0 | 3.0 | 3.0 | 2.0 | 3.0 | | | 2.0 | 2.0 | | 2.0 | |
| Lane Grp Cap (vph) | 23 | 1779 | 775 | 520 | 2702 | | | 180 | 209 | | 209 | |
| v/s Ratio Prot | 0.01 | c0.25 | | c0.14 | 0.11 | | | | | | | |
| v/s Ratio Perm | | | 0.24 | | | | | c0.05 | 0.02 | | 0.01 | |
| v/c Ratio | 0.57 | 0.51 | 0.49 | 0.51 | 0.14 | | | 0.41 | 0.15 | | 0.04 | |
| Uniform Delay, d1 | 49.1 | 17.1 | 17.0 | 30.6 | 3.4 | | | 39.8 | 38.4 | | 38.1 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 0.59 | 0.46 | | | 1.00 | 1.00 | | 1.00 | |
| Incremental Delay, d2 | 17.6 | 1.0 | 2.2 | 0.3 | 0.1 | | | 0.6 | 0.1 | | 0.0 | |
| Delay (s) | 66.6 | 18.2 | 19.2 | 18.3 | 1.7 | | | 40.4 | 38.6 | | 38.1 | |
| Level of Service | E | B | B | B | A | | | D | D | | D | |
| Approach Delay (s) | | 19.0 | | | 8.4 | | | 39.0 | | | 38.1 | |
| Approach LOS | | B | | | A | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 18.8 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.49 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 10.3 |
| Intersection Capacity Utilization | 62.9% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 32: US 101 SB Off Ramp/Enfrente Rd & Ignacio Blvd

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 34 | 831 | 307 | 186 | 426 | 41 | 0 | 0 | 938 | 264 | 137 | 211 |
| Future Volume (vph) | 34 | 831 | 307 | 186 | 426 | 41 | 0 | 0 | 938 | 264 | 137 | 211 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Grade (%) | | 0% | | | 0% | | | 2% | | | 0% | |
| Total Lost time (s) | 3.0 | 8.0 | 8.0 | 4.0 | 5.0 | | | | 4.0 | | 4.0 | 4.0 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | | | 0.88 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.96 | 1.00 | 1.00 | | | | 1.00 | | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | | | | 0.85 | | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | | 1.00 | | 0.97 | 1.00 |
| Satd. Flow (prot) | 1805 | 3610 | 1550 | 1787 | 3545 | | | | 2814 | | 1809 | 1578 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | | 1.00 | | 0.97 | 1.00 |
| Satd. Flow (perm) | 1805 | 3610 | 1550 | 1787 | 3545 | | | | 2814 | | 1809 | 1578 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 35 | 866 | 320 | 194 | 444 | 43 | 0 | 0 | 977 | 275 | 143 | 220 |
| RTOR Reduction (vph) | 0 | 0 | 135 | 0 | 6 | 0 | 0 | 0 | 325 | 0 | 0 | 158 |
| Lane Group Flow (vph) | 35 | 866 | 185 | 194 | 481 | 0 | 0 | 0 | 652 | 0 | 418 | 62 |
| Confl. Peds. (#/hr) | | | 7 | | | 20 | | | | | | 1 |
| Confl. Bikes (#/hr) | | | | | | 3 | | | | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 5% | 1% |
| Turn Type | Prot | NA | Perm | Prot | NA | | | | Over | Split | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | | | 1 | 7 | 7 | |
| Permitted Phases | | | 2 | | | | | | | | | 7 |
| Actuated Green, G (s) | 6.6 | 28.8 | 28.8 | 27.2 | 53.4 | | | | 27.2 | | 28.0 | 28.0 |
| Effective Green, g (s) | 6.6 | 28.8 | 28.8 | 27.2 | 53.4 | | | | 27.2 | | 28.0 | 28.0 |
| Actuated g/C Ratio | 0.07 | 0.29 | 0.29 | 0.27 | 0.53 | | | | 0.27 | | 0.28 | 0.28 |
| Clearance Time (s) | 3.0 | 8.0 | 8.0 | 4.0 | 5.0 | | | | 4.0 | | 4.0 | 4.0 |
| Vehicle Extension (s) | 2.0 | 2.5 | 2.5 | 3.0 | 4.0 | | | | 3.0 | | 2.5 | 2.5 |
| Lane Grp Cap (vph) | 119 | 1039 | 446 | 486 | 1893 | | | | 765 | | 506 | 441 |
| v/s Ratio Prot | 0.02 | c0.24 | | 0.11 | 0.14 | | | | c0.23 | | c0.23 | |
| v/s Ratio Perm | | | 0.12 | | | | | | | | | 0.04 |
| v/c Ratio | 0.29 | 0.83 | 0.41 | 0.40 | 0.25 | | | | 0.85 | | 0.83 | 0.14 |
| Uniform Delay, d1 | 44.5 | 33.4 | 28.8 | 29.7 | 12.6 | | | | 34.5 | | 33.7 | 27.0 |
| Progression Factor | 0.91 | 0.67 | 0.46 | 1.61 | 1.92 | | | | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.5 | 7.3 | 2.6 | 0.5 | 0.3 | | | | 9.1 | | 10.4 | 0.1 |
| Delay (s) | 40.8 | 29.6 | 15.8 | 48.4 | 24.4 | | | | 43.6 | | 44.1 | 27.1 |
| Level of Service | D | C | B | D | C | | | | D | | D | C |
| Approach Delay (s) | | 26.3 | | | 31.2 | | | 43.6 | | | 38.2 | |
| Approach LOS | | C | | | C | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 34.2 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.84 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 91.1% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
## 33: Nave Dr & Ignacio Blvd/Bel Marin Keys Blvd

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 737 | 1293 | 98 | 213 | 190 | 443 | 526 | 587 | 0 | 0 | 0 |
| Future Volume (vph) | 0 | 737 | 1293 | 98 | 213 | 190 | 443 | 526 | 587 | 0 | 0 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.0 | 4.6 | 3.0 | 4.0 | | 4.6 | 4.6 | 3.0 | | | |
| Lane Util. Factor | | 0.95 | 1.00 | 1.00 | 0.95 | | 0.91 | 0.91 | 1.00 | | | |
| Frpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 0.99 | | 1.00 | 1.00 | 0.99 | | | |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | | |
| Frt | | 1.00 | 0.85 | 1.00 | 0.93 | | 1.00 | 1.00 | 0.85 | | | |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 0.99 | 1.00 | | | |
| Satd. Flow (prot) | | 3610 | 1607 | 1805 | 3303 | | 1643 | 3397 | 1599 | | | |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 0.99 | 1.00 | | | |
| Satd. Flow (perm) | | 3610 | 1607 | 1805 | 3303 | | 1643 | 3397 | 1599 | | | |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 0 | 784 | 1376 | 104 | 227 | 202 | 471 | 560 | 624 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 84 | 0 | 114 | 0 | 0 | 0 | 10 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 784 | 1292 | 104 | 315 | 0 | 334 | 697 | 614 | 0 | 0 | 0 |
| Confl. Peds. (#/hr) | | | 1 | | | 1 | | | 1 | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 2% | 0% | 1% | 0% | 0% | 0% | 0% |
| Turn Type | | NA | pm+ov | Prot | NA | | Split | NA | pm+ov | | | |
| Protected Phases | | 2 | 3 | 1 | 6 | | 3 | 3 | 1 | | | |
| Permitted Phases | | | 2 | | | | | | 3 | | | |
| Actuated Green, G (s) | | 28.4 | 76.4 | 12.0 | 43.4 | | 48.0 | 48.0 | 60.0 | | | |
| Effective Green, g (s) | | 28.4 | 76.4 | 12.0 | 43.4 | | 48.0 | 48.0 | 60.0 | | | |
| Actuated g/C Ratio | | 0.28 | 0.76 | 0.12 | 0.43 | | 0.48 | 0.48 | 0.60 | | | |
| Clearance Time (s) | | 4.0 | 4.6 | 3.0 | 4.0 | | 4.6 | 4.6 | 3.0 | | | |
| Vehicle Extension (s) | | 4.0 | 2.0 | 2.0 | 4.0 | | 2.0 | 2.0 | 2.0 | | | |
| Lane Grp Cap (vph) | | 1025 | 1227 | 216 | 1433 | | 788 | 1630 | 959 | | | |
| v/s Ratio Prot | | 0.22 | c0.51 | 0.06 | 0.10 | | 0.20 | 0.21 | c0.08 | | | |
| v/s Ratio Perm | | | 0.30 | | | | | | 0.31 | | | |
| v/c Ratio | | 0.76 | 1.05 | 0.48 | 0.22 | | 0.42 | 0.43 | 0.64 | | | |
| Uniform Delay, d1 | | 32.7 | 11.8 | 41.1 | 17.7 | | 17.0 | 17.0 | 13.0 | | | |
| Progression Factor | | 0.91 | 1.51 | 1.19 | 0.95 | | 1.00 | 1.00 | 1.00 | | | |
| Incremental Delay, d2 | | 3.0 | 34.8 | 0.6 | 0.4 | | 0.1 | 0.1 | 1.0 | | | |
| Delay (s) | | 32.7 | 52.7 | 49.4 | 17.2 | | 17.1 | 17.1 | 14.0 | | | |
| Level of Service | | C | D | D | B | | B | B | B | | | |
| Approach Delay (s) | | 45.4 | | | 23.4 | | | 15.9 | | | 0.0 | |
| Approach LOS | | D | | | C | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 31.5 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 1.00 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 11.6 |
| Intersection Capacity Utilization | 97.3% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
## 34: Bel Marin Keys Blvd & Commercial Blvd

11/22/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 0 | 11 | 73 | 0 | 9 | 46 | 1055 | 230 | 12 | 410 | 1 |
| Future Volume (vph) | 0 | 0 | 11 | 73 | 0 | 9 | 46 | 1055 | 230 | 12 | 410 | 1 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.0 | | | 4.0 | 4.0 | 3.0 | 3.9 | | 3.0 | 3.5 | |
| Lane Util. Factor | | 1.00 | | | 1.00 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | | 0.99 | | | 1.00 | 0.98 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 0.86 | | | 1.00 | 0.85 | 1.00 | 0.97 | | 1.00 | 1.00 | |
| Flt Protected | | 1.00 | | | 0.95 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 1620 | | | 1801 | 1395 | 1805 | 3496 | | 1805 | 3573 | |
| Flt Permitted | | 1.00 | | | 0.75 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | | 1620 | | | 1421 | 1395 | 1805 | 3496 | | 1805 | 3573 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 0 | 0 | 12 | 77 | 0 | 9 | 48 | 1111 | 242 | 13 | 432 | 1 |
| RTOR Reduction (vph) | 0 | 11 | 0 | 0 | 0 | 8 | 0 | 10 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 1 | 0 | 0 | 77 | 1 | 48 | 1343 | 0 | 13 | 433 | 0 |
| Confl. Peds. (#/hr) | 3 | | 2 | 2 | | 3 | | | 3 | | | |
| Heavy Vehicles (%) | 2% | 0% | 0% | 0% | 0% | 14% | 0% | 0% | 0% | 0% | 1% | 0% |
| Turn Type | | NA | | Perm | NA | Perm | Prot | NA | | Prot | NA | |
| Protected Phases | | 4 | | | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | | | | | | |
| Actuated Green, G (s) | | 12.1 | | | 12.1 | 12.1 | 5.3 | 75.2 | | 1.8 | 72.1 | |
| Effective Green, g (s) | | 12.1 | | | 12.1 | 12.1 | 5.3 | 75.2 | | 1.8 | 72.1 | |
| Actuated g/C Ratio | | 0.12 | | | 0.12 | 0.12 | 0.05 | 0.75 | | 0.02 | 0.72 | |
| Clearance Time (s) | | 4.0 | | | 4.0 | 4.0 | 3.0 | 3.9 | | 3.0 | 3.5 | |
| Vehicle Extension (s) | | 3.0 | | | 3.0 | 3.0 | 2.5 | 3.0 | | 2.5 | 4.0 | |
| Lane Grp Cap (vph) | | 196 | | | 171 | 168 | 95 | 2628 | | 32 | 2576 | |
| v/s Ratio Prot | | 0.00 | | | | | c0.03 | c0.38 | | 0.01 | 0.12 | |
| v/s Ratio Perm | | | | | c0.05 | 0.00 | | | | | | |
| v/c Ratio | | 0.01 | | | 0.45 | 0.01 | 0.51 | 0.51 | | 0.41 | 0.17 | |
| Uniform Delay, d1 | | 38.7 | | | 40.9 | 38.7 | 46.1 | 5.0 | | 48.6 | 4.4 | |
| Progression Factor | | 1.00 | | | 1.00 | 1.00 | 0.90 | 0.61 | | 0.92 | 1.36 | |
| Incremental Delay, d2 | | 0.0 | | | 1.9 | 0.0 | 2.1 | 0.5 | | 6.0 | 0.1 | |
| Delay (s) | | 38.7 | | | 42.7 | 38.7 | 43.6 | 3.6 | | 50.5 | 6.2 | |
| Level of Service | | D | | | D | D | D | A | | D | A | |
| Approach Delay (s) | | 38.7 | | | 42.3 | | | 4.9 | | | 7.5 | |
| Approach LOS | | D | | | D | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 7.4 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.52 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 10.9 |
| Intersection Capacity Utilization | 59.4% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 35: Bel Marin Keys Blvd & Hamilton Dr/Digital Dr

11/22/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 1 | 46 | 75 | 2 | 9 | 104 | 490 | 468 | 9 | 302 | 3 |
| Future Volume (vph) | 0 | 1 | 46 | 75 | 2 | 9 | 104 | 490 | 468 | 9 | 302 | 3 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.5 | 3.5 | 3.5 | 3.5 | | 3.0 | 4.0 | | 3.0 | 4.0 | |
| Lane Util. Factor | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | | 1.00 | 0.99 | 1.00 | 0.99 | | 1.00 | 0.99 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 1.00 | 0.85 | 1.00 | 0.88 | | 1.00 | 0.93 | | 1.00 | 1.00 | |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 1900 | 1533 | 1803 | 1649 | | 1770 | 3306 | | 1805 | 3568 | |
| Flt Permitted | | 1.00 | 1.00 | 0.76 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | | 1900 | 1533 | 1437 | 1649 | | 1770 | 3306 | | 1805 | 3568 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 0 | 1 | 48 | 79 | 2 | 9 | 109 | 516 | 493 | 9 | 318 | 3 |
| RTOR Reduction (vph) | 0 | 0 | 42 | 0 | 8 | 0 | 0 | 81 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 1 | 6 | 79 | 3 | 0 | 109 | 928 | 0 | 9 | 321 | 0 |
| Confl. Peds. (#/hr) | 1 | | 1 | 1 | | 1 | | | 2 | | | 8 |
| Heavy Vehicles (%) | 0% | 0% | 4% | 0% | 0% | 0% | 2% | 0% | 0% | 0% | 1% | 0% |
| Turn Type | | NA | Perm | Perm | NA | | Prot | NA | | Prot | NA | |
| Protected Phases | | 4 | | | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | 4 | 8 | | | | | | | | |
| Actuated Green, G (s) | | 12.1 | 12.1 | 12.1 | 12.1 | | 11.2 | 75.6 | | 1.8 | 66.2 | |
| Effective Green, g (s) | | 12.1 | 12.1 | 12.1 | 12.1 | | 11.2 | 75.6 | | 1.8 | 66.2 | |
| Actuated g/C Ratio | | 0.12 | 0.12 | 0.12 | 0.12 | | 0.11 | 0.76 | | 0.02 | 0.66 | |
| Clearance Time (s) | | 3.5 | 3.5 | 3.5 | 3.5 | | 3.0 | 4.0 | | 3.0 | 4.0 | |
| Vehicle Extension (s) | | 2.0 | 2.0 | 2.5 | 2.5 | | 2.0 | 4.0 | | 2.0 | 4.0 | |
| Lane Grp Cap (vph) | | 229 | 185 | 173 | 199 | | 198 | 2499 | | 32 | 2362 | |
| v/s Ratio Prot | | 0.00 | | | 0.00 | | c0.06 | c0.28 | | 0.00 | 0.09 | |
| v/s Ratio Perm | | | 0.00 | c0.05 | | | | | | | | |
| v/c Ratio | | 0.00 | 0.03 | 0.46 | 0.02 | | 0.55 | 0.37 | | 0.28 | 0.14 | |
| Uniform Delay, d1 | | 38.7 | 38.8 | 40.9 | 38.7 | | 42.0 | 4.1 | | 48.5 | 6.3 | |
| Progression Factor | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.08 | 1.34 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 0.0 | 0.0 | 1.4 | 0.0 | | 1.7 | 0.4 | | 1.8 | 0.1 | |
| Delay (s) | | 38.7 | 38.8 | 42.3 | 38.7 | | 47.0 | 5.9 | | 50.2 | 6.4 | |
| Level of Service | | D | D | D | D | | D | A | | D | A | |
| Approach Delay (s) | | 38.8 | | | 41.8 | | | 9.9 | | | 7.6 | |
| Approach LOS | | D | | | D | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 12.2 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.42 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 10.5 |
| Intersection Capacity Utilization | 57.3% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 36: Nave Dr & US 101 NB Off Ramp

11/22/2017

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 696 | 174 | 0 | 860 | 1189 | 188 |
| Future Volume (vph) | 696 | 174 | 0 | 860 | 1189 | 188 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | | 5.0 | 5.0 | |
| Lane Util. Factor | 0.97 | 1.00 | | 0.95 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 0.99 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.85 | | 1.00 | 0.98 | |
| Flt Protected | 0.95 | 1.00 | | 1.00 | 1.00 | |
| Satd. Flow (prot) | 3467 | 1563 | | 3574 | 3506 | |
| Flt Permitted | 0.95 | 1.00 | | 1.00 | 1.00 | |
| Satd. Flow (perm) | 3467 | 1563 | | 3574 | 3506 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 757 | 189 | 0 | 935 | 1292 | 204 |
| RTOR Reduction (vph) | 0 | 20 | 0 | 0 | 18 | 0 |
| Lane Group Flow (vph) | 757 | 169 | 0 | 935 | 1478 | 0 |
| Confl. Peds. (#/hr) | | 1 | | | | |
| Heavy Vehicles (%) | 1% | 2% | 0% | 1% | 1% | 0% |
| Turn Type | Prot | Perm | | NA | NA | |
| Protected Phases | 4 | | | 2 | 6 | |
| Permitted Phases | | 4 | | | | |
| Actuated Green, G (s) | 27.0 | 27.0 | | 35.0 | 35.0 | |
| Effective Green, g (s) | 27.0 | 27.0 | | 35.0 | 35.0 | |
| Actuated g/C Ratio | 0.39 | 0.39 | | 0.50 | 0.50 | |
| Clearance Time (s) | 3.0 | 3.0 | | 5.0 | 5.0 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 1337 | 602 | | 1787 | 1753 | |
| v/s Ratio Prot | c0.22 | | | 0.26 | c0.42 | |
| v/s Ratio Perm | | 0.11 | | | | |
| v/c Ratio | 0.57 | 0.28 | | 0.52 | 0.84 | |
| Uniform Delay, d1 | 16.9 | 14.8 | | 11.9 | 15.1 | |
| Progression Factor | 1.00 | 1.00 | | 0.37 | 1.00 | |
| Incremental Delay, d2 | 1.7 | 1.2 | | 1.0 | 5.1 | |
| Delay (s) | 18.6 | 16.0 | | 5.3 | 20.3 | |
| Level of Service | B | B | | A | C | |
| Approach Delay (s) | 18.1 | | | 5.3 | 20.3 | |
| Approach LOS | B | | | A | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 15.5 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.72 | | |
| Actuated Cycle Length (s) | 70.0 | Sum of lost time (s) | 8.0 |
| Intersection Capacity Utilization | 68.9% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 38 | 20 | 697 | 82 | 97 | 1114 |
| Future Volume (vph) | 38 | 20 | 697 | 82 | 97 | 1114 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.2 | 3.2 | 4.4 | | 3.0 | 4.4 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 0.85 | 0.99 | | 1.00 | 1.00 |
| Flt Protected | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 1615 | 1868 | | 1770 | 1881 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | 1805 | 1615 | 1868 | | 1770 | 1881 |
| Peak-hour factor, PHF | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Adj. Flow (vph) | 42 | 22 | 766 | 90 | 107 | 1224 |
| RTOR Reduction (vph) | 0 | 21 | 5 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 42 | 1 | 851 | 0 | 107 | 1224 |
| Confl. Peds. (#/hr) | | | | 2 | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 2% | 1% |
| Turn Type | Prot | Perm | NA | | Prot | NA |
| Protected Phases | 8 | | 2 | | 1 | 6 |
| Permitted Phases | | 8 | | | | |
| Actuated Green, G (s) | 3.6 | 3.6 | 48.6 | | 7.2 | 58.8 |
| Effective Green, g (s) | 3.6 | 3.6 | 48.6 | | 7.2 | 58.8 |
| Actuated g/C Ratio | 0.05 | 0.05 | 0.69 | | 0.10 | 0.84 |
| Clearance Time (s) | 3.2 | 3.2 | 4.4 | | 3.0 | 4.4 |
| Vehicle Extension (s) | 1.0 | 1.0 | 1.0 | | 1.0 | 1.0 |
| Lane Grp Cap (vph) | 92 | 83 | 1296 | | 182 | 1580 |
| v/s Ratio Prot | c0.02 | | 0.46 | | 0.06 | c0.65 |
| v/s Ratio Perm | | 0.00 | | | | |
| v/c Ratio | 0.46 | 0.01 | 0.66 | | 0.59 | 0.77 |
| Uniform Delay, d1 | 32.2 | 31.5 | 6.0 | | 30.0 | 2.6 |
| Progression Factor | 1.00 | 1.00 | 0.73 | | 1.28 | 1.58 |
| Incremental Delay, d2 | 1.3 | 0.0 | 2.1 | | 1.9 | 2.3 |
| Delay (s) | 33.6 | 31.5 | 6.4 | | 40.3 | 6.4 |
| Level of Service | C | C | A | | D | A |
| Approach Delay (s) | 32.9 | | 6.4 | | | 9.1 |
| Approach LOS | C | | A | | | A |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 8.8 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.79 | | |
| Actuated Cycle Length (s) | 70.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 70.6% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group





| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 119 | 265 | 484 | 41 | 357 | 762 |
| Future Volume (vph) | 119 | 265 | 484 | 41 | 357 | 762 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.2 | 3.2 | 4.4 | 4.4 | 3.0 | 4.4 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.85 | 1.00 | 0.85 | 1.00 | 1.00 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (prot) | 1770 | 1599 | 1900 | 1578 | 1787 | 1850 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (perm) | 1770 | 1599 | 1900 | 1578 | 1787 | 1900 |
| Peak-hour factor, PHF | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Adj. Flow (vph) | 131 | 291 | 532 | 45 | 392 | 837 |
| RTOR Reduction (vph) | 0 | 251 | 0 | 13 | 0 | 0 |
| Lane Group Flow (vph) | 131 | 40 | 532 | 32 | 392 | 837 |
| Confl. Peds. (#/hr) | | | | 2 | | |
| Heavy Vehicles (%) | 2% | 1% | 0% | 0% | 1% | 0% |
| Turn Type | Prot | Perm | NA | Perm | Prot | NA |
| Protected Phases | 8 | | 2 | | 1 | 6 |
| Permitted Phases | | 8 | | 2 | | |
| Actuated Green, G (s) | 9.7 | 9.7 | 25.4 | 25.4 | 24.3 | 52.7 |
| Effective Green, g (s) | 9.7 | 9.7 | 25.4 | 25.4 | 24.3 | 52.7 |
| Actuated g/C Ratio | 0.14 | 0.14 | 0.36 | 0.36 | 0.35 | 0.75 |
| Clearance Time (s) | 3.2 | 3.2 | 4.4 | 4.4 | 3.0 | 4.4 |
| Vehicle Extension (s) | 2.0 | 2.0 | 3.0 | 3.0 | 2.0 | 3.0 |
| Lane Grp Cap (vph) | 245 | 221 | 689 | 572 | 620 | 1392 |
| v/s Ratio Prot | c0.07 | | c0.28 | | c0.22 | 0.45 |
| v/s Ratio Perm | | 0.03 | | 0.02 | | |
| v/c Ratio | 0.53 | 0.18 | 0.77 | 0.06 | 0.63 | 0.60 |
| Uniform Delay, d1 | 28.1 | 26.6 | 19.7 | 14.5 | 19.1 | 3.9 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.25 | 0.67 |
| Incremental Delay, d2 | 1.1 | 0.1 | 8.2 | 0.2 | 1.1 | 1.3 |
| Delay (s) | 29.2 | 26.8 | 27.9 | 14.7 | 24.9 | 3.9 |
| Level of Service | C | C | C | B | C | A |
| Approach Delay (s) | 27.5 | | 26.9 | | | 10.6 |
| Approach LOS | C | | C | | | B |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 18.0 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.68 | | |
| Actuated Cycle Length (s) | 70.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 62.2% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 39: Nave Dr & Main Gate Dr



| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 264 | 175 | 226 | 459 | 292 | 335 |
| Future Volume (vph) | 264 | 175 | 226 | 459 | 292 | 335 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | 4.1 | 4.1 | 3.0 | 4.4 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.85 | 1.00 | 0.85 | 1.00 | 1.00 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 1615 | 1900 | 1615 | 1805 | 1881 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (perm) | 1805 | 1615 | 1900 | 1615 | 1805 | 1881 |
| Peak-hour factor, PHF | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| Adj. Flow (vph) | 284 | 188 | 243 | 494 | 314 | 360 |
| RTOR Reduction (vph) | 0 | 140 | 0 | 369 | 0 | 0 |
| Lane Group Flow (vph) | 284 | 48 | 243 | 125 | 314 | 360 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 1% |
| Turn Type | Prot | Perm | NA | Perm | Prot | NA |
| Protected Phases | 8 | | 2 | | 1 | 6 |
| Permitted Phases | | 8 | | 2 | | |
| Actuated Green, G (s) | 11.4 | 11.4 | 11.4 | 11.4 | 12.2 | 26.3 |
| Effective Green, g (s) | 11.4 | 11.4 | 11.4 | 11.4 | 12.2 | 26.3 |
| Actuated g/C Ratio | 0.25 | 0.25 | 0.25 | 0.25 | 0.27 | 0.58 |
| Clearance Time (s) | 3.0 | 3.0 | 4.1 | 4.1 | 3.0 | 4.4 |
| Vehicle Extension (s) | 2.0 | 2.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| Lane Grp Cap (vph) | 456 | 408 | 480 | 408 | 488 | 1096 |
| v/s Ratio Prot | c0.16 | | c0.13 | | c0.17 | 0.19 |
| v/s Ratio Perm | | 0.03 | | 0.08 | | |
| v/c Ratio | 0.62 | 0.12 | 0.51 | 0.31 | 0.64 | 0.33 |
| Uniform Delay, d1 | 14.9 | 13.0 | 14.4 | 13.6 | 14.5 | 4.8 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 1.9 | 0.0 | 0.3 | 0.2 | 2.2 | 0.1 |
| Delay (s) | 16.9 | 13.0 | 14.7 | 13.8 | 16.7 | 4.9 |
| Level of Service | B | B | B | B | B | A |
| Approach Delay (s) | 15.3 | | 14.1 | | | 10.4 |
| Approach LOS | B | | B | | | B |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 13.1 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.59 | | |
| Actuated Cycle Length (s) | 45.1 | Sum of lost time (s) | 10.1 |
| Intersection Capacity Utilization | 52.8% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 40: Nave Dr & Bolling Dr



| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 336 | 110 | 517 | 98 | 83 | 530 |
| Future Volume (vph) | 336 | 110 | 517 | 98 | 83 | 530 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | 4.1 | | 3.0 | 3.5 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 0.97 | 1.00 | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 0.85 | 0.98 | | 1.00 | 1.00 |
| Flt Protected | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | 1787 | 1571 | 1844 | | 1805 | 1881 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | 1787 | 1571 | 1844 | | 1805 | 1881 |
| Peak-hour factor, PHF | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Adj. Flow (vph) | 369 | 121 | 568 | 108 | 91 | 582 |
| RTOR Reduction (vph) | 0 | 86 | 9 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 369 | 35 | 667 | 0 | 91 | 582 |
| Confl. Peds. (#/hr) | | 6 | | | | |
| Heavy Vehicles (%) | 1% | 0% | 1% | 0% | 0% | 1% |
| Turn Type | Prot | Perm | NA | | Prot | NA |
| Protected Phases | 4 | | 6 | | 5 | 2 |
| Permitted Phases | | 4 | | | | |
| Actuated Green, G (s) | 17.5 | 17.5 | 25.6 | | 6.5 | 35.7 |
| Effective Green, g (s) | 17.5 | 17.5 | 25.6 | | 6.5 | 35.7 |
| Actuated g/C Ratio | 0.29 | 0.29 | 0.43 | | 0.11 | 0.60 |
| Clearance Time (s) | 3.0 | 3.0 | 4.1 | | 3.0 | 3.5 |
| Vehicle Extension (s) | 2.0 | 2.0 | 2.0 | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 523 | 460 | 790 | | 196 | 1124 |
| v/s Ratio Prot | c0.21 | | c0.36 | | 0.05 | c0.31 |
| v/s Ratio Perm | | 0.02 | | | | |
| v/c Ratio | 0.71 | 0.08 | 0.84 | | 0.46 | 0.52 |
| Uniform Delay, d1 | 18.8 | 15.3 | 15.3 | | 25.0 | 7.0 |
| Progression Factor | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 3.5 | 0.0 | 7.9 | | 0.6 | 0.2 |
| Delay (s) | 22.3 | 15.3 | 23.2 | | 25.6 | 7.2 |
| Level of Service | C | B | C | | C | A |
| Approach Delay (s) | 20.6 | | 23.2 | | | 9.7 |
| Approach LOS | C | | C | | | A |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 17.5 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.76 | | |
| Actuated Cycle Length (s) | 59.7 | Sum of lost time (s) | 10.1 |
| Intersection Capacity Utilization | 69.6% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Intersection | |
|---|---|
| Intersection Delay, s/veh | 32.1 |
| Intersection LOS | D |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 125 | 11 | 0 | 63 | 117 | 618 | 2 | 157 | 43 | 109 | 21 | 6 |
| Future Vol, veh/h | 125 | 11 | 0 | 63 | 117 | 618 | 2 | 157 | 43 | 109 | 21 | 6 |
| Peak Hour Factor | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 132 | 12 | 0 | 66 | 123 | 651 | 2 | 165 | 45 | 115 | 22 | 6 |
| Number of Lanes | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Opposing Approach | WB | EB | SB | NB |
| Opposing Lanes | 2 | 1 | 2 | 1 |
| Conflicting Approach Left | SB | NB | EB | WB |
| Conflicting Lanes Left | 2 | 1 | 1 | 2 |
| Conflicting Approach Right | NB | SB | WB | EB |
| Conflicting Lanes Right | 1 | 2 | 2 | 1 |
| HCM Control Delay | 13.3 | 42.8 | 15.5 | 13.1 |
| HCM LOS | B | E | C | B |

| Lane | NBLn1 | EBLn1 | WBLn1 | WBLn2 | SBLn1 | SBLn2 |
|---|---|---|---|---|---|---|
| Vol Left, % | 1% | 92% | 35% | 0% | 100% | 0% |
| Vol Thru, % | 78% | 8% | 65% | 0% | 0% | 78% |
| Vol Right, % | 21% | 0% | 0% | 100% | 0% | 22% |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 202 | 136 | 180 | 618 | 109 | 27 |
| LT Vol | 2 | 125 | 63 | 0 | 109 | 0 |
| Through Vol | 157 | 11 | 117 | 0 | 0 | 21 |
| RT Vol | 43 | 0 | 0 | 618 | 0 | 6 |
| Lane Flow Rate | 213 | 143 | 189 | 651 | 115 | 28 |
| Geometry Grp | 6 | 6 | 7 | 7 | 7 | 7 |
| Degree of Util (X) | 0.427 | 0.29 | 0.33 | 0.974 | 0.259 | 0.059 |
| Departure Headway (Hd) | 7.221 | 7.304 | 6.279 | 5.392 | 8.116 | 7.444 |
| Convergence, Y/N | Yes | Yes | Yes | Yes | Yes | Yes |
| Cap | 502 | 492 | 568 | 664 | 444 | 483 |
| Service Time | 5.221 | 5.333 | 4.075 | 3.187 | 5.832 | 5.159 |
| HCM Lane V/C Ratio | 0.424 | 0.291 | 0.333 | 0.98 | 0.259 | 0.058 |
| HCM Control Delay | 15.5 | 13.3 | 12.2 | 51.7 | 13.7 | 10.6 |
| HCM Lane LOS | C | B | B | F | B | B |
| HCM 95th-tile Q | 2.1 | 1.2 | 1.4 | 14.5 | 1 | 0.2 |

| Intersection | |
|---|---|
| Intersection Delay, s/veh | 100.8 |
| Intersection LOS | F |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 12 | 448 | 96 | 320 | 941 | 32 | 112 | 16 | 158 | 19 | 12 | 12 |
| Future Vol, veh/h | 12 | 448 | 96 | 320 | 941 | 32 | 112 | 16 | 158 | 19 | 12 | 12 |
| Peak Hour Factor | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 13 | 472 | 101 | 337 | 991 | 34 | 118 | 17 | 166 | 20 | 13 | 13 |
| Number of Lanes | 1 | 2 | 0 | 1 | 2 | 0 | 0 | 1 | 1 | 0 | 1 | 0 |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Opposing Approach | WB | EB | SB | NB |
| Opposing Lanes | 3 | 3 | 1 | 2 |
| Conflicting Approach Left | SB | NB | EB | WB |
| Conflicting Lanes Left | 1 | 2 | 3 | 3 |
| Conflicting Approach Right | NB | SB | WB | EB |
| Conflicting Lanes Right | 2 | 1 | 3 | 3 |
| HCM Control Delay | 36.1 | 148.9 | 22 | 16.9 |
| HCM LOS | E | F | C | C |

| Lane | NBLn1 | NBLn2 | EBLn1 | EBLn2 | EBLn3 | WBLn1 | WBLn2 | WBLn3 | SBLn1 |
|---|---|---|---|---|---|---|---|---|---|
| Vol Left, % | 88% | 0% | 100% | 0% | 0% | 100% | 0% | 0% | 44% |
| Vol Thru, % | 12% | 0% | 0% | 100% | 61% | 0% | 100% | 91% | 28% |
| Vol Right, % | 0% | 100% | 0% | 0% | 39% | 0% | 0% | 9% | 28% |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 128 | 158 | 12 | 299 | 245 | 320 | 627 | 346 | 43 |
| LT Vol | 112 | 0 | 12 | 0 | 0 | 320 | 0 | 0 | 19 |
| Through Vol | 16 | 0 | 0 | 299 | 149 | 0 | 627 | 314 | 12 |
| RT Vol | 0 | 158 | 0 | 0 | 96 | 0 | 0 | 32 | 12 |
| Lane Flow Rate | 135 | 166 | 13 | 314 | 258 | 337 | 660 | 364 | 45 |
| Geometry Grp | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Degree of Util (X) | 0.406 | 0.449 | 0.034 | 0.808 | 0.644 | 0.82 | 1.513 | 0.827 | 0.143 |
| Departure Headway (Hd) | 11.777 | 10.616 | 10.456 | 9.94 | 9.658 | 8.765 | 8.25 | 8.183 | 12.185 |
| Convergence, Y/N | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Cap | 307 | 341 | 344 | 368 | 377 | 414 | 442 | 444 | 296 |
| Service Time | 9.477 | 8.316 | 8.156 | 7.64 | 7.358 | 6.509 | 5.993 | 5.926 | 9.885 |
| HCM Lane V/C Ratio | 0.44 | 0.487 | 0.038 | 0.853 | 0.684 | 0.814 | 1.493 | 0.82 | 0.152 |
| HCM Control Delay | 22.3 | 21.7 | 13.5 | 43.5 | 28.3 | 40.9 | 264.1 | 39.7 | 16.9 |
| HCM Lane LOS | C | C | B | E | D | E | F | E | C |
| HCM 95th-tile Q | 1.9 | 2.2 | 0.1 | 7 | 4.3 | 7.5 | 34.9 | 7.8 | 0.5 |



# MOVEMENT SUMMARY

## Site: 1 [PM E+P Alt]

Simmons Lane/San Marin Drive
PM Existing plus Project Alternative

Roundabout

| Movement Performance - Vehicles | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Mov ID | OD Mov | Demand Flows Total veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | Distance ft | Prop. Queued | Effective Stop Rate per veh | Average Speed mph |
| South: NB Simmons Ln | | | | | | | | | | | |
| 3 | L2 | 118 | 2.0 | 0.376 | 9.1 | LOS A | 1.9 | 47.2 | 0.65 | 0.64 | 31.9 |
| 8 | T1 | 17 | 2.0 | 0.376 | 9.1 | LOS A | 1.9 | 47.2 | 0.65 | 0.64 | 31.9 |
| 18 | R2 | 166 | 2.0 | 0.376 | 9.1 | LOS A | 1.9 | 47.2 | 0.65 | 0.64 | 31.1 |
| Approach | | 301 | 2.0 | 0.376 | 9.1 | LOS A | 1.9 | 47.2 | 0.65 | 0.64 | 31.4 |
| East: WB San Marin Drive | | | | | | | | | | | |
| 1 | L2 | 337 | 2.0 | 0.277 | 5.5 | LOS A | 1.4 | 34.3 | 0.33 | 0.20 | 32.1 |
| 6 | T1 | 991 | 2.0 | 0.844 | 20.6 | LOS C | 13.7 | 348.0 | 0.90 | 0.65 | 28.1 |
| 16 | R2 | 34 | 2.0 | 0.844 | 20.6 | LOS C | 13.7 | 348.0 | 0.90 | 0.65 | 27.4 |
| Approach | | 1361 | 2.0 | 0.844 | 16.9 | LOS B | 13.7 | 348.0 | 0.76 | 0.54 | 29.0 |
| North: SB Simmons Ln | | | | | | | | | | | |
| 7 | L2 | 20 | 2.0 | 0.114 | 10.8 | LOS B | 0.4 | 9.1 | 0.74 | 0.74 | 31.0 |
| 4 | T1 | 13 | 2.0 | 0.114 | 10.8 | LOS B | 0.4 | 9.1 | 0.74 | 0.74 | 31.0 |
| 14 | R2 | 13 | 2.0 | 0.114 | 10.8 | LOS B | 0.4 | 9.1 | 0.74 | 0.74 | 30.3 |
| Approach | | 45 | 2.0 | 0.114 | 10.8 | LOS B | 0.4 | 9.1 | 0.74 | 0.74 | 30.8 |
| West: EB San Marin Drive | | | | | | | | | | | |
| 5 | L2 | 13 | 2.0 | 0.635 | 13.6 | LOS B | 5.4 | 136.3 | 0.76 | 0.78 | 30.8 |
| 2 | T1 | 472 | 2.0 | 0.635 | 13.6 | LOS B | 5.4 | 136.3 | 0.76 | 0.78 | 30.8 |
| 12 | R2 | 101 | 2.0 | 0.635 | 13.6 | LOS B | 5.4 | 136.3 | 0.76 | 0.78 | 30.0 |
| Approach | | 585 | 2.0 | 0.635 | 13.6 | LOS B | 5.4 | 136.3 | 0.76 | 0.78 | 30.7 |
| All Vehicles | | 2293 | 2.0 | 0.844 | 14.9 | LOS B | 13.7 | 348.0 | 0.74 | 0.62 | 29.7 |

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.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## LANE SUMMARY

**Site: 1 [PM E+P Alt]**

Simmons Lane/San Marin Drive
PM Existing plus Project Alternative

Roundabout

**Lane Use and Performance**

| | Demand Flows Total veh/h | HV % | Cap. veh/h | Deg. Satn v/c | Lane Util. % | Average Delay sec | Level of Service | 95% Back of Queue Veh | Dist ft | Lane Config | Lane Length ft | Cap. Adj. % | Prob. Block. % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| South: NB Simmons Ln | | | | | | | | | | | | | |
| Lane 1[d] | 301 | 2.0 | 801 | 0.376 | 100 | 9.1 | LOS A | 1.9 | 47.2 | Full | 1600 | 0.0 | 0.0 |
| Approach | 301 | 2.0 | | 0.376 | | 9.1 | LOS A | 1.9 | 47.2 | | | | |
| East: WB San Marin Drive | | | | | | | | | | | | | |
| Lane 1 | 337 | 2.0 | 1214 | 0.277 | 100 | 5.5 | LOS A | 1.4 | 34.3 | Short | 100 | 0.0 | NA |
| Lane 2[d] | 1024 | 2.0 | 1214 | 0.844 | 100 | 20.6 | LOS C | 13.7 | 348.0 | Full | 1600 | 0.0 | 0.0 |
| Approach | 1361 | 2.0 | | 0.844 | | 16.9 | LOS B | 13.7 | 348.0 | | | | |
| North: SB Simmons Ln | | | | | | | | | | | | | |
| Lane 1[d] | 45 | 2.0 | 398 | 0.114 | 100 | 10.8 | LOS B | 0.4 | 9.1 | Full | 1600 | 0.0 | 0.0 |
| Approach | 45 | 2.0 | | 0.114 | | 10.8 | LOS B | 0.4 | 9.1 | | | | |
| West: EB San Marin Drive | | | | | | | | | | | | | |
| Lane 1[d] | 585 | 2.0 | 921 | 0.635 | 100 | 13.6 | LOS B | 5.4 | 136.3 | Full | 1600 | 0.0 | 0.0 |
| Approach | 585 | 2.0 | | 0.635 | | 13.6 | LOS B | 5.4 | 136.3 | | | | |
| Intersection | 2293 | 2.0 | | 0.844 | | 14.9 | LOS B | 13.7 | 348.0 | | | | |

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach


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## HCM Signalized Intersection Capacity Analysis
1: Simmons Ln & San Marin Dr

06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 12 | 448 | 96 | 320 | 941 | 32 | 112 | 16 | 158 | 19 | 12 | 12 |
| Future Volume (vph) | 12 | 448 | 96 | 320 | 941 | 32 | 112 | 16 | 158 | 19 | 12 | 12 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | | 4.0 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | | 1.00 | 0.85 | | 0.96 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 0.96 | 1.00 | | 0.98 | |
| Satd. Flow (prot) | 1770 | 1863 | 1583 | 1770 | 1863 | 1583 | | 1785 | 1583 | | 1754 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 0.72 | 1.00 | | 0.86 | |
| Satd. Flow (perm) | 1770 | 1863 | 1583 | 1770 | 1863 | 1583 | | 1341 | 1583 | | 1545 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 13 | 472 | 101 | 337 | 991 | 34 | 118 | 17 | 166 | 20 | 13 | 13 |
| RTOR Reduction (vph) | 0 | 0 | 63 | 0 | 0 | 13 | 0 | 0 | 91 | 0 | 11 | 0 |
| Lane Group Flow (vph) | 13 | 472 | 38 | 337 | 991 | 21 | 0 | 135 | 75 | 0 | 35 | 0 |
| Turn Type | Prot | NA | Perm | Prot | NA | Perm | Perm | NA | pm+ov | Perm | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | | 2 | 3 | | 6 | |
| Permitted Phases | | | 4 | | | 8 | 2 | | 2 | 6 | | |
| Actuated Green, G (s) | 0.6 | 26.8 | 26.8 | 18.2 | 44.4 | 44.4 | | 13.4 | 31.6 | | 13.4 | |
| Effective Green, g (s) | 0.6 | 26.8 | 26.8 | 18.2 | 44.4 | 44.4 | | 13.4 | 31.6 | | 13.4 | |
| Actuated g/C Ratio | 0.01 | 0.38 | 0.38 | 0.26 | 0.63 | 0.63 | | 0.19 | 0.45 | | 0.19 | |
| Clearance Time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | | 4.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | |
| Lane Grp Cap (vph) | 15 | 709 | 602 | 457 | 1174 | 998 | | 255 | 800 | | 294 | |
| v/s Ratio Prot | 0.01 | 0.25 | | c0.19 | c0.53 | | | | 0.02 | | | |
| v/s Ratio Perm | | | 0.02 | | | 0.01 | | c0.10 | 0.02 | | 0.02 | |
| v/c Ratio | 0.87 | 0.67 | 0.06 | 0.74 | 0.84 | 0.02 | | 0.53 | 0.09 | | 0.12 | |
| Uniform Delay, d1 | 34.9 | 18.1 | 13.8 | 23.9 | 10.3 | 4.9 | | 25.7 | 11.2 | | 23.6 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | |
| Incremental Delay, d2 | 162.9 | 2.4 | 0.0 | 6.1 | 5.7 | 0.0 | | 2.0 | 0.1 | | 0.2 | |
| Delay (s) | 197.8 | 20.5 | 13.9 | 30.0 | 16.0 | 4.9 | | 27.6 | 11.2 | | 23.8 | |
| Level of Service | F | C | B | C | B | A | | C | B | | C | |
| Approach Delay (s) | | 23.3 | | | 19.2 | | | 18.6 | | | 23.8 | |
| Approach LOS | | C | | | B | | | B | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 20.2 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.79 | | |
| Actuated Cycle Length (s) | 70.4 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 75.6% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 2: W Campus Dr & San Marin Dr

11/22/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 3 | 664 | 0 | 3 | 1315 | 15 | 0 | 0 | 0 | 67 | 0 | 8 |
| Future Volume (vph) | 3 | 664 | 0 | 3 | 1315 | 15 | 0 | 0 | 0 | 67 | 0 | 8 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.8 | | 4.0 | 4.8 | 4.8 | | | | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 | | | | 0.95 | 0.95 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | | | 1.00 | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | | 1.00 | 1.00 | 0.85 | | | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | | | | 0.95 | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 3574 | | 1805 | 3574 | 1615 | | | | 1715 | 1715 | 1615 |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | | | | 0.82 | 0.82 | 1.00 |
| Satd. Flow (perm) | 1805 | 3574 | | 1805 | 3574 | 1615 | | | | 1473 | 1473 | 1615 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 3 | 699 | 0 | 3 | 1384 | 16 | 0 | 0 | 0 | 71 | 0 | 8 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 7 |
| Lane Group Flow (vph) | 3 | 699 | 0 | 3 | 1384 | 10 | 0 | 0 | 0 | 35 | 36 | 1 |
| Confl. Peds. (#/hr) | | | 2 | | | | | | | | | |
| Heavy Vehicles (%) | 0% | 1% | 0% | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Prot | NA | | Prot | NA | Perm | | | | Perm | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | | | | 6 | 8 | | | 4 | | 4 |
| Actuated Green, G (s) | 1.3 | 30.3 | | 1.2 | 30.2 | 30.2 | | | | 4.9 | 4.9 | 4.9 |
| Effective Green, g (s) | 1.3 | 30.3 | | 1.2 | 30.2 | 30.2 | | | | 4.9 | 4.9 | 4.9 |
| Actuated g/C Ratio | 0.03 | 0.62 | | 0.02 | 0.61 | 0.61 | | | | 0.10 | 0.10 | 0.10 |
| Clearance Time (s) | 4.0 | 4.8 | | 4.0 | 4.8 | 4.8 | | | | 4.0 | 4.0 | 4.0 |
| Vehicle Extension (s) | 2.0 | 4.0 | | 2.0 | 4.0 | 4.0 | | | | 2.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 47 | 2201 | | 44 | 2193 | 991 | | | | 146 | 146 | 160 |
| v/s Ratio Prot | c0.00 | 0.20 | | 0.00 | c0.39 | | | | | | | |
| v/s Ratio Perm | | | | | | 0.01 | | | | 0.02 | c0.02 | 0.00 |
| v/c Ratio | 0.06 | 0.32 | | 0.07 | 0.63 | 0.01 | | | | 0.24 | 0.25 | 0.00 |
| Uniform Delay, d1 | 23.4 | 4.5 | | 23.5 | 6.0 | 3.7 | | | | 20.4 | 20.4 | 20.0 |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.2 | 0.1 | | 0.2 | 0.7 | 0.0 | | | | 0.3 | 0.3 | 0.0 |
| Delay (s) | 23.6 | 4.6 | | 23.7 | 6.7 | 3.7 | | | | 20.7 | 20.8 | 20.0 |
| Level of Service | C | A | | C | A | A | | | | C | C | B |
| Approach Delay (s) | | 4.7 | | | 6.7 | | | 0.0 | | | 20.7 | |
| Approach LOS | | A | | | A | | | A | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 6.5 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.56 | | |
| Actuated Cycle Length (s) | 49.2 | Sum of lost time (s) | 12.8 |
| Intersection Capacity Utilization | 52.0% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 3: San Marin Dr & E Campus Drive

11/22/2017

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 1 | 737 | 1337 | 47 | 49 | 3 |
| Future Volume (vph) | 1 | 737 | 1337 | 47 | 49 | 3 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 4.3 | 4.3 | 4.3 | 3.0 | 3.0 |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | 1.00 | 0.97 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 1.00 | 0.85 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 3574 | 3574 | 1615 | 3502 | 1595 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (perm) | 1805 | 3574 | 3574 | 1615 | 3502 | 1595 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 1 | 768 | 1393 | 49 | 51 | 3 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 16 | 0 | 3 |
| Lane Group Flow (vph) | 1 | 768 | 1393 | 33 | 51 | 0 |
| Confl. Peds. (#/hr) | | | | | | 1 |
| Heavy Vehicles (%) | 0% | 1% | 1% | 0% | 0% | 0% |
| Turn Type | Prot | NA | NA | Perm | Prot | Perm |
| Protected Phases | 5 | 2 | 6 | | 4 | |
| Permitted Phases | | | | 6 | | 4 |
| Actuated Green, G (s) | 1.0 | 38.5 | 34.5 | 34.5 | 5.6 | 5.6 |
| Effective Green, g (s) | 1.0 | 38.5 | 34.5 | 34.5 | 5.6 | 5.6 |
| Actuated g/C Ratio | 0.02 | 0.75 | 0.67 | 0.67 | 0.11 | 0.11 |
| Clearance Time (s) | 3.0 | 4.3 | 4.3 | 4.3 | 3.0 | 3.0 |
| Vehicle Extension (s) | 2.0 | 4.0 | 4.0 | 4.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 35 | 2677 | 2398 | 1083 | 381 | 173 |
| v/s Ratio Prot | 0.00 | c0.21 | c0.39 | | c0.01 | |
| v/s Ratio Perm | | | | 0.02 | | 0.00 |
| v/c Ratio | 0.03 | 0.29 | 0.58 | 0.03 | 0.13 | 0.00 |
| Uniform Delay, d1 | 24.7 | 2.1 | 4.6 | 2.8 | 20.7 | 20.4 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.1 | 0.1 | 0.4 | 0.0 | 0.1 | 0.0 |
| Delay (s) | 24.8 | 2.1 | 5.0 | 2.9 | 20.8 | 20.4 |
| Level of Service | C | A | A | A | C | C |
| Approach Delay (s) | | 2.2 | 4.9 | | 20.7 | |
| Approach LOS | | A | A | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 4.4 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.52 | | |
| Actuated Cycle Length (s) | 51.4 | Sum of lost time (s) | 10.3 |
| Intersection Capacity Utilization | 49.6% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 29 | 601 | 178 | 386 | 952 | 202 | 291 | 95 | 518 | 629 | 150 | 100 |
| Future Volume (vph) | 29 | 601 | 178 | 386 | 952 | 202 | 291 | 95 | 518 | 629 | 150 | 100 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.6 | | 3.0 | 4.0 | | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 | |
| Lane Util. Factor | 1.00 | 0.91 | | 1.00 | 0.91 | | 0.97 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 0.99 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 0.97 | | 1.00 | 0.97 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.94 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1787 | 4942 | | 1752 | 5001 | | 3467 | 1881 | 1568 | 1787 | 1756 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1787 | 4942 | | 1752 | 5001 | | 3467 | 1881 | 1568 | 1787 | 1756 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 31 | 633 | 187 | 406 | 1002 | 213 | 306 | 100 | 545 | 662 | 158 | 105 |
| RTOR Reduction (vph) | 0 | 43 | 0 | 0 | 26 | 0 | 0 | 0 | 209 | 0 | 19 | 0 |
| Lane Group Flow (vph) | 31 | 777 | 0 | 406 | 1189 | 0 | 306 | 100 | 336 | 662 | 244 | 0 |
| Confl. Peds. (#/hr) | | | 4 | | | | | | | | | 5 |
| Confl. Bikes (#/hr) | | | | | | | | | | | | 1 |
| Heavy Vehicles (%) | 1% | 1% | 1% | 3% | 1% | 1% | 1% | 1% | 3% | 1% | 1% | 1% |
| Turn Type | Prot | NA | | Prot | NA | | Split | NA | Perm | Split | NA | |
| Protected Phases | 1 | 6 | | 5 | 2 | | 7 | 7 | | 8 | 8 | |
| Permitted Phases | | | | | 2 | | | | 7 | | | |
| Actuated Green, G (s) | 6.0 | 40.0 | | 14.2 | 47.8 | | 16.9 | 16.9 | 16.9 | 43.7 | 43.7 | |
| Effective Green, g (s) | 6.0 | 40.0 | | 14.2 | 47.8 | | 16.9 | 16.9 | 16.9 | 43.7 | 43.7 | |
| Actuated g/C Ratio | 0.05 | 0.31 | | 0.11 | 0.37 | | 0.13 | 0.13 | 0.13 | 0.34 | 0.34 | |
| Clearance Time (s) | 3.0 | 3.6 | | 3.0 | 4.0 | | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 | |
| Vehicle Extension (s) | 2.0 | 4.0 | | 5.0 | 4.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 82 | 1520 | | 191 | 1838 | | 450 | 244 | 203 | 600 | 590 | |
| v/s Ratio Prot | 0.02 | c0.16 | | c0.23 | c0.24 | | 0.09 | 0.05 | | c0.37 | 0.14 | |
| v/s Ratio Perm | | | | | | | | | c0.21 | | | |
| v/c Ratio | 0.38 | 0.51 | | 2.13 | 0.65 | | 0.68 | 0.41 | 1.66 | 1.10 | 0.41 | |
| Uniform Delay, d1 | 60.2 | 37.0 | | 57.9 | 34.1 | | 54.0 | 52.0 | 56.5 | 43.1 | 33.3 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 1.1 | 0.4 | | 523.8 | 1.8 | | 3.4 | 0.4 | 316.2 | 68.3 | 0.2 | |
| Delay (s) | 61.3 | 37.4 | | 581.7 | 35.9 | | 57.3 | 52.4 | 372.7 | 111.5 | 33.5 | |
| Level of Service | E | D | | F | D | | E | D | F | F | C | |
| Approach Delay (s) | | 38.2 | | | 172.6 | | | 237.6 | | | 89.3 | |
| Approach LOS | | D | | | F | | | F | | | F | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 142.8 | HCM 2000 Level of Service | F |
| HCM 2000 Volume to Capacity ratio | 1.15 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 15.6 |
| Intersection Capacity Utilization | 96.7% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |





| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 29 | 601 | 178 | 386 | 952 | 202 | 291 | 95 | 518 | 629 | 150 | 100 |
| Future Volume (vph) | 29 | 601 | 178 | 386 | 952 | 202 | 291 | 95 | 518 | 629 | 150 | 100 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.6 | | 3.0 | 4.0 | 4.3 | 4.3 | 4.3 | 3.0 | 4.3 | 4.3 | |
| Lane Util. Factor | 1.00 | 0.91 | | 0.97 | 0.95 | 1.00 | 0.95 | 0.95 | 0.88 | 0.91 | 0.91 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 0.97 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.97 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 0.98 | 1.00 | 0.95 | 0.97 | |
| Satd. Flow (prot) | 1787 | 4942 | | 3400 | 3574 | 1599 | 1698 | 1743 | 2760 | 1626 | 3232 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 0.98 | 1.00 | 0.95 | 0.97 | |
| Satd. Flow (perm) | 1787 | 4942 | | 3400 | 3574 | 1599 | 1698 | 1743 | 2760 | 1626 | 3232 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 31 | 633 | 187 | 406 | 1002 | 213 | 306 | 100 | 545 | 662 | 158 | 105 |
| RTOR Reduction (vph) | 0 | 35 | 0 | 0 | 0 | 64 | 0 | 0 | 87 | 0 | 14 | 0 |
| Lane Group Flow (vph) | 31 | 785 | 0 | 406 | 1002 | 149 | 202 | 204 | 458 | 331 | 580 | 0 |
| Confl. Peds. (#/hr) | | | 4 | | | | | | | | | 5 |
| Confl. Bikes (#/hr) | | | | | | | | | | | | 1 |
| Heavy Vehicles (%) | 1% | 1% | 1% | 3% | 1% | 1% | 1% | 1% | 3% | 1% | 1% | 1% |
| Turn Type | Prot | NA | | Prot | NA | pm+ov | Split | NA | pm+ov | Split | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | 4 | 8 | 8 | 1 | 4 | 4 | |
| Permitted Phases | | | | | | 6 | | | 8 | | | |
| Actuated Green, G (s) | 6.0 | 51.7 | | 19.2 | 64.5 | 98.2 | 20.2 | 20.2 | 39.4 | 33.7 | 33.7 | |
| Effective Green, g (s) | 6.0 | 51.7 | | 19.2 | 64.5 | 98.2 | 20.2 | 20.2 | 39.4 | 33.7 | 33.7 | |
| Actuated g/C Ratio | 0.04 | 0.37 | | 0.14 | 0.46 | 0.70 | 0.14 | 0.14 | 0.28 | 0.24 | 0.24 | |
| Clearance Time (s) | 3.0 | 3.6 | | 3.0 | 4.0 | 4.3 | 4.3 | 4.3 | 3.0 | 4.3 | 4.3 | |
| Vehicle Extension (s) | 2.0 | 4.0 | | 5.0 | 4.0 | 2.0 | 2.0 | 2.0 | 5.0 | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 76 | 1825 | | 466 | 1646 | 1121 | 244 | 251 | 776 | 391 | 777 | |
| v/s Ratio Prot | 0.02 | c0.16 | | c0.12 | c0.28 | 0.03 | c0.12 | 0.12 | 0.08 | c0.20 | 0.18 | |
| v/s Ratio Perm | | | | | | 0.06 | | | 0.09 | | | |
| v/c Ratio | 0.41 | 0.43 | | 0.87 | 0.61 | 0.13 | 0.83 | 0.81 | 0.59 | 0.85 | 0.75 | |
| Uniform Delay, d1 | 65.3 | 33.1 | | 59.2 | 28.3 | 6.9 | 58.2 | 58.1 | 43.3 | 50.7 | 49.2 | |
| Progression Factor | 1.00 | 1.00 | | 0.77 | 0.57 | 2.04 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 1.3 | 0.7 | | 16.0 | 1.5 | 0.0 | 19.2 | 17.0 | 1.8 | 14.9 | 3.5 | |
| Delay (s) | 66.6 | 33.8 | | 61.8 | 17.7 | 14.0 | 77.4 | 75.1 | 45.2 | 65.6 | 52.7 | |
| Level of Service | E | C | | E | B | B | E | E | D | E | D | |
| Approach Delay (s) | | 35.0 | | | 28.3 | | | 58.4 | | | 57.3 | |
| Approach LOS | | D | | | C | | | E | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 42.4 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.73 | | |
| Actuated Cycle Length (s) | 140.0 | Sum of lost time (s) | 15.6 |
| Intersection Capacity Utilization | 92.3% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 5: US 101 SB Ramps & San Marin Dr

11/22/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 837 | 875 | 155 | 1255 | 0 | 0 | 0 | 0 | 54 | 2 | 338 |
| Future Volume (vph) | 0 | 837 | 875 | 155 | 1255 | 0 | 0 | 0 | 0 | 54 | 2 | 338 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.9 | 4.9 | 3.0 | 5.3 | | | | | | 4.0 | 4.0 |
| Lane Util. Factor | | 0.95 | 1.00 | 1.00 | 0.95 | | | | | | 1.00 | 0.88 |
| Frpb, ped/bikes | | 1.00 | 0.98 | 1.00 | 1.00 | | | | | | 1.00 | 1.00 |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | | | | | 1.00 | 1.00 |
| Frt | | 1.00 | 0.85 | 1.00 | 1.00 | | | | | | 1.00 | 0.85 |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | | 0.95 | 1.00 |
| Satd. Flow (prot) | | 3574 | 1575 | 1805 | 3574 | | | | | | 1812 | 2814 |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | | 0.95 | 1.00 |
| Satd. Flow (perm) | | 3574 | 1575 | 1805 | 3574 | | | | | | 1812 | 2814 |
| Peak-hour factor, PHF | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| Adj. Flow (vph) | 0 | 863 | 902 | 160 | 1294 | 0 | 0 | 0 | 0 | 56 | 2 | 348 |
| RTOR Reduction (vph) | 0 | 0 | 273 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 177 |
| Lane Group Flow (vph) | 0 | 863 | 629 | 160 | 1294 | 0 | 0 | 0 | 0 | 0 | 58 | 171 |
| Confl. Peds. (#/hr) | | | 4 | | | | | | | | | |
| Heavy Vehicles (%) | 0% | 1% | 1% | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 1% |
| Turn Type | | NA | Perm | Prot | NA | | | | | Split | NA | Perm |
| Protected Phases | | 2 | | 1 | 6 | | | | | 4 | 4 | |
| Permitted Phases | | | 2 | | | | | | | | | 4 |
| Actuated Green, G (s) | | 41.8 | 41.8 | 9.0 | 53.4 | | | | | | 7.3 | 7.3 |
| Effective Green, g (s) | | 41.8 | 41.8 | 9.0 | 53.4 | | | | | | 7.3 | 7.3 |
| Actuated g/C Ratio | | 0.60 | 0.60 | 0.13 | 0.76 | | | | | | 0.10 | 0.10 |
| Clearance Time (s) | | 4.9 | 4.9 | 3.0 | 5.3 | | | | | | 4.0 | 4.0 |
| Vehicle Extension (s) | | 4.0 | 4.0 | 2.0 | 4.0 | | | | | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | | 2134 | 940 | 232 | 2726 | | | | | | 188 | 293 |
| v/s Ratio Prot | | 0.24 | | c0.09 | 0.36 | | | | | | 0.03 | |
| v/s Ratio Perm | | | c0.40 | | | | | | | | | c0.06 |
| v/c Ratio | | 0.40 | 0.67 | 0.69 | 0.47 | | | | | | 0.31 | 0.58 |
| Uniform Delay, d1 | | 7.5 | 9.5 | 29.2 | 3.1 | | | | | | 29.0 | 29.9 |
| Progression Factor | | 1.00 | 1.00 | 1.00 | 1.00 | | | | | | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.6 | 3.8 | 6.6 | 0.6 | | | | | | 0.3 | 1.9 |
| Delay (s) | | 8.1 | 13.2 | 35.8 | 3.7 | | | | | | 29.4 | 31.8 |
| Level of Service | | A | B | D | A | | | | | | C | C |
| Approach Delay (s) | | 10.7 | | | 7.2 | | | 0.0 | | | 31.4 | |
| Approach LOS | | B | | | A | | | A | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 11.6 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.66 | | |
| Actuated Cycle Length (s) | 70.0 | Sum of lost time (s) | 11.9 |
| Intersection Capacity Utilization | 118.8% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 6: US 101 NB Ramps & San Marin Dr

11/22/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 424 | 417 | 0 | 0 | 422 | 51 | 1086 | 108 | 196 | 0 | 0 | 0 |
| Future Volume (vph) | 424 | 417 | 0 | 0 | 422 | 51 | 1086 | 108 | 196 | 0 | 0 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.6 | | | 4.9 | 4.9 | 3.5 | 3.5 | | | | |
| Lane Util. Factor | 0.97 | 1.00 | | | 0.95 | 1.00 | 0.95 | 0.95 | | | | |
| Frpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | 0.99 | 1.00 | 0.99 | | | | |
| Flpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | | | |
| Frt | 1.00 | 1.00 | | | 1.00 | 0.85 | 1.00 | 0.96 | | | | |
| Flt Protected | 0.95 | 1.00 | | | 1.00 | 1.00 | 0.95 | 0.97 | | | | |
| Satd. Flow (prot) | 3467 | 1881 | | | 3574 | 1593 | 1681 | 1638 | | | | |
| Flt Permitted | 0.95 | 1.00 | | | 1.00 | 1.00 | 0.95 | 0.97 | | | | |
| Satd. Flow (perm) | 3467 | 1881 | | | 3574 | 1593 | 1681 | 1638 | | | | |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 442 | 434 | 0 | 0 | 440 | 53 | 1131 | 112 | 204 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 44 | 0 | 22 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 442 | 434 | 0 | 0 | 440 | 9 | 735 | 691 | 0 | 0 | 0 | 0 |
| Confl. Peds. (#/hr) | | | 3 | | | 1 | | | 1 | 1 | | |
| Heavy Vehicles (%) | 1% | 1% | 0% | 0% | 1% | 0% | 2% | 0% | 3% | 0% | 0% | 0% |
| Turn Type | Prot | NA | | | NA | Perm | Split | NA | | | | |
| Protected Phases | 5 | 2 | | | 6 | | 8 | 8 | | | | |
| Permitted Phases | | | | | | 6 | | | | | | |
| Actuated Green, G (s) | 10.1 | 25.6 | | | 11.7 | 11.7 | 31.6 | 31.6 | | | | |
| Effective Green, g (s) | 10.1 | 25.6 | | | 11.7 | 11.7 | 31.6 | 31.6 | | | | |
| Actuated g/C Ratio | 0.15 | 0.39 | | | 0.18 | 0.18 | 0.48 | 0.48 | | | | |
| Clearance Time (s) | 3.5 | 4.6 | | | 4.9 | 4.9 | 3.5 | 3.5 | | | | |
| Vehicle Extension (s) | 2.0 | 4.0 | | | 4.0 | 4.0 | 2.5 | 2.5 | | | | |
| Lane Grp Cap (vph) | 536 | 737 | | | 640 | 285 | 813 | 792 | | | | |
| v/s Ratio Prot | c0.13 | c0.23 | | | 0.12 | | c0.44 | 0.42 | | | | |
| v/s Ratio Perm | | | | | | 0.01 | | | | | | |
| v/c Ratio | 0.82 | 0.59 | | | 0.69 | 0.03 | 0.90 | 0.87 | | | | |
| Uniform Delay, d1 | 26.7 | 15.7 | | | 25.1 | 22.1 | 15.5 | 15.1 | | | | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | | | |
| Incremental Delay, d2 | 9.5 | 1.4 | | | 3.3 | 0.1 | 13.4 | 10.4 | | | | |
| Delay (s) | 36.3 | 17.1 | | | 28.4 | 22.2 | 28.8 | 25.4 | | | | |
| Level of Service | D | B | | | C | C | C | C | | | | |
| Approach Delay (s) | | 26.8 | | | 27.8 | | | 27.2 | | | 0.0 | |
| Approach LOS | | C | | | C | | | C | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 27.1 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.85 | | |
| Actuated Cycle Length (s) | 65.3 | Sum of lost time (s) | 11.9 |
| Intersection Capacity Utilization | 118.8% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 7: Redwood Blvd & Olive St

11/22/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 150 | 73 | 34 | 176 | 107 | 109 | 75 | 801 | 201 | 125 | 474 | 142 |
| Future Volume (vph) | 150 | 73 | 34 | 176 | 107 | 109 | 75 | 801 | 201 | 125 | 474 | 142 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 5.1 | 5.1 | | | 5.1 | | 4.0 | 3.9 | 3.9 | 4.0 | 3.9 | |
| Lane Util. Factor | 1.00 | 1.00 | | | 1.00 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | |
| Frt | 1.00 | 0.95 | | | 0.96 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.97 | |
| Flt Protected | 0.95 | 1.00 | | | 0.98 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1770 | 1774 | | | 1753 | | 1770 | 3539 | 1583 | 1770 | 3417 | |
| Flt Permitted | 0.95 | 1.00 | | | 0.98 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1770 | 1774 | | | 1753 | | 1770 | 3539 | 1583 | 1770 | 3417 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 158 | 77 | 36 | 185 | 113 | 115 | 79 | 843 | 212 | 132 | 499 | 149 |
| RTOR Reduction (vph) | 0 | 17 | 0 | 0 | 12 | 0 | 0 | 0 | 79 | 0 | 24 | 0 |
| Lane Group Flow (vph) | 158 | 96 | 0 | 0 | 401 | 0 | 79 | 843 | 133 | 132 | 624 | 0 |
| Turn Type | Split | NA | | Split | NA | | Prot | NA | Perm | Prot | NA | |
| Protected Phases | 4 | 4 | | 8 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | | | | | | | 2 | | | |
| Actuated Green, G (s) | 13.3 | 13.3 | | | 25.1 | | 7.7 | 26.9 | 26.9 | 10.1 | 29.3 | |
| Effective Green, g (s) | 13.3 | 13.3 | | | 25.1 | | 7.7 | 26.9 | 26.9 | 10.1 | 29.3 | |
| Actuated g/C Ratio | 0.14 | 0.14 | | | 0.27 | | 0.08 | 0.29 | 0.29 | 0.11 | 0.31 | |
| Clearance Time (s) | 5.1 | 5.1 | | | 5.1 | | 4.0 | 3.9 | 3.9 | 4.0 | 3.9 | |
| Vehicle Extension (s) | 1.0 | 1.0 | | | 1.0 | | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | |
| Lane Grp Cap (vph) | 251 | 252 | | | 470 | | 145 | 1018 | 455 | 191 | 1070 | |
| v/s Ratio Prot | c0.09 | 0.05 | | | c0.23 | | 0.04 | c0.24 | | c0.07 | 0.18 | |
| v/s Ratio Perm | | | | | | | | | 0.08 | | | |
| v/c Ratio | 0.63 | 0.38 | | | 0.85 | | 0.54 | 0.83 | 0.29 | 0.69 | 0.58 | |
| Uniform Delay, d1 | 37.8 | 36.4 | | | 32.4 | | 41.2 | 31.1 | 25.9 | 40.2 | 27.0 | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 3.5 | 0.4 | | | 13.4 | | 2.2 | 5.4 | 0.1 | 8.4 | 0.5 | |
| Delay (s) | 41.3 | 36.7 | | | 45.9 | | 43.5 | 36.5 | 26.0 | 48.6 | 27.5 | |
| Level of Service | D | D | | | D | | D | D | C | D | C | |
| Approach Delay (s) | | 39.4 | | | 45.9 | | | 35.0 | | | 31.1 | |
| Approach LOS | | D | | | D | | | D | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 36.0 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.77 | | |
| Actuated Cycle Length (s) | 93.5 | Sum of lost time (s) | 18.1 |
| Intersection Capacity Utilization | 70.1% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 8: Redwood Blvd & Grant Ave

11/22/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 124 | 141 | 312 | 45 | 176 | 85 | 405 | 625 | 71 | 60 | 509 | 157 |
| Future Volume (vph) | 124 | 141 | 312 | 45 | 176 | 85 | 405 | 625 | 71 | 60 | 509 | 157 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.5 | 3.5 | | 3.5 | 3.7 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.96 | 1.00 | 1.00 | 0.96 | 1.00 | 0.99 | | 1.00 | 0.99 | |
| Flpb, ped/bikes | 0.99 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.98 | | 1.00 | 0.96 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1752 | 1900 | 1528 | 1803 | 1900 | 1557 | 1805 | 3460 | | 1805 | 3394 | |
| Flt Permitted | 0.56 | 1.00 | 1.00 | 0.63 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1038 | 1900 | 1528 | 1192 | 1900 | 1557 | 1805 | 3460 | | 1805 | 3394 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 131 | 148 | 328 | 47 | 185 | 89 | 426 | 658 | 75 | 63 | 536 | 165 |
| RTOR Reduction (vph) | 0 | 0 | 241 | 0 | 0 | 66 | 0 | 8 | 0 | 0 | 27 | 0 |
| Lane Group Flow (vph) | 131 | 148 | 87 | 47 | 185 | 23 | 426 | 725 | 0 | 63 | 674 | 0 |
| Confl. Peds. (#/hr) | 22 | | 46 | 2 | | 34 | | | 36 | | | 10 |
| Confl. Bikes (#/hr) | | | 5 | | | 5 | | | 5 | | | 5 |
| Heavy Vehicles (%) | 2% | 0% | 1% | 0% | 0% | 0% | 0% | 2% | 0% | 0% | 2% | 0% |
| Turn Type | Perm | NA | Perm | Perm | NA | Perm | Prot | NA | | Prot | NA | |
| Protected Phases | | 8 | | | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | 8 | | 8 | 4 | | 4 | | | | | | |
| Actuated Green, G (s) | 20.3 | 20.3 | 20.3 | 20.3 | 20.3 | 20.3 | 23.3 | 33.9 | | 11.7 | 22.1 | |
| Effective Green, g (s) | 20.3 | 20.3 | 20.3 | 20.3 | 20.3 | 20.3 | 23.3 | 33.9 | | 11.7 | 22.1 | |
| Actuated g/C Ratio | 0.26 | 0.26 | 0.26 | 0.26 | 0.26 | 0.26 | 0.30 | 0.44 | | 0.15 | 0.29 | |
| Clearance Time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.5 | 3.5 | | 3.5 | 3.7 | |
| Vehicle Extension (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 2.5 | 3.0 | | 2.5 | 3.0 | |
| Lane Grp Cap (vph) | 274 | 501 | 403 | 314 | 501 | 411 | 546 | 1525 | | 274 | 975 | |
| v/s Ratio Prot | | 0.08 | | | 0.10 | | c0.24 | 0.21 | | 0.03 | c0.20 | |
| v/s Ratio Perm | c0.13 | | 0.06 | 0.04 | | 0.02 | | | | | | |
| v/c Ratio | 0.48 | 0.30 | 0.21 | 0.15 | 0.37 | 0.06 | 0.78 | 0.48 | | 0.23 | 0.69 | |
| Uniform Delay, d1 | 23.8 | 22.6 | 22.1 | 21.7 | 23.1 | 21.1 | 24.5 | 15.2 | | 28.6 | 24.4 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 1.8 | 0.5 | 0.4 | 0.3 | 0.6 | 0.1 | 6.9 | 0.2 | | 0.3 | 2.1 | |
| Delay (s) | 25.6 | 23.0 | 22.4 | 22.0 | 23.7 | 21.2 | 31.3 | 15.4 | | 29.0 | 26.5 | |
| Level of Service | C | C | C | C | C | C | C | B | | C | C | |
| Approach Delay (s) | | 23.3 | | | 22.8 | | | 21.3 | | | 26.7 | |
| Approach LOS | | C | | | C | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 23.3 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.66 | | |
| Actuated Cycle Length (s) | 76.9 | Sum of lost time (s) | 11.2 |
| Intersection Capacity Utilization | 92.3% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Intersection | |
|---|---|
| Intersection Delay, s/veh | 89.6 |
| Intersection LOS | F |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 89 | 156 | 54 | 74 | 300 | 192 | 66 | 129 | 58 | 177 | 230 | 413 |
| Future Vol, veh/h | 89 | 156 | 54 | 74 | 300 | 192 | 66 | 129 | 58 | 177 | 230 | 413 |
| Peak Hour Factor | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 94 | 164 | 57 | 78 | 316 | 202 | 69 | 136 | 61 | 186 | 242 | 435 |
| Number of Lanes | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Opposing Approach | WB | EB | SB | NB |
| Opposing Lanes | 2 | 2 | 3 | 2 |
| Conflicting Approach Left | SB | NB | EB | WB |
| Conflicting Lanes Left | 3 | 2 | 2 | 2 |
| Conflicting Approach Right | NB | SB | WB | EB |
| Conflicting Lanes Right | 2 | 3 | 2 | 2 |
| HCM Control Delay | 28.5 | 196.3 | 26.4 | 57.8 |
| HCM LOS | D | F | D | F |

| Lane | NBLn1 | NBLn2 | EBLn1 | EBLn2 | WBLn1 | WBLn2 | SBLn1 | SBLn2 | SBLn3 |
|---|---|---|---|---|---|---|---|---|---|
| Vol Left, % | 100% | 0% | 100% | 0% | 100% | 0% | 100% | 0% | 0% |
| Vol Thru, % | 0% | 69% | 0% | 74% | 0% | 61% | 0% | 100% | 0% |
| Vol Right, % | 0% | 31% | 0% | 26% | 0% | 39% | 0% | 0% | 100% |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 66 | 187 | 89 | 210 | 74 | 492 | 177 | 230 | 413 |
| LT Vol | 66 | 0 | 89 | 0 | 74 | 0 | 177 | 0 | 0 |
| Through Vol | 0 | 129 | 0 | 156 | 0 | 300 | 0 | 230 | 0 |
| RT Vol | 0 | 58 | 0 | 54 | 0 | 192 | 0 | 0 | 413 |
| Lane Flow Rate | 69 | 197 | 94 | 221 | 78 | 518 | 186 | 242 | 435 |
| Geometry Grp | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Degree of Util (X) | 0.218 | 0.577 | 0.288 | 0.638 | 0.227 | 1.401 | 0.507 | 0.625 | 1.039 |
| Departure Headway (Hd) | 12.467 | 11.703 | 12.129 | 11.414 | 10.841 | 10.04 | 10.802 | 10.278 | 9.544 |
| Convergence, Y/N | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Cap | 290 | 311 | 298 | 318 | 333 | 368 | 335 | 353 | 383 |
| Service Time | 10.167 | 9.403 | 9.829 | 9.114 | 8.541 | 7.74 | 8.502 | 7.978 | 7.244 |
| HCM Lane V/C Ratio | 0.238 | 0.633 | 0.315 | 0.695 | 0.234 | 1.408 | 0.555 | 0.686 | 1.136 |
| HCM Control Delay | 18.6 | 29.2 | 19.7 | 32.2 | 16.7 | 223.3 | 24.1 | 28.7 | 88.4 |
| HCM Lane LOS | C | D | C | D | C | F | C | D | F |
| HCM 95th-tile Q | 0.8 | 3.4 | 1.2 | 4.1 | 0.9 | 25.4 | 2.7 | 4 | 13.1 |



# MOVEMENT SUMMARY

## Site: 9 [PM Existing + Project Alt]

Novato Boulevard/San Marin Dr-Sutro Ave
PM Existing + Project Alternative

Roundabout

**Movement Performance - Vehicles**

| Mov ID | OD Mov | Demand Flows Total veh/h | Demand Flows HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance ft | Prop. Queued | Effective Stop Rate per veh | Average Speed mph |
|---|---|---|---|---|---|---|---|---|---|---|---|
| South: NB Sutro Ave | | | | | | | | | | | |
| 3 | L2 | 69 | 2.0 | 0.312 | 7.7 | LOS A | 1.5 | 37.7 | 0.59 | 0.55 | 32.9 |
| 8 | T1 | 136 | 2.0 | 0.312 | 7.7 | LOS A | 1.5 | 37.7 | 0.59 | 0.55 | 32.9 |
| 18 | R2 | 61 | 2.0 | 0.312 | 7.7 | LOS A | 1.5 | 37.7 | 0.59 | 0.55 | 32.0 |
| Approach | | 266 | 2.0 | 0.312 | 7.7 | LOS A | 1.5 | 37.7 | 0.59 | 0.55 | 32.7 |
| East: WB Novato Blvd | | | | | | | | | | | |
| 1 | L2 | 78 | 2.0 | 0.601 | 12.0 | LOS B | 4.8 | 122.3 | 0.70 | 0.64 | 31.3 |
| 6 | T1 | 316 | 2.0 | 0.601 | 12.0 | LOS B | 4.8 | 122.3 | 0.70 | 0.64 | 31.3 |
| 16 | R2 | 202 | 2.0 | 0.601 | 12.0 | LOS B | 4.8 | 122.3 | 0.70 | 0.64 | 30.5 |
| Approach | | 596 | 2.0 | 0.601 | 12.0 | LOS B | 4.8 | 122.3 | 0.70 | 0.64 | 31.0 |
| North: SB San Marin Drive | | | | | | | | | | | |
| 7 | L2 | 186 | 2.0 | 0.473 | 9.9 | LOS A | 2.7 | 67.5 | 0.64 | 0.65 | 31.5 |
| 4 | T1 | 242 | 2.0 | 0.473 | 9.9 | LOS A | 2.7 | 67.5 | 0.64 | 0.65 | 31.5 |
| 14 | R2 | 435 | 2.0 | 0.480 | 10.0 | LOS A | 2.7 | 69.4 | 0.65 | 0.66 | 31.4 |
| Approach | | 863 | 2.0 | 0.480 | 9.9 | LOS A | 2.7 | 69.4 | 0.65 | 0.65 | 31.5 |
| West: EB Novato Blvd | | | | | | | | | | | |
| 5 | L2 | 94 | 2.0 | 0.394 | 9.4 | LOS A | 2.0 | 51.1 | 0.66 | 0.66 | 32.0 |
| 2 | T1 | 164 | 2.0 | 0.394 | 9.4 | LOS A | 2.0 | 51.1 | 0.66 | 0.66 | 32.0 |
| 12 | R2 | 57 | 2.0 | 0.394 | 9.4 | LOS A | 2.0 | 51.1 | 0.66 | 0.66 | 31.2 |
| Approach | | 315 | 2.0 | 0.394 | 9.4 | LOS A | 2.0 | 51.1 | 0.66 | 0.66 | 31.9 |
| All Vehicles | | 2040 | 2.0 | 0.601 | 10.1 | LOS B | 4.8 | 122.3 | 0.66 | 0.64 | 31.5 |

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.


Organisation: W-TRANS | Processed: Tuesday, June 13, 2017 3:20:25 PM
Project: N:\AAA\MAX\NOV\126NOV\SIDRA\Novato-San Marin.sip7

## LANE SUMMARY

### Site: 9 [PM Existing + Project Alt]

Novato Boulevard/San Marin Dr-Sutro Ave
PM Existing + Project Alternative

Roundabout

**Lane Use and Performance**

| | Demand Flows Total veh/h | HV % | Cap. veh/h | Deg. Satn v/c | Lane Util. % | Average Delay sec | Level of Service | 95% Back of Queue Veh | Dist ft | Lane Config | Lane Length ft | Cap. Adj. % | Prob. Block. % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| South: NB Sutro Ave | | | | | | | | | | | | | |
| Lane 1[d] | 266 | 2.0 | 852 | 0.312 | 100 | 7.7 | LOS A | 1.5 | 37.7 | Full | 1600 | 0.0 | 0.0 |
| Approach | 266 | 2.0 | | 0.312 | | 7.7 | LOS A | 1.5 | 37.7 | | | | |
| East: WB Novato Blvd | | | | | | | | | | | | | |
| Lane 1[d] | 596 | 2.0 | 991 | 0.601 | 100 | 12.0 | LOS B | 4.8 | 122.3 | Full | 1600 | 0.0 | 0.0 |
| Approach | 596 | 2.0 | | 0.601 | | 12.0 | LOS B | 4.8 | 122.3 | | | | |
| North: SB San Marin Drive | | | | | | | | | | | | | |
| Lane 1 | 428 | 2.0 | 906 | 0.473 | 100 | 9.9 | LOS A | 2.7 | 67.5 | Full | 1600 | 0.0 | 0.0 |
| Lane 2[d] | 435 | 2.0 | 906 | 0.480 | 100 | 10.0 | LOS A | 2.7 | 69.4 | Short | 30 | 0.0 | NA |
| Approach | 863 | 2.0 | | 0.480 | | 9.9 | LOS A | 2.7 | 69.4 | | | | |
| West: EB Novato Blvd | | | | | | | | | | | | | |
| Lane 1[d] | 315 | 2.0 | 799 | 0.394 | 100 | 9.4 | LOS A | 2.0 | 51.1 | Full | 1600 | 0.0 | 0.0 |
| Approach | 315 | 2.0 | | 0.394 | | 9.4 | LOS A | 2.0 | 51.1 | | | | |
| Intersection | 2040 | 2.0 | | 0.601 | | 10.1 | LOS B | 4.8 | 122.3 | | | | |

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach



## HCM Signalized Intersection Capacity Analysis
9: San Marin Dr/Sutro Ave & Novato Blvd #1

06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 89 | 156 | 54 | 74 | 300 | 192 | 66 | 129 | 58 | 177 | 230 | 413 |
| Future Volume (vph) | 89 | 156 | 54 | 74 | 300 | 192 | 66 | 129 | 58 | 177 | 230 | 413 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 4.0 | | 3.0 | 4.0 | | 3.0 | 4.0 | | 3.0 | 4.0 | 4.0 |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.96 | | 1.00 | 0.94 | | 1.00 | 0.95 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1770 | 1791 | | 1770 | 1754 | | 1770 | 1776 | | 1770 | 1863 | 1583 |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1770 | 1791 | | 1770 | 1754 | | 1770 | 1776 | | 1770 | 1863 | 1583 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 94 | 164 | 57 | 78 | 316 | 202 | 69 | 136 | 61 | 186 | 242 | 435 |
| RTOR Reduction (vph) | 0 | 13 | 0 | 0 | 25 | 0 | 0 | 20 | 0 | 0 | 0 | 308 |
| Lane Group Flow (vph) | 94 | 208 | 0 | 78 | 493 | 0 | 69 | 177 | 0 | 186 | 242 | 127 |
| Turn Type | Prot | NA | | Prot | NA | | Prot | NA | | Prot | NA | Perm |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | | | | | | | | | | 6 |
| Actuated Green, G (s) | 5.1 | 23.4 | | 6.2 | 24.5 | | 6.0 | 14.6 | | 11.9 | 20.5 | 20.5 |
| Effective Green, g (s) | 5.1 | 23.4 | | 6.2 | 24.5 | | 6.0 | 14.6 | | 11.9 | 20.5 | 20.5 |
| Actuated g/C Ratio | 0.07 | 0.33 | | 0.09 | 0.35 | | 0.09 | 0.21 | | 0.17 | 0.29 | 0.29 |
| Clearance Time (s) | 3.0 | 4.0 | | 3.0 | 4.0 | | 3.0 | 4.0 | | 3.0 | 4.0 | 4.0 |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | 128 | 597 | | 156 | 613 | | 151 | 369 | | 300 | 544 | 462 |
| v/s Ratio Prot | c0.05 | 0.12 | | 0.04 | c0.28 | | 0.04 | 0.10 | | c0.11 | c0.13 | |
| v/s Ratio Perm | | | | | | | | | | | | 0.08 |
| v/c Ratio | 0.73 | 0.35 | | 0.50 | 0.80 | | 0.46 | 0.48 | | 0.62 | 0.44 | 0.28 |
| Uniform Delay, d1 | 31.8 | 17.6 | | 30.5 | 20.6 | | 30.5 | 24.4 | | 27.0 | 20.2 | 19.1 |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 19.5 | 0.4 | | 2.5 | 7.6 | | 2.2 | 1.0 | | 3.8 | 0.6 | 0.3 |
| Delay (s) | 51.3 | 18.0 | | 33.0 | 28.2 | | 32.7 | 25.4 | | 30.8 | 20.8 | 19.4 |
| Level of Service | D | B | | C | C | | C | C | | C | C | B |
| Approach Delay (s) | | 27.9 | | | 28.8 | | | 27.3 | | | 22.2 | |
| Approach LOS | | C | | | C | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 25.7 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.68 | | |
| Actuated Cycle Length (s) | 70.1 | Sum of lost time (s) | 14.0 |
| Intersection Capacity Utilization | 66.7% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## 10: Wilson Ave & Novato Blvd #2


| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 524 | 40 | 442 | 802 | 45 | 292 |
| Future Volume (vph) | 524 | 40 | 442 | 802 | 45 | 292 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.9 | | 3.0 | 3.6 | 3.6 | 3.6 |
| Lane Util. Factor | 0.95 | | 1.00 | 0.95 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | | 1.00 | 1.00 | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 0.99 | | 1.00 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 1.00 | | 0.95 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (prot) | 3533 | | 1787 | 3610 | 1805 | 1593 |
| Flt Permitted | 1.00 | | 0.95 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (perm) | 3533 | | 1787 | 3610 | 1805 | 1593 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 552 | 42 | 465 | 844 | 47 | 307 |
| RTOR Reduction (vph) | 5 | 0 | 0 | 0 | 0 | 260 |
| Lane Group Flow (vph) | 589 | 0 | 465 | 844 | 47 | 47 |
| Confl. Peds. (#/hr) | | 3 | | | 6 | 2 |
| Heavy Vehicles (%) | 1% | 0% | 1% | 0% | 0% | 0% |
| Turn Type | NA | | Prot | NA | Prot | Perm |
| Protected Phases | 2 | | 1 | 6 | 4 | |
| Permitted Phases | | | | | | 4 |
| Actuated Green, G (s) | 30.9 | | 19.3 | 38.3 | 11.1 | 11.1 |
| Effective Green, g (s) | 30.9 | | 19.3 | 38.3 | 11.1 | 11.1 |
| Actuated g/C Ratio | 0.43 | | 0.27 | 0.53 | 0.15 | 0.15 |
| Clearance Time (s) | 3.9 | | 3.0 | 3.6 | 3.6 | 3.6 |
| Vehicle Extension (s) | 3.0 | | 2.0 | 3.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 1520 | | 480 | 1925 | 279 | 246 |
| v/s Ratio Prot | c0.17 | | c0.26 | c0.23 | 0.03 | |
| v/s Ratio Perm | | | | | | c0.03 |
| v/c Ratio | 0.39 | | 0.97 | 0.44 | 0.17 | 0.19 |
| Uniform Delay, d1 | 14.0 | | 26.0 | 10.2 | 26.3 | 26.4 |
| Progression Factor | 1.00 | | 0.91 | 0.44 | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.7 | | 29.5 | 0.6 | 0.1 | 0.1 |
| Delay (s) | 14.7 | | 53.1 | 5.1 | 26.4 | 26.6 |
| Level of Service | B | | D | A | C | C |
| Approach Delay (s) | 14.7 | | | 22.1 | 26.6 | |
| Approach LOS | B | | | C | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 20.9 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.56 | | |
| Actuated Cycle Length (s) | 71.8 | Sum of lost time (s) | 10.5 |
| Intersection Capacity Utilization | 59.1% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group




## 11: Novato Blvd #2 & Simmons Ln


| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 128 | 689 | 975 | 104 | 106 | 281 |
| Future Volume (vph) | 128 | 689 | 975 | 104 | 106 | 281 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.9 | 3.6 | | 3.0 | 3.0 |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.99 | | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 3574 | 3551 | | 1805 | 1599 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | 1805 | 3574 | 3551 | | 1805 | 1599 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 135 | 725 | 1026 | 109 | 112 | 296 |
| RTOR Reduction (vph) | 0 | 0 | 7 | 0 | 0 | 247 |
| Lane Group Flow (vph) | 135 | 725 | 1128 | 0 | 112 | 49 |
| Confl. Peds. (#/hr) | | | | | 2 | |
| Confl. Bikes (#/hr) | | | | 1 | | |
| Heavy Vehicles (%) | 0% | 1% | 0% | 0% | 0% | 1% |
| Turn Type | Prot | NA | NA | | Prot | Perm |
| Protected Phases | 5 | 2 | 6 | | 8 | |
| Permitted Phases | | | | | | 8 |
| Actuated Green, G (s) | 12.2 | 30.9 | 38.3 | | 11.7 | 11.7 |
| Effective Green, g (s) | 12.2 | 30.9 | 38.3 | | 11.7 | 11.7 |
| Actuated g/C Ratio | 0.17 | 0.43 | 0.53 | | 0.16 | 0.16 |
| Clearance Time (s) | 3.0 | 3.9 | 3.6 | | 3.0 | 3.0 |
| Vehicle Extension (s) | 2.0 | 3.0 | 3.0 | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 306 | 1538 | 1894 | | 294 | 260 |
| v/s Ratio Prot | 0.07 | c0.20 | c0.32 | | c0.06 | |
| v/s Ratio Perm | | | | | | 0.03 |
| v/c Ratio | 0.44 | 0.47 | 0.60 | | 0.38 | 0.19 |
| Uniform Delay, d1 | 26.7 | 14.6 | 11.5 | | 26.8 | 26.0 |
| Progression Factor | 0.69 | 0.52 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 4.3 | 1.0 | 1.4 | | 0.3 | 0.1 |
| Delay (s) | 22.8 | 8.6 | 12.8 | | 27.1 | 26.1 |
| Level of Service | C | A | B | | C | C |
| Approach Delay (s) | | 10.9 | 12.8 | | 26.4 | |
| Approach LOS | | B | B | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 14.4 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.55 | | |
| Actuated Cycle Length (s) | 71.8 | Sum of lost time (s) | 10.5 |
| Intersection Capacity Utilization | 54.5% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 12: Grant Ave & Novato Blvd #2

01/23/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 160 | 636 | 1 | 2 | 876 | 51 | 1 | 6 | 4 | 24 | 1 | 288 |
| Future Volume (vph) | 160 | 636 | 1 | 2 | 876 | 51 | 1 | 6 | 4 | 24 | 1 | 288 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.5 | 4.5 | 3.5 | 4.9 | 4.9 | | 4.0 | | 3.5 | 3.5 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 | | 1.00 | | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.96 | | 0.98 | | 1.00 | 0.99 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | | 0.97 | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | | 0.95 | | 1.00 | 0.85 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1787 | 1863 | 1534 | 1805 | 3539 | 1529 | | 1762 | | 1737 | 1595 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 0.53 | | 0.75 | 1.00 | |
| Satd. Flow (perm) | 1787 | 1863 | 1534 | 1805 | 3539 | 1529 | | 947 | | 1372 | 1595 | |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 167 | 662 | 1 | 2 | 912 | 53 | 1 | 6 | 4 | 25 | 1 | 300 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 18 | 0 | 4 | 0 | 0 | 269 | 0 |
| Lane Group Flow (vph) | 167 | 663 | 1 | 2 | 913 | 35 | 0 | 7 | 0 | 25 | 32 | 0 |
| Confl. Peds. (#/hr) | | | 11 | | | 8 | 1 | | 14 | 14 | | 1 |
| Confl. Bikes (#/hr) | | | 1 | | | 4 | | | 2 | | | |
| Heavy Vehicles (%) | 1% | 2% | 0% | 0% | 2% | 1% | 0% | 0% | 0% | 1% | 0% | 0% |
| Turn Type | Prot | NA | Perm | Prot | NA | Perm | Perm | NA | | Perm | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | 2 | | | 6 | 8 | | | 4 | | |
| Actuated Green, G (s) | 14.6 | 86.1 | 86.1 | 1.2 | 72.3 | 72.3 | | 10.7 | | 11.2 | 11.2 | |
| Effective Green, g (s) | 14.6 | 86.1 | 86.1 | 1.2 | 72.3 | 72.3 | | 10.7 | | 11.2 | 11.2 | |
| Actuated g/C Ratio | 0.13 | 0.78 | 0.78 | 0.01 | 0.66 | 0.66 | | 0.10 | | 0.10 | 0.10 | |
| Clearance Time (s) | 3.5 | 4.5 | 4.5 | 3.5 | 4.9 | 4.9 | | 4.0 | | 3.5 | 3.5 | |
| Vehicle Extension (s) | 2.0 | 3.0 | 3.0 | 2.0 | 3.0 | 3.0 | | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 237 | 1458 | 1200 | 19 | 2326 | 1004 | | 92 | | 139 | 162 | |
| v/s Ratio Prot | c0.09 | c0.36 | | 0.00 | 0.26 | | | | | | c0.02 | |
| v/s Ratio Perm | | | 0.00 | | | 0.02 | | 0.01 | | 0.02 | | |
| v/c Ratio | 0.70 | 0.45 | 0.00 | 0.11 | 0.39 | 0.03 | | 0.08 | | 0.18 | 0.19 | |
| Uniform Delay, d1 | 45.6 | 4.0 | 2.6 | 53.9 | 8.7 | 6.6 | | 45.2 | | 45.2 | 45.3 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.34 | 0.22 | 0.22 | | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 7.5 | 1.0 | 0.0 | 0.6 | 0.4 | 0.0 | | 0.1 | | 0.2 | 0.2 | |
| Delay (s) | 53.2 | 5.1 | 2.6 | 73.0 | 2.3 | 1.5 | | 45.3 | | 45.4 | 45.5 | |
| Level of Service | D | A | A | E | A | A | | D | | D | D | |
| Approach Delay (s) | | 14.7 | | | 2.4 | | | 45.3 | | | 45.5 | |
| Approach LOS | | B | | | A | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 14.0 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.48 | | |
| Actuated Cycle Length (s) | 110.0 | Sum of lost time (s) | 12.4 |
| Intersection Capacity Utilization | 67.0% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 13: Tamalpais Ave/7th St & Novato Blvd #2

01/23/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 134 | 555 | 41 | 67 | 784 | 215 | 43 | 119 | 43 | 184 | 110 | 123 |
| Future Volume (vph) | 134 | 555 | 41 | 67 | 784 | 215 | 43 | 119 | 43 | 184 | 110 | 123 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 5.0 | | 3.5 | 5.0 | 5.0 | 3.5 | 3.5 | | 3.5 | 3.5 | 3.5 |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 0.96 | 1.00 | 0.99 | | 1.00 | 1.00 | 0.96 |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 0.99 | 1.00 | | 0.99 | 1.00 | 1.00 |
| Frt | 1.00 | 0.99 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.96 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1787 | 1838 | | 1787 | 1863 | 1541 | 1768 | 1786 | | 1765 | 1881 | 1533 |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.62 | 1.00 | | 0.51 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1787 | 1838 | | 1787 | 1863 | 1541 | 1148 | 1786 | | 939 | 1881 | 1533 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 140 | 578 | 43 | 70 | 817 | 224 | 45 | 124 | 45 | 192 | 115 | 128 |
| RTOR Reduction (vph) | 0 | 2 | 0 | 0 | 0 | 33 | 0 | 13 | 0 | 0 | 0 | 100 |
| Lane Group Flow (vph) | 140 | 619 | 0 | 70 | 817 | 191 | 45 | 156 | 0 | 192 | 115 | 28 |
| Confl. Peds. (#/hr) | | | 10 | | | 6 | 5 | | 7 | 7 | | 5 |
| Confl. Bikes (#/hr) | | | | | | 3 | | | 2 | | | 5 |
| Heavy Vehicles (%) | 1% | 2% | 1% | 1% | 2% | 1% | 1% | 1% | 1% | 1% | 1% | 1% |
| Turn Type | Prot | NA | | Prot | NA | Perm | Perm | NA | | Perm | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | | | | 6 | 8 | | | 4 | | 4 |
| Actuated Green, G (s) | 12.7 | 66.3 | | 7.5 | 61.1 | 61.1 | 24.2 | 24.2 | | 24.2 | 24.2 | 24.2 |
| Effective Green, g (s) | 12.7 | 66.3 | | 7.5 | 61.1 | 61.1 | 24.2 | 24.2 | | 24.2 | 24.2 | 24.2 |
| Actuated g/C Ratio | 0.12 | 0.60 | | 0.07 | 0.56 | 0.56 | 0.22 | 0.22 | | 0.22 | 0.22 | 0.22 |
| Clearance Time (s) | 3.5 | 5.0 | | 3.5 | 5.0 | 5.0 | 3.5 | 3.5 | | 3.5 | 3.5 | 3.5 |
| Vehicle Extension (s) | 2.0 | 5.0 | | 2.0 | 5.0 | 5.0 | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 206 | 1107 | | 121 | 1034 | 855 | 252 | 392 | | 206 | 413 | 337 |
| v/s Ratio Prot | c0.08 | 0.34 | | 0.04 | c0.44 | | | 0.09 | | | 0.06 | |
| v/s Ratio Perm | | | | | | 0.12 | 0.04 | | | c0.20 | | 0.02 |
| v/c Ratio | 0.68 | 0.56 | | 0.58 | 0.79 | 0.22 | 0.18 | 0.40 | | 0.93 | 0.28 | 0.08 |
| Uniform Delay, d1 | 46.7 | 13.1 | | 49.7 | 19.4 | 12.4 | 34.8 | 36.7 | | 42.1 | 35.6 | 34.1 |
| Progression Factor | 0.89 | 1.15 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 6.4 | 1.9 | | 4.1 | 6.2 | 0.6 | 0.1 | 0.2 | | 43.3 | 0.1 | 0.0 |
| Delay (s) | 48.2 | 17.0 | | 53.8 | 25.5 | 13.0 | 35.0 | 36.9 | | 85.4 | 35.8 | 34.1 |
| Level of Service | D | B | | D | C | B | C | D | | F | D | C |
| Approach Delay (s) | | 22.7 | | | 24.8 | | | 36.5 | | | 57.2 | |
| Approach LOS | | C | | | C | | | D | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 30.7 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.81 | | |
| Actuated Cycle Length (s) | 110.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 84.8% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 14: Diablo Ave & Novato Blvd #2

01/23/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 24 | 254 | 22 | 284 | 327 | 625 | 49 | 438 | 238 | 447 | 334 | 12 |
| Future Volume (vph) | 24 | 254 | 22 | 284 | 327 | 625 | 49 | 438 | 238 | 447 | 334 | 12 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 12 | 12 | 11 | 11 | 12 | 11 | 11 | 12 | 12 | 12 | 12 |
| Total Lost time (s) | | 3.7 | | 4.1 | 4.1 | 4.1 | 4.4 | 4.4 | 4.4 | 4.1 | 4.1 | |
| Lane Util. Factor | | 0.95 | | 0.91 | 0.91 | 1.00 | 1.00 | 1.00 | 1.00 | 0.91 | 0.91 | |
| Frpb, ped/bikes | | 1.00 | | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | | 0.99 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | |
| Flt Protected | | 1.00 | | 0.95 | 0.99 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.98 | |
| Satd. Flow (prot) | | 3514 | | 1557 | 3269 | 1501 | 1728 | 1801 | 1560 | 1610 | 3319 | |
| Flt Permitted | | 1.00 | | 0.95 | 0.99 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.98 | |
| Satd. Flow (perm) | | 3514 | | 1557 | 3269 | 1501 | 1728 | 1801 | 1560 | 1610 | 3319 | |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 26 | 270 | 23 | 302 | 348 | 665 | 52 | 466 | 253 | 476 | 355 | 13 |
| RTOR Reduction (vph) | 0 | 4 | 0 | 0 | 0 | 274 | 0 | 0 | 155 | 0 | 2 | 0 |
| Lane Group Flow (vph) | 0 | 315 | 0 | 211 | 439 | 391 | 52 | 466 | 98 | 276 | 566 | 0 |
| Confl. Peds. (#/hr) | | | 10 | | | 15 | | | 2 | | | 3 |
| Confl. Bikes (#/hr) | | | 1 | | | 1 | | | | | | 6 |
| Heavy Vehicles (%) | 1% | 1% | 1% | 2% | 1% | 2% | 1% | 2% | 2% | 2% | 2% | 1% |
| Turn Type | Split | NA | | Split | NA | Perm | Split | NA | Perm | Split | NA | |
| Protected Phases | 3 | 3 | | 4 | 4 | | 1 | 1 | | 2 | 2 | |
| Permitted Phases | | | | | | 4 | | | 1 | | 2 | |
| Actuated Green, G (s) | | 15.9 | | 29.2 | 29.2 | 29.2 | 32.2 | 32.2 | 32.2 | 24.0 | 24.0 | |
| Effective Green, g (s) | | 15.9 | | 29.2 | 29.2 | 29.2 | 32.2 | 32.2 | 32.2 | 24.0 | 24.0 | |
| Actuated g/C Ratio | | 0.14 | | 0.25 | 0.25 | 0.25 | 0.27 | 0.27 | 0.27 | 0.20 | 0.20 | |
| Clearance Time (s) | | 3.7 | | 4.1 | 4.1 | 4.1 | 4.4 | 4.4 | 4.4 | 4.1 | 4.1 | |
| Vehicle Extension (s) | | 2.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | | 475 | | 386 | 811 | 372 | 473 | 493 | 427 | 328 | 677 | |
| v/s Ratio Prot | | c0.09 | | 0.14 | 0.13 | | 0.03 | c0.26 | | c0.17 | 0.17 | |
| v/s Ratio Perm | | | | | | c0.26 | | | 0.06 | | | |
| v/c Ratio | | 0.66 | | 0.55 | 0.54 | 1.05 | 0.11 | 0.95 | 0.23 | 0.84 | 0.84 | |
| Uniform Delay, d1 | | 48.3 | | 38.4 | 38.4 | 44.2 | 32.0 | 41.8 | 33.1 | 45.0 | 44.9 | |
| Progression Factor | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 2.7 | | 0.9 | 0.4 | 60.4 | 0.0 | 26.9 | 0.1 | 16.8 | 8.5 | |
| Delay (s) | | 51.0 | | 39.3 | 38.8 | 104.6 | 32.0 | 68.7 | 33.2 | 61.8 | 53.4 | |
| Level of Service | | D | | D | D | F | C | E | C | E | D | |
| Approach Delay (s) | | 51.0 | | | 72.1 | | | 54.6 | | | 56.1 | |
| Approach LOS | | D | | | E | | | D | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 61.7 | HCM 2000 Level of Service | E |
| HCM 2000 Volume to Capacity ratio | 0.91 | | |
| Actuated Cycle Length (s) | 117.6 | Sum of lost time (s) | 16.3 |
| Intersection Capacity Utilization | 85.9% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 14: Diablo Ave & Novato Blvd #2

02/12/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 24 | 254 | 22 | 284 | 327 | 625 | 49 | 438 | 238 | 447 | 334 | 12 |
| Future Volume (vph) | 24 | 254 | 22 | 284 | 327 | 625 | 49 | 438 | 238 | 447 | 334 | 12 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 11 | 11 | 11 | 11 | 11 | 12 | 11 | 11 | 12 | 10 | 12 | 12 |
| Total Lost time (s) | 4.0 | 4.1 | 4.1 | 4.0 | 4.0 | 4.0 | 4.0 | 4.1 | | 4.0 | 4.0 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | | 0.97 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.95 | | 1.00 | 0.99 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1728 | 1818 | 1512 | 1711 | 1818 | 1555 | 1728 | 3225 | | 3204 | 1852 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1728 | 1818 | 1512 | 1711 | 1818 | 1555 | 1728 | 3225 | | 3204 | 1852 | |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 26 | 270 | 23 | 302 | 348 | 665 | 52 | 466 | 253 | 476 | 355 | 13 |
| RTOR Reduction (vph) | 0 | 0 | 19 | 0 | 0 | 87 | 0 | 65 | 0 | 0 | 1 | 0 |
| Lane Group Flow (vph) | 26 | 270 | 4 | 302 | 348 | 578 | 52 | 654 | 0 | 476 | 367 | 0 |
| Confl. Peds. (#/hr) | | | 10 | | | 15 | | | 2 | | | 3 |
| Confl. Bikes (#/hr) | | | 1 | | | 1 | | | | | | 6 |
| Heavy Vehicles (%) | 1% | 1% | 1% | 2% | 1% | 2% | 1% | 2% | 2% | 2% | 2% | 1% |
| Turn Type | Prot | NA | Perm | Prot | NA | pm+ov | Prot | NA | | Prot | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | 1 | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | 4 | | | 8 | | | | | | |
| Actuated Green, G (s) | 4.8 | 19.5 | 19.5 | 22.1 | 36.9 | 54.2 | 6.4 | 24.8 | | 17.3 | 35.8 | |
| Effective Green, g (s) | 4.8 | 19.5 | 19.5 | 22.1 | 36.9 | 54.2 | 6.4 | 24.8 | | 17.3 | 35.8 | |
| Actuated g/C Ratio | 0.05 | 0.20 | 0.20 | 0.22 | 0.37 | 0.54 | 0.06 | 0.25 | | 0.17 | 0.36 | |
| Clearance Time (s) | 4.0 | 4.1 | 4.1 | 4.0 | 4.0 | 4.0 | 4.0 | 4.1 | | 4.0 | 4.0 | |
| Vehicle Extension (s) | 3.0 | 2.0 | 2.0 | 3.0 | 3.0 | 3.0 | 3.0 | 2.0 | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 83 | 354 | 295 | 378 | 671 | 843 | 110 | 800 | | 554 | 663 | |
| v/s Ratio Prot | 0.02 | c0.15 | | c0.18 | 0.19 | 0.12 | 0.03 | c0.20 | | c0.15 | 0.20 | |
| v/s Ratio Perm | | | 0.00 | | | 0.25 | | | | | | |
| v/c Ratio | 0.31 | 0.76 | 0.02 | 0.80 | 0.52 | 0.69 | 0.47 | 0.82 | | 0.86 | 0.55 | |
| Uniform Delay, d1 | 46.0 | 38.0 | 32.4 | 36.8 | 24.6 | 16.6 | 45.1 | 35.4 | | 40.1 | 25.6 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 2.2 | 8.5 | 0.0 | 11.2 | 0.7 | 2.3 | 3.2 | 6.2 | | 12.6 | 1.0 | |
| Delay (s) | 48.1 | 46.5 | 32.5 | 48.0 | 25.3 | 19.0 | 48.3 | 41.6 | | 52.7 | 26.7 | |
| Level of Service | D | D | C | D | C | B | D | D | | D | C | |
| Approach Delay (s) | | 45.6 | | | 27.3 | | | 42.1 | | | 41.3 | |
| Approach LOS | | D | | | C | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 36.2 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.81 | | |
| Actuated Cycle Length (s) | 99.9 | Sum of lost time (s) | 16.2 |
| Intersection Capacity Utilization | 79.7% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

# HCM Signalized Intersection Capacity Analysis
## 15: Redwood Blvd & Diablo Ave/De Long Ave



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 284 | 577 | 107 | 107 | 958 | 402 | 138 | 317 | 87 | 332 | 230 | 228 |
| Future Volume (vph) | 284 | 577 | 107 | 107 | 958 | 402 | 138 | 317 | 87 | 332 | 230 | 228 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 9 |
| Total Lost time (s) | 4.0 | 3.7 | | 4.0 | 4.1 | | 3.5 | 4.8 | 4.8 | 3.5 | 3.5 | 3.5 |
| Lane Util. Factor | 0.97 | 0.95 | | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 | 0.97 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.97 |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.98 | | 1.00 | 0.96 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3467 | 3525 | | 1805 | 3340 | | 1805 | 3610 | 1508 | 3303 | 1900 | 1394 |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3467 | 3525 | | 1805 | 3340 | | 1805 | 3610 | 1508 | 3303 | 1900 | 1394 |
| Peak-hour factor, PHF | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Adj. Flow (vph) | 290 | 589 | 109 | 109 | 978 | 410 | 141 | 323 | 89 | 339 | 235 | 233 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 33 | 0 | 0 | 50 |
| Lane Group Flow (vph) | 290 | 698 | 0 | 109 | 1388 | 0 | 141 | 323 | 56 | 339 | 235 | 183 |
| Confl. Peds. (#/hr) | | | | | | 2 | | | 7 | | | 14 |
| Confl. Bikes (#/hr) | | | | | | | | | | | | 3 |
| Heavy Vehicles (%) | 1% | 0% | 0% | 0% | 2% | 5% | 0% | 0% | 5% | 6% | 0% | 1% |
| Turn Type | Prot | NA | | Prot | NA | | Prot | NA | Perm | Prot | NA | Perm |
| Protected Phases | 3 | 8 | | 7 | 4 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | | | | | | | 2 | | | 6 |
| Actuated Green, G (s) | 17.1 | 61.0 | | 17.0 | 60.5 | | 14.6 | 22.1 | 22.1 | 13.9 | 22.7 | 22.7 |
| Effective Green, g (s) | 17.1 | 61.0 | | 17.0 | 60.5 | | 14.6 | 22.1 | 22.1 | 13.9 | 22.7 | 22.7 |
| Actuated g/C Ratio | 0.13 | 0.47 | | 0.13 | 0.47 | | 0.11 | 0.17 | 0.17 | 0.11 | 0.17 | 0.17 |
| Clearance Time (s) | 4.0 | 3.7 | | 4.0 | 4.1 | | 3.5 | 4.8 | 4.8 | 3.5 | 3.5 | 3.5 |
| Vehicle Extension (s) | 2.5 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 456 | 1654 | | 236 | 1554 | | 202 | 613 | 256 | 353 | 331 | 243 |
| v/s Ratio Prot | c0.08 | 0.20 | | 0.06 | c0.42 | | 0.08 | 0.09 | | c0.10 | 0.12 | |
| v/s Ratio Perm | | | | | | | | | 0.04 | | | c0.13 |
| v/c Ratio | 0.64 | 0.42 | | 0.46 | 0.89 | | 0.70 | 0.53 | 0.22 | 0.96 | 0.71 | 0.76 |
| Uniform Delay, d1 | 53.5 | 22.8 | | 52.3 | 31.8 | | 55.6 | 49.2 | 46.5 | 57.8 | 50.5 | 51.0 |
| Progression Factor | 1.00 | 1.00 | | 1.44 | 0.52 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 2.5 | 0.8 | | 0.3 | 5.1 | | 8.2 | 0.4 | 0.2 | 37.2 | 5.6 | 11.2 |
| Delay (s) | 56.0 | 23.6 | | 75.4 | 21.7 | | 63.8 | 49.6 | 46.7 | 94.9 | 56.2 | 62.2 |
| Level of Service | E | C | | E | C | | E | D | D | F | E | E |
| Approach Delay (s) | | 33.1 | | | 25.6 | | | 52.7 | | | 74.2 | |
| Approach LOS | | C | | | C | | | D | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 41.6 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.84 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 16.4 |
| Intersection Capacity Utilization | 96.0% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 16: Reichert Ave & De Long Ave



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 87 | 872 | 18 | 95 | 1341 | 348 | 12 | 30 | 51 | 247 | 18 | 82 |
| Future Volume (vph) | 87 | 872 | 18 | 95 | 1341 | 348 | 12 | 30 | 51 | 247 | 18 | 82 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 0.95 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 0.99 | | 1.00 | 1.00 | 0.98 | 1.00 | 0.98 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 0.99 | 1.00 | 1.00 | 0.99 | 1.00 | |
| Frt | 1.00 | 1.00 | | 1.00 | 0.97 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.88 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1805 | 3527 | | 1805 | 3427 | | 1794 | 1900 | 1577 | 1763 | 1634 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.62 | 1.00 | 1.00 | 0.74 | 1.00 | |
| Satd. Flow (perm) | 1805 | 3527 | | 1805 | 3427 | | 1172 | 1900 | 1577 | 1366 | 1634 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 92 | 918 | 19 | 100 | 1412 | 366 | 13 | 32 | 54 | 260 | 19 | 86 |
| RTOR Reduction (vph) | 0 | 1 | 0 | 0 | 14 | 0 | 0 | 0 | 15 | 0 | 28 | 0 |
| Lane Group Flow (vph) | 92 | 936 | 0 | 100 | 1764 | 0 | 13 | 32 | 39 | 260 | 77 | 0 |
| Confl. Peds. (#/hr) | | | 5 | | | 11 | 5 | | 5 | 11 | | 5 |
| Confl. Bikes (#/hr) | | | 5 | | | 5 | | | 5 | | | 5 |
| Heavy Vehicles (%) | 0% | 2% | 0% | 0% | 1% | 1% | 0% | 0% | 0% | 1% | 0% | 0% |
| Turn Type | Prot | NA | | Prot | NA | | Perm | NA | Perm | Perm | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | | | | | 8 | | 8 | 4 | | |
| Actuated Green, G (s) | 11.0 | 80.4 | | 10.8 | 80.2 | | 28.2 | 28.2 | 28.2 | 28.2 | 28.2 | |
| Effective Green, g (s) | 11.0 | 80.4 | | 10.8 | 80.2 | | 28.2 | 28.2 | 28.2 | 28.2 | 28.2 | |
| Actuated g/C Ratio | 0.08 | 0.62 | | 0.08 | 0.62 | | 0.22 | 0.22 | 0.22 | 0.22 | 0.22 | |
| Clearance Time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | |
| Vehicle Extension (s) | 2.0 | 3.0 | | 2.0 | 3.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 152 | 2181 | | 149 | 2114 | | 254 | 412 | 342 | 296 | 354 | |
| v/s Ratio Prot | 0.05 | 0.27 | | c0.06 | c0.51 | | | 0.02 | | | 0.05 | |
| v/s Ratio Perm | | | | | | | 0.01 | | 0.02 | c0.19 | | |
| v/c Ratio | 0.61 | 0.43 | | 0.67 | 0.83 | | 0.05 | 0.08 | 0.11 | 0.88 | 0.22 | |
| Uniform Delay, d1 | 57.4 | 12.9 | | 57.9 | 19.7 | | 40.3 | 40.5 | 40.9 | 49.2 | 41.8 | |
| Progression Factor | 0.75 | 1.15 | | 0.98 | 0.72 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 3.8 | 0.5 | | 7.2 | 3.3 | | 0.0 | 0.0 | 0.1 | 23.5 | 0.1 | |
| Delay (s) | 46.8 | 15.3 | | 63.8 | 17.5 | | 40.3 | 40.6 | 40.9 | 72.8 | 41.9 | |
| Level of Service | D | B | | E | B | | D | D | D | E | D | |
| Approach Delay (s) | | 18.1 | | | 19.9 | | | 40.7 | | | 63.9 | |
| Approach LOS | | B | | | B | | | D | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 24.8 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.83 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 86.7% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 17: US 101 SB Ramps & De Long Ave



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 211 | 999 | 27 | 1732 | 0 | 0 | 0 | 0 | 10 | 7 | 177 |
| Future Volume (vph) | 0 | 211 | 999 | 27 | 1732 | 0 | 0 | 0 | 0 | 10 | 7 | 177 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.6 | 3.6 | 3.0 | 3.6 | | | | | 4.0 | 4.0 | |
| Lane Util. Factor | | 0.95 | 1.00 | 1.00 | 0.95 | | | | | 0.95 | 0.95 | |
| Frt | | 1.00 | 0.85 | 1.00 | 1.00 | | | | | 1.00 | 0.86 | |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 3574 | 1599 | 1770 | 3539 | | | | | 1681 | 1515 | |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | 0.95 | 1.00 | |
| Satd. Flow (perm) | | 3574 | 1599 | 1770 | 3539 | | | | | 1681 | 1515 | |
| Peak-hour factor, PHF | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Adj. Flow (vph) | 0 | 215 | 1019 | 28 | 1767 | 0 | 0 | 0 | 0 | 10 | 7 | 181 |
| RTOR Reduction (vph) | 0 | 0 | 282 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 43 | 0 |
| Lane Group Flow (vph) | 0 | 215 | 737 | 28 | 1767 | 0 | 0 | 0 | 0 | 9 | 146 | 0 |
| Heavy Vehicles (%) | 0% | 1% | 1% | 2% | 2% | 2% | 2% | 2% | 2% | 2% | 2% | 2% |
| Turn Type | | NA | Perm | Prot | NA | | | | | Split | NA | |
| Protected Phases | | 6 | | 5 | 2 | | | | | 4 | 4 | |
| Permitted Phases | | | 6 | | | | | | | | | |
| Actuated Green, G (s) | | 91.3 | 91.3 | 10.9 | 105.2 | | | | | 17.2 | 17.2 | |
| Effective Green, g (s) | | 91.3 | 91.3 | 10.9 | 105.2 | | | | | 17.2 | 17.2 | |
| Actuated g/C Ratio | | 0.70 | 0.70 | 0.08 | 0.81 | | | | | 0.13 | 0.13 | |
| Clearance Time (s) | | 3.6 | 3.6 | 3.0 | 3.6 | | | | | 4.0 | 4.0 | |
| Vehicle Extension (s) | | 4.0 | 4.0 | 2.0 | 4.0 | | | | | 2.5 | 2.5 | |
| Lane Grp Cap (vph) | | 2510 | 1122 | 148 | 2863 | | | | | 222 | 200 | |
| v/s Ratio Prot | | 0.06 | | 0.02 | c0.50 | | | | | 0.01 | c0.10 | |
| v/s Ratio Perm | | | c0.46 | | | | | | | | | |
| v/c Ratio | | 0.09 | 0.66 | 0.19 | 0.62 | | | | | 0.04 | 0.73 | |
| Uniform Delay, d1 | | 6.1 | 10.7 | 55.4 | 4.7 | | | | | 49.2 | 54.2 | |
| Progression Factor | | 0.78 | 5.89 | 0.79 | 0.48 | | | | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 0.1 | 2.7 | 0.2 | 0.7 | | | | | 0.1 | 12.3 | |
| Delay (s) | | 4.9 | 65.7 | 43.7 | 3.0 | | | | | 49.3 | 66.4 | |
| Level of Service | | A | E | D | A | | | | | D | E | |
| Approach Delay (s) | | 55.1 | | | 3.6 | | | 0.0 | | | 65.7 | |
| Approach LOS | | E | | | A | | | A | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 27.1 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.67 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 127.7% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 18: US 101 NB Ramps & De Long Ave

11/22/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 178 | 45 | 0 | 0 | 61 | 28 | 1684 | 24 | 33 | 0 | 0 | 0 |
| Future Volume (vph) | 178 | 45 | 0 | 0 | 61 | 28 | 1684 | 24 | 33 | 0 | 0 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 3.6 | | | 3.6 | | 4.5 | 4.5 | | | | |
| Lane Util. Factor | 1.00 | 0.95 | | | 0.95 | | 0.95 | 0.95 | | | | |
| Frpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | | | | |
| Flpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | | | | |
| Frt | 1.00 | 1.00 | | | 0.95 | | 1.00 | 0.99 | | | | |
| Flt Protected | 0.95 | 1.00 | | | 1.00 | | 0.95 | 0.96 | | | | |
| Satd. Flow (prot) | 1770 | 3610 | | | 3353 | | 1698 | 1695 | | | | |
| Flt Permitted | 0.95 | 1.00 | | | 1.00 | | 0.95 | 0.96 | | | | |
| Satd. Flow (perm) | 1770 | 3610 | | | 3353 | | 1698 | 1695 | | | | |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 185 | 47 | 0 | 0 | 64 | 29 | 1754 | 25 | 34 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 27 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 185 | 47 | 0 | 0 | 66 | 0 | 912 | 900 | 0 | 0 | 0 | 0 |
| Confl. Peds. (#/hr) | | | | | | 1 | | | | | | |
| Heavy Vehicles (%) | 2% | 0% | 0% | 0% | 0% | 7% | 1% | 0% | 6% | 0% | 0% | 0% |
| Turn Type | Prot | NA | | | NA | | Split | NA | | | | |
| Protected Phases | 1 | 6 | | | 2 | | 4 | 4 | | | | |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | 15.8 | 27.6 | | | 8.3 | | 94.3 | 94.3 | | | | |
| Effective Green, g (s) | 15.8 | 27.6 | | | 8.3 | | 94.3 | 94.3 | | | | |
| Actuated g/C Ratio | 0.12 | 0.21 | | | 0.06 | | 0.73 | 0.73 | | | | |
| Clearance Time (s) | 3.5 | 3.6 | | | 3.6 | | 4.5 | 4.5 | | | | |
| Vehicle Extension (s) | 2.5 | 2.0 | | | 2.0 | | 3.0 | 3.0 | | | | |
| Lane Grp Cap (vph) | 215 | 766 | | | 214 | | 1231 | 1229 | | | | |
| v/s Ratio Prot | c0.10 | 0.01 | | | c0.02 | | c0.54 | 0.53 | | | | |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | 0.86 | 0.06 | | | 0.31 | | 0.74 | 0.73 | | | | |
| Uniform Delay, d1 | 56.0 | 40.9 | | | 58.1 | | 10.6 | 10.5 | | | | |
| Progression Factor | 1.13 | 1.11 | | | 1.00 | | 1.00 | 1.00 | | | | |
| Incremental Delay, d2 | 27.5 | 0.0 | | | 0.3 | | 4.0 | 3.9 | | | | |
| Delay (s) | 90.6 | 45.2 | | | 58.4 | | 14.6 | 14.3 | | | | |
| Level of Service | F | D | | | E | | B | B | | | | |
| Approach Delay (s) | | 81.4 | | | 58.4 | | | 14.5 | | | 0.0 | |
| Approach LOS | | F | | | E | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 23.7 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.73 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 11.6 |
| Intersection Capacity Utilization | 127.7% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 19: Redwood Blvd & Lamont Ave

11/22/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 31 | 4 | 23 | 48 | 3 | 57 | 21 | 509 | 60 | 72 | 430 | 15 |
| Future Volume (vph) | 31 | 4 | 23 | 48 | 3 | 57 | 21 | 509 | 60 | 72 | 430 | 15 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.5 | 3.5 | | 3.5 | 3.5 | 3.5 | 4.8 | | 3.5 | 4.8 | 4.8 |
| Lane Util. Factor | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 |
| Frpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | 0.99 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Flpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | | 1.00 | 0.85 | | 1.00 | 0.85 | 1.00 | 0.98 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | | 0.96 | 1.00 | | 0.95 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | | 1818 | 1615 | | 1814 | 1595 | 1805 | 3545 | | 1805 | 3610 | 1615 |
| Flt Permitted | | 0.80 | 1.00 | | 0.77 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | | 1511 | 1615 | | 1462 | 1595 | 1805 | 3545 | | 1805 | 3610 | 1615 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 33 | 4 | 24 | 51 | 3 | 60 | 22 | 536 | 63 | 76 | 453 | 16 |
| RTOR Reduction (vph) | 0 | 0 | 18 | 0 | 0 | 46 | 0 | 8 | 0 | 0 | 0 | 8 |
| Lane Group Flow (vph) | 0 | 37 | 6 | 0 | 54 | 14 | 22 | 591 | 0 | 76 | 453 | 8 |
| Confl. Peds. (#/hr) | 1 | | | | | 1 | | | 2 | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Perm | NA | Perm | Perm | NA | Perm | Prot | NA | | Prot | NA | Perm |
| Protected Phases | | 8 | | | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | 8 | | 8 | 4 | | 4 | | | | | | 2 |
| Actuated Green, G (s) | | 12.1 | 12.1 | | 12.1 | 12.1 | 1.0 | 22.7 | | 5.4 | 27.1 | 27.1 |
| Effective Green, g (s) | | 12.1 | 12.1 | | 12.1 | 12.1 | 1.0 | 22.7 | | 5.4 | 27.1 | 27.1 |
| Actuated g/C Ratio | | 0.23 | 0.23 | | 0.23 | 0.23 | 0.02 | 0.44 | | 0.10 | 0.52 | 0.52 |
| Clearance Time (s) | | 3.5 | 3.5 | | 3.5 | 3.5 | 3.5 | 4.8 | | 3.5 | 4.8 | 4.8 |
| Vehicle Extension (s) | | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 | 3.0 | | 2.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | 351 | 375 | | 340 | 371 | 34 | 1547 | | 187 | 1881 | 841 |
| v/s Ratio Prot | | | | | | | 0.01 | c0.17 | | c0.04 | 0.13 | |
| v/s Ratio Perm | | 0.02 | 0.00 | | c0.04 | 0.01 | | | | | | 0.01 |
| v/c Ratio | | 0.11 | 0.01 | | 0.16 | 0.04 | 0.65 | 0.38 | | 0.41 | 0.24 | 0.01 |
| Uniform Delay, d1 | | 15.7 | 15.4 | | 15.9 | 15.4 | 25.3 | 9.9 | | 21.8 | 6.8 | 6.0 |
| Progression Factor | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.0 | 0.0 | | 0.1 | 0.0 | 27.5 | 0.2 | | 0.5 | 0.1 | 0.0 |
| Delay (s) | | 15.7 | 15.4 | | 16.0 | 15.5 | 52.8 | 10.1 | | 22.3 | 6.9 | 6.0 |
| Level of Service | | B | B | | B | B | D | B | | C | A | A |
| Approach Delay (s) | | 15.6 | | | 15.7 | | | 11.6 | | | 9.0 | |
| Approach LOS | | B | | | B | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 11.1 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.32 | | |
| Actuated Cycle Length (s) | 52.0 | Sum of lost time (s) | 11.8 |
| Intersection Capacity Utilization | 46.2% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 20: Redwood Blvd & Landing Ct



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 0 | 3 | 30 | 0 | 27 | 1 | 577 | 27 | 18 | 550 | 1 |
| Future Volume (vph) | 0 | 0 | 3 | 30 | 0 | 27 | 1 | 577 | 27 | 18 | 550 | 1 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.5 | | 3.5 | | 3.5 | | 4.8 | 4.8 | 3.5 | 4.8 | 4.8 |
| Lane Util. Factor | | 1.00 | | 1.00 | | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |
| Frpb, ped/bikes | | 0.99 | | 1.00 | | 1.00 | | 1.00 | 0.98 | 1.00 | 1.00 | 0.97 |
| Flpb, ped/bikes | | 1.00 | | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.86 | | 1.00 | | 0.85 | | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | | 1.00 | | 0.95 | | 1.00 | | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | | 1622 | | 1803 | | 1615 | | 3610 | 1579 | 1805 | 3610 | 1571 |
| Flt Permitted | | 1.00 | | 0.76 | | 1.00 | | 0.95 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | | 1622 | | 1434 | | 1615 | | 3446 | 1579 | 1805 | 3610 | 1571 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 0 | 0 | 3 | 32 | 0 | 28 | 1 | 607 | 28 | 19 | 579 | 1 |
| RTOR Reduction (vph) | 0 | 3 | 0 | 0 | 0 | 24 | 0 | 0 | 12 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 32 | 0 | 4 | 0 | 608 | 16 | 19 | 579 | 1 |
| Confl. Peds. (#/hr) | | | 4 | 4 | | | | | 3 | | | 6 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | | NA | | Perm | | Perm | Perm | NA | Perm | Prot | NA | Perm |
| Protected Phases | | 4 | | | | | | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | 2 | | | 6 |
| Actuated Green, G (s) | | 7.0 | | 7.0 | | 7.0 | | 27.9 | 27.9 | 0.8 | 32.2 | 32.2 |
| Effective Green, g (s) | | 7.0 | | 7.0 | | 7.0 | | 27.9 | 27.9 | 0.8 | 32.2 | 32.2 |
| Actuated g/C Ratio | | 0.15 | | 0.15 | | 0.15 | | 0.59 | 0.59 | 0.02 | 0.68 | 0.68 |
| Clearance Time (s) | | 3.5 | | 3.5 | | 3.5 | | 4.8 | 4.8 | 3.5 | 4.8 | 4.8 |
| Vehicle Extension (s) | | 3.0 | | 2.0 | | 2.0 | | 4.0 | 4.0 | 2.0 | 4.0 | 4.0 |
| Lane Grp Cap (vph) | | 239 | | 211 | | 238 | | 2024 | 927 | 30 | 2447 | 1064 |
| v/s Ratio Prot | | 0.00 | | | | | | | | c0.01 | 0.16 | |
| v/s Ratio Perm | | | | c0.02 | | 0.00 | | c0.18 | 0.01 | | | 0.00 |
| v/c Ratio | | 0.00 | | 0.15 | | 0.02 | | 0.30 | 0.02 | 0.63 | 0.24 | 0.00 |
| Uniform Delay, d1 | | 17.3 | | 17.7 | | 17.3 | | 4.9 | 4.1 | 23.2 | 2.9 | 2.5 |
| Progression Factor | | 1.00 | | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.0 | | 0.1 | | 0.0 | | 0.1 | 0.0 | 27.8 | 0.1 | 0.0 |
| Delay (s) | | 17.3 | | 17.8 | | 17.3 | | 5.0 | 4.1 | 51.0 | 3.0 | 2.5 |
| Level of Service | | B | | B | | B | | A | A | D | A | A |
| Approach Delay (s) | | 17.3 | | | 17.6 | | | 5.0 | | | 4.5 | |
| Approach LOS | | B | | | B | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 5.4 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.28 | | |
| Actuated Cycle Length (s) | 47.5 | Sum of lost time (s) | 11.8 |
| Intersection Capacity Utilization | 42.1% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 21: Novato Blvd #3 & Center Rd/Garden Ct



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 149 | 1 | 199 | 4 | 2 | 2 | 200 | 570 | 5 | 2 | 556 | 97 |
| Future Volume (vph) | 149 | 1 | 199 | 4 | 2 | 2 | 200 | 570 | 5 | 2 | 556 | 97 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.2 | 3.2 | | | 3.0 | | 3.0 | 4.4 | | 3.0 | 4.4 | |
| Lane Util. Factor | 1.00 | 1.00 | | | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.85 | | | 0.97 | | 1.00 | 1.00 | | 1.00 | 0.98 | |
| Flt Protected | 0.95 | 1.00 | | | 0.98 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1805 | 1616 | | | 1791 | | 1805 | 3604 | | 1805 | 3483 | |
| Flt Permitted | 0.75 | 1.00 | | | 0.90 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1430 | 1616 | | | 1655 | | 1805 | 3604 | | 1805 | 3483 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 157 | 1 | 209 | 4 | 2 | 2 | 211 | 600 | 5 | 2 | 585 | 102 |
| RTOR Reduction (vph) | 0 | 174 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 10 | 0 |
| Lane Group Flow (vph) | 157 | 36 | 0 | 0 | 6 | 0 | 211 | 605 | 0 | 2 | 677 | 0 |
| Confl. Peds. (#/hr) | | | | | | | | | 9 | | | 6 |
| Confl. Bikes (#/hr) | | | | | | | | | 2 | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 1% | 0% |
| Turn Type | Perm | NA | | Perm | NA | | Prot | NA | | Prot | NA | |
| Protected Phases | | 8 | | | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | 8 | | | 4 | | | | | | | | |
| Actuated Green, G (s) | 16.6 | 16.6 | | | 16.8 | | 16.1 | 70.6 | | 2.2 | 56.7 | |
| Effective Green, g (s) | 16.6 | 16.6 | | | 16.8 | | 16.1 | 70.6 | | 2.2 | 56.7 | |
| Actuated g/C Ratio | 0.17 | 0.17 | | | 0.17 | | 0.16 | 0.71 | | 0.02 | 0.57 | |
| Clearance Time (s) | 3.2 | 3.2 | | | 3.0 | | 3.0 | 4.4 | | 3.0 | 4.4 | |
| Vehicle Extension (s) | 3.0 | 3.0 | | | 2.0 | | 2.0 | 4.0 | | 2.0 | 4.0 | |
| Lane Grp Cap (vph) | 237 | 268 | | | 278 | | 290 | 2544 | | 39 | 1974 | |
| v/s Ratio Prot | | 0.02 | | | | | c0.12 | 0.17 | | 0.00 | c0.19 | |
| v/s Ratio Perm | c0.11 | | | | 0.00 | | | | | | | |
| v/c Ratio | 0.66 | 0.13 | | | 0.02 | | 0.73 | 0.24 | | 0.05 | 0.34 | |
| Uniform Delay, d1 | 39.1 | 35.6 | | | 34.7 | | 39.9 | 5.2 | | 47.9 | 11.6 | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | | 0.96 | 1.47 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 6.8 | 0.2 | | | 0.0 | | 7.3 | 0.2 | | 0.2 | 0.5 | |
| Delay (s) | 45.9 | 35.8 | | | 34.8 | | 45.4 | 7.8 | | 48.1 | 12.1 | |
| Level of Service | D | D | | | C | | D | A | | D | B | |
| Approach Delay (s) | | 40.1 | | | 34.8 | | | 17.5 | | | 12.2 | |
| Approach LOS | | D | | | C | | | B | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 20.1 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.47 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 55.1% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 22: Novato Blvd #3 & Arthur Street



| Movement | EBL | EBR | NBL | NBT | SBU | SBT | SBR |
|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | |
| Traffic Volume (vph) | 93 | 124 | 153 | 831 | 7 | 722 | 87 |
| Future Volume (vph) | 93 | 124 | 153 | 831 | 7 | 722 | 87 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 3.5 | 3.5 | 4.9 | 3.5 | 4.9 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 0.98 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 0.85 | 1.00 | 1.00 | 1.00 | 0.98 | |
| Flt Protected | 0.95 | 1.00 | 0.95 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1797 | 1589 | 1805 | 3574 | 1805 | 3552 | |
| Flt Permitted | 0.95 | 1.00 | 0.95 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1797 | 1589 | 1805 | 3574 | 1805 | 3552 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 98 | 131 | 161 | 875 | 7 | 760 | 92 |
| RTOR Reduction (vph) | 0 | 115 | 0 | 0 | 0 | 5 | 0 |
| Lane Group Flow (vph) | 98 | 16 | 161 | 875 | 7 | 847 | 0 |
| Confl. Peds. (#/hr) | 4 | 2 | | | | | |
| Confl. Bikes (#/hr) | | 1 | | | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 1% | 0% | 0% | 0% |
| Turn Type | Perm | Perm | Prot | NA | Prot | NA | |
| Protected Phases | | | 1 | 6 | 5 | 2 | |
| Permitted Phases | 4 | 4 | | | | | |
| Actuated Green, G (s) | 12.5 | 12.5 | 13.5 | 74.4 | 1.2 | 62.1 | |
| Effective Green, g (s) | 12.5 | 12.5 | 13.5 | 74.4 | 1.2 | 62.1 | |
| Actuated g/C Ratio | 0.12 | 0.12 | 0.14 | 0.74 | 0.01 | 0.62 | |
| Clearance Time (s) | 3.5 | 3.5 | 3.5 | 4.9 | 3.5 | 4.9 | |
| Vehicle Extension (s) | 2.0 | 2.0 | 2.0 | 4.0 | 2.0 | 4.0 | |
| Lane Grp Cap (vph) | 224 | 198 | 243 | 2659 | 21 | 2205 | |
| v/s Ratio Prot | | | c0.09 | 0.24 | 0.00 | c0.24 | |
| v/s Ratio Perm | c0.05 | 0.01 | | | | | |
| v/c Ratio | 0.44 | 0.08 | 0.66 | 0.33 | 0.33 | 0.38 | |
| Uniform Delay, d1 | 40.5 | 38.7 | 41.1 | 4.3 | 49.0 | 9.4 | |
| Progression Factor | 1.00 | 1.00 | 0.85 | 1.43 | 0.87 | 0.82 | |
| Incremental Delay, d2 | 0.5 | 0.1 | 3.5 | 0.2 | 3.3 | 0.5 | |
| Delay (s) | 41.0 | 38.7 | 38.5 | 6.4 | 45.9 | 8.2 | |
| Level of Service | D | D | D | A | D | A | |
| Approach Delay (s) | 39.7 | | | 11.4 | | 8.5 | |
| Approach LOS | D | | | B | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 13.3 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.43 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 11.9 |
| Intersection Capacity Utilization | 48.2% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 23: Novato Blvd #3 & Rowland Boulevard



| Movement | EBL | EBT | EBR | WBU | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 40 | 126 | 15 | 28 | 226 | 196 | 576 | 27 | 352 | 182 | 429 | 380 |
| Future Volume (vph) | 40 | 126 | 15 | 28 | 226 | 196 | 576 | 27 | 352 | 182 | 429 | 380 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 3.5 | | | 3.5 | 4.1 | 4.1 | 3.5 | 4.1 | | 3.5 | 4.4 |
| Lane Util. Factor | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 0.97 | 1.00 |
| Frpb, ped/bikes | 1.00 | 0.99 | | | 1.00 | 1.00 | 0.99 | 1.00 | 0.99 | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 0.98 | | | 1.00 | 1.00 | 0.85 | 1.00 | 0.95 | | 1.00 | 0.98 |
| Flt Protected | 0.95 | 1.00 | | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 1860 | | | 1789 | 1900 | 1592 | 1805 | 1774 | | 3502 | 1851 |
| Flt Permitted | 0.95 | 1.00 | | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | 1805 | 1860 | | | 1789 | 1900 | 1592 | 1805 | 1774 | | 3502 | 1851 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 42 | 133 | 16 | 29 | 238 | 206 | 606 | 28 | 371 | 192 | 452 | 400 |
| RTOR Reduction (vph) | 0 | 5 | 0 | 0 | 0 | 0 | 401 | 0 | 17 | 0 | 0 | 5 |
| Lane Group Flow (vph) | 42 | 144 | 0 | 0 | 267 | 206 | 205 | 28 | 546 | 0 | 452 | 461 |
| Confl. Peds. (#/hr) | | | 13 | | | | 2 | | | 5 | | |
| Confl. Bikes (#/hr) | | | 1 | | | | | | | 1 | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 1% | 0% | 0% | 0% | 1% | 1% | 0% | 0% |
| Turn Type | Prot | NA | | Prot | Prot | NA | Perm | Prot | NA | | Prot | NA |
| Protected Phases | 3 | 8 | | 7 | 7 | 4 | | 1 | 6 | | 5 | 2 |
| Permitted Phases | | | | | | | 4 | | | | | |
| Actuated Green, G (s) | 6.2 | 15.5 | | | 15.5 | 24.2 | 24.2 | 6.0 | 37.3 | | 17.1 | 48.1 |
| Effective Green, g (s) | 6.2 | 15.5 | | | 15.5 | 24.2 | 24.2 | 6.0 | 37.3 | | 17.1 | 48.1 |
| Actuated g/C Ratio | 0.06 | 0.16 | | | 0.16 | 0.24 | 0.24 | 0.06 | 0.37 | | 0.17 | 0.48 |
| Clearance Time (s) | 3.5 | 3.5 | | | 3.5 | 4.1 | 4.1 | 3.5 | 4.1 | | 3.5 | 4.4 |
| Vehicle Extension (s) | 2.0 | 2.0 | | | 2.0 | 2.0 | 2.0 | 2.0 | 3.0 | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 111 | 288 | | | 277 | 459 | 385 | 108 | 661 | | 598 | 890 |
| v/s Ratio Prot | 0.02 | c0.08 | | | c0.15 | 0.11 | | 0.02 | c0.31 | | c0.13 | 0.25 |
| v/s Ratio Perm | | | | | | | c0.13 | | | | | |
| v/c Ratio | 0.38 | 0.50 | | | 0.96 | 0.45 | 0.53 | 0.26 | 0.83 | | 0.76 | 0.52 |
| Uniform Delay, d1 | 45.0 | 38.7 | | | 42.0 | 32.2 | 33.0 | 44.9 | 28.4 | | 39.5 | 17.9 |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 0.69 | 0.51 |
| Incremental Delay, d2 | 0.8 | 0.5 | | | 43.7 | 0.3 | 0.7 | 0.5 | 8.3 | | 8.3 | 2.1 |
| Delay (s) | 45.8 | 39.2 | | | 85.6 | 32.5 | 33.7 | 45.3 | 36.7 | | 35.6 | 11.3 |
| Level of Service | D | D | | | F | C | C | D | D | | D | B |
| Approach Delay (s) | | 40.7 | | | | 46.3 | | | 37.1 | | | 23.2 |
| Approach LOS | | D | | | | D | | | D | | | C |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 36.4 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.79 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 15.5 |
| Intersection Capacity Utilization | 83.4% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 23: Novato Blvd #3 & Rowland Boulevard

11/22/2017

| Movement | SBR |
|---|---|
| Lane Configurations | |
| Traffic Volume (vph) | 63 |
| Future Volume (vph) | 63 |
| Ideal Flow (vphpl) | 1900 |
| Total Lost time (s) | |
| Lane Util. Factor | |
| Frpb, ped/bikes | |
| Flpb, ped/bikes | |
| Frt | |
| Flt Protected | |
| Satd. Flow (prot) | |
| Flt Permitted | |
| Satd. Flow (perm) | |
| Peak-hour factor, PHF | 0.95 |
| Adj. Flow (vph) | 66 |
| RTOR Reduction (vph) | 0 |
| Lane Group Flow (vph) | 0 |
| Confl. Peds. (#/hr) | 6 |
| Confl. Bikes (#/hr) | |
| Heavy Vehicles (%) | 0% |
| Turn Type | |
| Protected Phases | |
| Permitted Phases | |
| Actuated Green, G (s) | |
| Effective Green, g (s) | |
| Actuated g/C Ratio | |
| Clearance Time (s) | |
| Vehicle Extension (s) | |
| Lane Grp Cap (vph) | |
| v/s Ratio Prot | |
| v/s Ratio Perm | |
| v/c Ratio | |
| Uniform Delay, d1 | |
| Progression Factor | |
| Incremental Delay, d2 | |
| Delay (s) | |
| Level of Service | |
| Approach Delay (s) | |
| Approach LOS | |
| Intersection Summary | |



## HCM Signalized Intersection Capacity Analysis
### 24: Rowland Boulevard & Redwood Blvd

11/22/2017

| Movement | EBL | EBT | EBR | WBU | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 113 | 631 | 47 | 1 | 135 | 926 | 431 | 23 | 29 | 61 | 396 | 26 |
| Future Volume (vph) | 113 | 631 | 47 | 1 | 135 | 926 | 431 | 23 | 29 | 61 | 396 | 26 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.5 | 4.5 | | 3.5 | 4.5 | | 3.5 | 4.1 | | 3.5 | 4.8 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | | 0.97 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.98 | | 1.00 | 1.00 | | 1.00 | 0.99 | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | | 1.00 | 0.95 | | 1.00 | 0.90 | | 1.00 | 1.00 |
| Flt Protected | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 3574 | 1590 | | 1805 | 3422 | | 1805 | 3211 | | 3502 | 1900 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | 1805 | 3574 | 1590 | | 1805 | 3422 | | 1805 | 3211 | | 3502 | 1900 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 119 | 664 | 49 | 1 | 142 | 975 | 454 | 24 | 31 | 64 | 417 | 27 |
| RTOR Reduction (vph) | 0 | 0 | 29 | 0 | 0 | 41 | 0 | 0 | 54 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 119 | 664 | 20 | 0 | 143 | 1388 | 0 | 24 | 41 | 0 | 417 | 27 |
| Confl. Peds. (#/hr) | | | 4 | | | | 4 | | | 3 | | |
| Confl. Bikes (#/hr) | | | | | | | | | | 1 | | |
| Heavy Vehicles (%) | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Prot | NA | Perm | Prot | Prot | NA | | Prot | NA | | Prot | NA |
| Protected Phases | 5 | 2 | | 1 | 1 | 6 | | 3 | 8 | | 7 | 4 |
| Permitted Phases | | | 2 | | | | | | | | | |
| Actuated Green, G (s) | 11.2 | 38.2 | 38.2 | | 12.7 | 39.7 | | 4.0 | 13.9 | | 12.8 | 22.0 |
| Effective Green, g (s) | 11.2 | 38.2 | 38.2 | | 12.7 | 39.7 | | 4.0 | 13.9 | | 12.8 | 22.0 |
| Actuated g/C Ratio | 0.12 | 0.41 | 0.41 | | 0.14 | 0.43 | | 0.04 | 0.15 | | 0.14 | 0.24 |
| Clearance Time (s) | 3.5 | 4.5 | 4.5 | | 3.5 | 4.5 | | 3.5 | 4.1 | | 3.5 | 4.8 |
| Vehicle Extension (s) | 2.0 | 4.0 | 4.0 | | 2.0 | 4.0 | | 2.0 | 2.5 | | 2.5 | 2.5 |
| Lane Grp Cap (vph) | 216 | 1464 | 651 | | 245 | 1457 | | 77 | 478 | | 480 | 448 |
| v/s Ratio Prot | 0.07 | 0.19 | | | c0.08 | c0.41 | | 0.01 | 0.01 | | c0.12 | 0.01 |
| v/s Ratio Perm | | | 0.01 | | | | | | | | | |
| v/c Ratio | 0.55 | 0.45 | 0.03 | | 0.58 | 0.95 | | 0.31 | 0.08 | | 0.87 | 0.06 |
| Uniform Delay, d1 | 38.6 | 19.9 | 16.4 | | 37.8 | 25.8 | | 43.3 | 34.2 | | 39.4 | 27.6 |
| Progression Factor | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 1.7 | 0.3 | 0.0 | | 2.3 | 13.9 | | 0.8 | 0.1 | | 15.2 | 0.0 |
| Delay (s) | 40.4 | 20.2 | 16.5 | | 40.0 | 39.8 | | 44.1 | 34.2 | | 54.5 | 27.6 |
| Level of Service | D | C | B | | D | D | | D | C | | D | C |
| Approach Delay (s) | | 22.9 | | | | 39.8 | | | 36.2 | | | 46.5 |
| Approach LOS | | C | | | | D | | | D | | | D |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 36.4 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.75 | | |
| Actuated Cycle Length (s) | 93.2 | Sum of lost time (s) | 16.3 |
| Intersection Capacity Utilization | 78.4% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | SBR |
|---|---|
| Lane Configurations | |
| Traffic Volume (vph) | 144 |
| Future Volume (vph) | 144 |
| Ideal Flow (vphpl) | 1900 |
| Total Lost time (s) | 4.8 |
| Lane Util. Factor | 1.00 |
| Frpb, ped/bikes | 0.99 |
| Flpb, ped/bikes | 1.00 |
| Frt | 0.85 |
| Flt Protected | 1.00 |
| Satd. Flow (prot) | 1593 |
| Flt Permitted | 1.00 |
| Satd. Flow (perm) | 1593 |
| Peak-hour factor, PHF | 0.95 |
| Adj. Flow (vph) | 152 |
| RTOR Reduction (vph) | 116 |
| Lane Group Flow (vph) | 36 |
| Confl. Peds. (#/hr) | 2 |
| Confl. Bikes (#/hr) | |
| Heavy Vehicles (%) | 0% |
| Turn Type | Perm |
| Protected Phases | |
| Permitted Phases | 4 |
| Actuated Green, G (s) | 22.0 |
| Effective Green, g (s) | 22.0 |
| Actuated g/C Ratio | 0.24 |
| Clearance Time (s) | 4.8 |
| Vehicle Extension (s) | 2.5 |
| Lane Grp Cap (vph) | 376 |
| v/s Ratio Prot | |
| v/s Ratio Perm | c0.02 |
| v/c Ratio | 0.10 |
| Uniform Delay, d1 | 27.8 |
| Progression Factor | 1.00 |
| Incremental Delay, d2 | 0.1 |
| Delay (s) | 27.9 |
| Level of Service | C |
| Approach Delay (s) | |
| Approach LOS | |

Intersection Summary





| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 516 | 583 | 737 | 1297 | 0 | 0 | 0 | 0 | 309 | 6 | 173 |
| Future Volume (vph) | 0 | 516 | 583 | 737 | 1297 | 0 | 0 | 0 | 0 | 309 | 6 | 173 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.0 | 4.0 | 3.0 | 4.0 | | | | | 3.0 | 3.0 | |
| Lane Util. Factor | | 0.91 | 0.91 | 0.97 | 0.95 | | | | | 0.91 | 0.91 | |
| Frpb, ped/bikes | | 1.00 | 0.99 | 1.00 | 1.00 | | | | | 1.00 | 0.99 | |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | | | | 1.00 | 1.00 | |
| Frt | | 0.95 | 0.85 | 1.00 | 1.00 | | | | | 1.00 | 0.92 | |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | 0.95 | 0.98 | |
| Satd. Flow (prot) | | 3254 | 1450 | 3502 | 3610 | | | | | 1643 | 3062 | |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | 0.95 | 0.98 | |
| Satd. Flow (perm) | | 3254 | 1450 | 3502 | 3610 | | | | | 1643 | 3062 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 0 | 543 | 614 | 776 | 1365 | 0 | 0 | 0 | 0 | 325 | 6 | 182 |
| RTOR Reduction (vph) | 0 | 56 | 230 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 0 |
| Lane Group Flow (vph) | 0 | 745 | 126 | 776 | 1365 | 0 | 0 | 0 | 0 | 179 | 319 | 0 |
| Confl. Peds. (#/hr) | | | 2 | | | | | | | | | 7 |
| Confl. Bikes (#/hr) | | | | | | | | | | | | 1 |
| Heavy Vehicles (%) | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 33% | 0% |
| Turn Type | | NA | Perm | Prot | NA | | | | | Split | NA | |
| Protected Phases | | 2 | | 1 | 6 | | | | | 4 | 4 | |
| Permitted Phases | | | 2 | | | | | | | | | |
| Actuated Green, G (s) | | 20.1 | 20.1 | 13.5 | 36.6 | | | | | 13.4 | 13.4 | |
| Effective Green, g (s) | | 20.1 | 20.1 | 13.5 | 36.6 | | | | | 13.4 | 13.4 | |
| Actuated g/C Ratio | | 0.35 | 0.35 | 0.24 | 0.64 | | | | | 0.24 | 0.24 | |
| Clearance Time (s) | | 4.0 | 4.0 | 3.0 | 4.0 | | | | | 3.0 | 3.0 | |
| Vehicle Extension (s) | | 4.0 | 4.0 | 2.0 | 2.5 | | | | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | | 1147 | 511 | 829 | 2318 | | | | | 386 | 719 | |
| v/s Ratio Prot | | 0.23 | | c0.22 | c0.38 | | | | | c0.11 | 0.10 | |
| v/s Ratio Perm | | | 0.09 | | | | | | | | | |
| v/c Ratio | | 0.65 | 0.25 | 0.94 | 0.59 | | | | | 0.46 | 0.44 | |
| Uniform Delay, d1 | | 15.5 | 13.1 | 21.3 | 5.9 | | | | | 18.7 | 18.6 | |
| Progression Factor | | 1.00 | 1.00 | 1.00 | 1.00 | | | | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 1.4 | 0.3 | 17.3 | 0.3 | | | | | 0.3 | 0.2 | |
| Delay (s) | | 16.9 | 13.4 | 38.7 | 6.2 | | | | | 19.0 | 18.8 | |
| Level of Service | | B | B | D | A | | | | | B | B | |
| Approach Delay (s) | | 15.8 | | | 18.0 | | | 0.0 | | | 18.9 | |
| Approach LOS | | B | | | B | | | A | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 17.4 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.68 | | |
| Actuated Cycle Length (s) | 57.0 | Sum of lost time (s) | 10.0 |
| Intersection Capacity Utilization | 69.5% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL2 | EBL | EBT | WBT | WBR | WBR2 | NBL2 | NBL | NBT | NBR | NEL2 | NEL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 3 | 93 | 740 | 1215 | 1 | 499 | 793 | 11 | 1 | 778 | 18 | 18 |
| Future Volume (vph) | 3 | 93 | 740 | 1215 | 1 | 499 | 793 | 11 | 1 | 778 | 18 | 18 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | 4.0 | 4.0 | | 4.0 | 3.5 | | 3.5 | 3.0 | | 3.5 |
| Lane Util. Factor | | 1.00 | 0.95 | 0.86 | | 0.86 | 0.95 | | 0.95 | 0.88 | | 1.00 |
| Frpb, ped/bikes | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Frt | | 1.00 | 1.00 | 0.99 | | 0.85 | 1.00 | | 1.00 | 0.85 | | 0.98 |
| Flt Protected | | 0.95 | 1.00 | 1.00 | | 1.00 | 0.95 | | 0.95 | 1.00 | | 0.96 |
| Satd. Flow (prot) | | 1804 | 3574 | 4640 | | 1323 | 1715 | | 1718 | 2842 | | 1745 |
| Flt Permitted | | 0.95 | 1.00 | 1.00 | | 1.00 | 0.95 | | 0.95 | 1.00 | | 0.96 |
| Satd. Flow (perm) | | 1804 | 3574 | 4640 | | 1323 | 1715 | | 1718 | 2842 | | 1745 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 3 | 98 | 779 | 1279 | 1 | 525 | 835 | 12 | 1 | 819 | 19 | 19 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 7 | 0 | 213 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 101 | 779 | 1394 | 0 | 191 | 426 | 0 | 422 | 819 | 0 | 43 |
| Confl. Peds. (#/hr) | | | | | 1 | | | | | 8 | | |
| Heavy Vehicles (%) | 2% | 0% | 1% | 4% | 0% | 5% | 0% | 2% | 13% | 0% | 2% | 0% |
| Turn Type | Prot | Prot | NA | NA | | Perm | Split | Split | NA | custom | Perm | Prot |
| Protected Phases | 5 | 5 | 2 | 6 | | | 8 | 8 | 8 | 1 8 | | 7 |
| Permitted Phases | | | | | | 6 | | | | | 7 | |
| Actuated Green, G (s) | | 10.1 | 49.5 | 50.8 | | 50.8 | 36.3 | | 36.3 | 47.7 | | 8.8 |
| Effective Green, g (s) | | 10.1 | 49.5 | 50.8 | | 50.8 | 36.3 | | 36.3 | 47.7 | | 8.8 |
| Actuated g/C Ratio | | 0.08 | 0.41 | 0.42 | | 0.42 | 0.30 | | 0.30 | 0.40 | | 0.07 |
| Clearance Time (s) | | 3.0 | 4.0 | 4.0 | | 4.0 | 3.5 | | 3.5 | | | 3.5 |
| Vehicle Extension (s) | | 2.0 | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | | | 2.0 |
| Lane Grp Cap (vph) | | 151 | 1474 | 1964 | | 560 | 518 | | 519 | 1129 | | 127 |
| v/s Ratio Prot | | 0.06 | 0.22 | c0.30 | | | c0.25 | | 0.25 | c0.29 | | |
| v/s Ratio Perm | | | | | | 0.14 | | | | | | 0.02 |
| v/c Ratio | | 0.67 | 0.53 | 0.71 | | 0.34 | 0.82 | | 0.81 | 0.73 | | 0.34 |
| Uniform Delay, d1 | | 53.3 | 26.5 | 28.5 | | 23.3 | 38.9 | | 38.7 | 30.6 | | 52.8 |
| Progression Factor | | 1.00 | 1.00 | 0.90 | | 1.38 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Incremental Delay, d2 | | 8.4 | 1.4 | 1.9 | | 1.4 | 9.7 | | 9.0 | 2.0 | | 0.6 |
| Delay (s) | | 61.7 | 27.8 | 27.5 | | 33.6 | 48.6 | | 47.7 | 32.6 | | 53.4 |
| Level of Service | | E | C | C | | C | D | | D | C | | D |
| Approach Delay (s) | | | 31.7 | 28.9 | | | | | 40.5 | | | 53.4 |
| Approach LOS | | | C | C | | | | | D | | | D |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 34.1 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.72 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 14.0 |
| Intersection Capacity Utilization | 79.5% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

c Critical Lane Group





| Movement | NER |
|---|---|
| Lane Configurations | |
| Traffic Volume (vph) | 5 |
| Future Volume (vph) | 5 |
| Ideal Flow (vphpl) | 1900 |
| Total Lost time (s) | |
| Lane Util. Factor | |
| Frpb, ped/bikes | |
| Flpb, ped/bikes | |
| Frt | |
| Flt Protected | |
| Satd. Flow (prot) | |
| Flt Permitted | |
| Satd. Flow (perm) | |
| Peak-hour factor, PHF | 0.95 |
| Adj. Flow (vph) | 5 |
| RTOR Reduction (vph) | 0 |
| Lane Group Flow (vph) | 0 |
| Confl. Peds. (#/hr) | |
| Heavy Vehicles (%) | 15% |
| Turn Type | |
| Protected Phases | |
| Permitted Phases | |
| Actuated Green, G (s) | |
| Effective Green, g (s) | |
| Actuated g/C Ratio | |
| Clearance Time (s) | |
| Vehicle Extension (s) | |
| Lane Grp Cap (vph) | |
| v/s Ratio Prot | |
| v/s Ratio Perm | |
| v/c Ratio | |
| Uniform Delay, d1 | |
| Progression Factor | |
| Incremental Delay, d2 | |
| Delay (s) | |
| Level of Service | |
| Approach Delay (s) | |
| Approach LOS | |

Intersection Summary

## HCM Signalized Intersection Capacity Analysis
### 27: Rowland Boulevard & Rowland Way

11/22/2017

| Movement | EBU | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | |
| Traffic Volume (vph) | 6 | 225 | 1289 | 1372 | 26 | 36 | 339 |
| Future Volume (vph) | 6 | 225 | 1289 | 1372 | 26 | 36 | 339 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.5 | 4.0 | 4.0 | | 3.2 | 3.2 |
| Lane Util. Factor | | 0.97 | 0.91 | 0.95 | | 1.00 | 0.95 |
| Frpb, ped/bikes | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | | 1.00 | 1.00 | 1.00 | | 0.88 | 0.85 |
| Flt Protected | | 0.95 | 1.00 | 1.00 | | 0.99 | 1.00 |
| Satd. Flow (prot) | | 3468 | 5187 | 3593 | | 1634 | 1519 |
| Flt Permitted | | 0.95 | 1.00 | 1.00 | | 0.99 | 1.00 |
| Satd. Flow (perm) | | 3468 | 5187 | 3593 | | 1634 | 1519 |
| Peak-hour factor, PHF | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| Adj. Flow (vph) | 6 | 232 | 1329 | 1414 | 27 | 37 | 349 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 1 | 0 | 140 | 171 |
| Lane Group Flow (vph) | 0 | 238 | 1329 | 1440 | 0 | 54 | 21 |
| Confl. Peds. (#/hr) | | | | | 12 | 2 | |
| Heavy Vehicles (%) | 0% | 1% | 0% | 0% | 7% | 2% | 1% |
| Turn Type | Prot | Prot | NA | NA | | Prot | Perm |
| Protected Phases | 5 | 5 | 2 | 6 | | 4 | |
| Permitted Phases | | | | | | | 4 |
| Actuated Green, G (s) | | 12.8 | 99.8 | 83.5 | | 13.0 | 13.0 |
| Effective Green, g (s) | | 12.8 | 99.8 | 83.5 | | 13.0 | 13.0 |
| Actuated g/C Ratio | | 0.11 | 0.83 | 0.70 | | 0.11 | 0.11 |
| Clearance Time (s) | | 3.5 | 4.0 | 4.0 | | 3.2 | 3.2 |
| Vehicle Extension (s) | | 2.0 | 4.0 | 4.0 | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | | 369 | 4313 | 2500 | | 177 | 164 |
| v/s Ratio Prot | | c0.07 | 0.26 | c0.40 | | c0.03 | |
| v/s Ratio Perm | | | | | | | 0.01 |
| v/c Ratio | | 0.64 | 0.31 | 0.58 | | 0.31 | 0.13 |
| Uniform Delay, d1 | | 51.4 | 2.3 | 9.3 | | 49.3 | 48.4 |
| Progression Factor | | 1.02 | 1.20 | 0.99 | | 1.00 | 1.00 |
| Incremental Delay, d2 | | 2.4 | 0.2 | 0.9 | | 0.4 | 0.1 |
| Delay (s) | | 54.7 | 2.9 | 10.0 | | 49.7 | 48.5 |
| Level of Service | | D | A | A | | D | D |
| Approach Delay (s) | | | 10.8 | 10.0 | | 49.1 | |
| Approach LOS | | | B | A | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 14.8 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.55 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 10.7 |
| Intersection Capacity Utilization | 71.1% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 28: Rowland Boulevard & Vintage Way

11/22/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 17 | 489 | 811 | 2 | 576 | 6 | 822 | 3 | 2 | 4 | 3 | 0 |
| Future Volume (vph) | 17 | 489 | 811 | 2 | 576 | 6 | 822 | 3 | 2 | 4 | 3 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 4.0 | 4.0 | 3.0 | 4.0 | | 3.6 | 3.6 | | | 3.2 | |
| Lane Util. Factor | 1.00 | 0.95 | 0.88 | 1.00 | 0.95 | | 0.97 | 1.00 | | | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 0.99 | | | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | | 1.00 | 0.94 | | | 1.00 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | | 0.97 | |
| Satd. Flow (prot) | 1805 | 3539 | 2842 | 1805 | 3567 | | 3502 | 1768 | | | 1847 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | | 0.97 | |
| Satd. Flow (perm) | 1805 | 3539 | 2842 | 1805 | 3567 | | 3502 | 1768 | | | 1847 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 18 | 515 | 854 | 2 | 606 | 6 | 865 | 3 | 2 | 4 | 3 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 18 | 515 | 854 | 2 | 611 | 0 | 865 | 4 | 0 | 0 | 7 | 0 |
| Confl. Peds. (#/hr) | | | 9 | 9 | | 13 | | | 11 | | | |
| Confl. Bikes (#/hr) | | | 2 | | | 2 | | | | | | |
| Heavy Vehicles (%) | 0% | 2% | 0% | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Prot | NA | pt+ov | Prot | NA | | Split | NA | | Split | NA | |
| Protected Phases | 5 | 2 | 2 3 | 1 | 6 | | 3 | 3 | | 4 | 4 | |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | 5.4 | 49.6 | 105.0 | 2.8 | 47.0 | | 51.4 | 51.4 | | | 2.4 | |
| Effective Green, g (s) | 5.4 | 49.6 | 105.0 | 2.8 | 47.0 | | 51.4 | 51.4 | | | 2.4 | |
| Actuated g/C Ratio | 0.05 | 0.41 | 0.88 | 0.02 | 0.39 | | 0.43 | 0.43 | | | 0.02 | |
| Clearance Time (s) | 3.0 | 4.0 | | 3.0 | 4.0 | | 3.6 | 3.6 | | | 3.2 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | | 3.0 | 3.0 | | | 2.0 | |
| Lane Grp Cap (vph) | 81 | 1462 | 2486 | 42 | 1397 | | 1500 | 757 | | | 36 | |
| v/s Ratio Prot | 0.01 | 0.15 | c0.30 | 0.00 | c0.17 | | c0.25 | 0.00 | | | c0.00 | |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | 0.22 | 0.35 | 0.34 | 0.05 | 0.44 | | 0.58 | 0.01 | | | 0.19 | |
| Uniform Delay, d1 | 55.3 | 24.2 | 1.3 | 57.3 | 26.8 | | 26.0 | 19.7 | | | 57.8 | |
| Progression Factor | 1.20 | 1.20 | 0.93 | 1.00 | 1.00 | | 1.00 | 1.00 | | | 1.00 | |
| Incremental Delay, d2 | 0.5 | 0.6 | 0.4 | 0.2 | 1.0 | | 1.6 | 0.0 | | | 1.0 | |
| Delay (s) | 66.6 | 29.7 | 1.6 | 57.5 | 27.8 | | 27.7 | 19.7 | | | 58.8 | |
| Level of Service | E | C | A | E | C | | C | B | | | E | |
| Approach Delay (s) | | 12.9 | | | 27.9 | | | 27.6 | | | 58.8 | |
| Approach LOS | | B | | | C | | | C | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 20.6 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.50 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 13.8 |
| Intersection Capacity Utilization | 60.1% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
## 29: Novato Blvd #3 & Sunset Parkway

11/22/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 206 | 18 | 33 | 30 | 11 | 36 | 44 | 285 | 51 | 34 | 321 | 217 |
| Future Volume (vph) | 206 | 18 | 33 | 30 | 11 | 36 | 44 | 285 | 51 | 34 | 321 | 217 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.0 | | 3.5 | 3.5 | | 3.5 | 4.9 | | 3.5 | 4.6 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 0.98 | | 1.00 | 0.98 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.90 | | 1.00 | 0.89 | | 1.00 | 0.98 | | 1.00 | 0.94 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1787 | 1674 | | 1805 | 1642 | | 1805 | 1834 | | 1805 | 1778 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1787 | 1674 | | 1805 | 1642 | | 1805 | 1834 | | 1805 | 1778 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 217 | 19 | 35 | 32 | 12 | 38 | 46 | 300 | 54 | 36 | 338 | 228 |
| RTOR Reduction (vph) | 0 | 27 | 0 | 0 | 34 | 0 | 0 | 5 | 0 | 0 | 19 | 0 |
| Lane Group Flow (vph) | 217 | 27 | 0 | 32 | 16 | 0 | 46 | 349 | 0 | 36 | 547 | 0 |
| Confl. Peds. (#/hr) | | | 11 | | | 6 | | | 3 | | | |
| Confl. Bikes (#/hr) | | | | | | 1 | | | | | | |
| Heavy Vehicles (%) | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 1% | 0% | 0% | 0% | 1% |
| Turn Type | Prot | NA | | Prot | NA | | Prot | NA | | Prot | NA | |
| Protected Phases | 3 | 8 | | 7 | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | 12.9 | 17.8 | | 3.4 | 8.8 | | 5.2 | 38.5 | | 5.2 | 38.8 | |
| Effective Green, g (s) | 12.9 | 17.8 | | 3.4 | 8.8 | | 5.2 | 38.5 | | 5.2 | 38.8 | |
| Actuated g/C Ratio | 0.16 | 0.22 | | 0.04 | 0.11 | | 0.06 | 0.48 | | 0.06 | 0.48 | |
| Clearance Time (s) | 3.5 | 4.0 | | 3.5 | 3.5 | | 3.5 | 4.9 | | 3.5 | 4.6 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 285 | 368 | | 75 | 178 | | 116 | 873 | | 116 | 853 | |
| v/s Ratio Prot | c0.12 | 0.02 | | 0.02 | c0.01 | | c0.03 | 0.19 | | 0.02 | c0.31 | |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | 0.76 | 0.07 | | 0.43 | 0.09 | | 0.40 | 0.40 | | 0.31 | 0.64 | |
| Uniform Delay, d1 | 32.5 | 25.0 | | 37.7 | 32.4 | | 36.3 | 13.7 | | 36.1 | 15.8 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 10.3 | 0.0 | | 1.4 | 0.1 | | 0.8 | 1.4 | | 0.6 | 3.7 | |
| Delay (s) | 42.8 | 25.0 | | 39.2 | 32.5 | | 37.1 | 15.0 | | 36.6 | 19.5 | |
| Level of Service | D | C | | D | C | | D | B | | D | B | |
| Approach Delay (s) | | 39.2 | | | 35.1 | | | 17.6 | | | 20.5 | |
| Approach LOS | | D | | | D | | | B | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 24.3 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.58 | | |
| Actuated Cycle Length (s) | 80.8 | Sum of lost time (s) | 15.9 |
| Intersection Capacity Utilization | 63.2% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM 2010 AWSC
## 30: Redwood Blvd & Novato Blvd #3

11/22/2017

| Intersection | |
|---|---|
| Intersection Delay, s/veh | 40.2 |
| Intersection LOS | E |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 44 | 263 | 67 | 72 | 357 | 109 | 111 | 13 | 139 | 84 | 10 | 46 |
| Future Vol, veh/h | 44 | 263 | 67 | 72 | 357 | 109 | 111 | 13 | 139 | 84 | 10 | 46 |
| Peak Hour Factor | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Heavy Vehicles, % | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Mvmt Flow | 46 | 277 | 71 | 76 | 376 | 115 | 117 | 14 | 146 | 88 | 11 | 48 |
| Number of Lanes | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Opposing Approach | WB | EB | SB | NB |
| Opposing Lanes | 2 | 2 | 2 | 3 |
| Conflicting Approach Left | SB | NB | EB | WB |
| Conflicting Lanes Left | 2 | 3 | 2 | 2 |
| Conflicting Approach Right | NB | SB | WB | EB |
| Conflicting Lanes Right | 3 | 2 | 2 | 2 |
| HCM Control Delay | 30.2 | 66.2 | 15.1 | 14.4 |
| HCM LOS | D | F | C | B |

| Lane | NBLn1 | NBLn2 | NBLn3 | EBLn1 | EBLn2 | WBLn1 | WBLn2 | SBLn1 | SBLn2 |
|---|---|---|---|---|---|---|---|---|---|
| Vol Left, % | 100% | 0% | 0% | 100% | 0% | 100% | 0% | 100% | 0% |
| Vol Thru, % | 0% | 100% | 0% | 0% | 80% | 0% | 77% | 0% | 18% |
| Vol Right, % | 0% | 0% | 100% | 0% | 20% | 0% | 23% | 0% | 82% |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 111 | 13 | 139 | 44 | 330 | 72 | 466 | 84 | 56 |
| LT Vol | 111 | 0 | 0 | 44 | 0 | 72 | 0 | 84 | 0 |
| Through Vol | 0 | 13 | 0 | 0 | 263 | 0 | 357 | 0 | 10 |
| RT Vol | 0 | 0 | 139 | 0 | 67 | 0 | 109 | 0 | 46 |
| Lane Flow Rate | 117 | 14 | 146 | 46 | 347 | 76 | 491 | 88 | 59 |
| Geometry Grp | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Degree of Util (X) | 0.296 | 0.033 | 0.325 | 0.111 | 0.767 | 0.172 | 1.022 | 0.234 | 0.138 |
| Departure Headway (Hd) | 9.344 | 8.826 | 8.101 | 8.594 | 7.954 | 8.16 | 7.5 | 9.83 | 8.706 |
| Convergence, Y/N | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Cap | 387 | 408 | 446 | 415 | 452 | 438 | 481 | 368 | 414 |
| Service Time | 7.044 | 6.526 | 5.801 | 6.383 | 5.743 | 5.938 | 5.279 | 7.53 | 6.406 |
| HCM Lane V/C Ratio | 0.302 | 0.034 | 0.327 | 0.111 | 0.768 | 0.174 | 1.021 | 0.239 | 0.143 |
| HCM Control Delay | 15.9 | 11.8 | 14.7 | 12.5 | 32.6 | 12.6 | 74.5 | 15.5 | 12.8 |
| HCM Lane LOS | C | B | B | B | D | B | F | C | B |
| HCM 95th-tile Q | 1.2 | 0.1 | 1.4 | 0.4 | 6.6 | 0.6 | 14.2 | 0.9 | 0.5 |

# MOVEMENT SUMMARY

## Site: 30 [PM Existing + Project Alt]

Novato Boulevard/Redwood Boulevard
PM Existing + Project Alternative

Roundabout

**Movement Performance - Vehicles**

| Mov ID | OD Mov | Demand Flows Total veh/h | Demand Flows HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance ft | Prop. Queued | Effective Stop Rate per veh | Average Speed mph |
|---|---|---|---|---|---|---|---|---|---|---|---|
| South: NB Redwood Boulevard | | | | | | | | | | | |
| 3 | L2 | 117 | 2.0 | 0.314 | 7.5 | LOS A | 1.5 | 38.5 | 0.58 | 0.52 | 32.6 |
| 8 | T1 | 14 | 2.0 | 0.314 | 7.5 | LOS A | 1.5 | 38.5 | 0.58 | 0.52 | 32.5 |
| 18 | R2 | 146 | 2.0 | 0.314 | 7.5 | LOS A | 1.5 | 38.5 | 0.58 | 0.52 | 31.7 |
| Approach | | 277 | 2.0 | 0.314 | 7.5 | LOS A | 1.5 | 38.5 | 0.58 | 0.52 | 32.1 |
| East: WB Novato Blvd | | | | | | | | | | | |
| 1 | L2 | 76 | 2.0 | 0.503 | 8.9 | LOS A | 3.4 | 86.8 | 0.51 | 0.36 | 32.6 |
| 6 | T1 | 376 | 2.0 | 0.503 | 8.9 | LOS A | 3.4 | 86.8 | 0.51 | 0.36 | 32.6 |
| 16 | R2 | 115 | 2.0 | 0.503 | 8.9 | LOS A | 3.4 | 86.8 | 0.51 | 0.36 | 31.8 |
| Approach | | 566 | 2.0 | 0.503 | 8.9 | LOS A | 3.4 | 86.8 | 0.51 | 0.36 | 32.5 |
| North: SB Redwood Boulevard | | | | | | | | | | | |
| 7 | L2 | 88 | 2.0 | 0.197 | 7.0 | LOS A | 0.8 | 21.0 | 0.60 | 0.57 | 32.4 |
| 4 | T1 | 11 | 2.0 | 0.197 | 7.0 | LOS A | 0.8 | 21.0 | 0.60 | 0.57 | 32.4 |
| 14 | R2 | 48 | 2.0 | 0.197 | 7.0 | LOS A | 0.8 | 21.0 | 0.60 | 0.57 | 31.6 |
| Approach | | 147 | 2.0 | 0.197 | 7.0 | LOS A | 0.8 | 21.0 | 0.60 | 0.57 | 32.1 |
| West: EB Novato Blvd | | | | | | | | | | | |
| 5 | L2 | 46 | 2.0 | 0.273 | 5.5 | LOS A | 1.3 | 33.3 | 0.36 | 0.23 | 34.3 |
| 2 | T1 | 277 | 2.0 | 0.273 | 5.5 | LOS A | 1.3 | 33.3 | 0.36 | 0.23 | 34.3 |
| 12 | R2 | 71 | 2.0 | 0.060 | 3.5 | LOS A | 0.2 | 5.9 | 0.29 | 0.16 | 34.5 |
| Approach | | 394 | 2.0 | 0.273 | 5.2 | LOS A | 1.3 | 33.3 | 0.34 | 0.22 | 34.3 |
| All Vehicles | | 1384 | 2.0 | 0.503 | 7.4 | LOS A | 3.4 | 86.8 | 0.49 | 0.37 | 32.9 |

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.



# LANE SUMMARY

## Site: 30 [PM Existing + Project Alt]

Novato Boulevard/Redwood Boulevard
PM Existing + Project Alternative

Roundabout

**Lane Use and Performance**

| | Demand Flows Total veh/h | Demand Flows HV % | Cap. veh/h | Deg. Satn v/c | Lane Util. % | Average Delay sec | Level of Service | 95% Back of Queue Veh | 95% Back of Queue Dist ft | Lane Config | Lane Length ft | Cap. Adj. % | Prob. Block. % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| South: NB Redwood Boulevard | | | | | | | | | | | | | |
| Lane 1 d | 277 | 2.0 | 882 | 0.314 | 100 | 7.5 | LOS A | 1.5 | 38.5 | Full | 1600 | 0.0 | 0.0 |
| Approach | 277 | 2.0 | | 0.314 | | 7.5 | LOS A | 1.5 | 38.5 | | | | |
| East: WB Novato Blvd | | | | | | | | | | | | | |
| Lane 1 d | 566 | 2.0 | 1126 | 0.503 | 100 | 8.9 | LOS A | 3.4 | 86.8 | Full | 1600 | 0.0 | 0.0 |
| Approach | 566 | 2.0 | | 0.503 | | 8.9 | LOS A | 3.4 | 86.8 | | | | |
| North: SB Redwood Boulevard | | | | | | | | | | | | | |
| Lane 1 d | 147 | 2.0 | 749 | 0.197 | 100 | 7.0 | LOS A | 0.8 | 21.0 | Full | 1600 | 0.0 | 0.0 |
| Approach | 147 | 2.0 | | 0.197 | | 7.0 | LOS A | 0.8 | 21.0 | | | | |
| West: EB Novato Blvd | | | | | | | | | | | | | |
| Lane 1 d | 323 | 2.0 | 1184 | 0.273 | 100 | 5.5 | LOS A | 1.3 | 33.3 | Full | 1600 | 0.0 | 0.0 |
| Lane 2 | 71 | 2.0 | 1184 | 0.060 | 100 | 3.5 | LOS A | 0.2 | 5.9 | Short | 30 | 0.0 | NA |
| Approach | 394 | 2.0 | | 0.273 | | 5.2 | LOS A | 1.3 | 33.3 | | | | |
| Intersection | 1384 | 2.0 | | 0.503 | | 7.4 | LOS A | 3.4 | 86.8 | | | | |

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

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Organisation: W-TRANS | Processed: Tuesday, June 13, 2017 3:16:41 PM
Project: N:\AAA\MAX\NOV\126NOV\SIDRA\Novato-Redwood.sip7

## HCM Signalized Intersection Capacity Analysis
## 30: Redwood Blvd & Novato Blvd #3

06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 44 | 263 | 67 | 72 | 357 | 109 | 111 | 13 | 139 | 84 | 10 | 46 |
| Future Volume (vph) | 44 | 263 | 67 | 72 | 357 | 109 | 111 | 13 | 139 | 84 | 10 | 46 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 16 | 16 | 12 | 16 | 16 | 12 | 12 | 12 | 12 | 12 | 12 |
| Total Lost time (s) | 3.5 | 4.0 | | 3.5 | 4.0 | | 3.5 | 4.0 | 4.0 | 3.5 | 4.0 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 0.97 | | 1.00 | 0.96 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.88 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1787 | 2051 | | 1787 | 2042 | | 1787 | 1881 | 1599 | 1787 | 1652 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1787 | 2051 | | 1787 | 2042 | | 1787 | 1881 | 1599 | 1787 | 1652 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 46 | 277 | 71 | 76 | 376 | 115 | 117 | 14 | 146 | 88 | 11 | 48 |
| RTOR Reduction (vph) | 0 | 9 | 0 | 0 | 11 | 0 | 0 | 0 | 123 | 0 | 43 | 0 |
| Lane Group Flow (vph) | 46 | 339 | 0 | 76 | 480 | 0 | 117 | 14 | 23 | 88 | 16 | 0 |
| Heavy Vehicles (%) | 1% | 2% | 1% | 1% | 2% | 1% | 1% | 1% | 1% | 1% | 1% | 1% |
| Turn Type | Prot | NA | | Prot | NA | | Prot | NA | Perm | Prot | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | | | | | | | 2 | | | |
| Actuated Green, G (s) | 3.0 | 20.3 | | 4.1 | 21.4 | | 9.7 | 8.5 | 8.5 | 6.3 | 5.1 | |
| Effective Green, g (s) | 3.0 | 20.3 | | 4.1 | 21.4 | | 9.7 | 8.5 | 8.5 | 6.3 | 5.1 | |
| Actuated g/C Ratio | 0.06 | 0.37 | | 0.08 | 0.39 | | 0.18 | 0.16 | 0.16 | 0.12 | 0.09 | |
| Clearance Time (s) | 3.5 | 4.0 | | 3.5 | 4.0 | | 3.5 | 4.0 | 4.0 | 3.5 | 4.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 98 | 768 | | 135 | 806 | | 319 | 294 | 250 | 207 | 155 | |
| v/s Ratio Prot | 0.03 | 0.17 | | c0.04 | c0.23 | | c0.07 | 0.01 | | 0.05 | 0.01 | |
| v/s Ratio Perm | | | | | | | | | c0.01 | | | |
| v/c Ratio | 0.47 | 0.44 | | 0.56 | 0.59 | | 0.37 | 0.05 | 0.09 | 0.43 | 0.10 | |
| Uniform Delay, d1 | 24.8 | 12.7 | | 24.2 | 13.0 | | 19.6 | 19.4 | 19.5 | 22.3 | 22.5 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 3.5 | 0.4 | | 5.3 | 1.2 | | 0.7 | 0.1 | 0.2 | 1.4 | 0.3 | |
| Delay (s) | 28.4 | 13.1 | | 29.5 | 14.2 | | 20.3 | 19.5 | 19.7 | 23.7 | 22.7 | |
| Level of Service | C | B | | C | B | | C | B | B | C | C | |
| Approach Delay (s) | | 14.9 | | | 16.2 | | | 19.9 | | | 23.3 | |
| Approach LOS | | B | | | B | | | B | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 17.3 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.47 | | |
| Actuated Cycle Length (s) | 54.2 | Sum of lost time (s) | 15.0 |
| Intersection Capacity Utilization | 51.6% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
## 31: Alameda Del Prado & Ignacio Blvd

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 10 | 445 | 78 | 332 | 727 | 34 | 98 | 4 | 162 | 28 | 5 | 1 |
| Future Volume (vph) | 10 | 445 | 78 | 332 | 727 | 34 | 98 | 4 | 162 | 28 | 5 | 1 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.6 | 3.6 | 3.0 | 3.6 | | | 3.5 | 3.5 | | 3.7 | |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | | 1.00 | 1.00 | | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.97 | 1.00 | 1.00 | | | 1.00 | 0.98 | | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.99 | 1.00 | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | | | 1.00 | 0.85 | | 1.00 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 0.95 | 1.00 | | 0.96 | |
| Satd. Flow (prot) | 1770 | 3610 | 1573 | 1900 | 3586 | | | 1784 | 1589 | | 1812 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 0.76 | 1.00 | | 0.76 | |
| Satd. Flow (perm) | 1770 | 3610 | 1573 | 1805 | 3586 | | | 1421 | 1589 | | 1431 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 11 | 468 | 82 | 349 | 765 | 36 | 103 | 4 | 171 | 29 | 5 | 1 |
| RTOR Reduction (vph) | 0 | 0 | 30 | 0 | 2 | 0 | 0 | 0 | 146 | 0 | 1 | 0 |
| Lane Group Flow (vph) | 11 | 468 | 52 | 349 | 799 | 0 | 0 | 107 | 25 | 0 | 34 | 0 |
| Confl. Peds. (#/hr) | | | 4 | | | | 7 | | 4 | 4 | | 7 |
| Heavy Vehicles (%) | 2% | 0% | 0% | 0% | 0% | 0% | 1% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Prot | NA | Perm | Prot | NA | | Perm | NA | Perm | Perm | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | 2 | | | | 8 | | 8 | 4 | | |
| Actuated Green, G (s) | 1.2 | 47.6 | 47.6 | 27.4 | 73.8 | | | 14.9 | 14.9 | | 14.7 | |
| Effective Green, g (s) | 1.2 | 47.6 | 47.6 | 27.4 | 73.8 | | | 14.9 | 14.9 | | 14.7 | |
| Actuated g/C Ratio | 0.01 | 0.48 | 0.48 | 0.27 | 0.74 | | | 0.15 | 0.15 | | 0.15 | |
| Clearance Time (s) | 3.0 | 3.6 | 3.6 | 3.0 | 3.6 | | | 3.5 | 3.5 | | 3.7 | |
| Vehicle Extension (s) | 2.0 | 3.0 | 3.0 | 2.0 | 3.0 | | | 2.0 | 2.0 | | 2.0 | |
| Lane Grp Cap (vph) | 21 | 1718 | 748 | 520 | 2646 | | | 211 | 236 | | 210 | |
| v/s Ratio Prot | c0.01 | 0.13 | | c0.18 | c0.22 | | | | | | | |
| v/s Ratio Perm | | | 0.03 | | | | | c0.08 | 0.02 | | 0.02 | |
| v/c Ratio | 0.52 | 0.27 | 0.07 | 0.67 | 0.30 | | | 0.51 | 0.11 | | 0.16 | |
| Uniform Delay, d1 | 49.1 | 15.8 | 14.2 | 32.3 | 4.4 | | | 39.2 | 36.8 | | 37.3 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 0.74 | 0.77 | | | 1.00 | 1.00 | | 1.00 | |
| Incremental Delay, d2 | 10.4 | 0.4 | 0.2 | 2.4 | 0.3 | | | 0.7 | 0.1 | | 0.1 | |
| Delay (s) | 59.5 | 16.2 | 14.4 | 26.2 | 3.7 | | | 39.9 | 36.9 | | 37.4 | |
| Level of Service | E | B | B | C | A | | | D | D | | D | |
| Approach Delay (s) | | 16.8 | | | 10.5 | | | 38.0 | | | 37.4 | |
| Approach LOS | | B | | | B | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 16.5 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.45 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 10.3 |
| Intersection Capacity Utilization | 68.1% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 32: US 101 SB Off Ramp/Enfrente Rd & Ignacio Blvd/Ignacio Blvd #3

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 33 | 392 | 264 | 586 | 808 | 139 | 0 | 0 | 742 | 189 | 89 | 296 |
| Future Volume (vph) | 33 | 392 | 264 | 586 | 808 | 139 | 0 | 0 | 742 | 189 | 89 | 296 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Grade (%) | | 0% | | | 0% | | | 2% | | | 0% | |
| Total Lost time (s) | 3.0 | 8.0 | 8.0 | 4.0 | 5.0 | | | | 4.0 | | 4.0 | 4.0 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | | | 0.88 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.96 | 1.00 | 0.99 | | | | 1.00 | | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.98 | | | | 0.85 | | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | | 1.00 | | 0.97 | 1.00 |
| Satd. Flow (prot) | 1805 | 3610 | 1550 | 1787 | 3503 | | | | 2814 | | 1809 | 1578 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | | 1.00 | | 0.97 | 1.00 |
| Satd. Flow (perm) | 1805 | 3610 | 1550 | 1787 | 3503 | | | | 2814 | | 1809 | 1578 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 34 | 408 | 275 | 610 | 842 | 145 | 0 | 0 | 773 | 197 | 93 | 308 |
| RTOR Reduction (vph) | 0 | 0 | 201 | 0 | 10 | 0 | 0 | 0 | 410 | 0 | 0 | 241 |
| Lane Group Flow (vph) | 34 | 408 | 74 | 610 | 977 | 0 | 0 | 0 | 363 | 0 | 290 | 67 |
| Confl. Peds. (#/hr) | | | 7 | | | 20 | | | | | | 1 |
| Confl. Bikes (#/hr) | | | | | | 3 | | | | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 5% | 1% |
| Turn Type | Prot | NA | Perm | Prot | NA | | | | Over | Split | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | | | 1 | 7 | 7 | |
| Permitted Phases | | | 2 | | | | | | | | | 7 |
| Actuated Green, G (s) | 6.6 | 26.9 | 26.9 | 35.2 | 59.5 | | | | 35.2 | | 21.9 | 21.9 |
| Effective Green, g (s) | 6.6 | 26.9 | 26.9 | 35.2 | 59.5 | | | | 35.2 | | 21.9 | 21.9 |
| Actuated g/C Ratio | 0.07 | 0.27 | 0.27 | 0.35 | 0.60 | | | | 0.35 | | 0.22 | 0.22 |
| Clearance Time (s) | 3.0 | 8.0 | 8.0 | 4.0 | 5.0 | | | | 4.0 | | 4.0 | 4.0 |
| Vehicle Extension (s) | 2.0 | 2.5 | 2.5 | 3.0 | 4.0 | | | | 3.0 | | 2.5 | 2.5 |
| Lane Grp Cap (vph) | 119 | 971 | 416 | 629 | 2084 | | | | 990 | | 396 | 345 |
| v/s Ratio Prot | 0.02 | c0.11 | | c0.34 | c0.28 | | | | 0.13 | | c0.16 | |
| v/s Ratio Perm | | | 0.05 | | | | | | | | | 0.04 |
| v/c Ratio | 0.29 | 0.42 | 0.18 | 0.97 | 0.47 | | | | 0.37 | | 0.73 | 0.20 |
| Uniform Delay, d1 | 44.5 | 30.1 | 28.1 | 31.9 | 11.4 | | | | 24.1 | | 36.3 | 31.9 |
| Progression Factor | 0.98 | 0.68 | 0.40 | 0.80 | 0.78 | | | | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.5 | 1.3 | 0.9 | 20.5 | 0.5 | | | | 0.2 | | 6.5 | 0.2 |
| Delay (s) | 44.0 | 21.9 | 12.3 | 45.9 | 9.3 | | | | 24.3 | | 42.8 | 32.1 |
| Level of Service | D | C | B | D | A | | | | C | | D | C |
| Approach Delay (s) | | 19.2 | | | 23.3 | | | 24.3 | | | 37.3 | |
| Approach LOS | | B | | | C | | | C | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 25.0 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.76 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 78.4% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 33: Nave Dr & Ignacio Blvd #3/Bel Marin Keys Blvd #3

02/15/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 316 | 1013 | 118 | 651 | 564 | 868 | 749 | 252 | 0 | 0 | 0 |
| Future Volume (vph) | 0 | 316 | 1013 | 118 | 651 | 564 | 868 | 749 | 252 | 0 | 0 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.0 | 4.6 | 3.0 | 4.0 | | 4.6 | 4.6 | 3.0 | | | |
| Lane Util. Factor | | 0.95 | 1.00 | 1.00 | 0.95 | | 0.91 | 0.91 | 1.00 | | | |
| Frpb, ped/bikes | | 1.00 | 0.99 | 1.00 | 0.99 | | 1.00 | 1.00 | 0.99 | | | |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | | |
| Frt | | 1.00 | 0.85 | 1.00 | 0.93 | | 1.00 | 1.00 | 0.85 | | | |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 0.98 | 1.00 | | | |
| Satd. Flow (prot) | | 3610 | 1605 | 1805 | 3307 | | 1643 | 3382 | 1600 | | | |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 0.98 | 1.00 | | | |
| Satd. Flow (perm) | | 3610 | 1605 | 1805 | 3307 | | 1643 | 3382 | 1600 | | | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 0 | 333 | 1066 | 124 | 685 | 594 | 914 | 788 | 265 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 83 | 0 | 42 | 0 | 0 | 0 | 126 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 333 | 983 | 124 | 1237 | 0 | 558 | 1144 | 139 | 0 | 0 | 0 |
| Confl. Peds. (#/hr) | | | 1 | | | 1 | | | 1 | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 2% | 0% | 1% | 0% | 0% | 0% | 0% |
| Turn Type | | NA | pm+ov | Prot | NA | | Split | NA | pm+ov | | | |
| Protected Phases | | 2 | 3 | 1 | 6 | | 3 | 3 | 1 | | | |
| Permitted Phases | | | 2 | | | | | | 3 | | | |
| Actuated Green, G (s) | | 36.0 | 75.8 | 12.6 | 51.6 | | 39.8 | 39.8 | 52.4 | | | |
| Effective Green, g (s) | | 36.0 | 75.8 | 12.6 | 51.6 | | 39.8 | 39.8 | 52.4 | | | |
| Actuated g/C Ratio | | 0.36 | 0.76 | 0.13 | 0.52 | | 0.40 | 0.40 | 0.52 | | | |
| Clearance Time (s) | | 4.0 | 4.6 | 3.0 | 4.0 | | 4.6 | 4.6 | 3.0 | | | |
| Vehicle Extension (s) | | 4.0 | 2.0 | 2.0 | 4.0 | | 2.0 | 2.0 | 2.0 | | | |
| Lane Grp Cap (vph) | | 1299 | 1216 | 227 | 1706 | | 653 | 1346 | 838 | | | |
| v/s Ratio Prot | | 0.09 | c0.32 | 0.07 | c0.37 | | c0.34 | 0.34 | 0.02 | | | |
| v/s Ratio Perm | | | 0.29 | | | | | | 0.07 | | | |
| v/c Ratio | | 0.26 | 0.81 | 0.55 | 0.73 | | 0.85 | 0.85 | 0.17 | | | |
| Uniform Delay, d1 | | 22.6 | 7.6 | 41.0 | 18.7 | | 27.5 | 27.4 | 12.4 | | | |
| Progression Factor | | 1.09 | 1.09 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | | |
| Incremental Delay, d2 | | 0.4 | 3.4 | 1.4 | 2.7 | | 10.2 | 5.0 | 0.0 | | | |
| Delay (s) | | 24.9 | 11.6 | 42.5 | 21.4 | | 37.7 | 32.4 | 12.4 | | | |
| Level of Service | | C | B | D | C | | D | C | B | | | |
| Approach Delay (s) | | 14.8 | | | 23.3 | | | 31.2 | | | 0.0 | |
| Approach LOS | | B | | | C | | | C | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 24.1 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.82 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 11.6 |
| Intersection Capacity Utilization | 80.0% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 34: Bel Marin Keys Blvd #3 & Commercial Blvd

11/22/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 3 | 0 | 38 | 278 | 1 | 28 | 46 | 476 | 78 | 31 | 1121 | 7 |
| Future Volume (vph) | 3 | 0 | 38 | 278 | 1 | 28 | 46 | 476 | 78 | 31 | 1121 | 7 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.0 | | | 4.0 | 4.0 | 3.0 | 3.9 | | 3.0 | 3.5 | |
| Lane Util. Factor | | 1.00 | | | 1.00 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | | 0.99 | | | 1.00 | 0.99 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 0.87 | | | 1.00 | 0.85 | 1.00 | 0.98 | | 1.00 | 1.00 | |
| Flt Protected | | 1.00 | | | 0.95 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 1632 | | | 1807 | 1396 | 1805 | 3521 | | 1805 | 3571 | |
| Flt Permitted | | 0.98 | | | 0.69 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | | 1607 | | | 1316 | 1396 | 1805 | 3521 | | 1805 | 3571 | |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Adj. Flow (vph) | 3 | 0 | 42 | 309 | 1 | 31 | 51 | 529 | 87 | 34 | 1246 | 8 |
| RTOR Reduction (vph) | 0 | 32 | 0 | 0 | 0 | 22 | 0 | 14 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 13 | 0 | 0 | 310 | 9 | 51 | 602 | 0 | 34 | 1254 | 0 |
| Confl. Peds. (#/hr) | 3 | | 2 | 2 | | 3 | | | 3 | | | |
| Heavy Vehicles (%) | 2% | 0% | 0% | 0% | 0% | 14% | 0% | 0% | 0% | 0% | 1% | 0% |
| Turn Type | Perm | NA | | Perm | NA | Perm | Prot | NA | | Prot | NA | |
| Protected Phases | | 4 | | | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | | | | | | |
| Actuated Green, G (s) | | 22.1 | | | 22.1 | 22.1 | 4.2 | 38.4 | | 3.6 | 38.2 | |
| Effective Green, g (s) | | 22.1 | | | 22.1 | 22.1 | 4.2 | 38.4 | | 3.6 | 38.2 | |
| Actuated g/C Ratio | | 0.29 | | | 0.29 | 0.29 | 0.06 | 0.51 | | 0.05 | 0.51 | |
| Clearance Time (s) | | 4.0 | | | 4.0 | 4.0 | 3.0 | 3.9 | | 3.0 | 3.5 | |
| Vehicle Extension (s) | | 3.0 | | | 3.0 | 3.0 | 2.5 | 3.0 | | 2.5 | 4.0 | |
| Lane Grp Cap (vph) | | 473 | | | 387 | 411 | 101 | 1802 | | 86 | 1818 | |
| v/s Ratio Prot | | | | | | | c0.03 | 0.17 | | 0.02 | c0.35 | |
| v/s Ratio Perm | | 0.01 | | | c0.24 | 0.01 | | | | | | |
| v/c Ratio | | 0.03 | | | 0.80 | 0.02 | 0.50 | 0.33 | | 0.40 | 0.69 | |
| Uniform Delay, d1 | | 18.8 | | | 24.4 | 18.8 | 34.4 | 10.8 | | 34.6 | 13.9 | |
| Progression Factor | | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | 0.89 | 0.77 | |
| Incremental Delay, d2 | | 0.0 | | | 11.3 | 0.0 | 2.9 | 0.5 | | 1.8 | 1.8 | |
| Delay (s) | | 18.8 | | | 35.7 | 18.8 | 37.3 | 11.3 | | 32.7 | 12.5 | |
| Level of Service | | B | | | D | B | D | B | | C | B | |
| Approach Delay (s) | | 18.8 | | | 34.2 | | | 13.3 | | | 13.0 | |
| Approach LOS | | B | | | C | | | B | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 16.3 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.72 | | |
| Actuated Cycle Length (s) | 75.0 | Sum of lost time (s) | 10.9 |
| Intersection Capacity Utilization | 67.1% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 35: Bel Marin Keys Blvd #3 & Hamilton Dr/Digital Dr

11/22/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 5 | 7 | 154 | 482 | 4 | 13 | 45 | 344 | 102 | 6 | 529 | 2 |
| Future Volume (vph) | 5 | 7 | 154 | 482 | 4 | 13 | 45 | 344 | 102 | 6 | 529 | 2 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.5 | 3.5 | 3.5 | 3.5 | | 3.0 | 4.0 | | 3.0 | 4.0 | |
| Lane Util. Factor | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | | 1.00 | 0.99 | 1.00 | 0.99 | | 1.00 | 0.99 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 1.00 | 0.85 | 1.00 | 0.88 | | 1.00 | 0.97 | | 1.00 | 1.00 | |
| Flt Protected | | 0.98 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 1864 | 1533 | 1804 | 1662 | | 1770 | 3468 | | 1805 | 3572 | |
| Flt Permitted | | 0.96 | 1.00 | 0.75 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | | 1821 | 1533 | 1422 | 1662 | | 1770 | 3468 | | 1805 | 3572 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 5 | 8 | 167 | 524 | 4 | 14 | 49 | 374 | 111 | 7 | 575 | 2 |
| RTOR Reduction (vph) | 0 | 0 | 102 | 0 | 9 | 0 | 0 | 31 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 13 | 65 | 524 | 9 | 0 | 49 | 454 | 0 | 7 | 577 | 0 |
| Confl. Peds. (#/hr) | 1 | | 1 | 1 | | 1 | | | 2 | | | 8 |
| Heavy Vehicles (%) | 0% | 0% | 4% | 0% | 0% | 0% | 2% | 0% | 0% | 0% | 1% | 0% |
| Turn Type | Perm | NA | Perm | Perm | NA | | Prot | NA | | Prot | NA | |
| Protected Phases | | 4 | | | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | 4 | 8 | | | | | | | | |
| Actuated Green, G (s) | | 29.4 | 29.4 | 29.4 | 29.4 | | 5.4 | 33.3 | | 1.8 | 29.7 | |
| Effective Green, g (s) | | 29.4 | 29.4 | 29.4 | 29.4 | | 5.4 | 33.3 | | 1.8 | 29.7 | |
| Actuated g/C Ratio | | 0.39 | 0.39 | 0.39 | 0.39 | | 0.07 | 0.44 | | 0.02 | 0.40 | |
| Clearance Time (s) | | 3.5 | 3.5 | 3.5 | 3.5 | | 3.0 | 4.0 | | 3.0 | 4.0 | |
| Vehicle Extension (s) | | 2.0 | 2.0 | 2.5 | 2.5 | | 2.0 | 4.0 | | 2.0 | 4.0 | |
| Lane Grp Cap (vph) | | 713 | 600 | 557 | 651 | | 127 | 1539 | | 43 | 1414 | |
| v/s Ratio Prot | | | | | 0.01 | | c0.03 | 0.13 | | 0.00 | c0.16 | |
| v/s Ratio Perm | | 0.01 | 0.04 | c0.37 | | | | | | | | |
| v/c Ratio | | 0.02 | 0.11 | 0.94 | 0.01 | | 0.39 | 0.29 | | 0.16 | 0.41 | |
| Uniform Delay, d1 | | 14.0 | 14.5 | 22.0 | 13.9 | | 33.2 | 13.3 | | 35.9 | 16.3 | |
| Progression Factor | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.37 | 0.45 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 0.0 | 0.0 | 24.3 | 0.0 | | 0.7 | 0.5 | | 0.7 | 0.9 | |
| Delay (s) | | 14.0 | 14.5 | 46.2 | 13.9 | | 46.1 | 6.5 | | 36.5 | 17.2 | |
| Level of Service | | B | B | D | B | | D | A | | D | B | |
| Approach Delay (s) | | 14.5 | | | 45.2 | | | 10.1 | | | 17.4 | |
| Approach LOS | | B | | | D | | | B | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 23.2 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.65 | | |
| Actuated Cycle Length (s) | 75.0 | Sum of lost time (s) | 10.5 |
| Intersection Capacity Utilization | 71.7% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 704 | 233 | 0 | 1174 | 878 | 238 |
| Future Volume (vph) | 704 | 233 | 0 | 1174 | 878 | 238 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | | 5.0 | 5.0 | |
| Lane Util. Factor | 0.97 | 1.00 | | 0.95 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 0.99 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.85 | | 1.00 | 0.97 | |
| Flt Protected | 0.95 | 1.00 | | 1.00 | 1.00 | |
| Satd. Flow (prot) | 3467 | 1563 | | 3574 | 3467 | |
| Flt Permitted | 0.95 | 1.00 | | 1.00 | 1.00 | |
| Satd. Flow (perm) | 3467 | 1563 | | 3574 | 3467 | |
| Peak-hour factor, PHF | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Adj. Flow (vph) | 718 | 238 | 0 | 1198 | 896 | 243 |
| RTOR Reduction (vph) | 0 | 41 | 0 | 0 | 35 | 0 |
| Lane Group Flow (vph) | 718 | 197 | 0 | 1198 | 1104 | 0 |
| Confl. Peds. (#/hr) | | 1 | | | | |
| Heavy Vehicles (%) | 1% | 2% | 0% | 1% | 1% | 0% |
| Turn Type | Prot | Perm | | NA | NA | |
| Protected Phases | 4 | | | 2 | 6 | |
| Permitted Phases | | 4 | | | | |
| Actuated Green, G (s) | 31.0 | 31.0 | | 31.0 | 31.0 | |
| Effective Green, g (s) | 31.0 | 31.0 | | 31.0 | 31.0 | |
| Actuated g/C Ratio | 0.44 | 0.44 | | 0.44 | 0.44 | |
| Clearance Time (s) | 3.0 | 3.0 | | 5.0 | 5.0 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 1535 | 692 | | 1582 | 1535 | |
| v/s Ratio Prot | c0.21 | | | c0.34 | 0.32 | |
| v/s Ratio Perm | | 0.13 | | | | |
| v/c Ratio | 0.47 | 0.29 | | 0.76 | 0.72 | |
| Uniform Delay, d1 | 13.7 | 12.4 | | 16.3 | 15.9 | |
| Progression Factor | 1.00 | 1.00 | | 0.49 | 1.00 | |
| Incremental Delay, d2 | 1.0 | 1.0 | | 2.6 | 2.9 | |
| Delay (s) | 14.7 | 13.5 | | 10.6 | 18.9 | |
| Level of Service | B | B | | B | B | |
| Approach Delay (s) | 14.4 | | | 10.6 | 18.9 | |
| Approach LOS | B | | | B | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 14.6 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.61 | | |
| Actuated Cycle Length (s) | 70.0 | Sum of lost time (s) | 8.0 |
| Intersection Capacity Utilization | 62.5% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group





| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 114 | 43 | 898 | 127 | 140 | 770 |
| Future Volume (vph) | 114 | 43 | 898 | 127 | 140 | 770 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.2 | 3.2 | 4.4 | | 3.0 | 4.4 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 0.85 | 0.98 | | 1.00 | 1.00 |
| Flt Protected | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 1615 | 1863 | | 1770 | 1881 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | 1805 | 1615 | 1863 | | 1770 | 1881 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 119 | 45 | 935 | 132 | 146 | 802 |
| RTOR Reduction (vph) | 0 | 41 | 6 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 119 | 4 | 1061 | 0 | 146 | 802 |
| Confl. Peds. (#/hr) | | | | 2 | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 2% | 1% |
| Turn Type | Prot | Perm | NA | | Prot | NA |
| Protected Phases | 8 | | 2 | | 1 | 6 |
| Permitted Phases | | 8 | | | | |
| Actuated Green, G (s) | 6.4 | 6.4 | 45.0 | | 8.0 | 56.0 |
| Effective Green, g (s) | 6.4 | 6.4 | 45.0 | | 8.0 | 56.0 |
| Actuated g/C Ratio | 0.09 | 0.09 | 0.64 | | 0.11 | 0.80 |
| Clearance Time (s) | 3.2 | 3.2 | 4.4 | | 3.0 | 4.4 |
| Vehicle Extension (s) | 1.0 | 1.0 | 1.0 | | 1.0 | 1.0 |
| Lane Grp Cap (vph) | 165 | 147 | 1197 | | 202 | 1504 |
| v/s Ratio Prot | c0.07 | | c0.57 | | c0.08 | 0.43 |
| v/s Ratio Perm | | 0.00 | | | | |
| v/c Ratio | 0.72 | 0.03 | 0.89 | | 0.72 | 0.53 |
| Uniform Delay, d1 | 30.9 | 29.0 | 10.4 | | 29.9 | 2.4 |
| Progression Factor | 1.00 | 1.00 | 0.79 | | 1.07 | 0.87 |
| Incremental Delay, d2 | 12.3 | 0.0 | 8.4 | | 8.0 | 1.0 |
| Delay (s) | 43.3 | 29.0 | 16.6 | | 39.9 | 3.2 |
| Level of Service | D | C | B | | D | A |
| Approach Delay (s) | 39.4 | | 16.6 | | | 8.8 |
| Approach LOS | D | | B | | | A |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 14.9 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.85 | | |
| Actuated Cycle Length (s) | 70.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 79.4% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 90 | 382 | 523 | 54 | 319 | 430 |
| Future Volume (vph) | 90 | 382 | 523 | 54 | 319 | 430 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.2 | 3.2 | 4.4 | 4.4 | 3.0 | 4.4 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.85 | 1.00 | 0.85 | 1.00 | 1.00 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (prot) | 1770 | 1599 | 1900 | 1578 | 1787 | 1850 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (perm) | 1770 | 1599 | 1900 | 1578 | 1787 | 1900 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 95 | 402 | 551 | 57 | 336 | 453 |
| RTOR Reduction (vph) | 0 | 350 | 0 | 15 | 0 | 0 |
| Lane Group Flow (vph) | 95 | 52 | 551 | 42 | 336 | 453 |
| Confl. Peds. (#/hr) | | | | 2 | | |
| Heavy Vehicles (%) | 2% | 1% | 0% | 0% | 1% | 0% |
| Turn Type | Prot | Perm | NA | Perm | Prot | NA |
| Protected Phases | 8 | | 2 | | 1 | 6 |
| Permitted Phases | | 8 | | 2 | | |
| Actuated Green, G (s) | 9.1 | 9.1 | 28.4 | 28.4 | 21.9 | 53.3 |
| Effective Green, g (s) | 9.1 | 9.1 | 28.4 | 28.4 | 21.9 | 53.3 |
| Actuated g/C Ratio | 0.13 | 0.13 | 0.41 | 0.41 | 0.31 | 0.76 |
| Clearance Time (s) | 3.2 | 3.2 | 4.4 | 4.4 | 3.0 | 4.4 |
| Vehicle Extension (s) | 2.0 | 2.0 | 3.0 | 3.0 | 2.0 | 3.0 |
| Lane Grp Cap (vph) | 230 | 207 | 770 | 640 | 559 | 1408 |
| v/s Ratio Prot | c0.05 | | c0.29 | | c0.19 | 0.24 |
| v/s Ratio Perm | | 0.03 | | 0.03 | | |
| v/c Ratio | 0.41 | 0.25 | 0.72 | 0.07 | 0.60 | 0.32 |
| Uniform Delay, d1 | 28.0 | 27.4 | 17.4 | 12.7 | 20.4 | 2.6 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.23 |
| Incremental Delay, d2 | 0.4 | 0.2 | 5.6 | 0.2 | 1.1 | 0.5 |
| Delay (s) | 28.4 | 27.6 | 23.1 | 12.9 | 21.4 | 1.1 |
| Level of Service | C | C | C | B | C | A |
| Approach Delay (s) | 27.8 | | 22.1 | | | 9.8 |
| Approach LOS | C | | C | | | A |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 18.5 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.63 | | |
| Actuated Cycle Length (s) | 70.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 60.5% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group





| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 352 | 272 | 292 | 317 | 266 | 268 |
| Future Volume (vph) | 352 | 272 | 292 | 317 | 266 | 268 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | 4.1 | 4.1 | 3.0 | 4.4 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.85 | 1.00 | 0.85 | 1.00 | 1.00 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 1615 | 1900 | 1615 | 1805 | 1881 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (perm) | 1805 | 1615 | 1900 | 1615 | 1805 | 1881 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 371 | 286 | 307 | 334 | 280 | 282 |
| RTOR Reduction (vph) | 0 | 203 | 0 | 247 | 0 | 0 |
| Lane Group Flow (vph) | 371 | 83 | 307 | 87 | 280 | 282 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 1% |
| Turn Type | Prot | Perm | NA | Perm | Prot | NA |
| Protected Phases | 8 | | 2 | | 1 | 6 |
| Permitted Phases | | 8 | | 2 | | |
| Actuated Green, G (s) | 14.7 | 14.7 | 13.2 | 13.2 | 12.4 | 28.3 |
| Effective Green, g (s) | 14.7 | 14.7 | 13.2 | 13.2 | 12.4 | 28.3 |
| Actuated g/C Ratio | 0.29 | 0.29 | 0.26 | 0.26 | 0.25 | 0.56 |
| Clearance Time (s) | 3.0 | 3.0 | 4.1 | 4.1 | 3.0 | 4.4 |
| Vehicle Extension (s) | 2.0 | 2.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| Lane Grp Cap (vph) | 526 | 471 | 497 | 422 | 444 | 1056 |
| v/s Ratio Prot | c0.21 | | c0.16 | | c0.16 | 0.15 |
| v/s Ratio Perm | | 0.05 | | 0.05 | | |
| v/c Ratio | 0.71 | 0.18 | 0.62 | 0.21 | 0.63 | 0.27 |
| Uniform Delay, d1 | 15.9 | 13.3 | 16.4 | 14.5 | 17.0 | 5.7 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 3.5 | 0.1 | 1.6 | 0.1 | 2.1 | 0.0 |
| Delay (s) | 19.4 | 13.4 | 18.0 | 14.6 | 19.1 | 5.7 |
| Level of Service | B | B | B | B | B | A |
| Approach Delay (s) | 16.8 | | 16.2 | | | 12.4 |
| Approach LOS | B | | B | | | B |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 15.3 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.65 | | |
| Actuated Cycle Length (s) | 50.4 | Sum of lost time (s) | 10.1 |
| Intersection Capacity Utilization | 59.7% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 40: Nave Dr & Bolling Dr

11/22/2017

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 219 | 62 | 560 | 345 | 98 | 568 |
| Future Volume (vph) | 219 | 62 | 560 | 345 | 98 | 568 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | 4.1 | | 3.0 | 3.5 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 0.97 | 1.00 | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 0.85 | 0.95 | | 1.00 | 1.00 |
| Flt Protected | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | 1787 | 1569 | 1791 | | 1805 | 1881 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | 1787 | 1569 | 1791 | | 1805 | 1881 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 228 | 65 | 583 | 359 | 102 | 592 |
| RTOR Reduction (vph) | 0 | 52 | 23 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 228 | 13 | 919 | 0 | 102 | 592 |
| Confl. Peds. (#/hr) | | 6 | | | | |
| Heavy Vehicles (%) | 1% | 0% | 1% | 0% | 0% | 1% |
| Turn Type | Prot | Perm | NA | | Prot | NA |
| Protected Phases | 4 | | 6 | | 5 | 2 |
| Permitted Phases | | 4 | | | | |
| Actuated Green, G (s) | 14.1 | 14.1 | 37.6 | | 6.9 | 48.1 |
| Effective Green, g (s) | 14.1 | 14.1 | 37.6 | | 6.9 | 48.1 |
| Actuated g/C Ratio | 0.21 | 0.21 | 0.55 | | 0.10 | 0.70 |
| Clearance Time (s) | 3.0 | 3.0 | 4.1 | | 3.0 | 3.5 |
| Vehicle Extension (s) | 2.0 | 2.0 | 2.0 | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 366 | 322 | 980 | | 181 | 1316 |
| v/s Ratio Prot | c0.13 | | c0.51 | | c0.06 | 0.31 |
| v/s Ratio Perm | | 0.01 | | | | |
| v/c Ratio | 0.62 | 0.04 | 0.94 | | 0.56 | 0.45 |
| Uniform Delay, d1 | 24.9 | 21.9 | 14.5 | | 29.5 | 4.5 |
| Progression Factor | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 2.4 | 0.0 | 15.5 | | 2.4 | 0.1 |
| Delay (s) | 27.2 | 21.9 | 30.0 | | 31.8 | 4.6 |
| Level of Service | C | C | C | | C | A |
| Approach Delay (s) | 26.1 | | 30.0 | | | 8.6 |
| Approach LOS | C | | C | | | A |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 21.7 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.82 | | |
| Actuated Cycle Length (s) | 68.7 | Sum of lost time (s) | 10.1 |
| Intersection Capacity Utilization | 81.7% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM 2010 AWSC
### 41: Alameda Del Prado & Clay Ct/Nave Dr

11/22/2017

| Intersection | |
|---|---|
| Intersection Delay, s/veh | 19.2 |
| Intersection LOS | C |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 8 | 10 | 1 | 103 | 20 | 751 | 0 | 68 | 37 | 273 | 70 | 12 |
| Future Vol, veh/h | 8 | 10 | 1 | 103 | 20 | 751 | 0 | 68 | 37 | 273 | 70 | 12 |
| Peak Hour Factor | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 8 | 10 | 1 | 106 | 21 | 774 | 0 | 70 | 38 | 281 | 72 | 12 |
| Number of Lanes | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Opposing Approach | WB | EB | SB | NB |
| Opposing Lanes | 2 | 1 | 2 | 1 |
| Conflicting Approach Left | SB | NB | EB | WB |
| Conflicting Lanes Left | 2 | 1 | 1 | 2 |
| Conflicting Approach Right | NB | SB | WB | EB |
| Conflicting Lanes Right | 1 | 2 | 2 | 1 |
| HCM Control Delay | 10.7 | 20.8 | 11.8 | 17.8 |
| HCM LOS | B | C | B | C |

| Lane | NBLn1 | EBLn1 | WBLn1 | WBLn2 | SBLn1 | SBLn2 |
|---|---|---|---|---|---|---|
| Vol Left, % | 0% | 42% | 23% | 0% | 100% | 0% |
| Vol Thru, % | 65% | 53% | 4% | 0% | 0% | 85% |
| Vol Right, % | 35% | 5% | 72% | 100% | 0% | 15% |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 105 | 19 | 446 | 428 | 273 | 82 |
| LT Vol | 0 | 8 | 103 | 0 | 273 | 0 |
| Through Vol | 68 | 10 | 20 | 0 | 0 | 70 |
| RT Vol | 37 | 1 | 323 | 428 | 0 | 12 |
| Lane Flow Rate | 108 | 20 | 460 | 441 | 281 | 85 |
| Geometry Grp | 6 | 6 | 7 | 7 | 7 | 7 |
| Degree of Util (X) | 0.209 | 0.04 | 0.737 | 0.669 | 0.579 | 0.16 |
| Departure Headway (Hd) | 6.952 | 7.338 | 5.773 | 5.461 | 7.411 | 6.798 |
| Convergence, Y/N | Yes | Yes | Yes | Yes | Yes | Yes |
| Cap | 515 | 486 | 625 | 662 | 487 | 528 |
| Service Time | 5.004 | 5.41 | 3.521 | 3.209 | 5.158 | 4.545 |
| HCM Lane V/C Ratio | 0.21 | 0.041 | 0.736 | 0.666 | 0.577 | 0.161 |
| HCM Control Delay | 11.8 | 10.7 | 23 | 18.6 | 19.9 | 10.8 |
| HCM Lane LOS | B | B | C | C | C | B |
| HCM 95th-tile Q | 0.8 | 0.1 | 6.4 | 5.1 | 3.6 | 0.6 |

| Intersection | |
|---|---|
| Intersection Delay, s/veh | 63.9 |
| Intersection LOS | F |

| Movement | EBU | EBL | EBT | EBR | WBU | WBL | WBT | WBR | NBU | NBL | NBT | NBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 0 | 16 | 593 | 129 | 0 | 201 | 488 | 9 | 0 | 113 | 12 | 333 |
| Future Vol, veh/h | 0 | 16 | 593 | 129 | 0 | 201 | 488 | 9 | 0 | 113 | 12 | 333 |
| Peak Hour Factor | 0.95 | 0.93 | 0.93 | 0.93 | 0.95 | 0.93 | 0.93 | 0.93 | 0.95 | 0.93 | 0.93 | 0.93 |
| Heavy Vehicles, % | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 |
| Mvmt Flow | 0 | 17 | 638 | 139 | 0 | 216 | 525 | 10 | 0 | 122 | 13 | 358 |
| Number of Lanes | 0 | 1 | 2 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 1 | 1 |

| Approach | EB | WB | NB |
|---|---|---|---|
| Opposing Approach | WB | EB | SB |
| Opposing Lanes | 3 | 3 | 1 |
| Conflicting Approach Left | SB | NB | EB |
| Conflicting Lanes Left | 1 | 2 | 3 |
| Conflicting Approach Right | NB | SB | WB |
| Conflicting Lanes Right | 2 | 1 | 3 |
| HCM Control Delay | 94.4 | 41.1 | 55 |
| HCM LOS | F | E | F |

| Lane | NBLn1 | NBLn2 | EBLn1 | EBLn2 | EBLn3 | WBLn1 | WBLn2 | WBLn3 | SBLn1 |
|---|---|---|---|---|---|---|---|---|---|
| Vol Left, % | 90% | 0% | 100% | 0% | 0% | 100% | 0% | 0% | 51% |
| Vol Thru, % | 10% | 0% | 0% | 100% | 61% | 0% | 100% | 95% | 23% |
| Vol Right, % | 0% | 100% | 0% | 0% | 39% | 0% | 0% | 5% | 26% |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 125 | 333 | 16 | 395 | 327 | 201 | 325 | 172 | 57 |
| LT Vol | 113 | 0 | 16 | 0 | 0 | 201 | 0 | 0 | 29 |
| Through Vol | 12 | 0 | 0 | 395 | 198 | 0 | 325 | 163 | 13 |
| RT Vol | 0 | 333 | 0 | 0 | 129 | 0 | 0 | 9 | 15 |
| Lane Flow Rate | 134 | 358 | 17 | 425 | 351 | 216 | 350 | 185 | 61 |
| Geometry Grp | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Degree of Util (X) | 0.4 | 0.951 | 0.049 | 1.152 | 0.924 | 0.597 | 0.918 | 0.482 | 0.202 |
| Departure Headway (Hd) | 11.094 | 9.914 | 10.279 | 9.756 | 9.467 | 10.309 | 9.786 | 9.748 | 12.293 |
| Convergence, Y/N | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Cap | 327 | 369 | 348 | 374 | 383 | 352 | 374 | 373 | 294 |
| Service Time | 8.794 | 7.614 | 8.04 | 7.517 | 7.228 | 8.009 | 7.486 | 7.448 | 9.993 |
| HCM Lane V/C Ratio | 0.41 | 0.97 | 0.049 | 1.136 | 0.916 | 0.614 | 0.936 | 0.496 | 0.207 |
| HCM Control Delay | 21 | 67.7 | 13.6 | 125.8 | 60.4 | 27.2 | 60.2 | 21.2 | 18.1 |
| HCM Lane LOS | C | F | B | F | F | D | F | C | C |
| HCM 95th-tile Q | 1.9 | 10.3 | 0.2 | 16.5 | 9.8 | 3.7 | 9.5 | 2.5 | 0.7 |





| Intersection | |
|---|---|
| Intersection Delay, s/veh | |
| Intersection LOS | |

| Movement | SBU | SBL | SBT | SBR |
|---|---|---|---|---|
| Lane Configurations | | | | |
| Traffic Vol, veh/h | 0 | 29 | 13 | 15 |
| Future Vol, veh/h | 0 | 29 | 13 | 15 |
| Peak Hour Factor | 0.95 | 0.93 | 0.93 | 0.93 |
| Heavy Vehicles, % | 2 | 1 | 1 | 1 |
| Mvmt Flow | 0 | 31 | 14 | 16 |
| Number of Lanes | 0 | 0 | 1 | 0 |

| Approach | SB |
|---|---|
| Opposing Approach | NB |
| Opposing Lanes | 2 |
| Conflicting Approach Left | WB |
| Conflicting Lanes Left | 3 |
| Conflicting Approach Right | EB |
| Conflicting Lanes Right | 3 |
| HCM Control Delay | 18.1 |
| HCM LOS | C |

# MOVEMENT SUMMARY

## Site: 1 [AM Cumulative Alt]

Simmons Lane/San Marin Drive
AM Cumulative with Project Alternative

Roundabout

**Movement Performance - Vehicles**

| Mov ID | OD Mov | Demand Flows Total veh/h | Demand Flows HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance ft | Prop. Queued | Effective Stop Rate per veh | Average Speed mph |
|---|---|---|---|---|---|---|---|---|---|---|---|
| South: NB Simmons Ln | | | | | | | | | | | |
| 3 | L2 | 119 | 2.0 | 0.717 | 21.3 | LOS C | 5.9 | 149.5 | 0.87 | 1.04 | 27.4 |
| 8 | T1 | 13 | 2.0 | 0.717 | 21.3 | LOS C | 5.9 | 149.5 | 0.87 | 1.04 | 27.4 |
| 18 | R2 | 351 | 2.0 | 0.717 | 21.3 | LOS C | 5.9 | 149.5 | 0.87 | 1.04 | 26.8 |
| Approach | | 482 | 2.0 | 0.717 | 21.3 | LOS C | 5.9 | 149.5 | 0.87 | 1.04 | 27.0 |
| East: WB San Marin Drive | | | | | | | | | | | |
| 1 | L2 | 212 | 2.0 | 0.174 | 4.5 | LOS A | 0.8 | 19.4 | 0.29 | 0.17 | 32.6 |
| 6 | T1 | 514 | 2.0 | 0.431 | 7.4 | LOS A | 2.5 | 64.5 | 0.40 | 0.25 | 33.6 |
| 16 | R2 | 9 | 2.0 | 0.431 | 7.4 | LOS A | 2.5 | 64.5 | 0.40 | 0.25 | 32.7 |
| Approach | | 735 | 2.0 | 0.431 | 6.5 | LOS A | 2.5 | 64.5 | 0.37 | 0.23 | 33.3 |
| North: SB Simmons Ln | | | | | | | | | | | |
| 7 | L2 | 31 | 2.0 | 0.090 | 6.4 | LOS A | 0.3 | 7.8 | 0.57 | 0.57 | 32.8 |
| 4 | T1 | 14 | 2.0 | 0.090 | 6.4 | LOS A | 0.3 | 7.8 | 0.57 | 0.57 | 32.8 |
| 14 | R2 | 16 | 2.0 | 0.090 | 6.4 | LOS A | 0.3 | 7.8 | 0.57 | 0.57 | 32.0 |
| Approach | | 60 | 2.0 | 0.090 | 6.4 | LOS A | 0.3 | 7.8 | 0.57 | 0.57 | 32.6 |
| West: EB San Marin Drive | | | | | | | | | | | |
| 5 | L2 | 17 | 2.0 | 0.749 | 16.8 | LOS B | 9.0 | 229.2 | 0.84 | 0.78 | 29.5 |
| 2 | T1 | 624 | 2.0 | 0.749 | 16.8 | LOS B | 9.0 | 229.2 | 0.84 | 0.78 | 29.5 |
| 12 | R2 | 136 | 2.0 | 0.749 | 16.8 | LOS B | 9.0 | 229.2 | 0.84 | 0.78 | 28.8 |
| Approach | | 777 | 2.0 | 0.749 | 16.8 | LOS B | 9.0 | 229.2 | 0.84 | 0.78 | 29.4 |
| All Vehicles | | 2054 | 2.0 | 0.749 | 13.9 | LOS B | 9.0 | 229.2 | 0.67 | 0.64 | 30.1 |

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.



# LANE SUMMARY

## Site: 1 [AM Cumulative Alt]

Simmons Lane/San Marin Drive
AM Cumulative with Project Alternative

Roundabout

**Lane Use and Performance**

| | Demand Flows Total veh/h | Demand Flows HV % | Cap. veh/h | Deg. Satn v/c | Lane Util. % | Average Delay sec | Level of Service | 95% Back of Queue Veh | 95% Back of Queue Dist ft | Lane Config | Lane Length ft | Cap. Adj. % | Prob. Block. % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| South: NB Simmons Ln | | | | | | | | | | | | | |
| Lane 1[d] | 482 | 2.0 | 673 | 0.717 | 100 | 21.3 | LOS C | 5.9 | 149.5 | Full | 1600 | 0.0 | 0.0 |
| Approach | 482 | 2.0 | | 0.717 | | 21.3 | LOS C | 5.9 | 149.5 | | | | |
| East: WB San Marin Drive | | | | | | | | | | | | | |
| Lane 1 | 212 | 2.0 | 1213 | 0.174 | 100 | 4.5 | LOS A | 0.8 | 19.4 | Short | 100 | 0.0 | NA |
| Lane 2[d] | 523 | 2.0 | 1213 | 0.431 | 100 | 7.4 | LOS A | 2.5 | 64.5 | Full | 1600 | 0.0 | 0.0 |
| Approach | 735 | 2.0 | | 0.431 | | 6.5 | LOS A | 2.5 | 64.5 | | | | |
| North: SB Simmons Ln | | | | | | | | | | | | | |
| Lane 1[d] | 60 | 2.0 | 670 | 0.090 | 100 | 6.4 | LOS A | 0.3 | 7.8 | Full | 1600 | 0.0 | 0.0 |
| Approach | 60 | 2.0 | | 0.090 | | 6.4 | LOS A | 0.3 | 7.8 | | | | |
| West: EB San Marin Drive | | | | | | | | | | | | | |
| Lane 1[d] | 777 | 2.0 | 1037 | 0.749 | 100 | 16.8 | LOS B | 9.0 | 229.2 | Full | 1600 | 0.0 | 0.0 |
| Approach | 777 | 2.0 | | 0.749 | | 16.8 | LOS B | 9.0 | 229.2 | | | | |
| Intersection | 2054 | 2.0 | | 0.749 | | 13.9 | LOS B | 9.0 | 229.2 | | | | |

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

## HCM Signalized Intersection Capacity Analysis
### 1: Simmons Ln & San Marin Dr

06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 16 | 593 | 129 | 201 | 488 | 9 | 113 | 12 | 333 | 29 | 13 | 15 |
| Future Volume (vph) | 16 | 593 | 129 | 201 | 488 | 9 | 113 | 12 | 333 | 29 | 13 | 15 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | | 4.0 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | | 1.00 | 0.85 | | 0.96 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 0.96 | 1.00 | | 0.98 | |
| Satd. Flow (prot) | 1787 | 1881 | 1599 | 1787 | 1881 | 1599 | | 1800 | 1599 | | 1770 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 0.77 | 1.00 | | 0.82 | |
| Satd. Flow (perm) | 1787 | 1881 | 1599 | 1787 | 1881 | 1599 | | 1456 | 1599 | | 1495 | |
| Peak-hour factor, PHF | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| Adj. Flow (vph) | 17 | 638 | 139 | 216 | 525 | 10 | 122 | 13 | 358 | 31 | 14 | 16 |
| RTOR Reduction (vph) | 0 | 0 | 59 | 0 | 0 | 4 | 0 | 0 | 88 | 0 | 13 | 0 |
| Lane Group Flow (vph) | 17 | 638 | 80 | 216 | 525 | 6 | 0 | 135 | 270 | 0 | 48 | 0 |
| Heavy Vehicles (%) | 1% | 1% | 1% | 1% | 1% | 1% | 1% | 1% | 1% | 1% | 1% | 1% |
| Turn Type | Prot | NA | Perm | Prot | NA | Perm | Perm | NA | pm+ov | Perm | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | | 2 | 3 | | 6 | |
| Permitted Phases | | | 4 | | | 8 | 2 | | 2 | 6 | | |
| Actuated Green, G (s) | 0.6 | 32.1 | 32.1 | 13.1 | 44.6 | 44.6 | | 13.3 | 26.4 | | 13.3 | |
| Effective Green, g (s) | 0.6 | 32.1 | 32.1 | 13.1 | 44.6 | 44.6 | | 13.3 | 26.4 | | 13.3 | |
| Actuated g/C Ratio | 0.01 | 0.46 | 0.46 | 0.19 | 0.63 | 0.63 | | 0.19 | 0.37 | | 0.19 | |
| Clearance Time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | | 4.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | |
| Lane Grp Cap (vph) | 15 | 856 | 728 | 332 | 1189 | 1011 | | 274 | 689 | | 282 | |
| v/s Ratio Prot | 0.01 | c0.34 | | c0.12 | 0.28 | | | | c0.07 | | | |
| v/s Ratio Perm | | | 0.05 | | | 0.00 | | c0.09 | 0.10 | | 0.03 | |
| v/c Ratio | 1.13 | 0.75 | 0.11 | 0.65 | 0.44 | 0.01 | | 0.49 | 0.39 | | 0.17 | |
| Uniform Delay, d1 | 35.0 | 15.8 | 11.0 | 26.6 | 6.6 | 4.8 | | 25.6 | 16.2 | | 24.0 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | |
| Incremental Delay, d2 | 279.2 | 3.6 | 0.1 | 4.5 | 0.3 | 0.0 | | 1.4 | 0.4 | | 0.3 | |
| Delay (s) | 314.1 | 19.4 | 11.1 | 31.1 | 6.9 | 4.8 | | 27.0 | 16.5 | | 24.3 | |
| Level of Service | F | B | B | C | A | A | | C | B | | C | |
| Approach Delay (s) | | 24.2 | | | 13.8 | | | 19.4 | | | 24.3 | |
| Approach LOS | | C | | | B | | | B | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 19.4 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.67 | | |
| Actuated Cycle Length (s) | 70.5 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 65.2% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 2: W Campus Dr & San Marin Dr

06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 37 | 950 | 2 | 2 | 710 | 204 | 1 | 0 | 4 | 25 | 0 | 1 |
| Future Volume (vph) | 37 | 950 | 2 | 2 | 710 | 204 | 1 | 0 | 4 | 25 | 0 | 1 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.8 | | 4.0 | 4.8 | 4.8 | | 4.0 | | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 | | 1.00 | | 0.95 | 0.95 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | | 1.00 | 1.00 | 0.85 | | 0.89 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | | 0.99 | | 0.95 | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 3573 | | 1805 | 3574 | 1615 | | 1678 | | 1715 | 1715 | 1615 |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1805 | 3573 | | 1805 | 3574 | 1615 | | 1695 | | 1805 | 1805 | 1615 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 40 | 1033 | 2 | 2 | 772 | 222 | 1 | 0 | 4 | 27 | 0 | 1 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 102 | 0 | 5 | 0 | 0 | 0 | 1 |
| Lane Group Flow (vph) | 40 | 1035 | 0 | 2 | 772 | 120 | 0 | 0 | 0 | 13 | 14 | 0 |
| Confl. Peds. (#/hr) | | | 2 | | | | | | | | | |
| Heavy Vehicles (%) | 0% | 1% | 0% | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Prot | NA | | Prot | NA | Perm | Perm | NA | | Perm | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | | | | 6 | 8 | | | 4 | | 4 |
| Actuated Green, G (s) | 2.3 | 21.6 | | 1.0 | 20.3 | 20.3 | | 2.3 | | 2.3 | 2.3 | 2.3 |
| Effective Green, g (s) | 2.3 | 21.6 | | 1.0 | 20.3 | 20.3 | | 2.3 | | 2.3 | 2.3 | 2.3 |
| Actuated g/C Ratio | 0.06 | 0.57 | | 0.03 | 0.54 | 0.54 | | 0.06 | | 0.06 | 0.06 | 0.06 |
| Clearance Time (s) | 4.0 | 4.8 | | 4.0 | 4.8 | 4.8 | | 4.0 | | 4.0 | 4.0 | 4.0 |
| Vehicle Extension (s) | 2.0 | 4.0 | | 2.0 | 4.0 | 4.0 | | 2.0 | | 2.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 110 | 2047 | | 47 | 1924 | 869 | | 103 | | 110 | 110 | 98 |
| v/s Ratio Prot | c0.02 | c0.29 | | 0.00 | 0.22 | | | | | | | |
| v/s Ratio Perm | | | | | | 0.07 | | 0.00 | | 0.01 | c0.01 | 0.00 |
| v/c Ratio | 0.36 | 0.51 | | 0.04 | 0.40 | 0.14 | | 0.00 | | 0.12 | 0.13 | 0.00 |
| Uniform Delay, d1 | 17.0 | 4.8 | | 17.9 | 5.1 | 4.3 | | 16.6 | | 16.7 | 16.8 | 16.6 |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.7 | 0.3 | | 0.1 | 0.2 | 0.1 | | 0.0 | | 0.2 | 0.2 | 0.0 |
| Delay (s) | 17.7 | 5.1 | | 18.0 | 5.3 | 4.4 | | 16.6 | | 16.9 | 16.9 | 16.6 |
| Level of Service | B | A | | B | A | A | | B | | B | B | B |
| Approach Delay (s) | | 5.6 | | | 5.1 | | | 16.6 | | | 16.9 | |
| Approach LOS | | A | | | A | | | B | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 5.5 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.48 | | |
| Actuated Cycle Length (s) | 37.7 | Sum of lost time (s) | 12.8 |
| Intersection Capacity Utilization | 47.0% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 3: San Marin Dr & E Campus Drive

06/13/2017

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 71 | 972 | 914 | 400 | 64 | 48 |
| Future Volume (vph) | 71 | 972 | 914 | 400 | 64 | 48 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 4.3 | 4.3 | 4.3 | 3.0 | 3.0 |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | 1.00 | 0.97 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 1.00 | 0.85 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 3574 | 3574 | 1615 | 3502 | 1594 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (perm) | 1805 | 3574 | 3574 | 1615 | 3502 | 1594 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 77 | 1057 | 993 | 435 | 70 | 52 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 103 | 0 | 48 |
| Lane Group Flow (vph) | 77 | 1057 | 993 | 332 | 70 | 4 |
| Confl. Peds. (#/hr) | | | | | | 1 |
| Heavy Vehicles (%) | 0% | 1% | 1% | 0% | 0% | 0% |
| Turn Type | Prot | NA | NA | Perm | Perm | Perm |
| Protected Phases | 5 | 2 | 6 | | | |
| Permitted Phases | | | | 6 | 4 | 4 |
| Actuated Green, G (s) | 10.0 | 112.1 | 99.1 | 99.1 | 10.6 | 10.6 |
| Effective Green, g (s) | 10.0 | 112.1 | 99.1 | 99.1 | 10.6 | 10.6 |
| Actuated g/C Ratio | 0.08 | 0.86 | 0.76 | 0.76 | 0.08 | 0.08 |
| Clearance Time (s) | 3.0 | 4.3 | 4.3 | 4.3 | 3.0 | 3.0 |
| Vehicle Extension (s) | 2.0 | 4.0 | 4.0 | 4.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 138 | 3081 | 2724 | 1231 | 285 | 129 |
| v/s Ratio Prot | c0.04 | 0.30 | c0.28 | | | |
| v/s Ratio Perm | | | | 0.21 | c0.02 | 0.00 |
| v/c Ratio | 0.56 | 0.34 | 0.36 | 0.27 | 0.25 | 0.03 |
| Uniform Delay, d1 | 57.9 | 1.8 | 5.1 | 4.6 | 56.0 | 55.0 |
| Progression Factor | 1.00 | 1.00 | 0.54 | 0.36 | 1.00 | 1.00 |
| Incremental Delay, d2 | 2.8 | 0.3 | 0.1 | 0.1 | 0.2 | 0.0 |
| Delay (s) | 60.6 | 2.1 | 2.8 | 1.8 | 56.1 | 55.0 |
| Level of Service | E | A | A | A | E | E |
| Approach Delay (s) | | 6.0 | 2.5 | | 55.6 | |
| Approach LOS | | A | A | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 6.4 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.37 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 10.3 |
| Intersection Capacity Utilization | 51.2% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 4: Redwood Blvd & San Marin Dr

06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 71 | 797 | 171 | 378 | 1086 | 737 | 179 | 143 | 314 | 180 | 60 | 48 |
| Future Volume (vph) | 71 | 797 | 171 | 378 | 1086 | 737 | 179 | 143 | 314 | 180 | 60 | 48 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.6 | | 3.0 | 4.0 | | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 | |
| Lane Util. Factor | 1.00 | 0.91 | | 1.00 | 0.91 | | 0.97 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 0.99 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 0.97 | | 1.00 | 0.94 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.93 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1787 | 4986 | | 1752 | 4824 | | 3467 | 1881 | 1568 | 1787 | 1741 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1787 | 4986 | | 1752 | 4824 | | 3467 | 1881 | 1568 | 1787 | 1741 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 75 | 839 | 180 | 398 | 1143 | 776 | 188 | 151 | 331 | 189 | 63 | 51 |
| RTOR Reduction (vph) | 0 | 26 | 0 | 0 | 70 | 0 | 0 | 0 | 293 | 0 | 25 | 0 |
| Lane Group Flow (vph) | 75 | 993 | 0 | 398 | 1849 | 0 | 188 | 151 | 38 | 189 | 89 | 0 |
| Confl. Peds. (#/hr) | | | 4 | | | | | | | | | 5 |
| Confl. Bikes (#/hr) | | | | | | | | | | | | 1 |
| Heavy Vehicles (%) | 1% | 1% | 1% | 3% | 1% | 1% | 1% | 1% | 3% | 1% | 1% | 1% |
| Turn Type | Prot | NA | | Prot | NA | | Split | NA | Perm | Split | NA | |
| Protected Phases | 1 | 6 | | 5 | 2 | | 7 | 7 | | 8 | 8 | |
| Permitted Phases | | | | | 2 | | | | 7 | | | |
| Actuated Green, G (s) | 8.3 | 44.8 | | 35.3 | 71.4 | | 14.8 | 14.8 | 14.8 | 19.9 | 19.9 | |
| Effective Green, g (s) | 8.3 | 44.8 | | 35.3 | 71.4 | | 14.8 | 14.8 | 14.8 | 19.9 | 19.9 | |
| Actuated g/C Ratio | 0.06 | 0.34 | | 0.27 | 0.55 | | 0.11 | 0.11 | 0.11 | 0.15 | 0.15 | |
| Clearance Time (s) | 3.0 | 3.6 | | 3.0 | 4.0 | | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 | |
| Vehicle Extension (s) | 2.0 | 4.0 | | 5.0 | 4.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 114 | 1718 | | 475 | 2649 | | 394 | 214 | 178 | 273 | 266 | |
| v/s Ratio Prot | 0.04 | 0.20 | | c0.23 | c0.38 | | 0.05 | c0.08 | | c0.11 | 0.05 | |
| v/s Ratio Perm | | | | | | | | | 0.02 | | | |
| v/c Ratio | 0.66 | 0.58 | | 0.84 | 0.70 | | 0.48 | 0.71 | 0.21 | 0.69 | 0.33 | |
| Uniform Delay, d1 | 59.5 | 34.9 | | 44.7 | 21.4 | | 54.0 | 55.5 | 52.3 | 52.1 | 49.1 | |
| Progression Factor | 1.17 | 0.95 | | 1.03 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 9.6 | 1.4 | | 7.9 | 0.9 | | 0.3 | 8.3 | 0.2 | 6.0 | 0.3 | |
| Delay (s) | 79.0 | 34.4 | | 53.8 | 22.2 | | 54.3 | 63.8 | 52.5 | 58.2 | 49.4 | |
| Level of Service | E | C | | D | C | | D | E | D | E | D | |
| Approach Delay (s) | | 37.5 | | | 27.6 | | | 55.6 | | | 54.9 | |
| Approach LOS | | D | | | C | | | E | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 36.2 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.76 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 15.6 |
| Intersection Capacity Utilization | 92.3% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 4: Redwood Blvd & San Marin Dr

06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 71 | 797 | 171 | 378 | 1086 | 737 | 179 | 143 | 314 | 180 | 60 | 48 |
| Future Volume (vph) | 71 | 797 | 171 | 378 | 1086 | 737 | 179 | 143 | 314 | 180 | 60 | 48 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.6 | | 3.0 | 4.0 | 4.3 | 4.3 | 4.3 | 3.0 | 4.3 | 4.3 | |
| Lane Util. Factor | 1.00 | 0.91 | | 0.97 | 0.95 | 1.00 | 0.95 | 0.95 | 0.88 | 0.91 | 0.91 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 0.97 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.96 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 0.99 | 1.00 | 0.95 | 0.98 | |
| Satd. Flow (prot) | 1787 | 4986 | | 3400 | 3574 | 1599 | 1698 | 1775 | 2760 | 1626 | 3209 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 0.99 | 1.00 | 0.95 | 0.98 | |
| Satd. Flow (perm) | 1787 | 4986 | | 3400 | 3574 | 1599 | 1698 | 1775 | 2760 | 1626 | 3209 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 75 | 839 | 180 | 398 | 1143 | 776 | 188 | 151 | 331 | 189 | 63 | 51 |
| RTOR Reduction (vph) | 0 | 25 | 0 | 0 | 0 | 72 | 0 | 0 | 220 | 0 | 31 | 0 |
| Lane Group Flow (vph) | 75 | 994 | 0 | 398 | 1143 | 704 | 165 | 174 | 111 | 102 | 170 | 0 |
| Confl. Peds. (#/hr) | | | 4 | | | | | | | | | 5 |
| Confl. Bikes (#/hr) | | | | | | | | | | | | 1 |
| Heavy Vehicles (%) | 1% | 1% | 1% | 3% | 1% | 1% | 1% | 1% | 3% | 1% | 1% | 1% |
| Turn Type | Prot | NA | | Prot | NA | pm+ov | Split | NA | pm+ov | Split | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | 4 | 8 | 8 | 1 | 4 | 4 | |
| Permitted Phases | | | | | | 6 | | | 8 | | | |
| Actuated Green, G (s) | 8.0 | 48.7 | | 26.2 | 66.5 | 87.6 | 16.8 | 16.8 | 43.0 | 21.1 | 21.1 | |
| Effective Green, g (s) | 8.0 | 48.7 | | 26.2 | 66.5 | 87.6 | 16.8 | 16.8 | 43.0 | 21.1 | 21.1 | |
| Actuated g/C Ratio | 0.06 | 0.38 | | 0.20 | 0.52 | 0.68 | 0.13 | 0.13 | 0.34 | 0.16 | 0.16 | |
| Clearance Time (s) | 3.0 | 3.6 | | 3.0 | 4.0 | 4.3 | 4.3 | 4.3 | 3.0 | 4.3 | 4.3 | |
| Vehicle Extension (s) | 2.0 | 4.0 | | 5.0 | 4.0 | 2.0 | 2.0 | 2.0 | 5.0 | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 111 | 1897 | | 695 | 1856 | 1094 | 222 | 232 | 927 | 268 | 528 | |
| v/s Ratio Prot | c0.04 | 0.20 | | 0.12 | 0.32 | c0.11 | 0.10 | c0.10 | 0.02 | 0.06 | 0.05 | |
| v/s Ratio Perm | | | | | | 0.33 | | | 0.02 | | | |
| v/c Ratio | 0.68 | 0.52 | | 0.57 | 0.62 | 0.64 | 0.74 | 0.75 | 0.12 | 0.38 | 0.32 | |
| Uniform Delay, d1 | 58.7 | 30.7 | | 45.9 | 21.7 | 11.4 | 53.5 | 53.6 | 29.4 | 47.6 | 47.1 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 0.76 | 1.19 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 12.0 | 1.0 | | 1.2 | 1.0 | 0.6 | 11.1 | 11.4 | 0.1 | 0.3 | 0.1 | |
| Delay (s) | 70.8 | 31.7 | | 46.8 | 17.4 | 14.2 | 64.7 | 65.0 | 29.5 | 48.0 | 47.3 | |
| Level of Service | E | C | | D | B | B | E | E | C | D | D | |
| Approach Delay (s) | | 34.4 | | | 21.4 | | | 47.4 | | | 47.5 | |
| Approach LOS | | C | | | C | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 30.4 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.66 | | |
| Actuated Cycle Length (s) | 128.0 | Sum of lost time (s) | 15.6 |
| Intersection Capacity Utilization | 82.6% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 5: US 101 SB Ramps & San Marin Dr

06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 744 | 549 | 186 | 1451 | 0 | 0 | 0 | 0 | 101 | 1 | 750 |
| Future Volume (vph) | 0 | 744 | 549 | 186 | 1451 | 0 | 0 | 0 | 0 | 101 | 1 | 750 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.9 | 4.9 | 3.0 | 5.3 | | | | | | 4.0 | 4.0 |
| Lane Util. Factor | | 0.95 | 1.00 | 1.00 | 0.95 | | | | | | 1.00 | 0.88 |
| Frpb, ped/bikes | | 1.00 | 0.99 | 1.00 | 1.00 | | | | | | 1.00 | 1.00 |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | | | | | 1.00 | 1.00 |
| Frt | | 1.00 | 0.85 | 1.00 | 1.00 | | | | | | 1.00 | 0.85 |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | | 0.95 | 1.00 |
| Satd. Flow (prot) | | 3574 | 1575 | 1805 | 3574 | | | | | | 1810 | 2814 |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | | 0.95 | 1.00 |
| Satd. Flow (perm) | | 3574 | 1575 | 1805 | 3574 | | | | | | 1810 | 2814 |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 0 | 791 | 584 | 198 | 1544 | 0 | 0 | 0 | 0 | 107 | 1 | 798 |
| RTOR Reduction (vph) | 0 | 0 | 332 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 66 |
| Lane Group Flow (vph) | 0 | 791 | 252 | 198 | 1544 | 0 | 0 | 0 | 0 | 0 | 108 | 732 |
| Confl. Peds. (#/hr) | | | 4 | | | | | | | | | |
| Heavy Vehicles (%) | 0% | 1% | 1% | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 1% |
| Turn Type | | NA | Perm | Prot | NA | | | | | Split | NA | Perm |
| Protected Phases | | 2 | | 1 | 6 | | | | | 4 | 4 | |
| Permitted Phases | | | 2 | | | | | | | | | 4 |
| Actuated Green, G (s) | | 28.1 | 28.1 | 8.0 | 38.7 | | | | | | 17.0 | 17.0 |
| Effective Green, g (s) | | 28.1 | 28.1 | 8.0 | 38.7 | | | | | | 17.0 | 17.0 |
| Actuated g/C Ratio | | 0.43 | 0.43 | 0.12 | 0.60 | | | | | | 0.26 | 0.26 |
| Clearance Time (s) | | 4.9 | 4.9 | 3.0 | 5.3 | | | | | | 4.0 | 4.0 |
| Vehicle Extension (s) | | 4.0 | 4.0 | 2.0 | 4.0 | | | | | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | | 1545 | 680 | 222 | 2127 | | | | | | 473 | 735 |
| v/s Ratio Prot | | 0.22 | | c0.11 | c0.43 | | | | | | 0.06 | |
| v/s Ratio Perm | | | 0.16 | | | | | | | | | c0.26 |
| v/c Ratio | | 0.51 | 0.37 | 0.89 | 0.73 | | | | | | 0.23 | 1.00 |
| Uniform Delay, d1 | | 13.5 | 12.5 | 28.1 | 9.4 | | | | | | 18.8 | 24.0 |
| Progression Factor | | 0.43 | 2.72 | 1.00 | 1.00 | | | | | | 1.00 | 1.00 |
| Incremental Delay, d2 | | 1.0 | 1.3 | 32.3 | 2.2 | | | | | | 0.1 | 32.0 |
| Delay (s) | | 6.8 | 35.2 | 60.3 | 11.6 | | | | | | 18.9 | 56.0 |
| Level of Service | | A | D | E | B | | | | | | B | E |
| Approach Delay (s) | | 18.9 | | | 17.1 | | | 0.0 | | | 51.6 | |
| Approach LOS | | B | | | B | | | A | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 25.5 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.87 | | |
| Actuated Cycle Length (s) | 65.0 | Sum of lost time (s) | 11.9 |
| Intersection Capacity Utilization | 113.1% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 411 | 432 | 0 | 0 | 757 | 96 | 874 | 0 | 180 | 0 | 0 | 0 |
| Future Volume (vph) | 411 | 432 | 0 | 0 | 757 | 96 | 874 | 0 | 180 | 0 | 0 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.6 | | | 4.9 | 4.9 | 3.5 | 3.5 | | | | |
| Lane Util. Factor | 0.97 | 1.00 | | | 0.95 | 1.00 | 0.95 | 0.95 | | | | |
| Frpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | 0.99 | 1.00 | 0.99 | | | | |
| Flpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | | | |
| Frt | 1.00 | 1.00 | | | 1.00 | 0.85 | 1.00 | 0.95 | | | | |
| Flt Protected | 0.95 | 1.00 | | | 1.00 | 1.00 | 0.95 | 0.97 | | | | |
| Satd. Flow (prot) | 3467 | 1881 | | | 3574 | 1594 | 1681 | 1606 | | | | |
| Flt Permitted | 0.95 | 1.00 | | | 1.00 | 1.00 | 0.95 | 0.97 | | | | |
| Satd. Flow (perm) | 3467 | 1881 | | | 3574 | 1594 | 1681 | 1606 | | | | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 433 | 455 | 0 | 0 | 797 | 101 | 920 | 0 | 189 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 73 | 0 | 57 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 433 | 455 | 0 | 0 | 797 | 28 | 570 | 482 | 0 | 0 | 0 | 0 |
| Confl. Peds. (#/hr) | | | 3 | | | 1 | | | 1 | 1 | | |
| Heavy Vehicles (%) | 1% | 1% | 0% | 0% | 1% | 0% | 2% | 0% | 3% | 0% | 0% | 0% |
| Turn Type | Prot | NA | | | NA | Perm | Split | NA | | | | |
| Protected Phases | 5 | 2 | | | 6 | | 8 | 8 | | | | |
| Permitted Phases | | | | | | 6 | | | | | | |
| Actuated Green, G (s) | 9.4 | 30.5 | | | 17.3 | 17.3 | 23.5 | 23.5 | | | | |
| Effective Green, g (s) | 9.4 | 30.5 | | | 17.3 | 17.3 | 23.5 | 23.5 | | | | |
| Actuated g/C Ratio | 0.15 | 0.49 | | | 0.28 | 0.28 | 0.38 | 0.38 | | | | |
| Clearance Time (s) | 3.5 | 4.6 | | | 4.9 | 4.9 | 3.5 | 3.5 | | | | |
| Vehicle Extension (s) | 2.0 | 4.0 | | | 4.0 | 4.0 | 2.5 | 2.5 | | | | |
| Lane Grp Cap (vph) | 524 | 923 | | | 995 | 444 | 636 | 607 | | | | |
| v/s Ratio Prot | c0.12 | 0.24 | | | c0.22 | | c0.34 | 0.30 | | | | |
| v/s Ratio Perm | | | | | | 0.02 | | | | | | |
| v/c Ratio | 0.83 | 0.49 | | | 0.80 | 0.06 | 0.90 | 0.79 | | | | |
| Uniform Delay, d1 | 25.6 | 10.6 | | | 20.8 | 16.5 | 18.2 | 17.2 | | | | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | | | |
| Incremental Delay, d2 | 9.8 | 0.6 | | | 5.0 | 0.1 | 15.2 | 6.9 | | | | |
| Delay (s) | 35.4 | 11.2 | | | 25.8 | 16.5 | 33.3 | 24.0 | | | | |
| Level of Service | D | B | | | C | B | C | C | | | | |
| Approach Delay (s) | | 23.0 | | | 24.7 | | | 28.8 | | | 0.0 | |
| Approach LOS | | C | | | C | | | C | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 25.8 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.85 | | |
| Actuated Cycle Length (s) | 62.1 | Sum of lost time (s) | 11.9 |
| Intersection Capacity Utilization | 113.1% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |

c Critical Lane Group





| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 411 | 432 | 0 | 0 | 757 | 96 | 874 | 0 | 180 | 0 | 0 | 0 |
| Future Volume (vph) | 411 | 432 | 0 | 0 | 757 | 96 | 874 | 0 | 180 | 0 | 0 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.6 | | | 4.9 | 4.9 | 3.5 | 3.5 | | | | |
| Lane Util. Factor | 0.97 | 1.00 | | | 0.95 | 1.00 | 0.97 | 1.00 | | | | |
| Frpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | 0.99 | 1.00 | 0.98 | | | | |
| Flpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | | | |
| Frt | 1.00 | 1.00 | | | 1.00 | 0.85 | 1.00 | 0.85 | | | | |
| Flt Protected | 0.95 | 1.00 | | | 1.00 | 1.00 | 0.95 | 1.00 | | | | |
| Satd. Flow (prot) | 3467 | 1881 | | | 3574 | 1594 | 3433 | 1535 | | | | |
| Flt Permitted | 0.95 | 1.00 | | | 1.00 | 1.00 | 0.95 | 1.00 | | | | |
| Satd. Flow (perm) | 3467 | 1881 | | | 3574 | 1594 | 3433 | 1535 | | | | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 433 | 455 | 0 | 0 | 797 | 101 | 920 | 0 | 189 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 50 | 0 | 100 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 433 | 455 | 0 | 0 | 797 | 51 | 920 | 89 | 0 | 0 | 0 | 0 |
| Confl. Peds. (#/hr) | | | 3 | | | 1 | | | 1 | 1 | | |
| Heavy Vehicles (%) | 1% | 1% | 0% | 0% | 1% | 0% | 2% | 0% | 3% | 0% | 0% | 0% |
| Turn Type | Prot | NA | | | NA | Perm | Split | NA | | | | |
| Protected Phases | 5 | 2 | | | 6 | | 8 | 8 | | | | |
| Permitted Phases | | | | | | 6 | | | | | | |
| Actuated Green, G (s) | 20.3 | 59.9 | | | 35.8 | 35.8 | 60.0 | 60.0 | | | | |
| Effective Green, g (s) | 20.3 | 59.9 | | | 35.8 | 35.8 | 60.0 | 60.0 | | | | |
| Actuated g/C Ratio | 0.16 | 0.47 | | | 0.28 | 0.28 | 0.47 | 0.47 | | | | |
| Clearance Time (s) | 3.5 | 4.6 | | | 4.9 | 4.9 | 3.5 | 3.5 | | | | |
| Vehicle Extension (s) | 2.0 | 4.0 | | | 4.0 | 4.0 | 2.5 | 2.5 | | | | |
| Lane Grp Cap (vph) | 549 | 880 | | | 999 | 445 | 1609 | 719 | | | | |
| v/s Ratio Prot | c0.12 | 0.24 | | | c0.22 | | c0.27 | 0.06 | | | | |
| v/s Ratio Perm | | | | | | 0.03 | | | | | | |
| v/c Ratio | 0.79 | 0.52 | | | 0.80 | 0.11 | 0.57 | 0.12 | | | | |
| Uniform Delay, d1 | 51.8 | 23.9 | | | 42.7 | 34.3 | 24.7 | 19.2 | | | | |
| Progression Factor | 0.73 | 0.38 | | | 1.00 | 1.00 | 1.00 | 1.00 | | | | |
| Incremental Delay, d2 | 5.8 | 0.6 | | | 4.8 | 0.2 | 1.5 | 0.4 | | | | |
| Delay (s) | 43.6 | 9.8 | | | 47.5 | 34.5 | 26.2 | 19.5 | | | | |
| Level of Service | D | A | | | D | C | C | B | | | | |
| Approach Delay (s) | | 26.3 | | | 46.0 | | | 25.0 | | | 0.0 | |
| Approach LOS | | C | | | D | | | C | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 31.9 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.68 | | |
| Actuated Cycle Length (s) | 128.0 | Sum of lost time (s) | 11.9 |
| Intersection Capacity Utilization | 100.4% | ICU Level of Service | G |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 7: Redwood Blvd & Olive St

06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 111 | 98 | 33 | 142 | 130 | 116 | 18 | 452 | 139 | 151 | 409 | 87 |
| Future Volume (vph) | 111 | 98 | 33 | 142 | 130 | 116 | 18 | 452 | 139 | 151 | 409 | 87 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 5.1 | 5.1 | | | 5.1 | | 4.0 | 3.9 | 3.9 | 4.0 | 3.9 | |
| Lane Util. Factor | 1.00 | 1.00 | | | 1.00 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | |
| Frt | 1.00 | 0.96 | | | 0.96 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.97 | |
| Flt Protected | 0.95 | 1.00 | | | 0.98 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1770 | 1792 | | | 1755 | | 1770 | 3539 | 1583 | 1770 | 3446 | |
| Flt Permitted | 0.95 | 1.00 | | | 0.98 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1770 | 1792 | | | 1755 | | 1770 | 3539 | 1583 | 1770 | 3446 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 121 | 107 | 36 | 154 | 141 | 126 | 20 | 491 | 151 | 164 | 445 | 95 |
| RTOR Reduction (vph) | 0 | 12 | 0 | 0 | 13 | 0 | 0 | 0 | 101 | 0 | 16 | 0 |
| Lane Group Flow (vph) | 121 | 131 | 0 | 0 | 408 | 0 | 20 | 491 | 50 | 164 | 524 | 0 |
| Turn Type | Split | NA | | Split | NA | | Prot | NA | Perm | Prot | NA | |
| Protected Phases | 4 | 4 | | 8 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | | | | | | | 2 | | | |
| Actuated Green, G (s) | 11.8 | 11.8 | | | 25.4 | | 3.5 | 18.2 | 18.2 | 11.6 | 26.3 | |
| Effective Green, g (s) | 11.8 | 11.8 | | | 25.4 | | 3.5 | 18.2 | 18.2 | 11.6 | 26.3 | |
| Actuated g/C Ratio | 0.14 | 0.14 | | | 0.30 | | 0.04 | 0.21 | 0.21 | 0.14 | 0.31 | |
| Clearance Time (s) | 5.1 | 5.1 | | | 5.1 | | 4.0 | 3.9 | 3.9 | 4.0 | 3.9 | |
| Vehicle Extension (s) | 1.0 | 1.0 | | | 1.0 | | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | |
| Lane Grp Cap (vph) | 245 | 248 | | | 523 | | 72 | 756 | 338 | 241 | 1064 | |
| v/s Ratio Prot | 0.07 | c0.07 | | | c0.23 | | 0.01 | c0.14 | | c0.09 | 0.15 | |
| v/s Ratio Perm | | | | | | | | | 0.03 | | | |
| v/c Ratio | 0.49 | 0.53 | | | 0.78 | | 0.28 | 0.65 | 0.15 | 0.68 | 0.49 | |
| Uniform Delay, d1 | 33.9 | 34.1 | | | 27.3 | | 39.6 | 30.5 | 27.2 | 35.0 | 24.0 | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 0.6 | 0.9 | | | 6.9 | | 0.8 | 1.5 | 0.1 | 6.2 | 0.1 | |
| Delay (s) | 34.5 | 35.0 | | | 34.2 | | 40.3 | 32.0 | 27.2 | 41.1 | 24.1 | |
| Level of Service | C | C | | | C | | D | C | C | D | C | |
| Approach Delay (s) | | 34.8 | | | 34.2 | | | 31.2 | | | 28.1 | |
| Approach LOS | | C | | | C | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 31.2 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.68 | | |
| Actuated Cycle Length (s) | 85.1 | Sum of lost time (s) | 18.1 |
| Intersection Capacity Utilization | 66.5% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 8: Redwood Blvd & Grant Ave

06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 100 | 99 | 199 | 23 | 76 | 45 | 224 | 389 | 48 | 35 | 434 | 87 |
| Future Volume (vph) | 100 | 99 | 199 | 23 | 76 | 45 | 224 | 389 | 48 | 35 | 434 | 87 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.5 | 3.5 | | 3.5 | 3.7 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | | 1.00 | 0.99 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.98 | | 1.00 | 0.97 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1763 | 1900 | 1564 | 1803 | 1900 | 1588 | 1805 | 3474 | | 1805 | 3438 | |
| Flt Permitted | 0.70 | 1.00 | 1.00 | 0.69 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1304 | 1900 | 1564 | 1305 | 1900 | 1588 | 1805 | 3474 | | 1805 | 3438 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 109 | 108 | 216 | 25 | 83 | 49 | 243 | 423 | 52 | 38 | 472 | 95 |
| RTOR Reduction (vph) | 0 | 0 | 156 | 0 | 0 | 35 | 0 | 8 | 0 | 0 | 16 | 0 |
| Lane Group Flow (vph) | 109 | 108 | 60 | 25 | 83 | 14 | 243 | 467 | 0 | 38 | 551 | 0 |
| Confl. Peds. (#/hr) | 9 | | 11 | 2 | | 1 | | | 10 | | | 9 |
| Confl. Bikes (#/hr) | | | 5 | | | 5 | | | 5 | | | 5 |
| Heavy Vehicles (%) | 2% | 0% | 1% | 0% | 0% | 0% | 0% | 2% | 0% | 0% | 2% | 0% |
| Turn Type | Perm | NA | Perm | Perm | NA | Perm | Prot | NA | | Prot | NA | |
| Protected Phases | | 8 | | | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | 8 | | 8 | 4 | | 4 | | | | | | |
| Actuated Green, G (s) | 17.7 | 17.7 | 17.7 | 17.7 | 17.7 | 17.7 | 15.6 | 28.8 | | 6.7 | 19.7 | |
| Effective Green, g (s) | 17.7 | 17.7 | 17.7 | 17.7 | 17.7 | 17.7 | 15.6 | 28.8 | | 6.7 | 19.7 | |
| Actuated g/C Ratio | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.24 | 0.45 | | 0.10 | 0.31 | |
| Clearance Time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.5 | 3.5 | | 3.5 | 3.7 | |
| Vehicle Extension (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 2.5 | 3.0 | | 2.5 | 3.0 | |
| Lane Grp Cap (vph) | 359 | 523 | 431 | 359 | 523 | 437 | 438 | 1558 | | 188 | 1054 | |
| v/s Ratio Prot | | 0.06 | | | 0.04 | | c0.13 | 0.13 | | 0.02 | c0.16 | |
| v/s Ratio Perm | c0.08 | | 0.04 | 0.02 | | 0.01 | | | | | | |
| v/c Ratio | 0.30 | 0.21 | 0.14 | 0.07 | 0.16 | 0.03 | 0.55 | 0.30 | | 0.20 | 0.52 | |
| Uniform Delay, d1 | 18.4 | 17.9 | 17.5 | 17.2 | 17.6 | 17.0 | 21.3 | 11.3 | | 26.3 | 18.4 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 0.7 | 0.3 | 0.2 | 0.1 | 0.2 | 0.0 | 1.2 | 0.1 | | 0.4 | 0.5 | |
| Delay (s) | 19.0 | 18.1 | 17.7 | 17.3 | 17.8 | 17.0 | 22.5 | 11.4 | | 26.7 | 18.8 | |
| Level of Service | B | B | B | B | B | B | C | B | | C | B | |
| Approach Delay (s) | | 18.1 | | | 17.5 | | | 15.1 | | | 19.3 | |
| Approach LOS | | B | | | B | | | B | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 17.3 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.46 | | |
| Actuated Cycle Length (s) | 64.2 | Sum of lost time (s) | 11.2 |
| Intersection Capacity Utilization | 55.7% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

HCM 2010 AWSC
9: San Marin Dr/Sutro Ave & Novato Blvd 06/13/2017

| Intersection | |
|---|---|
| Intersection Delay, s/veh | 39 |
| Intersection LOS | E |

| Movement | EBU | EBL | EBT | EBR | WBU | WBL | WBT | WBR | NBU | NBL | NBT | NBR | SBU | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | | | | | |
| Traffic Vol, veh/h | 0 | 108 | 193 | 63 | 0 | 21 | 180 | 177 | 0 | 116 | 161 | 51 | 0 | 197 | 98 | 102 |
| Future Vol, veh/h | 0 | 108 | 193 | 63 | 0 | 21 | 180 | 177 | 0 | 116 | 161 | 51 | 0 | 197 | 98 | 102 |
| Peak Hour Factor | 0.95 | 0.92 | 0.92 | 0.92 | 0.95 | 0.92 | 0.92 | 0.92 | 0.95 | 0.92 | 0.92 | 0.92 | 0.95 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 0 | 117 | 210 | 68 | 0 | 23 | 196 | 192 | 0 | 126 | 175 | 55 | 0 | 214 | 107 | 111 |
| Number of Lanes | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 1 |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Opposing Approach | WB | EB | SB | NB |
| Opposing Lanes | 2 | 2 | 3 | 2 |
| Conflicting Approach Left | SB | NB | EB | WB |
| Conflicting Lanes Left | 3 | 2 | 2 | 2 |
| Conflicting Approach Right | NB | SB | WB | EB |
| Conflicting Lanes Right | 2 | 3 | 2 | 2 |
| HCM Control Delay | 30.8 | 76.9 | 24.8 | 22.1 |
| HCM LOS | D | F | C | C |

| Lane | NBLn1 | NBLn2 | EBLn1 | EBLn2 | WBLn1 | WBLn2 | SBLn1 | SBLn2 | SBLn3 |
|---|---|---|---|---|---|---|---|---|---|
| Vol Left, % | 100% | 0% | 100% | 0% | 100% | 0% | 100% | 0% | 0% |
| Vol Thru, % | 0% | 76% | 0% | 75% | 0% | 50% | 0% | 100% | 0% |
| Vol Right, % | 0% | 24% | 0% | 25% | 0% | 50% | 0% | 0% | 100% |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 116 | 212 | 108 | 256 | 21 | 357 | 197 | 98 | 102 |
| LT Vol | 116 | 0 | 108 | 0 | 21 | 0 | 197 | 0 | 0 |
| Through Vol | 0 | 161 | 0 | 193 | 0 | 180 | 0 | 98 | 0 |
| RT Vol | 0 | 51 | 0 | 63 | 0 | 177 | 0 | 0 | 102 |
| Lane Flow Rate | 126 | 230 | 117 | 278 | 23 | 388 | 214 | 107 | 111 |
| Geometry Grp | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Degree of Util (X) | 0.363 | 0.622 | 0.333 | 0.745 | 0.065 | 1.014 | 0.609 | 0.288 | 0.281 |
| Departure Headway (Hd) | 10.718 | 10.014 | 10.448 | 9.749 | 10.284 | 9.406 | 10.499 | 9.976 | 9.244 |
| Convergence, Y/N | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Cap | 338 | 364 | 346 | 373 | 352 | 392 | 347 | 362 | 391 |
| Service Time | 8.418 | 7.714 | 8.148 | 7.449 | 7.939 | 7.061 | 8.199 | 7.676 | 6.944 |
| HCM Lane V/C Ratio | 0.373 | 0.632 | 0.338 | 0.745 | 0.065 | 0.99 | 0.617 | 0.296 | 0.284 |
| HCM Control Delay | 19.4 | 27.8 | 18.3 | 36.1 | 13.6 | 80.6 | 28.3 | 16.7 | 15.5 |
| HCM Lane LOS | C | D | C | E | B | F | D | C | C |
| HCM 95th-tile Q | 1.6 | 4 | 1.4 | 5.9 | 0.2 | 12.4 | 3.8 | 1.2 | 1.1 |



HCM Signalized Intersection Capacity Analysis
9: San Marin Dr/Sutro Ave & Novato Blvd #1 06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 108 | 193 | 63 | 21 | 180 | 177 | 116 | 161 | 51 | 197 | 98 | 102 |
| Future Volume (vph) | 108 | 193 | 63 | 21 | 180 | 177 | 116 | 161 | 51 | 197 | 98 | 102 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 4.0 | | 3.0 | 4.0 | | 3.0 | 4.0 | | 3.0 | 4.0 | 4.0 |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.96 | | 1.00 | 0.93 | | 1.00 | 0.96 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1770 | 1794 | | 1770 | 1724 | | 1770 | 1796 | | 1770 | 1863 | 1583 |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1770 | 1794 | | 1770 | 1724 | | 1770 | 1796 | | 1770 | 1863 | 1583 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 117 | 210 | 68 | 23 | 196 | 192 | 126 | 175 | 55 | 214 | 107 | 111 |
| RTOR Reduction (vph) | 0 | 12 | 0 | 0 | 38 | 0 | 0 | 13 | 0 | 0 | 0 | 77 |
| Lane Group Flow (vph) | 117 | 266 | 0 | 23 | 350 | 0 | 126 | 217 | 0 | 214 | 107 | 34 |
| Turn Type | Prot | NA | | Prot | NA | | Prot | NA | | Prot | NA | Perm |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | | | | | | | | | | 6 |
| Actuated Green, G (s) | 7.0 | 25.9 | | 1.6 | 20.5 | | 7.8 | 15.7 | | 13.5 | 21.4 | 21.4 |
| Effective Green, g (s) | 7.0 | 25.9 | | 1.6 | 20.5 | | 7.8 | 15.7 | | 13.5 | 21.4 | 21.4 |
| Actuated g/C Ratio | 0.10 | 0.37 | | 0.02 | 0.29 | | 0.11 | 0.22 | | 0.19 | 0.30 | 0.30 |
| Clearance Time (s) | 3.0 | 4.0 | | 3.0 | 4.0 | | 3.0 | 4.0 | | 3.0 | 4.0 | 4.0 |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | 175 | 657 | | 40 | 499 | | 195 | 398 | | 337 | 563 | 479 |
| v/s Ratio Prot | c0.07 | 0.15 | | 0.01 | c0.20 | | 0.07 | c0.12 | | c0.12 | 0.06 | |
| v/s Ratio Perm | | | | | | | | | | | | 0.02 |
| v/c Ratio | 0.67 | 0.40 | | 0.57 | 0.70 | | 0.65 | 0.54 | | 0.64 | 0.19 | 0.07 |
| Uniform Delay, d1 | 30.7 | 16.7 | | 34.2 | 22.4 | | 30.1 | 24.3 | | 26.3 | 18.2 | 17.6 |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 9.3 | 0.4 | | 18.4 | 4.4 | | 7.2 | 1.5 | | 3.9 | 0.2 | 0.1 |
| Delay (s) | 40.0 | 17.1 | | 52.6 | 26.8 | | 37.3 | 25.9 | | 30.2 | 18.4 | 17.6 |
| Level of Service | D | B | | D | C | | D | C | | C | B | B |
| Approach Delay (s) | | 23.9 | | | 28.2 | | | 29.9 | | | 24.1 | |
| Approach LOS | | C | | | C | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 26.4 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.64 | | |
| Actuated Cycle Length (s) | 70.7 | Sum of lost time (s) | 14.0 |
| Intersection Capacity Utilization | 62.1% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

# MOVEMENT SUMMARY

## Site: 9 [AM Cumulative Alt]

Novato Boulevard/San Marin Dr-Sutro Ave
AM Cumulative with Project Alternative

Roundabout

**Movement Performance - Vehicles**

| Mov ID | OD Mov | Demand Flows Total veh/h | Demand Flows HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance ft | Prop. Queued | Effective Stop Rate per veh | Average Speed mph |
|---|---|---|---|---|---|---|---|---|---|---|---|
| South: NB Sutro Ave | | | | | | | | | | | |
| 3 | L2 | 126 | 2.0 | 0.463 | 10.9 | LOS B | 2.6 | 66.9 | 0.70 | 0.74 | 31.2 |
| 8 | T1 | 175 | 2.0 | 0.463 | 10.9 | LOS B | 2.6 | 66.9 | 0.70 | 0.74 | 31.2 |
| 18 | R2 | 55 | 2.0 | 0.463 | 10.9 | LOS B | 2.6 | 66.9 | 0.70 | 0.74 | 30.4 |
| Approach | | 357 | 2.0 | 0.463 | 10.9 | LOS B | 2.6 | 66.9 | 0.70 | 0.74 | 31.1 |
| East: WB Novato Blvd | | | | | | | | | | | |
| 1 | L2 | 23 | 2.0 | 0.469 | 10.0 | LOS B | 2.8 | 70.8 | 0.66 | 0.65 | 32.3 |
| 6 | T1 | 196 | 2.0 | 0.469 | 10.0 | LOS B | 2.8 | 70.8 | 0.66 | 0.65 | 32.3 |
| 16 | R2 | 192 | 2.0 | 0.469 | 10.0 | LOS B | 2.8 | 70.8 | 0.66 | 0.65 | 31.4 |
| Approach | | 411 | 2.0 | 0.469 | 10.0 | LOS B | 2.8 | 70.8 | 0.66 | 0.65 | 31.9 |
| North: SB San Marin Drive | | | | | | | | | | | |
| 7 | L2 | 214 | 2.0 | 0.317 | 6.8 | LOS A | 1.5 | 37.8 | 0.51 | 0.42 | 32.3 |
| 4 | T1 | 107 | 2.0 | 0.317 | 6.8 | LOS A | 1.5 | 37.8 | 0.51 | 0.42 | 32.3 |
| 14 | R2 | 111 | 2.0 | 0.110 | 4.5 | LOS A | 0.4 | 11.0 | 0.42 | 0.32 | 34.0 |
| Approach | | 432 | 2.0 | 0.317 | 6.2 | LOS A | 1.5 | 37.8 | 0.48 | 0.40 | 32.7 |
| West: EB Novato Blvd | | | | | | | | | | | |
| 5 | L2 | 117 | 2.0 | 0.418 | 8.6 | LOS A | 2.3 | 58.1 | 0.60 | 0.52 | 32.4 |
| 2 | T1 | 210 | 2.0 | 0.418 | 8.6 | LOS A | 2.3 | 58.1 | 0.60 | 0.52 | 32.4 |
| 12 | R2 | 68 | 2.0 | 0.418 | 8.6 | LOS A | 2.3 | 58.1 | 0.60 | 0.52 | 31.6 |
| Approach | | 396 | 2.0 | 0.418 | 8.6 | LOS A | 2.3 | 58.1 | 0.60 | 0.52 | 32.2 |
| All Vehicles | | 1595 | 2.0 | 0.469 | 8.9 | LOS A | 2.8 | 70.8 | 0.61 | 0.57 | 32.0 |

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.



# LANE SUMMARY

## Site: 9 [AM Cumulative Alt]

Novato Boulevard/San Marin Dr-Sutro Ave
AM Cumulative with Project Alternative

Roundabout

**Lane Use and Performance**

| | Demand Flows Total veh/h | Demand Flows HV % | Cap. veh/h | Deg. Satn v/c | Lane Util. % | Average Delay sec | Level of Service | 95% Back of Queue Veh | 95% Back of Queue Dist ft | Lane Config | Lane Length ft | Cap. Adj. % | Prob. Block. % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| South: NB Sutro Ave | | | | | | | | | | | | | |
| Lane 1[d] | 357 | 2.0 | 770 | 0.463 | 100 | 10.9 | LOS B | 2.6 | 66.9 | Full | 1600 | 0.0 | 0.0 |
| Approach | 357 | 2.0 | | 0.463 | | 10.9 | LOS B | 2.6 | 66.9 | | | | |
| East: WB Novato Blvd | | | | | | | | | | | | | |
| Lane 1[d] | 411 | 2.0 | 875 | 0.469 | 100 | 10.0 | LOS B | 2.8 | 70.8 | Full | 1600 | 0.0 | 0.0 |
| Approach | 411 | 2.0 | | 0.469 | | 10.0 | LOS B | 2.8 | 70.8 | | | | |
| North: SB San Marin Drive | | | | | | | | | | | | | |
| Lane 1[d] | 321 | 2.0 | 1011 | 0.317 | 100 | 6.8 | LOS A | 1.5 | 37.8 | Full | 1600 | 0.0 | 0.0 |
| Lane 2 | 111 | 2.0 | 1011 | 0.110 | 100 | 4.5 | LOS A | 0.4 | 11.0 | Short | 30 | 0.0 | NA |
| Approach | 432 | 2.0 | | 0.317 | | 6.2 | LOS A | 1.5 | 37.8 | | | | |
| West: EB Novato Blvd | | | | | | | | | | | | | |
| Lane 1[d] | 396 | 2.0 | 946 | 0.418 | 100 | 8.6 | LOS A | 2.3 | 58.1 | Full | 1600 | 0.0 | 0.0 |
| Approach | 396 | 2.0 | | 0.418 | | 8.6 | LOS A | 2.3 | 58.1 | | | | |
| Intersection | 1595 | 2.0 | | 0.469 | | 8.9 | LOS A | 2.8 | 70.8 | | | | |

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 725 | 17 | 270 | 478 | 30 | 466 |
| Future Volume (vph) | 725 | 17 | 270 | 478 | 30 | 466 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.9 | | 3.0 | 3.6 | 3.6 | 3.6 |
| Lane Util. Factor | 0.95 | | 1.00 | 0.95 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | | 1.00 | 1.00 | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | | 1.00 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 1.00 | | 0.95 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (prot) | 3561 | | 1787 | 3610 | 1805 | 1593 |
| Flt Permitted | 1.00 | | 0.95 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (perm) | 3561 | | 1787 | 3610 | 1805 | 1593 |
| Peak-hour factor, PHF | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 |
| Adj. Flow (vph) | 853 | 20 | 318 | 562 | 35 | 548 |
| RTOR Reduction (vph) | 1 | 0 | 0 | 0 | 0 | 348 |
| Lane Group Flow (vph) | 872 | 0 | 318 | 562 | 35 | 200 |
| Confl. Peds. (#/hr) | | 3 | | | 6 | 2 |
| Heavy Vehicles (%) | 1% | 0% | 1% | 0% | 0% | 0% |
| Turn Type | NA | | Prot | NA | Prot | Perm |
| Protected Phases | 2 | | 1 | 6 | 4 | |
| Permitted Phases | | | | | | 4 |
| Actuated Green, G (s) | 45.8 | | 18.0 | 46.1 | 15.7 | 15.7 |
| Effective Green, g (s) | 45.8 | | 18.0 | 46.1 | 15.7 | 15.7 |
| Actuated g/C Ratio | 0.51 | | 0.20 | 0.51 | 0.17 | 0.17 |
| Clearance Time (s) | 3.9 | | 3.0 | 3.6 | 3.6 | 3.6 |
| Vehicle Extension (s) | 3.0 | | 2.0 | 3.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 1812 | | 357 | 1849 | 314 | 277 |
| v/s Ratio Prot | c0.24 | | c0.18 | 0.16 | 0.02 | |
| v/s Ratio Perm | | | | | | c0.13 |
| v/c Ratio | 0.48 | | 0.89 | 0.30 | 0.11 | 0.72 |
| Uniform Delay, d1 | 14.4 | | 35.0 | 12.7 | 31.3 | 35.1 |
| Progression Factor | 1.00 | | 1.03 | 0.49 | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.9 | | 21.4 | 0.4 | 0.1 | 7.6 |
| Delay (s) | 15.3 | | 57.4 | 6.6 | 31.3 | 42.7 |
| Level of Service | B | | E | A | C | D |
| Approach Delay (s) | 15.3 | | | 25.0 | 42.0 | |
| Approach LOS | B | | | C | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 25.6 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.62 | | |
| Actuated Cycle Length (s) | 90.0 | Sum of lost time (s) | 10.5 |
| Intersection Capacity Utilization | 56.3% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |





| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 291 | 880 | 491 | 96 | 87 | 277 |
| Future Volume (vph) | 291 | 880 | 491 | 96 | 87 | 277 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.9 | 3.6 | | 3.0 | 3.0 |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.98 | | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 3574 | 3510 | | 1805 | 1599 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | 1805 | 3574 | 3510 | | 1805 | 1599 |
| Peak-hour factor, PHF | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 |
| Adj. Flow (vph) | 342 | 1035 | 578 | 113 | 102 | 326 |
| RTOR Reduction (vph) | 0 | 0 | 14 | 0 | 0 | 267 |
| Lane Group Flow (vph) | 342 | 1035 | 677 | 0 | 102 | 59 |
| Confl. Peds. (#/hr) | | | | | 2 | |
| Confl. Bikes (#/hr) | | | | 1 | | |
| Heavy Vehicles (%) | 0% | 1% | 0% | 0% | 0% | 1% |
| Turn Type | Prot | NA | NA | | Prot | Perm |
| Protected Phases | 5 | 2 | 6 | | 8 | |
| Permitted Phases | | | | | | 8 |
| Actuated Green, G (s) | 18.0 | 45.8 | 46.1 | | 16.3 | 16.3 |
| Effective Green, g (s) | 18.0 | 45.8 | 46.1 | | 16.3 | 16.3 |
| Actuated g/C Ratio | 0.20 | 0.51 | 0.51 | | 0.18 | 0.18 |
| Clearance Time (s) | 3.0 | 3.9 | 3.6 | | 3.0 | 3.0 |
| Vehicle Extension (s) | 2.0 | 3.0 | 3.0 | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 361 | 1818 | 1797 | | 326 | 289 |
| v/s Ratio Prot | c0.19 | c0.29 | 0.19 | | c0.06 | |
| v/s Ratio Perm | | | | | | 0.04 |
| v/c Ratio | 0.95 | 0.57 | 0.38 | | 0.31 | 0.20 |
| Uniform Delay, d1 | 35.5 | 15.3 | 13.3 | | 32.0 | 31.3 |
| Progression Factor | 1.05 | 0.49 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 32.0 | 1.1 | 0.6 | | 0.2 | 0.1 |
| Delay (s) | 69.4 | 8.5 | 13.9 | | 32.2 | 31.5 |
| Level of Service | E | A | B | | C | C |
| Approach Delay (s) | | 23.7 | 13.9 | | 31.6 | |
| Approach LOS | | C | B | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 22.3 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.61 | | |
| Actuated Cycle Length (s) | 90.0 | Sum of lost time (s) | 10.5 |
| Intersection Capacity Utilization | 47.8% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 12: Novato Blvd & Grant Ave

01/23/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 200 | 877 | 3 | 4 | 437 | 60 | 1 | 0 | 2 | 37 | 1 | 186 |
| Future Volume (vph) | 200 | 877 | 3 | 4 | 437 | 60 | 1 | 0 | 2 | 37 | 1 | 186 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.5 | 4.5 | 3.5 | 4.9 | 4.9 | | 4.0 | | 3.5 | 3.5 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 | | 1.00 | | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.96 | | 0.97 | | 1.00 | 0.98 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | | 0.98 | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | | 0.91 | | 1.00 | 0.85 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 0.98 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1787 | 1863 | 1576 | 1805 | 3539 | 1534 | | 1644 | | 1748 | 1569 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 0.70 | | 0.76 | 1.00 | |
| Satd. Flow (perm) | 1787 | 1863 | 1576 | 1805 | 3539 | 1534 | | 1168 | | 1390 | 1569 | |
| Peak-hour factor, PHF | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 |
| Adj. Flow (vph) | 235 | 1032 | 4 | 5 | 514 | 71 | 1 | 0 | 2 | 44 | 1 | 219 |
| RTOR Reduction (vph) | 0 | 0 | 1 | 0 | 0 | 28 | 0 | 3 | 0 | 0 | 194 | 0 |
| Lane Group Flow (vph) | 235 | 1032 | 3 | 5 | 514 | 43 | 0 | 0 | 0 | 44 | 26 | 0 |
| Confl. Peds. (#/hr) | | | 1 | | | 8 | 5 | | 12 | 12 | | 5 |
| Confl. Bikes (#/hr) | | | 4 | | | 2 | | | 2 | | | 1 |
| Heavy Vehicles (%) | 1% | 2% | 0% | 0% | 2% | 1% | 0% | 0% | 0% | 1% | 0% | 1% |
| Turn Type | Prot | NA | Perm | Prot | NA | Perm | Perm | NA | | Perm | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | 2 | | | 6 | 8 | | | 4 | | |
| Actuated Green, G (s) | 16.7 | 75.9 | 75.9 | 1.2 | 60.0 | 60.0 | | 10.9 | | 11.4 | 11.4 | |
| Effective Green, g (s) | 16.7 | 75.9 | 75.9 | 1.2 | 60.0 | 60.0 | | 10.9 | | 11.4 | 11.4 | |
| Actuated g/C Ratio | 0.17 | 0.76 | 0.76 | 0.01 | 0.60 | 0.60 | | 0.11 | | 0.11 | 0.11 | |
| Clearance Time (s) | 3.5 | 4.5 | 4.5 | 3.5 | 4.9 | 4.9 | | 4.0 | | 3.5 | 3.5 | |
| Vehicle Extension (s) | 2.0 | 3.0 | 3.0 | 2.0 | 3.0 | 3.0 | | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 298 | 1414 | 1196 | 21 | 2123 | 920 | | 127 | | 158 | 178 | |
| v/s Ratio Prot | c0.13 | c0.55 | | 0.00 | 0.15 | | | | | | 0.02 | |
| v/s Ratio Perm | | | 0.00 | | | 0.03 | | 0.00 | | c0.03 | | |
| v/c Ratio | 0.79 | 0.73 | 0.00 | 0.24 | 0.24 | 0.05 | | 0.00 | | 0.28 | 0.15 | |
| Uniform Delay, d1 | 40.0 | 6.5 | 2.9 | 48.9 | 9.4 | 8.2 | | 39.7 | | 40.5 | 39.9 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 0.87 | 1.00 | 1.50 | | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 12.0 | 1.9 | 0.0 | 2.0 | 0.3 | 0.1 | | 0.0 | | 0.4 | 0.1 | |
| Delay (s) | 52.0 | 8.4 | 2.9 | 44.8 | 9.6 | 12.5 | | 39.7 | | 40.9 | 40.1 | |
| Level of Service | D | A | A | D | A | B | | D | | D | D | |
| Approach Delay (s) | | 16.5 | | | 10.3 | | | 39.7 | | | 40.2 | |
| Approach LOS | | B | | | B | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 17.7 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.71 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 12.4 |
| Intersection Capacity Utilization | 75.3% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 13: Tamalpais Ave/7th St & Novato Blvd

01/23/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 96 | 785 | 37 | 62 | 460 | 122 | 39 | 102 | 38 | 72 | 109 | 46 |
| Future Volume (vph) | 96 | 785 | 37 | 62 | 460 | 122 | 39 | 102 | 38 | 72 | 109 | 46 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 5.0 | | 3.5 | 5.0 | 5.0 | 3.5 | 3.5 | | 3.5 | 3.5 | 3.5 |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 0.95 | 1.00 | 0.99 | | 1.00 | 1.00 | 0.96 |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 0.99 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.99 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.96 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1787 | 1847 | | 1787 | 1863 | 1523 | 1770 | 1794 | | 1784 | 1881 | 1531 |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.56 | 1.00 | | 0.46 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1787 | 1847 | | 1787 | 1863 | 1523 | 1049 | 1794 | | 862 | 1881 | 1531 |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 102 | 835 | 39 | 66 | 489 | 130 | 41 | 109 | 40 | 77 | 116 | 49 |
| RTOR Reduction (vph) | 0 | 1 | 0 | 0 | 0 | 19 | 0 | 15 | 0 | 0 | 0 | 42 |
| Lane Group Flow (vph) | 102 | 873 | 0 | 66 | 489 | 111 | 41 | 134 | 0 | 77 | 116 | 7 |
| Confl. Peds. (#/hr) | | | 11 | | | 17 | 6 | | 1 | 1 | | 6 |
| Confl. Bikes (#/hr) | | | 9 | | | 1 | | | 1 | | | 4 |
| Heavy Vehicles (%) | 1% | 2% | 1% | 1% | 2% | 1% | 1% | 1% | 1% | 1% | 1% | 1% |
| Turn Type | Prot | NA | | Prot | NA | Perm | Perm | NA | | Perm | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | | | | 6 | 8 | | | 4 | | 4 |
| Actuated Green, G (s) | 9.2 | 66.3 | | 7.8 | 64.9 | 64.9 | 13.9 | 13.9 | | 13.9 | 13.9 | 13.9 |
| Effective Green, g (s) | 9.2 | 66.3 | | 7.8 | 64.9 | 64.9 | 13.9 | 13.9 | | 13.9 | 13.9 | 13.9 |
| Actuated g/C Ratio | 0.09 | 0.66 | | 0.08 | 0.65 | 0.65 | 0.14 | 0.14 | | 0.14 | 0.14 | 0.14 |
| Clearance Time (s) | 3.5 | 5.0 | | 3.5 | 5.0 | 5.0 | 3.5 | 3.5 | | 3.5 | 3.5 | 3.5 |
| Vehicle Extension (s) | 2.0 | 5.0 | | 2.0 | 5.0 | 5.0 | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 164 | 1224 | | 139 | 1209 | 988 | 145 | 249 | | 119 | 261 | 212 |
| v/s Ratio Prot | c0.06 | c0.47 | | 0.04 | 0.26 | | | 0.07 | | | 0.06 | |
| v/s Ratio Perm | | | | | | 0.07 | 0.04 | | | c0.09 | | 0.00 |
| v/c Ratio | 0.62 | 0.71 | | 0.47 | 0.40 | 0.11 | 0.28 | 0.54 | | 0.65 | 0.44 | 0.03 |
| Uniform Delay, d1 | 43.7 | 10.8 | | 44.1 | 8.4 | 6.6 | 38.6 | 40.1 | | 40.7 | 39.5 | 37.2 |
| Progression Factor | 0.87 | 1.05 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 3.8 | 2.6 | | 0.9 | 1.0 | 0.2 | 0.4 | 1.1 | | 8.7 | 0.4 | 0.0 |
| Delay (s) | 41.8 | 13.9 | | 45.1 | 9.4 | 6.9 | 39.0 | 41.2 | | 49.5 | 39.9 | 37.3 |
| Level of Service | D | B | | D | A | A | D | D | | D | D | D |
| Approach Delay (s) | | 16.8 | | | 12.3 | | | 40.7 | | | 42.4 | |
| Approach LOS | | B | | | B | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 20.5 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.70 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 82.0% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

# HCM Signalized Intersection Capacity Analysis
## 14: Novato Blvd & Diablo Ave

01/23/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 22 | 244 | 37 | 200 | 245 | 324 | 36 | 308 | 212 | 474 | 421 | 28 |
| Future Volume (vph) | 22 | 244 | 37 | 200 | 245 | 324 | 36 | 308 | 212 | 474 | 421 | 28 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 12 | 12 | 11 | 11 | 12 | 11 | 11 | 12 | 12 | 12 | 12 |
| Total Lost time (s) | | 3.7 | | 4.1 | 4.1 | 4.1 | 4.4 | 4.4 | 4.4 | 4.1 | 4.1 | |
| Lane Util. Factor | | 0.95 | | 0.91 | 0.91 | 1.00 | 1.00 | 1.00 | 1.00 | 0.91 | 0.91 | |
| Frpb, ped/bikes | | 1.00 | | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | | 0.98 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | |
| Flt Protected | | 1.00 | | 0.95 | 0.99 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.99 | |
| Satd. Flow (prot) | | 3487 | | 1557 | 3273 | 1510 | 1728 | 1801 | 1556 | 1610 | 3320 | |
| Flt Permitted | | 1.00 | | 0.95 | 0.99 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.99 | |
| Satd. Flow (perm) | | 3487 | | 1557 | 3273 | 1510 | 1728 | 1801 | 1556 | 1610 | 3320 | |
| Peak-hour factor, PHF | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Adj. Flow (vph) | 22 | 249 | 38 | 204 | 250 | 331 | 37 | 314 | 216 | 484 | 430 | 29 |
| RTOR Reduction (vph) | 0 | 8 | 0 | 0 | 0 | 216 | 0 | 0 | 167 | 0 | 2 | 0 |
| Lane Group Flow (vph) | 0 | 301 | 0 | 147 | 307 | 115 | 37 | 314 | 49 | 310 | 631 | 0 |
| Confl. Peds. (#/hr) | | | 7 | | | 15 | | | 2 | | | 4 |
| Confl. Bikes (#/hr) | | | 1 | | | 1 | | | 3 | | | 5 |
| Heavy Vehicles (%) | 1% | 1% | 1% | 2% | 1% | 2% | 1% | 2% | 2% | 2% | 2% | 1% |
| Turn Type | Split | NA | | Split | NA | Perm | Split | NA | Perm | Split | NA | |
| Protected Phases | 3 | 3 | | 4 | 4 | | 1 | 1 | | 2 | 2 | |
| Permitted Phases | | | | | | 4 | | | 1 | | 2 | |
| Actuated Green, G (s) | | 14.6 | | 15.3 | 15.3 | 15.3 | 21.0 | 21.0 | 21.0 | 24.5 | 24.5 | |
| Effective Green, g (s) | | 14.6 | | 15.3 | 15.3 | 15.3 | 21.0 | 21.0 | 21.0 | 24.5 | 24.5 | |
| Actuated g/C Ratio | | 0.16 | | 0.17 | 0.17 | 0.17 | 0.23 | 0.23 | 0.23 | 0.27 | 0.27 | |
| Clearance Time (s) | | 3.7 | | 4.1 | 4.1 | 4.1 | 4.4 | 4.4 | 4.4 | 4.1 | 4.1 | |
| Vehicle Extension (s) | | 2.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | | 555 | | 259 | 546 | 251 | 395 | 412 | 356 | 430 | 887 | |
| v/s Ratio Prot | | c0.09 | | c0.09 | 0.09 | | 0.02 | c0.17 | | c0.19 | 0.19 | |
| v/s Ratio Perm | | | | | | 0.08 | | | 0.03 | | | |
| v/c Ratio | | 0.54 | | 0.57 | 0.56 | 0.46 | 0.09 | 0.76 | 0.14 | 0.72 | 0.71 | |
| Uniform Delay, d1 | | 35.5 | | 35.2 | 35.1 | 34.5 | 27.9 | 33.0 | 28.2 | 30.5 | 30.4 | |
| Progression Factor | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 0.6 | | 1.7 | 0.8 | 0.5 | 0.0 | 7.3 | 0.1 | 5.0 | 2.3 | |
| Delay (s) | | 36.1 | | 36.9 | 35.9 | 35.0 | 27.9 | 40.4 | 28.2 | 35.5 | 32.7 | |
| Level of Service | | D | | D | D | C | C | D | C | D | C | |
| Approach Delay (s) | | 36.1 | | | 35.7 | | | 34.9 | | | 33.6 | |
| Approach LOS | | D | | | D | | | C | | | C | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| HCM 2000 Control Delay | 34.8 | HCM 2000 Level of Service | | C |
| HCM 2000 Volume to Capacity ratio | 0.67 | | | |
| Actuated Cycle Length (s) | 91.7 | Sum of lost time (s) | | 16.3 |
| Intersection Capacity Utilization | 73.6% | ICU Level of Service | | D |
| Analysis Period (min) | 15 | | | |

c Critical Lane Group



# HCM Signalized Intersection Capacity Analysis
## 14: Diablo Ave & Novato Blvd

02/12/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 22 | 244 | 37 | 200 | 245 | 324 | 36 | 308 | 212 | 474 | 421 | 28 |
| Future Volume (vph) | 22 | 244 | 37 | 200 | 245 | 324 | 36 | 308 | 212 | 474 | 421 | 28 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 11 | 11 | 11 | 11 | 11 | 12 | 11 | 11 | 12 | 10 | 12 | 12 |
| Total Lost time (s) | 4.0 | 4.1 | 4.1 | 4.0 | 4.0 | 4.0 | 4.0 | 4.1 | | 4.0 | 4.0 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | | 0.97 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.98 | 1.00 | 0.99 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.94 | | 1.00 | 0.99 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1728 | 1818 | 1518 | 1711 | 1818 | 1558 | 1728 | 3190 | | 3204 | 1843 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1728 | 1818 | 1518 | 1711 | 1818 | 1558 | 1728 | 3190 | | 3204 | 1843 | |
| Peak-hour factor, PHF | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Adj. Flow (vph) | 22 | 249 | 38 | 204 | 250 | 331 | 37 | 314 | 216 | 484 | 430 | 29 |
| RTOR Reduction (vph) | 0 | 0 | 29 | 0 | 0 | 135 | 0 | 124 | 0 | 0 | 2 | 0 |
| Lane Group Flow (vph) | 22 | 249 | 9 | 204 | 250 | 196 | 37 | 406 | 0 | 484 | 457 | 0 |
| Confl. Peds. (#/hr) | | | 7 | | | 15 | | | 2 | | | 4 |
| Confl. Bikes (#/hr) | | | 1 | | | 1 | | | 3 | | | 5 |
| Heavy Vehicles (%) | 1% | 1% | 1% | 2% | 1% | 2% | 1% | 2% | 2% | 2% | 2% | 1% |
| Turn Type | Prot | NA | Perm | Prot | NA | pm+ov | Prot | NA | | Prot | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | 1 | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | 4 | | | 8 | | | | | | |
| Actuated Green, G (s) | 1.7 | 19.5 | 19.5 | 13.5 | 31.4 | 48.0 | 3.3 | 18.3 | | 16.6 | 31.7 | |
| Effective Green, g (s) | 1.7 | 19.5 | 19.5 | 13.5 | 31.4 | 48.0 | 3.3 | 18.3 | | 16.6 | 31.7 | |
| Actuated g/C Ratio | 0.02 | 0.23 | 0.23 | 0.16 | 0.37 | 0.57 | 0.04 | 0.22 | | 0.20 | 0.38 | |
| Clearance Time (s) | 4.0 | 4.1 | 4.1 | 4.0 | 4.0 | 4.0 | 4.0 | 4.1 | | 4.0 | 4.0 | |
| Vehicle Extension (s) | 3.0 | 2.0 | 2.0 | 3.0 | 3.0 | 3.0 | 3.0 | 2.0 | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 34 | 421 | 351 | 274 | 678 | 963 | 67 | 694 | | 632 | 694 | |
| v/s Ratio Prot | 0.01 | c0.14 | | c0.12 | 0.14 | 0.04 | 0.02 | 0.13 | | c0.15 | c0.25 | |
| v/s Ratio Perm | | | 0.01 | | | 0.09 | | | | | | |
| v/c Ratio | 0.65 | 0.59 | 0.03 | 0.74 | 0.37 | 0.20 | 0.55 | 0.59 | | 0.77 | 0.66 | |
| Uniform Delay, d1 | 40.9 | 28.8 | 25.0 | 33.7 | 19.1 | 8.8 | 39.7 | 29.5 | | 31.9 | 21.7 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 35.3 | 1.5 | 0.0 | 10.5 | 0.3 | 0.1 | 9.5 | 0.8 | | 5.5 | 2.3 | |
| Delay (s) | 76.2 | 30.2 | 25.0 | 44.1 | 19.5 | 8.9 | 49.2 | 30.3 | | 37.4 | 24.0 | |
| Level of Service | E | C | C | D | B | A | D | C | | D | C | |
| Approach Delay (s) | | 32.9 | | | 21.4 | | | 31.5 | | | 30.9 | |
| Approach LOS | | C | | | C | | | C | | | C | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| HCM 2000 Control Delay | 28.4 | HCM 2000 Level of Service | | C |
| HCM 2000 Volume to Capacity ratio | 0.71 | | | |
| Actuated Cycle Length (s) | 84.1 | Sum of lost time (s) | | 16.2 |
| Intersection Capacity Utilization | 70.2% | ICU Level of Service | | C |
| Analysis Period (min) | 15 | | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 15: Redwood Blvd & Diablo Ave/De Long Ave



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 234 | 489 | 168 | 156 | 574 | 213 | 54 | 143 | 31 | 204 | 276 | 171 |
| Future Volume (vph) | 234 | 489 | 168 | 156 | 574 | 213 | 54 | 143 | 31 | 204 | 276 | 171 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 9 |
| Total Lost time (s) | 5.0 | 4.0 | | 5.0 | 4.1 | | 4.0 | 4.8 | 4.8 | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 0.95 | | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 | 0.97 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 0.99 | | 1.00 | 0.99 | | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.98 |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.96 | | 1.00 | 0.96 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3467 | 3454 | | 1805 | 3351 | | 1805 | 3610 | 1505 | 3303 | 1900 | 1408 |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3467 | 3454 | | 1805 | 3351 | | 1805 | 3610 | 1505 | 3303 | 1900 | 1408 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 254 | 532 | 183 | 170 | 624 | 232 | 59 | 155 | 34 | 222 | 300 | 186 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 0 | 0 | 58 |
| Lane Group Flow (vph) | 254 | 715 | 0 | 170 | 856 | 0 | 59 | 155 | 19 | 222 | 300 | 128 |
| Confl. Peds. (#/hr) | | | 5 | | | 5 | | | 5 | | | 5 |
| Confl. Bikes (#/hr) | | | 5 | | | 5 | | | 5 | | | 5 |
| Heavy Vehicles (%) | 1% | 0% | 0% | 0% | 2% | 5% | 0% | 0% | 5% | 6% | 0% | 1% |
| Turn Type | Prot | NA | | Prot | NA | | Prot | NA | Perm | Prot | NA | Perm |
| Protected Phases | 3 | 8 | | 7 | 4 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | | | | | | | 2 | | | 6 |
| Actuated Green, G (s) | 17.0 | 48.2 | | 17.0 | 48.1 | | 10.4 | 36.0 | 36.0 | 11.0 | 37.4 | 37.4 |
| Effective Green, g (s) | 17.0 | 48.2 | | 17.0 | 48.1 | | 10.4 | 36.0 | 36.0 | 11.0 | 37.4 | 37.4 |
| Actuated g/C Ratio | 0.13 | 0.37 | | 0.13 | 0.37 | | 0.08 | 0.28 | 0.28 | 0.08 | 0.29 | 0.29 |
| Clearance Time (s) | 5.0 | 4.0 | | 5.0 | 4.1 | | 4.0 | 4.8 | 4.8 | 4.0 | 4.0 | 4.0 |
| Vehicle Extension (s) | 2.5 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 453 | 1280 | | 236 | 1239 | | 144 | 999 | 416 | 279 | 546 | 405 |
| v/s Ratio Prot | 0.07 | 0.21 | | c0.09 | c0.26 | | 0.03 | 0.04 | | c0.07 | c0.16 | |
| v/s Ratio Perm | | | | | | | | | 0.01 | | | 0.09 |
| v/c Ratio | 0.56 | 0.56 | | 0.72 | 0.69 | | 0.41 | 0.16 | 0.05 | 0.80 | 0.55 | 0.32 |
| Uniform Delay, d1 | 53.0 | 32.5 | | 54.2 | 34.7 | | 56.9 | 35.5 | 34.4 | 58.4 | 39.2 | 36.3 |
| Progression Factor | 1.00 | 1.00 | | 1.12 | 0.88 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 1.3 | 1.8 | | 7.7 | 2.7 | | 0.7 | 0.3 | 0.2 | 13.6 | 3.9 | 2.0 |
| Delay (s) | 54.3 | 34.2 | | 68.5 | 33.3 | | 57.6 | 35.8 | 34.6 | 72.0 | 43.1 | 38.3 |
| Level of Service | D | C | | E | C | | E | D | C | E | D | D |
| Approach Delay (s) | | 39.5 | | | 39.2 | | | 40.8 | | | 50.9 | |
| Approach LOS | | D | | | D | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 42.2 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.67 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 17.9 |
| Intersection Capacity Utilization | 103.4% | ICU Level of Service | G |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 16: Reichert Ave & De Long Ave



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 71 | 664 | 14 | 66 | 949 | 208 | 13 | 22 | 40 | 190 | 37 | 78 |
| Future Volume (vph) | 71 | 664 | 14 | 66 | 949 | 208 | 13 | 22 | 40 | 190 | 37 | 78 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 0.95 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 0.99 | | 1.00 | 1.00 | 0.98 | 1.00 | 0.98 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 0.99 | 1.00 | 1.00 | 0.99 | 1.00 | |
| Frt | 1.00 | 1.00 | | 1.00 | 0.97 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.90 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1805 | 3527 | | 1805 | 3459 | | 1793 | 1900 | 1578 | 1778 | 1676 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.55 | 1.00 | 1.00 | 0.74 | 1.00 | |
| Satd. Flow (perm) | 1805 | 3527 | | 1805 | 3459 | | 1039 | 1900 | 1578 | 1388 | 1676 | |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Adj. Flow (vph) | 79 | 738 | 16 | 73 | 1054 | 231 | 14 | 24 | 44 | 211 | 41 | 87 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 9 | 0 | 28 | 0 |
| Lane Group Flow (vph) | 79 | 754 | 0 | 73 | 1279 | 0 | 14 | 24 | 35 | 211 | 100 | 0 |
| Confl. Peds. (#/hr) | | | 6 | | | 3 | 6 | | 4 | 4 | | 6 |
| Confl. Bikes (#/hr) | | | 5 | | | 5 | | | 5 | | | 5 |
| Heavy Vehicles (%) | 0% | 2% | 0% | 0% | 1% | 1% | 0% | 0% | 0% | 1% | 0% | 0% |
| Turn Type | Prot | NA | | Prot | NA | | Perm | NA | Perm | Perm | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | | | | | 8 | | 8 | 4 | | |
| Actuated Green, G (s) | 9.0 | 86.0 | | 8.7 | 85.7 | | 24.7 | 24.7 | 24.7 | 24.7 | 24.7 | |
| Effective Green, g (s) | 9.0 | 86.0 | | 8.7 | 85.7 | | 24.7 | 24.7 | 24.7 | 24.7 | 24.7 | |
| Actuated g/C Ratio | 0.07 | 0.66 | | 0.07 | 0.66 | | 0.19 | 0.19 | 0.19 | 0.19 | 0.19 | |
| Clearance Time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | |
| Vehicle Extension (s) | 2.0 | 3.0 | | 2.0 | 3.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 124 | 2333 | | 120 | 2280 | | 197 | 361 | 299 | 263 | 318 | |
| v/s Ratio Prot | c0.04 | 0.21 | | 0.04 | c0.37 | | | 0.01 | | | 0.06 | |
| v/s Ratio Perm | | | | | | | 0.01 | | 0.02 | c0.15 | | |
| v/c Ratio | 0.64 | 0.32 | | 0.61 | 0.56 | | 0.07 | 0.07 | 0.12 | 0.80 | 0.32 | |
| Uniform Delay, d1 | 58.9 | 9.5 | | 59.0 | 12.0 | | 43.2 | 43.2 | 43.6 | 50.3 | 45.4 | |
| Progression Factor | 1.01 | 1.12 | | 1.09 | 0.97 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 6.4 | 0.3 | | 5.5 | 0.9 | | 0.1 | 0.0 | 0.1 | 15.2 | 0.2 | |
| Delay (s) | 65.7 | 10.9 | | 69.7 | 12.6 | | 43.3 | 43.2 | 43.7 | 65.5 | 45.6 | |
| Level of Service | E | B | | E | B | | D | D | D | E | D | |
| Approach Delay (s) | | 16.1 | | | 15.7 | | | 43.5 | | | 58.0 | |
| Approach LOS | | B | | | B | | | D | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 22.2 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.62 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 68.7% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
## 17: US 101 SB Ramps & De Long Ave

06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 194 | 669 | 20 | 840 | 0 | 0 | 0 | 0 | 12 | 2 | 313 |
| Future Volume (vph) | 0 | 194 | 669 | 20 | 840 | 0 | 0 | 0 | 0 | 12 | 2 | 313 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.6 | 3.6 | 3.0 | 3.6 | | | | | 4.0 | 4.0 | |
| Lane Util. Factor | | 0.95 | 1.00 | 1.00 | 0.95 | | | | | 0.95 | 0.95 | |
| Frt | | 1.00 | 0.85 | 1.00 | 1.00 | | | | | 1.00 | 0.85 | |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 3574 | 1599 | 1770 | 3539 | | | | | 1681 | 1506 | |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | 0.95 | 1.00 | |
| Satd. Flow (perm) | | 3574 | 1599 | 1770 | 3539 | | | | | 1681 | 1506 | |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 0 | 206 | 712 | 21 | 894 | 0 | 0 | 0 | 0 | 13 | 2 | 333 |
| RTOR Reduction (vph) | 0 | 0 | 280 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 111 | 0 |
| Lane Group Flow (vph) | 0 | 206 | 432 | 21 | 894 | 0 | 0 | 0 | 0 | 12 | 225 | 0 |
| Heavy Vehicles (%) | 0% | 1% | 1% | 2% | 2% | 2% | 2% | 2% | 2% | 2% | 2% | 2% |
| Turn Type | | NA | Perm | Prot | NA | | | | | Split | NA | |
| Protected Phases | | 6 | | 5 | 2 | | | | | 4 | 4 | |
| Permitted Phases | | | 6 | | | | | | | | | |
| Actuated Green, G (s) | | 39.4 | 39.4 | 1.4 | 43.8 | | | | | 13.6 | 13.6 | |
| Effective Green, g (s) | | 39.4 | 39.4 | 1.4 | 43.8 | | | | | 13.6 | 13.6 | |
| Actuated g/C Ratio | | 0.61 | 0.61 | 0.02 | 0.67 | | | | | 0.21 | 0.21 | |
| Clearance Time (s) | | 3.6 | 3.6 | 3.0 | 3.6 | | | | | 4.0 | 4.0 | |
| Vehicle Extension (s) | | 4.0 | 4.0 | 2.0 | 4.0 | | | | | 2.5 | 2.5 | |
| Lane Grp Cap (vph) | | 2166 | 969 | 38 | 2384 | | | | | 351 | 315 | |
| v/s Ratio Prot | | 0.06 | | c0.01 | 0.25 | | | | | 0.01 | c0.15 | |
| v/s Ratio Perm | | | c0.27 | | | | | | | | | |
| v/c Ratio | | 0.10 | 0.45 | 0.55 | 0.38 | | | | | 0.03 | 0.71 | |
| Uniform Delay, d1 | | 5.3 | 6.9 | 31.5 | 4.6 | | | | | 20.5 | 23.9 | |
| Progression Factor | | 1.00 | 6.33 | 1.00 | 1.00 | | | | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 0.1 | 1.4 | 9.5 | 0.5 | | | | | 0.0 | 6.9 | |
| Delay (s) | | 5.5 | 45.1 | 41.0 | 5.1 | | | | | 20.5 | 30.8 | |
| Level of Service | | A | D | D | A | | | | | C | C | |
| Approach Delay (s) | | 36.2 | | | 5.9 | | | 0.0 | | | 30.5 | |
| Approach LOS | | D | | | A | | | A | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 22.6 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.51 | | |
| Actuated Cycle Length (s) | 65.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 64.8% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
## 18: US 101 NB Ramps & De Long Ave

06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 173 | 34 | 0 | 1 | 58 | 9 | 803 | 2 | 18 | 0 | 0 | 0 |
| Future Volume (vph) | 173 | 34 | 0 | 1 | 58 | 9 | 803 | 2 | 18 | 0 | 0 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 3.6 | | | 3.6 | | 4.5 | 4.5 | | | | |
| Lane Util. Factor | 1.00 | 0.95 | | | 0.95 | | 0.95 | 0.95 | | | | |
| Frt | 1.00 | 1.00 | | | 0.98 | | 1.00 | 0.99 | | | | |
| Flt Protected | 0.95 | 1.00 | | | 1.00 | | 0.95 | 0.95 | | | | |
| Satd. Flow (prot) | 1770 | 3610 | | | 3478 | | 1698 | 1689 | | | | |
| Flt Permitted | 0.95 | 1.00 | | | 0.95 | | 0.95 | 0.95 | | | | |
| Satd. Flow (perm) | 1770 | 3610 | | | 3310 | | 1698 | 1689 | | | | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 188 | 37 | 0 | 1 | 63 | 10 | 873 | 2 | 20 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 188 | 37 | 0 | 0 | 65 | 0 | 445 | 448 | 0 | 0 | 0 | 0 |
| Heavy Vehicles (%) | 2% | 0% | 0% | 0% | 0% | 12% | 1% | 0% | 8% | 0% | 0% | 0% |
| Turn Type | Prot | NA | | | NA | | Split | NA | | | | |
| Protected Phases | 1 | 6 | | | 2 | | 4 | 4 | | | | |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | 8.8 | 16.8 | | | 4.5 | | 20.4 | 20.4 | | | | |
| Effective Green, g (s) | 8.8 | 16.8 | | | 4.5 | | 20.4 | 20.4 | | | | |
| Actuated g/C Ratio | 0.19 | 0.37 | | | 0.10 | | 0.45 | 0.45 | | | | |
| Clearance Time (s) | 3.5 | 3.6 | | | 3.6 | | 4.5 | 4.5 | | | | |
| Vehicle Extension (s) | 2.5 | 2.0 | | | 2.0 | | 3.0 | 3.0 | | | | |
| Lane Grp Cap (vph) | 343 | 1338 | | | 328 | | 764 | 760 | | | | |
| v/s Ratio Prot | c0.11 | 0.01 | | | | | 0.26 | c0.27 | | | | |
| v/s Ratio Perm | | | | | c0.02 | | | | | | | |
| v/c Ratio | 0.55 | 0.03 | | | 1.00dr | | 0.58 | 0.59 | | | | |
| Uniform Delay, d1 | 16.5 | 9.1 | | | 18.7 | | 9.3 | 9.3 | | | | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | | | | |
| Incremental Delay, d2 | 1.4 | 0.0 | | | 0.1 | | 1.1 | 1.2 | | | | |
| Delay (s) | 17.9 | 9.1 | | | 18.9 | | 10.4 | 10.5 | | | | |
| Level of Service | B | A | | | B | | B | B | | | | |
| Approach Delay (s) | | 16.4 | | | 18.9 | | | 10.5 | | | 0.0 | |
| Approach LOS | | B | | | B | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 12.1 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.53 | | |
| Actuated Cycle Length (s) | 45.3 | Sum of lost time (s) | 11.6 |
| Intersection Capacity Utilization | 46.2% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

dr Defacto Right Lane. Recode with 1 though lane as a right lane.

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 19: Redwood Blvd & Lamont Ave



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 11 | 2 | 8 | 105 | 2 | 51 | 17 | 269 | 41 | 65 | 496 | 29 |
| Future Volume (vph) | 11 | 2 | 8 | 105 | 2 | 51 | 17 | 269 | 41 | 65 | 496 | 29 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.5 | 3.5 | | 3.5 | 3.5 | 3.5 | 4.8 | | 3.5 | 4.8 | 4.8 |
| Lane Util. Factor | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 |
| Frpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | 0.99 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Flpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | | 1.00 | 0.85 | | 1.00 | 0.85 | 1.00 | 0.98 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | | 0.96 | 1.00 | | 0.95 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | | 1821 | 1615 | | 1811 | 1595 | 1805 | 3527 | | 1805 | 3610 | 1615 |
| Flt Permitted | | 0.84 | 1.00 | | 0.74 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | | 1588 | 1615 | | 1399 | 1595 | 1805 | 3527 | | 1805 | 3610 | 1615 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 12 | 2 | 9 | 114 | 2 | 55 | 18 | 292 | 45 | 71 | 539 | 32 |
| RTOR Reduction (vph) | 0 | 0 | 7 | 0 | 0 | 40 | 0 | 12 | 0 | 0 | 0 | 18 |
| Lane Group Flow (vph) | 0 | 14 | 2 | 0 | 116 | 15 | 18 | 325 | 0 | 71 | 539 | 14 |
| Confl. Peds. (#/hr) | 1 | | | | | 1 | | | 2 | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Perm | NA | Perm | Perm | NA | Perm | Prot | NA | | Prot | NA | Perm |
| Protected Phases | | 8 | | | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | 8 | | 8 | 4 | | 4 | | | | | | 2 |
| Actuated Green, G (s) | | 12.7 | 12.7 | | 12.7 | 12.7 | 0.9 | 18.8 | | 3.1 | 21.0 | 21.0 |
| Effective Green, g (s) | | 12.7 | 12.7 | | 12.7 | 12.7 | 0.9 | 18.8 | | 3.1 | 21.0 | 21.0 |
| Actuated g/C Ratio | | 0.27 | 0.27 | | 0.27 | 0.27 | 0.02 | 0.41 | | 0.07 | 0.45 | 0.45 |
| Clearance Time (s) | | 3.5 | 3.5 | | 3.5 | 3.5 | 3.5 | 4.8 | | 3.5 | 4.8 | 4.8 |
| Vehicle Extension (s) | | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 | 3.0 | | 2.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | 434 | 442 | | 382 | 436 | 35 | 1429 | | 120 | 1633 | 730 |
| v/s Ratio Prot | | | | | | | 0.01 | 0.09 | | c0.04 | c0.15 | |
| v/s Ratio Perm | | 0.01 | 0.00 | | c0.08 | 0.01 | | | | | | 0.01 |
| v/c Ratio | | 0.03 | 0.01 | | 0.30 | 0.03 | 0.51 | 0.23 | | 0.59 | 0.33 | 0.02 |
| Uniform Delay, d1 | | 12.3 | 12.3 | | 13.3 | 12.4 | 22.5 | 9.0 | | 21.0 | 8.2 | 7.0 |
| Progression Factor | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.0 | 0.0 | | 0.2 | 0.0 | 5.2 | 0.1 | | 5.1 | 0.1 | 0.0 |
| Delay (s) | | 12.4 | 12.3 | | 13.5 | 12.4 | 27.7 | 9.1 | | 26.2 | 8.3 | 7.0 |
| Level of Service | | B | B | | B | B | C | A | | C | A | A |
| Approach Delay (s) | | 12.3 | | | 13.1 | | | 10.1 | | | 10.2 | |
| Approach LOS | | B | | | B | | | B | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 10.6 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.34 | | |
| Actuated Cycle Length (s) | 46.4 | Sum of lost time (s) | 11.8 |
| Intersection Capacity Utilization | 45.1% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 20: Redwood Blvd & Landing Ct



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 2 | 0 | 1 | 25 | 0 | 12 | 1 | 312 | 32 | 25 | 485 | 1 |
| Future Volume (vph) | 2 | 0 | 1 | 25 | 0 | 12 | 1 | 312 | 32 | 25 | 485 | 1 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.5 | | 3.5 | | 3.5 | | 4.8 | 4.8 | 3.5 | 4.8 | 4.8 |
| Lane Util. Factor | | 1.00 | | 1.00 | | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |
| Frpb, ped/bikes | | 1.00 | | 1.00 | | 1.00 | | 1.00 | 0.98 | 1.00 | 1.00 | 0.97 |
| Flpb, ped/bikes | | 1.00 | | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.95 | | 1.00 | | 0.85 | | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | | 0.97 | | 0.95 | | 1.00 | | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | | 1748 | | 1803 | | 1615 | | 3609 | 1579 | 1805 | 3610 | 1572 |
| Flt Permitted | | 0.97 | | 0.76 | | 1.00 | | 0.95 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | | 1748 | | 1434 | | 1615 | | 3444 | 1579 | 1805 | 3610 | 1572 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 2 | 0 | 1 | 27 | 0 | 13 | 1 | 339 | 35 | 27 | 527 | 1 |
| RTOR Reduction (vph) | 0 | 3 | 0 | 0 | 0 | 11 | 0 | 0 | 14 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 27 | 0 | 2 | 0 | 340 | 21 | 27 | 527 | 1 |
| Confl. Peds. (#/hr) | | | 4 | 4 | | | | | 3 | | | 6 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Perm | NA | | Perm | | Perm | Perm | NA | Perm | Prot | NA | Perm |
| Protected Phases | | 4 | | | | | | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | 2 | | | 6 |
| Actuated Green, G (s) | | 5.5 | | 5.5 | | 5.5 | | 26.1 | 26.1 | 0.8 | 30.4 | 30.4 |
| Effective Green, g (s) | | 5.5 | | 5.5 | | 5.5 | | 26.1 | 26.1 | 0.8 | 30.4 | 30.4 |
| Actuated g/C Ratio | | 0.12 | | 0.12 | | 0.12 | | 0.59 | 0.59 | 0.02 | 0.69 | 0.69 |
| Clearance Time (s) | | 3.5 | | 3.5 | | 3.5 | | 4.8 | 4.8 | 3.5 | 4.8 | 4.8 |
| Vehicle Extension (s) | | 3.0 | | 2.0 | | 2.0 | | 4.0 | 4.0 | 2.0 | 4.0 | 4.0 |
| Lane Grp Cap (vph) | | 217 | | 178 | | 200 | | 2033 | 932 | 32 | 2482 | 1081 |
| v/s Ratio Prot | | | | | | | | | | c0.01 | c0.15 | |
| v/s Ratio Perm | | 0.00 | | c0.02 | | 0.00 | | 0.10 | 0.01 | | | 0.00 |
| v/c Ratio | | 0.00 | | 0.15 | | 0.01 | | 0.17 | 0.02 | 0.84 | 0.21 | 0.00 |
| Uniform Delay, d1 | | 16.9 | | 17.3 | | 17.0 | | 4.1 | 3.8 | 21.6 | 2.5 | 2.2 |
| Progression Factor | | 1.00 | | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.0 | | 0.1 | | 0.0 | | 0.1 | 0.0 | 93.1 | 0.1 | 0.0 |
| Delay (s) | | 16.9 | | 17.4 | | 17.0 | | 4.2 | 3.8 | 114.7 | 2.6 | 2.2 |
| Level of Service | | B | | B | | B | | A | A | F | A | A |
| Approach Delay (s) | | 16.9 | | | 17.3 | | | 4.1 | | | 8.0 | |
| Approach LOS | | B | | | B | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 6.9 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.23 | | |
| Actuated Cycle Length (s) | 44.2 | Sum of lost time (s) | 11.8 |
| Intersection Capacity Utilization | 40.6% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 21: Novato Blvd & Center Rd/Garden Ct

06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 57 | 0 | 302 | 3 | 0 | 3 | 123 | 473 | 4 | 1 | 694 | 69 |
| Future Volume (vph) | 57 | 0 | 302 | 3 | 0 | 3 | 123 | 473 | 4 | 1 | 694 | 69 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.2 | 3.2 | | | 3.0 | | 3.0 | 4.4 | | 3.0 | 4.4 | |
| Lane Util. Factor | 1.00 | 1.00 | | | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.85 | | | 0.93 | | 1.00 | 1.00 | | 1.00 | 0.99 | |
| Flt Protected | 0.95 | 1.00 | | | 0.98 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1805 | 1615 | | | 1729 | | 1805 | 3605 | | 1805 | 3518 | |
| Flt Permitted | 0.75 | 1.00 | | | 0.59 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1432 | 1615 | | | 1050 | | 1805 | 3605 | | 1805 | 3518 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 62 | 0 | 328 | 3 | 0 | 3 | 134 | 514 | 4 | 1 | 754 | 75 |
| RTOR Reduction (vph) | 0 | 290 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 4 | 0 |
| Lane Group Flow (vph) | 62 | 38 | 0 | 0 | 1 | 0 | 134 | 518 | 0 | 1 | 825 | 0 |
| Confl. Peds. (#/hr) | | | | | | | | | 9 | | | 6 |
| Confl. Bikes (#/hr) | | | | | | | | | 2 | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 1% | 0% |
| Turn Type | Perm | NA | | Perm | NA | | Prot | NA | | Prot | NA | |
| Protected Phases | | 8 | | | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | 8 | | | 4 | | | | | | | | |
| Actuated Green, G (s) | 11.6 | 11.6 | | | 11.8 | | 12.4 | 75.6 | | 2.2 | 65.4 | |
| Effective Green, g (s) | 11.6 | 11.6 | | | 11.8 | | 12.4 | 75.6 | | 2.2 | 65.4 | |
| Actuated g/C Ratio | 0.12 | 0.12 | | | 0.12 | | 0.12 | 0.76 | | 0.02 | 0.65 | |
| Clearance Time (s) | 3.2 | 3.2 | | | 3.0 | | 3.0 | 4.4 | | 3.0 | 4.4 | |
| Vehicle Extension (s) | 3.0 | 3.0 | | | 2.0 | | 2.0 | 4.0 | | 2.0 | 4.0 | |
| Lane Grp Cap (vph) | 166 | 187 | | | 123 | | 223 | 2725 | | 39 | 2300 | |
| v/s Ratio Prot | | 0.02 | | | | | c0.07 | 0.14 | | 0.00 | c0.23 | |
| v/s Ratio Perm | c0.04 | | | | 0.00 | | | | | | | |
| v/c Ratio | 0.37 | 0.20 | | | 0.01 | | 0.60 | 0.19 | | 0.03 | 0.36 | |
| Uniform Delay, d1 | 40.8 | 40.0 | | | 38.9 | | 41.5 | 3.5 | | 47.9 | 7.8 | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | | 0.68 | 1.38 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 1.4 | 0.5 | | | 0.0 | | 3.1 | 0.2 | | 0.1 | 0.4 | |
| Delay (s) | 42.3 | 40.6 | | | 38.9 | | 31.2 | 4.9 | | 47.9 | 8.3 | |
| Level of Service | D | D | | | D | | C | A | | D | A | |
| Approach Delay (s) | | 40.8 | | | 38.9 | | | 10.3 | | | 8.3 | |
| Approach LOS | | D | | | D | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 15.9 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.39 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 58.8% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 22: Novato Blvd & Arthur St

06/13/2017

| Movement | EBL | EBR | NBL | NBT | SBU | SBT | SBR |
|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | |
| Traffic Volume (vph) | 162 | 129 | 229 | 511 | 18 | 867 | 186 |
| Future Volume (vph) | 162 | 129 | 229 | 511 | 18 | 867 | 186 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 3.5 | 3.5 | 4.9 | 3.5 | 4.9 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 0.98 | 1.00 | 1.00 | 1.00 | 0.99 | |
| Flpb, ped/bikes | 0.99 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 0.85 | 1.00 | 1.00 | 1.00 | 0.97 | |
| Flt Protected | 0.95 | 1.00 | 0.95 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1785 | 1579 | 1805 | 3610 | 1805 | 3467 | |
| Flt Permitted | 0.95 | 1.00 | 0.95 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1785 | 1579 | 1805 | 3610 | 1805 | 3467 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 176 | 140 | 249 | 555 | 20 | 942 | 202 |
| RTOR Reduction (vph) | 0 | 118 | 0 | 0 | 0 | 13 | 0 |
| Lane Group Flow (vph) | 176 | 22 | 249 | 555 | 20 | 1131 | 0 |
| Confl. Peds. (#/hr) | 10 | 8 | | | | | 5 |
| Confl. Bikes (#/hr) | | 1 | | | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 1% | 0% |
| Turn Type | Perm | Perm | Prot | NA | Prot | NA | |
| Protected Phases | | | 1 | 6 | 5 | 2 | |
| Permitted Phases | 4 | 4 | | | | | |
| Actuated Green, G (s) | 15.7 | 15.7 | 17.8 | 69.7 | 2.7 | 54.6 | |
| Effective Green, g (s) | 15.7 | 15.7 | 17.8 | 69.7 | 2.7 | 54.6 | |
| Actuated g/C Ratio | 0.16 | 0.16 | 0.18 | 0.70 | 0.03 | 0.55 | |
| Clearance Time (s) | 3.5 | 3.5 | 3.5 | 4.9 | 3.5 | 4.9 | |
| Vehicle Extension (s) | 2.0 | 2.0 | 2.0 | 4.0 | 2.0 | 4.0 | |
| Lane Grp Cap (vph) | 280 | 247 | 321 | 2516 | 48 | 1892 | |
| v/s Ratio Prot | | | c0.14 | 0.15 | 0.01 | c0.33 | |
| v/s Ratio Perm | c0.10 | 0.01 | | | | | |
| v/c Ratio | 0.63 | 0.09 | 0.78 | 0.22 | 0.42 | 0.60 | |
| Uniform Delay, d1 | 39.4 | 36.0 | 39.2 | 5.4 | 47.9 | 15.3 | |
| Progression Factor | 1.00 | 1.00 | 0.81 | 1.12 | 1.39 | 0.74 | |
| Incremental Delay, d2 | 3.2 | 0.1 | 8.5 | 0.2 | 2.0 | 1.3 | |
| Delay (s) | 42.6 | 36.1 | 40.1 | 6.2 | 68.5 | 12.6 | |
| Level of Service | D | D | D | A | E | B | |
| Approach Delay (s) | 39.7 | | | 16.7 | | 13.6 | |
| Approach LOS | D | | | B | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 18.3 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.64 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 11.9 |
| Intersection Capacity Utilization | 65.6% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 23: Novato Blvd & Rowland Blvd

06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 45 | 140 | 16 | 355 | 321 | 347 | 45 | 305 | 221 | 405 | 420 | 187 |
| Future Volume (vph) | 45 | 140 | 16 | 355 | 321 | 347 | 45 | 305 | 221 | 405 | 420 | 187 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 3.5 | | 3.5 | 4.1 | 4.1 | 3.5 | 4.1 | | 3.5 | 4.4 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 0.97 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 0.99 | | 1.00 | 1.00 | 0.99 | 1.00 | 0.99 | | 1.00 | 0.99 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.98 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.94 | | 1.00 | 0.95 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1805 | 1857 | | 1770 | 1900 | 1576 | 1805 | 1745 | | 3502 | 1790 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1805 | 1857 | | 1770 | 1900 | 1576 | 1805 | 1745 | | 3502 | 1790 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 47 | 147 | 17 | 374 | 338 | 365 | 47 | 321 | 233 | 426 | 442 | 197 |
| RTOR Reduction (vph) | 0 | 5 | 0 | 0 | 0 | 254 | 0 | 25 | 0 | 0 | 13 | 0 |
| Lane Group Flow (vph) | 47 | 159 | 0 | 374 | 338 | 111 | 47 | 529 | 0 | 426 | 626 | 0 |
| Confl. Peds. (#/hr) | | | 24 | | | 2 | | | 13 | | | 10 |
| Confl. Bikes (#/hr) | | | 1 | | | | | | 1 | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 2% | 0% | 1% | 0% | 0% | 2% | 0% | 0% | 0% |
| Turn Type | Prot | NA | | Prot | NA | Perm | Prot | NA | | Prot | NA | |
| Protected Phases | 3 | 8 | | 7 | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | | | | | | 4 | | | | | | |
| Actuated Green, G (s) | 5.4 | 18.0 | | 18.5 | 30.5 | 30.5 | 6.0 | 33.0 | | 15.9 | 42.6 | |
| Effective Green, g (s) | 5.4 | 18.0 | | 18.5 | 30.5 | 30.5 | 6.0 | 33.0 | | 15.9 | 42.6 | |
| Actuated g/C Ratio | 0.05 | 0.18 | | 0.18 | 0.30 | 0.30 | 0.06 | 0.33 | | 0.16 | 0.43 | |
| Clearance Time (s) | 3.5 | 3.5 | | 3.5 | 4.1 | 4.1 | 3.5 | 4.1 | | 3.5 | 4.4 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 3.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 97 | 334 | | 327 | 579 | 480 | 108 | 575 | | 556 | 762 | |
| v/s Ratio Prot | 0.03 | 0.09 | | c0.21 | c0.18 | | 0.03 | c0.30 | | c0.12 | 0.35 | |
| v/s Ratio Perm | | | | | | 0.07 | | | | | | |
| v/c Ratio | 0.48 | 0.48 | | 1.14 | 0.58 | 0.23 | 0.44 | 0.92 | | 0.77 | 0.82 | |
| Uniform Delay, d1 | 45.9 | 36.8 | | 40.8 | 29.4 | 26.0 | 45.4 | 32.2 | | 40.3 | 25.3 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.39 | 0.61 | |
| Incremental Delay, d2 | 1.4 | 0.4 | | 94.6 | 1.0 | 0.1 | 1.0 | 22.1 | | 4.8 | 8.3 | |
| Delay (s) | 47.3 | 37.2 | | 135.4 | 30.4 | 26.1 | 46.4 | 54.4 | | 60.6 | 23.8 | |
| Level of Service | D | D | | F | C | C | D | D | | E | C | |
| Approach Delay (s) | | 39.4 | | | 65.4 | | | 53.7 | | | 38.5 | |
| Approach LOS | | D | | | E | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 51.5 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.89 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 15.5 |
| Intersection Capacity Utilization | 90.8% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 24: Redwood Blvd & Rowland Blvd

06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 115 | 694 | 49 | 21 | 794 | 287 | 72 | 23 | 81 | 299 | 19 | 301 |
| Future Volume (vph) | 115 | 694 | 49 | 21 | 794 | 287 | 72 | 23 | 81 | 299 | 19 | 301 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.4 | 4.4 | 3.5 | 3.7 | 3.7 | 3.5 | 4.1 | | 3.5 | 4.8 | 4.8 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | 0.97 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.99 | 1.00 | 0.99 | | 1.00 | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.88 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1805 | 3574 | 1589 | 1805 | 3574 | 1578 | 1805 | 3150 | | 3502 | 1900 | 1593 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1805 | 3574 | 1589 | 1805 | 3574 | 1578 | 1805 | 3150 | | 3502 | 1900 | 1593 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 125 | 754 | 53 | 23 | 863 | 312 | 78 | 25 | 88 | 325 | 21 | 327 |
| RTOR Reduction (vph) | 0 | 0 | 28 | 0 | 0 | 77 | 0 | 76 | 0 | 0 | 0 | 245 |
| Lane Group Flow (vph) | 125 | 754 | 25 | 23 | 863 | 235 | 78 | 37 | 0 | 325 | 21 | 82 |
| Confl. Peds. (#/hr) | | | 6 | | | 2 | | | 3 | | | 2 |
| Confl. Bikes (#/hr) | | | | | | | | | 1 | | | |
| Heavy Vehicles (%) | 0% | 1% | 0% | 0% | 1% | 1% | 0% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Prot | NA | Perm | Prot | NA | Perm | Prot | NA | | Prot | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | 3 | 8 | | 7 | 4 | |
| Permitted Phases | | | 2 | | | 6 | | | | | | 4 |
| Actuated Green, G (s) | 11.2 | 38.4 | 38.4 | 3.0 | 30.9 | 30.9 | 8.0 | 10.7 | | 12.6 | 14.6 | 14.6 |
| Effective Green, g (s) | 11.2 | 38.4 | 38.4 | 3.0 | 30.9 | 30.9 | 8.0 | 10.7 | | 12.6 | 14.6 | 14.6 |
| Actuated g/C Ratio | 0.14 | 0.48 | 0.48 | 0.04 | 0.39 | 0.39 | 0.10 | 0.13 | | 0.16 | 0.18 | 0.18 |
| Clearance Time (s) | 3.5 | 4.4 | 4.4 | 3.5 | 3.7 | 3.7 | 3.5 | 4.1 | | 3.5 | 4.8 | 4.8 |
| Vehicle Extension (s) | 2.0 | 4.0 | 4.0 | 2.0 | 4.0 | 4.0 | 2.0 | 2.5 | | 2.5 | 2.5 | 2.5 |
| Lane Grp Cap (vph) | 252 | 1711 | 760 | 67 | 1377 | 607 | 180 | 420 | | 550 | 345 | 289 |
| v/s Ratio Prot | c0.07 | 0.21 | | 0.01 | c0.24 | | 0.04 | 0.01 | | c0.09 | 0.01 | |
| v/s Ratio Perm | | | 0.02 | | | 0.15 | | | | | | c0.05 |
| v/c Ratio | 0.50 | 0.44 | 0.03 | 0.34 | 0.63 | 0.39 | 0.43 | 0.09 | | 0.59 | 0.06 | 0.29 |
| Uniform Delay, d1 | 31.9 | 13.8 | 11.1 | 37.6 | 20.0 | 17.8 | 34.0 | 30.5 | | 31.4 | 27.1 | 28.3 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.6 | 0.2 | 0.0 | 1.1 | 1.0 | 0.6 | 0.6 | 0.1 | | 1.4 | 0.1 | 0.4 |
| Delay (s) | 32.5 | 14.1 | 11.1 | 38.8 | 21.0 | 18.4 | 34.6 | 30.5 | | 32.8 | 27.2 | 28.7 |
| Level of Service | C | B | B | D | C | B | C | C | | C | C | C |
| Approach Delay (s) | | 16.4 | | | 20.7 | | | 32.2 | | | 30.6 | |
| Approach LOS | | B | | | C | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 22.3 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.56 | | |
| Actuated Cycle Length (s) | 80.2 | Sum of lost time (s) | 16.2 |
| Intersection Capacity Utilization | 60.9% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
## 25: US 101 SB Ramps & Rowland Blvd

06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 576 | 467 | 136 | 652 | 0 | 0 | 0 | 0 | 273 | 49 | 489 |
| Future Volume (vph) | 0 | 576 | 467 | 136 | 652 | 0 | 0 | 0 | 0 | 273 | 49 | 489 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.6 | 3.6 | 3.0 | 3.6 | | | | | 3.0 | 3.0 | |
| Lane Util. Factor | | 0.91 | 0.91 | 0.97 | 0.95 | | | | | 0.91 | 0.91 | |
| Frpb, ped/bikes | | 1.00 | 0.99 | 1.00 | 1.00 | | | | | 1.00 | 0.99 | |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | | | | 1.00 | 1.00 | |
| Frt | | 0.97 | 0.85 | 1.00 | 1.00 | | | | | 1.00 | 0.87 | |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 3315 | 1450 | 3367 | 3574 | | | | | 1643 | 2844 | |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | 0.95 | 1.00 | |
| Satd. Flow (perm) | | 3315 | 1450 | 3367 | 3574 | | | | | 1643 | 2844 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 0 | 626 | 508 | 148 | 709 | 0 | 0 | 0 | 0 | 297 | 53 | 532 |
| RTOR Reduction (vph) | 0 | 27 | 209 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 73 | 0 |
| Lane Group Flow (vph) | 0 | 762 | 136 | 148 | 709 | 0 | 0 | 0 | 0 | 267 | 542 | 0 |
| Confl. Peds. (#/hr) | | | 2 | | | | | | | | | 2 |
| Confl. Bikes (#/hr) | | | | | | | | | | | | 1 |
| Heavy Vehicles (%) | 0% | 1% | 0% | 4% | 1% | 0% | 0% | 0% | 0% | 0% | 40% | 1% |
| Turn Type | | NA | Perm | Prot | NA | | | | | Split | NA | |
| Protected Phases | | 2 | | 1 | 6 | | | | | 4 | 4 | |
| Permitted Phases | | | 2 | | | | | | | | | |
| Actuated Green, G (s) | | 19.0 | 19.0 | 3.8 | 25.8 | | | | | 15.8 | 15.8 | |
| Effective Green, g (s) | | 19.0 | 19.0 | 3.8 | 25.8 | | | | | 15.8 | 15.8 | |
| Actuated g/C Ratio | | 0.39 | 0.39 | 0.08 | 0.54 | | | | | 0.33 | 0.33 | |
| Clearance Time (s) | | 3.6 | 3.6 | 3.0 | 3.6 | | | | | 3.0 | 3.0 | |
| Vehicle Extension (s) | | 4.0 | 4.0 | 2.0 | 2.5 | | | | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | | 1306 | 571 | 265 | 1913 | | | | | 538 | 932 | |
| v/s Ratio Prot | | c0.23 | | c0.04 | 0.20 | | | | | 0.16 | c0.19 | |
| v/s Ratio Perm | | | 0.09 | | | | | | | | | |
| v/c Ratio | | 0.58 | 0.24 | 0.56 | 0.37 | | | | | 0.50 | 0.94dr | |
| Uniform Delay, d1 | | 11.5 | 9.8 | 21.4 | 6.5 | | | | | 13.0 | 13.5 | |
| Progression Factor | | 1.00 | 1.00 | 1.00 | 1.00 | | | | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 0.8 | 0.3 | 1.5 | 0.1 | | | | | 0.3 | 0.6 | |
| Delay (s) | | 12.3 | 10.1 | 22.8 | 6.6 | | | | | 13.3 | 14.1 | |
| Level of Service | | B | B | C | A | | | | | B | B | |
| Approach Delay (s) | | 11.6 | | | 9.4 | | | 0.0 | | | 13.8 | |
| Approach LOS | | B | | | A | | | A | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 11.6 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.58 | | |
| Actuated Cycle Length (s) | 48.2 | Sum of lost time (s) | 9.6 |
| Intersection Capacity Utilization | 52.5% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

dr Defacto Right Lane. Recode with 1 though lane as a right lane.
c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
## 26: US 101 NB Ramps & Rowland Blvd

06/13/2017

| Movement | EBL2 | EBL | EBT | WBT | WBR | WBR2 | NBL2 | NBL | NBT | NBR | NEL2 | NEL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 28 | 243 | 607 | 312 | 2 | 144 | 485 | 8 | 9 | 426 | 13 | 4 |
| Future Volume (vph) | 28 | 243 | 607 | 312 | 2 | 144 | 485 | 8 | 9 | 426 | 13 | 4 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | 3.6 | 3.6 | | 3.6 | 3.5 | | 3.5 | 3.0 | | 3.5 |
| Lane Util. Factor | | 1.00 | 0.95 | 0.86 | | 0.86 | 0.95 | | 0.95 | 0.88 | | 1.00 |
| Frpb, ped/bikes | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Frt | | 1.00 | 1.00 | 0.98 | | 0.85 | 1.00 | | 1.00 | 0.85 | | 0.99 |
| Flt Protected | | 0.95 | 1.00 | 1.00 | | 1.00 | 0.95 | | 0.95 | 1.00 | | 0.96 |
| Satd. Flow (prot) | | 1805 | 3574 | 4621 | | 1323 | 1715 | | 1681 | 2787 | | 1794 |
| Flt Permitted | | 0.95 | 1.00 | 1.00 | | 1.00 | 0.95 | | 0.95 | 1.00 | | 0.96 |
| Satd. Flow (perm) | | 1805 | 3574 | 4621 | | 1323 | 1715 | | 1681 | 2787 | | 1794 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 30 | 264 | 660 | 339 | 2 | 157 | 527 | 9 | 10 | 463 | 14 | 4 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 14 | 0 | 87 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 294 | 660 | 373 | 0 | 24 | 274 | 0 | 272 | 463 | 0 | 20 |
| Confl. Peds. (#/hr) | | | | | | | | | | 2 | | |
| Heavy Vehicles (%) | 0% | 0% | 1% | 4% | 0% | 5% | 0% | 0% | 67% | 2% | 0% | 0% |
| Turn Type | Prot | Prot | NA | NA | | Perm | Split | Split | NA | custom | Perm | Prot |
| Protected Phases | 5 | 5 | 2 | 6 | | | 8 | 8 | 8 | 1 8 | | 7 |
| Permitted Phases | | | | | | 6 | | | | | 7 | |
| Actuated Green, G (s) | | 16.4 | 18.0 | 14.1 | | 14.1 | 16.9 | | 16.9 | 32.9 | | 3.1 |
| Effective Green, g (s) | | 16.4 | 18.0 | 14.1 | | 14.1 | 16.9 | | 16.9 | 29.4 | | 3.1 |
| Actuated g/C Ratio | | 0.26 | 0.28 | 0.22 | | 0.22 | 0.26 | | 0.26 | 0.46 | | 0.05 |
| Clearance Time (s) | | 3.0 | 3.6 | 3.6 | | 3.6 | 3.5 | | 3.5 | | | 3.5 |
| Vehicle Extension (s) | | 2.0 | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | | | 2.0 |
| Lane Grp Cap (vph) | | 461 | 1003 | 1016 | | 291 | 452 | | 443 | 1278 | | 86 |
| v/s Ratio Prot | | 0.16 | c0.18 | c0.08 | | | 0.16 | | c0.16 | 0.17 | | |
| v/s Ratio Perm | | | | | | 0.02 | | | | | | 0.01 |
| v/c Ratio | | 0.64 | 0.66 | 0.37 | | 0.08 | 0.61 | | 0.61 | 0.36 | | 0.23 |
| Uniform Delay, d1 | | 21.2 | 20.3 | 21.2 | | 19.9 | 20.7 | | 20.7 | 11.3 | | 29.4 |
| Progression Factor | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Incremental Delay, d2 | | 2.1 | 1.2 | 0.1 | | 0.0 | 1.6 | | 1.8 | 0.1 | | 0.5 |
| Delay (s) | | 23.3 | 21.5 | 21.3 | | 19.9 | 22.3 | | 22.5 | 11.3 | | 29.9 |
| Level of Service | | C | C | C | | B | C | | C | B | | C |
| Approach Delay (s) | | | 22.1 | 21.0 | | | | | 17.3 | | | 29.9 |
| Approach LOS | | | C | C | | | | | B | | | C |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 20.0 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.55 | | |
| Actuated Cycle Length (s) | 64.1 | Sum of lost time (s) | 13.6 |
| Intersection Capacity Utilization | 62.4% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## 26: US 101 NB Ramps & Rowland Blvd


| Movement | NER |
|---|---|
| Lane Configurations | |
| Traffic Volume (vph) | 2 |
| Future Volume (vph) | 2 |
| Ideal Flow (vphpl) | 1900 |
| Total Lost time (s) | |
| Lane Util. Factor | |
| Frpb, ped/bikes | |
| Flpb, ped/bikes | |
| Frt | |
| Flt Protected | |
| Satd. Flow (prot) | |
| Flt Permitted | |
| Satd. Flow (perm) | |
| Peak-hour factor, PHF | 0.92 |
| Adj. Flow (vph) | 2 |
| RTOR Reduction (vph) | 0 |
| Lane Group Flow (vph) | 0 |
| Confl. Peds. (#/hr) | |
| Heavy Vehicles (%) | 0% |
| Turn Type | |
| Protected Phases | |
| Permitted Phases | |
| Actuated Green, G (s) | |
| Effective Green, g (s) | |
| Actuated g/C Ratio | |
| Clearance Time (s) | |
| Vehicle Extension (s) | |
| Lane Grp Cap (vph) | |
| v/s Ratio Prot | |
| v/s Ratio Perm | |
| v/c Ratio | |
| Uniform Delay, d1 | |
| Progression Factor | |
| Incremental Delay, d2 | |
| Delay (s) | |
| Level of Service | |
| Approach Delay (s) | |
| Approach LOS | |

Intersection Summary




## 27: Rowland Blvd & Rowland Way


| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 421 | 626 | 366 | 23 | 13 | 86 |
| Future Volume (vph) | 421 | 626 | 366 | 23 | 13 | 86 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 3.6 | 3.2 | | 3.2 | 3.2 |
| Lane Util. Factor | 0.97 | 0.91 | 0.95 | | 1.00 | 0.95 |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.99 | | 0.89 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | | 0.99 | 1.00 |
| Satd. Flow (prot) | 3467 | 5085 | 3397 | | 1607 | 1490 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | | 0.99 | 1.00 |
| Satd. Flow (perm) | 3467 | 5085 | 3397 | | 1607 | 1490 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 458 | 680 | 398 | 25 | 14 | 93 |
| RTOR Reduction (vph) | 0 | 0 | 5 | 0 | 34 | 46 |
| Lane Group Flow (vph) | 458 | 680 | 418 | 0 | 20 | 7 |
| Confl. Peds. (#/hr) | | | | 1 | 2 | |
| Heavy Vehicles (%) | 1% | 2% | 5% | 9% | 6% | 3% |
| Turn Type | Prot | NA | NA | | Prot | Perm |
| Protected Phases | 5 | 2 | 6 | | 4 | |
| Permitted Phases | | | | | | 4 |
| Actuated Green, G (s) | 13.0 | 32.0 | 15.9 | | 6.2 | 6.2 |
| Effective Green, g (s) | 13.0 | 32.0 | 15.9 | | 6.2 | 6.2 |
| Actuated g/C Ratio | 0.29 | 0.71 | 0.35 | | 0.14 | 0.14 |
| Clearance Time (s) | 3.5 | 3.6 | 3.2 | | 3.2 | 3.2 |
| Vehicle Extension (s) | 2.0 | 4.0 | 4.0 | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 1001 | 3616 | 1200 | | 221 | 205 |
| v/s Ratio Prot | c0.13 | 0.13 | c0.12 | | c0.01 | |
| v/s Ratio Perm | | | | | | 0.00 |
| v/c Ratio | 0.46 | 0.19 | 0.35 | | 0.09 | 0.04 |
| Uniform Delay, d1 | 13.1 | 2.2 | 10.7 | | 16.9 | 16.8 |
| Progression Factor | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.1 | 0.0 | 0.2 | | 0.1 | 0.0 |
| Delay (s) | 13.2 | 2.2 | 11.0 | | 17.0 | 16.8 |
| Level of Service | B | A | B | | B | B |
| Approach Delay (s) | | 6.6 | 11.0 | | 16.9 | |
| Approach LOS | | A | B | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 8.4 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.34 | | |
| Actuated Cycle Length (s) | 45.0 | Sum of lost time (s) | 9.9 |
| Intersection Capacity Utilization | 38.4% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 28: Vintage Way & Rowland Blvd

06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 7 | 335 | 300 | 2 | 242 | 3 | 130 | 3 | 0 | 1 | 2 | 1 |
| Future Volume (vph) | 7 | 335 | 300 | 2 | 242 | 3 | 130 | 3 | 0 | 1 | 2 | 1 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.6 | 3.6 | 3.0 | 3.6 | | 3.6 | 3.6 | | | 3.2 | |
| Lane Util. Factor | 1.00 | 0.95 | 0.88 | 1.00 | 0.95 | | 0.97 | 1.00 | | | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | | 1.00 | 1.00 | | | 0.97 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | | 0.99 | |
| Satd. Flow (prot) | 1805 | 3195 | 2814 | 1805 | 3249 | | 3367 | 1900 | | | 1813 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | | 0.99 | |
| Satd. Flow (perm) | 1805 | 3195 | 2814 | 1805 | 3249 | | 3367 | 1900 | | | 1813 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 8 | 364 | 326 | 2 | 263 | 3 | 141 | 3 | 0 | 1 | 2 | 1 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| Lane Group Flow (vph) | 8 | 364 | 326 | 2 | 265 | 0 | 141 | 3 | 0 | 0 | 3 | 0 |
| Confl. Peds. (#/hr) | | | 1 | | | 3 | | | 1 | | | |
| Confl. Bikes (#/hr) | | | 2 | | | 2 | | | | | | |
| Heavy Vehicles (%) | 0% | 13% | 1% | 0% | 11% | 0% | 4% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Prot | NA | pt+ov | Prot | NA | | Split | NA | | Split | NA | |
| Protected Phases | 5 | 2 | 2 3 | 1 | 6 | | 3 | 3 | | 4 | 4 | |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | 1.1 | 10.8 | 30.9 | 0.5 | 10.2 | | 16.5 | 16.5 | | | 1.1 | |
| Effective Green, g (s) | 1.1 | 10.8 | 30.9 | 0.5 | 10.2 | | 16.5 | 16.5 | | | 1.1 | |
| Actuated g/C Ratio | 0.03 | 0.26 | 0.73 | 0.01 | 0.24 | | 0.39 | 0.39 | | | 0.03 | |
| Clearance Time (s) | 3.0 | 3.6 | | 3.0 | 3.6 | | 3.6 | 3.6 | | | 3.2 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | | 3.0 | 3.0 | | | 2.0 | |
| Lane Grp Cap (vph) | 46 | 815 | 2055 | 21 | 783 | | 1313 | 741 | | | 47 | |
| v/s Ratio Prot | c0.00 | c0.11 | c0.12 | 0.00 | 0.08 | | 0.04 | 0.00 | | | c0.00 | |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | 0.17 | 0.45 | 0.16 | 0.10 | 0.34 | | 0.11 | 0.00 | | | 0.06 | |
| Uniform Delay, d1 | 20.2 | 13.2 | 1.7 | 20.7 | 13.3 | | 8.2 | 7.9 | | | 20.1 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | | 1.00 | |
| Incremental Delay, d2 | 0.7 | 0.1 | 0.0 | 0.7 | 0.1 | | 0.0 | 0.0 | | | 0.2 | |
| Delay (s) | 20.8 | 13.4 | 1.8 | 21.4 | 13.4 | | 8.2 | 7.9 | | | 20.3 | |
| Level of Service | C | B | A | C | B | | A | A | | | C | |
| Approach Delay (s) | | 8.0 | | | 13.4 | | | 8.2 | | | 20.3 | |
| Approach LOS | | A | | | B | | | A | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 9.4 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.28 | | |
| Actuated Cycle Length (s) | 42.3 | Sum of lost time (s) | 13.4 |
| Intersection Capacity Utilization | 36.0% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 29: Novato Blvd & Sunset Pkwy

06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 242 | 68 | 26 | 39 | 102 | 101 | 25 | 255 | 56 | 54 | 336 | 312 |
| Future Volume (vph) | 242 | 68 | 26 | 39 | 102 | 101 | 25 | 255 | 56 | 54 | 336 | 312 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.0 | | 3.5 | 3.5 | | 3.5 | 4.9 | | 3.5 | 4.6 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 0.99 | | 1.00 | 0.97 | | 1.00 | 1.00 | | 1.00 | 0.99 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.96 | | 1.00 | 0.93 | | 1.00 | 0.97 | | 1.00 | 0.93 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1787 | 1809 | | 1805 | 1711 | | 1805 | 1841 | | 1770 | 1715 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1787 | 1809 | | 1805 | 1711 | | 1805 | 1841 | | 1770 | 1715 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 263 | 74 | 28 | 42 | 111 | 110 | 27 | 277 | 61 | 59 | 365 | 339 |
| RTOR Reduction (vph) | 0 | 14 | 0 | 0 | 39 | 0 | 0 | 7 | 0 | 0 | 29 | 0 |
| Lane Group Flow (vph) | 263 | 88 | 0 | 42 | 182 | 0 | 27 | 331 | 0 | 59 | 675 | 0 |
| Confl. Peds. (#/hr) | | | 4 | | | 21 | | | 3 | | | 5 |
| Confl. Bikes (#/hr) | | | | | | 1 | | | | | | |
| Heavy Vehicles (%) | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 2% | 1% | 2% |
| Turn Type | Prot | NA | | Prot | NA | | Prot | NA | | Prot | NA | |
| Protected Phases | 3 | 8 | | 7 | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | 12.8 | 23.0 | | 5.7 | 16.4 | | 3.4 | 32.6 | | 5.7 | 35.2 | |
| Effective Green, g (s) | 12.8 | 23.0 | | 5.7 | 16.4 | | 3.4 | 32.6 | | 5.7 | 35.2 | |
| Actuated g/C Ratio | 0.15 | 0.28 | | 0.07 | 0.20 | | 0.04 | 0.39 | | 0.07 | 0.42 | |
| Clearance Time (s) | 3.5 | 4.0 | | 3.5 | 3.5 | | 3.5 | 4.9 | | 3.5 | 4.6 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 275 | 501 | | 124 | 338 | | 74 | 723 | | 121 | 728 | |
| v/s Ratio Prot | c0.15 | 0.05 | | 0.02 | c0.11 | | 0.01 | 0.18 | | c0.03 | c0.39 | |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | 0.96 | 0.18 | | 0.34 | 0.54 | | 0.36 | 0.46 | | 0.49 | 0.93 | |
| Uniform Delay, d1 | 34.8 | 22.8 | | 36.8 | 29.8 | | 38.7 | 18.6 | | 37.2 | 22.6 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 41.8 | 0.1 | | 0.6 | 0.8 | | 1.1 | 0.2 | | 1.1 | 17.5 | |
| Delay (s) | 76.5 | 22.8 | | 37.4 | 30.7 | | 39.8 | 18.8 | | 38.3 | 40.1 | |
| Level of Service | E | C | | D | C | | D | B | | D | D | |
| Approach Delay (s) | | 61.5 | | | 31.7 | | | 20.3 | | | 40.0 | |
| Approach LOS | | E | | | C | | | C | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 39.1 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.83 | | |
| Actuated Cycle Length (s) | 82.9 | Sum of lost time (s) | 15.9 |
| Intersection Capacity Utilization | 86.3% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Intersection | |
|---|---|
| Intersection Delay, s/veh | 233.4 |
| Intersection LOS | F |

| Movement | EBU | EBL | EBT | EBR | WBU | WBL | WBT | WBR | NBU | NBL | NBT | NBR | SBU | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | | | | | |
| Traffic Vol, veh/h | 0 | 49 | 486 | 386 | 0 | 327 | 180 | 28 | 0 | 94 | 6 | 71 | 0 | 99 | 22 | 67 |
| Future Vol, veh/h | 0 | 49 | 486 | 386 | 0 | 327 | 180 | 28 | 0 | 94 | 6 | 71 | 0 | 99 | 22 | 67 |
| Peak Hour Factor | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Heavy Vehicles, % | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 |
| Mvmt Flow | 0 | 52 | 512 | 406 | 0 | 344 | 189 | 29 | 0 | 99 | 6 | 75 | 0 | 104 | 23 | 71 |
| Number of Lanes | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 0 |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Opposing Approach | WB | EB | SB | NB |
| Opposing Lanes | 2 | 2 | 2 | 3 |
| Conflicting Approach Left | SB | NB | EB | WB |
| Conflicting Lanes Left | 2 | 3 | 2 | 2 |
| Conflicting Approach Right | NB | SB | WB | EB |
| Conflicting Lanes Right | 3 | 2 | 2 | 2 |
| HCM Control Delay | 433.9 | 33.5 | 16.9 | 17.3 |
| HCM LOS | F | D | C | C |

| Lane | NBLn1 | NBLn2 | NBLn3 | EBLn1 | EBLn2 | WBLn1 | WBLn2 | SBLn1 | SBLn2 |
|---|---|---|---|---|---|---|---|---|---|
| Vol Left, % | 100% | 0% | 0% | 100% | 0% | 100% | 0% | 100% | 0% |
| Vol Thru, % | 0% | 100% | 0% | 0% | 56% | 0% | 87% | 0% | 25% |
| Vol Right, % | 0% | 0% | 100% | 0% | 44% | 0% | 13% | 0% | 75% |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 94 | 6 | 71 | 49 | 872 | 327 | 208 | 99 | 89 |
| LT Vol | 94 | 0 | 0 | 49 | 0 | 327 | 0 | 99 | 0 |
| Through Vol | 0 | 6 | 0 | 0 | 486 | 0 | 180 | 0 | 22 |
| RT Vol | 0 | 0 | 71 | 0 | 386 | 0 | 28 | 0 | 67 |
| Lane Flow Rate | 99 | 6 | 75 | 52 | 918 | 344 | 219 | 104 | 94 |
| Geometry Grp | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Degree of Util (X) | 0.263 | 0.016 | 0.174 | 0.122 | 1.96 | 0.795 | 0.47 | 0.274 | 0.22 |
| Departure Headway (Hd) | 11.572 | 11.043 | 10.302 | 8.498 | 7.688 | 9.98 | 9.381 | 11.464 | 10.374 |
| Convergence, Y/N | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Cap | 313 | 326 | 351 | 424 | 486 | 365 | 388 | 316 | 349 |
| Service Time | 9.272 | 8.743 | 8.002 | 6.198 | 5.388 | 7.68 | 7.081 | 9.164 | 8.074 |
| HCM Lane V/C Ratio | 0.316 | 0.018 | 0.214 | 0.123 | 1.889 | 0.942 | 0.564 | 0.329 | 0.269 |
| HCM Control Delay | 18.4 | 13.9 | 15.2 | 12.4 | 457.6 | 42 | 20.1 | 18.4 | 16 |
| HCM Lane LOS | C | B | C | B | F | E | C | C | C |
| HCM 95th-tile Q | 1 | 0 | 0.6 | 0.4 | 61.8 | 6.7 | 2.4 | 1.1 | 0.8 |





| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 49 | 486 | 386 | 327 | 180 | 28 | 94 | 6 | 71 | 99 | 22 | 67 |
| Future Volume (vph) | 49 | 486 | 386 | 327 | 180 | 28 | 94 | 6 | 71 | 99 | 22 | 67 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 16 | 16 | 12 | 16 | 16 | 12 | 12 | 12 | 12 | 12 | 12 |
| Total Lost time (s) | 3.5 | 4.0 | | 3.5 | 4.0 | | 3.5 | 4.0 | 4.0 | 3.5 | 4.0 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 0.93 | | 1.00 | 0.98 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.89 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1787 | 1980 | | 1787 | 2072 | | 1787 | 1881 | 1599 | 1787 | 1668 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1787 | 1980 | | 1787 | 2072 | | 1787 | 1881 | 1599 | 1787 | 1668 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 52 | 512 | 406 | 344 | 189 | 29 | 99 | 6 | 75 | 104 | 23 | 71 |
| RTOR Reduction (vph) | 0 | 20 | 0 | 0 | 3 | 0 | 0 | 0 | 69 | 0 | 64 | 0 |
| Lane Group Flow (vph) | 52 | 898 | 0 | 344 | 215 | 0 | 99 | 6 | 6 | 104 | 30 | 0 |
| Heavy Vehicles (%) | 1% | 2% | 1% | 1% | 2% | 1% | 1% | 1% | 1% | 1% | 1% | 1% |
| Turn Type | Prot | NA | | Prot | NA | | Prot | NA | Perm | Prot | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | | | | | | | 2 | | | |
| Actuated Green, G (s) | 6.9 | 56.0 | | 25.6 | 74.7 | | 8.5 | 8.8 | 8.8 | 10.5 | 10.8 | |
| Effective Green, g (s) | 6.9 | 56.0 | | 25.6 | 74.7 | | 8.5 | 8.8 | 8.8 | 10.5 | 10.8 | |
| Actuated g/C Ratio | 0.06 | 0.48 | | 0.22 | 0.64 | | 0.07 | 0.08 | 0.08 | 0.09 | 0.09 | |
| Clearance Time (s) | 3.5 | 4.0 | | 3.5 | 4.0 | | 3.5 | 4.0 | 4.0 | 3.5 | 4.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 106 | 956 | | 394 | 1335 | | 131 | 142 | 121 | 161 | 155 | |
| v/s Ratio Prot | 0.03 | c0.45 | | c0.19 | 0.10 | | c0.06 | 0.00 | | 0.06 | c0.02 | |
| v/s Ratio Perm | | | | | | | | | 0.00 | | | |
| v/c Ratio | 0.49 | 0.94 | | 0.87 | 0.16 | | 0.76 | 0.04 | 0.05 | 0.65 | 0.19 | |
| Uniform Delay, d1 | 52.8 | 28.4 | | 43.6 | 8.2 | | 52.7 | 49.6 | 49.7 | 50.9 | 48.5 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 3.5 | 16.3 | | 18.7 | 0.1 | | 21.7 | 0.1 | 0.2 | 8.6 | 0.6 | |
| Delay (s) | 56.3 | 44.6 | | 62.3 | 8.2 | | 74.3 | 49.8 | 49.8 | 59.5 | 49.1 | |
| Level of Service | E | D | | E | A | | E | D | D | E | D | |
| Approach Delay (s) | | 45.3 | | | 41.3 | | | 63.3 | | | 54.6 | |
| Approach LOS | | D | | | D | | | E | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 46.8 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.83 | | |
| Actuated Cycle Length (s) | 115.9 | Sum of lost time (s) | 15.0 |
| Intersection Capacity Utilization | 89.4% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

# MOVEMENT SUMMARY

## Site: 30 [AM Cumulative Alt]

Novato Boulevard/Redwood Boulevard
AM Cumulative with Project Alternative

Roundabout

**Movement Performance - Vehicles**

| Mov ID | OD Mov | Demand Flows Total veh/h | Demand Flows HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance ft | Prop. Queued | Effective Stop Rate per veh | Average Speed mph |
|---|---|---|---|---|---|---|---|---|---|---|---|
| South: NB Redwood Boulevard | | | | | | | | | | | |
| 3 | L2 | 101 | 2.0 | 0.276 | 8.8 | LOS A | 1.2 | 29.9 | 0.66 | 0.66 | 31.7 |
| 8 | T1 | 6 | 2.0 | 0.276 | 8.8 | LOS A | 1.2 | 29.9 | 0.66 | 0.66 | 31.6 |
| 18 | R2 | 76 | 2.0 | 0.276 | 8.8 | LOS A | 1.2 | 29.9 | 0.66 | 0.66 | 30.9 |
| Approach | | 184 | 2.0 | 0.276 | 8.8 | LOS A | 1.2 | 29.9 | 0.66 | 0.66 | 31.3 |
| East: WB Novato Blvd | | | | | | | | | | | |
| 1 | L2 | 352 | 2.0 | 0.502 | 8.8 | LOS A | 3.5 | 87.9 | 0.49 | 0.33 | 31.6 |
| 6 | T1 | 194 | 2.0 | 0.502 | 8.8 | LOS A | 3.5 | 87.9 | 0.49 | 0.33 | 31.6 |
| 16 | R2 | 30 | 2.0 | 0.502 | 8.8 | LOS A | 3.5 | 87.9 | 0.49 | 0.33 | 30.8 |
| Approach | | 575 | 2.0 | 0.502 | 8.8 | LOS A | 3.5 | 87.9 | 0.49 | 0.33 | 31.5 |
| North: SB Redwood Boulevard | | | | | | | | | | | |
| 7 | L2 | 106 | 2.0 | 0.293 | 8.8 | LOS A | 1.3 | 32.3 | 0.65 | 0.65 | 31.7 |
| 4 | T1 | 24 | 2.0 | 0.293 | 8.8 | LOS A | 1.3 | 32.3 | 0.65 | 0.65 | 31.7 |
| 14 | R2 | 72 | 2.0 | 0.293 | 8.8 | LOS A | 1.3 | 32.3 | 0.65 | 0.65 | 30.9 |
| Approach | | 202 | 2.0 | 0.293 | 8.8 | LOS A | 1.3 | 32.3 | 0.65 | 0.65 | 31.4 |
| West: EB Novato Blvd | | | | | | | | | | | |
| 5 | L2 | 53 | 2.0 | 0.754 | 21.4 | LOS C | 5.8 | 146.9 | 0.77 | 0.91 | 27.8 |
| 2 | T1 | 523 | 2.0 | 0.754 | 21.4 | LOS C | 5.8 | 146.9 | 0.77 | 0.91 | 27.8 |
| 12 | R2 | 415 | 2.0 | 0.466 | 9.9 | LOS A | 2.6 | 65.5 | 0.65 | 0.66 | 31.4 |
| Approach | | 990 | 2.0 | 0.754 | 16.6 | LOS B | 5.8 | 146.9 | 0.72 | 0.81 | 29.2 |
| All Vehicles | | 1952 | 2.0 | 0.754 | 12.7 | LOS B | 5.8 | 146.9 | 0.64 | 0.64 | 30.3 |

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.



# LANE SUMMARY

## Site: 30 [AM Cumulative Alt]

Novato Boulevard/Redwood Boulevard
AM Cumulative with Project Alternative

Roundabout

**Lane Use and Performance**

| | Demand Flows Total veh/h | Demand Flows HV % | Cap. veh/h | Deg. Satn v/c | Lane Util. % | Average Delay sec | Level of Service | 95% Back of Queue Veh | 95% Back of Queue Dist ft | Lane Config | Lane Length ft | Cap. Adj. % | Prob. Block. % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| South: NB Redwood Boulevard | | | | | | | | | | | | | |
| Lane 1[d] | 184 | 2.0 | 666 | 0.276 | 100 | 8.8 | LOS A | 1.2 | 29.9 | Full | 1600 | 0.0 | 0.0 |
| Approach | 184 | 2.0 | | 0.276 | | 8.8 | LOS A | 1.2 | 29.9 | | | | |
| East: WB Novato Blvd | | | | | | | | | | | | | |
| Lane 1[d] | 575 | 2.0 | 1145 | 0.502 | 100 | 8.8 | LOS A | 3.5 | 87.9 | Full | 1600 | 0.0 | 0.0 |
| Approach | 575 | 2.0 | | 0.502 | | 8.8 | LOS A | 3.5 | 87.9 | | | | |
| North: SB Redwood Boulevard | | | | | | | | | | | | | |
| Lane 1[d] | 202 | 2.0 | 691 | 0.293 | 100 | 8.8 | LOS A | 1.3 | 32.3 | Full | 1600 | 0.0 | 0.0 |
| Approach | 202 | 2.0 | | 0.293 | | 8.8 | LOS A | 1.3 | 32.3 | | | | |
| West: EB Novato Blvd | | | | | | | | | | | | | |
| Lane 1[d] | 575 | 2.0 | 763[1] | 0.754 | 100 | 21.4 | LOS C | 5.8 | 146.9 | Full | 1600 | 0.0 | 0.0 |
| Lane 2 | 415 | 2.0 | 890 | 0.466 | 100 | 9.9 | LOS A | 2.6 | 65.5 | Short | 30 | 0.0 | NA |
| Approach | 990 | 2.0 | | 0.754 | | 16.6 | LOS B | 5.8 | 146.9 | | | | |
| Intersection | 1952 | 2.0 | | 0.754 | | 12.7 | LOS B | 5.8 | 146.9 | | | | |

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.
d Dominant lane on roundabout approach

## HCM Signalized Intersection Capacity Analysis
### 31: Alameda Del Prado & Ignacio Blvd

06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 13 | 880 | 469 | 268 | 371 | 19 | 69 | 4 | 240 | 7 | 2 | 0 |
| Future Volume (vph) | 13 | 880 | 469 | 268 | 371 | 19 | 69 | 4 | 240 | 7 | 2 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.6 | 3.6 | 3.0 | 3.6 | | | 3.5 | 3.5 | | 3.7 | |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | | 1.00 | 1.00 | | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.97 | 1.00 | 1.00 | | | 1.00 | 0.98 | | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.99 | 1.00 | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | | | 1.00 | 0.85 | | 1.00 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 0.95 | 1.00 | | 0.96 | |
| Satd. Flow (prot) | 1770 | 3610 | 1573 | 1900 | 3583 | | | 1786 | 1589 | | 1824 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 0.73 | 1.00 | | 0.85 | |
| Satd. Flow (perm) | 1770 | 3610 | 1573 | 1805 | 3583 | | | 1368 | 1589 | | 1608 | |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 14 | 917 | 489 | 279 | 386 | 20 | 72 | 4 | 250 | 7 | 2 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 89 | 0 | 2 | 0 | 0 | 0 | 217 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 14 | 917 | 400 | 279 | 404 | 0 | 0 | 76 | 33 | 0 | 9 | 0 |
| Confl. Peds. (#/hr) | | | 4 | | | | 7 | | 4 | 4 | | 7 |
| Heavy Vehicles (%) | 2% | 0% | 0% | 0% | 0% | 0% | 1% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Prot | NA | Perm | Prot | NA | | Perm | NA | Perm | Perm | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | 2 | | | | 8 | | 8 | 4 | | |
| Actuated Green, G (s) | 1.4 | 49.2 | 49.2 | 27.4 | 75.2 | | | 13.3 | 13.3 | | 13.1 | |
| Effective Green, g (s) | 1.4 | 49.2 | 49.2 | 27.4 | 75.2 | | | 13.3 | 13.3 | | 13.1 | |
| Actuated g/C Ratio | 0.01 | 0.49 | 0.49 | 0.27 | 0.75 | | | 0.13 | 0.13 | | 0.13 | |
| Clearance Time (s) | 3.0 | 3.6 | 3.6 | 3.0 | 3.6 | | | 3.5 | 3.5 | | 3.7 | |
| Vehicle Extension (s) | 2.0 | 3.0 | 3.0 | 2.0 | 3.0 | | | 2.0 | 2.0 | | 2.0 | |
| Lane Grp Cap (vph) | 24 | 1776 | 773 | 520 | 2694 | | | 181 | 211 | | 210 | |
| v/s Ratio Prot | 0.01 | 0.25 | | c0.15 | 0.11 | | | | | | | |
| v/s Ratio Perm | | | c0.25 | | | | | c0.06 | 0.02 | | 0.01 | |
| v/c Ratio | 0.58 | 0.52 | 0.52 | 0.54 | 0.15 | | | 0.42 | 0.16 | | 0.04 | |
| Uniform Delay, d1 | 49.0 | 17.3 | 17.3 | 30.9 | 3.5 | | | 39.8 | 38.4 | | 38.0 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 0.60 | 0.49 | | | 1.00 | 1.00 | | 1.00 | |
| Incremental Delay, d2 | 21.1 | 1.1 | 2.5 | 0.5 | 0.1 | | | 0.6 | 0.1 | | 0.0 | |
| Delay (s) | 70.1 | 18.4 | 19.8 | 19.1 | 1.8 | | | 40.4 | 38.5 | | 38.0 | |
| Level of Service | E | B | B | B | A | | | D | D | | D | |
| Approach Delay (s) | | 19.4 | | | 8.9 | | | 39.0 | | | 38.0 | |
| Approach LOS | | B | | | A | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 19.1 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.51 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 10.3 |
| Intersection Capacity Utilization | 63.7% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 32: US 101 SB Off Ramp/Enfrente Rd & Ignacio Blvd

06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 36 | 854 | 314 | 189 | 436 | 43 | 0 | 0 | 954 | 265 | 143 | 218 |
| Future Volume (vph) | 36 | 854 | 314 | 189 | 436 | 43 | 0 | 0 | 954 | 265 | 143 | 218 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 8.0 | 8.0 | 3.0 | 4.0 | | | | 3.0 | | 3.5 | 3.5 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | | | 0.88 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.96 | 1.00 | 1.00 | | | | 1.00 | | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | | | | 0.85 | | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | | 1.00 | | 0.97 | 1.00 |
| Satd. Flow (prot) | 1805 | 3610 | 1550 | 1787 | 3544 | | | | 2842 | | 1809 | 1578 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | | 1.00 | | 0.97 | 1.00 |
| Satd. Flow (perm) | 1805 | 3610 | 1550 | 1787 | 3544 | | | | 2842 | | 1809 | 1578 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 38 | 890 | 327 | 197 | 454 | 45 | 0 | 0 | 994 | 276 | 149 | 227 |
| RTOR Reduction (vph) | 0 | 0 | 134 | 0 | 6 | 0 | 0 | 0 | 325 | 0 | 0 | 163 |
| Lane Group Flow (vph) | 38 | 890 | 193 | 197 | 493 | 0 | 0 | 0 | 669 | 0 | 425 | 64 |
| Confl. Peds. (#/hr) | | | 7 | | | 20 | | | | | | 1 |
| Confl. Bikes (#/hr) | | | | | | 3 | | | | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 5% | 1% |
| Turn Type | Prot | NA | Perm | Prot | NA | | | | Over | Split | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | | | 1 | 7 | 7 | |
| Permitted Phases | | | 2 | | | | | | | | | 7 |
| Actuated Green, G (s) | 6.6 | 28.9 | 28.9 | 28.2 | 54.5 | | | | 28.2 | | 28.4 | 28.4 |
| Effective Green, g (s) | 6.6 | 28.9 | 28.9 | 28.2 | 54.5 | | | | 28.2 | | 28.4 | 28.4 |
| Actuated g/C Ratio | 0.07 | 0.29 | 0.29 | 0.28 | 0.54 | | | | 0.28 | | 0.28 | 0.28 |
| Clearance Time (s) | 3.0 | 8.0 | 8.0 | 3.0 | 4.0 | | | | 3.0 | | 3.5 | 3.5 |
| Vehicle Extension (s) | 2.0 | 2.5 | 2.5 | 3.0 | 4.0 | | | | 3.0 | | 2.5 | 2.5 |
| Lane Grp Cap (vph) | 119 | 1043 | 447 | 503 | 1931 | | | | 801 | | 513 | 448 |
| v/s Ratio Prot | 0.02 | c0.25 | | 0.11 | 0.14 | | | | c0.24 | | c0.23 | |
| v/s Ratio Perm | | | 0.12 | | | | | | | | | 0.04 |
| v/c Ratio | 0.32 | 0.85 | 0.43 | 0.39 | 0.26 | | | | 0.83 | | 0.83 | 0.14 |
| Uniform Delay, d1 | 44.6 | 33.5 | 28.9 | 29.0 | 12.0 | | | | 33.7 | | 33.5 | 26.7 |
| Progression Factor | 0.90 | 0.68 | 0.47 | 1.56 | 1.97 | | | | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.5 | 8.2 | 2.8 | 0.5 | 0.3 | | | | 7.5 | | 10.4 | 0.1 |
| Delay (s) | 40.7 | 30.9 | 16.3 | 45.6 | 24.0 | | | | 41.2 | | 43.9 | 26.8 |
| Level of Service | D | C | B | D | C | | | | D | | D | C |
| Approach Delay (s) | | 27.4 | | | 30.1 | | | 41.2 | | | 38.0 | |
| Approach LOS | | C | | | C | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 33.7 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.84 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 14.5 |
| Intersection Capacity Utilization | 92.6% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 33: Nave Dr & Ignacio Blvd/Bel Marin Keys Blvd

06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 751 | 1311 | 98 | 222 | 200 | 447 | 543 | 612 | 0 | 0 | 0 |
| Future Volume (vph) | 0 | 751 | 1311 | 98 | 222 | 200 | 447 | 543 | 612 | 0 | 0 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.0 | 4.6 | 3.0 | 4.0 | | 4.6 | 4.6 | 3.0 | | | |
| Lane Util. Factor | | 0.95 | 1.00 | 1.00 | 0.95 | | 0.91 | 0.91 | 1.00 | | | |
| Frpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 0.99 | | 1.00 | 1.00 | 0.99 | | | |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | | |
| Frt | | 1.00 | 0.85 | 1.00 | 0.93 | | 1.00 | 1.00 | 0.85 | | | |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 0.99 | 1.00 | | | |
| Satd. Flow (prot) | | 3610 | 1607 | 1805 | 3300 | | 1643 | 3398 | 1599 | | | |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 0.99 | 1.00 | | | |
| Satd. Flow (perm) | | 3610 | 1607 | 1805 | 3300 | | 1643 | 3398 | 1599 | | | |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 0 | 799 | 1395 | 104 | 236 | 213 | 476 | 578 | 651 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 84 | 0 | 121 | 0 | 0 | 0 | 10 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 799 | 1311 | 104 | 328 | 0 | 343 | 711 | 641 | 0 | 0 | 0 |
| Confl. Peds. (#/hr) | | | 1 | | | 1 | | | 1 | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 2% | 0% | 1% | 0% | 0% | 0% | 0% |
| Turn Type | | NA | pm+ov | Prot | NA | | Split | NA | pm+ov | | | |
| Protected Phases | | 2 | 3 | 1 | 6 | | 3 | 3 | 1 | | | |
| Permitted Phases | | | 2 | | | | | | 3 | | | |
| Actuated Green, G (s) | | 28.4 | 76.4 | 12.0 | 43.4 | | 48.0 | 48.0 | 60.0 | | | |
| Effective Green, g (s) | | 28.4 | 76.4 | 12.0 | 43.4 | | 48.0 | 48.0 | 60.0 | | | |
| Actuated g/C Ratio | | 0.28 | 0.76 | 0.12 | 0.43 | | 0.48 | 0.48 | 0.60 | | | |
| Clearance Time (s) | | 4.0 | 4.6 | 3.0 | 4.0 | | 4.6 | 4.6 | 3.0 | | | |
| Vehicle Extension (s) | | 4.0 | 2.0 | 2.0 | 4.0 | | 2.0 | 2.0 | 2.0 | | | |
| Lane Grp Cap (vph) | | 1025 | 1227 | 216 | 1432 | | 788 | 1631 | 959 | | | |
| v/s Ratio Prot | | 0.22 | c0.51 | 0.06 | 0.10 | | 0.21 | 0.21 | c0.08 | | | |
| v/s Ratio Perm | | | 0.30 | | | | | | 0.32 | | | |
| v/c Ratio | | 0.78 | 1.07 | 0.48 | 0.23 | | 0.44 | 0.44 | 0.67 | | | |
| Uniform Delay, d1 | | 32.9 | 11.8 | 41.1 | 17.8 | | 17.1 | 17.1 | 13.4 | | | |
| Progression Factor | | 0.90 | 1.53 | 1.18 | 0.93 | | 1.00 | 1.00 | 1.00 | | | |
| Incremental Delay, d2 | | 3.2 | 40.3 | 0.6 | 0.4 | | 0.1 | 0.1 | 1.4 | | | |
| Delay (s) | | 32.9 | 58.4 | 48.9 | 16.9 | | 17.2 | 17.2 | 14.7 | | | |
| Level of Service | | C | E | D | B | | B | B | B | | | |
| Approach Delay (s) | | 49.1 | | | 22.9 | | | 16.3 | | | 0.0 | |
| Approach LOS | | D | | | C | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 33.3 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 1.01 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 11.6 |
| Intersection Capacity Utilization | 98.5% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 34: Bel Marin Keys Blvd & Commercial Blvd

06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 0 | 12 | 77 | 0 | 9 | 48 | 1080 | 242 | 13 | 428 | 1 |
| Future Volume (vph) | 0 | 0 | 12 | 77 | 0 | 9 | 48 | 1080 | 242 | 13 | 428 | 1 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.0 | | | 4.0 | 4.0 | 3.0 | 3.9 | | 3.0 | 3.5 | |
| Lane Util. Factor | | 1.00 | | | 1.00 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | | 0.99 | | | 1.00 | 0.98 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 0.86 | | | 1.00 | 0.85 | 1.00 | 0.97 | | 1.00 | 1.00 | |
| Flt Protected | | 1.00 | | | 0.95 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 1620 | | | 1801 | 1395 | 1805 | 3493 | | 1805 | 3573 | |
| Flt Permitted | | 1.00 | | | 0.75 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | | 1620 | | | 1420 | 1395 | 1805 | 3493 | | 1805 | 3573 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 0 | 0 | 13 | 81 | 0 | 9 | 51 | 1137 | 255 | 14 | 451 | 1 |
| RTOR Reduction (vph) | 0 | 11 | 0 | 0 | 0 | 8 | 0 | 10 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 2 | 0 | 0 | 81 | 1 | 51 | 1382 | 0 | 14 | 452 | 0 |
| Confl. Peds. (#/hr) | 3 | | 2 | 2 | | 3 | | | 3 | | | |
| Heavy Vehicles (%) | 2% | 0% | 0% | 0% | 0% | 14% | 0% | 0% | 0% | 0% | 1% | 0% |
| Turn Type | | NA | | Perm | NA | Perm | Prot | NA | | Prot | NA | |
| Protected Phases | | 4 | | | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | | | | | | |
| Actuated Green, G (s) | | 12.2 | | | 12.2 | 12.2 | 6.8 | 75.1 | | 1.8 | 70.5 | |
| Effective Green, g (s) | | 12.2 | | | 12.2 | 12.2 | 6.8 | 75.1 | | 1.8 | 70.5 | |
| Actuated g/C Ratio | | 0.12 | | | 0.12 | 0.12 | 0.07 | 0.75 | | 0.02 | 0.70 | |
| Clearance Time (s) | | 4.0 | | | 4.0 | 4.0 | 3.0 | 3.9 | | 3.0 | 3.5 | |
| Vehicle Extension (s) | | 3.0 | | | 3.0 | 3.0 | 2.5 | 3.0 | | 2.5 | 4.0 | |
| Lane Grp Cap (vph) | | 197 | | | 173 | 170 | 122 | 2623 | | 32 | 2518 | |
| v/s Ratio Prot | | 0.00 | | | | | c0.03 | c0.40 | | 0.01 | 0.13 | |
| v/s Ratio Perm | | | | | c0.06 | 0.00 | | | | | | |
| v/c Ratio | | 0.01 | | | 0.47 | 0.01 | 0.42 | 0.53 | | 0.44 | 0.18 | |
| Uniform Delay, d1 | | 38.6 | | | 40.9 | 38.6 | 44.7 | 5.1 | | 48.6 | 5.0 | |
| Progression Factor | | 1.00 | | | 1.00 | 1.00 | 0.90 | 0.62 | | 0.92 | 1.32 | |
| Incremental Delay, d2 | | 0.0 | | | 2.0 | 0.0 | 1.1 | 0.5 | | 6.8 | 0.2 | |
| Delay (s) | | 38.6 | | | 42.9 | 38.6 | 41.3 | 3.7 | | 51.7 | 6.7 | |
| Level of Service | | D | | | D | D | D | A | | D | A | |
| Approach Delay (s) | | 38.6 | | | 42.4 | | | 5.0 | | | 8.1 | |
| Approach LOS | | D | | | D | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 7.6 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.53 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 10.9 |
| Intersection Capacity Utilization | 60.5% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 35: Bel Marin Keys Blvd & Hamilton Dr/Digital Dr

06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 1 | 48 | 79 | 2 | 9 | 109 | 502 | 491 | 9 | 320 | 3 |
| Future Volume (vph) | 0 | 1 | 48 | 79 | 2 | 9 | 109 | 502 | 491 | 9 | 320 | 3 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.5 | 3.5 | 3.5 | 3.5 | | 3.0 | 4.0 | | 3.0 | 4.0 | |
| Lane Util. Factor | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | | 1.00 | 0.99 | 1.00 | 0.99 | | 1.00 | 0.99 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 1.00 | 0.85 | 1.00 | 0.88 | | 1.00 | 0.93 | | 1.00 | 1.00 | |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 1900 | 1533 | 1803 | 1649 | | 1770 | 3303 | | 1805 | 3569 | |
| Flt Permitted | | 1.00 | 1.00 | 0.76 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | | 1900 | 1533 | 1437 | 1649 | | 1770 | 3303 | | 1805 | 3569 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 0 | 1 | 51 | 83 | 2 | 9 | 115 | 528 | 517 | 9 | 337 | 3 |
| RTOR Reduction (vph) | 0 | 0 | 45 | 0 | 8 | 0 | 0 | 84 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 1 | 6 | 83 | 3 | 0 | 115 | 961 | 0 | 9 | 340 | 0 |
| Confl. Peds. (#/hr) | 1 | | 1 | 1 | | 1 | | | 2 | | | 8 |
| Heavy Vehicles (%) | 0% | 0% | 4% | 0% | 0% | 0% | 2% | 0% | 0% | 0% | 1% | 0% |
| Turn Type | | NA | Perm | Perm | NA | | Prot | NA | | Prot | NA | |
| Protected Phases | | 4 | | | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | 4 | 8 | | | | | | | | |
| Actuated Green, G (s) | | 12.3 | 12.3 | 12.3 | 12.3 | | 11.5 | 75.4 | | 1.8 | 65.7 | |
| Effective Green, g (s) | | 12.3 | 12.3 | 12.3 | 12.3 | | 11.5 | 75.4 | | 1.8 | 65.7 | |
| Actuated g/C Ratio | | 0.12 | 0.12 | 0.12 | 0.12 | | 0.12 | 0.75 | | 0.02 | 0.66 | |
| Clearance Time (s) | | 3.5 | 3.5 | 3.5 | 3.5 | | 3.0 | 4.0 | | 3.0 | 4.0 | |
| Vehicle Extension (s) | | 2.0 | 2.0 | 2.5 | 2.5 | | 2.0 | 4.0 | | 2.0 | 4.0 | |
| Lane Grp Cap (vph) | | 233 | 188 | 176 | 202 | | 203 | 2490 | | 32 | 2344 | |
| v/s Ratio Prot | | 0.00 | | | 0.00 | | c0.06 | c0.29 | | 0.00 | 0.10 | |
| v/s Ratio Perm | | | 0.00 | c0.06 | | | | | | | | |
| v/c Ratio | | 0.00 | 0.03 | 0.47 | 0.02 | | 0.57 | 0.39 | | 0.28 | 0.14 | |
| Uniform Delay, d1 | | 38.5 | 38.6 | 40.8 | 38.5 | | 41.9 | 4.3 | | 48.5 | 6.5 | |
| Progression Factor | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.06 | 1.35 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 0.0 | 0.0 | 1.5 | 0.0 | | 1.9 | 0.4 | | 1.8 | 0.1 | |
| Delay (s) | | 38.5 | 38.6 | 42.3 | 38.6 | | 46.5 | 6.2 | | 50.2 | 6.6 | |
| Level of Service | | D | D | D | D | | D | A | | D | A | |
| Approach Delay (s) | | 38.6 | | | 41.8 | | | 10.2 | | | 7.8 | |
| Approach LOS | | D | | | D | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 12.3 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.43 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 10.5 |
| Intersection Capacity Utilization | 58.6% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 36: Nave Dr & US 101 NB Off Ramp

06/13/2017

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 706 | 174 | 0 | 877 | 1200 | 195 |
| Future Volume (vph) | 706 | 174 | 0 | 877 | 1200 | 195 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | | 5.0 | 5.0 | |
| Lane Util. Factor | 0.97 | 1.00 | | 0.95 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 0.99 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.85 | | 1.00 | 0.98 | |
| Flt Protected | 0.95 | 1.00 | | 1.00 | 1.00 | |
| Satd. Flow (prot) | 3467 | 1563 | | 3574 | 3504 | |
| Flt Permitted | 0.95 | 1.00 | | 1.00 | 1.00 | |
| Satd. Flow (perm) | 3467 | 1563 | | 3574 | 3504 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 767 | 189 | 0 | 953 | 1304 | 212 |
| RTOR Reduction (vph) | 0 | 20 | 0 | 0 | 19 | 0 |
| Lane Group Flow (vph) | 767 | 169 | 0 | 953 | 1498 | 0 |
| Confl. Peds. (#/hr) | | 1 | | | | |
| Heavy Vehicles (%) | 1% | 2% | 0% | 1% | 1% | 0% |
| Turn Type | Prot | Perm | | NA | NA | |
| Protected Phases | 4 | | | 2 | 6 | |
| Permitted Phases | | 4 | | | | |
| Actuated Green, G (s) | 27.0 | 27.0 | | 35.0 | 35.0 | |
| Effective Green, g (s) | 27.0 | 27.0 | | 35.0 | 35.0 | |
| Actuated g/C Ratio | 0.39 | 0.39 | | 0.50 | 0.50 | |
| Clearance Time (s) | 3.0 | 3.0 | | 5.0 | 5.0 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 1337 | 602 | | 1787 | 1752 | |
| v/s Ratio Prot | c0.22 | | | 0.27 | c0.43 | |
| v/s Ratio Perm | | 0.11 | | | | |
| v/c Ratio | 0.57 | 0.28 | | 0.53 | 0.85 | |
| Uniform Delay, d1 | 17.0 | 14.8 | | 11.9 | 15.3 | |
| Progression Factor | 1.00 | 1.00 | | 0.37 | 1.00 | |
| Incremental Delay, d2 | 1.8 | 1.2 | | 1.0 | 5.6 | |
| Delay (s) | 18.8 | 16.0 | | 5.4 | 20.9 | |
| Level of Service | B | B | | A | C | |
| Approach Delay (s) | 18.2 | | | 5.4 | 20.9 | |
| Approach LOS | B | | | A | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 15.8 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.73 | | |
| Actuated Cycle Length (s) | 70.0 | Sum of lost time (s) | 8.0 |
| Intersection Capacity Utilization | 69.4% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 40 | 21 | 714 | 86 | 102 | 1125 |
| Future Volume (vph) | 40 | 21 | 714 | 86 | 102 | 1125 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.2 | 3.2 | 4.4 | | 3.0 | 4.4 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 0.85 | 0.99 | | 1.00 | 1.00 |
| Flt Protected | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 1615 | 1868 | | 1770 | 1881 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | 1805 | 1615 | 1868 | | 1770 | 1881 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 43 | 23 | 776 | 93 | 111 | 1223 |
| RTOR Reduction (vph) | 0 | 22 | 5 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 43 | 1 | 864 | 0 | 111 | 1223 |
| Confl. Peds. (#/hr) | | | | 2 | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 2% | 1% |
| Turn Type | Prot | Perm | NA | | Prot | NA |
| Protected Phases | 8 | | 2 | | 1 | 6 |
| Permitted Phases | | 8 | | | | |
| Actuated Green, G (s) | 3.6 | 3.6 | 48.6 | | 7.2 | 58.8 |
| Effective Green, g (s) | 3.6 | 3.6 | 48.6 | | 7.2 | 58.8 |
| Actuated g/C Ratio | 0.05 | 0.05 | 0.69 | | 0.10 | 0.84 |
| Clearance Time (s) | 3.2 | 3.2 | 4.4 | | 3.0 | 4.4 |
| Vehicle Extension (s) | 1.0 | 1.0 | 1.0 | | 1.0 | 1.0 |
| Lane Grp Cap (vph) | 92 | 83 | 1296 | | 182 | 1580 |
| v/s Ratio Prot | c0.02 | | 0.46 | | 0.06 | c0.65 |
| v/s Ratio Perm | | 0.00 | | | | |
| v/c Ratio | 0.47 | 0.01 | 0.67 | | 0.61 | 0.77 |
| Uniform Delay, d1 | 32.3 | 31.5 | 6.1 | | 30.1 | 2.6 |
| Progression Factor | 1.00 | 1.00 | 0.74 | | 1.28 | 1.55 |
| Incremental Delay, d2 | 1.4 | 0.0 | 2.2 | | 2.3 | 2.3 |
| Delay (s) | 33.6 | 31.5 | 6.6 | | 40.9 | 6.2 |
| Level of Service | C | C | A | | D | A |
| Approach Delay (s) | 32.9 | | 6.6 | | | 9.1 |
| Approach LOS | C | | A | | | A |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 8.9 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.79 | | |
| Actuated Cycle Length (s) | 70.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 71.2% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group





| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 119 | 277 | 488 | 42 | 359 | 771 |
| Future Volume (vph) | 119 | 277 | 488 | 42 | 359 | 771 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.2 | 3.2 | 4.4 | 4.4 | 3.0 | 4.4 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.85 | 1.00 | 0.85 | 1.00 | 1.00 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (prot) | 1770 | 1599 | 1900 | 1578 | 1787 | 1850 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (perm) | 1770 | 1599 | 1900 | 1578 | 1787 | 1900 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 129 | 301 | 530 | 46 | 390 | 838 |
| RTOR Reduction (vph) | 0 | 260 | 0 | 13 | 0 | 0 |
| Lane Group Flow (vph) | 129 | 41 | 530 | 33 | 390 | 838 |
| Confl. Peds. (#/hr) | | | | 2 | | |
| Heavy Vehicles (%) | 2% | 1% | 0% | 0% | 1% | 0% |
| Turn Type | Prot | Perm | NA | Perm | Prot | NA |
| Protected Phases | 8 | | 2 | | 1 | 6 |
| Permitted Phases | | 8 | | 2 | | |
| Actuated Green, G (s) | 9.6 | 9.6 | 25.4 | 25.4 | 24.4 | 52.8 |
| Effective Green, g (s) | 9.6 | 9.6 | 25.4 | 25.4 | 24.4 | 52.8 |
| Actuated g/C Ratio | 0.14 | 0.14 | 0.36 | 0.36 | 0.35 | 0.75 |
| Clearance Time (s) | 3.2 | 3.2 | 4.4 | 4.4 | 3.0 | 4.4 |
| Vehicle Extension (s) | 2.0 | 2.0 | 3.0 | 3.0 | 2.0 | 3.0 |
| Lane Grp Cap (vph) | 242 | 219 | 689 | 572 | 622 | 1395 |
| v/s Ratio Prot | c0.07 | | c0.28 | | c0.22 | 0.45 |
| v/s Ratio Perm | | 0.03 | | 0.02 | | |
| v/c Ratio | 0.53 | 0.19 | 0.77 | 0.06 | 0.63 | 0.60 |
| Uniform Delay, d1 | 28.1 | 26.7 | 19.7 | 14.5 | 19.0 | 3.9 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.25 | 0.67 |
| Incremental Delay, d2 | 1.1 | 0.2 | 8.1 | 0.2 | 1.0 | 1.3 |
| Delay (s) | 29.2 | 26.9 | 27.8 | 14.7 | 24.7 | 3.9 |
| Level of Service | C | C | C | B | C | A |
| Approach Delay (s) | 27.6 | | 26.7 | | | 10.5 |
| Approach LOS | C | | C | | | B |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 18.0 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.67 | | |
| Actuated Cycle Length (s) | 70.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 62.5% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## 39: Nave Dr & Main Gate Dr


| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 264 | 179 | 228 | 460 | 300 | 336 |
| Future Volume (vph) | 264 | 179 | 228 | 460 | 300 | 336 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | 4.1 | 4.1 | 3.0 | 4.4 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.85 | 1.00 | 0.85 | 1.00 | 1.00 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 1615 | 1900 | 1615 | 1805 | 1881 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (perm) | 1805 | 1615 | 1900 | 1615 | 1805 | 1881 |
| Peak-hour factor, PHF | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| Adj. Flow (vph) | 284 | 192 | 245 | 495 | 323 | 361 |
| RTOR Reduction (vph) | 0 | 143 | 0 | 370 | 0 | 0 |
| Lane Group Flow (vph) | 284 | 49 | 245 | 125 | 323 | 361 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 1% |
| Turn Type | Prot | Perm | NA | Perm | Prot | NA |
| Protected Phases | 8 | | 2 | | 1 | 6 |
| Permitted Phases | | 8 | | 2 | | |
| Actuated Green, G (s) | 11.4 | 11.4 | 11.4 | 11.4 | 12.2 | 26.3 |
| Effective Green, g (s) | 11.4 | 11.4 | 11.4 | 11.4 | 12.2 | 26.3 |
| Actuated g/C Ratio | 0.25 | 0.25 | 0.25 | 0.25 | 0.27 | 0.58 |
| Clearance Time (s) | 3.0 | 3.0 | 4.1 | 4.1 | 3.0 | 4.4 |
| Vehicle Extension (s) | 2.0 | 2.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| Lane Grp Cap (vph) | 456 | 408 | 480 | 408 | 488 | 1096 |
| v/s Ratio Prot | c0.16 | | c0.13 | | c0.18 | 0.19 |
| v/s Ratio Perm | | 0.03 | | 0.08 | | |
| v/c Ratio | 0.62 | 0.12 | 0.51 | 0.31 | 0.66 | 0.33 |
| Uniform Delay, d1 | 14.9 | 13.0 | 14.5 | 13.6 | 14.6 | 4.8 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 1.9 | 0.0 | 0.4 | 0.2 | 2.6 | 0.1 |
| Delay (s) | 16.9 | 13.0 | 14.8 | 13.8 | 17.2 | 4.9 |
| Level of Service | B | B | B | B | B | A |
| Approach Delay (s) | 15.3 | | 14.1 | | | 10.7 |
| Approach LOS | B | | B | | | B |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 13.2 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.60 | | |
| Actuated Cycle Length (s) | 45.1 | Sum of lost time (s) | 10.1 |
| Intersection Capacity Utilization | 53.3% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |




## 40: Nave Dr & Bolling Dr


| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 338 | 110 | 520 | 98 | 83 | 531 |
| Future Volume (vph) | 338 | 110 | 520 | 98 | 83 | 531 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | 4.1 | | 3.0 | 3.5 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 0.97 | 1.00 | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 0.85 | 0.98 | | 1.00 | 1.00 |
| Flt Protected | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | 1787 | 1571 | 1844 | | 1805 | 1881 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | 1787 | 1571 | 1844 | | 1805 | 1881 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 367 | 120 | 565 | 107 | 90 | 577 |
| RTOR Reduction (vph) | 0 | 85 | 9 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 367 | 35 | 663 | 0 | 90 | 577 |
| Confl. Peds. (#/hr) | | 6 | | | | |
| Heavy Vehicles (%) | 1% | 0% | 1% | 0% | 0% | 1% |
| Turn Type | Prot | Perm | NA | | Prot | NA |
| Protected Phases | 4 | | 6 | | 5 | 2 |
| Permitted Phases | | 4 | | | | |
| Actuated Green, G (s) | 17.4 | 17.4 | 25.3 | | 6.5 | 35.4 |
| Effective Green, g (s) | 17.4 | 17.4 | 25.3 | | 6.5 | 35.4 |
| Actuated g/C Ratio | 0.29 | 0.29 | 0.43 | | 0.11 | 0.60 |
| Clearance Time (s) | 3.0 | 3.0 | 4.1 | | 3.0 | 3.5 |
| Vehicle Extension (s) | 2.0 | 2.0 | 2.0 | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 524 | 460 | 786 | | 197 | 1122 |
| v/s Ratio Prot | c0.21 | | c0.36 | | 0.05 | c0.31 |
| v/s Ratio Perm | | 0.02 | | | | |
| v/c Ratio | 0.70 | 0.08 | 0.84 | | 0.46 | 0.51 |
| Uniform Delay, d1 | 18.6 | 15.1 | 15.2 | | 24.7 | 6.9 |
| Progression Factor | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 3.4 | 0.0 | 7.9 | | 0.6 | 0.2 |
| Delay (s) | 22.1 | 15.2 | 23.1 | | 25.4 | 7.1 |
| Level of Service | C | B | C | | C | A |
| Approach Delay (s) | 20.4 | | 23.1 | | | 9.6 |
| Approach LOS | C | | C | | | A |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 17.4 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.75 | | |
| Actuated Cycle Length (s) | 59.3 | Sum of lost time (s) | 10.1 |
| Intersection Capacity Utilization | 69.9% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Intersection | |
|---|---|
| Intersection Delay, s/veh | 33.6 |
| Intersection LOS | D |

| Movement | EBU | EBL | EBT | EBR | WBU | WBL | WBT | WBR | NBU | NBL | NBT | NBR | SBU | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | | | | | |
| Traffic Vol, veh/h | 0 | 131 | 12 | 0 | 0 | 66 | 123 | 619 | 0 | 2 | 164 | 45 | 0 | 109 | 21 | 6 |
| Future Vol, veh/h | 0 | 131 | 12 | 0 | 0 | 66 | 123 | 619 | 0 | 2 | 164 | 45 | 0 | 109 | 21 | 6 |
| Peak Hour Factor | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 0 | 138 | 13 | 0 | 0 | 69 | 129 | 652 | 0 | 2 | 173 | 47 | 0 | 115 | 22 | 6 |
| Number of Lanes | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Opposing Approach | WB | EB | SB | NB |
| Opposing Lanes | 2 | 1 | 2 | 1 |
| Conflicting Approach Left | SB | NB | EB | WB |
| Conflicting Lanes Left | 2 | 1 | 1 | 2 |
| Conflicting Approach Right | NB | SB | WB | EB |
| Conflicting Lanes Right | 1 | 2 | 2 | 1 |
| HCM Control Delay | 13.7 | 45.2 | 16.1 | 13.2 |
| HCM LOS | B | E | C | B |

| Lane | NBLn1 | EBLn1 | WBLn1 | WBLn2 | SBLn1 | SBLn2 |
|---|---|---|---|---|---|---|
| Vol Left, % | 1% | 92% | 35% | 0% | 100% | 0% |
| Vol Thru, % | 78% | 8% | 65% | 0% | 0% | 78% |
| Vol Right, % | 21% | 0% | 0% | 100% | 0% | 22% |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 211 | 143 | 189 | 619 | 109 | 27 |
| LT Vol | 2 | 131 | 66 | 0 | 109 | 0 |
| Through Vol | 164 | 12 | 123 | 0 | 0 | 21 |
| RT Vol | 45 | 0 | 0 | 619 | 0 | 6 |
| Lane Flow Rate | 222 | 151 | 199 | 652 | 115 | 28 |
| Geometry Grp | 6 | 6 | 7 | 7 | 7 | 7 |
| Degree of Util (X) | 0.449 | 0.309 | 0.35 | 0.987 | 0.261 | 0.059 |
| Departure Headway (Hd) | 7.274 | 7.379 | 6.443 | 5.555 | 8.204 | 7.531 |
| Convergence, Y/N | Yes | Yes | Yes | Yes | Yes | Yes |
| Cap | 498 | 489 | 561 | 658 | 439 | 477 |
| Service Time | 5.274 | 5.404 | 4.143 | 3.255 | 5.922 | 5.248 |
| HCM Lane V/C Ratio | 0.446 | 0.309 | 0.355 | 0.991 | 0.262 | 0.059 |
| HCM Control Delay | 16.1 | 13.7 | 12.6 | 55.1 | 13.8 | 10.7 |
| HCM Lane LOS | C | B | B | F | B | B |
| HCM 95th-tile Q | 2.3 | 1.3 | 1.6 | 15 | 1 | 0.2 |

| Intersection | |
|---|---|
| Intersection Delay, s/veh | 129.9 |
| Intersection LOS | F |

| Movement | EBU | EBL | EBT | EBR | WBU | WBL | WBT | WBR | NBU | NBL | NBT | NBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 0 | 12 | 481 | 96 | 0 | 342 | 1009 | 32 | 0 | 112 | 16 | 169 |
| Future Vol, veh/h | 0 | 12 | 481 | 96 | 0 | 342 | 1009 | 32 | 0 | 112 | 16 | 169 |
| Peak Hour Factor | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 0 | 13 | 506 | 101 | 0 | 360 | 1062 | 34 | 0 | 118 | 17 | 178 |
| Number of Lanes | 0 | 1 | 2 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 1 | 1 |

| Approach | EB | WB | NB |
|---|---|---|---|
| Opposing Approach | WB | EB | SB |
| Opposing Lanes | 3 | 3 | 1 |
| Conflicting Approach Left | SB | NB | EB |
| Conflicting Lanes Left | 1 | 2 | 3 |
| Conflicting Approach Right | NB | SB | WB |
| Conflicting Lanes Right | 2 | 1 | 3 |
| HCM Control Delay | 47.5 | 191 | 25.4 |
| HCM LOS | E | F | D |

| Lane | NBLn1 | NBLn2 | EBLn1 | EBLn2 | EBLn3 | WBLn1 | WBLn2 | WBLn3 | SBLn1 |
|---|---|---|---|---|---|---|---|---|---|
| Vol Left, % | 88% | 0% | 100% | 0% | 0% | 100% | 0% | 0% | 43% |
| Vol Thru, % | 12% | 0% | 0% | 100% | 63% | 0% | 100% | 91% | 27% |
| Vol Right, % | 0% | 100% | 0% | 0% | 37% | 0% | 0% | 9% | 30% |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 128 | 169 | 12 | 321 | 256 | 342 | 673 | 368 | 44 |
| LT Vol | 112 | 0 | 12 | 0 | 0 | 342 | 0 | 0 | 19 |
| Through Vol | 16 | 0 | 0 | 321 | 160 | 0 | 673 | 336 | 12 |
| RT Vol | 0 | 169 | 0 | 0 | 96 | 0 | 0 | 32 | 13 |
| Lane Flow Rate | 135 | 178 | 13 | 338 | 270 | 360 | 708 | 388 | 46 |
| Geometry Grp | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Degree of Util (X) | 0.431 | 0.513 | 0.035 | 0.899 | 0.699 | 0.904 | 1.676 | 0.911 | 0.154 |
| Departure Headway (Hd) | 12.783 | 11.62 | 11.082 | 10.564 | 10.293 | 9.039 | 8.523 | 8.46 | 12.971 |
| Convergence, Y/N | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Cap | 284 | 313 | 325 | 344 | 353 | 400 | 432 | 426 | 278 |
| Service Time | 10.483 | 9.32 | 8.782 | 8.264 | 7.993 | 6.817 | 6.301 | 6.238 | 10.671 |
| HCM Lane V/C Ratio | 0.475 | 0.569 | 0.04 | 0.983 | 0.765 | 0.9 | 1.639 | 0.911 | 0.165 |
| HCM Control Delay | 24.8 | 25.9 | 14.2 | 59.7 | 33.7 | 54.8 | 335.5 | 53.7 | 18 |
| HCM Lane LOS | C | D | B | F | D | F | F | F | C |
| HCM 95th-tile Q | 2.1 | 2.8 | 0.1 | 8.8 | 5 | 9.4 | 41.7 | 9.9 | 0.5 |





| Intersection | |
|---|---|
| Intersection Delay, s/veh | |
| Intersection LOS | |

| Movement | SBU | SBL | SBT | SBR |
|---|---|---|---|---|
| Lane Configurations | | | | |
| Traffic Vol, veh/h | 0 | 19 | 12 | 13 |
| Future Vol, veh/h | 0 | 19 | 12 | 13 |
| Peak Hour Factor | 0.95 | 0.95 | 0.95 | 0.95 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 |
| Mvmt Flow | 0 | 20 | 13 | 14 |
| Number of Lanes | 0 | 0 | 1 | 0 |

| Approach | SB |
|---|---|
| Opposing Approach | NB |
| Opposing Lanes | 2 |
| Conflicting Approach Left | WB |
| Conflicting Lanes Left | 3 |
| Conflicting Approach Right | EB |
| Conflicting Lanes Right | 3 |
| HCM Control Delay | 18 |
| HCM LOS | C |

# MOVEMENT SUMMARY

## Site: 1 [PM Cumulative Alt]

Simmons Lane/San Marin Drive
PM Cumulative with Project Alternative

Roundabout

**Movement Performance - Vehicles**

| Mov ID | OD Mov | Demand Flows Total veh/h | Demand Flows HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance ft | Prop. Queued | Effective Stop Rate per veh | Average Speed mph |
|---|---|---|---|---|---|---|---|---|---|---|---|
| South: NB Simmons Ln | | | | | | | | | | | |
| 3 | L2 | 117 | 2.0 | 0.398 | 9.7 | LOS A | 2.0 | 51.8 | 0.67 | 0.68 | 31.6 |
| 8 | T1 | 17 | 2.0 | 0.398 | 9.7 | LOS A | 2.0 | 51.8 | 0.67 | 0.68 | 31.6 |
| 18 | R2 | 176 | 2.0 | 0.398 | 9.7 | LOS A | 2.0 | 51.8 | 0.67 | 0.68 | 30.9 |
| Approach | | 309 | 2.0 | 0.398 | 9.7 | LOS A | 2.0 | 51.8 | 0.67 | 0.68 | 31.2 |
| East: WB San Marin Drive | | | | | | | | | | | |
| 1 | L2 | 356 | 2.0 | 0.293 | 5.6 | LOS A | 1.5 | 36.9 | 0.33 | 0.20 | 32.1 |
| 6 | T1 | 1051 | 2.0 | 1.010 | 49.7 | LOS F | 44.4 | 1128.4 | 1.00 | 1.08 | 20.7 |
| 16 | R2 | 33 | 2.0 | 1.010 | 49.7 | LOS F | 44.4 | 1128.4 | 1.00 | 1.08 | 20.3 |
| Approach | | 1441 | 2.0 | 1.010 | 38.8 | LOS D | 44.4 | 1128.4 | 0.83 | 0.86 | 22.7 |
| North: SB Simmons Ln | | | | | | | | | | | |
| 7 | L2 | 20 | 2.0 | 0.122 | 11.6 | LOS B | 0.4 | 9.7 | 0.76 | 0.76 | 30.7 |
| 4 | T1 | 13 | 2.0 | 0.122 | 11.6 | LOS B | 0.4 | 9.7 | 0.76 | 0.76 | 30.7 |
| 14 | R2 | 14 | 2.0 | 0.122 | 11.6 | LOS B | 0.4 | 9.7 | 0.76 | 0.76 | 30.0 |
| Approach | | 46 | 2.0 | 0.122 | 11.6 | LOS B | 0.4 | 9.7 | 0.76 | 0.76 | 30.5 |
| West: EB San Marin Drive | | | | | | | | | | | |
| 5 | L2 | 13 | 2.0 | 0.679 | 15.4 | LOS B | 6.3 | 159.3 | 0.81 | 0.87 | 30.1 |
| 2 | T1 | 501 | 2.0 | 0.679 | 15.4 | LOS B | 6.3 | 159.3 | 0.81 | 0.87 | 30.1 |
| 12 | R2 | 100 | 2.0 | 0.679 | 15.4 | LOS B | 6.3 | 159.3 | 0.81 | 0.87 | 29.4 |
| Approach | | 614 | 2.0 | 0.679 | 15.4 | LOS B | 6.3 | 159.3 | 0.81 | 0.87 | 30.0 |
| All Vehicles | | 2409 | 2.0 | 1.010 | 28.6 | LOS C | 44.4 | 1128.4 | 0.81 | 0.84 | 25.2 |

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.



# LANE SUMMARY

## Site: 1 [PM Cumulative Alt]

Simmons Lane/San Marin Drive
PM Cumulative with Project Alternative

Roundabout

**Lane Use and Performance**

| | Demand Flows Total veh/h | Demand Flows HV % | Cap. veh/h | Deg. Satn v/c | Lane Util. % | Average Delay sec | Level of Service | 95% Back of Queue Veh | 95% Back of Queue Dist ft | Lane Config | Lane Length ft | Cap. Adj. % | Prob. Block. % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| South: NB Simmons Ln | | | | | | | | | | | | | |
| Lane 1[d] | 309 | 2.0 | 777 | 0.398 | 100 | 9.7 | LOS A | 2.0 | 51.8 | Full | 1600 | 0.0 | 0.0 |
| Approach | 309 | 2.0 | | 0.398 | | 9.7 | LOS A | 2.0 | 51.8 | | | | |
| East: WB San Marin Drive | | | | | | | | | | | | | |
| Lane 1 | 356 | 2.0 | 1216 | 0.293 | 100 | 5.6 | LOS A | 1.5 | 36.9 | Short | 100 | 0.0 | NA |
| Lane 2[d] | 1084 | 2.0 | 1074[1] | 1.010 | 100 | 49.7 | LOS F | 44.4 | 1128.4 | Full | 1600 | 0.0 | 0.0 |
| Approach | 1441 | 2.0 | | 1.010 | | 38.8 | LOS D | 44.4 | 1128.4 | | | | |
| North: SB Simmons Ln | | | | | | | | | | | | | |
| Lane 1[d] | 46 | 2.0 | 375 | 0.122 | 100 | 11.6 | LOS B | 0.4 | 9.7 | Full | 1600 | 0.0 | 0.0 |
| Approach | 46 | 2.0 | | 0.122 | | 11.6 | LOS B | 0.4 | 9.7 | | | | |
| West: EB San Marin Drive | | | | | | | | | | | | | |
| Lane 1[d] | 614 | 2.0 | 903 | 0.679 | 100 | 15.4 | LOS B | 6.3 | 159.3 | Full | 1600 | 0.0 | 0.0 |
| Approach | 614 | 2.0 | | 0.679 | | 15.4 | LOS B | 6.3 | 159.3 | | | | |
| Intersection | 2409 | 2.0 | | 1.010 | | 28.6 | LOS C | 44.4 | 1128.4 | | | | |

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.
d Dominant lane on roundabout approach

## HCM Signalized Intersection Capacity Analysis
### 1: Simmons Ln & San Marin Dr

06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 12 | 481 | 96 | 342 | 1009 | 32 | 112 | 16 | 169 | 19 | 12 | 13 |
| Future Volume (vph) | 12 | 481 | 96 | 342 | 1009 | 32 | 112 | 16 | 169 | 19 | 12 | 13 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | | 4.0 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | | 1.00 | 0.85 | | 0.96 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 0.96 | 1.00 | | 0.98 | |
| Satd. Flow (prot) | 1770 | 1863 | 1583 | 1770 | 1863 | 1583 | | 1785 | 1583 | | 1751 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 0.75 | 1.00 | | 0.86 | |
| Satd. Flow (perm) | 1770 | 1863 | 1583 | 1770 | 1863 | 1583 | | 1401 | 1583 | | 1540 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 13 | 506 | 101 | 360 | 1062 | 34 | 118 | 17 | 178 | 20 | 13 | 14 |
| RTOR Reduction (vph) | 0 | 0 | 58 | 0 | 0 | 11 | 0 | 0 | 86 | 0 | 12 | 0 |
| Lane Group Flow (vph) | 13 | 506 | 43 | 360 | 1062 | 23 | 0 | 135 | 92 | 0 | 35 | 0 |
| Turn Type | Prot | NA | Perm | Prot | NA | Perm | Perm | NA | pm+ov | Perm | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | | 2 | 3 | | 6 | |
| Permitted Phases | | | 4 | | | 8 | 2 | | 2 | 6 | | |
| Actuated Green, G (s) | 0.7 | 33.2 | 33.2 | 19.2 | 51.7 | 51.7 | | 13.6 | 32.8 | | 13.6 | |
| Effective Green, g (s) | 0.7 | 33.2 | 33.2 | 19.2 | 51.7 | 51.7 | | 13.6 | 32.8 | | 13.6 | |
| Actuated g/C Ratio | 0.01 | 0.43 | 0.43 | 0.25 | 0.66 | 0.66 | | 0.17 | 0.42 | | 0.17 | |
| Clearance Time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | | 4.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | |
| Lane Grp Cap (vph) | 15 | 792 | 673 | 435 | 1234 | 1049 | | 244 | 746 | | 268 | |
| v/s Ratio Prot | 0.01 | 0.27 | | c0.20 | c0.57 | | | | 0.03 | | | |
| v/s Ratio Perm | | | 0.03 | | | 0.01 | | c0.10 | 0.03 | | 0.02 | |
| v/c Ratio | 0.87 | 0.64 | 0.06 | 0.83 | 0.86 | 0.02 | | 0.55 | 0.12 | | 0.13 | |
| Uniform Delay, d1 | 38.6 | 17.7 | 13.2 | 27.8 | 10.3 | 4.5 | | 29.4 | 13.8 | | 27.2 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | |
| Incremental Delay, d2 | 162.9 | 1.7 | 0.0 | 12.2 | 6.3 | 0.0 | | 2.7 | 0.1 | | 0.2 | |
| Delay (s) | 201.5 | 19.4 | 13.3 | 40.1 | 16.7 | 4.5 | | 32.1 | 13.9 | | 27.4 | |
| Level of Service | F | B | B | D | B | A | | C | B | | C | |
| Approach Delay (s) | | 22.2 | | | 22.2 | | | 21.8 | | | 27.4 | |
| Approach LOS | | C | | | C | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 22.2 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.82 | | |
| Actuated Cycle Length (s) | 78.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 79.4% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 2: W Campus Dr & San Marin Dr

06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 8 | 707 | 0 | 3 | 1381 | 45 | 0 | 0 | 0 | 207 | 0 | 36 |
| Future Volume (vph) | 8 | 707 | 0 | 3 | 1381 | 45 | 0 | 0 | 0 | 207 | 0 | 36 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.8 | | 4.0 | 4.8 | 4.8 | | | | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 | | | | 0.95 | 0.95 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | | | 1.00 | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | | 1.00 | 1.00 | 0.85 | | | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | | | | 0.95 | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 3574 | | 1805 | 3574 | 1615 | | | | 1715 | 1715 | 1615 |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | | | | 0.76 | 0.76 | 1.00 |
| Satd. Flow (perm) | 1805 | 3574 | | 1805 | 3574 | 1615 | | | | 1367 | 1367 | 1615 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 8 | 744 | 0 | 3 | 1454 | 47 | 0 | 0 | 0 | 218 | 0 | 38 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 18 | 0 | 0 | 0 | 0 | 0 | 33 |
| Lane Group Flow (vph) | 8 | 744 | 0 | 3 | 1454 | 29 | 0 | 0 | 0 | 109 | 109 | 5 |
| Confl. Peds. (#/hr) | | | 2 | | | | | | | | | |
| Heavy Vehicles (%) | 0% | 1% | 0% | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Prot | NA | | Prot | NA | Perm | | | | Perm | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | | | | 6 | 8 | | | 4 | | 4 |
| Actuated Green, G (s) | 1.5 | 36.6 | | 1.3 | 36.4 | 36.4 | | | | 8.4 | 8.4 | 8.4 |
| Effective Green, g (s) | 1.5 | 36.6 | | 1.3 | 36.4 | 36.4 | | | | 8.4 | 8.4 | 8.4 |
| Actuated g/C Ratio | 0.03 | 0.62 | | 0.02 | 0.62 | 0.62 | | | | 0.14 | 0.14 | 0.14 |
| Clearance Time (s) | 4.0 | 4.8 | | 4.0 | 4.8 | 4.8 | | | | 4.0 | 4.0 | 4.0 |
| Vehicle Extension (s) | 2.0 | 4.0 | | 2.0 | 4.0 | 4.0 | | | | 2.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 45 | 2213 | | 39 | 2201 | 994 | | | | 194 | 194 | 229 |
| v/s Ratio Prot | c0.00 | 0.21 | | 0.00 | c0.41 | | | | | | | |
| v/s Ratio Perm | | | | | | 0.02 | | | | c0.08 | 0.08 | 0.00 |
| v/c Ratio | 0.18 | 0.34 | | 0.08 | 0.66 | 0.03 | | | | 0.56 | 0.56 | 0.02 |
| Uniform Delay, d1 | 28.2 | 5.4 | | 28.3 | 7.3 | 4.4 | | | | 23.6 | 23.6 | 21.8 |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.7 | 0.1 | | 0.3 | 0.8 | 0.0 | | | | 2.2 | 2.2 | 0.0 |
| Delay (s) | 28.9 | 5.5 | | 28.6 | 8.2 | 4.5 | | | | 25.8 | 25.8 | 21.8 |
| Level of Service | C | A | | C | A | A | | | | C | C | C |
| Approach Delay (s) | | 5.8 | | | 8.1 | | | 0.0 | | | 25.3 | |
| Approach LOS | | A | | | A | | | A | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 9.2 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.63 | | |
| Actuated Cycle Length (s) | 59.1 | Sum of lost time (s) | 12.8 |
| Intersection Capacity Utilization | 53.8% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 3: San Marin Dr & E Campus Drive

06/13/2017

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 3 | 918 | 1424 | 136 | 493 | 12 |
| Future Volume (vph) | 3 | 918 | 1424 | 136 | 493 | 12 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 4.3 | 4.3 | 4.3 | 3.0 | 3.0 |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | 1.00 | 0.97 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 1.00 | 0.85 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 3574 | 3574 | 1615 | 3502 | 1595 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (perm) | 1805 | 3574 | 3574 | 1615 | 3502 | 1595 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 3 | 956 | 1483 | 142 | 514 | 12 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 53 | 0 | 10 |
| Lane Group Flow (vph) | 3 | 956 | 1483 | 89 | 514 | 3 |
| Confl. Peds. (#/hr) | | | | | | 1 |
| Heavy Vehicles (%) | 0% | 1% | 1% | 0% | 0% | 0% |
| Turn Type | Prot | NA | NA | Perm | Prot | Perm |
| Protected Phases | 5 | 2 | 6 | | 4 | |
| Permitted Phases | | | | 6 | | 4 |
| Actuated Green, G (s) | 1.3 | 48.7 | 44.4 | 44.4 | 18.2 | 18.2 |
| Effective Green, g (s) | 1.3 | 48.7 | 44.4 | 44.4 | 18.2 | 18.2 |
| Actuated g/C Ratio | 0.02 | 0.66 | 0.60 | 0.60 | 0.25 | 0.25 |
| Clearance Time (s) | 3.0 | 4.3 | 4.3 | 4.3 | 3.0 | 3.0 |
| Vehicle Extension (s) | 2.0 | 4.0 | 4.0 | 4.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 31 | 2345 | 2138 | 966 | 858 | 391 |
| v/s Ratio Prot | 0.00 | c0.27 | c0.41 | | c0.15 | |
| v/s Ratio Perm | | | | 0.05 | | 0.00 |
| v/c Ratio | 0.10 | 0.41 | 0.69 | 0.09 | 0.60 | 0.01 |
| Uniform Delay, d1 | 35.9 | 6.0 | 10.2 | 6.3 | 24.8 | 21.2 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.5 | 0.2 | 1.1 | 0.1 | 0.8 | 0.0 |
| Delay (s) | 36.4 | 6.1 | 11.3 | 6.4 | 25.5 | 21.2 |
| Level of Service | D | A | B | A | C | C |
| Approach Delay (s) | | 6.2 | 10.9 | | 25.4 | |
| Approach LOS | | A | B | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 11.9 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.66 | | |
| Actuated Cycle Length (s) | 74.2 | Sum of lost time (s) | 10.3 |
| Intersection Capacity Utilization | 60.8% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 4: Redwood Blvd & San Marin Dr

06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 36 | 1167 | 229 | 417 | 1110 | 232 | 302 | 100 | 562 | 730 | 165 | 107 |
| Future Volume (vph) | 36 | 1167 | 229 | 417 | 1110 | 232 | 302 | 100 | 562 | 730 | 165 | 107 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.6 | | 3.0 | 4.0 | | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 | |
| Lane Util. Factor | 1.00 | 0.91 | | 1.00 | 0.91 | | 0.97 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 0.99 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 0.98 | | 1.00 | 0.97 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.94 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1787 | 4997 | | 1752 | 5003 | | 3467 | 1881 | 1568 | 1787 | 1758 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1787 | 4997 | | 1752 | 5003 | | 3467 | 1881 | 1568 | 1787 | 1758 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 38 | 1228 | 241 | 439 | 1168 | 244 | 318 | 105 | 592 | 768 | 174 | 113 |
| RTOR Reduction (vph) | 0 | 22 | 0 | 0 | 24 | 0 | 0 | 0 | 177 | 0 | 18 | 0 |
| Lane Group Flow (vph) | 38 | 1447 | 0 | 439 | 1388 | 0 | 318 | 105 | 415 | 768 | 269 | 0 |
| Confl. Peds. (#/hr) | | | 4 | | | | | | | | | 5 |
| Confl. Bikes (#/hr) | | | | | | | | | | | | 1 |
| Heavy Vehicles (%) | 1% | 1% | 1% | 3% | 1% | 1% | 1% | 1% | 3% | 1% | 1% | 1% |
| Turn Type | Prot | NA | | Prot | NA | | Split | NA | Perm | Split | NA | |
| Protected Phases | 1 | 6 | | 5 | 2 | | 7 | 7 | | 8 | 8 | |
| Permitted Phases | | | | | 2 | | | | 7 | | | |
| Actuated Green, G (s) | 8.0 | 44.1 | | 14.8 | 50.5 | | 12.2 | 12.2 | 12.2 | 43.7 | 43.7 | |
| Effective Green, g (s) | 8.0 | 44.1 | | 14.8 | 50.5 | | 12.2 | 12.2 | 12.2 | 43.7 | 43.7 | |
| Actuated g/C Ratio | 0.06 | 0.34 | | 0.11 | 0.39 | | 0.09 | 0.09 | 0.09 | 0.34 | 0.34 | |
| Clearance Time (s) | 3.0 | 3.6 | | 3.0 | 4.0 | | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 | |
| Vehicle Extension (s) | 2.0 | 4.0 | | 5.0 | 4.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 109 | 1695 | | 199 | 1943 | | 325 | 176 | 147 | 600 | 590 | |
| v/s Ratio Prot | 0.02 | c0.29 | | c0.25 | 0.28 | | 0.09 | 0.06 | | c0.43 | 0.15 | |
| v/s Ratio Perm | | | | | | | | | c0.26 | | | |
| v/c Ratio | 0.35 | 0.85 | | 2.21 | 0.71 | | 0.98 | 0.60 | 2.83 | 1.28 | 0.46 | |
| Uniform Delay, d1 | 58.5 | 39.9 | | 57.6 | 33.6 | | 58.8 | 56.5 | 58.9 | 43.1 | 33.8 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 0.7 | 4.6 | | 558.8 | 2.3 | | 43.4 | 3.6 | 839.9 | 138.5 | 0.2 | |
| Delay (s) | 59.2 | 44.5 | | 616.4 | 35.9 | | 102.2 | 60.1 | 898.8 | 181.6 | 34.0 | |
| Level of Service | E | D | | F | D | | F | E | F | F | C | |
| Approach Delay (s) | | 44.9 | | | 173.6 | | | 562.4 | | | 141.5 | |
| Approach LOS | | D | | | F | | | F | | | F | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 204.3 | HCM 2000 Level of Service | F |
| HCM 2000 Volume to Capacity ratio | 1.40 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 15.6 |
| Intersection Capacity Utilization | 114.6% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 4: Redwood Blvd & San Marin Dr

06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 36 | 1167 | 229 | 417 | 1110 | 232 | 302 | 100 | 562 | 730 | 165 | 107 |
| Future Volume (vph) | 36 | 1167 | 229 | 417 | 1110 | 232 | 302 | 100 | 562 | 730 | 165 | 107 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.6 | | 3.0 | 4.0 | 4.3 | 4.3 | 4.3 | 3.0 | 4.3 | 4.3 | |
| Lane Util. Factor | 1.00 | 0.91 | | 0.97 | 0.95 | 1.00 | 0.95 | 0.95 | 0.88 | 0.91 | 0.91 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 0.98 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.97 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 0.98 | 1.00 | 0.95 | 0.97 | |
| Satd. Flow (prot) | 1787 | 4996 | | 3400 | 3574 | 1599 | 1698 | 1743 | 2760 | 1626 | 3235 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 0.98 | 1.00 | 0.95 | 0.97 | |
| Satd. Flow (perm) | 1787 | 4996 | | 3400 | 3574 | 1599 | 1698 | 1743 | 2760 | 1626 | 3235 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 38 | 1228 | 241 | 439 | 1168 | 244 | 318 | 105 | 592 | 768 | 174 | 113 |
| RTOR Reduction (vph) | 0 | 21 | 0 | 0 | 0 | 76 | 0 | 0 | 49 | 0 | 12 | 0 |
| Lane Group Flow (vph) | 38 | 1448 | 0 | 439 | 1168 | 168 | 210 | 213 | 543 | 384 | 659 | 0 |
| Confl. Peds. (#/hr) | | | 4 | | | | | | | | | 5 |
| Confl. Bikes (#/hr) | | | | | | | | | | | | 1 |
| Heavy Vehicles (%) | 1% | 1% | 1% | 3% | 1% | 1% | 1% | 1% | 3% | 1% | 1% | 1% |
| Turn Type | Prot | NA | | Prot | NA | pm+ov | Split | NA | pm+ov | Split | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | 4 | 8 | 8 | 1 | 4 | 4 | |
| Permitted Phases | | | | | | 6 | | | 8 | | | |
| Actuated Green, G (s) | 8.0 | 46.6 | | 20.6 | 58.8 | 96.3 | 20.1 | 20.1 | 40.7 | 37.5 | 37.5 | |
| Effective Green, g (s) | 8.0 | 46.6 | | 20.6 | 58.8 | 96.3 | 20.1 | 20.1 | 40.7 | 37.5 | 37.5 | |
| Actuated g/C Ratio | 0.06 | 0.33 | | 0.15 | 0.42 | 0.69 | 0.14 | 0.14 | 0.29 | 0.27 | 0.27 | |
| Clearance Time (s) | 3.0 | 3.6 | | 3.0 | 4.0 | 4.3 | 4.3 | 4.3 | 3.0 | 4.3 | 4.3 | |
| Vehicle Extension (s) | 2.0 | 4.0 | | 5.0 | 4.0 | 2.0 | 2.0 | 2.0 | 5.0 | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 102 | 1662 | | 500 | 1501 | 1099 | 243 | 250 | 802 | 435 | 866 | |
| v/s Ratio Prot | 0.02 | c0.29 | | c0.13 | 0.33 | 0.04 | c0.12 | 0.12 | 0.10 | c0.24 | 0.20 | |
| v/s Ratio Perm | | | | | | 0.06 | | | 0.10 | | | |
| v/c Ratio | 0.37 | 0.87 | | 0.88 | 0.78 | 0.15 | 0.86 | 0.85 | 0.68 | 0.88 | 0.76 | |
| Uniform Delay, d1 | 63.6 | 43.9 | | 58.5 | 35.0 | 7.6 | 58.6 | 58.5 | 43.8 | 49.1 | 47.1 | |
| Progression Factor | 1.00 | 1.00 | | 0.83 | 0.57 | 3.38 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 0.8 | 6.6 | | 14.6 | 3.4 | 0.0 | 25.0 | 22.6 | 3.0 | 18.2 | 3.6 | |
| Delay (s) | 64.4 | 50.5 | | 63.0 | 23.5 | 25.7 | 83.6 | 81.1 | 46.8 | 67.3 | 50.7 | |
| Level of Service | E | D | | E | C | C | F | F | D | E | D | |
| Approach Delay (s) | | 50.8 | | | 33.1 | | | 61.6 | | | 56.8 | |
| Approach LOS | | D | | | C | | | E | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 48.0 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.88 | | |
| Actuated Cycle Length (s) | 140.0 | Sum of lost time (s) | 15.6 |
| Intersection Capacity Utilization | 96.0% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 5: US 101 SB Ramps & San Marin Dr

06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 1302 | 1122 | 199 | 1427 | 0 | 0 | 0 | 0 | 67 | 2 | 386 |
| Future Volume (vph) | 0 | 1302 | 1122 | 199 | 1427 | 0 | 0 | 0 | 0 | 67 | 2 | 386 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.9 | 4.9 | 3.0 | 5.3 | | | | | | 4.0 | 4.0 |
| Lane Util. Factor | | 0.95 | 1.00 | 1.00 | 0.95 | | | | | | 1.00 | 0.88 |
| Frpb, ped/bikes | | 1.00 | 0.98 | 1.00 | 1.00 | | | | | | 1.00 | 1.00 |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | | | | | 1.00 | 1.00 |
| Frt | | 1.00 | 0.85 | 1.00 | 1.00 | | | | | | 1.00 | 0.85 |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | | 0.95 | 1.00 |
| Satd. Flow (prot) | | 3574 | 1575 | 1805 | 3574 | | | | | | 1812 | 2814 |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | | 0.95 | 1.00 |
| Satd. Flow (perm) | | 3574 | 1575 | 1805 | 3574 | | | | | | 1812 | 2814 |
| Peak-hour factor, PHF | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| Adj. Flow (vph) | 0 | 1342 | 1157 | 205 | 1471 | 0 | 0 | 0 | 0 | 69 | 2 | 398 |
| RTOR Reduction (vph) | 0 | 0 | 264 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 127 |
| Lane Group Flow (vph) | 0 | 1342 | 893 | 205 | 1471 | 0 | 0 | 0 | 0 | 0 | 71 | 271 |
| Confl. Peds. (#/hr) | | | 4 | | | | | | | | | |
| Heavy Vehicles (%) | 0% | 1% | 1% | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 1% |
| Turn Type | | NA | Perm | Prot | NA | | | | | Split | NA | Perm |
| Protected Phases | | 2 | | 1 | 6 | | | | | 4 | 4 | |
| Permitted Phases | | | 2 | | | | | | | | | 4 |
| Actuated Green, G (s) | | 41.2 | 41.2 | 9.0 | 52.8 | | | | | | 7.9 | 7.9 |
| Effective Green, g (s) | | 41.2 | 41.2 | 9.0 | 52.8 | | | | | | 7.9 | 7.9 |
| Actuated g/C Ratio | | 0.59 | 0.59 | 0.13 | 0.75 | | | | | | 0.11 | 0.11 |
| Clearance Time (s) | | 4.9 | 4.9 | 3.0 | 5.3 | | | | | | 4.0 | 4.0 |
| Vehicle Extension (s) | | 4.0 | 4.0 | 2.0 | 4.0 | | | | | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | | 2103 | 927 | 232 | 2695 | | | | | | 204 | 317 |
| v/s Ratio Prot | | 0.38 | | c0.11 | 0.41 | | | | | | 0.04 | |
| v/s Ratio Perm | | | c0.57 | | | | | | | | | c0.10 |
| v/c Ratio | | 0.64 | 0.96 | 0.88 | 0.55 | | | | | | 0.35 | 0.86 |
| Uniform Delay, d1 | | 9.5 | 13.7 | 30.0 | 3.6 | | | | | | 28.7 | 30.5 |
| Progression Factor | | 1.00 | 1.00 | 1.00 | 1.00 | | | | | | 1.00 | 1.00 |
| Incremental Delay, d2 | | 1.5 | 22.0 | 29.5 | 0.8 | | | | | | 0.4 | 19.0 |
| Delay (s) | | 11.0 | 35.7 | 59.5 | 4.4 | | | | | | 29.0 | 49.5 |
| Level of Service | | B | D | E | A | | | | | | C | D |
| Approach Delay (s) | | 22.4 | | | 11.1 | | | 0.0 | | | 46.4 | |
| Approach LOS | | C | | | B | | | A | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 20.8 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.94 | | |
| Actuated Cycle Length (s) | 70.0 | Sum of lost time (s) | 11.9 |
| Intersection Capacity Utilization | 144.0% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

# HCM Signalized Intersection Capacity Analysis
## 6: US 101 NB Ramps & San Marin Dr

06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 629 | 690 | 0 | 0 | 568 | 63 | 1157 | 113 | 263 | 0 | 0 | 0 |
| Future Volume (vph) | 629 | 690 | 0 | 0 | 568 | 63 | 1157 | 113 | 263 | 0 | 0 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.6 | | | 4.9 | 4.9 | 3.5 | 3.5 | | | | |
| Lane Util. Factor | 0.97 | 1.00 | | | 0.95 | 1.00 | 0.95 | 0.95 | | | | |
| Frpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | 0.99 | 1.00 | 0.99 | | | | |
| Flpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | | | |
| Frt | 1.00 | 1.00 | | | 1.00 | 0.85 | 1.00 | 0.95 | | | | |
| Flt Protected | 0.95 | 1.00 | | | 1.00 | 1.00 | 0.95 | 0.98 | | | | |
| Satd. Flow (prot) | 3467 | 1881 | | | 3574 | 1593 | 1681 | 1624 | | | | |
| Flt Permitted | 0.95 | 1.00 | | | 1.00 | 1.00 | 0.95 | 0.98 | | | | |
| Satd. Flow (perm) | 3467 | 1881 | | | 3574 | 1593 | 1681 | 1624 | | | | |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 655 | 719 | 0 | 0 | 592 | 66 | 1205 | 118 | 274 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 55 | 0 | 28 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 655 | 719 | 0 | 0 | 592 | 11 | 807 | 762 | 0 | 0 | 0 | 0 |
| Confl. Peds. (#/hr) | | | 3 | | | 1 | | | 1 | 1 | | |
| Heavy Vehicles (%) | 1% | 1% | 0% | 0% | 1% | 0% | 2% | 0% | 3% | 0% | 0% | 0% |
| Turn Type | Prot | NA | | | NA | Perm | Split | NA | | | | |
| Protected Phases | 5 | 2 | | | 6 | | 8 | 8 | | | | |
| Permitted Phases | | | | | | 6 | | | | | | |
| Actuated Green, G (s) | 10.3 | 26.0 | | | 11.9 | 11.9 | 34.6 | 34.6 | | | | |
| Effective Green, g (s) | 10.3 | 26.0 | | | 11.9 | 11.9 | 34.6 | 34.6 | | | | |
| Actuated g/C Ratio | 0.15 | 0.38 | | | 0.17 | 0.17 | 0.50 | 0.50 | | | | |
| Clearance Time (s) | 3.5 | 4.6 | | | 4.9 | 4.9 | 3.5 | 3.5 | | | | |
| Vehicle Extension (s) | 2.0 | 4.0 | | | 4.0 | 4.0 | 2.5 | 2.5 | | | | |
| Lane Grp Cap (vph) | 519 | 711 | | | 619 | 275 | 846 | 817 | | | | |
| v/s Ratio Prot | c0.19 | c0.38 | | | 0.17 | | c0.48 | 0.47 | | | | |
| v/s Ratio Perm | | | | | | 0.01 | | | | | | |
| v/c Ratio | 1.26 | 1.01 | | | 0.96 | 0.04 | 0.95 | 0.93 | | | | |
| Uniform Delay, d1 | 29.2 | 21.4 | | | 28.1 | 23.7 | 16.3 | 16.0 | | | | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | | | |
| Incremental Delay, d2 | 132.8 | 36.6 | | | 25.7 | 0.1 | 20.4 | 17.3 | | | | |
| Delay (s) | 162.0 | 57.9 | | | 53.8 | 23.7 | 36.7 | 33.3 | | | | |
| Level of Service | F | E | | | D | C | D | C | | | | |
| Approach Delay (s) | | 107.5 | | | 50.8 | | | 35.0 | | | 0.0 | |
| Approach LOS | | F | | | D | | | D | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 65.3 | HCM 2000 Level of Service | E |
| HCM 2000 Volume to Capacity ratio | 1.07 | | |
| Actuated Cycle Length (s) | 68.7 | Sum of lost time (s) | 11.9 |
| Intersection Capacity Utilization | 144.0% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



# HCM Signalized Intersection Capacity Analysis
## 6: US 101 NB Ramps & San Marin Dr

06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 629 | 690 | 0 | 0 | 568 | 63 | 1157 | 113 | 263 | 0 | 0 | 0 |
| Future Volume (vph) | 629 | 690 | 0 | 0 | 568 | 63 | 1157 | 113 | 263 | 0 | 0 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.6 | | | 4.9 | 4.9 | 3.5 | 3.5 | | | | |
| Lane Util. Factor | 0.97 | 1.00 | | | 0.95 | 1.00 | 0.97 | 1.00 | | | | |
| Frpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | 0.99 | 1.00 | 0.99 | | | | |
| Flpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | | | |
| Frt | 1.00 | 1.00 | | | 1.00 | 0.85 | 1.00 | 0.90 | | | | |
| Flt Protected | 0.95 | 1.00 | | | 1.00 | 1.00 | 0.95 | 1.00 | | | | |
| Satd. Flow (prot) | 3467 | 1881 | | | 3574 | 1593 | 3433 | 1641 | | | | |
| Flt Permitted | 0.95 | 1.00 | | | 1.00 | 1.00 | 0.95 | 1.00 | | | | |
| Satd. Flow (perm) | 3467 | 1881 | | | 3574 | 1593 | 3433 | 1641 | | | | |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 655 | 719 | 0 | 0 | 592 | 66 | 1205 | 118 | 274 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 39 | 0 | 54 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 655 | 719 | 0 | 0 | 592 | 27 | 1205 | 338 | 0 | 0 | 0 | 0 |
| Confl. Peds. (#/hr) | | | 3 | | | 1 | | | 1 | 1 | | |
| Heavy Vehicles (%) | 1% | 1% | 0% | 0% | 1% | 0% | 2% | 0% | 3% | 0% | 0% | 0% |
| Turn Type | Prot | NA | | | NA | Perm | Split | NA | | | | |
| Protected Phases | 5 | 2 | | | 6 | | 8 | 8 | | | | |
| Permitted Phases | | | | | | 6 | | | | | | |
| Actuated Green, G (s) | 30.2 | 62.5 | | | 28.5 | 28.5 | 69.4 | 69.4 | | | | |
| Effective Green, g (s) | 30.2 | 62.5 | | | 28.5 | 28.5 | 69.4 | 69.4 | | | | |
| Actuated g/C Ratio | 0.22 | 0.45 | | | 0.20 | 0.20 | 0.50 | 0.50 | | | | |
| Clearance Time (s) | 3.5 | 4.6 | | | 4.9 | 4.9 | 3.5 | 3.5 | | | | |
| Vehicle Extension (s) | 2.0 | 4.0 | | | 4.0 | 4.0 | 2.5 | 2.5 | | | | |
| Lane Grp Cap (vph) | 747 | 839 | | | 727 | 324 | 1701 | 813 | | | | |
| v/s Ratio Prot | 0.19 | c0.38 | | | 0.17 | | c0.35 | 0.21 | | | | |
| v/s Ratio Perm | | | | | | 0.02 | | | | | | |
| v/c Ratio | 0.88 | 0.86 | | | 0.81 | 0.08 | 0.71 | 0.42 | | | | |
| Uniform Delay, d1 | 53.1 | 34.7 | | | 53.2 | 45.2 | 27.4 | 22.4 | | | | |
| Progression Factor | 0.72 | 0.55 | | | 1.00 | 1.00 | 1.00 | 1.00 | | | | |
| Incremental Delay, d2 | 7.3 | 5.9 | | | 7.3 | 0.2 | 2.5 | 1.6 | | | | |
| Delay (s) | 45.5 | 24.9 | | | 60.6 | 45.3 | 30.0 | 24.0 | | | | |
| Level of Service | D | C | | | E | D | C | C | | | | |
| Approach Delay (s) | | 34.7 | | | 59.0 | | | 28.5 | | | 0.0 | |
| Approach LOS | | C | | | E | | | C | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 36.4 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.80 | | |
| Actuated Cycle Length (s) | 140.0 | Sum of lost time (s) | 11.9 |
| Intersection Capacity Utilization | 112.1% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 7: Redwood Blvd & Olive St

06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 166 | 74 | 36 | 188 | 107 | 112 | 77 | 835 | 210 | 137 | 539 | 157 |
| Future Volume (vph) | 166 | 74 | 36 | 188 | 107 | 112 | 77 | 835 | 210 | 137 | 539 | 157 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 5.1 | 5.1 | | | 5.1 | | 4.0 | 3.9 | 3.9 | 4.0 | 3.9 | |
| Lane Util. Factor | 1.00 | 1.00 | | | 1.00 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | |
| Frt | 1.00 | 0.95 | | | 0.96 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.97 | |
| Flt Protected | 0.95 | 1.00 | | | 0.98 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1770 | 1771 | | | 1753 | | 1770 | 3539 | 1583 | 1770 | 3420 | |
| Flt Permitted | 0.95 | 1.00 | | | 0.98 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1770 | 1771 | | | 1753 | | 1770 | 3539 | 1583 | 1770 | 3420 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 175 | 78 | 38 | 198 | 113 | 118 | 81 | 879 | 221 | 144 | 567 | 165 |
| RTOR Reduction (vph) | 0 | 18 | 0 | 0 | 12 | 0 | 0 | 0 | 78 | 0 | 23 | 0 |
| Lane Group Flow (vph) | 175 | 98 | 0 | 0 | 417 | 0 | 81 | 879 | 143 | 144 | 709 | 0 |
| Turn Type | Split | NA | | Split | NA | | Prot | NA | Perm | Prot | NA | |
| Protected Phases | 4 | 4 | | 8 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | | | | | | | 2 | | | |
| Actuated Green, G (s) | 14.0 | 14.0 | | | 26.1 | | 7.8 | 28.4 | 28.4 | 10.1 | 30.7 | |
| Effective Green, g (s) | 14.0 | 14.0 | | | 26.1 | | 7.8 | 28.4 | 28.4 | 10.1 | 30.7 | |
| Actuated g/C Ratio | 0.14 | 0.14 | | | 0.27 | | 0.08 | 0.29 | 0.29 | 0.10 | 0.32 | |
| Clearance Time (s) | 5.1 | 5.1 | | | 5.1 | | 4.0 | 3.9 | 3.9 | 4.0 | 3.9 | |
| Vehicle Extension (s) | 1.0 | 1.0 | | | 1.0 | | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | |
| Lane Grp Cap (vph) | 256 | 256 | | | 473 | | 142 | 1039 | 464 | 184 | 1085 | |
| v/s Ratio Prot | c0.10 | 0.06 | | | c0.24 | | 0.05 | c0.25 | | c0.08 | 0.21 | |
| v/s Ratio Perm | | | | | | | | | 0.09 | | | |
| v/c Ratio | 0.68 | 0.38 | | | 0.88 | | 0.57 | 0.85 | 0.31 | 0.78 | 0.65 | |
| Uniform Delay, d1 | 39.2 | 37.4 | | | 33.8 | | 42.8 | 32.1 | 26.5 | 42.2 | 28.4 | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 5.9 | 0.3 | | | 16.9 | | 3.4 | 6.2 | 0.1 | 17.9 | 1.1 | |
| Delay (s) | 45.1 | 37.8 | | | 50.8 | | 46.2 | 38.3 | 26.7 | 60.1 | 29.5 | |
| Level of Service | D | D | | | D | | D | D | C | E | C | |
| Approach Delay (s) | | 42.2 | | | 50.8 | | | 36.7 | | | 34.5 | |
| Approach LOS | | D | | | D | | | D | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 38.8 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.81 | | |
| Actuated Cycle Length (s) | 96.7 | Sum of lost time (s) | 18.1 |
| Intersection Capacity Utilization | 71.9% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 8: Redwood Blvd & Grant Ave

06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 141 | 142 | 329 | 49 | 178 | 88 | 414 | 652 | 74 | 62 | 556 | 181 |
| Future Volume (vph) | 141 | 142 | 329 | 49 | 178 | 88 | 414 | 652 | 74 | 62 | 556 | 181 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.5 | 3.5 | | 3.5 | 3.7 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.96 | 1.00 | 0.99 | | 1.00 | 0.99 | |
| Flpb, ped/bikes | 0.99 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.98 | | 1.00 | 0.96 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1752 | 1900 | 1526 | 1803 | 1900 | 1555 | 1805 | 3459 | | 1805 | 3386 | |
| Flt Permitted | 0.55 | 1.00 | 1.00 | 0.62 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1019 | 1900 | 1526 | 1176 | 1900 | 1555 | 1805 | 3459 | | 1805 | 3386 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 148 | 149 | 346 | 52 | 187 | 93 | 436 | 686 | 78 | 65 | 585 | 191 |
| RTOR Reduction (vph) | 0 | 0 | 254 | 0 | 0 | 68 | 0 | 8 | 0 | 0 | 29 | 0 |
| Lane Group Flow (vph) | 148 | 149 | 92 | 52 | 187 | 25 | 436 | 756 | 0 | 65 | 747 | 0 |
| Confl. Peds. (#/hr) | 22 | | 46 | 2 | | 34 | | | 36 | | | 10 |
| Confl. Bikes (#/hr) | | | 5 | | | 5 | | | 5 | | | 5 |
| Heavy Vehicles (%) | 2% | 0% | 1% | 0% | 0% | 0% | 0% | 2% | 0% | 0% | 2% | 0% |
| Turn Type | Perm | NA | Perm | Perm | NA | Perm | Prot | NA | | Prot | NA | |
| Protected Phases | | 8 | | | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | 8 | | 8 | 4 | | 4 | | | | | | |
| Actuated Green, G (s) | 21.5 | 21.5 | 21.5 | 21.5 | 21.5 | 21.5 | 24.2 | 36.7 | | 12.0 | 24.3 | |
| Effective Green, g (s) | 21.5 | 21.5 | 21.5 | 21.5 | 21.5 | 21.5 | 24.2 | 36.7 | | 12.0 | 24.3 | |
| Actuated g/C Ratio | 0.26 | 0.26 | 0.26 | 0.26 | 0.26 | 0.26 | 0.30 | 0.45 | | 0.15 | 0.30 | |
| Clearance Time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.5 | 3.5 | | 3.5 | 3.7 | |
| Vehicle Extension (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 2.5 | 3.0 | | 2.5 | 3.0 | |
| Lane Grp Cap (vph) | 269 | 503 | 404 | 311 | 503 | 411 | 537 | 1563 | | 266 | 1013 | |
| v/s Ratio Prot | | 0.08 | | | 0.10 | | c0.24 | 0.22 | | 0.04 | c0.22 | |
| v/s Ratio Perm | c0.15 | | 0.06 | 0.04 | | 0.02 | | | | | | |
| v/c Ratio | 0.55 | 0.30 | 0.23 | 0.17 | 0.37 | 0.06 | 0.81 | 0.48 | | 0.24 | 0.74 | |
| Uniform Delay, d1 | 25.7 | 23.8 | 23.3 | 23.0 | 24.3 | 22.3 | 26.4 | 15.6 | | 30.6 | 25.6 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 3.0 | 0.5 | 0.4 | 0.3 | 0.6 | 0.1 | 8.9 | 0.2 | | 0.3 | 2.8 | |
| Delay (s) | 28.7 | 24.3 | 23.7 | 23.3 | 25.0 | 22.4 | 35.3 | 15.8 | | 30.9 | 28.4 | |
| Level of Service | C | C | C | C | C | C | D | B | | C | C | |
| Approach Delay (s) | | 25.0 | | | 24.0 | | | 22.9 | | | 28.6 | |
| Approach LOS | | C | | | C | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 25.1 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.70 | | |
| Actuated Cycle Length (s) | 81.2 | Sum of lost time (s) | 11.2 |
| Intersection Capacity Utilization | 94.8% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM 2010 AWSC
### 9: San Marin Dr/Sutro Ave & Novato Blvd #1

06/13/2017

| Intersection | |
|---|---|
| Intersection Delay, s/veh | 127.1 |
| Intersection LOS | F |

| Movement | EBU | EBL | EBT | EBR | WBU | WBL | WBT | WBR | NBU | NBL | NBT | NBR | SBU | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | | | | | |
| Traffic Vol, veh/h | 0 | 105 | 172 | 56 | 0 | 77 | 345 | 198 | 0 | 69 | 132 | 61 | 0 | 185 | 235 | 460 |
| Future Vol, veh/h | 0 | 105 | 172 | 56 | 0 | 77 | 345 | 198 | 0 | 69 | 132 | 61 | 0 | 185 | 235 | 460 |
| Peak Hour Factor | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 0 | 111 | 181 | 59 | 0 | 81 | 363 | 208 | 0 | 73 | 139 | 64 | 0 | 195 | 247 | 484 |
| Number of Lanes | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 1 |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Opposing Approach | WB | EB | SB | NB |
| Opposing Lanes | 2 | 2 | 3 | 2 |
| Conflicting Approach Left | SB | NB | EB | WB |
| Conflicting Lanes Left | 3 | 2 | 2 | 2 |
| Conflicting Approach Right | NB | SB | WB | EB |
| Conflicting Lanes Right | 2 | 3 | 2 | 2 |
| HCM Control Delay | 33.8 | 273.5 | 29.6 | 88.3 |
| HCM LOS | D | F | D | F |

| Lane | NBLn1 | NBLn2 | EBLn1 | EBLn2 | WBLn1 | WBLn2 | SBLn1 | SBLn2 | SBLn3 |
|---|---|---|---|---|---|---|---|---|---|
| Vol Left, % | 100% | 0% | 100% | 0% | 100% | 0% | 100% | 0% | 0% |
| Vol Thru, % | 0% | 68% | 0% | 75% | 0% | 64% | 0% | 100% | 0% |
| Vol Right, % | 0% | 32% | 0% | 25% | 0% | 36% | 0% | 0% | 100% |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 69 | 193 | 105 | 228 | 77 | 543 | 185 | 235 | 460 |
| LT Vol | 69 | 0 | 105 | 0 | 77 | 0 | 185 | 0 | 0 |
| Through Vol | 0 | 132 | 0 | 172 | 0 | 345 | 0 | 235 | 0 |
| RT Vol | 0 | 61 | 0 | 56 | 0 | 198 | 0 | 0 | 460 |
| Lane Flow Rate | 73 | 203 | 111 | 240 | 81 | 572 | 195 | 247 | 484 |
| Geometry Grp | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Degree of Util (X) | 0.233 | 0.61 | 0.345 | 0.704 | 0.244 | 1.602 | 0.544 | 0.657 | 1.192 |
| Departure Headway (Hd) | 13.273 | 12.499 | 12.829 | 12.119 | 11.346 | 10.561 | 11.417 | 10.889 | 10.152 |
| Convergence, Y/N | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Cap | 272 | 291 | 282 | 300 | 319 | 349 | 317 | 334 | 363 |
| Service Time | 10.973 | 10.199 | 10.529 | 9.819 | 9.046 | 8.261 | 9.117 | 8.589 | 7.852 |
| HCM Lane V/C Ratio | 0.268 | 0.698 | 0.394 | 0.8 | 0.254 | 1.639 | 0.615 | 0.74 | 1.333 |
| HCM Control Delay | 20 | 33 | 22.1 | 39.2 | 17.7 | 309.8 | 26.9 | 32.2 | 141.6 |
| HCM Lane LOS | C | D | C | E | C | F | D | D | F |
| HCM 95th-tile Q | 0.9 | 3.7 | 1.5 | 4.9 | 0.9 | 32 | 3.1 | 4.4 | 17.5 |



## HCM Signalized Intersection Capacity Analysis
### 9: San Marin Dr/Sutro Ave & Novato Blvd #1

06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 105 | 172 | 56 | 77 | 345 | 198 | 69 | 132 | 61 | 185 | 235 | 460 |
| Future Volume (vph) | 105 | 172 | 56 | 77 | 345 | 198 | 69 | 132 | 61 | 185 | 235 | 460 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 4.0 | | 3.0 | 4.0 | | 3.0 | 4.0 | | 3.0 | 4.0 | 4.0 |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.96 | | 1.00 | 0.95 | | 1.00 | 0.95 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1770 | 1794 | | 1770 | 1761 | | 1770 | 1775 | | 1770 | 1863 | 1583 |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1770 | 1794 | | 1770 | 1761 | | 1770 | 1775 | | 1770 | 1863 | 1583 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 111 | 181 | 59 | 81 | 363 | 208 | 73 | 139 | 64 | 195 | 247 | 484 |
| RTOR Reduction (vph) | 0 | 12 | 0 | 0 | 22 | 0 | 0 | 21 | 0 | 0 | 0 | 294 |
| Lane Group Flow (vph) | 111 | 228 | 0 | 81 | 549 | 0 | 73 | 182 | 0 | 195 | 247 | 190 |
| Turn Type | Prot | NA | | Prot | NA | | Prot | NA | | Prot | NA | Perm |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | | | | | | | | | | 6 |
| Actuated Green, G (s) | 7.1 | 29.0 | | 6.5 | 28.4 | | 4.6 | 14.5 | | 11.6 | 21.5 | 21.5 |
| Effective Green, g (s) | 7.1 | 29.0 | | 6.5 | 28.4 | | 4.6 | 14.5 | | 11.6 | 21.5 | 21.5 |
| Actuated g/C Ratio | 0.09 | 0.38 | | 0.09 | 0.38 | | 0.06 | 0.19 | | 0.15 | 0.28 | 0.28 |
| Clearance Time (s) | 3.0 | 4.0 | | 3.0 | 4.0 | | 3.0 | 4.0 | | 3.0 | 4.0 | 4.0 |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | 166 | 688 | | 152 | 661 | | 107 | 340 | | 271 | 529 | 450 |
| v/s Ratio Prot | c0.06 | 0.13 | | 0.05 | c0.31 | | 0.04 | 0.10 | | c0.11 | c0.13 | |
| v/s Ratio Perm | | | | | | | | | | | | 0.12 |
| v/c Ratio | 0.67 | 0.33 | | 0.53 | 0.83 | | 0.68 | 0.54 | | 0.72 | 0.47 | 0.42 |
| Uniform Delay, d1 | 33.1 | 16.5 | | 33.1 | 21.4 | | 34.8 | 27.5 | | 30.5 | 22.3 | 22.0 |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 9.8 | 0.3 | | 3.6 | 8.7 | | 16.5 | 1.6 | | 8.8 | 0.7 | 0.6 |
| Delay (s) | 42.9 | 16.7 | | 36.7 | 30.2 | | 51.2 | 29.1 | | 39.3 | 23.0 | 22.6 |
| Level of Service | D | B | | D | C | | D | C | | D | C | C |
| Approach Delay (s) | | 25.0 | | | 31.0 | | | 35.0 | | | 26.2 | |
| Approach LOS | | C | | | C | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 28.5 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.72 | | |
| Actuated Cycle Length (s) | 75.6 | Sum of lost time (s) | 14.0 |
| Intersection Capacity Utilization | 72.5% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

# MOVEMENT SUMMARY

## Site: 9 [PM Cumulative Alt]

Novato Boulevard/San Marin Dr-Sutro Ave
PM Cumulative with Project Alternative

Roundabout

**Movement Performance - Vehicles**

| Mov ID | OD Mov | Demand Flows Total veh/h | Demand Flows HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance ft | Prop. Queued | Effective Stop Rate per veh | Average Speed mph |
|---|---|---|---|---|---|---|---|---|---|---|---|
| South: NB Sutro Ave | | | | | | | | | | | |
| 3 | L2 | 73 | 2.0 | 0.338 | 8.3 | LOS A | 1.6 | 40.9 | 0.62 | 0.60 | 32.6 |
| 8 | T1 | 139 | 2.0 | 0.338 | 8.3 | LOS A | 1.6 | 40.9 | 0.62 | 0.60 | 32.6 |
| 18 | R2 | 64 | 2.0 | 0.338 | 8.3 | LOS A | 1.6 | 40.9 | 0.62 | 0.60 | 31.7 |
| Approach | | 276 | 2.0 | 0.338 | 8.3 | LOS A | 1.6 | 40.9 | 0.62 | 0.60 | 32.4 |
| East: WB Novato Blvd | | | | | | | | | | | |
| 1 | L2 | 81 | 2.0 | 0.674 | 14.4 | LOS B | 6.4 | 162.4 | 0.78 | 0.77 | 30.2 |
| 6 | T1 | 363 | 2.0 | 0.674 | 14.4 | LOS B | 6.4 | 162.4 | 0.78 | 0.77 | 30.2 |
| 16 | R2 | 208 | 2.0 | 0.674 | 14.4 | LOS B | 6.4 | 162.4 | 0.78 | 0.77 | 29.5 |
| Approach | | 653 | 2.0 | 0.674 | 14.4 | LOS B | 6.4 | 162.4 | 0.78 | 0.77 | 30.0 |
| North: SB San Marin Drive | | | | | | | | | | | |
| 7 | L2 | 195 | 2.0 | 0.513 | 11.1 | LOS B | 3.1 | 77.6 | 0.69 | 0.73 | 31.0 |
| 4 | T1 | 247 | 2.0 | 0.513 | 11.1 | LOS B | 3.1 | 77.6 | 0.69 | 0.73 | 31.0 |
| 14 | R2 | 484 | 2.0 | 0.562 | 12.2 | LOS B | 3.6 | 92.6 | 0.72 | 0.78 | 30.4 |
| Approach | | 926 | 2.0 | 0.562 | 11.7 | LOS B | 3.6 | 92.6 | 0.70 | 0.76 | 30.7 |
| West: EB Novato Blvd | | | | | | | | | | | |
| 5 | L2 | 111 | 2.0 | 0.447 | 10.5 | LOS B | 2.5 | 63.1 | 0.69 | 0.72 | 31.5 |
| 2 | T1 | 181 | 2.0 | 0.447 | 10.5 | LOS B | 2.5 | 63.1 | 0.69 | 0.72 | 31.5 |
| 12 | R2 | 59 | 2.0 | 0.447 | 10.5 | LOS B | 2.5 | 63.1 | 0.69 | 0.72 | 30.7 |
| Approach | | 351 | 2.0 | 0.447 | 10.5 | LOS B | 2.5 | 63.1 | 0.69 | 0.72 | 31.4 |
| All Vehicles | | 2205 | 2.0 | 0.674 | 11.9 | LOS B | 6.4 | 162.4 | 0.71 | 0.73 | 30.8 |

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.



# LANE SUMMARY

## Site: 9 [PM Cumulative Alt]

Novato Boulevard/San Marin Dr-Sutro Ave
PM Cumulative with Project Alternative

Roundabout

**Lane Use and Performance**

| | Demand Flows Total veh/h | Demand Flows HV % | Cap. veh/h | Deg. Satn v/c | Lane Util. % | Average Delay sec | Level of Service | 95% Back of Queue Veh | 95% Back of Queue Dist ft | Lane Config | Lane Length ft | Cap. Adj. % | Prob. Block. % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| South: NB Sutro Ave | | | | | | | | | | | | | |
| Lane 1[d] | 276 | 2.0 | 816 | 0.338 | 100 | 8.3 | LOS A | 1.6 | 40.9 | Full | 1600 | 0.0 | 0.0 |
| Approach | 276 | 2.0 | | 0.338 | | 8.3 | LOS A | 1.6 | 40.9 | | | | |
| East: WB Novato Blvd | | | | | | | | | | | | | |
| Lane 1[d] | 653 | 2.0 | 968 | 0.674 | 100 | 14.4 | LOS B | 6.4 | 162.4 | Full | 1600 | 0.0 | 0.0 |
| Approach | 653 | 2.0 | | 0.674 | | 14.4 | LOS B | 6.4 | 162.4 | | | | |
| North: SB San Marin Drive | | | | | | | | | | | | | |
| Lane 1 | 442 | 2.0 | 862 | 0.513 | 100 | 11.1 | LOS B | 3.1 | 77.6 | Full | 1600 | 0.0 | 0.0 |
| Lane 2[d] | 484 | 2.0 | 862 | 0.562 | 100 | 12.2 | LOS B | 3.6 | 92.6 | Short | 30 | 0.0 | NA |
| Approach | 926 | 2.0 | | 0.562 | | 11.7 | LOS B | 3.6 | 92.6 | | | | |
| West: EB Novato Blvd | | | | | | | | | | | | | |
| Lane 1[d] | 351 | 2.0 | 785 | 0.447 | 100 | 10.5 | LOS B | 2.5 | 63.1 | Full | 1600 | 0.0 | 0.0 |
| Approach | 351 | 2.0 | | 0.447 | | 10.5 | LOS B | 2.5 | 63.1 | | | | |
| Intersection | 2205 | 2.0 | | 0.674 | | 11.9 | LOS B | 6.4 | 162.4 | | | | |

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 557 | 42 | 452 | 862 | 46 | 295 |
| Future Volume (vph) | 557 | 42 | 452 | 862 | 46 | 295 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.9 | | 3.0 | 3.6 | 3.6 | 3.6 |
| Lane Util. Factor | 0.95 | | 1.00 | 0.95 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | | 1.00 | 1.00 | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 0.99 | | 1.00 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 1.00 | | 0.95 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (prot) | 3533 | | 1787 | 3610 | 1805 | 1593 |
| Flt Permitted | 1.00 | | 0.95 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (perm) | 3533 | | 1787 | 3610 | 1805 | 1593 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 586 | 44 | 476 | 907 | 48 | 311 |
| RTOR Reduction (vph) | 5 | 0 | 0 | 0 | 0 | 262 |
| Lane Group Flow (vph) | 625 | 0 | 476 | 907 | 48 | 49 |
| Confl. Peds. (#/hr) | | 3 | | | 6 | 2 |
| Heavy Vehicles (%) | 1% | 0% | 1% | 0% | 0% | 0% |
| Turn Type | NA | | Prot | NA | Prot | Perm |
| Protected Phases | 2 | | 1 | 6 | 4 | |
| Permitted Phases | | | | | | 4 |
| Actuated Green, G (s) | 30.9 | | 19.3 | 38.3 | 11.3 | 11.3 |
| Effective Green, g (s) | 30.9 | | 19.3 | 38.3 | 11.3 | 11.3 |
| Actuated g/C Ratio | 0.43 | | 0.27 | 0.53 | 0.16 | 0.16 |
| Clearance Time (s) | 3.9 | | 3.0 | 3.6 | 3.6 | 3.6 |
| Vehicle Extension (s) | 3.0 | | 2.0 | 3.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 1516 | | 479 | 1920 | 283 | 250 |
| v/s Ratio Prot | c0.18 | | c0.27 | c0.25 | 0.03 | |
| v/s Ratio Perm | | | | | | c0.03 |
| v/c Ratio | 0.41 | | 0.99 | 0.47 | 0.17 | 0.20 |
| Uniform Delay, d1 | 14.3 | | 26.3 | 10.5 | 26.3 | 26.4 |
| Progression Factor | 1.00 | | 0.93 | 0.47 | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.8 | | 35.4 | 0.7 | 0.1 | 0.1 |
| Delay (s) | 15.1 | | 59.9 | 5.6 | 26.4 | 26.5 |
| Level of Service | B | | E | A | C | C |
| Approach Delay (s) | 15.1 | | | 24.3 | 26.5 | |
| Approach LOS | B | | | C | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 22.2 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.58 | | |
| Actuated Cycle Length (s) | 72.0 | Sum of lost time (s) | 10.5 |
| Intersection Capacity Utilization | 59.7% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |





| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 137 | 715 | 1028 | 106 | 113 | 296 |
| Future Volume (vph) | 137 | 715 | 1028 | 106 | 113 | 296 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.9 | 3.6 | | 3.0 | 3.0 |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.99 | | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 3574 | 3552 | | 1805 | 1599 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | 1805 | 3574 | 3552 | | 1805 | 1599 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 144 | 753 | 1082 | 112 | 119 | 312 |
| RTOR Reduction (vph) | 0 | 0 | 7 | 0 | 0 | 241 |
| Lane Group Flow (vph) | 144 | 753 | 1187 | 0 | 119 | 71 |
| Confl. Peds. (#/hr) | | | | | 2 | |
| Confl. Bikes (#/hr) | | | | 1 | | |
| Heavy Vehicles (%) | 0% | 1% | 0% | 0% | 0% | 1% |
| Turn Type | Prot | NA | NA | | Prot | Perm |
| Protected Phases | 5 | 2 | 6 | | 8 | |
| Permitted Phases | | | | | | 8 |
| Actuated Green, G (s) | 12.2 | 30.9 | 38.3 | | 11.9 | 11.9 |
| Effective Green, g (s) | 12.2 | 30.9 | 38.3 | | 11.9 | 11.9 |
| Actuated g/C Ratio | 0.17 | 0.43 | 0.53 | | 0.17 | 0.17 |
| Clearance Time (s) | 3.0 | 3.9 | 3.6 | | 3.0 | 3.0 |
| Vehicle Extension (s) | 2.0 | 3.0 | 3.0 | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 305 | 1533 | 1889 | | 298 | 264 |
| v/s Ratio Prot | 0.08 | c0.21 | c0.33 | | c0.07 | |
| v/s Ratio Perm | | | | | | 0.04 |
| v/c Ratio | 0.47 | 0.49 | 0.63 | | 0.40 | 0.27 |
| Uniform Delay, d1 | 27.0 | 14.9 | 11.8 | | 26.9 | 26.2 |
| Progression Factor | 0.68 | 0.51 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 4.8 | 1.1 | 1.6 | | 0.3 | 0.2 |
| Delay (s) | 23.2 | 8.6 | 13.4 | | 27.2 | 26.4 |
| Level of Service | C | A | B | | C | C |
| Approach Delay (s) | | 11.0 | 13.4 | | 26.6 | |
| Approach LOS | | B | B | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 14.8 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.58 | | |
| Actuated Cycle Length (s) | 72.0 | Sum of lost time (s) | 10.5 |
| Intersection Capacity Utilization | 56.8% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 12: Grant Ave & Novato Blvd #2

01/23/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 160 | 675 | 1 | 2 | 943 | 54 | 1 | 6 | 4 | 25 | 1 | 288 |
| Future Volume (vph) | 160 | 675 | 1 | 2 | 943 | 54 | 1 | 6 | 4 | 25 | 1 | 288 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.5 | 4.5 | 3.5 | 4.9 | 4.9 | | 4.0 | | 3.5 | 3.5 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 | | 1.00 | | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.96 | | 0.98 | | 1.00 | 0.98 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | | 0.97 | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | | 0.95 | | 1.00 | 0.85 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1787 | 1863 | 1534 | 1805 | 3539 | 1529 | | 1762 | | 1737 | 1591 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 0.53 | | 0.75 | 1.00 | |
| Satd. Flow (perm) | 1787 | 1863 | 1534 | 1805 | 3539 | 1529 | | 947 | | 1372 | 1591 | |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 167 | 703 | 1 | 2 | 982 | 56 | 1 | 6 | 4 | 26 | 1 | 300 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 19 | 0 | 4 | 0 | 0 | 269 | 0 |
| Lane Group Flow (vph) | 167 | 703 | 1 | 2 | 982 | 37 | 0 | 7 | 0 | 26 | 32 | 0 |
| Confl. Peds. (#/hr) | | | 11 | | | 8 | 1 | | 14 | 14 | | 1 |
| Confl. Bikes (#/hr) | | | 1 | | | 4 | | | 2 | | | 1 |
| Heavy Vehicles (%) | 1% | 2% | 0% | 0% | 2% | 1% | 0% | 0% | 0% | 1% | 0% | 0% |
| Turn Type | Prot | NA | Perm | Prot | NA | Perm | Perm | NA | | Perm | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | 2 | | | 6 | 8 | | | 4 | | |
| Actuated Green, G (s) | 14.6 | 86.1 | 86.1 | 1.2 | 72.3 | 72.3 | | 10.7 | | 11.2 | 11.2 | |
| Effective Green, g (s) | 14.6 | 86.1 | 86.1 | 1.2 | 72.3 | 72.3 | | 10.7 | | 11.2 | 11.2 | |
| Actuated g/C Ratio | 0.13 | 0.78 | 0.78 | 0.01 | 0.66 | 0.66 | | 0.10 | | 0.10 | 0.10 | |
| Clearance Time (s) | 3.5 | 4.5 | 4.5 | 3.5 | 4.9 | 4.9 | | 4.0 | | 3.5 | 3.5 | |
| Vehicle Extension (s) | 2.0 | 3.0 | 3.0 | 2.0 | 3.0 | 3.0 | | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 237 | 1458 | 1200 | 19 | 2326 | 1004 | | 92 | | 139 | 161 | |
| v/s Ratio Prot | c0.09 | c0.38 | | 0.00 | 0.28 | | | | | | c0.02 | |
| v/s Ratio Perm | | | 0.00 | | | 0.02 | | 0.01 | | 0.02 | | |
| v/c Ratio | 0.70 | 0.48 | 0.00 | 0.11 | 0.42 | 0.04 | | 0.08 | | 0.19 | 0.20 | |
| Uniform Delay, d1 | 45.6 | 4.2 | 2.6 | 53.9 | 8.9 | 6.6 | | 45.2 | | 45.2 | 45.3 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.44 | 0.23 | 0.20 | | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 7.5 | 1.1 | 0.0 | 0.6 | 0.4 | 0.0 | | 0.1 | | 0.2 | 0.2 | |
| Delay (s) | 53.2 | 5.3 | 2.6 | 77.9 | 2.4 | 1.4 | | 45.3 | | 45.5 | 45.5 | |
| Level of Service | D | A | A | E | A | A | | D | | D | D | |
| Approach Delay (s) | | 14.5 | | | 2.5 | | | 45.3 | | | 45.5 | |
| Approach LOS | | B | | | A | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 13.6 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.50 | | |
| Actuated Cycle Length (s) | 110.0 | Sum of lost time (s) | 12.4 |
| Intersection Capacity Utilization | 69.1% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 13: Tamalpais Ave/7th St & Novato Blvd #2

01/23/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 135 | 591 | 43 | 72 | 848 | 215 | 44 | 124 | 46 | 185 | 112 | 125 |
| Future Volume (vph) | 135 | 591 | 43 | 72 | 848 | 215 | 44 | 124 | 46 | 185 | 112 | 125 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 5.0 | | 3.5 | 5.0 | 5.0 | 3.5 | 3.5 | | 3.5 | 3.5 | 3.5 |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 0.96 | 1.00 | 0.99 | | 1.00 | 1.00 | 0.97 |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 0.99 | 1.00 | | 0.99 | 1.00 | 1.00 |
| Frt | 1.00 | 0.99 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.96 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1787 | 1839 | | 1787 | 1863 | 1542 | 1768 | 1782 | | 1765 | 1881 | 1547 |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.61 | 1.00 | | 0.49 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1787 | 1839 | | 1787 | 1863 | 1542 | 1144 | 1782 | | 918 | 1881 | 1547 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 141 | 616 | 45 | 75 | 883 | 224 | 46 | 129 | 48 | 193 | 117 | 130 |
| RTOR Reduction (vph) | 0 | 2 | 0 | 0 | 0 | 33 | 0 | 13 | 0 | 0 | 0 | 101 |
| Lane Group Flow (vph) | 141 | 659 | 0 | 75 | 883 | 191 | 46 | 164 | 0 | 193 | 117 | 29 |
| Confl. Peds. (#/hr) | | | 10 | | | 6 | 5 | | 7 | 7 | | 5 |
| Confl. Bikes (#/hr) | | | 3 | | | 2 | | | 5 | | | |
| Heavy Vehicles (%) | 1% | 2% | 1% | 1% | 2% | 1% | 1% | 1% | 1% | 1% | 1% | 1% |
| Turn Type | Prot | NA | | Prot | NA | Perm | Perm | NA | | Perm | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | | | | 6 | 8 | | | 4 | | 4 |
| Actuated Green, G (s) | 12.7 | 65.9 | | 7.4 | 60.6 | 60.6 | 24.7 | 24.7 | | 24.7 | 24.7 | 24.7 |
| Effective Green, g (s) | 12.7 | 65.9 | | 7.4 | 60.6 | 60.6 | 24.7 | 24.7 | | 24.7 | 24.7 | 24.7 |
| Actuated g/C Ratio | 0.12 | 0.60 | | 0.07 | 0.55 | 0.55 | 0.22 | 0.22 | | 0.22 | 0.22 | 0.22 |
| Clearance Time (s) | 3.5 | 5.0 | | 3.5 | 5.0 | 5.0 | 3.5 | 3.5 | | 3.5 | 3.5 | 3.5 |
| Vehicle Extension (s) | 2.0 | 5.0 | | 2.0 | 5.0 | 5.0 | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 206 | 1101 | | 120 | 1026 | 849 | 256 | 400 | | 206 | 422 | 347 |
| v/s Ratio Prot | c0.08 | 0.36 | | 0.04 | c0.47 | | | 0.09 | | | 0.06 | |
| v/s Ratio Perm | | | | | | 0.12 | 0.04 | | | c0.21 | | 0.02 |
| v/c Ratio | 0.68 | 0.60 | | 0.62 | 0.86 | 0.22 | 0.18 | 0.41 | | 0.94 | 0.28 | 0.08 |
| Uniform Delay, d1 | 46.7 | 13.8 | | 49.9 | 21.1 | 12.7 | 34.5 | 36.4 | | 41.9 | 35.3 | 33.7 |
| Progression Factor | 0.89 | 1.13 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 6.8 | 2.2 | | 7.1 | 9.4 | 0.6 | 0.1 | 0.2 | | 44.3 | 0.1 | 0.0 |
| Delay (s) | 48.6 | 17.8 | | 57.1 | 30.5 | 13.3 | 34.6 | 36.7 | | 86.2 | 35.4 | 33.7 |
| Level of Service | D | B | | E | C | B | C | D | | F | D | C |
| Approach Delay (s) | | 23.2 | | | 28.9 | | | 36.2 | | | 57.2 | |
| Approach LOS | | C | | | C | | | D | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 32.5 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.86 | | |
| Actuated Cycle Length (s) | 110.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 88.6% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
14: Diablo Ave & Novato Blvd #2 01/23/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 24 | 258 | 23 | 290 | 337 | 662 | 51 | 470 | 239 | 467 | 354 | 12 |
| Future Volume (vph) | 24 | 258 | 23 | 290 | 337 | 662 | 51 | 470 | 239 | 467 | 354 | 12 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 12 | 12 | 11 | 11 | 12 | 11 | 11 | 12 | 12 | 12 | 12 |
| Total Lost time (s) | | 3.7 | | 4.1 | 4.1 | 4.1 | 4.4 | 4.4 | 4.4 | 4.1 | 4.1 | |
| Lane Util. Factor | | 0.95 | | 0.91 | 0.91 | 1.00 | 1.00 | 1.00 | 1.00 | 0.91 | 0.91 | |
| Frpb, ped/bikes | | 1.00 | | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | | 0.99 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | |
| Flt Protected | | 1.00 | | 0.95 | 0.99 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.98 | |
| Satd. Flow (prot) | | 3513 | | 1557 | 3269 | 1500 | 1728 | 1801 | 1560 | 1610 | 3320 | |
| Flt Permitted | | 1.00 | | 0.95 | 0.99 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.98 | |
| Satd. Flow (perm) | | 3513 | | 1557 | 3269 | 1500 | 1728 | 1801 | 1560 | 1610 | 3320 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 25 | 272 | 24 | 305 | 355 | 697 | 54 | 495 | 252 | 492 | 373 | 13 |
| RTOR Reduction (vph) | 0 | 5 | 0 | 0 | 0 | 283 | 0 | 0 | 146 | 0 | 1 | 0 |
| Lane Group Flow (vph) | 0 | 316 | 0 | 213 | 447 | 414 | 54 | 495 | 106 | 285 | 592 | 0 |
| Confl. Peds. (#/hr) | | | 10 | | | 15 | | | 2 | | | 3 |
| Confl. Bikes (#/hr) | | | 1 | | | 1 | | | | | | 6 |
| Heavy Vehicles (%) | 1% | 1% | 1% | 2% | 1% | 2% | 1% | 2% | 2% | 2% | 2% | 1% |
| Turn Type | Split | NA | | Split | NA | Perm | Split | NA | Perm | Split | NA | |
| Protected Phases | 3 | 3 | | 4 | 4 | | 1 | 1 | | 2 | 2 | |
| Permitted Phases | | | | | | 4 | | | 1 | | 2 | |
| Actuated Green, G (s) | | 16.0 | | 29.1 | 29.1 | 29.1 | 32.2 | 32.2 | 32.2 | 25.0 | 25.0 | |
| Effective Green, g (s) | | 16.0 | | 29.1 | 29.1 | 29.1 | 32.2 | 32.2 | 32.2 | 25.0 | 25.0 | |
| Actuated g/C Ratio | | 0.13 | | 0.25 | 0.25 | 0.25 | 0.27 | 0.27 | 0.27 | 0.21 | 0.21 | |
| Clearance Time (s) | | 3.7 | | 4.1 | 4.1 | 4.1 | 4.4 | 4.4 | 4.4 | 4.1 | 4.1 | |
| Vehicle Extension (s) | | 2.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | | 473 | | 382 | 802 | 368 | 469 | 488 | 423 | 339 | 699 | |
| v/s Ratio Prot | | c0.09 | | 0.14 | 0.14 | | 0.03 | c0.27 | | 0.18 | c0.18 | |
| v/s Ratio Perm | | | | | | c0.28 | | | 0.07 | | | |
| v/c Ratio | | 0.67 | | 0.56 | 0.56 | 1.13 | 0.12 | 1.01 | 0.25 | 0.84 | 0.85 | |
| Uniform Delay, d1 | | 48.8 | | 39.1 | 39.1 | 44.8 | 32.5 | 43.2 | 33.8 | 44.9 | 45.0 | |
| Progression Factor | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 2.8 | | 1.0 | 0.5 | 85.3 | 0.0 | 44.4 | 0.1 | 16.3 | 9.0 | |
| Delay (s) | | 51.5 | | 40.1 | 39.6 | 130.0 | 32.5 | 87.6 | 33.9 | 61.2 | 54.0 | |
| Level of Service | | D | | D | D | F | C | F | C | E | D | |
| Approach Delay (s) | | 51.5 | | | 86.1 | | | 67.0 | | | 56.3 | |
| Approach LOS | | D | | | F | | | E | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 70.5 | HCM 2000 Level of Service | E |
| HCM 2000 Volume to Capacity ratio | 0.95 | | |
| Actuated Cycle Length (s) | 118.6 | Sum of lost time (s) | 16.3 |
| Intersection Capacity Utilization | 90.0% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



HCM Signalized Intersection Capacity Analysis
14: Diablo Ave & Novato Blvd #2 02/12/2018

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 24 | 258 | 23 | 290 | 337 | 662 | 51 | 470 | 239 | 467 | 354 | 12 |
| Future Volume (vph) | 24 | 258 | 23 | 290 | 337 | 662 | 51 | 470 | 239 | 467 | 354 | 12 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 11 | 11 | 11 | 11 | 11 | 12 | 11 | 11 | 12 | 10 | 12 | 12 |
| Total Lost time (s) | 4.0 | 4.1 | 4.1 | 4.0 | 4.0 | 4.0 | 4.0 | 4.1 | | 4.0 | 4.0 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | | 0.97 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.95 | | 1.00 | 0.99 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1728 | 1818 | 1511 | 1711 | 1818 | 1554 | 1728 | 3233 | | 3204 | 1852 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1728 | 1818 | 1511 | 1711 | 1818 | 1554 | 1728 | 3233 | | 3204 | 1852 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 25 | 272 | 24 | 305 | 355 | 697 | 54 | 495 | 252 | 492 | 373 | 13 |
| RTOR Reduction (vph) | 0 | 0 | 19 | 0 | 0 | 80 | 0 | 55 | 0 | 0 | 1 | 0 |
| Lane Group Flow (vph) | 25 | 272 | 5 | 305 | 355 | 617 | 54 | 692 | 0 | 492 | 385 | 0 |
| Confl. Peds. (#/hr) | | | 10 | | | 15 | | | 2 | | | 3 |
| Confl. Bikes (#/hr) | | | 1 | | | 1 | | | | | | 6 |
| Heavy Vehicles (%) | 1% | 1% | 1% | 2% | 1% | 2% | 1% | 2% | 2% | 2% | 2% | 1% |
| Turn Type | Prot | NA | Perm | Prot | NA | pm+ov | Prot | NA | | Prot | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | 1 | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | 4 | | | 8 | | | | | | |
| Actuated Green, G (s) | 4.9 | 20.2 | 20.2 | 23.0 | 38.4 | 56.7 | 6.5 | 26.3 | | 18.3 | 38.2 | |
| Effective Green, g (s) | 4.9 | 20.2 | 20.2 | 23.0 | 38.4 | 56.7 | 6.5 | 26.3 | | 18.3 | 38.2 | |
| Actuated g/C Ratio | 0.05 | 0.19 | 0.19 | 0.22 | 0.37 | 0.55 | 0.06 | 0.25 | | 0.18 | 0.37 | |
| Clearance Time (s) | 4.0 | 4.1 | 4.1 | 4.0 | 4.0 | 4.0 | 4.0 | 4.1 | | 4.0 | 4.0 | |
| Vehicle Extension (s) | 3.0 | 2.0 | 2.0 | 3.0 | 3.0 | 3.0 | 3.0 | 2.0 | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 81 | 353 | 293 | 378 | 671 | 847 | 108 | 817 | | 563 | 680 | |
| v/s Ratio Prot | 0.01 | 0.15 | | c0.18 | 0.20 | c0.13 | 0.03 | c0.21 | | c0.15 | 0.21 | |
| v/s Ratio Perm | | | 0.00 | | | 0.27 | | | | | | |
| v/c Ratio | 0.31 | 0.77 | 0.02 | 0.81 | 0.53 | 0.73 | 0.50 | 0.85 | | 0.87 | 0.57 | |
| Uniform Delay, d1 | 47.9 | 39.7 | 33.9 | 38.4 | 25.7 | 17.8 | 47.2 | 36.9 | | 41.7 | 26.3 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 2.2 | 9.1 | 0.0 | 11.9 | 0.8 | 3.2 | 3.6 | 7.8 | | 14.1 | 1.1 | |
| Delay (s) | 50.1 | 48.8 | 33.9 | 50.3 | 26.5 | 21.0 | 50.8 | 44.7 | | 55.8 | 27.4 | |
| Level of Service | D | D | C | D | C | C | D | D | | E | C | |
| Approach Delay (s) | | 47.8 | | | 29.0 | | | 45.1 | | | 43.3 | |
| Approach LOS | | D | | | C | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 38.4 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.83 | | |
| Actuated Cycle Length (s) | 104.0 | Sum of lost time (s) | 16.2 |
| Intersection Capacity Utilization | 81.6% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 293 | 590 | 111 | 109 | 983 | 421 | 142 | 328 | 87 | 358 | 248 | 252 |
| Future Volume (vph) | 293 | 590 | 111 | 109 | 983 | 421 | 142 | 328 | 87 | 358 | 248 | 252 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 9 |
| Total Lost time (s) | 4.0 | 3.7 | | 4.0 | 4.1 | | 3.5 | 4.8 | 4.8 | 3.5 | 3.5 | 3.5 |
| Lane Util. Factor | 0.97 | 0.95 | | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 | 0.97 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.97 |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.98 | | 1.00 | 0.95 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3467 | 3524 | | 1805 | 3336 | | 1805 | 3610 | 1508 | 3303 | 1900 | 1394 |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3467 | 3524 | | 1805 | 3336 | | 1805 | 3610 | 1508 | 3303 | 1900 | 1394 |
| Peak-hour factor, PHF | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Adj. Flow (vph) | 299 | 602 | 113 | 111 | 1003 | 430 | 145 | 335 | 89 | 365 | 253 | 257 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 33 | 0 | 0 | 49 |
| Lane Group Flow (vph) | 299 | 715 | 0 | 111 | 1433 | 0 | 145 | 335 | 56 | 365 | 253 | 208 |
| Confl. Peds. (#/hr) | | | | | | 2 | | | 7 | | | 14 |
| Confl. Bikes (#/hr) | | | | | | | | | | | | 3 |
| Heavy Vehicles (%) | 1% | 0% | 0% | 0% | 2% | 5% | 0% | 0% | 5% | 6% | 0% | 1% |
| Turn Type | Prot | NA | | Prot | NA | | Prot | NA | Perm | Prot | NA | Perm |
| Protected Phases | 3 | 8 | | 7 | 4 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | | | | | | | 2 | | | 6 |
| Actuated Green, G (s) | 17.1 | 59.7 | | 17.0 | 59.2 | | 14.6 | 23.4 | 23.4 | 13.9 | 24.0 | 24.0 |
| Effective Green, g (s) | 17.1 | 59.7 | | 17.0 | 59.2 | | 14.6 | 23.4 | 23.4 | 13.9 | 24.0 | 24.0 |
| Actuated g/C Ratio | 0.13 | 0.46 | | 0.13 | 0.46 | | 0.11 | 0.18 | 0.18 | 0.11 | 0.18 | 0.18 |
| Clearance Time (s) | 4.0 | 3.7 | | 4.0 | 4.1 | | 3.5 | 4.8 | 4.8 | 3.5 | 3.5 | 3.5 |
| Vehicle Extension (s) | 2.5 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 456 | 1618 | | 236 | 1519 | | 202 | 649 | 271 | 353 | 350 | 257 |
| v/s Ratio Prot | c0.09 | 0.20 | | 0.06 | c0.43 | | 0.08 | 0.09 | | c0.11 | 0.13 | |
| v/s Ratio Perm | | | | | | | | | 0.04 | | | c0.15 |
| v/c Ratio | 0.66 | 0.44 | | 0.47 | 0.94 | | 0.72 | 0.52 | 0.21 | 1.03 | 0.72 | 0.81 |
| Uniform Delay, d1 | 53.7 | 23.8 | | 52.3 | 33.8 | | 55.7 | 48.2 | 45.4 | 58.0 | 49.9 | 50.8 |
| Progression Factor | 1.00 | 1.00 | | 1.44 | 0.56 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 3.0 | 0.9 | | 0.3 | 8.1 | | 9.7 | 0.3 | 0.1 | 57.0 | 6.1 | 16.1 |
| Delay (s) | 56.7 | 24.7 | | 75.6 | 27.0 | | 65.4 | 48.5 | 45.5 | 115.0 | 56.0 | 66.9 |
| Level of Service | E | C | | E | C | | E | D | D | F | E | E |
| Approach Delay (s) | | 34.1 | | | 30.5 | | | 52.3 | | | 83.8 | |
| Approach LOS | | C | | | C | | | D | | | F | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 46.2 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.89 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 16.4 |
| Intersection Capacity Utilization | 97.9% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 16: Reichert Ave & De Long Ave

06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 87 | 907 | 23 | 100 | 1380 | 357 | 19 | 32 | 60 | 257 | 19 | 83 |
| Future Volume (vph) | 87 | 907 | 23 | 100 | 1380 | 357 | 19 | 32 | 60 | 257 | 19 | 83 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 0.95 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 0.99 | | 1.00 | 1.00 | 0.98 | 1.00 | 0.98 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 0.99 | 1.00 | 1.00 | 0.99 | 1.00 | |
| Frt | 1.00 | 1.00 | | 1.00 | 0.97 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.88 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1805 | 3525 | | 1805 | 3427 | | 1794 | 1900 | 1577 | 1763 | 1636 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.62 | 1.00 | 1.00 | 0.73 | 1.00 | |
| Satd. Flow (perm) | 1805 | 3525 | | 1805 | 3427 | | 1170 | 1900 | 1577 | 1364 | 1636 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 92 | 955 | 24 | 105 | 1453 | 376 | 20 | 34 | 63 | 271 | 20 | 87 |
| RTOR Reduction (vph) | 0 | 1 | 0 | 0 | 14 | 0 | 0 | 0 | 15 | 0 | 28 | 0 |
| Lane Group Flow (vph) | 92 | 978 | 0 | 105 | 1815 | 0 | 20 | 34 | 48 | 271 | 79 | 0 |
| Confl. Peds. (#/hr) | | | 5 | | | 11 | 5 | | 5 | 11 | | 5 |
| Confl. Bikes (#/hr) | | | 5 | | | 5 | | | 5 | | | 5 |
| Heavy Vehicles (%) | 0% | 2% | 0% | 0% | 1% | 1% | 0% | 0% | 0% | 1% | 0% | 0% |
| Turn Type | Prot | NA | | Prot | NA | | Perm | NA | Perm | Perm | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | | | | | 8 | | 8 | 4 | | |
| Actuated Green, G (s) | 11.0 | 79.4 | | 11.0 | 79.4 | | 29.0 | 29.0 | 29.0 | 29.0 | 29.0 | |
| Effective Green, g (s) | 11.0 | 79.4 | | 11.0 | 79.4 | | 29.0 | 29.0 | 29.0 | 29.0 | 29.0 | |
| Actuated g/C Ratio | 0.08 | 0.61 | | 0.08 | 0.61 | | 0.22 | 0.22 | 0.22 | 0.22 | 0.22 | |
| Clearance Time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | |
| Vehicle Extension (s) | 2.0 | 3.0 | | 2.0 | 3.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 152 | 2152 | | 152 | 2093 | | 261 | 423 | 351 | 304 | 364 | |
| v/s Ratio Prot | 0.05 | 0.28 | | c0.06 | c0.53 | | | 0.02 | | | 0.05 | |
| v/s Ratio Perm | | | | | | | 0.02 | | 0.03 | c0.20 | | |
| v/c Ratio | 0.61 | 0.45 | | 0.69 | 0.87 | | 0.08 | 0.08 | 0.14 | 0.89 | 0.22 | |
| Uniform Delay, d1 | 57.4 | 13.6 | | 57.8 | 20.9 | | 39.9 | 40.0 | 40.5 | 49.0 | 41.2 | |
| Progression Factor | 0.72 | 1.19 | | 1.01 | 0.68 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 3.6 | 0.5 | | 8.1 | 4.0 | | 0.0 | 0.0 | 0.1 | 25.6 | 0.1 | |
| Delay (s) | 44.9 | 16.7 | | 66.3 | 18.3 | | 40.0 | 40.0 | 40.5 | 74.6 | 41.3 | |
| Level of Service | D | B | | E | B | | D | D | D | E | D | |
| Approach Delay (s) | | 19.2 | | | 20.9 | | | 40.3 | | | 65.2 | |
| Approach LOS | | B | | | C | | | D | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 25.8 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.86 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 88.5% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 17: US 101 SB Ramps & De Long Ave

06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 223 | 1042 | 28 | 1775 | 0 | 0 | 0 | 0 | 10 | 7 | 187 |
| Future Volume (vph) | 0 | 223 | 1042 | 28 | 1775 | 0 | 0 | 0 | 0 | 10 | 7 | 187 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.6 | 3.6 | 3.0 | 3.6 | | | | | 4.0 | 4.0 | |
| Lane Util. Factor | | 0.95 | 1.00 | 1.00 | 0.95 | | | | | 0.95 | 0.95 | |
| Frt | | 1.00 | 0.85 | 1.00 | 1.00 | | | | | 1.00 | 0.86 | |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 3574 | 1599 | 1770 | 3539 | | | | | 1681 | 1514 | |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | 0.95 | 1.00 | |
| Satd. Flow (perm) | | 3574 | 1599 | 1770 | 3539 | | | | | 1681 | 1514 | |
| Peak-hour factor, PHF | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Adj. Flow (vph) | 0 | 228 | 1063 | 29 | 1811 | 0 | 0 | 0 | 0 | 10 | 7 | 191 |
| RTOR Reduction (vph) | 0 | 0 | 277 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 39 | 0 |
| Lane Group Flow (vph) | 0 | 228 | 786 | 29 | 1811 | 0 | 0 | 0 | 0 | 9 | 160 | 0 |
| Heavy Vehicles (%) | 0% | 1% | 1% | 2% | 2% | 2% | 2% | 2% | 2% | 2% | 2% | 2% |
| Turn Type | | NA | Perm | Prot | NA | | | | | Split | NA | |
| Protected Phases | | 6 | | 5 | 2 | | | | | 4 | 4 | |
| Permitted Phases | | | 6 | | | | | | | | | |
| Actuated Green, G (s) | | 91.8 | 91.8 | 9.3 | 104.1 | | | | | 18.3 | 18.3 | |
| Effective Green, g (s) | | 91.8 | 91.8 | 9.3 | 104.1 | | | | | 18.3 | 18.3 | |
| Actuated g/C Ratio | | 0.71 | 0.71 | 0.07 | 0.80 | | | | | 0.14 | 0.14 | |
| Clearance Time (s) | | 3.6 | 3.6 | 3.0 | 3.6 | | | | | 4.0 | 4.0 | |
| Vehicle Extension (s) | | 4.0 | 4.0 | 2.0 | 4.0 | | | | | 2.5 | 2.5 | |
| Lane Grp Cap (vph) | | 2523 | 1129 | 126 | 2833 | | | | | 236 | 213 | |
| v/s Ratio Prot | | 0.06 | | 0.02 | c0.51 | | | | | 0.01 | c0.11 | |
| v/s Ratio Perm | | | c0.49 | | | | | | | | | |
| v/c Ratio | | 0.09 | 0.70 | 0.23 | 0.64 | | | | | 0.04 | 0.75 | |
| Uniform Delay, d1 | | 6.0 | 11.0 | 57.0 | 5.3 | | | | | 48.2 | 53.7 | |
| Progression Factor | | 0.78 | 4.55 | 0.86 | 0.53 | | | | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 0.1 | 3.1 | 0.2 | 0.7 | | | | | 0.0 | 13.3 | |
| Delay (s) | | 4.7 | 53.3 | 49.1 | 3.5 | | | | | 48.3 | 67.0 | |
| Level of Service | | A | D | D | A | | | | | D | E | |
| Approach Delay (s) | | 44.8 | | | 4.2 | | | 0.0 | | | 66.2 | |
| Approach LOS | | D | | | A | | | A | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 23.8 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.71 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 131.5% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 18: US 101 NB Ramps & De Long Ave

06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 190 | 45 | 0 | 0 | 63 | 29 | 1727 | 25 | 33 | 0 | 0 | 0 |
| Future Volume (vph) | 190 | 45 | 0 | 0 | 63 | 29 | 1727 | 25 | 33 | 0 | 0 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 3.6 | | | 3.6 | | 4.5 | 4.5 | | | | |
| Lane Util. Factor | 1.00 | 0.95 | | | 0.95 | | 0.95 | 0.95 | | | | |
| Frpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | | | | |
| Flpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | | | | |
| Frt | 1.00 | 1.00 | | | 0.95 | | 1.00 | 0.99 | | | | |
| Flt Protected | 0.95 | 1.00 | | | 1.00 | | 0.95 | 0.96 | | | | |
| Satd. Flow (prot) | 1770 | 3610 | | | 3353 | | 1698 | 1695 | | | | |
| Flt Permitted | 0.95 | 1.00 | | | 1.00 | | 0.95 | 0.96 | | | | |
| Satd. Flow (perm) | 1770 | 3610 | | | 3353 | | 1698 | 1695 | | | | |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 198 | 47 | 0 | 0 | 66 | 30 | 1799 | 26 | 34 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 28 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 198 | 47 | 0 | 0 | 68 | 0 | 935 | 923 | 0 | 0 | 0 | 0 |
| Confl. Peds. (#/hr) | | | | | | 1 | | | | | | |
| Heavy Vehicles (%) | 2% | 0% | 0% | 0% | 0% | 7% | 1% | 0% | 6% | 0% | 0% | 0% |
| Turn Type | Prot | NA | | | NA | | Split | NA | | | | |
| Protected Phases | 1 | 6 | | | 2 | | 4 | 4 | | | | |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | 16.1 | 27.9 | | | 8.3 | | 94.0 | 94.0 | | | | |
| Effective Green, g (s) | 16.1 | 27.9 | | | 8.3 | | 94.0 | 94.0 | | | | |
| Actuated g/C Ratio | 0.12 | 0.21 | | | 0.06 | | 0.72 | 0.72 | | | | |
| Clearance Time (s) | 3.5 | 3.6 | | | 3.6 | | 4.5 | 4.5 | | | | |
| Vehicle Extension (s) | 2.5 | 2.0 | | | 2.0 | | 3.0 | 3.0 | | | | |
| Lane Grp Cap (vph) | 219 | 774 | | | 214 | | 1227 | 1225 | | | | |
| v/s Ratio Prot | c0.11 | 0.01 | | | c0.02 | | c0.55 | 0.54 | | | | |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | 0.90 | 0.06 | | | 0.32 | | 0.76 | 0.75 | | | | |
| Uniform Delay, d1 | 56.2 | 40.6 | | | 58.1 | | 11.1 | 11.0 | | | | |
| Progression Factor | 1.08 | 1.01 | | | 1.00 | | 1.00 | 1.00 | | | | |
| Incremental Delay, d2 | 35.6 | 0.0 | | | 0.3 | | 4.5 | 4.3 | | | | |
| Delay (s) | 96.0 | 41.2 | | | 58.5 | | 15.6 | 15.3 | | | | |
| Level of Service | F | D | | | E | | B | B | | | | |
| Approach Delay (s) | | 85.5 | | | 58.5 | | | 15.4 | | | 0.0 | |
| Approach LOS | | F | | | E | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 25.1 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.75 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 11.6 |
| Intersection Capacity Utilization | 131.5% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 19: Redwood Blvd & Lamont Ave

06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 33 | 4 | 24 | 48 | 3 | 57 | 22 | 525 | 63 | 74 | 453 | 16 |
| Future Volume (vph) | 33 | 4 | 24 | 48 | 3 | 57 | 22 | 525 | 63 | 74 | 453 | 16 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.5 | 3.5 | | 3.5 | 3.5 | 3.5 | 4.8 | | 3.5 | 4.8 | 4.8 |
| Lane Util. Factor | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 |
| Frpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | 0.99 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Flpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | | 1.00 | 0.85 | | 1.00 | 0.85 | 1.00 | 0.98 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | | 0.96 | 1.00 | | 0.95 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | | 1818 | 1615 | | 1814 | 1595 | 1805 | 3544 | | 1805 | 3610 | 1615 |
| Flt Permitted | | 0.79 | 1.00 | | 0.77 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | | 1504 | 1615 | | 1461 | 1595 | 1805 | 3544 | | 1805 | 3610 | 1615 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 35 | 4 | 25 | 51 | 3 | 60 | 23 | 553 | 66 | 78 | 477 | 17 |
| RTOR Reduction (vph) | 0 | 0 | 19 | 0 | 0 | 46 | 0 | 8 | 0 | 0 | 0 | 8 |
| Lane Group Flow (vph) | 0 | 39 | 6 | 0 | 54 | 14 | 23 | 611 | 0 | 78 | 477 | 9 |
| Confl. Peds. (#/hr) | 1 | | | | | 1 | | | 2 | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Perm | NA | Perm | Perm | NA | Perm | Prot | NA | | Prot | NA | Perm |
| Protected Phases | | 8 | | | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | 8 | | 8 | 4 | | 4 | | | | | | 2 |
| Actuated Green, G (s) | | 12.2 | 12.2 | | 12.2 | 12.2 | 1.0 | 22.7 | | 5.4 | 27.1 | 27.1 |
| Effective Green, g (s) | | 12.2 | 12.2 | | 12.2 | 12.2 | 1.0 | 22.7 | | 5.4 | 27.1 | 27.1 |
| Actuated g/C Ratio | | 0.23 | 0.23 | | 0.23 | 0.23 | 0.02 | 0.44 | | 0.10 | 0.52 | 0.52 |
| Clearance Time (s) | | 3.5 | 3.5 | | 3.5 | 3.5 | 3.5 | 4.8 | | 3.5 | 4.8 | 4.8 |
| Vehicle Extension (s) | | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 | 3.0 | | 2.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | 352 | 378 | | 342 | 373 | 34 | 1544 | | 187 | 1877 | 840 |
| v/s Ratio Prot | | | | | | | 0.01 | c0.17 | | c0.04 | 0.13 | |
| v/s Ratio Perm | | 0.03 | 0.00 | | c0.04 | 0.01 | | | | | | 0.01 |
| v/c Ratio | | 0.11 | 0.02 | | 0.16 | 0.04 | 0.68 | 0.40 | | 0.42 | 0.25 | 0.01 |
| Uniform Delay, d1 | | 15.7 | 15.3 | | 15.9 | 15.4 | 25.4 | 10.0 | | 21.9 | 6.9 | 6.0 |
| Progression Factor | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.1 | 0.0 | | 0.1 | 0.0 | 34.5 | 0.2 | | 0.5 | 0.1 | 0.0 |
| Delay (s) | | 15.7 | 15.3 | | 15.9 | 15.4 | 59.9 | 10.2 | | 22.4 | 7.0 | 6.0 |
| Level of Service | | B | B | | B | B | E | B | | C | A | A |
| Approach Delay (s) | | 15.6 | | | 15.7 | | | 12.0 | | | 9.1 | |
| Approach LOS | | B | | | B | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 11.2 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.33 | | |
| Actuated Cycle Length (s) | 52.1 | Sum of lost time (s) | 11.8 |
| Intersection Capacity Utilization | 46.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 20: Redwood Blvd & Landing Ct
06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 0 | 3 | 30 | 0 | 27 | 1 | 592 | 27 | 18 | 572 | 1 |
| Future Volume (vph) | 0 | 0 | 3 | 30 | 0 | 27 | 1 | 592 | 27 | 18 | 572 | 1 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.5 | | 3.5 | | 3.5 | | 4.8 | 4.8 | 3.5 | 4.8 | 4.8 |
| Lane Util. Factor | | 1.00 | | 1.00 | | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |
| Frpb, ped/bikes | | 0.99 | | 1.00 | | 1.00 | | 1.00 | 0.98 | 1.00 | 1.00 | 0.97 |
| Flpb, ped/bikes | | 1.00 | | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.86 | | 1.00 | | 0.85 | | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | | 1.00 | | 0.95 | | 1.00 | | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | | 1622 | | 1802 | | 1615 | | 3610 | 1579 | 1805 | 3610 | 1571 |
| Flt Permitted | | 1.00 | | 0.76 | | 1.00 | | 0.95 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | | 1622 | | 1434 | | 1615 | | 3446 | 1579 | 1805 | 3610 | 1571 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 0 | 0 | 3 | 32 | 0 | 28 | 1 | 623 | 28 | 19 | 602 | 1 |
| RTOR Reduction (vph) | 0 | 3 | 0 | 0 | 0 | 24 | 0 | 0 | 12 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 32 | 0 | 4 | 0 | 624 | 16 | 19 | 602 | 1 |
| Confl. Peds. (#/hr) | | | 4 | 4 | | | | | 3 | | | 6 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | | NA | | Perm | | Perm | Perm | NA | Perm | Prot | NA | Perm |
| Protected Phases | | 4 | | | | | | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | 2 | | | 6 |
| Actuated Green, G (s) | | 7.0 | | 7.0 | | 7.0 | | 28.0 | 28.0 | 0.8 | 32.3 | 32.3 |
| Effective Green, g (s) | | 7.0 | | 7.0 | | 7.0 | | 28.0 | 28.0 | 0.8 | 32.3 | 32.3 |
| Actuated g/C Ratio | | 0.15 | | 0.15 | | 0.15 | | 0.59 | 0.59 | 0.02 | 0.68 | 0.68 |
| Clearance Time (s) | | 3.5 | | 3.5 | | 3.5 | | 4.8 | 4.8 | 3.5 | 4.8 | 4.8 |
| Vehicle Extension (s) | | 3.0 | | 2.0 | | 2.0 | | 4.0 | 4.0 | 2.0 | 4.0 | 4.0 |
| Lane Grp Cap (vph) | | 238 | | 210 | | 237 | | 2027 | 928 | 30 | 2449 | 1066 |
| v/s Ratio Prot | | 0.00 | | | | | | | | c0.01 | 0.17 | |
| v/s Ratio Perm | | | | c0.02 | | 0.00 | | c0.18 | 0.01 | | | 0.00 |
| v/c Ratio | | 0.00 | | 0.15 | | 0.02 | | 0.31 | 0.02 | 0.63 | 0.25 | 0.00 |
| Uniform Delay, d1 | | 17.3 | | 17.7 | | 17.4 | | 4.9 | 4.1 | 23.3 | 3.0 | 2.5 |
| Progression Factor | | 1.00 | | 1.00 | | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.0 | | 0.1 | | 0.0 | | 0.1 | 0.0 | 27.8 | 0.1 | 0.0 |
| Delay (s) | | 17.3 | | 17.8 | | 17.4 | | 5.0 | 4.1 | 51.1 | 3.0 | 2.5 |
| Level of Service | | B | | B | | B | | A | A | D | A | A |
| Approach Delay (s) | | 17.3 | | | 17.6 | | | 5.0 | | | 4.5 | |
| Approach LOS | | B | | | B | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 5.4 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.28 | | |
| Actuated Cycle Length (s) | 47.6 | Sum of lost time (s) | 11.8 |
| Intersection Capacity Utilization | 42.6% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 21: Novato Blvd #3 & Center Rd/Garden Ct
06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 155 | 1 | 205 | 4 | 2 | 2 | 207 | 605 | 5 | 2 | 582 | 102 |
| Future Volume (vph) | 155 | 1 | 205 | 4 | 2 | 2 | 207 | 605 | 5 | 2 | 582 | 102 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.2 | 3.2 | | | 3.0 | | 3.0 | 4.4 | | 3.0 | 4.4 | |
| Lane Util. Factor | 1.00 | 1.00 | | | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.85 | | | 0.97 | | 1.00 | 1.00 | | 1.00 | 0.98 | |
| Flt Protected | 0.95 | 1.00 | | | 0.98 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1805 | 1616 | | | 1791 | | 1805 | 3605 | | 1805 | 3483 | |
| Flt Permitted | 0.75 | 1.00 | | | 0.90 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1430 | 1616 | | | 1655 | | 1805 | 3605 | | 1805 | 3483 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 163 | 1 | 216 | 4 | 2 | 2 | 218 | 637 | 5 | 2 | 613 | 107 |
| RTOR Reduction (vph) | 0 | 179 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 10 | 0 |
| Lane Group Flow (vph) | 163 | 38 | 0 | 0 | 6 | 0 | 218 | 642 | 0 | 2 | 710 | 0 |
| Confl. Peds. (#/hr) | | | | | | | | | 9 | | | 6 |
| Confl. Bikes (#/hr) | | | | | | | | | 2 | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 1% | 0% |
| Turn Type | Perm | NA | | Perm | NA | | Prot | NA | | Prot | NA | |
| Protected Phases | | 8 | | | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | 8 | | | 4 | | | | | | | | |
| Actuated Green, G (s) | 16.9 | 16.9 | | | 17.1 | | 16.4 | 70.3 | | 2.2 | 56.1 | |
| Effective Green, g (s) | 16.9 | 16.9 | | | 17.1 | | 16.4 | 70.3 | | 2.2 | 56.1 | |
| Actuated g/C Ratio | 0.17 | 0.17 | | | 0.17 | | 0.16 | 0.70 | | 0.02 | 0.56 | |
| Clearance Time (s) | 3.2 | 3.2 | | | 3.0 | | 3.0 | 4.4 | | 3.0 | 4.4 | |
| Vehicle Extension (s) | 3.0 | 3.0 | | | 2.0 | | 2.0 | 4.0 | | 2.0 | 4.0 | |
| Lane Grp Cap (vph) | 241 | 273 | | | 283 | | 296 | 2534 | | 39 | 1953 | |
| v/s Ratio Prot | | 0.02 | | | | | c0.12 | 0.18 | | 0.00 | c0.20 | |
| v/s Ratio Perm | c0.11 | | | | 0.00 | | | | | | | |
| v/c Ratio | 0.68 | 0.14 | | | 0.02 | | 0.74 | 0.25 | | 0.05 | 0.36 | |
| Uniform Delay, d1 | 39.0 | 35.3 | | | 34.5 | | 39.7 | 5.4 | | 47.9 | 12.1 | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | | 0.92 | 1.45 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 7.3 | 0.2 | | | 0.0 | | 7.7 | 0.2 | | 0.2 | 0.5 | |
| Delay (s) | 46.3 | 35.6 | | | 34.5 | | 44.1 | 8.0 | | 48.1 | 12.6 | |
| Level of Service | D | D | | | C | | D | A | | D | B | |
| Approach Delay (s) | | 40.2 | | | 34.5 | | | 17.2 | | | 12.7 | |
| Approach LOS | | D | | | C | | | B | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 20.0 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.49 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 56.4% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 22: Novato Blvd #3 & Arthur Street

06/13/2017

| Movement | EBL | EBR | NBL | NBT | SBU | SBT | SBR |
|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | |
| Traffic Volume (vph) | 93 | 128 | 158 | 882 | 7 | 749 | 87 |
| Future Volume (vph) | 93 | 128 | 158 | 882 | 7 | 749 | 87 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 3.5 | 3.5 | 4.9 | 3.5 | 4.9 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 0.98 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 0.85 | 1.00 | 1.00 | 1.00 | 0.98 | |
| Flt Protected | 0.95 | 1.00 | 0.95 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1797 | 1589 | 1805 | 3574 | 1805 | 3553 | |
| Flt Permitted | 0.95 | 1.00 | 0.95 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1797 | 1589 | 1805 | 3574 | 1805 | 3553 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 98 | 135 | 166 | 928 | 7 | 788 | 92 |
| RTOR Reduction (vph) | 0 | 118 | 0 | 0 | 0 | 5 | 0 |
| Lane Group Flow (vph) | 98 | 17 | 166 | 928 | 7 | 875 | 0 |
| Confl. Peds. (#/hr) | 4 | 2 | | | | | |
| Confl. Bikes (#/hr) | | 1 | | | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 1% | 0% | 0% | 0% |
| Turn Type | Perm | Perm | Prot | NA | Prot | NA | |
| Protected Phases | | | 1 | 6 | 5 | 2 | |
| Permitted Phases | 4 | 4 | | | | | |
| Actuated Green, G (s) | 12.5 | 12.5 | 13.7 | 74.4 | 1.2 | 61.9 | |
| Effective Green, g (s) | 12.5 | 12.5 | 13.7 | 74.4 | 1.2 | 61.9 | |
| Actuated g/C Ratio | 0.12 | 0.12 | 0.14 | 0.74 | 0.01 | 0.62 | |
| Clearance Time (s) | 3.5 | 3.5 | 3.5 | 4.9 | 3.5 | 4.9 | |
| Vehicle Extension (s) | 2.0 | 2.0 | 2.0 | 4.0 | 2.0 | 4.0 | |
| Lane Grp Cap (vph) | 224 | 198 | 247 | 2659 | 21 | 2199 | |
| v/s Ratio Prot | | | c0.09 | 0.26 | 0.00 | c0.25 | |
| v/s Ratio Perm | c0.05 | 0.01 | | | | | |
| v/c Ratio | 0.44 | 0.09 | 0.67 | 0.35 | 0.33 | 0.40 | |
| Uniform Delay, d1 | 40.5 | 38.7 | 41.0 | 4.4 | 49.0 | 9.6 | |
| Progression Factor | 1.00 | 1.00 | 0.86 | 1.22 | 0.83 | 1.10 | |
| Incremental Delay, d2 | 0.5 | 0.1 | 3.6 | 0.2 | 3.3 | 0.5 | |
| Delay (s) | 41.0 | 38.8 | 39.0 | 5.6 | 43.9 | 11.1 | |
| Level of Service | D | D | D | A | D | B | |
| Approach Delay (s) | 39.7 | | | 10.7 | | 11.3 | |
| Approach LOS | D | | | B | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 14.0 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.45 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 11.9 |
| Intersection Capacity Utilization | 49.3% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 23: Novato Blvd #3 & Rowland Boulevard

06/13/2017

| Movement | EBL | EBT | EBR | WBU | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 40 | 128 | 16 | 28 | 240 | 203 | 616 | 28 | 363 | 188 | 448 | 388 |
| Future Volume (vph) | 40 | 128 | 16 | 28 | 240 | 203 | 616 | 28 | 363 | 188 | 448 | 388 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 3.5 | | | 3.5 | 4.1 | 4.1 | 3.5 | 4.1 | | 3.5 | 4.4 |
| Lane Util. Factor | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 0.97 | 1.00 |
| Frpb, ped/bikes | 1.00 | 0.99 | | | 1.00 | 1.00 | 0.99 | 1.00 | 0.99 | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 0.98 | | | 1.00 | 1.00 | 0.85 | 1.00 | 0.95 | | 1.00 | 0.98 |
| Flt Protected | 0.95 | 1.00 | | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 1858 | | | 1789 | 1900 | 1592 | 1805 | 1774 | | 3502 | 1852 |
| Flt Permitted | 0.95 | 1.00 | | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | 1805 | 1858 | | | 1789 | 1900 | 1592 | 1805 | 1774 | | 3502 | 1852 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 42 | 135 | 17 | 29 | 253 | 214 | 648 | 29 | 382 | 198 | 472 | 408 |
| RTOR Reduction (vph) | 0 | 5 | 0 | 0 | 0 | 0 | 389 | 0 | 17 | 0 | 0 | 5 |
| Lane Group Flow (vph) | 42 | 147 | 0 | 0 | 282 | 214 | 259 | 29 | 563 | 0 | 472 | 470 |
| Confl. Peds. (#/hr) | | | 13 | | | | 2 | | | 5 | | |
| Confl. Bikes (#/hr) | | | 1 | | | | | | | 1 | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 1% | 0% | 0% | 0% | 1% | 1% | 0% | 0% |
| Turn Type | Prot | NA | | Prot | Prot | NA | Perm | Prot | NA | | Prot | NA |
| Protected Phases | 3 | 8 | | 7 | 7 | 4 | | 1 | 6 | | 5 | 2 |
| Permitted Phases | | | | | | | 4 | | | | | |
| Actuated Green, G (s) | 5.6 | 16.4 | | | 15.5 | 25.7 | 25.7 | 6.0 | 38.3 | | 15.2 | 47.2 |
| Effective Green, g (s) | 5.6 | 16.4 | | | 15.5 | 25.7 | 25.7 | 6.0 | 38.3 | | 15.2 | 47.2 |
| Actuated g/C Ratio | 0.06 | 0.16 | | | 0.16 | 0.26 | 0.26 | 0.06 | 0.38 | | 0.15 | 0.47 |
| Clearance Time (s) | 3.5 | 3.5 | | | 3.5 | 4.1 | 4.1 | 3.5 | 4.1 | | 3.5 | 4.4 |
| Vehicle Extension (s) | 2.0 | 2.0 | | | 2.0 | 2.0 | 2.0 | 2.0 | 3.0 | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 101 | 304 | | | 277 | 488 | 409 | 108 | 679 | | 532 | 874 |
| v/s Ratio Prot | 0.02 | c0.08 | | | c0.16 | 0.11 | | 0.02 | c0.32 | | c0.13 | 0.25 |
| v/s Ratio Perm | | | | | | | c0.16 | | | | | |
| v/c Ratio | 0.42 | 0.48 | | | 1.02 | 0.44 | 0.63 | 0.27 | 0.83 | | 0.89 | 0.54 |
| Uniform Delay, d1 | 45.6 | 38.0 | | | 42.2 | 31.1 | 33.0 | 44.9 | 27.9 | | 41.6 | 18.7 |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 0.70 | 0.54 |
| Incremental Delay, d2 | 1.0 | 0.4 | | | 58.8 | 0.2 | 2.3 | 0.5 | 8.3 | | 18.5 | 2.2 |
| Delay (s) | 46.6 | 38.4 | | | 101.0 | 31.3 | 35.3 | 45.4 | 36.2 | | 47.4 | 12.4 |
| Level of Service | D | D | | | F | C | D | D | D | | D | B |
| Approach Delay (s) | | 40.2 | | | | 50.8 | | | 36.6 | | | 29.8 |
| Approach LOS | | D | | | | D | | | D | | | C |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 40.2 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.84 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 15.5 |
| Intersection Capacity Utilization | 86.8% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 23: Novato Blvd #3 & Rowland Boulevard
06/13/2017

| Movement | SBR |
|---|---|
| Lane Configurations | |
| Traffic Volume (vph) | 64 |
| Future Volume (vph) | 64 |
| Ideal Flow (vphpl) | 1900 |
| Total Lost time (s) | |
| Lane Util. Factor | |
| Frpb, ped/bikes | |
| Flpb, ped/bikes | |
| Frt | |
| Flt Protected | |
| Satd. Flow (prot) | |
| Flt Permitted | |
| Satd. Flow (perm) | |
| Peak-hour factor, PHF | 0.95 |
| Adj. Flow (vph) | 67 |
| RTOR Reduction (vph) | 0 |
| Lane Group Flow (vph) | 0 |
| Confl. Peds. (#/hr) | 6 |
| Confl. Bikes (#/hr) | |
| Heavy Vehicles (%) | 0% |
| Turn Type | |
| Protected Phases | |
| Permitted Phases | |
| Actuated Green, G (s) | |
| Effective Green, g (s) | |
| Actuated g/C Ratio | |
| Clearance Time (s) | |
| Vehicle Extension (s) | |
| Lane Grp Cap (vph) | |
| v/s Ratio Prot | |
| v/s Ratio Perm | |
| v/c Ratio | |
| Uniform Delay, d1 | |
| Progression Factor | |
| Incremental Delay, d2 | |
| Delay (s) | |
| Level of Service | |
| Approach Delay (s) | |
| Approach LOS | |
| Intersection Summary | |



## HCM Signalized Intersection Capacity Analysis
### 24: Rowland Boulevard & Redwood Blvd
06/13/2017

| Movement | EBL | EBT | EBR | WBU | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 116 | 654 | 49 | 1 | 142 | 977 | 453 | 24 | 30 | 64 | 432 | 27 |
| Future Volume (vph) | 116 | 654 | 49 | 1 | 142 | 977 | 453 | 24 | 30 | 64 | 432 | 27 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.5 | 4.5 | | 3.5 | 4.5 | | 3.5 | 4.1 | | 3.5 | 4.8 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | | 0.97 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.98 | | 1.00 | 1.00 | | 1.00 | 0.99 | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | | 1.00 | 0.95 | | 1.00 | 0.90 | | 1.00 | 1.00 |
| Flt Protected | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 3574 | 1590 | | 1805 | 3422 | | 1805 | 3209 | | 3502 | 1900 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | 1805 | 3574 | 1590 | | 1805 | 3422 | | 1805 | 3209 | | 3502 | 1900 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 122 | 688 | 52 | 1 | 149 | 1028 | 477 | 25 | 32 | 67 | 455 | 28 |
| RTOR Reduction (vph) | 0 | 0 | 31 | 0 | 0 | 41 | 0 | 0 | 57 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 122 | 688 | 21 | 0 | 150 | 1464 | 0 | 25 | 42 | 0 | 455 | 28 |
| Confl. Peds. (#/hr) | | | 4 | | | | 4 | | | 3 | | |
| Confl. Bikes (#/hr) | | | | | | | | | | 1 | | |
| Heavy Vehicles (%) | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Prot | NA | Perm | Prot | Prot | NA | | Prot | NA | | Prot | NA |
| Protected Phases | 5 | 2 | | 1 | 1 | 6 | | 3 | 8 | | 7 | 4 |
| Permitted Phases | | | 2 | | | | | | | | | |
| Actuated Green, G (s) | 11.2 | 38.2 | 38.2 | | 12.7 | 39.7 | | 4.0 | 13.9 | | 12.8 | 22.0 |
| Effective Green, g (s) | 11.2 | 38.2 | 38.2 | | 12.7 | 39.7 | | 4.0 | 13.9 | | 12.8 | 22.0 |
| Actuated g/C Ratio | 0.12 | 0.41 | 0.41 | | 0.14 | 0.43 | | 0.04 | 0.15 | | 0.14 | 0.24 |
| Clearance Time (s) | 3.5 | 4.5 | 4.5 | | 3.5 | 4.5 | | 3.5 | 4.1 | | 3.5 | 4.8 |
| Vehicle Extension (s) | 2.0 | 4.0 | 4.0 | | 2.0 | 4.0 | | 2.0 | 2.5 | | 2.5 | 2.5 |
| Lane Grp Cap (vph) | 216 | 1464 | 651 | | 245 | 1457 | | 77 | 478 | | 480 | 448 |
| v/s Ratio Prot | 0.07 | 0.19 | | | c0.08 | c0.43 | | 0.01 | 0.01 | | c0.13 | 0.01 |
| v/s Ratio Perm | | | 0.01 | | | | | | | | | |
| v/c Ratio | 0.56 | 0.47 | 0.03 | | 0.61 | 1.00 | | 0.32 | 0.09 | | 0.95 | 0.06 |
| Uniform Delay, d1 | 38.7 | 20.1 | 16.4 | | 37.9 | 26.8 | | 43.3 | 34.2 | | 39.9 | 27.6 |
| Progression Factor | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 2.0 | 0.3 | 0.0 | | 3.2 | 24.7 | | 0.9 | 0.1 | | 28.1 | 0.0 |
| Delay (s) | 40.7 | 20.4 | 16.5 | | 41.1 | 51.4 | | 44.2 | 34.2 | | 67.9 | 27.6 |
| Level of Service | D | C | B | | D | D | | D | C | | E | C |
| Approach Delay (s) | | 23.1 | | | | 50.5 | | | 36.2 | | | 56.4 |
| Approach LOS | | C | | | | D | | | D | | | E |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 43.9 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.79 | | |
| Actuated Cycle Length (s) | 93.2 | Sum of lost time (s) | 16.3 |
| Intersection Capacity Utilization | 81.4% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | SBR |
|---|---|
| Lane Configurations | |
| Traffic Volume (vph) | 148 |
| Future Volume (vph) | 148 |
| Ideal Flow (vphpl) | 1900 |
| Total Lost time (s) | 4.8 |
| Lane Util. Factor | 1.00 |
| Frpb, ped/bikes | 0.99 |
| Flpb, ped/bikes | 1.00 |
| Frt | 0.85 |
| Flt Protected | 1.00 |
| Satd. Flow (prot) | 1593 |
| Flt Permitted | 1.00 |
| Satd. Flow (perm) | 1593 |
| Peak-hour factor, PHF | 0.95 |
| Adj. Flow (vph) | 156 |
| RTOR Reduction (vph) | 119 |
| Lane Group Flow (vph) | 37 |
| Confl. Peds. (#/hr) | 2 |
| Confl. Bikes (#/hr) | |
| Heavy Vehicles (%) | 0% |
| Turn Type | Perm |
| Protected Phases | |
| Permitted Phases | 4 |
| Actuated Green, G (s) | 22.0 |
| Effective Green, g (s) | 22.0 |
| Actuated g/C Ratio | 0.24 |
| Clearance Time (s) | 4.8 |
| Vehicle Extension (s) | 2.5 |
| Lane Grp Cap (vph) | 376 |
| v/s Ratio Prot | |
| v/s Ratio Perm | c0.02 |
| v/c Ratio | 0.10 |
| Uniform Delay, d1 | 27.8 |
| Progression Factor | 1.00 |
| Incremental Delay, d2 | 0.1 |
| Delay (s) | 27.9 |
| Level of Service | C |
| Approach Delay (s) | |
| Approach LOS | |

Intersection Summary





| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 545 | 613 | 765 | 1357 | 0 | 0 | 0 | 0 | 321 | 6 | 186 |
| Future Volume (vph) | 0 | 545 | 613 | 765 | 1357 | 0 | 0 | 0 | 0 | 321 | 6 | 186 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.0 | 4.0 | 3.0 | 4.0 | | | | | 3.0 | 3.0 | |
| Lane Util. Factor | | 0.91 | 0.91 | 0.97 | 0.95 | | | | | 0.91 | 0.91 | |
| Frpb, ped/bikes | | 1.00 | 0.99 | 1.00 | 1.00 | | | | | 1.00 | 0.99 | |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | | | | 1.00 | 1.00 | |
| Frt | | 0.95 | 0.85 | 1.00 | 1.00 | | | | | 1.00 | 0.92 | |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | 0.95 | 0.98 | |
| Satd. Flow (prot) | | 3258 | 1450 | 3502 | 3610 | | | | | 1643 | 3057 | |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 1.00 | | | | | 0.95 | 0.98 | |
| Satd. Flow (perm) | | 3258 | 1450 | 3502 | 3610 | | | | | 1643 | 3057 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 0 | 574 | 645 | 805 | 1428 | 0 | 0 | 0 | 0 | 338 | 6 | 196 |
| RTOR Reduction (vph) | 0 | 53 | 245 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 0 |
| Lane Group Flow (vph) | 0 | 785 | 136 | 805 | 1428 | 0 | 0 | 0 | 0 | 189 | 339 | 0 |
| Confl. Peds. (#/hr) | | | 2 | | | | | | | | | 7 |
| Confl. Bikes (#/hr) | | | | | | | | | | | | 1 |
| Heavy Vehicles (%) | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 33% | 0% |
| Turn Type | | NA | Perm | Prot | NA | | | | | Split | NA | |
| Protected Phases | | 2 | | 1 | 6 | | | | | 4 | 4 | |
| Permitted Phases | | | 2 | | | | | | | | | |
| Actuated Green, G (s) | | 20.7 | 20.7 | 13.4 | 37.1 | | | | | 13.8 | 13.8 | |
| Effective Green, g (s) | | 20.7 | 20.7 | 13.4 | 37.1 | | | | | 13.8 | 13.8 | |
| Actuated g/C Ratio | | 0.36 | 0.36 | 0.23 | 0.64 | | | | | 0.24 | 0.24 | |
| Clearance Time (s) | | 4.0 | 4.0 | 3.0 | 4.0 | | | | | 3.0 | 3.0 | |
| Vehicle Extension (s) | | 4.0 | 4.0 | 2.0 | 2.5 | | | | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | | 1164 | 518 | 810 | 2313 | | | | | 391 | 728 | |
| v/s Ratio Prot | | 0.24 | | c0.23 | c0.40 | | | | | c0.12 | 0.11 | |
| v/s Ratio Perm | | | 0.09 | | | | | | | | | |
| v/c Ratio | | 0.67 | 0.26 | 0.99 | 0.62 | | | | | 0.48 | 0.47 | |
| Uniform Delay, d1 | | 15.7 | 13.2 | 22.2 | 6.2 | | | | | 19.0 | 18.9 | |
| Progression Factor | | 1.00 | 1.00 | 1.00 | 1.00 | | | | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 1.7 | 0.4 | 29.9 | 0.4 | | | | | 0.3 | 0.2 | |
| Delay (s) | | 17.5 | 13.6 | 52.1 | 6.6 | | | | | 19.3 | 19.1 | |
| Level of Service | | B | B | D | A | | | | | B | B | |
| Approach Delay (s) | | 16.2 | | | 23.0 | | | 0.0 | | | 19.2 | |
| Approach LOS | | B | | | C | | | A | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 20.4 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.72 | | |
| Actuated Cycle Length (s) | 57.9 | Sum of lost time (s) | 10.0 |
| Intersection Capacity Utilization | 72.0% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL2 | EBL | EBT | WBT | WBR | WBR2 | NBL2 | NBL | NBT | NBR | NEL2 | NEL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 4 | 99 | 776 | 1266 | 2 | 517 | 830 | 15 | 2 | 801 | 20 | 20 |
| Future Volume (vph) | 4 | 99 | 776 | 1266 | 2 | 517 | 830 | 15 | 2 | 801 | 20 | 20 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | 4.0 | 4.0 | | 4.0 | 3.5 | | 3.5 | 3.0 | | 3.5 |
| Lane Util. Factor | | 1.00 | 0.95 | 0.86 | | 0.86 | 0.95 | | 0.95 | 0.88 | | 1.00 |
| Frpb, ped/bikes | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Frt | | 1.00 | 1.00 | 0.99 | | 0.85 | 1.00 | | 1.00 | 0.85 | | 0.98 |
| Flt Protected | | 0.95 | 1.00 | 1.00 | | 1.00 | 0.95 | | 0.95 | 1.00 | | 0.96 |
| Satd. Flow (prot) | | 1804 | 3574 | 4640 | | 1323 | 1715 | | 1717 | 2842 | | 1742 |
| Flt Permitted | | 0.95 | 1.00 | 1.00 | | 1.00 | 0.95 | | 0.95 | 1.00 | | 0.96 |
| Satd. Flow (perm) | | 1804 | 3574 | 4640 | | 1323 | 1715 | | 1717 | 2842 | | 1742 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 4 | 104 | 817 | 1333 | 2 | 544 | 874 | 16 | 2 | 843 | 21 | 21 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 8 | 0 | 214 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 108 | 817 | 1452 | 0 | 205 | 446 | 0 | 446 | 843 | 0 | 48 |
| Confl. Peds. (#/hr) | | | | | 1 | | | | | 8 | | |
| Heavy Vehicles (%) | 2% | 0% | 1% | 4% | 0% | 5% | 0% | 2% | 13% | 0% | 2% | 0% |
| Turn Type | Prot | Prot | NA | NA | | Perm | Split | Split | NA | custom | Perm | Prot |
| Protected Phases | 5 | 5 | 2 | 6 | | | 8 | 8 | 8 | 1 8 | | 7 |
| Permitted Phases | | | | | | 6 | | | | | 7 | |
| Actuated Green, G (s) | | 10.2 | 48.5 | 49.8 | | 49.8 | 37.2 | | 37.2 | 48.7 | | 8.8 |
| Effective Green, g (s) | | 10.2 | 48.5 | 49.8 | | 49.8 | 37.2 | | 37.2 | 48.7 | | 8.8 |
| Actuated g/C Ratio | | 0.08 | 0.40 | 0.41 | | 0.41 | 0.31 | | 0.31 | 0.41 | | 0.07 |
| Clearance Time (s) | | 3.0 | 4.0 | 4.0 | | 4.0 | 3.5 | | 3.5 | | | 3.5 |
| Vehicle Extension (s) | | 2.0 | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | | | 2.0 |
| Lane Grp Cap (vph) | | 153 | 1444 | 1925 | | 549 | 531 | | 532 | 1153 | | 127 |
| v/s Ratio Prot | | 0.06 | 0.23 | c0.31 | | | c0.26 | | 0.26 | c0.30 | | |
| v/s Ratio Perm | | | | | | 0.15 | | | | | | 0.03 |
| v/c Ratio | | 0.71 | 0.57 | 0.75 | | 0.37 | 0.84 | | 0.84 | 0.73 | | 0.38 |
| Uniform Delay, d1 | | 53.4 | 27.6 | 29.9 | | 24.3 | 38.6 | | 38.6 | 30.1 | | 53.0 |
| Progression Factor | | 1.00 | 1.00 | 0.90 | | 1.28 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Incremental Delay, d2 | | 11.4 | 1.6 | 2.4 | | 1.6 | 10.7 | | 10.6 | 2.1 | | 0.7 |
| Delay (s) | | 64.9 | 29.2 | 29.3 | | 32.7 | 49.4 | | 49.2 | 32.2 | | 53.7 |
| Level of Service | | E | C | C | | C | D | | D | C | | D |
| Approach Delay (s) | | | 33.4 | 30.1 | | | | | 41.0 | | | 53.7 |
| Approach LOS | | | C | C | | | | | D | | | D |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 35.1 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.75 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 14.0 |
| Intersection Capacity Utilization | 81.9% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

c Critical Lane Group





| Movement | NER |
|---|---|
| Lane Configurations | |
| Traffic Volume (vph) | 6 |
| Future Volume (vph) | 6 |
| Ideal Flow (vphpl) | 1900 |
| Total Lost time (s) | |
| Lane Util. Factor | |
| Frpb, ped/bikes | |
| Flpb, ped/bikes | |
| Frt | |
| Flt Protected | |
| Satd. Flow (prot) | |
| Flt Permitted | |
| Satd. Flow (perm) | |
| Peak-hour factor, PHF | 0.95 |
| Adj. Flow (vph) | 6 |
| RTOR Reduction (vph) | 0 |
| Lane Group Flow (vph) | 0 |
| Confl. Peds. (#/hr) | |
| Heavy Vehicles (%) | 15% |
| Turn Type | |
| Protected Phases | |
| Permitted Phases | |
| Actuated Green, G (s) | |
| Effective Green, g (s) | |
| Actuated g/C Ratio | |
| Clearance Time (s) | |
| Vehicle Extension (s) | |
| Lane Grp Cap (vph) | |
| v/s Ratio Prot | |
| v/s Ratio Perm | |
| v/c Ratio | |
| Uniform Delay, d1 | |
| Progression Factor | |
| Incremental Delay, d2 | |
| Delay (s) | |
| Level of Service | |
| Approach Delay (s) | |
| Approach LOS | |

Intersection Summary

## HCM Signalized Intersection Capacity Analysis
## 27: Rowland Boulevard & Rowland Way

06/13/2017

| Movement | EBU | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | |
| Traffic Volume (vph) | 6 | 236 | 1347 | 1441 | 27 | 38 | 356 |
| Future Volume (vph) | 6 | 236 | 1347 | 1441 | 27 | 38 | 356 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.5 | 4.0 | 4.0 | | 3.2 | 3.2 |
| Lane Util. Factor | | 0.97 | 0.91 | 0.95 | | 1.00 | 0.95 |
| Frpb, ped/bikes | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | | 1.00 | 1.00 | 1.00 | | 0.88 | 0.85 |
| Flt Protected | | 0.95 | 1.00 | 1.00 | | 0.99 | 1.00 |
| Satd. Flow (prot) | | 3468 | 5187 | 3594 | | 1634 | 1519 |
| Flt Permitted | | 0.95 | 1.00 | 1.00 | | 0.99 | 1.00 |
| Satd. Flow (perm) | | 3468 | 5187 | 3594 | | 1634 | 1519 |
| Peak-hour factor, PHF | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| Adj. Flow (vph) | 6 | 243 | 1389 | 1486 | 28 | 39 | 367 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 1 | 0 | 147 | 180 |
| Lane Group Flow (vph) | 0 | 249 | 1389 | 1513 | 0 | 57 | 22 |
| Confl. Peds. (#/hr) | | | | | 12 | 2 | |
| Heavy Vehicles (%) | 0% | 1% | 0% | 0% | 7% | 2% | 1% |
| Turn Type | Prot | Prot | NA | NA | | Prot | Perm |
| Protected Phases | 5 | 5 | 2 | 6 | | 4 | |
| Permitted Phases | | | | | | | 4 |
| Actuated Green, G (s) | | 13.1 | 99.7 | 83.1 | | 13.1 | 13.1 |
| Effective Green, g (s) | | 13.1 | 99.7 | 83.1 | | 13.1 | 13.1 |
| Actuated g/C Ratio | | 0.11 | 0.83 | 0.69 | | 0.11 | 0.11 |
| Clearance Time (s) | | 3.5 | 4.0 | 4.0 | | 3.2 | 3.2 |
| Vehicle Extension (s) | | 2.0 | 4.0 | 4.0 | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | | 378 | 4309 | 2488 | | 178 | 165 |
| v/s Ratio Prot | | c0.07 | 0.27 | c0.42 | | c0.03 | |
| v/s Ratio Perm | | | | | | | 0.01 |
| v/c Ratio | | 0.66 | 0.32 | 0.61 | | 0.32 | 0.13 |
| Uniform Delay, d1 | | 51.3 | 2.3 | 9.8 | | 49.3 | 48.3 |
| Progression Factor | | 1.02 | 1.17 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | | 2.5 | 0.2 | 1.0 | | 0.4 | 0.1 |
| Delay (s) | | 54.6 | 2.9 | 10.8 | | 49.7 | 48.5 |
| Level of Service | | D | A | B | | D | D |
| Approach Delay (s) | | | 10.8 | 10.8 | | 49.1 | |
| Approach LOS | | | B | B | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 15.1 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.58 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 10.7 |
| Intersection Capacity Utilization | 73.7% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
## 28: Rowland Boulevard & Vintage Way

06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 18 | 544 | 831 | 2 | 640 | 6 | 839 | 3 | 2 | 4 | 3 | 0 |
| Future Volume (vph) | 18 | 544 | 831 | 2 | 640 | 6 | 839 | 3 | 2 | 4 | 3 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 4.0 | 4.0 | 3.0 | 4.0 | | 3.6 | 3.6 | | | 3.2 | |
| Lane Util. Factor | 1.00 | 0.95 | 0.88 | 1.00 | 0.95 | | 0.97 | 1.00 | | | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 0.99 | | | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | | 1.00 | 0.94 | | | 1.00 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | | 0.97 | |
| Satd. Flow (prot) | 1805 | 3539 | 2842 | 1805 | 3568 | | 3502 | 1768 | | | 1847 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | | 0.97 | |
| Satd. Flow (perm) | 1805 | 3539 | 2842 | 1805 | 3568 | | 3502 | 1768 | | | 1847 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 19 | 573 | 875 | 2 | 674 | 6 | 883 | 3 | 2 | 4 | 3 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 19 | 573 | 875 | 2 | 679 | 0 | 883 | 4 | 0 | 0 | 7 | 0 |
| Confl. Peds. (#/hr) | | | 9 | 9 | | 13 | | | 11 | | | |
| Confl. Bikes (#/hr) | | | 2 | | | 2 | | | | | | |
| Heavy Vehicles (%) | 0% | 2% | 0% | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Prot | NA | pt+ov | Prot | NA | | Split | NA | | Split | NA | |
| Protected Phases | 5 | 2 | 2 3 | 1 | 6 | | 3 | 3 | | 4 | 4 | |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | 5.4 | 49.6 | 105.0 | 2.8 | 47.0 | | 51.4 | 51.4 | | | 2.4 | |
| Effective Green, g (s) | 5.4 | 49.6 | 105.0 | 2.8 | 47.0 | | 51.4 | 51.4 | | | 2.4 | |
| Actuated g/C Ratio | 0.05 | 0.41 | 0.88 | 0.02 | 0.39 | | 0.43 | 0.43 | | | 0.02 | |
| Clearance Time (s) | 3.0 | 4.0 | | 3.0 | 4.0 | | 3.6 | 3.6 | | | 3.2 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | | 3.0 | 3.0 | | | 2.0 | |
| Lane Grp Cap (vph) | 81 | 1462 | 2486 | 42 | 1397 | | 1500 | 757 | | | 36 | |
| v/s Ratio Prot | 0.01 | 0.16 | c0.31 | 0.00 | c0.19 | | c0.25 | 0.00 | | | c0.00 | |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | 0.23 | 0.39 | 0.35 | 0.05 | 0.49 | | 0.59 | 0.01 | | | 0.19 | |
| Uniform Delay, d1 | 55.3 | 24.6 | 1.4 | 57.3 | 27.4 | | 26.2 | 19.7 | | | 57.8 | |
| Progression Factor | 1.17 | 1.17 | 0.96 | 1.00 | 1.00 | | 1.00 | 1.00 | | | 1.00 | |
| Incremental Delay, d2 | 0.5 | 0.8 | 0.4 | 0.2 | 1.2 | | 1.7 | 0.0 | | | 1.0 | |
| Delay (s) | 65.5 | 29.7 | 1.7 | 57.5 | 28.6 | | 27.9 | 19.7 | | | 58.8 | |
| Level of Service | E | C | A | E | C | | C | B | | | E | |
| Approach Delay (s) | | 13.5 | | | 28.7 | | | 27.9 | | | 58.8 | |
| Approach LOS | | B | | | C | | | C | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 21.2 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.53 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 13.8 |
| Intersection Capacity Utilization | 60.6% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
## 29: Novato Blvd #3 & Sunset Parkway

06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 210 | 19 | 35 | 32 | 12 | 38 | 46 | 298 | 54 | 36 | 332 | 228 |
| Future Volume (vph) | 210 | 19 | 35 | 32 | 12 | 38 | 46 | 298 | 54 | 36 | 332 | 228 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.0 | | 3.5 | 3.5 | | 3.5 | 4.9 | | 3.5 | 4.6 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 0.98 | | 1.00 | 0.98 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.90 | | 1.00 | 0.89 | | 1.00 | 0.98 | | 1.00 | 0.94 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1787 | 1674 | | 1805 | 1644 | | 1805 | 1834 | | 1805 | 1777 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1787 | 1674 | | 1805 | 1644 | | 1805 | 1834 | | 1805 | 1777 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 221 | 20 | 37 | 34 | 13 | 40 | 48 | 314 | 57 | 38 | 349 | 240 |
| RTOR Reduction (vph) | 0 | 30 | 0 | 0 | 36 | 0 | 0 | 5 | 0 | 0 | 20 | 0 |
| Lane Group Flow (vph) | 221 | 27 | 0 | 34 | 17 | 0 | 48 | 366 | 0 | 38 | 569 | 0 |
| Confl. Peds. (#/hr) | | | 11 | | | 6 | | | 3 | | | |
| Confl. Bikes (#/hr) | | | | | | 1 | | | | | | |
| Heavy Vehicles (%) | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 1% | 0% | 0% | 0% | 1% |
| Turn Type | Prot | NA | | Prot | NA | | Prot | NA | | Prot | NA | |
| Protected Phases | 3 | 8 | | 7 | 4 | | 1 | 6 | | 5 | 2 | |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | 13.1 | 15.6 | | 5.2 | 8.2 | | 5.2 | 38.3 | | 5.2 | 38.6 | |
| Effective Green, g (s) | 13.1 | 15.6 | | 5.2 | 8.2 | | 5.2 | 38.3 | | 5.2 | 38.6 | |
| Actuated g/C Ratio | 0.16 | 0.19 | | 0.06 | 0.10 | | 0.06 | 0.48 | | 0.06 | 0.48 | |
| Clearance Time (s) | 3.5 | 4.0 | | 3.5 | 3.5 | | 3.5 | 4.9 | | 3.5 | 4.6 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 291 | 325 | | 117 | 168 | | 117 | 875 | | 117 | 855 | |
| v/s Ratio Prot | c0.12 | c0.02 | | 0.02 | 0.01 | | c0.03 | 0.20 | | 0.02 | c0.32 | |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | 0.76 | 0.08 | | 0.29 | 0.10 | | 0.41 | 0.42 | | 0.32 | 0.67 | |
| Uniform Delay, d1 | 32.0 | 26.4 | | 35.7 | 32.7 | | 36.0 | 13.7 | | 35.8 | 15.9 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 9.7 | 0.0 | | 0.5 | 0.1 | | 0.9 | 1.5 | | 0.6 | 4.1 | |
| Delay (s) | 41.7 | 26.5 | | 36.2 | 32.8 | | 36.9 | 15.1 | | 36.4 | 20.0 | |
| Level of Service | D | C | | D | C | | D | B | | D | B | |
| Approach Delay (s) | | 38.6 | | | 34.1 | | | 17.6 | | | 21.0 | |
| Approach LOS | | D | | | C | | | B | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 24.3 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.60 | | |
| Actuated Cycle Length (s) | 80.2 | Sum of lost time (s) | 15.9 |
| Intersection Capacity Utilization | 65.0% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM 2010 AWSC
## 30: Redwood Blvd & Novato Blvd #3

06/13/2017

| Intersection | |
|---|---|
| Intersection Delay, s/veh | 48.8 |
| Intersection LOS | E |

| Movement | EBU | EBL | EBT | EBR | WBU | WBL | WBT | WBR | NBU | NBL | NBT | NBR | SBU | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | | | | | |
| Traffic Vol, veh/h | 0 | 46 | 274 | 73 | 0 | 74 | 370 | 114 | 0 | 115 | 14 | 141 | 0 | 88 | 11 | 48 |
| Future Vol, veh/h | 0 | 46 | 274 | 73 | 0 | 74 | 370 | 114 | 0 | 115 | 14 | 141 | 0 | 88 | 11 | 48 |
| Peak Hour Factor | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Heavy Vehicles, % | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 |
| Mvmt Flow | 0 | 48 | 288 | 77 | 0 | 78 | 389 | 120 | 0 | 121 | 15 | 148 | 0 | 93 | 12 | 51 |
| Number of Lanes | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 0 |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Opposing Approach | WB | EB | SB | NB |
| Opposing Lanes | 2 | 2 | 2 | 3 |
| Conflicting Approach Left | SB | NB | EB | WB |
| Conflicting Lanes Left | 2 | 3 | 2 | 2 |
| Conflicting Approach Right | NB | SB | WB | EB |
| Conflicting Lanes Right | 3 | 2 | 2 | 2 |
| HCM Control Delay | 33.7 | 84.5 | 15.5 | 14.9 |
| HCM LOS | D | F | C | B |

| Lane | NBLn1 | NBLn2 | NBLn3 | EBLn1 | EBLn2 | WBLn1 | WBLn2 | SBLn1 | SBLn2 |
|---|---|---|---|---|---|---|---|---|---|
| Vol Left, % | 100% | 0% | 0% | 100% | 0% | 100% | 0% | 100% | 0% |
| Vol Thru, % | 0% | 100% | 0% | 0% | 79% | 0% | 76% | 0% | 19% |
| Vol Right, % | 0% | 0% | 100% | 0% | 21% | 0% | 24% | 0% | 81% |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 115 | 14 | 141 | 46 | 347 | 74 | 484 | 88 | 59 |
| LT Vol | 115 | 0 | 0 | 46 | 0 | 74 | 0 | 88 | 0 |
| Through Vol | 0 | 14 | 0 | 0 | 274 | 0 | 370 | 0 | 11 |
| RT Vol | 0 | 0 | 141 | 0 | 73 | 0 | 114 | 0 | 48 |
| Lane Flow Rate | 121 | 15 | 148 | 48 | 365 | 78 | 509 | 93 | 62 |
| Geometry Grp | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Degree of Util (X) | 0.309 | 0.035 | 0.328 | 0.115 | 0.8 | 0.181 | 1.09 | 0.248 | 0.147 |
| Departure Headway (Hd) | 9.564 | 9.045 | 8.318 | 8.866 | 8.219 | 8.365 | 7.703 | 10.047 | 8.926 |
| Convergence, Y/N | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Cap | 378 | 398 | 435 | 407 | 442 | 432 | 474 | 359 | 404 |
| Service Time | 7.264 | 6.745 | 6.018 | 6.566 | 5.919 | 6.065 | 5.403 | 7.747 | 6.626 |
| HCM Lane V/C Ratio | 0.32 | 0.038 | 0.34 | 0.118 | 0.826 | 0.181 | 1.074 | 0.259 | 0.153 |
| HCM Control Delay | 16.5 | 12.1 | 15 | 12.7 | 36.5 | 12.9 | 95.4 | 16 | 13.2 |
| HCM Lane LOS | C | B | B | B | E | B | F | C | B |
| HCM 95th-tile Q | 1.3 | 0.1 | 1.4 | 0.4 | 7.2 | 0.7 | 16.7 | 1 | 0.5 |

HCM Signalized Intersection Capacity Analysis
30: Redwood Blvd & Novato Blvd #3 06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 46 | 274 | 73 | 74 | 370 | 114 | 115 | 14 | 141 | 88 | 11 | 48 |
| Future Volume (vph) | 46 | 274 | 73 | 74 | 370 | 114 | 115 | 14 | 141 | 88 | 11 | 48 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 16 | 16 | 12 | 16 | 16 | 12 | 12 | 12 | 12 | 12 | 12 |
| Total Lost time (s) | 3.5 | 4.0 | | 3.5 | 4.0 | | 3.5 | 4.0 | 4.0 | 3.5 | 4.0 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 0.97 | | 1.00 | 0.96 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.88 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1787 | 2049 | | 1787 | 2041 | | 1787 | 1881 | 1599 | 1787 | 1653 | |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1787 | 2049 | | 1787 | 2041 | | 1787 | 1881 | 1599 | 1787 | 1653 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 48 | 288 | 77 | 78 | 389 | 120 | 121 | 15 | 148 | 93 | 12 | 51 |
| RTOR Reduction (vph) | 0 | 9 | 0 | 0 | 11 | 0 | 0 | 0 | 125 | 0 | 46 | 0 |
| Lane Group Flow (vph) | 48 | 356 | 0 | 78 | 498 | 0 | 121 | 15 | 23 | 93 | 17 | 0 |
| Heavy Vehicles (%) | 1% | 2% | 1% | 1% | 2% | 1% | 1% | 1% | 1% | 1% | 1% | 1% |
| Turn Type | Prot | NA | | Prot | NA | | Prot | NA | Perm | Prot | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | | | | | | | 2 | | | |
| Actuated Green, G (s) | 2.6 | 20.0 | | 4.2 | 21.6 | | 9.6 | 8.4 | 8.4 | 6.4 | 5.2 | |
| Effective Green, g (s) | 2.6 | 20.0 | | 4.2 | 21.6 | | 9.6 | 8.4 | 8.4 | 6.4 | 5.2 | |
| Actuated g/C Ratio | 0.05 | 0.37 | | 0.08 | 0.40 | | 0.18 | 0.16 | 0.16 | 0.12 | 0.10 | |
| Clearance Time (s) | 3.5 | 4.0 | | 3.5 | 4.0 | | 3.5 | 4.0 | 4.0 | 3.5 | 4.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 86 | 758 | | 138 | 816 | | 317 | 292 | 248 | 211 | 159 | |
| v/s Ratio Prot | 0.03 | 0.17 | | c0.04 | c0.24 | | c0.07 | 0.01 | | 0.05 | 0.01 | |
| v/s Ratio Perm | | | | | | | | | c0.01 | | | |
| v/c Ratio | 0.56 | 0.47 | | 0.57 | 0.61 | | 0.38 | 0.05 | 0.09 | 0.44 | 0.11 | |
| Uniform Delay, d1 | 25.1 | 13.0 | | 24.0 | 12.9 | | 19.6 | 19.4 | 19.5 | 22.1 | 22.3 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 7.6 | 0.5 | | 5.2 | 1.3 | | 0.8 | 0.1 | 0.2 | 1.5 | 0.3 | |
| Delay (s) | 32.8 | 13.4 | | 29.2 | 14.2 | | 20.4 | 19.5 | 19.7 | 23.6 | 22.6 | |
| Level of Service | C | B | | C | B | | C | B | B | C | C | |
| Approach Delay (s) | | 15.7 | | | 16.2 | | | 20.0 | | | 23.2 | |
| Approach LOS | | B | | | B | | | B | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 17.5 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.48 | | |
| Actuated Cycle Length (s) | 54.0 | Sum of lost time (s) | 15.0 |
| Intersection Capacity Utilization | 52.8% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



# MOVEMENT SUMMARY

## Site: 30 [PM Cumulative Alt]

Novato Boulevard/Redwood Boulevard
PM Cumulative with Project Alternative

Roundabout

**Movement Performance - Vehicles**

| Mov ID | OD Mov | Demand Flows Total veh/h | Demand Flows HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance ft | Prop. Queued | Effective Stop Rate per veh | Average Speed mph |
|---|---|---|---|---|---|---|---|---|---|---|---|
| South: NB Redwood Boulevard | | | | | | | | | | | |
| 3 | L2 | 121 | 2.0 | 0.328 | 7.8 | LOS A | 1.6 | 40.4 | 0.59 | 0.54 | 32.4 |
| 8 | T1 | 15 | 2.0 | 0.328 | 7.8 | LOS A | 1.6 | 40.4 | 0.59 | 0.54 | 32.4 |
| 18 | R2 | 148 | 2.0 | 0.328 | 7.8 | LOS A | 1.6 | 40.4 | 0.59 | 0.54 | 31.6 |
| Approach | | 284 | 2.0 | 0.328 | 7.8 | LOS A | 1.6 | 40.4 | 0.59 | 0.54 | 32.0 |
| East: WB Novato Blvd | | | | | | | | | | | |
| 1 | L2 | 78 | 2.0 | 0.526 | 9.4 | LOS A | 3.7 | 93.0 | 0.54 | 0.38 | 32.4 |
| 6 | T1 | 389 | 2.0 | 0.526 | 9.4 | LOS A | 3.7 | 93.0 | 0.54 | 0.38 | 32.4 |
| 16 | R2 | 120 | 2.0 | 0.526 | 9.4 | LOS A | 3.7 | 93.0 | 0.54 | 0.38 | 31.6 |
| Approach | | 587 | 2.0 | 0.526 | 9.4 | LOS A | 3.7 | 93.0 | 0.54 | 0.38 | 32.2 |
| North: SB Redwood Boulevard | | | | | | | | | | | |
| 7 | L2 | 93 | 2.0 | 0.211 | 7.3 | LOS A | 0.9 | 22.6 | 0.61 | 0.59 | 32.3 |
| 4 | T1 | 12 | 2.0 | 0.211 | 7.3 | LOS A | 0.9 | 22.6 | 0.61 | 0.59 | 32.2 |
| 14 | R2 | 51 | 2.0 | 0.211 | 7.3 | LOS A | 0.9 | 22.6 | 0.61 | 0.59 | 31.4 |
| Approach | | 155 | 2.0 | 0.211 | 7.3 | LOS A | 0.9 | 22.6 | 0.61 | 0.59 | 32.0 |
| West: EB Novato Blvd | | | | | | | | | | | |
| 5 | L2 | 48 | 2.0 | 0.287 | 5.7 | LOS A | 1.4 | 35.3 | 0.37 | 0.24 | 34.2 |
| 2 | T1 | 288 | 2.0 | 0.287 | 5.7 | LOS A | 1.4 | 35.3 | 0.37 | 0.24 | 34.2 |
| 12 | R2 | 77 | 2.0 | 0.065 | 3.6 | LOS A | 0.3 | 6.5 | 0.30 | 0.17 | 34.5 |
| Approach | | 414 | 2.0 | 0.287 | 5.3 | LOS A | 1.4 | 35.3 | 0.35 | 0.23 | 34.2 |
| All Vehicles | | 1440 | 2.0 | 0.526 | 7.7 | LOS A | 3.7 | 93.0 | 0.50 | 0.39 | 32.7 |

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.


Organisation: W-TRANS | Processed: Tuesday, June 13, 2017 3:16:43 PM
Project: N:\AAA\MAX\NOV\126NOV\SIDRA\Novato-Redwood.sip7

## LANE SUMMARY

**Site: 30 [PM Cumulative Alt]**

Novato Boulevard/Redwood Boulevard
PM Cumulative with Project Alternative

Roundabout

**Lane Use and Performance**

| | Demand Flows Total veh/h | HV % | Cap. veh/h | Deg. Satn v/c | Lane Util. % | Average Delay sec | Level of Service | 95% Back of Queue Veh | 95% Back of Queue Dist ft | Lane Config | Lane Length ft | Cap. Adj. % | Prob. Block. % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| South: NB Redwood Boulevard | | | | | | | | | | | | | |
| Lane 1[d] | 284 | 2.0 | 865 | 0.328 | 100 | 7.8 | LOS A | 1.6 | 40.4 | Full | 1600 | 0.0 | 0.0 |
| Approach | 284 | 2.0 | | 0.328 | | 7.8 | LOS A | 1.6 | 40.4 | | | | |
| East: WB Novato Blvd | | | | | | | | | | | | | |
| Lane 1[d] | 587 | 2.0 | 1117 | 0.526 | 100 | 9.4 | LOS A | 3.7 | 93.0 | Full | 1600 | 0.0 | 0.0 |
| Approach | 587 | 2.0 | | 0.526 | | 9.4 | LOS A | 3.7 | 93.0 | | | | |
| North: SB Redwood Boulevard | | | | | | | | | | | | | |
| Lane 1[d] | 155 | 2.0 | 734 | 0.211 | 100 | 7.3 | LOS A | 0.9 | 22.6 | Full | 1600 | 0.0 | 0.0 |
| Approach | 155 | 2.0 | | 0.211 | | 7.3 | LOS A | 0.9 | 22.6 | | | | |
| West: EB Novato Blvd | | | | | | | | | | | | | |
| Lane 1[d] | 337 | 2.0 | 1176 | 0.287 | 100 | 5.7 | LOS A | 1.4 | 35.3 | Full | 1600 | 0.0 | 0.0 |
| Lane 2 | 77 | 2.0 | 1176 | 0.065 | 100 | 3.6 | LOS A | 0.3 | 6.5 | Short | 30 | 0.0 | NA |
| Approach | 414 | 2.0 | | 0.287 | | 5.3 | LOS A | 1.4 | 35.3 | | | | |
| Intersection | 1440 | 2.0 | | 0.526 | | 7.7 | LOS A | 3.7 | 93.0 | | | | |

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach


Organisation: W-TRANS | Processed: Tuesday, June 13, 2017 3:16:43 PM
Project: N:\AAA\MAX\NOV\126NOV\SIDRA\Novato-Redwood.sip7



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 11 | 457 | 81 | 348 | 733 | 36 | 102 | 4 | 170 | 29 | 5 | 1 |
| Future Volume (vph) | 11 | 457 | 81 | 348 | 733 | 36 | 102 | 4 | 170 | 29 | 5 | 1 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.6 | 3.6 | 3.0 | 3.6 | | | 3.5 | 3.5 | | 3.7 | |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | | 1.00 | 1.00 | | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.97 | 1.00 | 1.00 | | | 1.00 | 0.98 | | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.99 | 1.00 | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | | | 1.00 | 0.85 | | 1.00 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 0.95 | 1.00 | | 0.96 | |
| Satd. Flow (prot) | 1770 | 3610 | 1573 | 1900 | 3585 | | | 1784 | 1589 | | 1811 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 0.76 | 1.00 | | 0.75 | |
| Satd. Flow (perm) | 1770 | 3610 | 1573 | 1805 | 3585 | | | 1413 | 1589 | | 1417 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 12 | 481 | 85 | 366 | 772 | 38 | 107 | 4 | 179 | 31 | 5 | 1 |
| RTOR Reduction (vph) | 0 | 0 | 31 | 0 | 2 | 0 | 0 | 0 | 152 | 0 | 1 | 0 |
| Lane Group Flow (vph) | 12 | 481 | 54 | 366 | 808 | 0 | 0 | 111 | 27 | 0 | 36 | 0 |
| Confl. Peds. (#/hr) | | | 4 | | | | 7 | | 4 | 4 | | 7 |
| Heavy Vehicles (%) | 2% | 0% | 0% | 0% | 0% | 0% | 1% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Prot | NA | Perm | Prot | NA | | Perm | NA | Perm | Perm | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | 2 | | | | 8 | | 8 | 4 | | |
| Actuated Green, G (s) | 1.2 | 47.4 | 47.4 | 27.4 | 73.6 | | | 15.1 | 15.1 | | 14.9 | |
| Effective Green, g (s) | 1.2 | 47.4 | 47.4 | 27.4 | 73.6 | | | 15.1 | 15.1 | | 14.9 | |
| Actuated g/C Ratio | 0.01 | 0.47 | 0.47 | 0.27 | 0.74 | | | 0.15 | 0.15 | | 0.15 | |
| Clearance Time (s) | 3.0 | 3.6 | 3.6 | 3.0 | 3.6 | | | 3.5 | 3.5 | | 3.7 | |
| Vehicle Extension (s) | 2.0 | 3.0 | 3.0 | 2.0 | 3.0 | | | 2.0 | 2.0 | | 2.0 | |
| Lane Grp Cap (vph) | 21 | 1711 | 745 | 520 | 2638 | | | 213 | 239 | | 211 | |
| v/s Ratio Prot | c0.01 | 0.13 | | c0.19 | c0.23 | | | | | | | |
| v/s Ratio Perm | | | 0.03 | | | | | c0.08 | 0.02 | | 0.03 | |
| v/c Ratio | 0.57 | 0.28 | 0.07 | 0.70 | 0.31 | | | 0.52 | 0.11 | | 0.17 | |
| Uniform Delay, d1 | 49.1 | 16.0 | 14.3 | 32.7 | 4.5 | | | 39.1 | 36.7 | | 37.2 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 0.76 | 0.80 | | | 1.00 | 1.00 | | 1.00 | |
| Incremental Delay, d2 | 21.2 | 0.4 | 0.2 | 3.2 | 0.3 | | | 1.1 | 0.1 | | 0.1 | |
| Delay (s) | 70.4 | 16.4 | 14.5 | 28.1 | 3.9 | | | 40.2 | 36.7 | | 37.3 | |
| Level of Service | E | B | B | C | A | | | D | D | | D | |
| Approach Delay (s) | | 17.2 | | | 11.4 | | | 38.1 | | | 37.3 | |
| Approach LOS | | B | | | B | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 17.2 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.46 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 10.3 |
| Intersection Capacity Utilization | 69.0% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 32: US 101 SB Off Ramp/Enfrente Rd & Ignacio Blvd/Ignacio Blvd #3

06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 35 | 401 | 267 | 590 | 812 | 145 | 0 | 0 | 771 | 201 | 92 | 308 |
| Future Volume (vph) | 35 | 401 | 267 | 590 | 812 | 145 | 0 | 0 | 771 | 201 | 92 | 308 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 8.0 | 8.0 | 3.0 | 4.0 | | | | 3.0 | | 3.5 | 3.5 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | | | 0.88 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.96 | 1.00 | 0.99 | | | | 1.00 | | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.98 | | | | 0.85 | | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | | 1.00 | | 0.97 | 1.00 |
| Satd. Flow (prot) | 1805 | 3610 | 1550 | 1787 | 3499 | | | | 2842 | | 1809 | 1578 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | | 1.00 | | 0.97 | 1.00 |
| Satd. Flow (perm) | 1805 | 3610 | 1550 | 1787 | 3499 | | | | 2842 | | 1809 | 1578 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 36 | 418 | 278 | 615 | 846 | 151 | 0 | 0 | 803 | 209 | 96 | 321 |
| RTOR Reduction (vph) | 0 | 0 | 203 | 0 | 11 | 0 | 0 | 0 | 390 | 0 | 0 | 241 |
| Lane Group Flow (vph) | 36 | 418 | 75 | 615 | 986 | 0 | 0 | 0 | 413 | 0 | 305 | 80 |
| Confl. Peds. (#/hr) | | | 7 | | | 20 | | | | | | 1 |
| Confl. Bikes (#/hr) | | | | | | 3 | | | | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 5% | 1% |
| Turn Type | Prot | NA | Perm | Prot | NA | | | | Over | Split | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | | | 1 | 7 | 7 | |
| Permitted Phases | | | 2 | | | | | | | | | 7 |
| Actuated Green, G (s) | 6.6 | 26.8 | 26.8 | 36.2 | 60.4 | | | | 36.2 | | 22.5 | 22.5 |
| Effective Green, g (s) | 6.6 | 26.8 | 26.8 | 36.2 | 60.4 | | | | 36.2 | | 22.5 | 22.5 |
| Actuated g/C Ratio | 0.07 | 0.27 | 0.27 | 0.36 | 0.60 | | | | 0.36 | | 0.22 | 0.22 |
| Clearance Time (s) | 3.0 | 8.0 | 8.0 | 3.0 | 4.0 | | | | 3.0 | | 3.5 | 3.5 |
| Vehicle Extension (s) | 2.0 | 2.5 | 2.5 | 3.0 | 4.0 | | | | 3.0 | | 2.5 | 2.5 |
| Lane Grp Cap (vph) | 119 | 967 | 415 | 646 | 2113 | | | | 1028 | | 407 | 355 |
| v/s Ratio Prot | 0.02 | c0.12 | | c0.34 | c0.28 | | | | 0.15 | | c0.17 | |
| v/s Ratio Perm | | | 0.05 | | | | | | | | | 0.05 |
| v/c Ratio | 0.30 | 0.43 | 0.18 | 0.95 | 0.47 | | | | 0.40 | | 0.75 | 0.23 |
| Uniform Delay, d1 | 44.5 | 30.3 | 28.1 | 31.1 | 10.9 | | | | 23.8 | | 36.1 | 31.6 |
| Progression Factor | 0.99 | 0.69 | 0.42 | 0.81 | 0.77 | | | | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.5 | 1.4 | 0.9 | 16.6 | 0.4 | | | | 0.3 | | 7.0 | 0.2 |
| Delay (s) | 44.8 | 22.2 | 12.7 | 41.6 | 8.8 | | | | 24.1 | | 43.1 | 31.9 |
| Level of Service | D | C | B | D | A | | | | C | | D | C |
| Approach Delay (s) | | 19.7 | | | 21.3 | | | 24.1 | | | 37.4 | |
| Approach LOS | | B | | | C | | | C | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 24.3 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.76 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 14.5 |
| Intersection Capacity Utilization | 79.6% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 33: Nave Dr & Ignacio Blvd #3/Bel Marin Keys Blvd #3

06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 335 | 1044 | 118 | 681 | 574 | 870 | 769 | 257 | 0 | 0 | 0 |
| Future Volume (vph) | 0 | 335 | 1044 | 118 | 681 | 574 | 870 | 769 | 257 | 0 | 0 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.0 | 4.6 | 3.0 | 4.0 | | 4.6 | 4.6 | 3.0 | | | |
| Lane Util. Factor | | 0.95 | 1.00 | 1.00 | 0.95 | | 0.91 | 0.91 | 1.00 | | | |
| Frpb, ped/bikes | | 1.00 | 0.99 | 1.00 | 0.99 | | 1.00 | 1.00 | 0.99 | | | |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | | |
| Frt | | 1.00 | 0.85 | 1.00 | 0.93 | | 1.00 | 1.00 | 0.85 | | | |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 0.98 | 1.00 | | | |
| Satd. Flow (prot) | | 3610 | 1605 | 1805 | 3312 | | 1643 | 3382 | 1600 | | | |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 0.98 | 1.00 | | | |
| Satd. Flow (perm) | | 3610 | 1605 | 1805 | 3312 | | 1643 | 3382 | 1600 | | | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 0 | 353 | 1099 | 124 | 717 | 604 | 916 | 809 | 271 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 83 | 0 | 39 | 0 | 0 | 0 | 127 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 353 | 1016 | 124 | 1282 | 0 | 559 | 1166 | 144 | 0 | 0 | 0 |
| Confl. Peds. (#/hr) | | | 1 | | | 1 | | | 1 | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 2% | 0% | 1% | 0% | 0% | 0% | 0% |
| Turn Type | | NA | pm+ov | Prot | NA | | Split | NA | pm+ov | | | |
| Protected Phases | | 2 | 3 | 1 | 6 | | 3 | 3 | 1 | | | |
| Permitted Phases | | | 2 | | | | | | 3 | | | |
| Actuated Green, G (s) | | 35.6 | 75.8 | 12.6 | 51.2 | | 40.2 | 40.2 | 52.8 | | | |
| Effective Green, g (s) | | 35.6 | 75.8 | 12.6 | 51.2 | | 40.2 | 40.2 | 52.8 | | | |
| Actuated g/C Ratio | | 0.36 | 0.76 | 0.13 | 0.51 | | 0.40 | 0.40 | 0.53 | | | |
| Clearance Time (s) | | 4.0 | 4.6 | 3.0 | 4.0 | | 4.6 | 4.6 | 3.0 | | | |
| Vehicle Extension (s) | | 4.0 | 2.0 | 2.0 | 4.0 | | 2.0 | 2.0 | 2.0 | | | |
| Lane Grp Cap (vph) | | 1285 | 1216 | 227 | 1695 | | 660 | 1359 | 844 | | | |
| v/s Ratio Prot | | 0.10 | c0.34 | 0.07 | c0.39 | | 0.34 | c0.34 | 0.02 | | | |
| v/s Ratio Perm | | | 0.30 | | | | | | 0.07 | | | |
| v/c Ratio | | 0.27 | 0.84 | 0.55 | 0.76 | | 0.85 | 0.86 | 0.17 | | | |
| Uniform Delay, d1 | | 23.0 | 8.0 | 41.0 | 19.4 | | 27.1 | 27.3 | 12.2 | | | |
| Progression Factor | | 1.09 | 1.09 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | | |
| Incremental Delay, d2 | | 0.5 | 4.3 | 1.4 | 3.2 | | 9.5 | 5.4 | 0.0 | | | |
| Delay (s) | | 25.5 | 13.0 | 42.5 | 22.6 | | 36.6 | 32.7 | 12.3 | | | |
| Level of Service | | C | B | D | C | | D | C | B | | | |
| Approach Delay (s) | | 16.0 | | | 24.3 | | | 31.0 | | | 0.0 | |
| Approach LOS | | B | | | C | | | C | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 24.6 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.84 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 11.6 |
| Intersection Capacity Utilization | 81.9% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 34: Bel Marin Keys Blvd #3 & Commercial Blvd

06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 3 | 0 | 40 | 292 | 1 | 29 | 48 | 499 | 82 | 33 | 1140 | 7 |
| Future Volume (vph) | 3 | 0 | 40 | 292 | 1 | 29 | 48 | 499 | 82 | 33 | 1140 | 7 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.0 | | | 4.0 | 4.0 | 3.0 | 3.9 | | 3.0 | 3.5 | |
| Lane Util. Factor | | 1.00 | | | 1.00 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | | 0.99 | | | 1.00 | 0.99 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 0.87 | | | 1.00 | 0.85 | 1.00 | 0.98 | | 1.00 | 1.00 | |
| Flt Protected | | 1.00 | | | 0.95 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 1631 | | | 1807 | 1396 | 1805 | 3521 | | 1805 | 3571 | |
| Flt Permitted | | 0.98 | | | 0.69 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | | 1608 | | | 1313 | 1396 | 1805 | 3521 | | 1805 | 3571 | |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Adj. Flow (vph) | 3 | 0 | 44 | 324 | 1 | 32 | 53 | 554 | 91 | 37 | 1267 | 8 |
| RTOR Reduction (vph) | 0 | 33 | 0 | 0 | 0 | 22 | 0 | 14 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 14 | 0 | 0 | 325 | 10 | 53 | 631 | 0 | 37 | 1275 | 0 |
| Confl. Peds. (#/hr) | 3 | | 2 | 2 | | 3 | | | 3 | | | |
| Heavy Vehicles (%) | 2% | 0% | 0% | 0% | 0% | 14% | 0% | 0% | 0% | 0% | 1% | 0% |
| Turn Type | Perm | NA | | Perm | NA | Perm | Prot | NA | | Prot | NA | |
| Protected Phases | | 4 | | | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | | | | | | |
| Actuated Green, G (s) | | 22.8 | | | 22.8 | 22.8 | 4.0 | 37.7 | | 3.6 | 37.7 | |
| Effective Green, g (s) | | 22.8 | | | 22.8 | 22.8 | 4.0 | 37.7 | | 3.6 | 37.7 | |
| Actuated g/C Ratio | | 0.30 | | | 0.30 | 0.30 | 0.05 | 0.50 | | 0.05 | 0.50 | |
| Clearance Time (s) | | 4.0 | | | 4.0 | 4.0 | 3.0 | 3.9 | | 3.0 | 3.5 | |
| Vehicle Extension (s) | | 3.0 | | | 3.0 | 3.0 | 2.5 | 3.0 | | 2.5 | 4.0 | |
| Lane Grp Cap (vph) | | 488 | | | 399 | 424 | 96 | 1769 | | 86 | 1795 | |
| v/s Ratio Prot | | | | | | | c0.03 | 0.18 | | 0.02 | c0.36 | |
| v/s Ratio Perm | | 0.01 | | | c0.25 | 0.01 | | | | | | |
| v/c Ratio | | 0.03 | | | 0.81 | 0.02 | 0.55 | 0.36 | | 0.43 | 0.71 | |
| Uniform Delay, d1 | | 18.3 | | | 24.1 | 18.3 | 34.6 | 11.3 | | 34.7 | 14.4 | |
| Progression Factor | | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | 0.89 | 0.76 | |
| Incremental Delay, d2 | | 0.0 | | | 12.1 | 0.0 | 5.4 | 0.6 | | 2.0 | 1.9 | |
| Delay (s) | | 18.4 | | | 36.2 | 18.3 | 40.0 | 11.9 | | 33.0 | 12.8 | |
| Level of Service | | B | | | D | B | D | B | | C | B | |
| Approach Delay (s) | | 18.4 | | | 34.6 | | | 14.0 | | | 13.4 | |
| Approach LOS | | B | | | C | | | B | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 16.8 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.74 | | |
| Actuated Cycle Length (s) | 75.0 | Sum of lost time (s) | 10.9 |
| Intersection Capacity Utilization | 69.5% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 35: Bel Marin Keys Blvd #3 & Hamilton Dr/Digital Dr

06/13/2017

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 5 | 7 | 162 | 506 | 4 | 14 | 47 | 367 | 107 | 6 | 548 | 2 |
| Future Volume (vph) | 5 | 7 | 162 | 506 | 4 | 14 | 47 | 367 | 107 | 6 | 548 | 2 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.5 | 3.5 | 3.5 | 3.5 | | 3.0 | 4.0 | | 3.0 | 4.0 | |
| Lane Util. Factor | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | | 1.00 | 0.99 | 1.00 | 0.99 | | 1.00 | 0.99 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 1.00 | 0.85 | 1.00 | 0.88 | | 1.00 | 0.97 | | 1.00 | 1.00 | |
| Flt Protected | | 0.98 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 1864 | 1533 | 1804 | 1658 | | 1770 | 3470 | | 1805 | 3572 | |
| Flt Permitted | | 0.96 | 1.00 | 0.75 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | | 1822 | 1533 | 1422 | 1658 | | 1770 | 3470 | | 1805 | 3572 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 5 | 8 | 176 | 550 | 4 | 15 | 51 | 399 | 116 | 7 | 596 | 2 |
| RTOR Reduction (vph) | 0 | 0 | 106 | 0 | 9 | 0 | 0 | 30 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 13 | 70 | 550 | 10 | 0 | 51 | 485 | 0 | 7 | 598 | 0 |
| Confl. Peds. (#/hr) | 1 | | 1 | 1 | | 1 | | | 2 | | | 8 |
| Heavy Vehicles (%) | 0% | 0% | 4% | 0% | 0% | 0% | 2% | 0% | 0% | 0% | 1% | 0% |
| Turn Type | Perm | NA | Perm | Perm | NA | | Prot | NA | | Prot | NA | |
| Protected Phases | | 4 | | | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | 4 | 8 | | | | | | | | |
| Actuated Green, G (s) | | 30.0 | 30.0 | 30.0 | 30.0 | | 5.4 | 32.7 | | 1.8 | 29.1 | |
| Effective Green, g (s) | | 30.0 | 30.0 | 30.0 | 30.0 | | 5.4 | 32.7 | | 1.8 | 29.1 | |
| Actuated g/C Ratio | | 0.40 | 0.40 | 0.40 | 0.40 | | 0.07 | 0.44 | | 0.02 | 0.39 | |
| Clearance Time (s) | | 3.5 | 3.5 | 3.5 | 3.5 | | 3.0 | 4.0 | | 3.0 | 4.0 | |
| Vehicle Extension (s) | | 2.0 | 2.0 | 2.5 | 2.5 | | 2.0 | 4.0 | | 2.0 | 4.0 | |
| Lane Grp Cap (vph) | | 728 | 613 | 568 | 663 | | 127 | 1512 | | 43 | 1385 | |
| v/s Ratio Prot | | | | | 0.01 | | c0.03 | 0.14 | | 0.00 | c0.17 | |
| v/s Ratio Perm | | 0.01 | 0.05 | c0.39 | | | | | | | | |
| v/c Ratio | | 0.02 | 0.11 | 0.97 | 0.02 | | 0.40 | 0.32 | | 0.16 | 0.43 | |
| Uniform Delay, d1 | | 13.6 | 14.2 | 22.0 | 13.6 | | 33.3 | 13.9 | | 35.9 | 16.9 | |
| Progression Factor | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.38 | 0.49 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 0.0 | 0.0 | 29.5 | 0.0 | | 0.7 | 0.5 | | 0.7 | 1.0 | |
| Delay (s) | | 13.6 | 14.2 | 51.6 | 13.6 | | 46.8 | 7.3 | | 36.5 | 17.9 | |
| Level of Service | | B | B | D | B | | D | A | | D | B | |
| Approach Delay (s) | | 14.1 | | | 50.3 | | | 10.9 | | | 18.1 | |
| Approach LOS | | B | | | D | | | B | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 25.1 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.68 | | |
| Actuated Cycle Length (s) | 75.0 | Sum of lost time (s) | 10.5 |
| Intersection Capacity Utilization | 73.0% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 714 | 233 | 0 | 1194 | 906 | 246 |
| Future Volume (vph) | 714 | 233 | 0 | 1194 | 906 | 246 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | | 5.0 | 5.0 | |
| Lane Util. Factor | 0.97 | 1.00 | | 0.95 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 0.99 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.85 | | 1.00 | 0.97 | |
| Flt Protected | 0.95 | 1.00 | | 1.00 | 1.00 | |
| Satd. Flow (prot) | 3467 | 1563 | | 3574 | 3467 | |
| Flt Permitted | 0.95 | 1.00 | | 1.00 | 1.00 | |
| Satd. Flow (perm) | 3467 | 1563 | | 3574 | 3467 | |
| Peak-hour factor, PHF | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Adj. Flow (vph) | 729 | 238 | 0 | 1218 | 924 | 251 |
| RTOR Reduction (vph) | 0 | 37 | 0 | 0 | 35 | 0 |
| Lane Group Flow (vph) | 729 | 201 | 0 | 1218 | 1140 | 0 |
| Confl. Peds. (#/hr) | | 1 | | | | |
| Heavy Vehicles (%) | 1% | 2% | 0% | 1% | 1% | 0% |
| Turn Type | Prot | Perm | | NA | NA | |
| Protected Phases | 4 | | | 2 | 6 | |
| Permitted Phases | | 4 | | | | |
| Actuated Green, G (s) | 31.0 | 31.0 | | 31.0 | 31.0 | |
| Effective Green, g (s) | 31.0 | 31.0 | | 31.0 | 31.0 | |
| Actuated g/C Ratio | 0.44 | 0.44 | | 0.44 | 0.44 | |
| Clearance Time (s) | 3.0 | 3.0 | | 5.0 | 5.0 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 1535 | 692 | | 1582 | 1535 | |
| v/s Ratio Prot | c0.21 | | | c0.34 | 0.33 | |
| v/s Ratio Perm | | 0.13 | | | | |
| v/c Ratio | 0.47 | 0.29 | | 0.77 | 0.74 | |
| Uniform Delay, d1 | 13.8 | 12.5 | | 16.5 | 16.2 | |
| Progression Factor | 1.00 | 1.00 | | 0.51 | 1.00 | |
| Incremental Delay, d2 | 1.1 | 1.1 | | 2.6 | 3.3 | |
| Delay (s) | 14.8 | 13.5 | | 11.0 | 19.5 | |
| Level of Service | B | B | | B | B | |
| Approach Delay (s) | 14.5 | | | 11.0 | 19.5 | |
| Approach LOS | B | | | B | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 15.0 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.62 | | |
| Actuated Cycle Length (s) | 70.0 | Sum of lost time (s) | 8.0 |
| Intersection Capacity Utilization | 63.0% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group





| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 120 | 45 | 918 | 133 | 147 | 797 |
| Future Volume (vph) | 120 | 45 | 918 | 133 | 147 | 797 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.2 | 3.2 | 4.4 | | 3.0 | 4.4 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 0.85 | 0.98 | | 1.00 | 1.00 |
| Flt Protected | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 1615 | 1862 | | 1770 | 1881 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | 1805 | 1615 | 1862 | | 1770 | 1881 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 125 | 47 | 956 | 139 | 153 | 830 |
| RTOR Reduction (vph) | 0 | 43 | 6 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 125 | 4 | 1089 | 0 | 153 | 830 |
| Confl. Peds. (#/hr) | | | | 2 | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 2% | 1% |
| Turn Type | Prot | Perm | NA | | Prot | NA |
| Protected Phases | 8 | | 2 | | 1 | 6 |
| Permitted Phases | | 8 | | | | |
| Actuated Green, G (s) | 6.5 | 6.5 | 44.8 | | 8.1 | 55.9 |
| Effective Green, g (s) | 6.5 | 6.5 | 44.8 | | 8.1 | 55.9 |
| Actuated g/C Ratio | 0.09 | 0.09 | 0.64 | | 0.12 | 0.80 |
| Clearance Time (s) | 3.2 | 3.2 | 4.4 | | 3.0 | 4.4 |
| Vehicle Extension (s) | 1.0 | 1.0 | 1.0 | | 1.0 | 1.0 |
| Lane Grp Cap (vph) | 167 | 149 | 1191 | | 204 | 1502 |
| v/s Ratio Prot | c0.07 | | c0.58 | | c0.09 | 0.44 |
| v/s Ratio Perm | | 0.00 | | | | |
| v/c Ratio | 0.75 | 0.03 | 0.91 | | 0.75 | 0.55 |
| Uniform Delay, d1 | 31.0 | 28.9 | 10.9 | | 30.0 | 2.5 |
| Progression Factor | 1.00 | 1.00 | 0.84 | | 1.08 | 0.90 |
| Incremental Delay, d2 | 14.8 | 0.0 | 10.4 | | 9.8 | 1.1 |
| Delay (s) | 45.7 | 28.9 | 19.6 | | 42.1 | 3.4 |
| Level of Service | D | C | B | | D | A |
| Approach Delay (s) | 41.1 | | 19.6 | | | 9.4 |
| Approach LOS | D | | B | | | A |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 16.8 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.87 | | |
| Actuated Cycle Length (s) | 70.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 81.5% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
## 38: Nave Dr & Hamilton Pkwy

06/13/2017

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 92 | 392 | 534 | 55 | 333 | 443 |
| Future Volume (vph) | 92 | 392 | 534 | 55 | 333 | 443 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.2 | 3.2 | 4.4 | 4.4 | 3.0 | 4.4 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.85 | 1.00 | 0.85 | 1.00 | 1.00 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (prot) | 1770 | 1599 | 1900 | 1578 | 1787 | 1850 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (perm) | 1770 | 1599 | 1900 | 1578 | 1787 | 1900 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 97 | 413 | 562 | 58 | 351 | 466 |
| RTOR Reduction (vph) | 0 | 359 | 0 | 15 | 0 | 0 |
| Lane Group Flow (vph) | 97 | 54 | 562 | 43 | 351 | 466 |
| Confl. Peds. (#/hr) | | | | 2 | | |
| Heavy Vehicles (%) | 2% | 1% | 0% | 0% | 1% | 0% |
| Turn Type | Prot | Perm | NA | Perm | Prot | NA |
| Protected Phases | 8 | | 2 | | 1 | 6 |
| Permitted Phases | | 8 | | 2 | | |
| Actuated Green, G (s) | 9.2 | 9.2 | 27.3 | 27.3 | 22.9 | 53.2 |
| Effective Green, g (s) | 9.2 | 9.2 | 27.3 | 27.3 | 22.9 | 53.2 |
| Actuated g/C Ratio | 0.13 | 0.13 | 0.39 | 0.39 | 0.33 | 0.76 |
| Clearance Time (s) | 3.2 | 3.2 | 4.4 | 4.4 | 3.0 | 4.4 |
| Vehicle Extension (s) | 2.0 | 2.0 | 3.0 | 3.0 | 2.0 | 3.0 |
| Lane Grp Cap (vph) | 232 | 210 | 741 | 615 | 584 | 1406 |
| v/s Ratio Prot | c0.05 | | c0.30 | | c0.20 | 0.25 |
| v/s Ratio Perm | | 0.03 | | 0.03 | | |
| v/c Ratio | 0.42 | 0.26 | 0.76 | 0.07 | 0.60 | 0.33 |
| Uniform Delay, d1 | 27.9 | 27.3 | 18.5 | 13.4 | 19.7 | 2.7 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 0.99 | 0.23 |
| Incremental Delay, d2 | 0.4 | 0.2 | 7.2 | 0.2 | 1.0 | 0.5 |
| Delay (s) | 28.4 | 27.6 | 25.6 | 13.6 | 20.6 | 1.2 |
| Level of Service | C | C | C | B | C | A |
| Approach Delay (s) | 27.7 | | 24.5 | | | 9.5 |
| Approach LOS | C | | C | | | A |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 19.1 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.64 | | |
| Actuated Cycle Length (s) | 70.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 62.0% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
## 39: Nave Dr & Main Gate Dr

06/13/2017

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 354 | 282 | 293 | 319 | 279 | 271 |
| Future Volume (vph) | 354 | 282 | 293 | 319 | 279 | 271 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | 4.1 | 4.1 | 3.0 | 4.4 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.85 | 1.00 | 0.85 | 1.00 | 1.00 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (prot) | 1805 | 1615 | 1900 | 1615 | 1805 | 1881 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (perm) | 1805 | 1615 | 1900 | 1615 | 1805 | 1881 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 373 | 297 | 308 | 336 | 294 | 285 |
| RTOR Reduction (vph) | 0 | 210 | 0 | 248 | 0 | 0 |
| Lane Group Flow (vph) | 373 | 87 | 308 | 88 | 294 | 285 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 1% |
| Turn Type | Prot | Perm | NA | Perm | Prot | NA |
| Protected Phases | 8 | | 2 | | 1 | 6 |
| Permitted Phases | | 8 | | 2 | | |
| Actuated Green, G (s) | 14.7 | 14.7 | 13.2 | 13.2 | 12.4 | 28.3 |
| Effective Green, g (s) | 14.7 | 14.7 | 13.2 | 13.2 | 12.4 | 28.3 |
| Actuated g/C Ratio | 0.29 | 0.29 | 0.26 | 0.26 | 0.25 | 0.56 |
| Clearance Time (s) | 3.0 | 3.0 | 4.1 | 4.1 | 3.0 | 4.4 |
| Vehicle Extension (s) | 2.0 | 2.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| Lane Grp Cap (vph) | 526 | 471 | 497 | 422 | 444 | 1056 |
| v/s Ratio Prot | c0.21 | | c0.16 | | c0.16 | 0.15 |
| v/s Ratio Perm | | 0.05 | | 0.05 | | |
| v/c Ratio | 0.71 | 0.18 | 0.62 | 0.21 | 0.66 | 0.27 |
| Uniform Delay, d1 | 15.9 | 13.4 | 16.4 | 14.5 | 17.1 | 5.7 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 3.6 | 0.1 | 1.6 | 0.1 | 2.9 | 0.1 |
| Delay (s) | 19.5 | 13.4 | 18.0 | 14.6 | 20.0 | 5.8 |
| Level of Service | B | B | B | B | B | A |
| Approach Delay (s) | 16.8 | | 16.2 | | | 13.0 |
| Approach LOS | B | | B | | | B |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 15.4 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.66 | | |
| Actuated Cycle Length (s) | 50.4 | Sum of lost time (s) | 10.1 |
| Intersection Capacity Utilization | 60.6% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
## 40: Nave Dr & Bolling Dr



| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 220 | 63 | 562 | 346 | 98 | 572 |
| Future Volume (vph) | 220 | 63 | 562 | 346 | 98 | 572 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | 4.1 | | 3.0 | 3.5 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 0.97 | 1.00 | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 0.85 | 0.95 | | 1.00 | 1.00 |
| Flt Protected | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | 1787 | 1569 | 1791 | | 1805 | 1881 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | 1787 | 1569 | 1791 | | 1805 | 1881 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 229 | 66 | 585 | 360 | 102 | 596 |
| RTOR Reduction (vph) | 0 | 52 | 23 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 229 | 14 | 922 | 0 | 102 | 596 |
| Confl. Peds. (#/hr) | | 6 | | | | |
| Heavy Vehicles (%) | 1% | 0% | 1% | 0% | 0% | 1% |
| Turn Type | Prot | Perm | NA | | Prot | NA |
| Protected Phases | 4 | | 6 | | 5 | 2 |
| Permitted Phases | | 4 | | | | |
| Actuated Green, G (s) | 14.1 | 14.1 | 37.6 | | 6.9 | 48.1 |
| Effective Green, g (s) | 14.1 | 14.1 | 37.6 | | 6.9 | 48.1 |
| Actuated g/C Ratio | 0.21 | 0.21 | 0.55 | | 0.10 | 0.70 |
| Clearance Time (s) | 3.0 | 3.0 | 4.1 | | 3.0 | 3.5 |
| Vehicle Extension (s) | 2.0 | 2.0 | 2.0 | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 366 | 322 | 980 | | 181 | 1316 |
| v/s Ratio Prot | c0.13 | | c0.51 | | c0.06 | 0.32 |
| v/s Ratio Perm | | 0.01 | | | | |
| v/c Ratio | 0.63 | 0.04 | 0.94 | | 0.56 | 0.45 |
| Uniform Delay, d1 | 24.9 | 21.9 | 14.5 | | 29.5 | 4.5 |
| Progression Factor | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 2.4 | 0.0 | 16.2 | | 2.4 | 0.1 |
| Delay (s) | 27.3 | 21.9 | 30.7 | | 31.8 | 4.6 |
| Level of Service | C | C | C | | C | A |
| Approach Delay (s) | 26.1 | | 30.7 | | | 8.6 |
| Approach LOS | C | | C | | | A |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 22.0 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.82 | | |
| Actuated Cycle Length (s) | 68.7 | Sum of lost time (s) | 10.1 |
| Intersection Capacity Utilization | 81.9% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM 2010 AWSC
## 41: Alameda Del Prado & Clay Ct/Nave Dr



| Intersection | |
|---|---|
| Intersection Delay, s/veh | 19.6 |
| Intersection LOS | C |

| Movement | EBU | EBL | EBT | EBR | WBU | WBL | WBT | WBR | NBU | NBL | NBT | NBR | SBU | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | | | | | |
| Traffic Vol, veh/h | 0 | 8 | 11 | 1 | 0 | 107 | 21 | 756 | 0 | 0 | 70 | 39 | 0 | 273 | 71 | 13 |
| Future Vol, veh/h | 0 | 8 | 11 | 1 | 0 | 107 | 21 | 756 | 0 | 0 | 70 | 39 | 0 | 273 | 71 | 13 |
| Peak Hour Factor | 0.95 | 0.97 | 0.97 | 0.97 | 0.95 | 0.97 | 0.97 | 0.97 | 0.95 | 0.97 | 0.97 | 0.97 | 0.95 | 0.97 | 0.97 | 0.97 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 0 | 8 | 11 | 1 | 0 | 110 | 22 | 779 | 0 | 0 | 72 | 40 | 0 | 281 | 73 | 13 |
| Number of Lanes | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Opposing Approach | WB | EB | SB | NB |
| Opposing Lanes | 2 | 1 | 2 | 1 |
| Conflicting Approach Left | SB | NB | EB | WB |
| Conflicting Lanes Left | 2 | 1 | 1 | 2 |
| Conflicting Approach Right | NB | SB | WB | EB |
| Conflicting Lanes Right | 1 | 2 | 2 | 1 |
| HCM Control Delay | 10.8 | 21.5 | 12 | 17.9 |
| HCM LOS | B | C | B | C |

| Lane | NBLn1 | EBLn1 | WBLn1 | WBLn2 | SBLn1 | SBLn2 |
|---|---|---|---|---|---|---|
| Vol Left, % | 0% | 40% | 24% | 0% | 100% | 0% |
| Vol Thru, % | 64% | 55% | 5% | 0% | 0% | 85% |
| Vol Right, % | 36% | 5% | 71% | 100% | 0% | 15% |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 109 | 20 | 446 | 438 | 273 | 84 |
| LT Vol | 0 | 8 | 107 | 0 | 273 | 0 |
| Through Vol | 70 | 11 | 21 | 0 | 0 | 71 |
| RT Vol | 39 | 1 | 318 | 438 | 0 | 13 |
| Lane Flow Rate | 112 | 21 | 459 | 452 | 281 | 87 |
| Geometry Grp | 6 | 6 | 7 | 7 | 7 | 7 |
| Degree of Util (X) | 0.218 | 0.042 | 0.741 | 0.689 | 0.582 | 0.164 |
| Departure Headway (Hd) | 6.974 | 7.371 | 5.809 | 5.484 | 7.445 | 6.827 |
| Convergence, Y/N | Yes | Yes | Yes | Yes | Yes | Yes |
| Cap | 515 | 484 | 620 | 655 | 484 | 525 |
| Service Time | 5.025 | 5.449 | 3.559 | 3.234 | 5.194 | 4.575 |
| HCM Lane V/C Ratio | 0.217 | 0.043 | 0.74 | 0.69 | 0.581 | 0.166 |
| HCM Control Delay | 12 | 10.8 | 23.4 | 19.6 | 20.1 | 10.9 |
| HCM Lane LOS | B | B | C | C | C | B |
| HCM 95th-tile Q | 0.8 | 0.1 | 6.5 | 5.5 | 3.6 | 0.6 |

# Project Alternative Roadway Segment Level of Service Calculations

## Arterial Level of Service: EB Novato Blvd #1

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| San Marin Dr | 9 | 14.6 | 27.5 | 0.1 | 17 |
| Eucalyptus | 135 | 11.3 | 45.5 | 0.4 | 33 |
| Total | | 25.9 | 73.1 | 0.5 | 27 |

## Arterial Level of Service: WB Novato Blvd #1

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| Sutro Ave | 9 | 24.5 | 59.5 | 0.4 | 25 |
| | 134 | 3.7 | 16.3 | 0.1 | 28 |
| Total | | 28.1 | 75.8 | 0.5 | 26 |

## Arterial Level of Service: EB Novato Blvd #2

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| | 138 | 4.2 | 46.3 | 0.4 | 33 |
| Raposa Vista | 137 | 12.0 | 27.3 | 0.2 | 22 |
| Wilson Ave | 10 | 16.2 | 28.6 | 0.1 | 17 |
| Simmons Ln | 11 | 5.7 | 12.3 | 0.1 | 19 |
| Grant Ave | 12 | 13.2 | 52.9 | 0.4 | 28 |
| Tamalpais Ave | 13 | 27.0 | 56.9 | 0.3 | 18 |
| Diablo Ave | 14 | 59.6 | 97.6 | 0.4 | 14 |
| Total | | 137.9 | 321.8 | 1.9 | 21 |

## Arterial Level of Service: WB Novato Blvd #2

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| 7th St | 13 | 24.4 | 59.8 | 0.4 | 23 |
| Grant Ave | 12 | 7.0 | 38.9 | 0.3 | 26 |
| Simmons Ln | 11 | 18.0 | 55.1 | 0.4 | 27 |
| Wilson Ave | 10 | 6.6 | 13.2 | 0.1 | 18 |
| Raposa Vista | 137 | 13.9 | 27.2 | 0.1 | 18 |
| | 138 | 4.2 | 21.5 | 0.2 | 28 |
| Eucalyptus | 135 | 10.7 | 49.0 | 0.4 | 31 |
| Total | | 84.9 | 264.7 | 1.9 | 25 |





## Arterial Level of Service: NB Novato Blvd #3

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| Redwood Blvd | 30 | 14.6 | 30.7 | 0.2 | 19 |
| | 92 | 5.0 | 72.5 | 0.5 | 26 |
| Sunset Parkway | 29 | 11.5 | 39.6 | 0.3 | 30 |
| Rowland Boulevard | 23 | 63.4 | 85.2 | 0.3 | 11 |
| Arthur Street | 22 | 10.8 | 38.6 | 0.3 | 31 |
| Garden Ct | 21 | 8.3 | 47.0 | 0.4 | 34 |
| Diablo Ave | 14 | 78.2 | 111.0 | 0.4 | 12 |
| Total | | 191.9 | 424.7 | 2.4 | 21 |

## Arterial Level of Service: SB Novato Blvd #3

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| Center Rd | 21 | 14.0 | 47.3 | 0.4 | 28 |
| Arthur Street | 22 | 11.0 | 45.4 | 0.4 | 35 |
| | 23 | 13.1 | 45.3 | 0.3 | 26 |
| Sunset Parkway | 29 | 15.6 | 39.1 | 0.3 | 24 |
| | 92 | 3.4 | 35.7 | 0.3 | 33 |
| Redwood Blvd | 30 | 13.5 | 62.7 | 0.5 | 30 |
| Total | | 70.5 | 275.5 | 2.3 | 30 |

## Arterial Level of Service: NB #3

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| Nave Dr | 33 | 25.3 | 35.4 | 0.1 | 13 |
| Commercial Blvd | 34 | 11.3 | 24.8 | 0.1 | 21 |
| Digital Dr | 35 | 8.1 | 19.4 | 0.1 | 24 |
| Total | | 44.7 | 79.7 | 0.4 | 18 |

## Arterial Level of Service: WB #3

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| Hamilton Dr | 35 | 13.7 | 25.2 | 0.1 | 20 |
| Commercial Blvd | 34 | 8.2 | 19.1 | 0.1 | 25 |
| US 101 NB On Ramp | 33 | 17.9 | 29.5 | 0.1 | 18 |
| Enfrente Rd | 32 | 15.4 | 28.1 | 0.1 | 16 |
| Total | | 55.1 | 101.9 | 0.5 | 19 |

## Arterial Level of Service: EB Novato Blvd #2

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| | 138 | 4.1 | 45.5 | 0.4 | 34 |
| Raposa Vista | 137 | 11.6 | 26.6 | 0.2 | 23 |
| Wilson Ave | 10 | 16.9 | 29.0 | 0.1 | 17 |
| Simmons Ln | 11 | 6.1 | 12.8 | 0.1 | 18 |
| Grant Ave | 12 | 11.7 | 51.7 | 0.4 | 29 |
| Tamalpais Ave | 13 | 25.5 | 55.6 | 0.3 | 18 |
| | 45 | 5.2 | 41.2 | 0.3 | 27 |
| Diablo Ave | 14 | 19.8 | 27.1 | 0.1 | 8 |
| Center Rd | 21 | 13.4 | 46.6 | 0.4 | 28 |
| Total | | 114.4 | 335.9 | 2.2 | 24 |

## Arterial Level of Service: WB Novato Blvd #2

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| Diablo Ave | 14 | 38.2 | 67.6 | 0.4 | 19 |
| | 45 | 5.2 | 13.5 | 0.1 | 17 |
| 7th St | 13 | 16.9 | 52.6 | 0.3 | 21 |
| Grant Ave | 12 | 7.1 | 39.4 | 0.3 | 26 |
| Simmons Ln | 11 | 17.6 | 54.8 | 0.4 | 27 |
| Wilson Ave | 10 | 7.1 | 13.7 | 0.1 | 17 |
| Raposa Vista | 137 | 14.0 | 27.3 | 0.1 | 18 |
| | 138 | 4.2 | 21.3 | 0.2 | 28 |
| Eucalyptus | 135 | 11.3 | 49.2 | 0.4 | 31 |
| Total | | 121.7 | 339.4 | 2.2 | 24 |

## Arterial Level of Service: NB Novato Blvd #3

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| Redwood Blvd | 30 | 14.3 | 30.3 | 0.2 | 19 |
| | 92 | 5.8 | 75.4 | 0.5 | 25 |
| Sunset Parkway | 29 | 13.5 | 41.8 | 0.3 | 28 |
| Rowland Boulevard | 23 | 55.9 | 76.8 | 0.3 | 12 |
| Arthur Street | 22 | 8.4 | 39.2 | 0.3 | 30 |
| Garden Ct | 21 | 6.7 | 44.6 | 0.4 | 36 |
| Diablo Ave | 14 | 38.2 | 67.6 | 0.4 | 19 |
| Total | | 142.9 | 375.6 | 2.4 | 23 |





## Arterial Level of Service: SB Novato Blvd #3

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| Center Rd | 21 | 13.4 | 46.6 | 0.4 | 28 |
| Arthur Street | 22 | 11.7 | 52.6 | 0.4 | 30 |
| | 23 | 14.0 | 45.2 | 0.3 | 26 |
| Sunset Parkway | 29 | 17.0 | 40.8 | 0.3 | 23 |
| | 92 | 3.5 | 35.8 | 0.3 | 33 |
| Redwood Blvd | 30 | 17.1 | 66.5 | 0.5 | 28 |
| Total | | 76.7 | 287.4 | 2.3 | 28 |

## Arterial Level of Service: EB Novato Blvd #1

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| San Marin Dr | 9 | 13.6 | 26.5 | 0.1 | 17 |
| Eucalyptus | 136 | 11.0 | 45.4 | 0.4 | 33 |
| Total | | 24.6 | 71.9 | 0.5 | 27 |

## Arterial Level of Service: WB Novato Blvd #1

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| Sutro Ave | 9 | 34.7 | 70.3 | 0.4 | 21 |
| | 135 | 3.8 | 16.6 | 0.1 | 28 |
| Total | | 38.5 | 87.0 | 0.5 | 22 |

## Arterial Level of Service: EB Novato Blvd #2

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| | 139 | 4.1 | 45.9 | 0.4 | 33 |
| Raposa Vista | 138 | 12.2 | 27.5 | 0.2 | 22 |
| Wilson Ave | 10 | 15.9 | 28.3 | 0.1 | 17 |
| Simmons Ln | 11 | 5.9 | 12.5 | 0.1 | 19 |
| Grant Ave | 12 | 11.8 | 52.0 | 0.4 | 28 |
| Tamalpais Ave | 13 | 27.8 | 58.0 | 0.3 | 17 |
| Diablo Ave | 14 | 72.0 | 111.2 | 0.4 | 12 |
| Total | | 149.7 | 335.3 | 1.9 | 20 |

## Arterial Level of Service: WB Novato Blvd #2

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| 7th St | 13 | 29.4 | 66.0 | 0.4 | 21 |
| Grant Ave | 12 | 6.5 | 38.7 | 0.3 | 26 |
| Simmons Ln | 11 | 17.8 | 54.8 | 0.4 | 27 |
| Wilson Ave | 10 | 6.7 | 13.3 | 0.1 | 18 |
| Raposa Vista | 138 | 14.3 | 27.4 | 0.1 | 18 |
| | 139 | 4.2 | 21.4 | 0.2 | 28 |
| Eucalyptus | 136 | 11.4 | 49.7 | 0.4 | 31 |
| Total | | 90.3 | 271.3 | 1.9 | 25 |





## Arterial Level of Service: NB Novato Blvd #3

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| Redwood Blvd | 30 | 14.5 | 30.6 | 0.2 | 19 |
| | 114 | 4.8 | 72.6 | 0.5 | 26 |
| Sunset Parkway | 29 | 10.9 | 39.0 | 0.3 | 30 |
| Rowland Boulevard | 23 | 65.1 | 86.4 | 0.3 | 11 |
| Arthur Street | 22 | 9.9 | 40.7 | 0.3 | 29 |
| Garden Ct | 21 | 7.6 | 46.3 | 0.4 | 35 |
| Diablo Ave | 14 | 80.4 | 112.7 | 0.4 | 12 |
| Total | | 193.4 | 428.3 | 2.4 | 20 |

## Arterial Level of Service: SB Novato Blvd #3

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| Center Rd | 21 | 11.1 | 45.3 | 0.4 | 29 |
| Arthur Street | 22 | 11.8 | 51.3 | 0.4 | 31 |
| | 23 | 12.2 | 44.1 | 0.3 | 27 |
| Sunset Parkway | 29 | 15.9 | 39.7 | 0.3 | 24 |
| | 114 | 3.5 | 35.5 | 0.3 | 33 |
| Redwood Blvd | 30 | 14.0 | 64.5 | 0.5 | 29 |
| Total | | 68.5 | 280.4 | 2.3 | 29 |

## Arterial Level of Service: NB #3

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| Nave Dr | 33 | 23.6 | 33.9 | 0.1 | 14 |
| Commercial Blvd | 34 | 11.8 | 25.2 | 0.1 | 21 |
| Digital Dr | 35 | 10.3 | 21.5 | 0.1 | 22 |
| Total | | 45.7 | 80.6 | 0.4 | 18 |

## Arterial Level of Service: WB #3

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| Hamilton Dr | 35 | 14.7 | 26.2 | 0.1 | 19 |
| Commercial Blvd | 34 | 9.1 | 19.7 | 0.1 | 24 |
| US 101 NB On Ramp | 33 | 20.0 | 31.6 | 0.1 | 17 |
| Enfrente Rd | 32 | 16.5 | 29.4 | 0.1 | 16 |
| Total | | 60.2 | 106.9 | 0.5 | 18 |

## Arterial Level of Service: EB Novato Blvd #2

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| | 139 | 4.3 | 45.9 | 0.4 | 33 |
| Raposa Vista | 138 | 12.8 | 28.2 | 0.2 | 21 |
| Wilson Ave | 10 | 18.7 | 31.2 | 0.1 | 16 |
| Simmons Ln | 11 | 7.2 | 13.9 | 0.1 | 17 |
| Grant Ave | 12 | 12.6 | 52.6 | 0.4 | 28 |
| Tamalpais Ave | 13 | 28.5 | 58.2 | 0.3 | 17 |
| | 200 | 4.6 | 37.9 | 0.3 | 28 |
| Diablo Ave | 14 | 22.6 | 32.7 | 0.1 | 10 |
| Center Rd | 21 | 14.8 | 48.3 | 0.4 | 27 |
| Total | | 126.1 | 349.0 | 2.2 | 23 |

## Arterial Level of Service: WB Novato Blvd #2

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| Diablo Ave | 14 | 47.1 | 76.2 | 0.4 | 17 |
| | 200 | 6.8 | 17.6 | 0.1 | 18 |
| 7th St | 13 | 22.6 | 55.3 | 0.3 | 19 |
| Grant Ave | 12 | 6.7 | 39.4 | 0.3 | 26 |
| Simmons Ln | 11 | 23.1 | 60.1 | 0.4 | 25 |
| Wilson Ave | 10 | 9.0 | 15.6 | 0.1 | 15 |
| Raposa Vista | 138 | 15.2 | 28.3 | 0.1 | 17 |
| | 139 | 4.3 | 21.5 | 0.2 | 28 |
| Eucalyptus | 136 | 13.1 | 51.4 | 0.4 | 30 |
| Total | | 147.9 | 365.7 | 2.2 | 22 |

## Arterial Level of Service: NB Novato Blvd #3

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| Redwood Blvd | 30 | 17.7 | 33.6 | 0.2 | 17 |
| | 114 | 5.9 | 73.8 | 0.5 | 26 |
| Sunset Parkway | 29 | 11.9 | 40.3 | 0.3 | 29 |
| Rowland Boulevard | 23 | 67.3 | 89.3 | 0.3 | 11 |
| Arthur Street | 22 | 10.6 | 41.0 | 0.3 | 29 |
| Garden Ct | 21 | 8.2 | 46.3 | 0.4 | 35 |
| Diablo Ave | 14 | 47.1 | 76.2 | 0.4 | 17 |
| Total | | 168.6 | 400.5 | 2.4 | 22 |





## Arterial Level of Service: SB Novato Blvd #3

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| Center Rd | 21 | 14.8 | 48.3 | 0.4 | 27 |
| Arthur Street | 22 | 12.9 | 52.3 | 0.4 | 31 |
| | 23 | 14.1 | 46.3 | 0.3 | 26 |
| Sunset Parkway | 29 | 16.7 | 40.3 | 0.3 | 24 |
| | 114 | 3.5 | 36.1 | 0.3 | 33 |
| Redwood Blvd | 30 | 19.0 | 68.7 | 0.5 | 28 |
| Total | | 81.0 | 292.0 | 2.3 | 28 |

# Project Alternative Freeway Level of Service Calculations

# HCS7 Freeway Facilities Report

## Project Information

| | | | |
|---|---|---|---|
| Analyst | W-Trans | Agency | |
| Jurisdiction | City of Novato | Time Period Analyzed | AM Existing+Project Alt - Northbound |
| Analysis Year | 2016 | Date | 6/8/17 |
| Project Description | City of Novato General Plan Update EIR | | |

## Facility Global Input

| | | | |
|---|---|---|---|
| Jam Density, pc/mi/ln | 190.0 | Density at Capacity, pc/mi/ln | 45.0 |
| Queue Discharge Capacity Drop, % | 7 | Total Segments | 24 |
| Total Time Periods | 1 | Time Period Duration, min | 15 |

## Segment Geometric Data

| No. | Coded | Analyzed | Name | Length, ft | Lanes |
|---|---|---|---|---|---|
| 1 | Basic | Basic | Novato S City Limits->Alameda del Prado | 2000 | 5 |
| 2 | Diverge | Basic | Alameda del Prado Off-> | 1500 | 5 |
| 3 | Basic | Basic | Alameda del Prado Off->Alameda del Prado On | 2000 | 4 |
| 4 | Merge | Merge | Alameda del Prado On-> | 1000 | 4 |
| 5 | Basic | Basic | Alameda del Prado On->Nave Off | 2600 | 4 |
| 6 | Diverge | Diverge | Nave Off-> | 1000 | 4 |
| 7 | Basic | Basic | Nave Off->Nave On | 2000 | 4 |
| 8 | Merge | Basic | Nave On-> | 500 | 5 |
| 9 | Merge | Merge | Ignacio On-> | 1500 | 5 |
| 10 | Diverge | Basic | SR37 Off-> | 1500 | 5 |
| 11 | Diverge | Diverge | Novato Blvd Off-> | 1500 | 4 |
| 12 | Basic | Basic | Novato Blvd Off->SR 37 On | 2650 | 4 |
| 13 | Weaving | Weaving | SR37->Rowland Blvd | 2050 | 5 |
| 14 | Basic | Basic | Rowland Blvd Off->Rowland Blvd On | 2900 | 4 |
| 15 | Merge | Merge | Rowland Blvd On-> | 1200 | 4 |
| 16 | Diverge | Diverge | De Long Off-> | 1200 | 4 |
| 17 | Basic | Basic | De Long Off->De Long On | 2000 | 4 |
| 18 | Merge | Merge | De Long Ave On-> | 1200 | 4 |
| 19 | Diverge | Diverge | Atherton Ave Off-> | 1200 | 4 |
| 20 | Basic | Basic | Atherton Ave Off->Atherton Ave On | 900 | 4 |
| 21 | Merge | Merge | Atherton Ave On-> | 1000 | 4 |
| 22 | Basic | Basic | Atherton On -> End HOV | 2300 | 3 |
| 23 | Basic | Basic | End HOV | 2000 | 2 |
| 24 | Basic | Basic | End HOV -> Begin 2 lane fwy | 2500 | 2 |

## Facility Segment Data

### Segment 1: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 4981 | 12000 | 0.42 | 75.4 | 13.2 | B |

### Segment 2: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 4981 | 371 | 12000 | 2000 | 0.42 | 0.19 | 75.4 | - | 13.2 | - | B |

### Segment 3: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 4613 | 9600 | 0.48 | 75.1 | 15.4 | B |

### Segment 4: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 4730 | 117 | 9600 | 2000 | 0.49 | 0.06 | 68.8 | 64.6 | 17.2 | 18.6 | B |

### Segment 5: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 4729 | 9600 | 0.49 | 75.0 | 15.8 | B |

### Segment 6: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 1.00 | 0.957 | 1.000 | 4729 | 869 | 9600 | 2000 | 0.49 | 0.43 | 67.5 | 58.5 | 17.5 | 24.4 | C |

### Segment 7: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 3821 | 9600 | 0.40 | 75.4 | 12.7 | B |

### Segment 8: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 4019 | 198 | 12000 | 2000 | 0.32 | 0.10 | 75.4 | - | 10.7 | - | A |

### Segment 9: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 4772 | 754 | 12000 | 2000 | 0.40 | 0.38 | 69.0 | 64.2 | 11.3 | 19.6 | B |

### Segment 10: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 4766 | 938 | 12000 | 4200 | 0.40 | 0.22 | 75.4 | - | 12.6 | - | B |

### Segment 11: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 3835 | 183 | 9600 | 2000 | 0.40 | 0.09 | 70.7 | 60.6 | 13.6 | 19.5 | B |

### Segment 12: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 3653 | 9600 | 0.38 | 75.4 | 12.1 | B |

### Segment 13: Weaving

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 4301 | 6630 | 0.65 | 65.2 | 13.3 | B |

### Segment 14: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 3341 | 9600 | 0.35 | 75.4 | 11.1 | B |

### Segment 15: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 3750 | 409 | 9600 | 2000 | 0.39 | 0.20 | 70.0 | 66.3 | 13.4 | 12.7 | B |

### Segment 16: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 3747 | 840 | 9600 | 2000 | 0.39 | 0.42 | 67.2 | 58.6 | 13.9 | 18.3 | B |

### Segment 17: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 2913 | 9600 | 0.30 | 75.4 | 9.7 | A |

### Segment 18: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 3098 | 185 | 9600 | 2000 | 0.32 | 0.09 | 70.6 | 66.5 | 11.0 | 9.7 | A |

### Segment 19: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 0.990 | 3097 | 874 | 9600 | 2000 | 0.32 | 0.44 | 66.4 | 58.5 | 11.7 | 16.1 | B |

### Segment 20: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 2238 | 9600 | 0.23 | 75.4 | 7.4 | A |

### Segment 21: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 2727 | 489 | 9014 | 1878 | 0.30 | 0.26 | 66.3 | 64.3 | 10.3 | 10.8 | B |

### Segment 22: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.94 | 1.000 | 2773 | 7200 | 0.39 | 71.7 | 12.9 | B |

### Segment 23: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 2724 | 4472 | 0.61 | 67.3 | 20.2 | C |

### Segment 24: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 2724 | 3628 | 0.75 | 51.0 | 26.7 | D |

### Facility Time Period Results

| T | Speed, mi/h | Density, pc/mi/ln | Density, veh/mi/ln | Travel Time, min | LOS |
|---|---|---|---|---|---|
| 1 | 70.9 | 13.4 | 12.9 | 6.4 | B |

### Facility Overall Results

| | | | |
|---|---|---|---|
| Space Mean Speed, mi/h | 70.9 | Density, veh/mi/ln | 12.9 |
| Average Travel Time, min | 6.4 | | |

# HCS7 Freeway Facilities Report

## Project Information

| | | | |
|---|---|---|---|
| Analyst | W-Trans | Agency | |
| Jurisdiction | City of Novato | Time Period Analyzed | AM Existing + Project Alt - Southbound |
| Analysis Year | 2016 | Date | 6/8/17 |
| Project Description | City of Novato General Plan EIR | | |

## Facility Global Input

| | | | |
|---|---|---|---|
| Jam Density, pc/mi/ln | 190.0 | Density at Capacity, pc/mi/ln | 45.0 |
| Queue Discharge Capacity Drop, % | 7 | Total Segments | 24 |
| Total Time Periods | 1 | Time Period Duration, min | 15 |

## Segment Geometric Data

| No. | Coded | Analyzed | Name | Length, ft | Lanes |
|---|---|---|---|---|---|
| 1 | Basic | Basic | N Novato City Limits->San Marin Dr | 3200 | 3 |
| 2 | Diverge | Diverge | San Marin Dr Off-> | 1500 | 3 |
| 3 | Basic | Basic | San Marin Dr Off->San Marin Dr On | 2100 | 3 |
| 4 | Merge | Merge | San Marin Dr On-> | 1175 | 3 |
| 5 | Diverge | Diverge | De Long Ave Off-> | 1175 | 3 |
| 6 | Basic | Basic | De Long Ave Off->De Long Ave On | 1975 | 3 |
| 7 | Merge | Merge | De Long Ave On-> | 1170 | 3 |
| 8 | Diverge | Diverge | BEGIN HOV | 200 | 3 |
| 9 | Diverge | Diverge | Rowland Blvd Off-> | 1170 | 3 |
| 10 | Basic | Basic | Rowland Blvd Off->Rowland Blvd On | 3150 | 3 |
| 11 | Merge | Merge | Rowland Blvd On-> | 1200 | 3 |
| 12 | Basic | Basic | Rowland Blvd->SR37-Novato Blvd | 770 | 3 |
| 13 | Diverge | Diverge | SR37-Novato Blvd Off-> | 1200 | 3 |
| 14 | Basic | Basic | SR37-Novato Blvd Off->SR37-Novato Blvd On | 3400 | 3 |
| 15 | Merge | Basic | SR37-Novato Blvd On-> | 1030 | 4 |
| 16 | Diverge | Diverge | Ignacio-Enfrente Off-> | 1000 | 4 |
| 17 | Diverge | Basic | BMK-Nave Off-> | 800 | 4 |
| 18 | Basic | Basic | Ignacio Blvd Off->Ignacio Blvd On | 1425 | 3 |
| 19 | Merge | Merge | Ignacio Blvd On-> | 1500 | 3 |
| 20 | Basic | Basic | Ignacio Blvd->Alameda Del Prado | 2250 | 3 |
| 21 | Diverge | Diverge | ADP Off-> | 1500 | 3 |
| 22 | Basic | Basic | ADP Off->ADP On | 1200 | 3 |
| 23 | Merge | Basic | ADP On-> | 1500 | 3 |
| 24 | Basic | Basic | Alameda Del Prado->S Novato City Limits | 1000 | 4 |

## Facility Segment Data

### Segment 1: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.957 | 6887 | 7200 | 0.96 | 56.5 | 40.7 | E |

### Segment 2: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.957 | 0.980 | 6875 | 723 | 7200 | 2000 | 0.96 | 0.36 | 66.2 | 61.1 | 34.6 | 38.8 | E |

### Segment 3: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.954 | 5946 | 7200 | 0.86 | 64.4 | 30.8 | D |

### Segment 4: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.960 | 0.980 | 6556 | 676 | 7200 | 2100 | 0.95 | 0.32 | 43.6 | 56.1 | 50.2 | 36.7 | F |

### Segment 5: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.960 | 0.980 | 6479 | 339 | 7200 | 2000 | 0.95 | 0.17 | 41.5 | 62.2 | 52.0 | 37.9 | F |

### Segment 6: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.958 | 5989 | 7200 | 0.90 | 31.0 | 64.5 | F |

### Segment 7: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.963 | 0.980 | 6704 | 715 | 7200 | 2000 | 1.00 | 0.36 | 60.3 | 56.6 | 37.1 | 36.3 | E |

### Segment 8: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 1.00 | 0.963 | 0.990 | 6704 | 1091 | 7200 | 2200 | 1.00 | 0.50 | 70.0 | 66.5 | 31.9 | 41.6 | E |

### Segment 9: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.95 | 0.963 | 0.980 | 5613 | 857 | 7200 | 2000 | 0.84 | 0.43 | 66.1 | 60.7 | 28.3 | 34.4 | D |

## Segment 10: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.960 | 4756 | 7200 | 0.72 | 71.4 | 22.2 | C |

## Segment 11: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.966 | 0.980 | 5408 | 652 | 7200 | 2000 | 0.81 | 0.33 | 64.3 | 61.4 | 28.0 | 30.2 | D |

## Segment 12: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.966 | 5408 | 7200 | 0.81 | 68.0 | 26.5 | D |

## Segment 13: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.966 | 0.962 | 5408 | 316 | 7200 | 2100 | 0.81 | 0.15 | 69.1 | 64.5 | 26.1 | 32.8 | D |

## Segment 14: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.967 | 5092 | 7200 | 0.76 | 69.8 | 24.3 | C |

## Segment 15: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.966 | 0.962 | 7802 | 2819 | 9600 | 4000 | 0.57 | 0.70 | 59.3 | - | 32.9 | - | D |

## Segment 16: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.966 | 0.980 | 7633 | 657 | 9600 | 2000 | 0.86 | 0.33 | 69.3 | 61.3 | 27.5 | 31.6 | D |

## Segment 17: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.964 | 0.980 | 6815 | 1008 | 9600 | 2000 | 0.79 | 0.50 | 31.5 | - | 54.1 | - | F |

## Segment 18: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.962 | 5656 | 7200 | 0.92 | 27.6 | 68.4 | F |

## Segment 19: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.965 | 0.980 | 6249 | 679 | 7200 | 2000 | 1.01 | 0.34 | 34.9 | 52.9 | 59.6 | 39.0 | F |

## Segment 20: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.965 | 6119 | 7200 | 1.01 | 32.5 | 62.7 | F |

## Segment 21: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.932 | 0.980 | 6033 | 215 | 7200 | 2000 | 1.04 | 0.11 | 30.3 | 62.6 | 66.3 | 41.6 | F |

## Segment 22: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.931 | 5737 | 7200 | 1.01 | 26.1 | 73.3 | F |

## Segment 23: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.934 | 0.980 | 6704 | 967 | 7200 | 2000 | 1.01 | 0.48 | 60.3 | - | 37.1 | - | F |

## Segment 24: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.934 | 6704 | 9600 | 0.86 | 70.1 | 23.9 | C |

## Facility Time Period Results

| T | Speed, mi/h | Density, pc/mi/ln | Density, veh/mi/ln | Travel Time, min | LOS |
|---|---|---|---|---|---|
| 1 | 46.9 | 41.1 | 39.3 | 8.9 | F |

## Facility Overall Results

| | | | |
|---|---|---|---|
| Space Mean Speed, mi/h | 46.9 | Density, veh/mi/ln | 39.3 |
| Average Travel Time, min | 8.9 | | |

# HCS7 Freeway Facilities Report

## Project Information

| | | | |
|---|---|---|---|
| Analyst | W-Trans | Agency | |
| Jurisdiction | City of Novato | Time Period Analyzed | PM Existing + Project Alt - Northbound |
| Analysis Year | 2016 | Date | 6/8/17 |
| Project Description | City of Novato General Plan Update EIR | | |

## Facility Global Input

| | | | |
|---|---|---|---|
| Jam Density, pc/mi/ln | 190.0 | Density at Capacity, pc/mi/ln | 45.0 |
| Queue Discharge Capacity Drop, % | 7 | Total Segments | 23 |
| Total Time Periods | 1 | Time Period Duration, min | 15 |

## Segment Geometric Data

| No. | Coded | Analyzed | Name | Length, ft | Lanes |
|---|---|---|---|---|---|
| 1 | Basic | Basic | Novato S City Limits->Alameda del Prado | 2000 | 4 |
| 2 | Diverge | Basic | Alameda del Prado Off-> | 1500 | 4 |
| 3 | Basic | Basic | Alameda del Prado Off->Alameda del Prado On | 2000 | 3 |
| 4 | Merge | Merge | Alameda del Prado On-> | 1000 | 3 |
| 5 | Basic | Basic | Alameda del Prado On->Nave Off | 2600 | 3 |
| 6 | Diverge | Diverge | Nave Off-> | 1000 | 3 |
| 7 | Basic | Basic | Nave Off->Nave On | 2000 | 3 |
| 8 | Merge | Basic | Nave On-> | 500 | 4 |
| 9 | Merge | Merge | Ignacio On-> | 1500 | 4 |
| 10 | Diverge | Basic | SR37 Off-> | 1500 | 4 |
| 11 | Diverge | Diverge | Novato Blvd Off-> | 1500 | 3 |
| 12 | Basic | Basic | Novato Blvd Off->SR 37 On | 2650 | 3 |
| 13 | Weaving | Weaving | SR37->Rowland Blvd | 2050 | 4 |
| 14 | Basic | Basic | Rowland Blvd Off->Rowland Blvd On | 2900 | 3 |
| 15 | Merge | Merge | Rowland Blvd On-> | 1200 | 3 |
| 16 | Diverge | Diverge | De Long Off-> | 1200 | 3 |
| 17 | Basic | Basic | De Long Off->De Long On | 2000 | 3 |
| 18 | Merge | Merge | De Long Ave On-> | 1200 | 3 |
| 19 | Diverge | Diverge | Atherton Ave Off-> | 1200 | 3 |
| 20 | Basic | Basic | Atherton Ave Off->Atherton Ave On | 900 | 3 |
| 21 | Merge | Merge | Atherton Ave On-> | 1000 | 3 |
| 22 | Merge | Merge | End HOV | 1000 | 3 |
| 23 | Basic | Basic | End HOV -> Begin 2 lane fwy | 5100 | 2 |

## Facility Segment Data

### Segment 1: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 7629 | 9600 | 0.83 | 40.8 | 46.8 | F |

### Segment 2: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 7409 | 928 | 9600 | 2000 | 0.83 | 0.46 | 28.5 | - | 65.1 | - | F |

### Segment 3: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 6397 | 7200 | 0.98 | 35.5 | 60.1 | F |

### Segment 4: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 6704 | 307 | 7200 | 2000 | 1.02 | 0.15 | 61.1 | 57.9 | 36.6 | 34.9 | F |

### Segment 5: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 6704 | 7200 | 1.02 | 58.2 | 38.4 | F |

### Segment 6: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 1.00 | 0.957 | 1.000 | 6704 | 937 | 7200 | 2000 | 1.02 | 0.47 | 64.2 | 58.3 | 34.8 | 37.7 | F |

### Segment 7: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 5767 | 7200 | 0.89 | 65.7 | 29.3 | D |

### Segment 8: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 6019 | 252 | 9600 | 2000 | 0.66 | 0.13 | 67.9 | - | 22.2 | - | C |

### Segment 9: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 7401 | 1382 | 9600 | 2000 | 0.83 | 0.69 | 64.4 | 59.4 | 28.7 | 33.2 | D |

### Segment 10: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 7401 | 2483 | 9600 | 4200 | 0.83 | 0.59 | 66.9 | - | 27.7 | - | D |

## Segment 11: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 4918 | 389 | 7200 | 2000 | 0.77 | 0.19 | 65.7 | 59.9 | 25.0 | 31.7 | D |

## Segment 12: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 4529 | 7200 | 0.72 | 72.4 | 20.9 | C |

## Segment 13: Weaving

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 5029 | 5064 | 1.10 | 28.1 | 45.0 | F |

## Segment 14: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 3849 | 7200 | 0.62 | 74.4 | 17.2 | B |

## Segment 15: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 4476 | 627 | 7200 | 2000 | 0.71 | 0.31 | 66.8 | 64.5 | 22.3 | 22.1 | C |

## Segment 16: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 4476 | 1833 | 7200 | 2000 | 0.71 | 0.92 | 60.6 | 55.6 | 24.6 | 28.8 | D |

## Segment 17: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 2643 | 7200 | 0.46 | 74.3 | 11.7 | B |

## Segment 18: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 2955 | 312 | 7200 | 2000 | 0.50 | 0.16 | 68.5 | 66.1 | 14.4 | 14.1 | B |

## Segment 19: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 0.990 | 2955 | 1208 | 7200 | 2000 | 0.50 | 0.60 | 61.6 | 57.5 | 16.0 | 20.1 | C |

## Segment 20: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 1747 | 7200 | 0.33 | 72.9 | 7.7 | A |

## Segment 21: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 2709 | 962 | 6761 | 1878 | 0.50 | 0.51 | 65.7 | 64.1 | 13.7 | 11.7 | B |

## Segment 22: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 3042 | 474 | 6761 | 1878 | 0.57 | 0.25 | 19.6 | 61.9 | 51.8 | 21.6 | F |

## Segment 23: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 3042 | 3274 | 1.17 | 55.6 | 21.1 | F |

## Facility Time Period Results

| T | Speed, mi/h | Density, pc/mi/ln | Density, veh/mi/ln | Travel Time, min | LOS |
|---|---|---|---|---|---|
| 1 | 50.9 | 30.8 | 29.5 | 8.8 | F |

## Facility Overall Results

| | | | |
|---|---|---|---|
| Space Mean Speed, mi/h | 50.9 | Density, veh/mi/ln | 29.5 |
| Average Travel Time, min | 8.8 | | |

# HCS7 Freeway Facilities Report

## Project Information

| | | | |
|---|---|---|---|
| Analyst | W-Trans | Agency | |
| Jurisdiction | City of Novato | Time Period Analyzed | PM Existing + Project Alt - Northbound |
| Analysis Year | 2016 | Date | 6/8/17 |
| Project Description | City of Novato General Plan Update EIR | | |

## Facility Global Input

| | | | |
|---|---|---|---|
| Jam Density, pc/mi/ln | 190.0 | Density at Capacity, pc/mi/ln | 45.0 |
| Queue Discharge Capacity Drop, % | 7 | Total Segments | 23 |
| Total Time Periods | 1 | Time Period Duration, min | 15 |

## Segment Geometric Data

| No. | Coded | Analyzed | Name | Length, ft | Lanes |
|---|---|---|---|---|---|
| 1 | Basic | Basic | Novato S City Limits->Alameda del Prado | 2000 | 4 |
| 2 | Diverge | Basic | Alameda del Prado Off-> | 1500 | 4 |
| 3 | Basic | Basic | Alameda del Prado Off->Alameda del Prado On | 2000 | 3 |
| 4 | Merge | Merge | Alameda del Prado On-> | 1000 | 3 |
| 5 | Basic | Basic | Alameda del Prado On->Nave Off | 2600 | 3 |
| 6 | Diverge | Diverge | Nave Off-> | 1000 | 3 |
| 7 | Basic | Basic | Nave Off->Nave On | 2000 | 3 |
| 8 | Merge | Basic | Nave On-> | 500 | 4 |
| 9 | Merge | Merge | Ignacio On-> | 1500 | 4 |
| 10 | Diverge | Basic | SR37 Off-> | 1500 | 4 |
| 11 | Diverge | Diverge | Novato Blvd Off-> | 1500 | 3 |
| 12 | Basic | Basic | Novato Blvd Off->SR 37 On | 2650 | 3 |
| 13 | Weaving | Weaving | SR37->Rowland Blvd | 2050 | 4 |
| 14 | Basic | Basic | Rowland Blvd Off->Rowland Blvd On | 2900 | 3 |
| 15 | Merge | Merge | Rowland Blvd On-> | 1200 | 3 |
| 16 | Diverge | Diverge | De Long Off-> | 1200 | 3 |
| 17 | Basic | Basic | De Long Off->De Long On | 2000 | 3 |
| 18 | Merge | Merge | De Long Ave On-> | 1200 | 3 |
| 19 | Diverge | Diverge | Atherton Ave Off-> | 1200 | 3 |
| 20 | Basic | Basic | Atherton Ave Off->Atherton Ave On | 900 | 3 |
| 21 | Merge | Merge | Atherton Ave On-> | 1000 | 3 |
| 22 | Merge | Merge | End HOV | 1000 | 3 |
| 23 | Basic | Basic | End HOV -> Begin 2 lane fwy | 5100 | 2 |

## Facility Segment Data

### Segment 1: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 7629 | 9600 | 0.83 | 40.8 | 46.8 | F |

### Segment 2: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 7409 | 928 | 9600 | 2000 | 0.83 | 0.46 | 28.5 | - | 65.1 | - | F |

### Segment 3: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 6397 | 7200 | 0.98 | 35.5 | 60.1 | F |

### Segment 4: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 6704 | 307 | 7200 | 2000 | 1.02 | 0.15 | 61.1 | 57.9 | 36.6 | 34.9 | F |

### Segment 5: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 6704 | 7200 | 1.02 | 58.2 | 38.4 | F |

### Segment 6: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 1.00 | 0.957 | 1.000 | 6704 | 937 | 7200 | 2000 | 1.02 | 0.47 | 64.2 | 58.3 | 34.8 | 37.7 | F |

### Segment 7: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 5767 | 7200 | 0.89 | 65.7 | 29.3 | D |

### Segment 8: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 6019 | 252 | 9600 | 2000 | 0.66 | 0.13 | 67.9 | - | 22.2 | - | C |

### Segment 9: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 7401 | 1382 | 9600 | 2000 | 0.83 | 0.69 | 64.4 | 59.4 | 28.7 | 33.2 | D |

### Segment 10: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 7401 | 2483 | 9600 | 4200 | 0.83 | 0.59 | 66.9 | - | 27.7 | - | D |

## Segment 11: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 4918 | 389 | 7200 | 2000 | 0.77 | 0.19 | 65.7 | 59.9 | 25.0 | 31.7 | D |

## Segment 12: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 4529 | 7200 | 0.72 | 72.4 | 20.9 | C |

## Segment 13: Weaving

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 5029 | 5064 | 1.10 | 28.1 | 45.0 | F |

## Segment 14: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 3849 | 7200 | 0.62 | 74.4 | 17.2 | B |

## Segment 15: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 4476 | 627 | 7200 | 2000 | 0.71 | 0.31 | 66.8 | 64.5 | 22.3 | 22.1 | C |

## Segment 16: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 4476 | 1833 | 7200 | 2000 | 0.71 | 0.92 | 60.6 | 55.6 | 24.6 | 28.8 | D |

## Segment 17: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 2643 | 7200 | 0.46 | 74.3 | 11.7 | B |

## Segment 18: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 2955 | 312 | 7200 | 2000 | 0.50 | 0.16 | 68.5 | 66.1 | 14.4 | 14.1 | B |

## Segment 19: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 0.990 | 2955 | 1208 | 7200 | 2000 | 0.50 | 0.60 | 61.6 | 57.5 | 16.0 | 20.1 | C |

## Segment 20: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 1747 | 7200 | 0.33 | 72.9 | 7.7 | A |

## Segment 21: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 2709 | 962 | 6761 | 1878 | 0.50 | 0.51 | 65.7 | 64.1 | 13.7 | 11.7 | B |

## Segment 22: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 3042 | 474 | 6761 | 1878 | 0.57 | 0.25 | 19.6 | 61.9 | 51.8 | 21.6 | F |

## Segment 23: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 3042 | 3274 | 1.17 | 55.6 | 21.1 | F |

## Facility Time Period Results

| T | Speed, mi/h | Density, pc/mi/ln | Density, veh/mi/ln | Travel Time, min | LOS |
|---|---|---|---|---|---|
| 1 | 50.9 | 30.8 | 29.5 | 8.8 | F |

## Facility Overall Results

| | | | |
|---|---|---|---|
| Space Mean Speed, mi/h | 50.9 | Density, veh/mi/ln | 29.5 |
| Average Travel Time, min | 8.8 | | |

# HCS7 Freeway Facilities Report

## Project Information

| | | | |
|---|---|---|---|
| Analyst | W-Trans | Agency | |
| Jurisdiction | City of Novato | Time Period Analyzed | AM Peak Cumulative with Project Alt - Northbound |
| Analysis Year | 2016 | Date | 6/8/17 |
| Project Description | City of Novato General Plan Update EIR | | |

## Facility Global Input

| | | | |
|---|---|---|---|
| Jam Density, pc/mi/ln | 190.0 | Density at Capacity, pc/mi/ln | 45.0 |
| Queue Discharge Capacity Drop, % | 7 | Total Segments | 24 |
| Total Time Periods | 1 | Time Period Duration, min | 15 |

## Segment Geometric Data

| No. | Coded | Analyzed | Name | Length, ft | Lanes |
|---|---|---|---|---|---|
| 1 | Basic | Basic | Novato S City Limits->Alameda del Prado | 2000 | 5 |
| 2 | Diverge | Basic | Alameda del Prado Off-> | 1500 | 5 |
| 3 | Basic | Basic | Alameda del Prado Off->Alameda del Prado On | 2000 | 4 |
| 4 | Merge | Merge | Alameda del Prado On-> | 1000 | 4 |
| 5 | Basic | Basic | Alameda del Prado On->Nave Off | 2600 | 4 |
| 6 | Diverge | Diverge | Nave Off-> | 1000 | 4 |
| 7 | Basic | Basic | Nave Off->Nave On | 2000 | 4 |
| 8 | Merge | Basic | Nave On-> | 500 | 5 |
| 9 | Merge | Merge | Ignacio On-> | 1500 | 5 |
| 10 | Diverge | Basic | SR37 Off-> | 1500 | 5 |
| 11 | Diverge | Diverge | Novato Blvd Off-> | 1500 | 4 |
| 12 | Basic | Basic | Novato Blvd Off->SR 37 On | 2650 | 4 |
| 13 | Weaving | Weaving | SR37->Rowland Blvd | 2050 | 5 |
| 14 | Basic | Basic | Rowland Blvd Off->Rowland Blvd On | 2900 | 4 |
| 15 | Merge | Merge | Rowland Blvd On-> | 1200 | 4 |
| 16 | Diverge | Diverge | De Long Off-> | 1200 | 4 |
| 17 | Basic | Basic | De Long Off->De Long On | 2000 | 4 |
| 18 | Merge | Merge | De Long Ave On-> | 1200 | 4 |
| 19 | Diverge | Diverge | Atherton Ave Off-> | 1200 | 4 |
| 20 | Basic | Basic | Atherton Ave Off->Atherton Ave On | 900 | 4 |
| 21 | Merge | Merge | Atherton Ave On-> | 1000 | 4 |
| 22 | Basic | Basic | Atherton On -> End HOV | 2300 | 3 |
| 23 | Basic | Basic | End HOV | 2000 | 2 |
| 24 | Basic | Basic | End HOV -> Begin 2 lane fwy | 2500 | 2 |

## Facility Segment Data

### Segment 1: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 5340 | 12000 | 0.44 | 75.3 | 14.2 | B |

### Segment 2: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 5340 | 375 | 12000 | 2000 | 0.44 | 0.19 | 75.3 | - | 14.2 | - | B |

### Segment 3: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 4968 | 9600 | 0.52 | 74.7 | 16.6 | B |

### Segment 4: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 5085 | 117 | 9600 | 2000 | 0.53 | 0.06 | 68.5 | 64.4 | 18.6 | 19.7 | B |

### Segment 5: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 5084 | 9600 | 0.53 | 74.5 | 17.1 | B |

### Segment 6: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 1.00 | 0.957 | 1.000 | 5084 | 877 | 9600 | 2000 | 0.53 | 0.44 | 67.5 | 58.5 | 18.8 | 25.8 | C |

### Segment 7: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 4167 | 9600 | 0.43 | 75.4 | 13.8 | B |

### Segment 8: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 4367 | 200 | 12000 | 2000 | 0.35 | 0.10 | 75.4 | - | 11.6 | - | B |

### Segment 9: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 5126 | 760 | 12000 | 2000 | 0.43 | 0.38 | 68.8 | 64.0 | 12.1 | 20.5 | C |

### Segment 10: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 5120 | 1036 | 12000 | 4200 | 0.43 | 0.25 | 75.4 | - | 13.6 | - | B |

### Segment 11: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 4092 | 189 | 9600 | 2000 | 0.43 | 0.09 | 70.6 | 60.5 | 14.5 | 20.5 | C |

### Segment 12: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 3904 | 9600 | 0.41 | 75.4 | 12.9 | B |

### Segment 13: Weaving

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 4614 | 6742 | 0.69 | 64.5 | 14.4 | B |

### Segment 14: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 3632 | 9600 | 0.38 | 75.4 | 12.0 | B |

### Segment 15: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 4046 | 414 | 9600 | 2000 | 0.42 | 0.21 | 69.8 | 66.2 | 14.5 | 13.6 | B |

### Segment 16: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 4043 | 865 | 9600 | 2000 | 0.42 | 0.43 | 67.2 | 58.5 | 15.0 | 19.6 | B |

### Segment 17: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 3184 | 9600 | 0.33 | 75.4 | 10.6 | A |

### Segment 18: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 3376 | 192 | 9600 | 2000 | 0.35 | 0.10 | 70.4 | 66.4 | 12.0 | 10.6 | B |

### Segment 19: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 0.990 | 3374 | 923 | 9600 | 2000 | 0.35 | 0.46 | 66.3 | 58.3 | 12.7 | 17.3 | B |

### Segment 20: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 2467 | 9600 | 0.26 | 75.4 | 8.2 | A |

### Segment 21: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 2974 | 507 | 9014 | 1878 | 0.33 | 0.27 | 66.2 | 64.1 | 11.2 | 12.0 | B |

### Segment 22: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.94 | 1.000 | 3024 | 7200 | 0.42 | 71.7 | 14.1 | B |

### Segment 23: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 2971 | 4472 | 0.66 | 66.2 | 22.4 | C |

### Segment 24: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 2971 | 3628 | 0.82 | 49.0 | 30.3 | D |

### Facility Time Period Results

| T | Speed, mi/h | Density, pc/mi/ln | Density, veh/mi/ln | Travel Time, min | LOS |
|---|---|---|---|---|---|
| 1 | 70.5 | 14.6 | 14.0 | 6.5 | B |

### Facility Overall Results

| | | | |
|---|---|---|---|
| Space Mean Speed, mi/h | 70.5 | Density, veh/mi/ln | 14.0 |
| Average Travel Time, min | 6.5 | | |

# HCS7 Freeway Facilities Report

## Project Information

| | | | |
|---|---|---|---|
| Analyst | W-Trans | Agency | |
| Jurisdiction | City of Novato | Time Period Analyzed | AM Peak Cumulative with Project Alt - Southbound |
| Analysis Year | 2016 | Date | 6/8/17 |
| Project Description | City of Novato General Plan EIR | | |

## Facility Global Input

| | | | |
|---|---|---|---|
| Jam Density, pc/mi/ln | 190.0 | Density at Capacity, pc/mi/ln | 45.0 |
| Queue Discharge Capacity Drop, % | 7 | Total Segments | 24 |
| Total Time Periods | 1 | Time Period Duration, min | 15 |

## Segment Geometric Data

| No. | Coded | Analyzed | Name | Length, ft | Lanes |
|---|---|---|---|---|---|
| 1 | Basic | Basic | N Novato City Limits->San Marin Dr | 3200 | 3 |
| 2 | Diverge | Diverge | San Marin Dr Off-> | 1500 | 3 |
| 3 | Basic | Basic | San Marin Dr Off->San Marin Dr On | 2100 | 3 |
| 4 | Merge | Merge | San Marin Dr On-> | 1175 | 3 |
| 5 | Diverge | Diverge | De Long Ave Off-> | 1175 | 3 |
| 6 | Basic | Basic | De Long Ave Off->De Long Ave On | 1975 | 3 |
| 7 | Merge | Merge | De Long Ave On-> | 1170 | 3 |
| 8 | Diverge | Diverge | BEGIN HOV | 200 | 3 |
| 9 | Diverge | Diverge | Rowland Blvd Off-> | 1170 | 3 |
| 10 | Basic | Basic | Rowland Blvd Off->Rowland Blvd On | 3150 | 3 |
| 11 | Merge | Merge | Rowland Blvd On-> | 1200 | 3 |
| 12 | Basic | Basic | Rowland Blvd->SR37-Novato Blvd | 770 | 3 |
| 13 | Diverge | Diverge | SR37-Novato Blvd Off-> | 1200 | 3 |
| 14 | Basic | Basic | SR37-Novato Blvd Off->SR37-Novato Blvd On | 3400 | 3 |
| 15 | Merge | Basic | SR37-Novato Blvd On-> | 1030 | 4 |
| 16 | Diverge | Diverge | Ignacio-Enfrente Off-> | 1000 | 4 |
| 17 | Diverge | Basic | BMK-Nave Off-> | 800 | 4 |
| 18 | Basic | Basic | Ignacio Blvd Off->Ignacio Blvd On | 1425 | 3 |
| 19 | Merge | Merge | Ignacio Blvd On-> | 1500 | 3 |
| 20 | Basic | Basic | Ignacio Blvd->Alameda Del Prado | 2250 | 3 |
| 21 | Diverge | Diverge | ADP Off-> | 1500 | 3 |
| 22 | Basic | Basic | ADP Off->ADP On | 1200 | 3 |
| 23 | Merge | Basic | ADP On-> | 1500 | 3 |
| 24 | Basic | Basic | Alameda Del Prado->S Novato City Limits | 1000 | 4 |

## Facility Segment Data

### Segment 1: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.957 | 6741 | 7200 | 1.00 | 41.4 | 54.2 | F |

### Segment 2: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.957 | 0.980 | 6707 | 729 | 7200 | 2000 | 1.00 | 0.36 | 66.3 | 61.1 | 33.7 | 37.9 | E |

### Segment 3: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.954 | 5777 | 7200 | 0.91 | 31.8 | 60.6 | F |

### Segment 4: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.960 | 0.980 | 6491 | 762 | 7200 | 2100 | 1.01 | 0.36 | 39.8 | 53.0 | 54.4 | 38.9 | F |

### Segment 5: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.960 | 0.980 | 6443 | 350 | 7200 | 2000 | 1.01 | 0.18 | 38.3 | 62.2 | 56.1 | 41.5 | F |

### Segment 6: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.958 | 5961 | 7200 | 0.96 | 30.3 | 65.5 | F |

### Segment 7: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.963 | 0.980 | 6704 | 743 | 7200 | 2000 | 1.06 | 0.37 | 60.2 | 56.5 | 37.1 | 36.4 | F |

### Segment 8: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 1.00 | 0.963 | 0.990 | 6704 | 1091 | 7200 | 2200 | 1.06 | 0.50 | 70.0 | 66.5 | 31.9 | 41.6 | F |

### Segment 9: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.95 | 0.963 | 0.980 | 5613 | 867 | 7200 | 2000 | 0.90 | 0.43 | 66.1 | 60.7 | 28.3 | 34.5 | D |

### Segment 10: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.960 | 4746 | 7200 | 0.78 | 71.5 | 22.1 | C |

### Segment 11: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.966 | 0.980 | 5442 | 696 | 7200 | 2000 | 0.87 | 0.35 | 64.2 | 61.3 | 28.3 | 30.5 | D |

### Segment 12: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.966 | 5442 | 7200 | 0.87 | 67.8 | 26.8 | D |

### Segment 13: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.966 | 0.962 | 5442 | 327 | 7200 | 2100 | 0.87 | 0.16 | 69.1 | 64.5 | 26.3 | 33.0 | D |

### Segment 14: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.967 | 5020 | 7200 | 0.83 | 70.2 | 23.8 | C |

### Segment 15: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.966 | 0.962 | 7775 | 2998 | 9600 | 4000 | 0.62 | 0.75 | 39.8 | - | 48.9 | - | F |

### Segment 16: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.966 | 0.980 | 7614 | 663 | 9600 | 2000 | 0.92 | 0.33 | 36.1 | 61.3 | 52.7 | 36.2 | F |

### Segment 17: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.964 | 0.980 | 6800 | 1023 | 9600 | 2000 | 0.86 | 0.51 | 24.0 | - | 70.8 | - | F |

### Segment 18: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.962 | 5650 | 7200 | 1.00 | 25.6 | 73.5 | F |

### Segment 19: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.965 | 0.980 | 6248 | 684 | 7200 | 2000 | 1.10 | 0.34 | 34.9 | 42.2 | 59.6 | 43.8 | F |

### Segment 20: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.965 | 6119 | 7200 | 1.09 | 32.5 | 62.7 | F |

### Segment 21: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.932 | 0.980 | 6032 | 215 | 7200 | 2000 | 1.13 | 0.11 | 30.3 | 62.6 | 66.4 | 47.1 | F |

### Segment 22: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.931 | 5736 | 7200 | 1.10 | 26.1 | 73.3 | F |

### Segment 23: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.934 | 0.980 | 6704 | 968 | 7200 | 2000 | 1.10 | 0.48 | 60.3 | - | 37.1 | - | F |

### Segment 24: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.934 | 6704 | 9600 | 0.93 | 70.1 | 23.9 | C |

## Facility Time Period Results

| T | Speed, mi/h | Density, pc/mi/ln | Density, veh/mi/ln | Travel Time, min | LOS |
|---|---|---|---|---|---|
| 1 | 41.6 | 46.3 | 44.3 | 10.0 | F |

## Facility Overall Results

| | | | |
|---|---|---|---|
| Space Mean Speed, mi/h | 41.6 | Density, veh/mi/ln | 44.3 |
| Average Travel Time, min | 10.0 | | |

# HCS7 Freeway Facilities Report

## Project Information

| | | | |
|---|---|---|---|
| Analyst | W-Trans | Agency | |
| Jurisdiction | City of Novato | Time Period Analyzed | PM Cumulative with Project Alternative - Northbound |
| Analysis Year | 2016 | Date | 6/8/17 |
| Project Description | City of Novato General Plan Update EIR | | |

## Facility Global Input

| | | | |
|---|---|---|---|
| Jam Density, pc/mi/ln | 190.0 | Density at Capacity, pc/mi/ln | 45.0 |
| Queue Discharge Capacity Drop, % | 7 | Total Segments | 23 |
| Total Time Periods | 1 | Time Period Duration, min | 15 |

## Segment Geometric Data

| No. | Coded | Analyzed | Name | Length, ft | Lanes |
|---|---|---|---|---|---|
| 1 | Basic | Basic | Novato S City Limits->Alameda del Prado | 2000 | 4 |
| 2 | Diverge | Basic | Alameda del Prado Off-> | 1500 | 4 |
| 3 | Basic | Basic | Alameda del Prado Off->Alameda del Prado On | 2000 | 3 |
| 4 | Merge | Merge | Alameda del Prado On-> | 1000 | 3 |
| 5 | Basic | Basic | Alameda del Prado On->Nave Off | 2600 | 3 |
| 6 | Diverge | Diverge | Nave Off-> | 1000 | 3 |
| 7 | Basic | Basic | Nave Off->Nave On | 2000 | 3 |
| 8 | Merge | Basic | Nave On-> | 500 | 4 |
| 9 | Merge | Merge | Ignacio On-> | 1500 | 4 |
| 10 | Diverge | Basic | SR37 Off-> | 1500 | 4 |
| 11 | Diverge | Diverge | Novato Blvd Off-> | 1500 | 3 |
| 12 | Basic | Basic | Novato Blvd Off->SR 37 On | 2650 | 3 |
| 13 | Weaving | Weaving | SR37->Rowland Blvd | 2050 | 4 |
| 14 | Basic | Basic | Rowland Blvd Off->Rowland Blvd On | 2900 | 3 |
| 15 | Merge | Merge | Rowland Blvd On-> | 1200 | 3 |
| 16 | Diverge | Diverge | De Long Off-> | 1200 | 3 |
| 17 | Basic | Basic | De Long Off->De Long On | 2000 | 3 |
| 18 | Merge | Merge | De Long Ave On-> | 1200 | 3 |
| 19 | Diverge | Diverge | Atherton Ave Off-> | 1200 | 3 |
| 20 | Basic | Basic | Atherton Ave Off->Atherton Ave On | 900 | 3 |
| 21 | Merge | Merge | Atherton Ave On-> | 1000 | 3 |
| 22 | Merge | Merge | End HOV | 1000 | 3 |
| 23 | Basic | Basic | End HOV -> Begin 2 lane fwy | 5100 | 2 |

## Facility Segment Data

### Segment 1: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 7602 | 9600 | 0.90 | 25.3 | 75.2 | F |

### Segment 2: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 7404 | 932 | 9600 | 2000 | 0.90 | 0.47 | 25.0 | - | 74.1 | - | F |

### Segment 3: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 6397 | 7200 | 1.07 | 35.2 | 60.6 | F |

### Segment 4: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 6704 | 307 | 7200 | 2000 | 1.11 | 0.15 | 61.1 | 57.9 | 36.6 | 34.9 | F |

### Segment 5: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 6704 | 7200 | 1.11 | 58.2 | 38.4 | F |

### Segment 6: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 1.00 | 0.957 | 1.000 | 6704 | 943 | 7200 | 2000 | 1.11 | 0.47 | 64.2 | 58.3 | 34.8 | 37.8 | F |

### Segment 7: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 5761 | 7200 | 0.98 | 65.7 | 29.2 | D |

### Segment 8: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 6016 | 255 | 9600 | 2000 | 0.73 | 0.13 | 67.9 | - | 22.2 | - | C |

### Segment 9: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 7418 | 1402 | 9600 | 2000 | 0.90 | 0.70 | 64.3 | 59.3 | 28.8 | 33.4 | D |

### Segment 10: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 7418 | 2751 | 9600 | 4200 | 0.90 | 0.66 | 65.9 | - | 28.1 | - | D |

## Segment 11: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 4667 | 397 | 7200 | 2000 | 0.82 | 0.20 | 65.6 | 59.9 | 23.7 | 30.6 | D |

## Segment 12: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 4270 | 7200 | 0.77 | 73.3 | 19.4 | C |

## Segment 13: Weaving

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 4734 | 4734 | 1.13 | 26.3 | 45.0 | F |

## Segment 14: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 3562 | 7200 | 0.67 | 74.5 | 15.8 | B |

## Segment 15: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 4202 | 640 | 7200 | 2000 | 0.76 | 0.32 | 67.1 | 64.9 | 20.9 | 20.8 | C |

## Segment 16: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 4202 | 1877 | 7200 | 2000 | 0.76 | 0.94 | 60.2 | 55.5 | 23.3 | 27.7 | C |

## Segment 17: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 2325 | 7200 | 0.50 | 74.3 | 10.3 | A |

## Segment 18: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 2649 | 324 | 7200 | 2000 | 0.55 | 0.16 | 68.7 | 66.3 | 12.9 | 12.6 | B |

## Segment 19: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 0.990 | 2649 | 1301 | 7200 | 2000 | 0.55 | 0.65 | 60.7 | 57.2 | 14.5 | 18.7 | B |

## Segment 20: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 1348 | 7200 | 0.37 | 72.7 | 6.0 | A |

## Segment 21: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 2325 | 977 | 6761 | 1878 | 0.54 | 0.52 | 65.8 | 64.3 | 11.8 | 9.8 | A |

## Segment 22: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 3049 | 868 | 6761 | 1878 | 0.66 | 0.46 | 17.8 | 60.5 | 57.2 | 25.9 | F |

## Segment 23: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 3049 | 3274 | 1.37 | 55.6 | 21.1 | F |

## Facility Time Period Results

| T | Speed, mi/h | Density, pc/mi/ln | Density, veh/mi/ln | Travel Time, min | LOS |
|---|---|---|---|---|---|
| 1 | 46.9 | 32.8 | 31.3 | 9.6 | F |

## Facility Overall Results

| | | | |
|---|---|---|---|
| Space Mean Speed, mi/h | 46.9 | Density, veh/mi/ln | 31.3 |
| Average Travel Time, min | 9.6 | | |


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# HCS7 Freeway Facilities Report

## Project Information

| | | | |
|---|---|---|---|
| Analyst | W-Trans | Agency | |
| Jurisdiction | City of Novato | Time Period Analyzed | PM Cumulative with Project Alternative - Southbound |
| Analysis Year | 2016 | Date | 6/8/17 |
| Project Description | | | |

## Facility Global Input

| | | | |
|---|---|---|---|
| Jam Density, pc/mi/ln | 190.0 | Density at Capacity, pc/mi/ln | 45.0 |
| Queue Discharge Capacity Drop, % | 7 | Total Segments | 24 |
| Total Time Periods | 1 | Time Period Duration, min | 15 |

## Segment Geometric Data

| No. | Coded | Analyzed | Name | Length, ft | Lanes |
|---|---|---|---|---|---|
| 1 | Basic | Basic | N Novato City Limits->San Marin Dr | 3753 | 3 |
| 2 | Diverge | Diverge | San Marin Dr Off-> | 1500 | 3 |
| 3 | Basic | Basic | San Marin Dr Off->San Marin Dr On | 2100 | 3 |
| 4 | Merge | Merge | San Marin Dr On-> | 1175 | 3 |
| 5 | Diverge | Diverge | De Long Ave Off-> | 1175 | 3 |
| 6 | Basic | Basic | De Long Ave Off->De Long Ave On | 1975 | 3 |
| 7 | Merge | Basic | De Long Ave On-> | 1170 | 3 |
| 8 | Diverge | Diverge | BEGIN HOV | 200 | 4 |
| 9 | Diverge | Diverge | Rowland Blvd Off-> | 1170 | 4 |
| 10 | Basic | Basic | Rowland Blvd Off->Rowland Blvd On | 3150 | 4 |
| 11 | Merge | Merge | Rowland Blvd On-> | 1200 | 4 |
| 12 | Basic | Basic | Rowland Blvd->SR37-Novato Blvd | 770 | 4 |
| 13 | Diverge | Diverge | SR37-Novato Blvd Off-> | 1200 | 4 |
| 14 | Basic | Basic | SR37-Novato Blvd Off->SR37-Novato Blvd On | 3400 | 4 |
| 15 | Merge | Basic | SR37-Novato Blvd On-> | 1030 | 5 |
| 16 | Diverge | Diverge | Ignacio-Enfrente Off-> | 1000 | 5 |
| 17 | Diverge | Basic | BMK-Nave Off-> | 800 | 5 |
| 18 | Basic | Basic | Ignacio Blvd Off->Ignacio Blvd On | 1425 | 4 |
| 19 | Merge | Merge | Ignacio Blvd On-> | 1500 | 4 |
| 20 | Basic | Basic | Ignacio Blvd->Alameda Del Prado | 2250 | 4 |
| 21 | Diverge | Diverge | ADP Off-> | 1500 | 4 |
| 22 | Basic | Basic | ADP Off->ADP On | 1200 | 4 |
| 23 | Merge | Merge | ADP On-> | 1500 | 4 |
| 24 | Basic | Basic | Alameda Del Prado->S Novato City Limits | 1000 | 4 |

## Facility Segment Data

### Segment 1: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.957 | 4002 | 7200 | 0.56 | 74.1 | 18.0 | B |

### Segment 2: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.957 | 0.980 | 4002 | 445 | 7200 | 2000 | 0.56 | 0.22 | 63.9 | 58.0 | 20.9 | 26.3 | C |

### Segment 3: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.954 | 3571 | 7200 | 0.50 | 74.9 | 15.9 | B |

### Segment 4: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.960 | 0.980 | 4726 | 1177 | 7200 | 2000 | 0.66 | 0.59 | 64.8 | 62.1 | 24.3 | 28.5 | D |

### Segment 5: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.960 | 0.980 | 4714 | 222 | 7200 | 2000 | 0.65 | 0.11 | 67.8 | 62.6 | 23.2 | 28.8 | D |

### Segment 6: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.958 | 4503 | 7200 | 0.63 | 72.5 | 20.7 | C |

### Segment 7: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.963 | 0.980 | 5638 | 1158 | 7200 | 2000 | 0.62 | 0.58 | 66.6 | - | 28.2 | - | D |

### Segment 8: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 1.00 | 0.963 | 0.990 | 5622 | 0 | 9600 | 2200 | 0.59 | 0.00 | 75.2 | 69.8 | 18.7 | 27.4 | C |

### Segment 9: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.95 | 0.963 | 0.980 | 5622 | 532 | 9600 | 2000 | 0.59 | 0.27 | 70.2 | 61.7 | 20.0 | 27.0 | C |

## Segment 10: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.960 | 5114 | 9600 | 0.53 | 74.4 | 17.2 | B |

## Segment 11: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.966 | 0.980 | 6549 | 1467 | 9600 | 2000 | 0.68 | 0.73 | 65.7 | 61.2 | 24.9 | 30.3 | D |

## Segment 12: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.966 | 6525 | 9600 | 0.68 | 70.8 | 23.0 | C |

## Segment 13: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.966 | 0.962 | 6525 | 754 | 9600 | 2100 | 0.68 | 0.36 | 70.7 | 63.2 | 23.1 | 31.5 | D |

## Segment 14: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.967 | 5791 | 9600 | 0.60 | 73.0 | 19.8 | C |

## Segment 15: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.966 | 0.962 | 7369 | 1572 | 12000 | 4000 | 0.48 | 0.39 | 72.8 | - | 20.2 | - | C |

## Segment 16: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.966 | 0.980 | 7315 | 613 | 12000 | 2000 | 0.61 | 0.31 | 70.6 | 61.4 | 16.6 | 24.7 | C |

## Segment 17: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.964 | 0.980 | 6726 | 812 | 12000 | 2000 | 0.56 | 0.41 | 74.0 | - | 18.2 | - | C |

## Segment 18: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.962 | 5938 | 9600 | 0.62 | 72.6 | 20.4 | C |

## Segment 19: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.965 | 0.980 | 6934 | 1015 | 9600 | 2000 | 0.72 | 0.51 | 66.0 | 61.6 | 26.3 | 29.6 | D |

## Segment 20: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.965 | 6919 | 9600 | 0.72 | 69.3 | 25.0 | C |

## Segment 21: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.932 | 0.980 | 7164 | 347 | 9600 | 2000 | 0.75 | 0.17 | 70.3 | 62.2 | 25.5 | 28.7 | D |

## Segment 22: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.931 | 6817 | 9600 | 0.71 | 69.7 | 24.4 | C |

## Segment 23: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.934 | 0.980 | 7520 | 725 | 9600 | 2000 | 0.78 | 0.36 | 67.4 | 64.6 | 27.9 | 22.7 | C |

## Segment 24: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.934 | 7533 | 9600 | 0.78 | 66.5 | 28.3 | D |

## Facility Time Period Results

| T | Speed, mi/h | Density, pc/mi/ln | Density, veh/mi/ln | Travel Time, min | LOS |
|---|---|---|---|---|---|
| 1 | 70.3 | 21.6 | 20.7 | 6.0 | C |

## Facility Overall Results

| | | | |
|---|---|---|---|
| Space Mean Speed, mi/h | 70.3 | Density, veh/mi/ln | 20.7 |
| Average Travel Time, min | 6.0 | | |

# HCS7 Basic Freeway Report

| Project Information | | | |
|---|---|---|---|
| Analyst | W-Trans | Date | 6/9/2017 |
| Agency | | Analysis Year | 2017 |
| Jurisdiction | City of Novato | Time Period Analyzed | AM Existing+Project Alt - Eastbound |
| Project Description | | | |
| **Geometric Data** | | | |
| Number of Lanes (N), ln | 2 | Terrain Type | Level |
| Segment Length (L), ft | - | Percent Grade, % | - |
| Measured or Base Free-Flow Speed | Base | Grade Length, mi | - |
| Base Free-Flow Speed (BFFS), mi/h | 75.4 | Total Ramp Density (TRD), ramps/mi | 0.80 |
| Lane Width, ft | 12 | Free-Flow Speed (FFS), mi/h | 72.7 |
| Right-Side Lateral Clearance, ft | 6 | | |
| **Adjustment Factors** | | | |
| Driver Population | Mostly Familiar | Final Speed Adjustment Factor (SAF) | 0.975 |
| Weather Type | Non-Severe Weather | Final Capacity Adjustment Factor (CAF) | 0.968 |
| Incident Type | No Incident | Demand Adjustment Factor (DAF) | 1.000 |
| **Demand and Capacity** | | | |
| Volume (V), veh/h | 1141 | Heavy Vehicle Adjustment Factor ($f_{HV}$) | 0.971 |
| Peak Hour Factor (PHF) | 0.95 | Flow Rate ($v_p$), pc/h/ln | 618 |
| Total Trucks, % | 3.00 | Capacity (c), pc/h/ln | 2400 |
| Single-Unit Trucks (SUT), % | - | Adjusted Capacity ($c_{adj}$), pc/h/ln | 2323 |
| Tractor-Trailers (TT), % | - | Volume-to-Capacity Ratio (v/c) | 0.27 |
| Passenger Car Equivalent ($E_T$) | 2.000 | | |
| **Speed and Density** | | | |
| Lane Width Adjustment ($f_{LW}$) | 0.0 | Average Speed (S), mi/h | 70.9 |
| Right-Side Lateral Clearance Adj. ($f_{RLC}$) | 0.0 | Density (D), pc/mi/ln | 8.7 |
| Total Ramp Density Adjustment | 2.7 | Level of Service (LOS) | A |
| Adjusted Free-Flow Speed ($FFS_{adj}$), mi/h | 70.9 | | |




# HCS7 Basic Freeway Report

| Project Information | | | |
|---|---|---|---|
| Analyst | W-Trans | Date | 6/9/2017 |
| Agency | | Analysis Year | 2017 |
| Jurisdiction | City of Novato | Time Period Analyzed | AM Existing+Project Alt - Westbound |
| Project Description | | | |
| **Geometric Data** | | | |
| Number of Lanes (N), ln | 2 | Terrain Type | Level |
| Segment Length (L), ft | - | Percent Grade, % | - |
| Measured or Base Free-Flow Speed | Base | Grade Length, mi | - |
| Base Free-Flow Speed (BFFS), mi/h | 75.4 | Total Ramp Density (TRD), ramps/mi | 0.80 |
| Lane Width, ft | 12 | Free-Flow Speed (FFS), mi/h | 72.7 |
| Right-Side Lateral Clearance, ft | 6 | | |
| **Adjustment Factors** | | | |
| Driver Population | Mostly Familiar | Final Speed Adjustment Factor (SAF) | 0.975 |
| Weather Type | Non-Severe Weather | Final Capacity Adjustment Factor (CAF) | 0.968 |
| Incident Type | No Incident | Demand Adjustment Factor (DAF) | 1.000 |
| **Demand and Capacity** | | | |
| Volume (V), veh/h | 2340 | Heavy Vehicle Adjustment Factor ($f_{HV}$) | 0.971 |
| Peak Hour Factor (PHF) | 0.95 | Flow Rate ($v_p$), pc/h/ln | 1268 |
| Total Trucks, % | 3.00 | Capacity (c), pc/h/ln | 2400 |
| Single-Unit Trucks (SUT), % | - | Adjusted Capacity ($c_{adj}$), pc/h/ln | 2323 |
| Tractor-Trailers (TT), % | - | Volume-to-Capacity Ratio (v/c) | 0.55 |
| Passenger Car Equivalent ($E_T$) | 2.000 | | |
| **Speed and Density** | | | |
| Lane Width Adjustment ($f_{LW}$) | 0.0 | Average Speed (S), mi/h | 70.5 |
| Right-Side Lateral Clearance Adj. ($f_{RLC}$) | 0.0 | Density (D), pc/mi/ln | 18.0 |
| Total Ramp Density Adjustment | 2.7 | Level of Service (LOS) | B |
| Adjusted Free-Flow Speed ($FFS_{adj}$), mi/h | 70.9 | | |

## HCS7 Basic Freeway Report

### Project Information

| | | | |
|---|---|---|---|
| Analyst | W-Trans | Date | 6/9/2017 |
| Agency | | Analysis Year | 2017 |
| Jurisdiction | City of Novato | Time Period Analyzed | PM Existing+Project Alt - Eastbound |
| Project Description | | | |

### Geometric Data

| | | | |
|---|---|---|---|
| Number of Lanes (N), ln | 2 | Terrain Type | Level |
| Segment Length (L), ft | - | Percent Grade, % | - |
| Measured or Base Free-Flow Speed | Base | Grade Length, mi | - |
| Base Free-Flow Speed (BFFS), mi/h | 75.4 | Total Ramp Density (TRD), ramps/mi | 0.80 |
| Lane Width, ft | 12 | Free-Flow Speed (FFS), mi/h | 72.7 |
| Right-Side Lateral Clearance, ft | 6 | | |

### Adjustment Factors

| | | | |
|---|---|---|---|
| Driver Population | Mostly Familiar | Final Speed Adjustment Factor (SAF) | 0.975 |
| Weather Type | Non-Severe Weather | Final Capacity Adjustment Factor (CAF) | 0.968 |
| Incident Type | No Incident | Demand Adjustment Factor (DAF) | 1.000 |

### Demand and Capacity

| | | | |
|---|---|---|---|
| Volume (V), veh/h | 2455 | Heavy Vehicle Adjustment Factor ($f_{HV}$) | 0.971 |
| Peak Hour Factor (PHF) | 0.95 | Flow Rate ($v_p$), pc/h/ln | 1330 |
| Total Trucks, % | 3.00 | Capacity (c), pc/h/ln | 2400 |
| Single-Unit Trucks (SUT), % | - | Adjusted Capacity ($c_{adj}$), pc/h/ln | 2323 |
| Tractor-Trailers (TT), % | - | Volume-to-Capacity Ratio (v/c) | 0.57 |
| Passenger Car Equivalent ($E_T$) | 2.000 | | |

### Speed and Density

| | | | |
|---|---|---|---|
| Lane Width Adjustment ($f_{LW}$) | 0.0 | Average Speed (S), mi/h | 70.2 |
| Right-Side Lateral Clearance Adj. ($f_{RLC}$) | 0.0 | Density (D), pc/mi/ln | 18.9 |
| Total Ramp Density Adjustment | 2.7 | Level of Service (LOS) | C |
| Adjusted Free-Flow Speed ($FFS_{adj}$), mi/h | 70.9 | | |




## HCS7 Basic Freeway Report

### Project Information

| | | | |
|---|---|---|---|
| Analyst | W-Trans | Date | 6/9/2017 |
| Agency | | Analysis Year | 2017 |
| Jurisdiction | City of Novato | Time Period Analyzed | PM Existing+Project Alt - Westbound |
| Project Description | | | |

### Geometric Data

| | | | |
|---|---|---|---|
| Number of Lanes (N), ln | 2 | Terrain Type | Level |
| Segment Length (L), ft | - | Percent Grade, % | - |
| Measured or Base Free-Flow Speed | Base | Grade Length, mi | - |
| Base Free-Flow Speed (BFFS), mi/h | 75.4 | Total Ramp Density (TRD), ramps/mi | 0.80 |
| Lane Width, ft | 12 | Free-Flow Speed (FFS), mi/h | 72.7 |
| Right-Side Lateral Clearance, ft | 6 | | |

### Adjustment Factors

| | | | |
|---|---|---|---|
| Driver Population | Mostly Familiar | Final Speed Adjustment Factor (SAF) | 0.975 |
| Weather Type | Non-Severe Weather | Final Capacity Adjustment Factor (CAF) | 0.968 |
| Incident Type | No Incident | Demand Adjustment Factor (DAF) | 1.000 |

### Demand and Capacity

| | | | |
|---|---|---|---|
| Volume (V), veh/h | 1361 | Heavy Vehicle Adjustment Factor ($f_{HV}$) | 0.971 |
| Peak Hour Factor (PHF) | 0.95 | Flow Rate ($v_p$), pc/h/ln | 738 |
| Total Trucks, % | 3.00 | Capacity (c), pc/h/ln | 2400 |
| Single-Unit Trucks (SUT), % | - | Adjusted Capacity ($c_{adj}$), pc/h/ln | 2323 |
| Tractor-Trailers (TT), % | - | Volume-to-Capacity Ratio (v/c) | 0.32 |
| Passenger Car Equivalent ($E_T$) | 2.000 | | |

### Speed and Density

| | | | |
|---|---|---|---|
| Lane Width Adjustment ($f_{LW}$) | 0.0 | Average Speed (S), mi/h | 70.9 |
| Right-Side Lateral Clearance Adj. ($f_{RLC}$) | 0.0 | Density (D), pc/mi/ln | 10.4 |
| Total Ramp Density Adjustment | 2.7 | Level of Service (LOS) | A |
| Adjusted Free-Flow Speed ($FFS_{adj}$), mi/h | 70.9 | | |

# HCS7 Basic Freeway Report

## Project Information

| | | | |
|---|---|---|---|
| Analyst | W-Trans | Date | 6/9/2017 |
| Agency | | Analysis Year | 2017 |
| Jurisdiction | City of Novato | Time Period Analyzed | AM Cumulative with Project Alternative - Eastbound |
| Project Description | | | |

## Geometric Data

| | | | |
|---|---|---|---|
| Number of Lanes (N), ln | 2 | Terrain Type | Level |
| Segment Length (L), ft | - | Percent Grade, % | - |
| Measured or Base Free-Flow Speed | Base | Grade Length, mi | - |
| Base Free-Flow Speed (BFFS), mi/h | 75.4 | Total Ramp Density (TRD), ramps/mi | 0.80 |
| Lane Width, ft | 12 | Free-Flow Speed (FFS), mi/h | 72.7 |
| Right-Side Lateral Clearance, ft | 6 | | |

## Adjustment Factors

| | | | |
|---|---|---|---|
| Driver Population | Mostly Familiar | Final Speed Adjustment Factor (SAF) | 0.975 |
| Weather Type | Non-Severe Weather | Final Capacity Adjustment Factor (CAF) | 0.968 |
| Incident Type | No Incident | Demand Adjustment Factor (DAF) | 1.000 |

## Demand and Capacity

| | | | |
|---|---|---|---|
| Volume (V), veh/h | 1141 | Heavy Vehicle Adjustment Factor ($f_{HV}$) | 0.971 |
| Peak Hour Factor (PHF) | 0.95 | Flow Rate ($v_p$), pc/h/ln | 618 |
| Total Trucks, % | 3.00 | Capacity (c), pc/h/ln | 2400 |
| Single-Unit Trucks (SUT), % | - | Adjusted Capacity ($c_{adj}$), pc/h/ln | 2323 |
| Tractor-Trailers (TT), % | - | Volume-to-Capacity Ratio (v/c) | 0.27 |
| Passenger Car Equivalent ($E_T$) | 2.000 | | |

## Speed and Density

| | | | |
|---|---|---|---|
| Lane Width Adjustment ($f_{LW}$) | 0.0 | Average Speed (S), mi/h | 70.9 |
| Right-Side Lateral Clearance Adj. ($f_{RLC}$) | 0.0 | Density (D), pc/mi/ln | 8.7 |
| Total Ramp Density Adjustment | 2.7 | Level of Service (LOS) | A |
| Adjusted Free-Flow Speed ($FFS_{adj}$), mi/h | 70.9 | | |




# HCS7 Basic Freeway Report

## Project Information

| | | | |
|---|---|---|---|
| Analyst | W-Trans | Date | 6/9/2017 |
| Agency | | Analysis Year | 2017 |
| Jurisdiction | City of Novato | Time Period Analyzed | AM Cumulative with Project Alternative - Westbound |
| Project Description | | | |

## Geometric Data

| | | | |
|---|---|---|---|
| Number of Lanes (N), ln | 2 | Terrain Type | Level |
| Segment Length (L), ft | - | Percent Grade, % | - |
| Measured or Base Free-Flow Speed | Base | Grade Length, mi | - |
| Base Free-Flow Speed (BFFS), mi/h | 75.4 | Total Ramp Density (TRD), ramps/mi | 0.80 |
| Lane Width, ft | 12 | Free-Flow Speed (FFS), mi/h | 72.7 |
| Right-Side Lateral Clearance, ft | 6 | | |

## Adjustment Factors

| | | | |
|---|---|---|---|
| Driver Population | Mostly Familiar | Final Speed Adjustment Factor (SAF) | 0.975 |
| Weather Type | Non-Severe Weather | Final Capacity Adjustment Factor (CAF) | 0.968 |
| Incident Type | No Incident | Demand Adjustment Factor (DAF) | 1.000 |

## Demand and Capacity

| | | | |
|---|---|---|---|
| Volume (V), veh/h | 2514 | Heavy Vehicle Adjustment Factor ($f_{HV}$) | 0.971 |
| Peak Hour Factor (PHF) | 0.95 | Flow Rate ($v_p$), pc/h/ln | 1362 |
| Total Trucks, % | 3.00 | Capacity (c), pc/h/ln | 2400 |
| Single-Unit Trucks (SUT), % | - | Adjusted Capacity ($c_{adj}$), pc/h/ln | 2323 |
| Tractor-Trailers (TT), % | - | Volume-to-Capacity Ratio (v/c) | 0.59 |
| Passenger Car Equivalent ($E_T$) | 2.000 | | |

## Speed and Density

| | | | |
|---|---|---|---|
| Lane Width Adjustment ($f_{LW}$) | 0.0 | Average Speed (S), mi/h | 70.0 |
| Right-Side Lateral Clearance Adj. ($f_{RLC}$) | 0.0 | Density (D), pc/mi/ln | 19.5 |
| Total Ramp Density Adjustment | 2.7 | Level of Service (LOS) | C |
| Adjusted Free-Flow Speed ($FFS_{adj}$), mi/h | 70.9 | | |

# HCS7 Basic Freeway Report

## Project Information

| | | | |
|---|---|---|---|
| Analyst | W-Trans | Date | 6/9/2017 |
| Agency | | Analysis Year | 2017 |
| Jurisdiction | City of Novato | Time Period Analyzed | PM Cumulative with Project Alternative - Eastbound |
| Project Description | | | |

## Geometric Data

| | | | |
|---|---|---|---|
| Number of Lanes (N), ln | 2 | Terrain Type | Level |
| Segment Length (L), ft | - | Percent Grade, % | - |
| Measured or Base Free-Flow Speed | Base | Grade Length, mi | - |
| Base Free-Flow Speed (BFFS), mi/h | 75.4 | Total Ramp Density (TRD), ramps/mi | 0.80 |
| Lane Width, ft | 12 | Free-Flow Speed (FFS), mi/h | 72.7 |
| Right-Side Lateral Clearance, ft | 6 | | |

## Adjustment Factors

| | | | |
|---|---|---|---|
| Driver Population | Mostly Familiar | Final Speed Adjustment Factor (SAF) | 0.975 |
| Weather Type | Non-Severe Weather | Final Capacity Adjustment Factor (CAF) | 0.968 |
| Incident Type | No Incident | Demand Adjustment Factor (DAF) | 1.000 |

## Demand and Capacity

| | | | |
|---|---|---|---|
| Volume (V), veh/h | 2692 | Heavy Vehicle Adjustment Factor ($f_{HV}$) | 0.971 |
| Peak Hour Factor (PHF) | 0.95 | Flow Rate ($v_p$), pc/h/ln | 1459 |
| Total Trucks, % | 3.00 | Capacity (c), pc/h/ln | 2400 |
| Single-Unit Trucks (SUT), % | - | Adjusted Capacity ($c_{adj}$), pc/h/ln | 2323 |
| Tractor-Trailers (TT), % | - | Volume-to-Capacity Ratio (v/c) | 0.63 |
| Passenger Car Equivalent ($E_T$) | 2.000 | | |

## Speed and Density

| | | | |
|---|---|---|---|
| Lane Width Adjustment ($f_{LW}$) | 0.0 | Average Speed (S), mi/h | 69.2 |
| Right-Side Lateral Clearance Adj. ($f_{RLC}$) | 0.0 | Density (D), pc/mi/ln | 21.1 |
| Total Ramp Density Adjustment | 2.7 | Level of Service (LOS) | C |
| Adjusted Free-Flow Speed ($FFS_{adj}$), mi/h | 70.9 | | |




# HCS7 Basic Freeway Report

## Project Information

| | | | |
|---|---|---|---|
| Analyst | W-Trans | Date | 6/9/2017 |
| Agency | | Analysis Year | 2017 |
| Jurisdiction | City of Novato | Time Period Analyzed | PM Cumulative with Project Alternative - Westbound |
| Project Description | | | |

## Geometric Data

| | | | |
|---|---|---|---|
| Number of Lanes (N), ln | 2 | Terrain Type | Level |
| Segment Length (L), ft | - | Percent Grade, % | - |
| Measured or Base Free-Flow Speed | Base | Grade Length, mi | - |
| Base Free-Flow Speed (BFFS), mi/h | 75.4 | Total Ramp Density (TRD), ramps/mi | 0.80 |
| Lane Width, ft | 12 | Free-Flow Speed (FFS), mi/h | 72.7 |
| Right-Side Lateral Clearance, ft | 6 | | |

## Adjustment Factors

| | | | |
|---|---|---|---|
| Driver Population | Mostly Familiar | Final Speed Adjustment Factor (SAF) | 0.975 |
| Weather Type | Non-Severe Weather | Final Capacity Adjustment Factor (CAF) | 0.968 |
| Incident Type | No Incident | Demand Adjustment Factor (DAF) | 1.000 |

## Demand and Capacity

| | | | |
|---|---|---|---|
| Volume (V), veh/h | 1465 | Heavy Vehicle Adjustment Factor ($f_{HV}$) | 0.971 |
| Peak Hour Factor (PHF) | 0.95 | Flow Rate ($v_p$), pc/h/ln | 794 |
| Total Trucks, % | 3.00 | Capacity (c), pc/h/ln | 2400 |
| Single-Unit Trucks (SUT), % | - | Adjusted Capacity ($c_{adj}$), pc/h/ln | 2323 |
| Tractor-Trailers (TT), % | - | Volume-to-Capacity Ratio (v/c) | 0.34 |
| Passenger Car Equivalent ($E_T$) | 2.000 | | |

## Speed and Density

| | | | |
|---|---|---|---|
| Lane Width Adjustment ($f_{LW}$) | 0.0 | Average Speed (S), mi/h | 70.9 |
| Right-Side Lateral Clearance Adj. ($f_{RLC}$) | 0.0 | Density (D), pc/mi/ln | 11.2 |
| Total Ramp Density Adjustment | 2.7 | Level of Service (LOS) | B |
| Adjusted Free-Flow Speed ($FFS_{adj}$), mi/h | 70.9 | | |

# Memorandum

**Date:** September 10, 2019

**Project:** NOV126

**To:** Mr. Steve Marshall
City of Novato

**From:** Zack Matley
zmatley@w-trans.com

**Copy:** Mr. Matt Maddox
Rincon Consultants

**Subject:** Additional General Plan Circulation Analysis – Evaluation of 300,000 s.f. of additional development associated with the Bel Marin Industrial Parks Biotech zoning overlay area

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The traffic analysis conducted for General Plan 2035 includes 500,000 square feet of new development related to potential intensification of health science uses in the Bel Marin Industrial Parks MPA. The analysis identifies several traffic operation impacts at and near the Bel Marin Keys Boulevard-Ignacio Boulevard interchange at US 101. One of these impacts, at the intersection of US 101 South Ramps/Ignacio Boulevard-Enfrente Road, could be mitigated through modifications to the freeway offramp and signal coordination, but is deemed significant and unavoidable because improvements would need to be made on Caltrans facilities outside of the City's jurisdiction and the City cannot guarantee their implementation. The significant and unavoidable impact affects both this intersection and the Bel Marin Keys Boulevard roadway segment, which is part of the regional Congestion Management Plan (CMP) roadway network.

As requested by the City, W-Trans has completed an additional focused analysis of the Bel Marin Keys Boulevard-Ignacio Boulevard interchange area assuming the addition of 300,000 square feet of additional health sciences uses in the Industrial Parks MPA instead of 500,000 square feet previously analyzed.

## Study Area

The focused study area including the following intersections (intersection numbers reflect those also used in the General Plan EIR).

31. Ignacio Boulevard/Alameda del Prado
32. US 101 South/Ignacio Boulevard-Enfrente Road
33. US 101 North/Bel Marin Keys Boulevard-Nave Drive
34. Bel Marin Keys Boulevard/Commercial Boulevard
35. Bel Marin Keys Boulevard/Digital Drive
36. US 101 North/Nave Drive

The roadway segment of Bel Marin Keys Drive between US 101 and Digital Drive, as well as the US 101 and SR 37 freeway segments within Novato are CMP transportation facilities that were also included in the analysis.

## Trip Generation

The number of added vehicle trips associated with the potential health science uses was determined using the same methodology applied in the General Plan EIR. Customized trip generation rates were developed as described in the January 16, 2018 memorandum prepared for the City by W-Trans, titled *Revised Trip Generation for the Bel Marin Industrial Barks Biotech Overlay Traffic Analysis*. The methodology uses a mix of rates from the ITE *Trip Generation Manual*, with the proportions of individual land uses based on information available for campuses planned by Genentech and Gilead in the Bay Area, and an additional ten percent reduction in auto trips associated with mandatory implementation of transportation demand management (TDM) measures. The added 300,000 square feet of health sciences uses is estimated to generate approximately 1,858 vehicle trips per day, including 227 trips both during the a.m. peak hour and p.m. peak hour.

## Results

The results of the analysis indicate that, with 300,000 square feet instead of 500,000 square feet of added health sciences uses, all six analyzed study intersections are expected to operate acceptably at LOS D or better during both the a.m. and p.m. peak hours under both Existing plus Project and Cumulative conditions. The intersection impacts identified in the General Plan EIR at US 101 South Ramps/Ignacio Boulevard-Enfrente Road (#32) and Bel Marin Keys Boulevard/Digital Drive (#35) are no longer projected to occur with the reduced development level.

The Bel Marin Keys Boulevard CMP roadway segment is projected to operate acceptably at LOS D or better during the p.m. peak hour under Existing plus Project and Cumulative conditions, in comparison to the unacceptable LOS E operation projected to occur under Cumulative conditions with the higher health sciences development levels assumed in the General Plan EIR. Both US 101 and SR 37 would also be expected to operate acceptably according to CMP criteria.

The intersection, roadway, and freeway level of service results are summarized in Tables 1 through 3, which are attached to this memorandum along with copies of the calculation sheets.

## Conclusion

The significant and unavoidable traffic impacts to the intersection of US 101 South Ramps/Ignacio Boulevard-Enfrente Road (#32) and the Bel Marin Keys CMP roadway segment would no longer be expected to occur with development of the reduced 300,000 square feet of health sciences uses in the Industrial Parks MPA.

We would like to offer one additional point regarding establishment of a square-footage based metric for health sciences uses in the Industrial Parks MPA. From a traffic perspective, the critical variable in determining significance is the number of peak hour trips added to the surrounding network, rather than the amount of new development. The above analysis and that completed for the DEIR use conservatively-developed trip generation rates that capture a wide range of potential health science tenants ranging from small-scale operations to large campus expansions, as is appropriate for a programmatic General Plan EIR. Individual health science applicants may ultimately be able to generate fewer trips per square foot than analyzed. Larger campus-type facilities in particular have the potential to internalize some trips (e.g., by providing onsite dining, services, and/or child care) and can also implement robust TDM measures more easily than smaller tenants. The City may wish to consider these influences when evaluating specific health sciences development applications. For example, if a specific project were able to provide evidence of a lower per-square-foot trip generation rate, be required by the City to monitor TDM effectiveness and auto trips generated over time, and comply with other development and zoning requirements, it may be possible to allow a larger building size without generating unanticipated traffic impacts.

We hope this information is useful to City staff and decision makers as General Plan 2035 advances toward adoption.

**Table 1 – Intersection Levels of Service with 300,000 square foot Industrial Parks Overlay**

| **Study Intersection** *Approach* | **AM Peak Hour** | | | | | | **PM Peak Hour** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Existing Conditions** | | **Existing +Project** | | **Cumulative Conditions** | | **Existing Conditions** | | **Existing +Project** | | **Cumulative Conditions** | |
| | **Delay** | **LOS** | **Delay** | **LOS** | **Delay** | **LOS** | **Delay** | **LOS** | **Delay** | **LOS** | **Delay** | **LOS** |
| 31. Ignacio Blvd/Alameda del Prado | 19.1 | B | 18.9 | B | 19.3 | B | 16.5 | B | 16.4 | B | 16.9 | B |
| 32. US 101 S/Ignacio Blvd-Enfrente Rd | 29.8 | C | 44.1 | D | 49.4 | D | 23.0 | C | 28.6 | C | 30.0 | C |
| 33. US 101 N/Bel Marin Keys Blvd-Nave Dr | 20.1 | C | 31.8 | C | 33.6 | C | 20.9 | C | 25.3 | C | 26.4 | C |
| 34. Bel Marin Keys Blvd/Commercial Blvd | 7.3 | A | 7.6 | A | 7.6 | A | 16.9 | B | 19.3 | B | 20.7 | C |
| 35. Bel Marin Keys Blvd/Digital Dr | 12.4 | B | 12.2 | B | 12.5 | B | 24.8 | C | 39.2 | D | 44.3 | D |
| 36. US 101 N/Nave Dr | 13.6 | B | 15.7 | B | 16.0 | B | 13.1 | B | 14.7 | B | 15.1 | B |

Notes: Results are expressed as Delay/LOS; Delay is measured in average seconds per vehicle; LOS = Level of Service

**Table 2 – PM Peak Hour Roadway LOS on Bel Marin Keys Boulevard with 300,000 square foot Industrial Parks Overlay**

| | Existing Conditions | | | Existing plus Project | | | Cumulative Conditions | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Speed** | **%FFS** | **LOS** | **Speed** | **%FFS** | **LOS** | **Speed** | **%FFS** | **LOS** |
| US 101 to Digital Drive | | | | | | | | | |
| Eastbound | 18 | 51% | C | 16 | 46% | D | 16 | 46% | D |
| Westbound | 19 | 54% | C | 18 | 51% | C | 17 | 49% | D |

Notes: Speed is measured in miles per hour; LOS = Level of Service; % FFS=percent free-flow speed; free-flow speed is 35 mph

**Table 3 – PM Peak Hour Freeway LOS with 300,000 square foot Industrial Parks Overlay**

| | Existing Conditions | | | Existing plus Project | | | Cumulative Conditions | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Speed** | **Density** | **LOS** | **Speed** | **Density** | **LOS** | **Speed** | **Density** | **LOS** |
| US 101 | | | | | | | | | |
| Northbound | 55.6 | 28.2 | D | 53.8 | 28.9 | D | 47.7 | 32.7 | D |
| Southbound | ≥65.0 | 17.7 | B | ≥65.0 | 19.9 | C | ≥65.0 | 22.0 | C |
| SR 37 | | | | | | | | | |
| Eastbound | ≥65.0 | 18.2 | C | ≥65.0 | 18.8 | C | ≥65.0 | 21.0 | C |
| Westbound | ≥65.0 | 9.8 | A | ≥65.0 | 10.1 | A | ≥65.0 | 10.9 | A |

Notes: Density is measured in passenger cars per mile per lane; LOS = Level of Service; Results reflect average conditions for the length of US 101 within Novato (some sub-segments operate at a lower LOS such as in the northern portion of the City approaching the Marin-Sonoma Narrows)

JZM/NOV126.M3

Attachments: Intersection, Roadway Segment, and Freeway Level of Service Calculations

## HCM Signalized Intersection Capacity Analysis
### 31: Alameda Del Prado & Ignacio Blvd

07/02/2019

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 12 | 870 | 448 | 255 | 357 | 18 | 67 | 4 | 230 | 7 | 2 | 0 |
| Future Volume (vph) | 12 | 870 | 448 | 255 | 357 | 18 | 67 | 4 | 230 | 7 | 2 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.6 | 3.6 | 3.0 | 3.6 | | | 3.5 | 3.5 | | 3.7 | |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | | 1.00 | 1.00 | | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.97 | 1.00 | 1.00 | | | 1.00 | 0.98 | | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.99 | 1.00 | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | | | 1.00 | 0.85 | | 1.00 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 0.95 | 1.00 | | 0.96 | |
| Satd. Flow (prot) | 1770 | 3610 | 1573 | 1900 | 3584 | | | 1786 | 1589 | | 1824 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 0.73 | 1.00 | | 0.85 | |
| Satd. Flow (perm) | 1770 | 3610 | 1573 | 1805 | 3584 | | | 1371 | 1589 | | 1609 | |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 12 | 906 | 467 | 266 | 372 | 19 | 70 | 4 | 240 | 7 | 2 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 86 | 0 | 2 | 0 | 0 | 0 | 208 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 13 | 906 | 381 | 266 | 389 | 0 | 0 | 74 | 32 | 0 | 9 | 0 |
| Confl. Peds. (#/hr) | | | 4 | | | | 7 | | 4 | 4 | | 7 |
| Heavy Vehicles (%) | 2% | 0% | 0% | 0% | 0% | 0% | 1% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Prot | NA | Perm | Prot | NA | | Perm | NA | Perm | Perm | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | 2 | | | | 8 | | 8 | 4 | | |
| Actuated Green, G (s) | 1.3 | 49.3 | 49.3 | 27.4 | 75.4 | | | 13.2 | 13.2 | | 13.0 | |
| Effective Green, g (s) | 1.3 | 49.3 | 49.3 | 27.4 | 75.4 | | | 13.2 | 13.2 | | 13.0 | |
| Actuated g/C Ratio | 0.01 | 0.49 | 0.49 | 0.27 | 0.75 | | | 0.13 | 0.13 | | 0.13 | |
| Clearance Time (s) | 3.0 | 3.6 | 3.6 | 3.0 | 3.6 | | | 3.5 | 3.5 | | 3.7 | |
| Vehicle Extension (s) | 2.0 | 3.0 | 3.0 | 2.0 | 3.0 | | | 2.0 | 2.0 | | 2.0 | |
| Lane Grp Cap (vph) | 23 | 1779 | 775 | 520 | 2702 | | | 180 | 209 | | 209 | |
| v/s Ratio Prot | 0.01 | c0.25 | | c0.14 | 0.11 | | | | | | | |
| v/s Ratio Perm | | | 0.24 | | | | | c0.05 | 0.02 | | 0.01 | |
| v/c Ratio | 0.57 | 0.51 | 0.49 | 0.51 | 0.14 | | | 0.41 | 0.15 | | 0.04 | |
| Uniform Delay, d1 | 49.1 | 17.2 | 17.0 | 30.6 | 3.4 | | | 39.8 | 38.4 | | 38.1 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 0.60 | 0.50 | | | 1.00 | 1.00 | | 1.00 | |
| Incremental Delay, d2 | 17.6 | 1.0 | 2.2 | 0.3 | 0.1 | | | 0.6 | 0.1 | | 0.0 | |
| Delay (s) | 66.6 | 18.2 | 19.2 | 18.7 | 1.8 | | | 40.4 | 38.6 | | 38.1 | |
| Level of Service | E | B | B | B | A | | | D | D | | D | |
| Approach Delay (s) | | 19.0 | | | 8.7 | | | 39.0 | | | 38.1 | |
| Approach LOS | | B | | | A | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 18.9 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.50 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 10.3 |
| Intersection Capacity Utilization | 62.9% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 32: US 101 SB Off Ramp/Enfrente Rd & Ignacio Blvd

07/02/2019

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 34 | 837 | 307 | 194 | 427 | 41 | 0 | 0 | 1063 | 264 | 137 | 211 |
| Future Volume (vph) | 34 | 837 | 307 | 194 | 427 | 41 | 0 | 0 | 1063 | 264 | 137 | 211 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Grade (%) | | 0% | | | 0% | | | 2% | | | 0% | |
| Total Lost time (s) | 3.0 | 8.0 | 8.0 | 4.0 | 5.0 | | | | 4.0 | | 4.0 | 4.0 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | | | 0.88 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.96 | 1.00 | 1.00 | | | | 1.00 | | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | | | | 0.85 | | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | | 1.00 | | 0.97 | 1.00 |
| Satd. Flow (prot) | 1805 | 3610 | 1550 | 1787 | 3545 | | | | 2814 | | 1809 | 1578 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | | 1.00 | | 0.97 | 1.00 |
| Satd. Flow (perm) | 1805 | 3610 | 1550 | 1787 | 3545 | | | | 2814 | | 1809 | 1578 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 35 | 872 | 320 | 202 | 445 | 43 | 0 | 0 | 1107 | 275 | 143 | 220 |
| RTOR Reduction (vph) | 0 | 0 | 135 | 0 | 6 | 0 | 0 | 0 | 325 | 0 | 0 | 158 |
| Lane Group Flow (vph) | 35 | 872 | 185 | 202 | 482 | 0 | 0 | 0 | 782 | 0 | 418 | 62 |
| Confl. Peds. (#/hr) | | | 7 | | | 20 | | | | | | 1 |
| Confl. Bikes (#/hr) | | | | | | 3 | | | | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 5% | 1% |
| Turn Type | Prot | NA | Perm | Prot | NA | | | | Over | Split | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | | | 1 | 7 | 7 | |
| Permitted Phases | | | 2 | | | | | | | | | 7 |
| Actuated Green, G (s) | 6.6 | 28.8 | 28.8 | 27.2 | 53.4 | | | | 27.2 | | 28.0 | 28.0 |
| Effective Green, g (s) | 6.6 | 28.8 | 28.8 | 27.2 | 53.4 | | | | 27.2 | | 28.0 | 28.0 |
| Actuated g/C Ratio | 0.07 | 0.29 | 0.29 | 0.27 | 0.53 | | | | 0.27 | | 0.28 | 0.28 |
| Clearance Time (s) | 3.0 | 8.0 | 8.0 | 4.0 | 5.0 | | | | 4.0 | | 4.0 | 4.0 |
| Vehicle Extension (s) | 2.0 | 2.5 | 2.5 | 3.0 | 4.0 | | | | 3.0 | | 2.5 | 2.5 |
| Lane Grp Cap (vph) | 119 | 1039 | 446 | 486 | 1893 | | | | 765 | | 506 | 441 |
| v/s Ratio Prot | 0.02 | c0.24 | | 0.11 | 0.14 | | | | c0.28 | | c0.23 | |
| v/s Ratio Perm | | | 0.12 | | | | | | | | | 0.04 |
| v/c Ratio | 0.29 | 0.84 | 0.42 | 0.42 | 0.25 | | | | 1.02 | | 0.83 | 0.14 |
| Uniform Delay, d1 | 44.5 | 33.4 | 28.8 | 29.9 | 12.6 | | | | 36.4 | | 33.7 | 27.0 |
| Progression Factor | 0.91 | 0.67 | 0.46 | 1.59 | 1.89 | | | | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.5 | 7.5 | 2.6 | 0.5 | 0.3 | | | | 38.4 | | 10.4 | 0.1 |
| Delay (s) | 40.8 | 30.0 | 16.0 | 48.1 | 24.1 | | | | 74.8 | | 44.1 | 27.1 |
| Level of Service | D | C | B | D | C | | | | E | | D | C |
| Approach Delay (s) | | 26.6 | | | 31.1 | | | 74.8 | | | 38.2 | |
| Approach LOS | | C | | | C | | | E | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 44.1 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.89 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 95.6% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 33: Nave Dr & Ignacio Blvd/Bel Marin Keys Blvd

07/02/2019

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 868 | 1293 | 100 | 222 | 213 | 443 | 526 | 645 | 0 | 0 | 0 |
| Future Volume (vph) | 0 | 868 | 1293 | 100 | 222 | 213 | 443 | 526 | 645 | 0 | 0 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.0 | 4.6 | 3.0 | 4.0 | | 4.6 | 4.6 | 3.0 | | | |
| Lane Util. Factor | | 0.95 | 1.00 | 1.00 | 0.95 | | 0.91 | 0.91 | 1.00 | | | |
| Frpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 0.99 | | 1.00 | 1.00 | 0.99 | | | |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | | |
| Frt | | 1.00 | 0.85 | 1.00 | 0.93 | | 1.00 | 1.00 | 0.85 | | | |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 0.99 | 1.00 | | | |
| Satd. Flow (prot) | | 3610 | 1607 | 1805 | 3290 | | 1643 | 3397 | 1599 | | | |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 0.99 | 1.00 | | | |
| Satd. Flow (perm) | | 3610 | 1607 | 1805 | 3290 | | 1643 | 3397 | 1599 | | | |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 0 | 923 | 1376 | 106 | 236 | 227 | 471 | 560 | 686 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 82 | 0 | 128 | 0 | 0 | 0 | 5 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 923 | 1294 | 106 | 335 | 0 | 334 | 697 | 681 | 0 | 0 | 0 |
| Confl. Peds. (#/hr) | | | 1 | | | 1 | | | 1 | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 2% | 0% | 1% | 0% | 0% | 0% | 0% |
| Turn Type | | NA | pm+ov | Prot | NA | | Split | NA | pm+ov | | | |
| Protected Phases | | 2 | 3 | 1 | 6 | | 3 | 3 | 1 | | | |
| Permitted Phases | | | 2 | | | | | | 3 | | | |
| Actuated Green, G (s) | | 28.4 | 76.4 | 12.0 | 43.4 | | 48.0 | 48.0 | 60.0 | | | |
| Effective Green, g (s) | | 28.4 | 76.4 | 12.0 | 43.4 | | 48.0 | 48.0 | 60.0 | | | |
| Actuated g/C Ratio | | 0.28 | 0.76 | 0.12 | 0.43 | | 0.48 | 0.48 | 0.60 | | | |
| Clearance Time (s) | | 4.0 | 4.6 | 3.0 | 4.0 | | 4.6 | 4.6 | 3.0 | | | |
| Vehicle Extension (s) | | 4.0 | 2.0 | 2.0 | 4.0 | | 2.0 | 2.0 | 2.0 | | | |
| Lane Grp Cap (vph) | | 1025 | 1227 | 216 | 1427 | | 788 | 1630 | 959 | | | |
| v/s Ratio Prot | | 0.26 | c0.51 | 0.06 | 0.10 | | 0.20 | 0.21 | c0.09 | | | |
| v/s Ratio Perm | | | 0.30 | | | | | | 0.34 | | | |
| v/c Ratio | | 0.90 | 1.05 | 0.49 | 0.23 | | 0.42 | 0.43 | 0.71 | | | |
| Uniform Delay, d1 | | 34.4 | 11.8 | 41.1 | 17.8 | | 17.0 | 17.0 | 13.9 | | | |
| Progression Factor | | 0.96 | 1.35 | 1.19 | 0.93 | | 1.00 | 1.00 | 1.00 | | | |
| Incremental Delay, d2 | | 6.1 | 33.7 | 0.6 | 0.4 | | 0.1 | 0.1 | 2.0 | | | |
| Delay (s) | | 39.1 | 49.6 | 49.8 | 16.9 | | 17.1 | 17.1 | 15.9 | | | |
| Level of Service | | D | D | D | B | | B | B | B | | | |
| Approach Delay (s) | | 45.4 | | | 23.0 | | | 16.6 | | | 0.0 | |
| Approach LOS | | D | | | C | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 31.8 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 1.01 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 11.6 |
| Intersection Capacity Utilization | 97.3% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 34: Bel Marin Keys Blvd & Commercial Blvd

07/02/2019

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 0 | 11 | 73 | 0 | 9 | 46 | 1244 | 230 | 12 | 444 | 1 |
| Future Volume (vph) | 0 | 0 | 11 | 73 | 0 | 9 | 46 | 1244 | 230 | 12 | 444 | 1 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.0 | | | 4.0 | 4.0 | 3.0 | 3.9 | | 3.0 | 3.5 | |
| Lane Util. Factor | | 1.00 | | | 1.00 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | | 0.99 | | | 1.00 | 0.98 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 0.86 | | | 1.00 | 0.85 | 1.00 | 0.98 | | 1.00 | 1.00 | |
| Flt Protected | | 1.00 | | | 0.95 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 1620 | | | 1801 | 1395 | 1805 | 3511 | | 1805 | 3573 | |
| Flt Permitted | | 1.00 | | | 0.75 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | | 1620 | | | 1421 | 1395 | 1805 | 3511 | | 1805 | 3573 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 0 | 0 | 12 | 77 | 0 | 9 | 48 | 1309 | 242 | 13 | 467 | 1 |
| RTOR Reduction (vph) | 0 | 11 | 0 | 0 | 0 | 8 | 0 | 8 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 1 | 0 | 0 | 77 | 1 | 48 | 1543 | 0 | 13 | 468 | 0 |
| Confl. Peds. (#/hr) | 3 | | 2 | 2 | | 3 | | | 3 | | | |
| Heavy Vehicles (%) | 2% | 0% | 0% | 0% | 0% | 14% | 0% | 0% | 0% | 0% | 1% | 0% |
| Turn Type | | NA | | Perm | NA | Perm | Prot | NA | | Prot | NA | |
| Protected Phases | | 4 | | | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | | | | | | |
| Actuated Green, G (s) | | 12.1 | | | 12.1 | 12.1 | 5.3 | 75.2 | | 1.8 | 72.1 | |
| Effective Green, g (s) | | 12.1 | | | 12.1 | 12.1 | 5.3 | 75.2 | | 1.8 | 72.1 | |
| Actuated g/C Ratio | | 0.12 | | | 0.12 | 0.12 | 0.05 | 0.75 | | 0.02 | 0.72 | |
| Clearance Time (s) | | 4.0 | | | 4.0 | 4.0 | 3.0 | 3.9 | | 3.0 | 3.5 | |
| Vehicle Extension (s) | | 3.0 | | | 3.0 | 3.0 | 2.5 | 3.0 | | 2.5 | 4.0 | |
| Lane Grp Cap (vph) | | 196 | | | 171 | 168 | 95 | 2640 | | 32 | 2576 | |
| v/s Ratio Prot | | 0.00 | | | | | c0.03 | c0.44 | | 0.01 | 0.13 | |
| v/s Ratio Perm | | | | | c0.05 | 0.00 | | | | | | |
| v/c Ratio | | 0.01 | | | 0.45 | 0.01 | 0.51 | 0.58 | | 0.41 | 0.18 | |
| Uniform Delay, d1 | | 38.7 | | | 40.9 | 38.7 | 46.1 | 5.5 | | 48.6 | 4.5 | |
| Progression Factor | | 1.00 | | | 1.00 | 1.00 | 0.92 | 0.70 | | 0.93 | 1.33 | |
| Incremental Delay, d2 | | 0.0 | | | 1.9 | 0.0 | 1.7 | 0.5 | | 6.0 | 0.2 | |
| Delay (s) | | 38.7 | | | 42.7 | 38.7 | 43.9 | 4.4 | | 51.3 | 6.1 | |
| Level of Service | | D | | | D | D | D | A | | D | A | |
| Approach Delay (s) | | 38.7 | | | 42.3 | | | 5.6 | | | 7.4 | |
| Approach LOS | | D | | | D | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 7.6 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.58 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 10.9 |
| Intersection Capacity Utilization | 64.6% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 35: Bel Marin Keys Blvd & Hamilton Dr/Digital Dr

07/02/2019

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 1 | 46 | 88 | 2 | 9 | 104 | 603 | 544 | 9 | 322 | 3 |
| Future Volume (vph) | 0 | 1 | 46 | 88 | 2 | 9 | 104 | 603 | 544 | 9 | 322 | 3 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.5 | 3.5 | 3.5 | 3.5 | | 3.0 | 4.0 | | 3.0 | 4.0 | |
| Lane Util. Factor | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | | 1.00 | 0.99 | 1.00 | 0.99 | | 1.00 | 0.99 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 1.00 | 0.85 | 1.00 | 0.88 | | 1.00 | 0.93 | | 1.00 | 1.00 | |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 1900 | 1533 | 1803 | 1649 | | 1770 | 3315 | | 1805 | 3569 | |
| Flt Permitted | | 1.00 | 1.00 | 0.76 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | | 1900 | 1533 | 1437 | 1649 | | 1770 | 3315 | | 1805 | 3569 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 0 | 1 | 48 | 93 | 2 | 9 | 109 | 635 | 573 | 9 | 339 | 3 |
| RTOR Reduction (vph) | 0 | 0 | 42 | 0 | 8 | 0 | 0 | 78 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 1 | 6 | 93 | 3 | 0 | 109 | 1130 | 0 | 9 | 342 | 0 |
| Confl. Peds. (#/hr) | 1 | | 1 | 1 | | 1 | | | 2 | | | 8 |
| Heavy Vehicles (%) | 0% | 0% | 4% | 0% | 0% | 0% | 2% | 0% | 0% | 0% | 1% | 0% |
| Turn Type | | NA | Perm | Perm | NA | | Prot | NA | | Prot | NA | |
| Protected Phases | | 4 | | | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | 4 | 8 | | | | | | | | |
| Actuated Green, G (s) | | 12.6 | 12.6 | 12.6 | 12.6 | | 11.2 | 75.1 | | 1.8 | 65.7 | |
| Effective Green, g (s) | | 12.6 | 12.6 | 12.6 | 12.6 | | 11.2 | 75.1 | | 1.8 | 65.7 | |
| Actuated g/C Ratio | | 0.13 | 0.13 | 0.13 | 0.13 | | 0.11 | 0.75 | | 0.02 | 0.66 | |
| Clearance Time (s) | | 3.5 | 3.5 | 3.5 | 3.5 | | 3.0 | 4.0 | | 3.0 | 4.0 | |
| Vehicle Extension (s) | | 2.0 | 2.0 | 2.5 | 2.5 | | 2.0 | 4.0 | | 2.0 | 4.0 | |
| Lane Grp Cap (vph) | | 239 | 193 | 181 | 207 | | 198 | 2489 | | 32 | 2344 | |
| v/s Ratio Prot | | 0.00 | | | 0.00 | | c0.06 | c0.34 | | 0.00 | 0.10 | |
| v/s Ratio Perm | | | 0.00 | c0.06 | | | | | | | | |
| v/c Ratio | | 0.00 | 0.03 | 0.51 | 0.02 | | 0.55 | 0.45 | | 0.28 | 0.15 | |
| Uniform Delay, d1 | | 38.2 | 38.3 | 40.8 | 38.3 | | 42.0 | 4.7 | | 48.5 | 6.5 | |
| Progression Factor | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.04 | 1.34 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 0.0 | 0.0 | 1.8 | 0.0 | | 1.6 | 0.5 | | 1.8 | 0.1 | |
| Delay (s) | | 38.2 | 38.4 | 42.7 | 38.3 | | 45.3 | 6.8 | | 50.2 | 6.6 | |
| Level of Service | | D | D | D | D | | D | A | | D | A | |
| Approach Delay (s) | | 38.4 | | | 42.2 | | | 10.0 | | | 7.8 | |
| Approach LOS | | D | | | D | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 12.2 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.49 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 10.5 |
| Intersection Capacity Utilization | 63.6% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 36: Nave Dr & US 101 NB Off Ramp

07/02/2019

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 744 | 174 | 0 | 870 | 1191 | 188 |
| Future Volume (vph) | 744 | 174 | 0 | 870 | 1191 | 188 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | | 5.0 | 5.0 | |
| Lane Util. Factor | 0.97 | 1.00 | | 0.95 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 0.99 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.85 | | 1.00 | 0.98 | |
| Flt Protected | 0.95 | 1.00 | | 1.00 | 1.00 | |
| Satd. Flow (prot) | 3467 | 1563 | | 3574 | 3506 | |
| Flt Permitted | 0.95 | 1.00 | | 1.00 | 1.00 | |
| Satd. Flow (perm) | 3467 | 1563 | | 3574 | 3506 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 809 | 189 | 0 | 946 | 1295 | 204 |
| RTOR Reduction (vph) | 0 | 20 | 0 | 0 | 18 | 0 |
| Lane Group Flow (vph) | 809 | 169 | 0 | 946 | 1481 | 0 |
| Confl. Peds. (#/hr) | | 1 | | | | |
| Heavy Vehicles (%) | 1% | 2% | 0% | 1% | 1% | 0% |
| Turn Type | Prot | Perm | | NA | NA | |
| Protected Phases | 4 | | | 2 | 6 | |
| Permitted Phases | | 4 | | | | |
| Actuated Green, G (s) | 27.0 | 27.0 | | 35.0 | 35.0 | |
| Effective Green, g (s) | 27.0 | 27.0 | | 35.0 | 35.0 | |
| Actuated g/C Ratio | 0.39 | 0.39 | | 0.50 | 0.50 | |
| Clearance Time (s) | 3.0 | 3.0 | | 5.0 | 5.0 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 1337 | 602 | | 1787 | 1753 | |
| v/s Ratio Prot | c0.23 | | | 0.26 | c0.42 | |
| v/s Ratio Perm | | 0.11 | | | | |
| v/c Ratio | 0.61 | 0.28 | | 0.53 | 0.84 | |
| Uniform Delay, d1 | 17.2 | 14.8 | | 11.9 | 15.1 | |
| Progression Factor | 1.00 | 1.00 | | 0.36 | 1.00 | |
| Incremental Delay, d2 | 2.0 | 1.2 | | 1.0 | 5.2 | |
| Delay (s) | 19.3 | 16.0 | | 5.2 | 20.4 | |
| Level of Service | B | B | | A | C | |
| Approach Delay (s) | 18.6 | | | 5.2 | 20.4 | |
| Approach LOS | B | | | A | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 15.7 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.74 | | |
| Actuated Cycle Length (s) | 70.0 | Sum of lost time (s) | 8.0 |
| Intersection Capacity Utilization | 68.9% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 31: Alameda Del Prado & Ignacio Blvd

07/02/2019

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 10 | 446 | 78 | 332 | 732 | 34 | 98 | 4 | 162 | 28 | 5 | 1 |
| Future Volume (vph) | 10 | 446 | 78 | 332 | 732 | 34 | 98 | 4 | 162 | 28 | 5 | 1 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.6 | 3.6 | 3.0 | 3.6 | | | 3.5 | 3.5 | | 3.7 | |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | | 1.00 | 1.00 | | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.97 | 1.00 | 1.00 | | | 1.00 | 0.98 | | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.99 | 1.00 | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | | | 1.00 | 0.85 | | 1.00 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 0.95 | 1.00 | | 0.96 | |
| Satd. Flow (prot) | 1770 | 3610 | 1573 | 1900 | 3586 | | | 1784 | 1589 | | 1812 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 0.76 | 1.00 | | 0.76 | |
| Satd. Flow (perm) | 1770 | 3610 | 1573 | 1805 | 3586 | | | 1421 | 1589 | | 1431 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 11 | 469 | 82 | 349 | 771 | 36 | 103 | 4 | 171 | 29 | 5 | 1 |
| RTOR Reduction (vph) | 0 | 0 | 30 | 0 | 2 | 0 | 0 | 0 | 146 | 0 | 1 | 0 |
| Lane Group Flow (vph) | 11 | 469 | 52 | 349 | 805 | 0 | 0 | 107 | 25 | 0 | 34 | 0 |
| Confl. Peds. (#/hr) | | | 4 | | | | 7 | | 4 | 4 | | 7 |
| Heavy Vehicles (%) | 2% | 0% | 0% | 0% | 0% | 0% | 1% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Prot | NA | Perm | Prot | NA | | Perm | NA | Perm | Perm | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | 2 | | | | 8 | | 8 | 4 | | |
| Actuated Green, G (s) | 1.2 | 47.6 | 47.6 | 27.4 | 73.8 | | | 14.9 | 14.9 | | 14.7 | |
| Effective Green, g (s) | 1.2 | 47.6 | 47.6 | 27.4 | 73.8 | | | 14.9 | 14.9 | | 14.7 | |
| Actuated g/C Ratio | 0.01 | 0.48 | 0.48 | 0.27 | 0.74 | | | 0.15 | 0.15 | | 0.15 | |
| Clearance Time (s) | 3.0 | 3.6 | 3.6 | 3.0 | 3.6 | | | 3.5 | 3.5 | | 3.7 | |
| Vehicle Extension (s) | 2.0 | 3.0 | 3.0 | 2.0 | 3.0 | | | 2.0 | 2.0 | | 2.0 | |
| Lane Grp Cap (vph) | 21 | 1718 | 748 | 520 | 2646 | | | 211 | 236 | | 210 | |
| v/s Ratio Prot | c0.01 | 0.13 | | c0.18 | c0.22 | | | | | | | |
| v/s Ratio Perm | | | 0.03 | | | | | c0.08 | 0.02 | | 0.02 | |
| v/c Ratio | 0.52 | 0.27 | 0.07 | 0.67 | 0.30 | | | 0.51 | 0.11 | | 0.16 | |
| Uniform Delay, d1 | 49.1 | 15.8 | 14.2 | 32.3 | 4.4 | | | 39.2 | 36.8 | | 37.3 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 0.73 | 0.75 | | | 1.00 | 1.00 | | 1.00 | |
| Incremental Delay, d2 | 10.4 | 0.4 | 0.2 | 2.4 | 0.3 | | | 0.7 | 0.1 | | 0.1 | |
| Delay (s) | 59.5 | 16.2 | 14.4 | 26.1 | 3.6 | | | 39.9 | 36.9 | | 37.4 | |
| Level of Service | E | B | B | C | A | | | D | D | | D | |
| Approach Delay (s) | | 16.8 | | | 10.4 | | | 38.0 | | | 37.4 | |
| Approach LOS | | B | | | B | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 16.4 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.45 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 10.3 |
| Intersection Capacity Utilization | 68.1% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 32: US 101 SB Off Ramp/Enfrente Rd & Ignacio Blvd/Ignacio Blvd #3

07/02/2019

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 33 | 393 | 264 | 633 | 813 | 139 | 0 | 0 | 767 | 189 | 89 | 296 |
| Future Volume (vph) | 33 | 393 | 264 | 633 | 813 | 139 | 0 | 0 | 767 | 189 | 89 | 296 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Grade (%) | | 0% | | | 0% | | | 2% | | | 0% | |
| Total Lost time (s) | 3.0 | 8.0 | 8.0 | 4.0 | 5.0 | | | | 4.0 | | 4.0 | 4.0 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | | | 0.88 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.96 | 1.00 | 0.99 | | | | 1.00 | | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.98 | | | | 0.85 | | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | | 1.00 | | 0.97 | 1.00 |
| Satd. Flow (prot) | 1805 | 3610 | 1550 | 1787 | 3503 | | | | 2814 | | 1809 | 1578 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | | 1.00 | | 0.97 | 1.00 |
| Satd. Flow (perm) | 1805 | 3610 | 1550 | 1787 | 3503 | | | | 2814 | | 1809 | 1578 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 34 | 409 | 275 | 659 | 847 | 145 | 0 | 0 | 799 | 197 | 93 | 308 |
| RTOR Reduction (vph) | 0 | 0 | 201 | 0 | 10 | 0 | 0 | 0 | 409 | 0 | 0 | 241 |
| Lane Group Flow (vph) | 34 | 409 | 74 | 659 | 982 | 0 | 0 | 0 | 390 | 0 | 290 | 67 |
| Confl. Peds. (#/hr) | | | 7 | | | 20 | | | | | | 1 |
| Confl. Bikes (#/hr) | | | | | | 3 | | | | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 5% | 1% |
| Turn Type | Prot | NA | Perm | Prot | NA | | | | Over | Split | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | | | 1 | 7 | 7 | |
| Permitted Phases | | | 2 | | | | | | | | | 7 |
| Actuated Green, G (s) | 6.6 | 26.9 | 26.9 | 35.2 | 59.5 | | | | 35.2 | | 21.9 | 21.9 |
| Effective Green, g (s) | 6.6 | 26.9 | 26.9 | 35.2 | 59.5 | | | | 35.2 | | 21.9 | 21.9 |
| Actuated g/C Ratio | 0.07 | 0.27 | 0.27 | 0.35 | 0.60 | | | | 0.35 | | 0.22 | 0.22 |
| Clearance Time (s) | 3.0 | 8.0 | 8.0 | 4.0 | 5.0 | | | | 4.0 | | 4.0 | 4.0 |
| Vehicle Extension (s) | 2.0 | 2.5 | 2.5 | 3.0 | 4.0 | | | | 3.0 | | 2.5 | 2.5 |
| Lane Grp Cap (vph) | 119 | 971 | 416 | 629 | 2084 | | | | 990 | | 396 | 345 |
| v/s Ratio Prot | 0.02 | c0.11 | | c0.37 | c0.28 | | | | 0.14 | | c0.16 | |
| v/s Ratio Perm | | | 0.05 | | | | | | | | | 0.04 |
| v/c Ratio | 0.29 | 0.42 | 0.18 | 1.05 | 0.47 | | | | 0.39 | | 0.73 | 0.20 |
| Uniform Delay, d1 | 44.5 | 30.1 | 28.1 | 32.4 | 11.4 | | | | 24.4 | | 36.3 | 31.9 |
| Progression Factor | 0.98 | 0.68 | 0.40 | 0.80 | 0.75 | | | | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.5 | 1.3 | 0.9 | 39.5 | 0.4 | | | | 0.3 | | 6.5 | 0.2 |
| Delay (s) | 44.1 | 21.9 | 12.2 | 65.6 | 8.9 | | | | 24.6 | | 42.8 | 32.1 |
| Level of Service | D | C | B | E | A | | | | C | | D | C |
| Approach Delay (s) | | 19.2 | | | 31.5 | | | 24.6 | | | 37.3 | |
| Approach LOS | | B | | | C | | | C | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 28.6 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.79 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 81.0% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 33: Nave Dr & Ignacio Blvd #3/Bel Marin Keys Blvd #3

07/02/2019

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 342 | 1013 | 128 | 703 | 686 | 868 | 749 | 264 | 0 | 0 | 0 |
| Future Volume (vph) | 0 | 342 | 1013 | 128 | 703 | 686 | 868 | 749 | 264 | 0 | 0 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.0 | 4.6 | 3.0 | 4.0 | | 4.6 | 4.6 | 3.0 | | | |
| Lane Util. Factor | | 0.95 | 1.00 | 1.00 | 0.95 | | 0.91 | 0.91 | 1.00 | | | |
| Frpb, ped/bikes | | 1.00 | 0.99 | 1.00 | 0.99 | | 1.00 | 1.00 | 0.99 | | | |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | | |
| Frt | | 1.00 | 0.85 | 1.00 | 0.93 | | 1.00 | 1.00 | 0.85 | | | |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 0.98 | 1.00 | | | |
| Satd. Flow (prot) | | 3610 | 1605 | 1805 | 3288 | | 1643 | 3382 | 1600 | | | |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 0.98 | 1.00 | | | |
| Satd. Flow (perm) | | 3610 | 1605 | 1805 | 3288 | | 1643 | 3382 | 1600 | | | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 0 | 360 | 1066 | 135 | 740 | 722 | 914 | 788 | 278 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 76 | 0 | 42 | 0 | 0 | 0 | 124 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 360 | 990 | 135 | 1420 | 0 | 558 | 1144 | 154 | 0 | 0 | 0 |
| Confl. Peds. (#/hr) | | | 1 | | | 1 | | | 1 | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 2% | 0% | 1% | 0% | 0% | 0% | 0% |
| Turn Type | | NA | pm+ov | Prot | NA | | Split | NA | pm+ov | | | |
| Protected Phases | | 2 | 3 | 1 | 6 | | 3 | 3 | 1 | | | |
| Permitted Phases | | | 2 | | | | | | 3 | | | |
| Actuated Green, G (s) | | 35.8 | 75.6 | 12.8 | 51.6 | | 39.8 | 39.8 | 52.6 | | | |
| Effective Green, g (s) | | 35.8 | 75.6 | 12.8 | 51.6 | | 39.8 | 39.8 | 52.6 | | | |
| Actuated g/C Ratio | | 0.36 | 0.76 | 0.13 | 0.52 | | 0.40 | 0.40 | 0.53 | | | |
| Clearance Time (s) | | 4.0 | 4.6 | 3.0 | 4.0 | | 4.6 | 4.6 | 3.0 | | | |
| Vehicle Extension (s) | | 4.0 | 2.0 | 2.0 | 4.0 | | 2.0 | 2.0 | 2.0 | | | |
| Lane Grp Cap (vph) | | 1292 | 1213 | 231 | 1696 | | 653 | 1346 | 841 | | | |
| v/s Ratio Prot | | 0.10 | 0.32 | 0.07 | c0.43 | | c0.34 | 0.34 | 0.02 | | | |
| v/s Ratio Perm | | | 0.29 | | | | | | 0.07 | | | |
| v/c Ratio | | 0.28 | 0.82 | 0.58 | 0.84 | | 0.85 | 0.85 | 0.18 | | | |
| Uniform Delay, d1 | | 22.9 | 7.8 | 41.1 | 20.6 | | 27.5 | 27.4 | 12.4 | | | |
| Progression Factor | | 1.08 | 1.03 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | | |
| Incremental Delay, d2 | | 0.5 | 3.6 | 2.4 | 5.1 | | 10.2 | 5.0 | 0.0 | | | |
| Delay (s) | | 25.3 | 11.6 | 43.5 | 25.7 | | 37.7 | 32.4 | 12.5 | | | |
| Level of Service | | C | B | D | C | | D | C | B | | | |
| Approach Delay (s) | | 15.1 | | | 27.2 | | | 31.1 | | | 0.0 | |
| Approach LOS | | B | | | C | | | C | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 25.3 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.87 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 11.6 |
| Intersection Capacity Utilization | 80.0% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 34: Bel Marin Keys Blvd #3 & Commercial Blvd

07/02/2019

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 3 | 0 | 38 | 278 | 1 | 28 | 46 | 514 | 78 | 31 | 1306 | 7 |
| Future Volume (vph) | 3 | 0 | 38 | 278 | 1 | 28 | 46 | 514 | 78 | 31 | 1306 | 7 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.0 | | | 4.0 | 4.0 | 3.0 | 3.9 | | 3.0 | 3.5 | |
| Lane Util. Factor | | 1.00 | | | 1.00 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | | 0.99 | | | 1.00 | 0.99 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 0.87 | | | 1.00 | 0.85 | 1.00 | 0.98 | | 1.00 | 1.00 | |
| Flt Protected | | 1.00 | | | 0.95 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 1632 | | | 1807 | 1396 | 1805 | 3527 | | 1805 | 3572 | |
| Flt Permitted | | 0.98 | | | 0.69 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | | 1607 | | | 1316 | 1396 | 1805 | 3527 | | 1805 | 3572 | |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Adj. Flow (vph) | 3 | 0 | 42 | 309 | 1 | 31 | 51 | 571 | 87 | 34 | 1451 | 8 |
| RTOR Reduction (vph) | 0 | 32 | 0 | 0 | 0 | 22 | 0 | 12 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 13 | 0 | 0 | 310 | 9 | 51 | 646 | 0 | 34 | 1459 | 0 |
| Confl. Peds. (#/hr) | 3 | | 2 | 2 | | 3 | | | 3 | | | |
| Heavy Vehicles (%) | 2% | 0% | 0% | 0% | 0% | 14% | 0% | 0% | 0% | 0% | 1% | 0% |
| Turn Type | Perm | NA | | Perm | NA | Perm | Prot | NA | | Prot | NA | |
| Protected Phases | | 4 | | | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | | | | | | |
| Actuated Green, G (s) | | 22.1 | | | 22.1 | 22.1 | 4.2 | 38.4 | | 3.6 | 38.2 | |
| Effective Green, g (s) | | 22.1 | | | 22.1 | 22.1 | 4.2 | 38.4 | | 3.6 | 38.2 | |
| Actuated g/C Ratio | | 0.29 | | | 0.29 | 0.29 | 0.06 | 0.51 | | 0.05 | 0.51 | |
| Clearance Time (s) | | 4.0 | | | 4.0 | 4.0 | 3.0 | 3.9 | | 3.0 | 3.5 | |
| Vehicle Extension (s) | | 3.0 | | | 3.0 | 3.0 | 2.5 | 3.0 | | 2.5 | 4.0 | |
| Lane Grp Cap (vph) | | 473 | | | 387 | 411 | 101 | 1805 | | 86 | 1819 | |
| v/s Ratio Prot | | | | | | | c0.03 | 0.18 | | 0.02 | c0.41 | |
| v/s Ratio Perm | | 0.01 | | | c0.24 | 0.01 | | | | | | |
| v/c Ratio | | 0.03 | | | 0.80 | 0.02 | 0.50 | 0.36 | | 0.40 | 0.80 | |
| Uniform Delay, d1 | | 18.8 | | | 24.4 | 18.8 | 34.4 | 10.9 | | 34.6 | 15.3 | |
| Progression Factor | | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.08 | 1.01 | |
| Incremental Delay, d2 | | 0.0 | | | 11.3 | 0.0 | 2.9 | 0.6 | | 1.5 | 2.7 | |
| Delay (s) | | 18.8 | | | 35.7 | 18.8 | 37.3 | 11.5 | | 38.9 | 18.2 | |
| Level of Service | | B | | | D | B | D | B | | D | B | |
| Approach Delay (s) | | 18.8 | | | 34.2 | | | 13.3 | | | 18.7 | |
| Approach LOS | | B | | | C | | | B | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 19.3 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.79 | | |
| Actuated Cycle Length (s) | 75.0 | Sum of lost time (s) | 10.9 |
| Intersection Capacity Utilization | 67.1% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 35: Bel Marin Keys Blvd #3 & Hamilton Dr/Digital Dr



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 5 | 7 | 154 | 556 | 4 | 13 | 45 | 367 | 117 | 6 | 639 | 2 |
| Future Volume (vph) | 5 | 7 | 154 | 556 | 4 | 13 | 45 | 367 | 117 | 6 | 639 | 2 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.5 | 3.5 | 3.5 | 3.5 | | 3.0 | 4.0 | | 3.0 | 4.0 | |
| Lane Util. Factor | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | | 1.00 | 0.98 | 1.00 | 0.99 | | 1.00 | 0.99 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | 1.00 | 0.99 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 1.00 | 0.85 | 1.00 | 0.88 | | 1.00 | 0.96 | | 1.00 | 1.00 | |
| Flt Protected | | 0.98 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 1864 | 1522 | 1739 | 1662 | | 1770 | 3381 | | 1805 | 3537 | |
| Flt Permitted | | 0.96 | 1.00 | 0.75 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | | 1823 | 1522 | 1371 | 1662 | | 1770 | 3381 | | 1805 | 3537 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 5 | 8 | 167 | 604 | 4 | 14 | 49 | 399 | 127 | 7 | 695 | 2 |
| RTOR Reduction (vph) | 0 | 0 | 99 | 0 | 8 | 0 | 0 | 35 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 13 | 68 | 604 | 10 | 0 | 49 | 491 | 0 | 7 | 697 | 0 |
| Confl. Peds. (#/hr) | 1 | | 10 | 10 | | 1 | | | 2 | | | 8 |
| Confl. Bikes (#/hr) | | | | | | | | | 5 | | | 5 |
| Heavy Vehicles (%) | 0% | 0% | 4% | 3% | 0% | 0% | 2% | 2% | 3% | 0% | 2% | 0% |
| Turn Type | Perm | NA | Perm | Perm | NA | | Prot | NA | | Prot | NA | |
| Protected Phases | | 4 | | | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | 4 | 8 | | | | | | | | |
| Actuated Green, G (s) | | 30.5 | 30.5 | 30.5 | 30.5 | | 5.4 | 32.2 | | 1.8 | 28.6 | |
| Effective Green, g (s) | | 30.5 | 30.5 | 30.5 | 30.5 | | 5.4 | 32.2 | | 1.8 | 28.6 | |
| Actuated g/C Ratio | | 0.41 | 0.41 | 0.41 | 0.41 | | 0.07 | 0.43 | | 0.02 | 0.38 | |
| Clearance Time (s) | | 3.5 | 3.5 | 3.5 | 3.5 | | 3.0 | 4.0 | | 3.0 | 4.0 | |
| Vehicle Extension (s) | | 2.0 | 2.0 | 2.5 | 2.5 | | 2.0 | 4.0 | | 2.0 | 4.0 | |
| Lane Grp Cap (vph) | | 741 | 618 | 557 | 675 | | 127 | 1451 | | 43 | 1348 | |
| v/s Ratio Prot | | | | | 0.01 | | c0.03 | 0.15 | | 0.00 | c0.20 | |
| v/s Ratio Perm | | 0.01 | 0.04 | c0.44 | | | | | | | | |
| v/c Ratio | | 0.02 | 0.11 | 1.08 | 0.01 | | 0.39 | 0.34 | | 0.16 | 0.52 | |
| Uniform Delay, d1 | | 13.3 | 13.8 | 22.2 | 13.3 | | 33.2 | 14.3 | | 35.9 | 17.9 | |
| Progression Factor | | 1.00 | 1.00 | 1.00 | 1.00 | | 0.80 | 1.59 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 0.0 | 0.0 | 63.0 | 0.0 | | 0.7 | 0.6 | | 0.7 | 1.4 | |
| Delay (s) | | 13.3 | 13.8 | 85.3 | 13.3 | | 27.3 | 23.4 | | 36.5 | 19.3 | |
| Level of Service | | B | B | F | B | | C | C | | D | B | |
| Approach Delay (s) | | 13.8 | | | 83.2 | | | 23.7 | | | 19.5 | |
| Approach LOS | | B | | | F | | | C | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 39.2 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.77 | | |
| Actuated Cycle Length (s) | 75.0 | Sum of lost time (s) | 10.5 |
| Intersection Capacity Utilization | 75.8% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |



## HCM Signalized Intersection Capacity Analysis
### 36: Nave Dr & US 101 NB Off Ramp



| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 714 | 233 | 0 | 1175 | 888 | 238 |
| Future Volume (vph) | 714 | 233 | 0 | 1175 | 888 | 238 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | | 5.0 | 5.0 | |
| Lane Util. Factor | 0.97 | 1.00 | | 0.95 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 0.99 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.85 | | 1.00 | 0.97 | |
| Flt Protected | 0.95 | 1.00 | | 1.00 | 1.00 | |
| Satd. Flow (prot) | 3467 | 1563 | | 3574 | 3468 | |
| Flt Permitted | 0.95 | 1.00 | | 1.00 | 1.00 | |
| Satd. Flow (perm) | 3467 | 1563 | | 3574 | 3468 | |
| Peak-hour factor, PHF | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Adj. Flow (vph) | 729 | 238 | 0 | 1199 | 906 | 243 |
| RTOR Reduction (vph) | 0 | 40 | 0 | 0 | 35 | 0 |
| Lane Group Flow (vph) | 729 | 198 | 0 | 1199 | 1114 | 0 |
| Confl. Peds. (#/hr) | | 1 | | | | |
| Heavy Vehicles (%) | 1% | 2% | 0% | 1% | 1% | 0% |
| Turn Type | Prot | Perm | | NA | NA | |
| Protected Phases | 4 | | | 2 | 6 | |
| Permitted Phases | | 4 | | | | |
| Actuated Green, G (s) | 31.0 | 31.0 | | 31.0 | 31.0 | |
| Effective Green, g (s) | 31.0 | 31.0 | | 31.0 | 31.0 | |
| Actuated g/C Ratio | 0.44 | 0.44 | | 0.44 | 0.44 | |
| Clearance Time (s) | 3.0 | 3.0 | | 5.0 | 5.0 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 1535 | 692 | | 1582 | 1535 | |
| v/s Ratio Prot | c0.21 | | | c0.34 | 0.32 | |
| v/s Ratio Perm | | 0.13 | | | | |
| v/c Ratio | 0.47 | 0.29 | | 0.76 | 0.73 | |
| Uniform Delay, d1 | 13.8 | 12.4 | | 16.4 | 16.0 | |
| Progression Factor | 1.00 | 1.00 | | 0.49 | 1.00 | |
| Incremental Delay, d2 | 1.1 | 1.0 | | 2.5 | 3.0 | |
| Delay (s) | 14.8 | 13.5 | | 10.6 | 19.0 | |
| Level of Service | B | B | | B | B | |
| Approach Delay (s) | 14.5 | | | 10.6 | 19.0 | |
| Approach LOS | B | | | B | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 14.7 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.62 | | |
| Actuated Cycle Length (s) | 70.0 | Sum of lost time (s) | 8.0 |
| Intersection Capacity Utilization | 62.5% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
### 31: Alameda Del Prado & Ignacio Blvd

07/02/2019

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 13 | 886 | 469 | 268 | 372 | 19 | 69 | 4 | 240 | 7 | 2 | 0 |
| Future Volume (vph) | 13 | 886 | 469 | 268 | 372 | 19 | 69 | 4 | 240 | 7 | 2 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.6 | 3.6 | 3.0 | 3.6 | | | 3.5 | 3.5 | | 3.7 | |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | | 1.00 | 1.00 | | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.97 | 1.00 | 1.00 | | | 1.00 | 0.98 | | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.99 | 1.00 | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | | | 1.00 | 0.85 | | 1.00 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 0.95 | 1.00 | | 0.96 | |
| Satd. Flow (prot) | 1770 | 3610 | 1573 | 1900 | 3583 | | | 1786 | 1589 | | 1824 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 0.73 | 1.00 | | 0.85 | |
| Satd. Flow (perm) | 1770 | 3610 | 1573 | 1805 | 3583 | | | 1368 | 1589 | | 1608 | |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 14 | 923 | 489 | 279 | 388 | 20 | 72 | 4 | 250 | 7 | 2 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 89 | 0 | 2 | 0 | 0 | 0 | 217 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 14 | 923 | 400 | 279 | 406 | 0 | 0 | 76 | 33 | 0 | 9 | 0 |
| Confl. Peds. (#/hr) | | | 4 | | | | 7 | | 4 | 4 | | 7 |
| Heavy Vehicles (%) | 2% | 0% | 0% | 0% | 0% | 0% | 1% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Prot | NA | Perm | Prot | NA | | Perm | NA | Perm | Perm | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | 2 | | | | 8 | | 8 | 4 | | |
| Actuated Green, G (s) | 1.4 | 49.2 | 49.2 | 27.4 | 75.2 | | | 13.3 | 13.3 | | 13.1 | |
| Effective Green, g (s) | 1.4 | 49.2 | 49.2 | 27.4 | 75.2 | | | 13.3 | 13.3 | | 13.1 | |
| Actuated g/C Ratio | 0.01 | 0.49 | 0.49 | 0.27 | 0.75 | | | 0.13 | 0.13 | | 0.13 | |
| Clearance Time (s) | 3.0 | 3.6 | 3.6 | 3.0 | 3.6 | | | 3.5 | 3.5 | | 3.7 | |
| Vehicle Extension (s) | 2.0 | 3.0 | 3.0 | 2.0 | 3.0 | | | 2.0 | 2.0 | | 2.0 | |
| Lane Grp Cap (vph) | 24 | 1776 | 773 | 520 | 2694 | | | 181 | 211 | | 210 | |
| v/s Ratio Prot | 0.01 | c0.26 | | c0.15 | 0.11 | | | | | | | |
| v/s Ratio Perm | | | 0.25 | | | | | c0.06 | 0.02 | | 0.01 | |
| v/c Ratio | 0.58 | 0.52 | 0.52 | 0.54 | 0.15 | | | 0.42 | 0.16 | | 0.04 | |
| Uniform Delay, d1 | 49.0 | 17.3 | 17.3 | 30.9 | 3.5 | | | 39.8 | 38.4 | | 38.0 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 0.66 | 0.46 | | | 1.00 | 1.00 | | 1.00 | |
| Incremental Delay, d2 | 21.1 | 1.1 | 2.5 | 0.5 | 0.1 | | | 0.6 | 0.1 | | 0.0 | |
| Delay (s) | 70.1 | 18.4 | 19.8 | 21.0 | 1.7 | | | 40.4 | 38.5 | | 38.0 | |
| Level of Service | E | B | B | C | A | | | D | D | | D | |
| Approach Delay (s) | | 19.4 | | | 9.5 | | | 39.0 | | | 38.0 | |
| Approach LOS | | B | | | A | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 19.3 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.51 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 10.3 |
| Intersection Capacity Utilization | 63.7% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 32: US 101 SB Off Ramp/Enfrente Rd & Ignacio Blvd

07/02/2019

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 36 | 860 | 314 | 197 | 437 | 43 | 0 | 0 | 1079 | 265 | 143 | 218 |
| Future Volume (vph) | 36 | 860 | 314 | 197 | 437 | 43 | 0 | 0 | 1079 | 265 | 143 | 218 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Grade (%) | | 0% | | | 0% | | | 2% | | | 0% | |
| Total Lost time (s) | 3.0 | 8.0 | 8.0 | 4.0 | 5.0 | | | | 4.0 | | 4.0 | 4.0 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | | | 0.88 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.96 | 1.00 | 1.00 | | | | 1.00 | | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | | | | 0.85 | | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | | 1.00 | | 0.97 | 1.00 |
| Satd. Flow (prot) | 1805 | 3610 | 1550 | 1770 | 3544 | | | | 2759 | | 1809 | 1578 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | | 1.00 | | 0.97 | 1.00 |
| Satd. Flow (perm) | 1805 | 3610 | 1550 | 1770 | 3544 | | | | 2759 | | 1809 | 1578 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 38 | 896 | 327 | 205 | 455 | 45 | 0 | 0 | 1124 | 276 | 149 | 227 |
| RTOR Reduction (vph) | 0 | 0 | 134 | 0 | 6 | 0 | 0 | 0 | 323 | 0 | 0 | 163 |
| Lane Group Flow (vph) | 38 | 896 | 193 | 205 | 494 | 0 | 0 | 0 | 801 | 0 | 425 | 64 |
| Confl. Peds. (#/hr) | | | 7 | | | 20 | | | | | | 1 |
| Confl. Bikes (#/hr) | | | | | | 3 | | | | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 2% | 0% | 0% | 0% | 0% | 2% | 0% | 5% | 1% |
| Turn Type | Prot | NA | Perm | Prot | NA | | | | Over | Split | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | | | 1 | 7 | 7 | |
| Permitted Phases | | | 2 | | | | | | | | | 7 |
| Actuated Green, G (s) | 6.6 | 28.5 | 28.5 | 27.2 | 53.1 | | | | 27.2 | | 28.3 | 28.3 |
| Effective Green, g (s) | 6.6 | 28.5 | 28.5 | 27.2 | 53.1 | | | | 27.2 | | 28.3 | 28.3 |
| Actuated g/C Ratio | 0.07 | 0.28 | 0.28 | 0.27 | 0.53 | | | | 0.27 | | 0.28 | 0.28 |
| Clearance Time (s) | 3.0 | 8.0 | 8.0 | 4.0 | 5.0 | | | | 4.0 | | 4.0 | 4.0 |
| Vehicle Extension (s) | 2.0 | 2.5 | 2.5 | 3.0 | 4.0 | | | | 3.0 | | 2.5 | 2.5 |
| Lane Grp Cap (vph) | 119 | 1028 | 441 | 481 | 1881 | | | | 750 | | 511 | 446 |
| v/s Ratio Prot | 0.02 | c0.25 | | 0.12 | 0.14 | | | | c0.29 | | c0.23 | |
| v/s Ratio Perm | | | 0.12 | | | | | | | | | 0.04 |
| v/c Ratio | 0.32 | 0.87 | 0.44 | 0.43 | 0.26 | | | | 1.07 | | 0.83 | 0.14 |
| Uniform Delay, d1 | 44.6 | 34.0 | 29.2 | 30.0 | 12.8 | | | | 36.4 | | 33.6 | 26.8 |
| Progression Factor | 0.98 | 0.72 | 0.55 | 1.56 | 1.85 | | | | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.5 | 9.4 | 2.9 | 0.6 | 0.3 | | | | 52.4 | | 10.9 | 0.1 |
| Delay (s) | 44.3 | 34.0 | 18.9 | 47.4 | 24.0 | | | | 88.8 | | 44.5 | 26.9 |
| Level of Service | D | C | B | D | C | | | | F | | D | C |
| Approach Delay (s) | | 30.4 | | | 30.8 | | | 88.8 | | | 38.4 | |
| Approach LOS | | C | | | C | | | F | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 49.4 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.92 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 97.2% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 33: Nave Dr & Ignacio Blvd/Bel Marin Keys Blvd

07/02/2019

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 882 | 1311 | 100 | 232 | 222 | 447 | 543 | 670 | 0 | 0 | 0 |
| Future Volume (vph) | 0 | 882 | 1311 | 100 | 232 | 222 | 447 | 543 | 670 | 0 | 0 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.0 | 4.6 | 3.0 | 4.0 | | 4.6 | 4.6 | 3.0 | | | |
| Lane Util. Factor | | 0.95 | 1.00 | 1.00 | 0.95 | | 0.91 | 0.91 | 1.00 | | | |
| Frpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 0.99 | | 1.00 | 1.00 | 0.99 | | | |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | | |
| Frt | | 1.00 | 0.85 | 1.00 | 0.93 | | 1.00 | 1.00 | 0.85 | | | |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 0.99 | 1.00 | | | |
| Satd. Flow (prot) | | 3539 | 1607 | 1805 | 3258 | | 1643 | 3398 | 1583 | | | |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 0.99 | 1.00 | | | |
| Satd. Flow (perm) | | 3539 | 1607 | 1805 | 3258 | | 1643 | 3398 | 1583 | | | |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 0 | 938 | 1395 | 106 | 247 | 236 | 476 | 578 | 713 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 82 | 0 | 127 | 0 | 0 | 0 | 5 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 938 | 1313 | 106 | 356 | 0 | 343 | 711 | 708 | 0 | 0 | 0 |
| Confl. Peds. (#/hr) | | | 1 | | | 1 | | | 1 | | | |
| Heavy Vehicles (%) | 0% | 2% | 0% | 0% | 2% | 2% | 0% | 1% | 1% | 0% | 0% | 0% |
| Turn Type | | NA | pm+ov | Prot | NA | | Split | NA | pm+ov | | | |
| Protected Phases | | 2 | 3 | 1 | 6 | | 3 | 3 | 1 | | | |
| Permitted Phases | | | 2 | | | | | | 3 | | | |
| Actuated Green, G (s) | | 28.4 | 76.4 | 12.0 | 43.4 | | 48.0 | 48.0 | 60.0 | | | |
| Effective Green, g (s) | | 28.4 | 76.4 | 12.0 | 43.4 | | 48.0 | 48.0 | 60.0 | | | |
| Actuated g/C Ratio | | 0.28 | 0.76 | 0.12 | 0.43 | | 0.48 | 0.48 | 0.60 | | | |
| Clearance Time (s) | | 4.0 | 4.6 | 3.0 | 4.0 | | 4.6 | 4.6 | 3.0 | | | |
| Vehicle Extension (s) | | 4.0 | 2.0 | 2.0 | 4.0 | | 2.0 | 2.0 | 2.0 | | | |
| Lane Grp Cap (vph) | | 1005 | 1227 | 216 | 1413 | | 788 | 1631 | 949 | | | |
| v/s Ratio Prot | | 0.27 | c0.51 | 0.06 | 0.11 | | 0.21 | 0.21 | c0.09 | | | |
| v/s Ratio Perm | | | 0.30 | | | | | | 0.36 | | | |
| v/c Ratio | | 0.93 | 1.07 | 0.49 | 0.25 | | 0.44 | 0.44 | 0.75 | | | |
| Uniform Delay, d1 | | 34.9 | 11.8 | 41.1 | 18.0 | | 17.1 | 17.1 | 14.5 | | | |
| Progression Factor | | 0.95 | 1.36 | 1.15 | 0.82 | | 1.00 | 1.00 | 1.00 | | | |
| Incremental Delay, d2 | | 7.6 | 38.7 | 0.6 | 0.4 | | 0.1 | 0.1 | 2.8 | | | |
| Delay (s) | | 40.7 | 54.7 | 48.1 | 15.1 | | 17.2 | 17.2 | 17.3 | | | |
| Level of Service | | D | D | D | B | | B | B | B | | | |
| Approach Delay (s) | | 49.1 | | | 21.0 | | | 17.2 | | | 0.0 | |
| Approach LOS | | D | | | C | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 33.6 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 1.03 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 11.6 |
| Intersection Capacity Utilization | 98.5% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 34: Bel Marin Keys Blvd & Commercial Blvd

07/02/2019

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 0 | 12 | 77 | 0 | 9 | 48 | 1269 | 242 | 13 | 461 | 1 |
| Future Volume (vph) | 0 | 0 | 12 | 77 | 0 | 9 | 48 | 1269 | 242 | 13 | 461 | 1 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.0 | | | 4.0 | 4.0 | 3.0 | 3.9 | | 3.0 | 3.5 | |
| Lane Util. Factor | | 1.00 | | | 1.00 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | | 0.99 | | | 1.00 | 0.98 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 0.86 | | | 1.00 | 0.85 | 1.00 | 0.98 | | 1.00 | 1.00 | |
| Flt Protected | | 1.00 | | | 0.95 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 1620 | | | 1766 | 1395 | 1805 | 3439 | | 1805 | 3538 | |
| Flt Permitted | | 1.00 | | | 0.75 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | | 1620 | | | 1392 | 1395 | 1805 | 3439 | | 1805 | 3538 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 0 | 0 | 13 | 81 | 0 | 9 | 51 | 1336 | 255 | 14 | 485 | 1 |
| RTOR Reduction (vph) | 0 | 11 | 0 | 0 | 0 | 8 | 0 | 8 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 2 | 0 | 0 | 81 | 1 | 51 | 1583 | 0 | 14 | 486 | 0 |
| Confl. Peds. (#/hr) | 3 | | 2 | 2 | | 3 | | | 3 | | | |
| Heavy Vehicles (%) | 2% | 0% | 0% | 2% | 0% | 14% | 0% | 2% | 2% | 0% | 2% | 0% |
| Turn Type | | NA | | Perm | NA | Perm | Prot | NA | | Prot | NA | |
| Protected Phases | | 4 | | | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | | | | | | |
| Actuated Green, G (s) | | 12.3 | | | 12.3 | 12.3 | 6.8 | 75.0 | | 1.8 | 70.4 | |
| Effective Green, g (s) | | 12.3 | | | 12.3 | 12.3 | 6.8 | 75.0 | | 1.8 | 70.4 | |
| Actuated g/C Ratio | | 0.12 | | | 0.12 | 0.12 | 0.07 | 0.75 | | 0.02 | 0.70 | |
| Clearance Time (s) | | 4.0 | | | 4.0 | 4.0 | 3.0 | 3.9 | | 3.0 | 3.5 | |
| Vehicle Extension (s) | | 3.0 | | | 3.0 | 3.0 | 2.5 | 3.0 | | 2.5 | 4.0 | |
| Lane Grp Cap (vph) | | 199 | | | 171 | 171 | 122 | 2579 | | 32 | 2490 | |
| v/s Ratio Prot | | 0.00 | | | | | c0.03 | c0.46 | | 0.01 | 0.14 | |
| v/s Ratio Perm | | | | | c0.06 | 0.00 | | | | | | |
| v/c Ratio | | 0.01 | | | 0.47 | 0.01 | 0.42 | 0.61 | | 0.44 | 0.20 | |
| Uniform Delay, d1 | | 38.5 | | | 40.8 | 38.5 | 44.7 | 5.8 | | 48.6 | 5.1 | |
| Progression Factor | | 1.00 | | | 1.00 | 1.00 | 0.94 | 0.61 | | 0.92 | 1.29 | |
| Incremental Delay, d2 | | 0.0 | | | 2.1 | 0.0 | 0.9 | 0.6 | | 6.8 | 0.2 | |
| Delay (s) | | 38.5 | | | 42.9 | 38.5 | 42.8 | 4.1 | | 51.4 | 6.7 | |
| Level of Service | | D | | | D | D | D | A | | D | A | |
| Approach Delay (s) | | 38.5 | | | 42.5 | | | 5.3 | | | 8.0 | |
| Approach LOS | | D | | | D | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 7.6 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.60 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 10.9 |
| Intersection Capacity Utilization | 65.7% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 35: Bel Marin Keys Blvd & Hamilton Dr/Digital Dr

07/02/2019

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 1 | 48 | 92 | 2 | 9 | 109 | 615 | 567 | 9 | 340 | 3 |
| Future Volume (vph) | 0 | 1 | 48 | 92 | 2 | 9 | 109 | 615 | 567 | 9 | 340 | 3 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.5 | 3.5 | 3.5 | 3.5 | | 3.0 | 4.0 | | 3.0 | 4.0 | |
| Lane Util. Factor | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | | 1.00 | 0.99 | 1.00 | 0.99 | | 1.00 | 0.99 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 1.00 | 0.85 | 1.00 | 0.88 | | 1.00 | 0.93 | | 1.00 | 1.00 | |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 1900 | 1533 | 1768 | 1649 | | 1770 | 3247 | | 1805 | 3534 | |
| Flt Permitted | | 1.00 | 1.00 | 0.76 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | | 1900 | 1533 | 1409 | 1649 | | 1770 | 3247 | | 1805 | 3534 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 0 | 1 | 51 | 97 | 2 | 9 | 115 | 647 | 597 | 9 | 358 | 3 |
| RTOR Reduction (vph) | 0 | 0 | 44 | 0 | 8 | 0 | 0 | 81 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 1 | 7 | 97 | 3 | 0 | 115 | 1163 | 0 | 9 | 361 | 0 |
| Confl. Peds. (#/hr) | 1 | | 1 | 1 | | 1 | | | 2 | | | 8 |
| Heavy Vehicles (%) | 0% | 0% | 4% | 2% | 0% | 0% | 2% | 2% | 2% | 0% | 2% | 0% |
| Turn Type | | NA | Perm | Perm | NA | | Prot | NA | | Prot | NA | |
| Protected Phases | | 4 | | | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | 4 | 8 | | | | | | | | |
| Actuated Green, G (s) | | 12.9 | 12.9 | 12.9 | 12.9 | | 11.5 | 74.8 | | 1.8 | 65.1 | |
| Effective Green, g (s) | | 12.9 | 12.9 | 12.9 | 12.9 | | 11.5 | 74.8 | | 1.8 | 65.1 | |
| Actuated g/C Ratio | | 0.13 | 0.13 | 0.13 | 0.13 | | 0.12 | 0.75 | | 0.02 | 0.65 | |
| Clearance Time (s) | | 3.5 | 3.5 | 3.5 | 3.5 | | 3.0 | 4.0 | | 3.0 | 4.0 | |
| Vehicle Extension (s) | | 2.0 | 2.0 | 2.5 | 2.5 | | 2.0 | 4.0 | | 2.0 | 4.0 | |
| Lane Grp Cap (vph) | | 245 | 197 | 181 | 212 | | 203 | 2428 | | 32 | 2300 | |
| v/s Ratio Prot | | 0.00 | | | 0.00 | | c0.06 | c0.36 | | 0.00 | 0.10 | |
| v/s Ratio Perm | | | 0.00 | c0.07 | | | | | | | | |
| v/c Ratio | | 0.00 | 0.03 | 0.54 | 0.01 | | 0.57 | 0.48 | | 0.28 | 0.16 | |
| Uniform Delay, d1 | | 38.0 | 38.1 | 40.7 | 38.0 | | 41.9 | 4.9 | | 48.5 | 6.8 | |
| Progression Factor | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.06 | 1.32 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 0.0 | 0.0 | 2.4 | 0.0 | | 1.8 | 0.6 | | 1.8 | 0.1 | |
| Delay (s) | | 38.0 | 38.1 | 43.1 | 38.0 | | 46.0 | 7.1 | | 50.2 | 6.9 | |
| Level of Service | | D | D | D | D | | D | A | | D | A | |
| Approach Delay (s) | | 38.1 | | | 42.6 | | | 10.4 | | | 8.0 | |
| Approach LOS | | D | | | D | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 12.5 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.51 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 10.5 |
| Intersection Capacity Utilization | 64.9% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 36: Nave Dr & US 101 NB Off Ramp

07/02/2019

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 754 | 174 | 0 | 887 | 1202 | 195 |
| Future Volume (vph) | 754 | 174 | 0 | 887 | 1202 | 195 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | | 5.0 | 5.0 | |
| Lane Util. Factor | 0.97 | 1.00 | | 0.95 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 0.99 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.85 | | 1.00 | 0.98 | |
| Flt Protected | 0.95 | 1.00 | | 1.00 | 1.00 | |
| Satd. Flow (prot) | 3467 | 1563 | | 3574 | 3504 | |
| Flt Permitted | 0.95 | 1.00 | | 1.00 | 1.00 | |
| Satd. Flow (perm) | 3467 | 1563 | | 3574 | 3504 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 820 | 189 | 0 | 964 | 1307 | 212 |
| RTOR Reduction (vph) | 0 | 20 | 0 | 0 | 19 | 0 |
| Lane Group Flow (vph) | 820 | 169 | 0 | 964 | 1501 | 0 |
| Confl. Peds. (#/hr) | | 1 | | | | |
| Heavy Vehicles (%) | 1% | 2% | 0% | 1% | 1% | 0% |
| Turn Type | Prot | Perm | | NA | NA | |
| Protected Phases | 4 | | | 2 | 6 | |
| Permitted Phases | | 4 | | | | |
| Actuated Green, G (s) | 27.0 | 27.0 | | 35.0 | 35.0 | |
| Effective Green, g (s) | 27.0 | 27.0 | | 35.0 | 35.0 | |
| Actuated g/C Ratio | 0.39 | 0.39 | | 0.50 | 0.50 | |
| Clearance Time (s) | 3.0 | 3.0 | | 5.0 | 5.0 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 1337 | 602 | | 1787 | 1752 | |
| v/s Ratio Prot | c0.24 | | | 0.27 | c0.43 | |
| v/s Ratio Perm | | 0.11 | | | | |
| v/c Ratio | 0.61 | 0.28 | | 0.54 | 0.86 | |
| Uniform Delay, d1 | 17.3 | 14.8 | | 12.0 | 15.3 | |
| Progression Factor | 1.00 | 1.00 | | 0.37 | 1.00 | |
| Incremental Delay, d2 | 2.1 | 1.2 | | 1.0 | 5.6 | |
| Delay (s) | 19.4 | 16.0 | | 5.4 | 20.9 | |
| Level of Service | B | B | | A | C | |
| Approach Delay (s) | 18.8 | | | 5.4 | 20.9 | |
| Approach LOS | B | | | A | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 16.0 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.75 | | |
| Actuated Cycle Length (s) | 70.0 | Sum of lost time (s) | 8.0 |
| Intersection Capacity Utilization | 69.4% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 31: Alameda Del Prado & Ignacio Blvd

07/02/2019

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 11 | 458 | 81 | 348 | 739 | 36 | 102 | 4 | 170 | 29 | 5 | 1 |
| Future Volume (vph) | 11 | 458 | 81 | 348 | 739 | 36 | 102 | 4 | 170 | 29 | 5 | 1 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.6 | 3.6 | 3.0 | 3.6 | | | 3.5 | 3.5 | | 3.7 | |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | | 1.00 | 1.00 | | 1.00 | |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.97 | 1.00 | 1.00 | | | 1.00 | 0.98 | | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.99 | 1.00 | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | | | 1.00 | 0.85 | | 1.00 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 0.95 | 1.00 | | 0.96 | |
| Satd. Flow (prot) | 1770 | 3610 | 1573 | 1900 | 3585 | | | 1784 | 1589 | | 1811 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 0.76 | 1.00 | | 0.75 | |
| Satd. Flow (perm) | 1770 | 3610 | 1573 | 1805 | 3585 | | | 1413 | 1589 | | 1417 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 12 | 482 | 85 | 366 | 778 | 38 | 107 | 4 | 179 | 31 | 5 | 1 |
| RTOR Reduction (vph) | 0 | 0 | 31 | 0 | 2 | 0 | 0 | 0 | 152 | 0 | 1 | 0 |
| Lane Group Flow (vph) | 12 | 482 | 54 | 366 | 814 | 0 | 0 | 111 | 27 | 0 | 36 | 0 |
| Confl. Peds. (#/hr) | | | 4 | | | | 7 | | 4 | 4 | | 7 |
| Heavy Vehicles (%) | 2% | 0% | 0% | 0% | 0% | 0% | 1% | 0% | 0% | 0% | 0% | 0% |
| Turn Type | Prot | NA | Perm | Prot | NA | | Perm | NA | Perm | Perm | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | 2 | | | | 8 | | 8 | 4 | | |
| Actuated Green, G (s) | 1.2 | 47.4 | 47.4 | 27.4 | 73.6 | | | 15.1 | 15.1 | | 14.9 | |
| Effective Green, g (s) | 1.2 | 47.4 | 47.4 | 27.4 | 73.6 | | | 15.1 | 15.1 | | 14.9 | |
| Actuated g/C Ratio | 0.01 | 0.47 | 0.47 | 0.27 | 0.74 | | | 0.15 | 0.15 | | 0.15 | |
| Clearance Time (s) | 3.0 | 3.6 | 3.6 | 3.0 | 3.6 | | | 3.5 | 3.5 | | 3.7 | |
| Vehicle Extension (s) | 2.0 | 3.0 | 3.0 | 2.0 | 3.0 | | | 2.0 | 2.0 | | 2.0 | |
| Lane Grp Cap (vph) | 21 | 1711 | 745 | 520 | 2638 | | | 213 | 239 | | 211 | |
| v/s Ratio Prot | c0.01 | 0.13 | | c0.19 | c0.23 | | | | | | | |
| v/s Ratio Perm | | | 0.03 | | | | | c0.08 | 0.02 | | 0.03 | |
| v/c Ratio | 0.57 | 0.28 | 0.07 | 0.70 | 0.31 | | | 0.52 | 0.11 | | 0.17 | |
| Uniform Delay, d1 | 49.1 | 16.0 | 14.3 | 32.7 | 4.5 | | | 39.1 | 36.7 | | 37.2 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 0.74 | 0.75 | | | 1.00 | 1.00 | | 1.00 | |
| Incremental Delay, d2 | 21.2 | 0.4 | 0.2 | 3.2 | 0.3 | | | 1.1 | 0.1 | | 0.1 | |
| Delay (s) | 70.4 | 16.4 | 14.5 | 27.3 | 3.7 | | | 40.2 | 36.7 | | 37.3 | |
| Level of Service | E | B | B | C | A | | | D | D | | D | |
| Approach Delay (s) | | 17.2 | | | 11.0 | | | 38.1 | | | 37.3 | |
| Approach LOS | | B | | | B | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 16.9 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.46 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 10.3 |
| Intersection Capacity Utilization | 69.0% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 32: US 101 SB Off Ramp/Enfrente Rd & Ignacio Blvd/Ignacio Blvd #3

07/02/2019

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 35 | 402 | 267 | 637 | 818 | 145 | 0 | 0 | 796 | 201 | 92 | 308 |
| Future Volume (vph) | 35 | 402 | 267 | 637 | 818 | 145 | 0 | 0 | 796 | 201 | 92 | 308 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Grade (%) | | 0% | | | 0% | | | 2% | | | 0% | |
| Total Lost time (s) | 3.0 | 8.0 | 8.0 | 4.0 | 5.0 | | | | 4.0 | | 4.0 | 4.0 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | | | 0.88 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.96 | 1.00 | 0.99 | | | | 1.00 | | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.98 | | | | 0.85 | | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | | 1.00 | | 0.97 | 1.00 |
| Satd. Flow (prot) | 1805 | 3610 | 1550 | 1770 | 3500 | | | | 2759 | | 1809 | 1578 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | | 1.00 | | 0.97 | 1.00 |
| Satd. Flow (perm) | 1805 | 3610 | 1550 | 1770 | 3500 | | | | 2759 | | 1809 | 1578 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 36 | 419 | 278 | 664 | 852 | 151 | 0 | 0 | 829 | 209 | 96 | 321 |
| RTOR Reduction (vph) | 0 | 0 | 205 | 0 | 11 | 0 | 0 | 0 | 389 | 0 | 0 | 241 |
| Lane Group Flow (vph) | 36 | 419 | 73 | 664 | 992 | 0 | 0 | 0 | 440 | 0 | 305 | 80 |
| Confl. Peds. (#/hr) | | | 7 | | | 20 | | | | | | 1 |
| Confl. Bikes (#/hr) | | | | | | 3 | | | | | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 2% | 0% | 0% | 0% | 0% | 2% | 0% | 5% | 1% |
| Turn Type | Prot | NA | Perm | Prot | NA | | | | Over | Split | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | | | 1 | 7 | 7 | |
| Permitted Phases | | | 2 | | | | | | | | | 7 |
| Actuated Green, G (s) | 6.6 | 26.3 | 26.3 | 35.2 | 58.9 | | | | 35.2 | | 22.5 | 22.5 |
| Effective Green, g (s) | 6.6 | 26.3 | 26.3 | 35.2 | 58.9 | | | | 35.2 | | 22.5 | 22.5 |
| Actuated g/C Ratio | 0.07 | 0.26 | 0.26 | 0.35 | 0.59 | | | | 0.35 | | 0.22 | 0.22 |
| Clearance Time (s) | 3.0 | 8.0 | 8.0 | 4.0 | 5.0 | | | | 4.0 | | 4.0 | 4.0 |
| Vehicle Extension (s) | 2.0 | 2.5 | 2.5 | 3.0 | 4.0 | | | | 3.0 | | 2.5 | 2.5 |
| Lane Grp Cap (vph) | 119 | 949 | 407 | 623 | 2061 | | | | 971 | | 407 | 355 |
| v/s Ratio Prot | 0.02 | c0.12 | | c0.38 | c0.28 | | | | 0.16 | | c0.17 | |
| v/s Ratio Perm | | | 0.05 | | | | | | | | | 0.05 |
| v/c Ratio | 0.30 | 0.44 | 0.18 | 1.07 | 0.48 | | | | 0.45 | | 0.75 | 0.23 |
| Uniform Delay, d1 | 44.5 | 30.7 | 28.5 | 32.4 | 11.8 | | | | 25.0 | | 36.1 | 31.6 |
| Progression Factor | 0.98 | 0.69 | 0.44 | 0.81 | 0.75 | | | | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.5 | 1.5 | 0.9 | 44.9 | 0.4 | | | | 0.3 | | 7.0 | 0.2 |
| Delay (s) | 44.1 | 22.7 | 13.4 | 71.2 | 9.2 | | | | 25.3 | | 43.1 | 31.9 |
| Level of Service | D | C | B | E | A | | | | C | | D | C |
| Approach Delay (s) | | 20.2 | | | 33.9 | | | 25.3 | | | 37.4 | |
| Approach LOS | | C | | | C | | | C | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 30.0 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.81 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 82.2% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
### 33: Nave Dr & Ignacio Blvd #3/Bel Marin Keys Blvd #3

07/02/2019

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 362 | 1044 | 127 | 734 | 696 | 870 | 769 | 269 | 0 | 0 | 0 |
| Future Volume (vph) | 0 | 362 | 1044 | 127 | 734 | 696 | 870 | 769 | 269 | 0 | 0 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.0 | 4.6 | 3.0 | 4.0 | | 4.6 | 4.6 | 3.0 | | | |
| Lane Util. Factor | | 0.95 | 1.00 | 1.00 | 0.95 | | 0.91 | 0.91 | 1.00 | | | |
| Frpb, ped/bikes | | 1.00 | 0.99 | 1.00 | 0.99 | | 1.00 | 1.00 | 0.99 | | | |
| Flpb, ped/bikes | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | | |
| Frt | | 1.00 | 0.85 | 1.00 | 0.93 | | 1.00 | 1.00 | 0.85 | | | |
| Flt Protected | | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 0.98 | 1.00 | | | |
| Satd. Flow (prot) | | 3539 | 1605 | 1805 | 3259 | | 1643 | 3382 | 1584 | | | |
| Flt Permitted | | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 0.98 | 1.00 | | | |
| Satd. Flow (perm) | | 3539 | 1605 | 1805 | 3259 | | 1643 | 3382 | 1584 | | | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 0 | 381 | 1099 | 134 | 773 | 733 | 916 | 809 | 283 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 76 | 0 | 39 | 0 | 0 | 0 | 113 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 381 | 1023 | 134 | 1467 | 0 | 559 | 1166 | 170 | 0 | 0 | 0 |
| Confl. Peds. (#/hr) | | | 1 | | | 1 | | | 1 | | | |
| Heavy Vehicles (%) | 0% | 2% | 0% | 0% | 2% | 2% | 0% | 1% | 1% | 0% | 0% | 0% |
| Turn Type | | NA | pm+ov | Prot | NA | | Split | NA | pm+ov | | | |
| Protected Phases | | 2 | 3 | 1 | 6 | | 3 | 3 | 1 | | | |
| Permitted Phases | | | 2 | | | | | | 3 | | | |
| Actuated Green, G (s) | | 35.5 | 75.7 | 12.7 | 51.2 | | 40.2 | 40.2 | 52.9 | | | |
| Effective Green, g (s) | | 35.5 | 75.7 | 12.7 | 51.2 | | 40.2 | 40.2 | 52.9 | | | |
| Actuated g/C Ratio | | 0.36 | 0.76 | 0.13 | 0.51 | | 0.40 | 0.40 | 0.53 | | | |
| Clearance Time (s) | | 4.0 | 4.6 | 3.0 | 4.0 | | 4.6 | 4.6 | 3.0 | | | |
| Vehicle Extension (s) | | 4.0 | 2.0 | 2.0 | 4.0 | | 2.0 | 2.0 | 2.0 | | | |
| Lane Grp Cap (vph) | | 1256 | 1214 | 229 | 1668 | | 660 | 1359 | 837 | | | |
| v/s Ratio Prot | | 0.11 | 0.34 | 0.07 | c0.45 | | 0.34 | c0.34 | 0.03 | | | |
| v/s Ratio Perm | | | 0.30 | | | | | | 0.08 | | | |
| v/c Ratio | | 0.30 | 0.84 | 0.59 | 0.88 | | 0.85 | 0.86 | 0.20 | | | |
| Uniform Delay, d1 | | 23.3 | 8.1 | 41.2 | 21.7 | | 27.1 | 27.3 | 12.4 | | | |
| Progression Factor | | 1.10 | 1.04 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | | |
| Incremental Delay, d2 | | 0.5 | 4.5 | 2.5 | 7.0 | | 9.5 | 5.4 | 0.0 | | | |
| Delay (s) | | 26.2 | 13.0 | 43.6 | 28.6 | | 36.6 | 32.7 | 12.5 | | | |
| Level of Service | | C | B | D | C | | D | C | B | | | |
| Approach Delay (s) | | 16.4 | | | 29.9 | | | 30.9 | | | 0.0 | |
| Approach LOS | | B | | | C | | | C | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 26.4 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.90 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 11.6 |
| Intersection Capacity Utilization | 81.9% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



## HCM Signalized Intersection Capacity Analysis
### 34: Bel Marin Keys Blvd #3 & Commercial Blvd

07/02/2019

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 3 | 0 | 40 | 292 | 1 | 29 | 48 | 537 | 82 | 33 | 1324 | 7 |
| Future Volume (vph) | 3 | 0 | 40 | 292 | 1 | 29 | 48 | 537 | 82 | 33 | 1324 | 7 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.0 | | | 4.0 | 4.0 | 3.0 | 3.9 | | 3.0 | 3.5 | |
| Lane Util. Factor | | 1.00 | | | 1.00 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | | 0.99 | | | 1.00 | 0.99 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 0.87 | | | 1.00 | 0.85 | 1.00 | 0.98 | | 1.00 | 1.00 | |
| Flt Protected | | 1.00 | | | 0.95 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 1631 | | | 1754 | 1396 | 1805 | 3453 | | 1805 | 3537 | |
| Flt Permitted | | 0.98 | | | 0.69 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | | 1608 | | | 1275 | 1396 | 1805 | 3453 | | 1805 | 3537 | |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Adj. Flow (vph) | 3 | 0 | 44 | 324 | 1 | 32 | 53 | 597 | 91 | 37 | 1471 | 8 |
| RTOR Reduction (vph) | 0 | 32 | 0 | 0 | 0 | 22 | 0 | 13 | 0 | 0 | 1 | 0 |
| Lane Group Flow (vph) | 0 | 15 | 0 | 0 | 325 | 10 | 53 | 675 | 0 | 37 | 1478 | 0 |
| Confl. Peds. (#/hr) | 3 | | 2 | 2 | | 3 | | | 3 | | | |
| Heavy Vehicles (%) | 2% | 0% | 0% | 3% | 0% | 14% | 0% | 2% | 3% | 0% | 2% | 0% |
| Turn Type | Perm | NA | | Perm | NA | Perm | Prot | NA | | Prot | NA | |
| Protected Phases | | 4 | | | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | | | | | | |
| Actuated Green, G (s) | | 23.2 | | | 23.2 | 23.2 | 3.9 | 37.3 | | 3.6 | 37.4 | |
| Effective Green, g (s) | | 23.2 | | | 23.2 | 23.2 | 3.9 | 37.3 | | 3.6 | 37.4 | |
| Actuated g/C Ratio | | 0.31 | | | 0.31 | 0.31 | 0.05 | 0.50 | | 0.05 | 0.50 | |
| Clearance Time (s) | | 4.0 | | | 4.0 | 4.0 | 3.0 | 3.9 | | 3.0 | 3.5 | |
| Vehicle Extension (s) | | 3.0 | | | 3.0 | 3.0 | 2.5 | 3.0 | | 2.5 | 4.0 | |
| Lane Grp Cap (vph) | | 497 | | | 394 | 431 | 93 | 1717 | | 86 | 1763 | |
| v/s Ratio Prot | | | | | | | c0.03 | 0.20 | | 0.02 | c0.42 | |
| v/s Ratio Perm | | 0.01 | | | c0.25 | 0.01 | | | | | | |
| v/c Ratio | | 0.03 | | | 0.82 | 0.02 | 0.57 | 0.39 | | 0.43 | 0.84 | |
| Uniform Delay, d1 | | 18.1 | | | 24.0 | 18.0 | 34.7 | 11.8 | | 34.7 | 16.2 | |
| Progression Factor | | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.06 | 1.02 | |
| Incremental Delay, d2 | | 0.0 | | | 13.1 | 0.0 | 6.4 | 0.7 | | 1.7 | 3.3 | |
| Delay (s) | | 18.1 | | | 37.1 | 18.0 | 41.1 | 12.5 | | 38.4 | 19.9 | |
| Level of Service | | B | | | D | B | D | B | | D | B | |
| Approach Delay (s) | | 18.1 | | | 35.4 | | | 14.5 | | | 20.3 | |
| Approach LOS | | B | | | D | | | B | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 20.7 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.82 | | |
| Actuated Cycle Length (s) | 75.0 | Sum of lost time (s) | 10.9 |
| Intersection Capacity Utilization | 69.5% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## 35: Bel Marin Keys Blvd #3 & Hamilton Dr/Digital Dr



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 5 | 7 | 162 | 580 | 4 | 14 | 47 | 390 | 122 | 6 | 658 | 2 |
| Future Volume (vph) | 5 | 7 | 162 | 580 | 4 | 14 | 47 | 390 | 122 | 6 | 658 | 2 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.5 | 3.5 | 3.5 | 3.5 | | 3.0 | 4.0 | | 3.0 | 4.0 | |
| Lane Util. Factor | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | | 1.00 | 0.98 | 1.00 | 0.99 | | 1.00 | 0.99 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | 1.00 | 0.99 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 1.00 | 0.85 | 1.00 | 0.88 | | 1.00 | 0.96 | | 1.00 | 1.00 | |
| Flt Protected | | 0.98 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 1864 | 1522 | 1739 | 1658 | | 1770 | 3382 | | 1805 | 3538 | |
| Flt Permitted | | 0.96 | 1.00 | 0.75 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | | 1822 | 1522 | 1371 | 1658 | | 1770 | 3382 | | 1805 | 3538 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 5 | 8 | 176 | 630 | 4 | 15 | 51 | 424 | 133 | 7 | 715 | 2 |
| RTOR Reduction (vph) | 0 | 0 | 104 | 0 | 9 | 0 | 0 | 34 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 13 | 72 | 630 | 10 | 0 | 51 | 523 | 0 | 7 | 717 | 0 |
| Confl. Peds. (#/hr) | 1 | | 10 | 10 | | 1 | | | 2 | | | 8 |
| Confl. Bikes (#/hr) | | | | | | | | | 5 | | | 5 |
| Heavy Vehicles (%) | 0% | 0% | 4% | 3% | 0% | 0% | 2% | 2% | 3% | 0% | 2% | 0% |
| Turn Type | Perm | NA | Perm | Perm | NA | | Prot | NA | | Prot | NA | |
| Protected Phases | | 4 | | | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | 4 | 8 | | | | | | | | |
| Actuated Green, G (s) | | 30.5 | 30.5 | 30.5 | 30.5 | | 5.4 | 32.2 | | 1.8 | 28.6 | |
| Effective Green, g (s) | | 30.5 | 30.5 | 30.5 | 30.5 | | 5.4 | 32.2 | | 1.8 | 28.6 | |
| Actuated g/C Ratio | | 0.41 | 0.41 | 0.41 | 0.41 | | 0.07 | 0.43 | | 0.02 | 0.38 | |
| Clearance Time (s) | | 3.5 | 3.5 | 3.5 | 3.5 | | 3.0 | 4.0 | | 3.0 | 4.0 | |
| Vehicle Extension (s) | | 2.0 | 2.0 | 2.5 | 2.5 | | 2.0 | 4.0 | | 2.0 | 4.0 | |
| Lane Grp Cap (vph) | | 740 | 618 | 557 | 674 | | 127 | 1452 | | 43 | 1349 | |
| v/s Ratio Prot | | | | | 0.01 | | c0.03 | 0.15 | | 0.00 | c0.20 | |
| v/s Ratio Perm | | 0.01 | 0.05 | c0.46 | | | | | | | | |
| v/c Ratio | | 0.02 | 0.12 | 1.13 | 0.01 | | 0.40 | 0.36 | | 0.16 | 0.53 | |
| Uniform Delay, d1 | | 13.3 | 13.9 | 22.2 | 13.3 | | 33.3 | 14.4 | | 35.9 | 18.0 | |
| Progression Factor | | 1.00 | 1.00 | 1.00 | 1.00 | | 0.77 | 1.63 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 0.0 | 0.0 | 79.6 | 0.0 | | 0.7 | 0.7 | | 0.7 | 1.5 | |
| Delay (s) | | 13.3 | 13.9 | 101.9 | 13.3 | | 26.4 | 24.3 | | 36.5 | 19.5 | |
| Level of Service | | B | B | F | B | | C | C | | D | B | |
| Approach Delay (s) | | 13.8 | | | 99.3 | | | 24.5 | | | 19.7 | |
| Approach LOS | | B | | | F | | | C | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 44.3 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.80 | | |
| Actuated Cycle Length (s) | 75.0 | Sum of lost time (s) | 10.5 |
| Intersection Capacity Utilization | 77.1% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |





## 36: Nave Dr & US 101 NB Off Ramp



| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 724 | 233 | 0 | 1196 | 915 | 246 |
| Future Volume (vph) | 724 | 233 | 0 | 1196 | 915 | 246 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | | 5.0 | 5.0 | |
| Lane Util. Factor | 0.97 | 1.00 | | 0.95 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 0.99 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.85 | | 1.00 | 0.97 | |
| Flt Protected | 0.95 | 1.00 | | 1.00 | 1.00 | |
| Satd. Flow (prot) | 3467 | 1563 | | 3574 | 3468 | |
| Flt Permitted | 0.95 | 1.00 | | 1.00 | 1.00 | |
| Satd. Flow (perm) | 3467 | 1563 | | 3574 | 3468 | |
| Peak-hour factor, PHF | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Adj. Flow (vph) | 739 | 238 | 0 | 1220 | 934 | 251 |
| RTOR Reduction (vph) | 0 | 36 | 0 | 0 | 35 | 0 |
| Lane Group Flow (vph) | 739 | 202 | 0 | 1220 | 1150 | 0 |
| Confl. Peds. (#/hr) | | 1 | | | | |
| Heavy Vehicles (%) | 1% | 2% | 0% | 1% | 1% | 0% |
| Turn Type | Prot | Perm | | NA | NA | |
| Protected Phases | 4 | | | 2 | 6 | |
| Permitted Phases | | 4 | | | | |
| Actuated Green, G (s) | 31.0 | 31.0 | | 31.0 | 31.0 | |
| Effective Green, g (s) | 31.0 | 31.0 | | 31.0 | 31.0 | |
| Actuated g/C Ratio | 0.44 | 0.44 | | 0.44 | 0.44 | |
| Clearance Time (s) | 3.0 | 3.0 | | 5.0 | 5.0 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 1535 | 692 | | 1582 | 1535 | |
| v/s Ratio Prot | c0.21 | | | c0.34 | 0.33 | |
| v/s Ratio Perm | | 0.13 | | | | |
| v/c Ratio | 0.48 | 0.29 | | 0.77 | 0.75 | |
| Uniform Delay, d1 | 13.8 | 12.5 | | 16.5 | 16.3 | |
| Progression Factor | 1.00 | 1.00 | | 0.51 | 1.00 | |
| Incremental Delay, d2 | 1.1 | 1.1 | | 2.6 | 3.4 | |
| Delay (s) | 14.9 | 13.5 | | 11.0 | 19.7 | |
| Level of Service | B | B | | B | B | |
| Approach Delay (s) | 14.6 | | | 11.0 | 19.7 | |
| Approach LOS | B | | | B | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 15.1 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.63 | | |
| Actuated Cycle Length (s) | 70.0 | Sum of lost time (s) | 8.0 |
| Intersection Capacity Utilization | 63.1% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## Arterial Level of Service
## PM Peak Hour Existing plus Project w/ 300 ksf MPA

07/02/2019

### Arterial Level of Service: NB #3

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| Nave Dr | 33 | 27.1 | 38.1 | 0.1 | 12 |
| Commercial Blvd | 34 | 11.7 | 25.1 | 0.1 | 21 |
| Digital Dr | 35 | 17.8 | 28.9 | 0.1 | 16 |
| Total | | 56.6 | 92.0 | 0.4 | 16 |

### Arterial Level of Service: WB #3

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| Hamilton Dr | 35 | 16.6 | 28.4 | 0.1 | 17 |
| Commercial Blvd | 34 | 10.2 | 20.7 | 0.1 | 23 |
| US 101 NB On Ramp | 33 | 21.4 | 32.9 | 0.1 | 16 |
| Enfrente Rd | 32 | 15.5 | 28.2 | 0.1 | 16 |
| Total | | 63.7 | 110.2 | 0.5 | 18 |



## Arterial Level of Service
## PM Peak Hour Cumulative with Project w/ 300 ksf MPA

07/02/2019

### Arterial Level of Service: NB #3

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| Nave Dr | 33 | 28.3 | 38.1 | 0.1 | 12 |
| Commercial Blvd | 34 | 12.8 | 26.4 | 0.1 | 20 |
| Digital Dr | 35 | 17.8 | 28.5 | 0.1 | 16 |
| Total | | 58.9 | 93.0 | 0.4 | 16 |

### Arterial Level of Service: WB #3

| Cross Street | Node | Delay (s/veh) | Travel time (s) | Dist (mi) | Arterial Speed |
|---|---|---|---|---|---|
| Hamilton Dr | 35 | 15.8 | 27.1 | 0.1 | 18 |
| Commercial Blvd | 34 | 10.4 | 21.4 | 0.1 | 22 |
| US 101 NB On Ramp | 33 | 23.5 | 34.9 | 0.1 | 15 |
| Enfrente Rd | 32 | 17.0 | 29.2 | 0.1 | 16 |
| Total | | 66.8 | 112.6 | 0.5 | 17 |

# HCS7 Freeway Facilities Report

## Project Information

| | | | |
|---|---|---|---|
| Analyst | W-Trans | Date | 7/10/19 |
| Agency | | Analysis Year | 2016 |
| Jurisdiction | City of Novato | Time Period Analyzed | PM Peak Existing + Project w 300 ksf MPA - Northbound |
| Project Description | City of Novato General Plan Update EIR | Unit | United States Customary |

## Facility Global Input

| | | | |
|---|---|---|---|
| Jam Density, pc/mi/ln | 190.0 | Density at Capacity, pc/mi/ln | 45.0 |
| Queue Discharge Capacity Drop, % | 7 | Total Segments | 23 |
| Total Time Periods | 1 | Time Period Duration, min | 15 |
| Facility Length, mi | 7.48 | | |

## Facility Segment Data

| No. | Coded | Analyzed | Name | Length, ft | Lanes |
|---|---|---|---|---|---|
| 1 | Basic | Basic | Novato S City Limits->Alameda del Prado | 2000 | 4 |
| 2 | Diverge | Basic | Alameda del Prado Off-> | 1500 | 4 |
| 3 | Basic | Basic | Alameda del Prado Off->Alameda del Prado On | 2000 | 3 |
| 4 | Merge | Merge | Alameda del Prado On-> | 1000 | 3 |
| 5 | Basic | Basic | Alameda del Prado On->Nave Off | 2600 | 3 |
| 6 | Diverge | Diverge | Nave Off-> | 1000 | 3 |
| 7 | Basic | Basic | Nave Off->Nave On | 2000 | 3 |
| 8 | Merge | Basic | Nave On-> | 500 | 4 |
| 9 | Merge | Merge | Ignacio On-> | 1500 | 4 |
| 10 | Diverge | Diverge | SR37 Off-> | 1500 | 4 |
| 11 | Diverge | Diverge | Novato Blvd Off-> | 1500 | 3 |
| 12 | Basic | Basic | Novato Blvd Off->SR 37 On | 2650 | 3 |
| 13 | Weaving | Weaving | SR37->Rowland Blvd | 2050 | 4 |
| 14 | Basic | Basic | Rowland Blvd Off->Rowland Blvd On | 2900 | 3 |
| 15 | Merge | Merge | Rowland Blvd On-> | 1200 | 3 |
| 16 | Diverge | Diverge | De Long Off-> | 1200 | 3 |
| 17 | Basic | Basic | De Long Off->De Long On | 2000 | 3 |
| 18 | Merge | Merge | De Long Ave On-> | 1200 | 3 |
| 19 | Diverge | Diverge | Atherton Ave Off-> | 1200 | 3 |
| 20 | Basic | Basic | Atherton Ave Off->Atherton Ave On | 900 | 3 |
| 21 | Merge | Merge | Atherton Ave On-> | 1000 | 3 |
| 22 | Merge | Merge | End HOV | 1000 | 3 |
| 23 | Basic | Basic | End HOV -> Begin 2 lane fwy | 5100 | 2 |

## Facility Segment Data

### Segment 1: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 7628 | 9600 | 0.83 | 40.0 | 47.7 | F |

### Segment 2: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 7408 | 928 | 9600 | 2000 | 0.83 | 0.46 | 28.3 | - | 65.4 | - | F |

### Segment 3: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 6397 | 7200 | 0.98 | 35.5 | 60.1 | F |

### Segment 4: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 6704 | 307 | 7200 | 2000 | 1.02 | 0.15 | 61.1 | 57.9 | 36.6 | 34.9 | F |

### Segment 5: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 6704 | 7200 | 1.02 | 58.2 | 38.4 | F |

### Segment 6: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 1.00 | 0.957 | 1.000 | 6704 | 947 | 7200 | 2000 | 1.02 | 0.47 | 64.2 | 58.3 | 34.8 | 37.8 | F |

### Segment 7: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 5757 | 7200 | 0.89 | 65.8 | 29.2 | D |

### Segment 8: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 6009 | 252 | 9600 | 2000 | 0.69 | 0.13 | 67.9 | - | 22.1 | - | C |

### Segment 9: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 7520 | 1511 | 9600 | 2000 | 0.85 | 0.76 | 63.8 | 58.6 | 29.5 | 34.1 | D |

### Segment 10: Diverge

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|

| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 7520 | 2526 | 9600 | 4200 | 0.85 | 0.60 | 66.8 | 57.9 | 28.1 | 23.6 | C |

### Segment 11: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 4994 | 389 | 7200 | 2000 | 0.78 | 0.19 | 65.7 | 59.9 | 25.3 | 32.0 | D |

### Segment 12: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 4586 | 7200 | 0.73 | 72.1 | 21.2 | C |

### Segment 13: Weaving

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 5246 | 5634 | 1.12 | 63.8 | 20.6 | F |

### Segment 14: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 3570 | 7200 | 0.63 | 74.9 | 15.9 | B |

### Segment 15: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 4197 | 627 | 7200 | 2000 | 0.72 | 0.31 | 67.1 | 64.9 | 20.8 | 20.8 | C |

### Segment 16: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 4197 | 1849 | 7200 | 2000 | 0.72 | 0.92 | 60.4 | 55.6 | 23.2 | 27.6 | C |

### Segment 17: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 2348 | 7200 | 0.46 | 74.3 | 10.4 | A |

### Segment 18: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 2660 | 312 | 7200 | 2000 | 0.50 | 0.16 | 68.8 | 66.3 | 12.9 | 12.7 | B |

### Segment 19: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 0.990 | 2660 | 1216 | 7200 | 2000 | 0.50 | 0.61 | 61.2 | 57.5 | 14.5 | 18.6 | B |

### Segment 20: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 1444 | 7200 | 0.34 | 72.8 | 6.4 | A |

### Segment 21: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 2406 | 962 | 6761 | 1878 | 0.50 | 0.51 | 65.8 | 64.3 | 12.2 | 10.2 | B |

### Segment 22: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 2880 | 474 | 6761 | 1878 | 0.57 | 0.25 | 64.7 | 62.7 | 14.8 | 16.6 | B |

### Segment 23: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 2880 | 3274 | 1.18 | 46.7 | 30.8 | F |

### Facility Time Period Results

| T | Speed, mi/h | Density, pc/mi/ln | Density, veh/mi/ln | Travel Time, min | LOS |
|---|---|---|---|---|---|
| 1 | 53.8 | 28.9 | 27.6 | 8.30 | F |

### Facility Overall Results

| | | | |
|---|---|---|---|
| Space Mean Speed, mi/h | 53.8 | Density, veh/mi/ln | 27.6 |
| Average Travel Time, min | 8.30 | Density, pc/mi/ln | 28.9 |

# HCS7 Freeway Facilities Report

## Project Information

| | | | |
|---|---|---|---|
| Analyst | W-Trans | Date | 6/8/17 |
| Agency | | Analysis Year | 2016 |
| Jurisdiction | City of Novato | Time Period Analyzed | PM Peak Existing + Project w 300 ksf MPA - Southbound |
| Project Description | | Unit | United States Customary |

## Facility Global Input

| | | | |
|---|---|---|---|
| Jam Density, pc/mi/ln | 190.0 | Density at Capacity, pc/mi/ln | 45.0 |
| Queue Discharge Capacity Drop, % | 7 | Total Segments | 24 |
| Total Time Periods | 1 | Time Period Duration, min | 15 |
| Facility Length, mi | 6.93 | | |

## Facility Segment Data

| No. | Coded | Analyzed | Name | Length, ft | Lanes |
|---|---|---|---|---|---|
| 1 | Basic | Basic | N Novato City Limits->San Marin Dr | 3200 | 3 |
| 2 | Diverge | Diverge | San Marin Dr Off-> | 1500 | 3 |
| 3 | Basic | Basic | San Marin Dr Off->San Marin Dr On | 2100 | 3 |
| 4 | Merge | Merge | San Marin Dr On-> | 1175 | 3 |
| 5 | Diverge | Diverge | De Long Ave Off-> | 1175 | 3 |
| 6 | Basic | Basic | De Long Ave Off->De Long Ave On | 1975 | 3 |
| 7 | Merge | Merge | De Long Ave On-> | 1170 | 3 |
| 8 | Diverge | Diverge | BEGIN HOV | 200 | 4 |
| 9 | Diverge | Diverge | Rowland Blvd Off-> | 1170 | 4 |
| 10 | Basic | Basic | Rowland Blvd Off->Rowland Blvd On | 3150 | 4 |
| 11 | Merge | Merge | Rowland Blvd On-> | 1200 | 4 |
| 12 | Basic | Basic | Rowland Blvd->SR37-Novato Blvd | 770 | 4 |
| 13 | Diverge | Diverge | SR37-Novato Blvd Off-> | 1200 | 4 |
| 14 | Basic | Basic | SR37-Novato Blvd Off->SR37-Novato Blvd On | 3400 | 4 |
| 15 | Merge | Merge | SR37-Novato Blvd On-> | 1030 | 5 |
| 16 | Diverge | Diverge | Ignacio-Enfrente Off-> | 1000 | 5 |
| 17 | Diverge | Basic | BMK-Nave Off-> | 800 | 5 |
| 18 | Basic | Basic | Ignacio Blvd Off->Ignacio Blvd On | 1425 | 4 |
| 19 | Merge | Merge | Ignacio Blvd On-> | 1500 | 4 |
| 20 | Basic | Basic | Ignacio Blvd->Alameda Del Prado | 2250 | 4 |
| 21 | Diverge | Diverge | ADP Off-> | 1500 | 4 |
| 22 | Basic | Basic | ADP Off->ADP On | 1200 | 4 |
| 23 | Merge | Merge | ADP On-> | 1500 | 4 |
| 24 | Basic | Basic | Alameda Del Prado->S Novato City Limits | 1000 | 4 |

## Facility Segment Data

### Segment 1: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.957 | 3619 | 7200 | 0.50 | 74.9 | 16.1 | B |

### Segment 2: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.957 | 0.980 | 3619 | 423 | 7200 | 2000 | 0.50 | 0.21 | 63.9 | 58.1 | 18.9 | 24.4 | C |

### Segment 3: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.954 | 3209 | 7200 | 0.45 | 74.8 | 14.2 | B |

### Segment 4: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.960 | 0.980 | 4301 | 1112 | 7200 | 2000 | 0.60 | 0.56 | 65.5 | 62.9 | 21.9 | 26.4 | C |

### Segment 5: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.960 | 0.980 | 4289 | 212 | 7200 | 2000 | 0.60 | 0.11 | 67.8 | 62.6 | 21.1 | 26.8 | C |

### Segment 6: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.958 | 4088 | 7200 | 0.57 | 73.8 | 18.5 | C |

### Segment 7: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.963 | 0.980 | 5184 | 1117 | 7200 | 2000 | 0.72 | 0.56 | 64.1 | 61.2 | 27.0 | 30.5 | D |

### Segment 8: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 1.00 | 0.963 | 0.990 | 5169 | 0 | 9600 | 2200 | 0.54 | 0.00 | 71.7 | 69.8 | 17.1 | 25.6 | C |

### Segment 9: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.963 | 0.980 | 5169 | 524 | 9600 | 2000 | 0.54 | 0.26 | 70.4 | 61.7 | 18.4 | 25.3 | C |

### Segment 10: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.960 | 4666 | 9600 | 0.49 | 75.0 | 15.5 | B |

### Segment 11: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.966 | 0.980 | 6064 | 1427 | 9600 | 2000 | 0.63 | 0.71 | 66.3 | 62.0 | 22.9 | 28.6 | D |

### Segment 12: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.966 | 6041 | 9600 | 0.63 | 72.4 | 20.9 | C |

### Segment 13: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.966 | 0.962 | 6041 | 677 | 9600 | 2100 | 0.63 | 0.32 | 71.0 | 63.4 | 21.3 | 29.3 | D |

### Segment 14: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.967 | 5382 | 9600 | 0.56 | 74.0 | 18.2 | C |

### Segment 15: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.966 | 0.962 | 6817 | 1430 | 12000 | 4000 | 0.57 | 0.36 | 68.7 | 65.7 | 19.8 | 19.8 | B |

### Segment 16: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.966 | 0.980 | 6768 | 597 | 12000 | 2000 | 0.56 | 0.30 | 70.0 | 61.5 | 19.3 | 24.2 | C |

### Segment 17: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.964 | 0.980 | 6193 | 825 | 12000 | 2000 | 0.52 | 0.41 | 74.1 | - | 16.6 | - | B |

### Segment 18: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.962 | 5392 | 9600 | 0.56 | 73.9 | 18.2 | C |

### Segment 19: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.965 | 0.980 | 6466 | 1091 | 9600 | 2000 | 0.67 | 0.55 | 66.4 | 62.1 | 24.3 | 28.4 | D |

### Segment 20: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.965 | 6449 | 9600 | 0.67 | 71.1 | 22.7 | C |

### Segment 21: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.932 | 0.980 | 6678 | 347 | 9600 | 2000 | 0.70 | 0.17 | 70.5 | 62.2 | 23.7 | 26.9 | C |

### Segment 22: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.931 | 6331 | 9600 | 0.66 | 71.5 | 22.1 | C |

### Segment 23: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.934 | 0.980 | 7031 | 721 | 9600 | 2000 | 0.73 | 0.36 | 68.0 | 65.3 | 25.8 | 21.1 | C |

### Segment 24: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.934 | 7043 | 9600 | 0.73 | 68.8 | 25.6 | C |

### Facility Time Period Results

| T | Speed, mi/h | Density, pc/mi/ln | Density, veh/mi/ln | Travel Time, min | LOS |
|---|---|---|---|---|---|
| 1 | 70.7 | 19.9 | 19.1 | 5.90 | C |

### Facility Overall Results

| | | | |
|---|---|---|---|
| Space Mean Speed, mi/h | 70.7 | Density, veh/mi/ln | 19.1 |
| Average Travel Time, min | 5.90 | Density, pc/mi/ln | 19.9 |

# HCS7 Freeway Facilities Report

## Project Information

| | | | |
|---|---|---|---|
| Analyst | W-Trans | Date | 7/10/19 |
| Agency | | Analysis Year | 2016 |
| Jurisdiction | City of Novato | Time Period Analyzed | PM Peak Cumulative with Project w 300 ksf MPA - Northbound |
| Project Description | City of Novato General Plan Update EIR | Unit | United States Customary |

## Facility Global Input

| | | | |
|---|---|---|---|
| Jam Density, pc/mi/ln | 190.0 | Density at Capacity, pc/mi/ln | 45.0 |
| Queue Discharge Capacity Drop, % | 7 | Total Segments | 23 |
| Total Time Periods | 1 | Time Period Duration, min | 15 |
| Facility Length, mi | 7.48 | | |

## Facility Segment Data

| No. | Coded | Analyzed | Name | Length, ft | Lanes |
|---|---|---|---|---|---|
| 1 | Basic | Basic | Novato S City Limits->Alameda del Prado | 2000 | 4 |
| 2 | Diverge | Basic | Alameda del Prado Off-> | 1500 | 4 |
| 3 | Basic | Basic | Alameda del Prado Off->Alameda del Prado On | 2000 | 3 |
| 4 | Merge | Merge | Alameda del Prado On-> | 1000 | 3 |
| 5 | Basic | Basic | Alameda del Prado On->Nave Off | 2600 | 3 |
| 6 | Diverge | Diverge | Nave Off-> | 1000 | 3 |
| 7 | Basic | Basic | Nave Off->Nave On | 2000 | 3 |
| 8 | Merge | Basic | Nave On-> | 500 | 4 |
| 9 | Merge | Merge | Ignacio On-> | 1500 | 4 |
| 10 | Diverge | Diverge | SR37 Off-> | 1500 | 4 |
| 11 | Diverge | Diverge | Novato Blvd Off-> | 1500 | 3 |
| 12 | Basic | Basic | Novato Blvd Off->SR 37 On | 2650 | 3 |
| 13 | Weaving | Weaving | SR37->Rowland Blvd | 2050 | 4 |
| 14 | Basic | Basic | Rowland Blvd Off->Rowland Blvd On | 2900 | 3 |
| 15 | Merge | Merge | Rowland Blvd On-> | 1200 | 3 |
| 16 | Diverge | Diverge | De Long Off-> | 1200 | 3 |
| 17 | Basic | Basic | De Long Off->De Long On | 2000 | 3 |
| 18 | Merge | Merge | De Long Ave On-> | 1200 | 3 |
| 19 | Diverge | Diverge | Atherton Ave Off-> | 1200 | 3 |
| 20 | Basic | Basic | Atherton Ave Off->Atherton Ave On | 900 | 3 |
| 21 | Merge | Merge | Atherton Ave On-> | 1000 | 3 |
| 22 | Merge | Merge | End HOV | 1000 | 3 |
| 23 | Basic | Basic | End HOV -> Begin 2 lane fwy | 5100 | 2 |

## Facility Segment Data

### Segment 1: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 7601 | 9600 | 0.90 | 25.3 | 75.2 | F |

### Segment 2: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 7404 | 932 | 9600 | 2000 | 0.90 | 0.47 | 25.0 | - | 74.1 | - | F |

### Segment 3: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 6397 | 7200 | 1.07 | 35.2 | 60.6 | F |

### Segment 4: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 6704 | 307 | 7200 | 2000 | 1.11 | 0.15 | 61.1 | 57.9 | 36.6 | 34.9 | F |

### Segment 5: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 6704 | 7200 | 1.11 | 58.2 | 38.4 | F |

### Segment 6: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 1.00 | 0.957 | 1.000 | 6704 | 953 | 7200 | 2000 | 1.11 | 0.48 | 64.1 | 58.2 | 34.9 | 37.8 | F |

### Segment 7: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 5751 | 7200 | 0.98 | 65.8 | 29.1 | D |

### Segment 8: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 6006 | 255 | 9600 | 2000 | 0.76 | 0.13 | 67.9 | - | 22.1 | - | C |

### Segment 9: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 7537 | 1531 | 9600 | 2000 | 0.92 | 0.77 | 63.8 | 58.5 | 29.5 | 34.3 | D |

### Segment 10: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 7537 | 2794 | 9600 | 4200 | 0.92 | 0.67 | 65.8 | 57.1 | 28.6 | 25.4 | C |

### Segment 11: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 4743 | 397 | 7200 | 2000 | 0.84 | 0.20 | 65.6 | 59.9 | 24.1 | 31.0 | D |

### Segment 12: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 4346 | 7200 | 0.78 | 73.0 | 19.8 | C |

### Segment 13: Weaving

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 5327 | 5868 | 1.14 | 61.8 | 21.5 | F |

### Segment 14: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 3607 | 7200 | 0.68 | 74.9 | 16.1 | B |

### Segment 15: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 4247 | 640 | 7200 | 2000 | 0.77 | 0.32 | 67.1 | 64.8 | 21.1 | 21.0 | C |

### Segment 16: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 4247 | 1894 | 7200 | 2000 | 0.77 | 0.95 | 60.2 | 55.4 | 23.5 | 28.0 | C |

### Segment 17: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 2353 | 7200 | 0.51 | 74.3 | 10.4 | A |

### Segment 18: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 2677 | 324 | 7200 | 2000 | 0.55 | 0.16 | 68.7 | 66.3 | 13.0 | 12.8 | B |

### Segment 19: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 0.990 | 2677 | 1310 | 7200 | 2000 | 0.55 | 0.66 | 60.7 | 57.2 | 14.7 | 18.9 | B |

### Segment 20: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 1367 | 7200 | 0.37 | 72.7 | 6.0 | A |

### Segment 21: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 2344 | 977 | 6761 | 1878 | 0.54 | 0.52 | 65.8 | 64.3 | 11.9 | 9.9 | A |

### Segment 22: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 1.00 | 0.95 | 0.957 | 1.000 | 3049 | 868 | 6761 | 1878 | 0.67 | 0.46 | 16.5 | 60.5 | 61.4 | 26.0 | F |

### Segment 23: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.957 | 3049 | 3274 | 1.38 | 42.6 | 35.8 | F |

### Facility Time Period Results

| T | Speed, mi/h | Density, pc/mi/ln | Density, veh/mi/ln | Travel Time, min | LOS |
|---|---|---|---|---|---|
| 1 | 47.7 | 32.7 | 31.3 | 9.40 | F |

### Facility Overall Results

| | | | |
|---|---|---|---|
| Space Mean Speed, mi/h | 47.7 | Density, veh/mi/ln | 31.3 |
| Average Travel Time, min | 9.40 | Density, pc/mi/ln | 32.7 |

# HCS7 Freeway Facilities Report

## Project Information

| | | | |
|---|---|---|---|
| Analyst | W-Trans | Date | 7/10/19 |
| Agency | | Analysis Year | 2016 |
| Jurisdiction | City of Novato | Time Period Analyzed | PM Cumulative with Project w 300 ksf MPA - Southbound |
| Project Description | | Unit | United States Customary |

## Facility Global Input

| | | | |
|---|---|---|---|
| Jam Density, pc/mi/ln | 190.0 | Density at Capacity, pc/mi/ln | 45.0 |
| Queue Discharge Capacity Drop, % | 7 | Total Segments | 24 |
| Total Time Periods | 1 | Time Period Duration, min | 15 |
| Facility Length, mi | 7.04 | | |

## Facility Segment Data

| No. | Coded | Analyzed | Name | Length, ft | Lanes |
|---|---|---|---|---|---|
| 1 | Basic | Basic | N Novato City Limits->San Marin Dr | 3771 | 3 |
| 2 | Diverge | Diverge | San Marin Dr Off-> | 1500 | 3 |
| 3 | Basic | Basic | San Marin Dr Off->San Marin Dr On | 2100 | 3 |
| 4 | Merge | Merge | San Marin Dr On-> | 1175 | 3 |
| 5 | Diverge | Diverge | De Long Ave Off-> | 1175 | 3 |
| 6 | Basic | Basic | De Long Ave Off->De Long Ave On | 1975 | 3 |
| 7 | Merge | Merge | De Long Ave On-> | 1170 | 3 |
| 8 | Diverge | Diverge | BEGIN HOV | 200 | 4 |
| 9 | Diverge | Diverge | Rowland Blvd Off-> | 1170 | 4 |
| 10 | Basic | Basic | Rowland Blvd Off->Rowland Blvd On | 3150 | 4 |
| 11 | Merge | Merge | Rowland Blvd On-> | 1200 | 4 |
| 12 | Basic | Basic | Rowland Blvd->SR37-Novato Blvd | 770 | 4 |
| 13 | Diverge | Diverge | SR37-Novato Blvd Off-> | 1200 | 4 |
| 14 | Basic | Basic | SR37-Novato Blvd Off->SR37-Novato Blvd On | 3400 | 4 |
| 15 | Merge | Merge | SR37-Novato Blvd On-> | 1030 | 5 |
| 16 | Diverge | Diverge | Ignacio-Enfrente Off-> | 1000 | 5 |
| 17 | Diverge | Basic | BMK-Nave Off-> | 800 | 5 |
| 18 | Basic | Basic | Ignacio Blvd Off->Ignacio Blvd On | 1425 | 4 |
| 19 | Merge | Merge | Ignacio Blvd On-> | 1500 | 4 |
| 20 | Basic | Basic | Ignacio Blvd->Alameda Del Prado | 2250 | 4 |
| 21 | Diverge | Diverge | ADP Off-> | 1500 | 4 |
| 22 | Basic | Basic | ADP Off->ADP On | 1200 | 4 |
| 23 | Merge | Merge | ADP On-> | 1500 | 4 |
| 24 | Basic | Basic | Alameda Del Prado->S Novato City Limits | 1000 | 4 |

## Facility Segment Data

### Segment 1: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.957 | 4013 | 7200 | 0.56 | 74.0 | 18.1 | C |

### Segment 2: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.957 | 0.980 | 4013 | 445 | 7200 | 2000 | 0.56 | 0.22 | 63.9 | 58.0 | 20.9 | 26.3 | C |

### Segment 3: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.954 | 3583 | 7200 | 0.50 | 74.8 | 15.9 | B |

### Segment 4: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.960 | 0.980 | 4740 | 1179 | 7200 | 2000 | 0.66 | 0.59 | 64.8 | 62.1 | 24.4 | 28.6 | D |

### Segment 5: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.960 | 0.980 | 4728 | 222 | 7200 | 2000 | 0.66 | 0.11 | 67.8 | 62.6 | 23.2 | 28.9 | D |

### Segment 6: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.958 | 4517 | 7200 | 0.63 | 72.4 | 20.8 | C |

### Segment 7: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.963 | 0.980 | 5655 | 1161 | 7200 | 2000 | 0.79 | 0.58 | 62.9 | 59.7 | 30.0 | 32.7 | D |

### Segment 8: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 1.00 | 0.963 | 0.990 | 5639 | 0 | 9600 | 2200 | 0.59 | 0.00 | 71.3 | 69.8 | 18.7 | 27.5 | C |

### Segment 9: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.963 | 0.980 | 5639 | 532 | 9600 | 2000 | 0.59 | 0.27 | 70.2 | 61.7 | 20.1 | 27.1 | C |

### Segment 10: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.960 | 5131 | 9600 | 0.53 | 74.4 | 17.2 | B |

### Segment 11: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.966 | 0.980 | 6567 | 1468 | 9600 | 2000 | 0.68 | 0.73 | 65.6 | 61.1 | 25.0 | 30.4 | D |

### Segment 12: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.966 | 6543 | 9600 | 0.68 | 70.7 | 23.1 | C |

### Segment 13: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.966 | 0.962 | 6543 | 754 | 9600 | 2100 | 0.68 | 0.36 | 70.7 | 63.2 | 23.1 | 31.5 | D |

### Segment 14: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.967 | 5809 | 9600 | 0.61 | 73.0 | 19.9 | C |

### Segment 15: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.966 | 0.962 | 7397 | 1582 | 12000 | 4000 | 0.62 | 0.40 | 68.1 | 65.0 | 21.7 | 21.5 | C |

### Segment 16: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.966 | 0.980 | 7343 | 613 | 12000 | 2000 | 0.61 | 0.31 | 69.9 | 61.4 | 21.0 | 24.8 | C |

### Segment 17: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.964 | 0.980 | 6753 | 839 | 12000 | 2000 | 0.56 | 0.42 | 73.9 | - | 18.3 | - | C |

### Segment 18: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.962 | 5939 | 9600 | 0.62 | 72.6 | 20.5 | C |

### Segment 19: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.965 | 0.980 | 6986 | 1066 | 9600 | 2000 | 0.73 | 0.53 | 65.8 | 61.4 | 26.5 | 30.0 | D |

### Segment 20: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.965 | 6969 | 9600 | 0.73 | 69.1 | 25.2 | C |

### Segment 21: Diverge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.932 | 0.980 | 7216 | 347 | 9600 | 2000 | 0.75 | 0.17 | 70.3 | 62.2 | 25.7 | 28.9 | D |

### Segment 22: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.931 | 6870 | 9600 | 0.72 | 69.5 | 24.7 | C |

### Segment 23: Merge

| Time Period | PHF | | fHV | | Flow Rate (pc/h) | | Capacity (pc/h) | | d/c Ratio | | Speed (mi/h) | | Density (pc/mi/ln) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | R | F | R | Freeway | Ramp | Freeway | Ramp | F | R | F | R | Freeway | Ramp | |
| 1 | 0.98 | 0.95 | 0.934 | 0.980 | 7575 | 727 | 9600 | 2000 | 0.79 | 0.36 | 67.3 | 64.5 | 28.1 | 22.8 | C |

### Segment 24: Basic

| Time Period | PHF | fHV | Flow Rate (pc/h) | Capacity (pc/h) | d/c Ratio | Speed (mi/h) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.98 | 0.934 | 7588 | 9600 | 0.79 | 66.2 | 28.7 | D |

### Facility Time Period Results

| T | Speed, mi/h | Density, pc/mi/ln | Density, veh/mi/ln | Travel Time, min | LOS |
|---|---|---|---|---|---|
| 1 | 69.9 | 22.0 | 21.0 | 6.00 | C |

### Facility Overall Results

| | | | |
|---|---|---|---|
| Space Mean Speed, mi/h | 69.9 | Density, veh/mi/ln | 21.0 |
| Average Travel Time, min | 6.00 | Density, pc/mi/ln | 22.0 |

# HCS7 Basic Freeway Report

## Project Information

| | | | |
|---|---|---|---|
| Analyst | W-Trans | Date | 7/10/19 |
| Agency | | Analysis Year | 2017 |
| Jurisdiction | City of Novato | Time Period Analyzed | PM Peak Existing+Project w 300 ksf MPA - Eastbound |
| Project Description | | Unit | United States Customary |

## Geometric Data

| | | | |
|---|---|---|---|
| Number of Lanes, ln | 2 | Terrain Type | Level |
| Segment Length (L), ft | - | Percent Grade, % | - |
| Measured or Base Free-Flow Speed | Base | Grade Length, mi | - |
| Base Free-Flow Speed (BFFS), mi/h | 75.4 | Total Ramp Density (TRD), ramps/mi | 0.00 |
| Lane Width, ft | 12 | Free-Flow Speed (FFS), mi/h | 75.4 |
| Right-Side Lateral Clearance, ft | 6 | | |

## Adjustment Factors

| | | | |
|---|---|---|---|
| Driver Population | Mostly Familiar | Final Speed Adjustment Factor (SAF) | 0.975 |
| Weather Type | Non-Severe Weather | Final Capacity Adjustment Factor (CAF) | 0.968 |
| Incident Type | No Incident | Demand Adjustment Factor (DAF) | 1.000 |

## Demand and Capacity

| | | | |
|---|---|---|---|
| Demand Volume veh/h | 2496 | Heavy Vehicle Adjustment Factor ($f_{HV}$) | 0.971 |
| Peak Hour Factor | 0.95 | Flow Rate ($V_p$), pc/h/ln | 1353 |
| Total Trucks, % | 3.00 | Capacity (c), pc/h/ln | 2400 |
| Single-Unit Trucks (SUT), % | - | Adjusted Capacity ($c_{adj}$), pc/h/ln | 2323 |
| Tractor-Trailers (TT), % | - | Volume-to-Capacity Ratio (v/c) | 0.58 |
| Passenger Car Equivalent ($E_T$) | 2.000 | | |

## Speed and Density

| | | | |
|---|---|---|---|
| Lane Width Adjustment ($f_{LW}$) | 0.0 | Average Speed (S), mi/h | 71.9 |
| Right-Side Lateral Clearance Adj. ($f_{RLC}$) | 0.0 | Density (D), pc/mi/ln | 18.8 |
| Total Ramp Density Adjustment | 0.0 | Level of Service (LOS) | C |
| Adjusted Free-Flow Speed ($FFS_{adj}$), mi/h | 73.5 | | |




# HCS7 Basic Freeway Report

## Project Information

| | | | |
|---|---|---|---|
| Analyst | W-Trans | Date | 7/10/19 |
| Agency | | Analysis Year | 2017 |
| Jurisdiction | City of Novato | Time Period Analyzed | PM Peak Existing+Project - Westbound |
| Project Description | | Unit | United States Customary |

## Geometric Data

| | | | |
|---|---|---|---|
| Number of Lanes, ln | 2 | Terrain Type | Level |
| Segment Length (L), ft | - | Percent Grade, % | - |
| Measured or Base Free-Flow Speed | Base | Grade Length, mi | - |
| Base Free-Flow Speed (BFFS), mi/h | 75.4 | Total Ramp Density (TRD), ramps/mi | 0.00 |
| Lane Width, ft | 12 | Free-Flow Speed (FFS), mi/h | 75.4 |
| Right-Side Lateral Clearance, ft | 6 | | |

## Adjustment Factors

| | | | |
|---|---|---|---|
| Driver Population | Mostly Familiar | Final Speed Adjustment Factor (SAF) | 0.975 |
| Weather Type | Non-Severe Weather | Final Capacity Adjustment Factor (CAF) | 0.968 |
| Incident Type | No Incident | Demand Adjustment Factor (DAF) | 1.000 |

## Demand and Capacity

| | | | |
|---|---|---|---|
| Demand Volume veh/h | 1375 | Heavy Vehicle Adjustment Factor ($f_{HV}$) | 0.971 |
| Peak Hour Factor | 0.95 | Flow Rate ($V_p$), pc/h/ln | 746 |
| Total Trucks, % | 3.00 | Capacity (c), pc/h/ln | 2400 |
| Single-Unit Trucks (SUT), % | - | Adjusted Capacity ($c_{adj}$), pc/h/ln | 2323 |
| Tractor-Trailers (TT), % | - | Volume-to-Capacity Ratio (v/c) | 0.32 |
| Passenger Car Equivalent ($E_T$) | 2.000 | | |

## Speed and Density

| | | | |
|---|---|---|---|
| Lane Width Adjustment ($f_{LW}$) | 0.0 | Average Speed (S), mi/h | 73.5 |
| Right-Side Lateral Clearance Adj. ($f_{RLC}$) | 0.0 | Density (D), pc/mi/ln | 10.1 |
| Total Ramp Density Adjustment | 0.0 | Level of Service (LOS) | A |
| Adjusted Free-Flow Speed ($FFS_{adj}$), mi/h | 73.5 | | |

# HCS7 Basic Freeway Report

## Project Information

| | | | |
|---|---|---|---|
| Analyst | W-Trans | Date | 7/10/19 |
| Agency | | Analysis Year | 2017 |
| Jurisdiction | City of Novato | Time Period Analyzed | PM Peak Cumulative with Project w 300 ksf MPA - Eastbound |
| Project Description | | Unit | United States Customary |

## Geometric Data

| | | | |
|---|---|---|---|
| Number of Lanes, ln | 2 | Terrain Type | Level |
| Segment Length (L), ft | - | Percent Grade, % | - |
| Measured or Base Free-Flow Speed | Base | Grade Length, mi | - |
| Base Free-Flow Speed (BFFS), mi/h | 75.4 | Total Ramp Density (TRD), ramps/mi | 0.00 |
| Lane Width, ft | 12 | Free-Flow Speed (FFS), mi/h | 75.4 |
| Right-Side Lateral Clearance, ft | 6 | | |

## Adjustment Factors

| | | | |
|---|---|---|---|
| Driver Population | Mostly Familiar | Final Speed Adjustment Factor (SAF) | 0.975 |
| Weather Type | Non-Severe Weather | Final Capacity Adjustment Factor (CAF) | 0.968 |
| Incident Type | No Incident | Demand Adjustment Factor (DAF) | 1.000 |

## Demand and Capacity

| | | | |
|---|---|---|---|
| Demand Volume veh/h | 2733 | Heavy Vehicle Adjustment Factor ($f_{HV}$) | 0.971 |
| Peak Hour Factor | 0.95 | Flow Rate ($V_p$), pc/h/ln | 1482 |
| Total Trucks, % | 3.00 | Capacity (c), pc/h/ln | 2400 |
| Single-Unit Trucks (SUT), % | - | Adjusted Capacity ($c_{adj}$), pc/h/ln | 2323 |
| Tractor-Trailers (TT), % | - | Volume-to-Capacity Ratio (v/c) | 0.64 |
| Passenger Car Equivalent ($E_T$) | 2.000 | | |

## Speed and Density

| | | | |
|---|---|---|---|
| Lane Width Adjustment ($f_{LW}$) | 0.0 | Average Speed (S), mi/h | 70.5 |
| Right-Side Lateral Clearance Adj. ($f_{RLC}$) | 0.0 | Density (D), pc/mi/ln | 21.0 |
| Total Ramp Density Adjustment | 0.0 | Level of Service (LOS) | C |
| Adjusted Free-Flow Speed ($FFS_{adj}$), mi/h | 73.5 | | |




# HCS7 Basic Freeway Report

## Project Information

| | | | |
|---|---|---|---|
| Analyst | W-Trans | Date | 7/10/19 |
| Agency | | Analysis Year | 2017 |
| Jurisdiction | City of Novato | Time Period Analyzed | PM Peak Cumulative with Project w 300 ksf MPA - Westbound |
| Project Description | | Unit | United States Customary |

## Geometric Data

| | | | |
|---|---|---|---|
| Number of Lanes, ln | 2 | Terrain Type | Level |
| Segment Length (L), ft | - | Percent Grade, % | - |
| Measured or Base Free-Flow Speed | Base | Grade Length, mi | - |
| Base Free-Flow Speed (BFFS), mi/h | 75.4 | Total Ramp Density (TRD), ramps/mi | 0.00 |
| Lane Width, ft | 12 | Free-Flow Speed (FFS), mi/h | 75.4 |
| Right-Side Lateral Clearance, ft | 6 | | |

## Adjustment Factors

| | | | |
|---|---|---|---|
| Driver Population | Mostly Familiar | Final Speed Adjustment Factor (SAF) | 0.975 |
| Weather Type | Non-Severe Weather | Final Capacity Adjustment Factor (CAF) | 0.968 |
| Incident Type | No Incident | Demand Adjustment Factor (DAF) | 1.000 |

## Demand and Capacity

| | | | |
|---|---|---|---|
| Demand Volume veh/h | 1479 | Heavy Vehicle Adjustment Factor ($f_{HV}$) | 0.971 |
| Peak Hour Factor | 0.95 | Flow Rate ($V_p$), pc/h/ln | 802 |
| Total Trucks, % | 3.00 | Capacity (c), pc/h/ln | 2400 |
| Single-Unit Trucks (SUT), % | - | Adjusted Capacity ($c_{adj}$), pc/h/ln | 2323 |
| Tractor-Trailers (TT), % | - | Volume-to-Capacity Ratio (v/c) | 0.35 |
| Passenger Car Equivalent ($E_T$) | 2.000 | | |

## Speed and Density

| | | | |
|---|---|---|---|
| Lane Width Adjustment ($f_{LW}$) | 0.0 | Average Speed (S), mi/h | 73.5 |
| Right-Side Lateral Clearance Adj. ($f_{RLC}$) | 0.0 | Density (D), pc/mi/ln | 10.9 |
| Total Ramp Density Adjustment | 0.0 | Level of Service (LOS) | A |
| Adjusted Free-Flow Speed ($FFS_{adj}$), mi/h | 73.5 | | |

# Appendix F

Native American Consultation Letters

THE CITY OF
NOVATO
CALIFORNIA

922 Machin Ave
Novato, CA 94945
(415) 899-8900
FAX (415) 899-8213
*www.novato.org*



February 26, 2015

The Federated Indians of the Graton Rancheria
Attn: Nick Tipon
6400 Redwood Drive, Suite 300
Rohnert Park, CA 94928

RE: City of Novato General Plan Update

Dear Mr. Tipon:

Pursuant to the requirements of the California Government Code §65352.3, the Federated Indians of the Graton Rancheria is invited to consult with the City of Novato regarding an update of the City of Novato General Plan. Last adopted in 1996, the General Plan is a comprehensive, long-range plan that identifies Novato's land use, transportation, environmental, economic, fiscal, and social goals and policies as they relate to the conservation and development of land in Novato. The City has initiated a review of the existing policies and programs of the 1996 General Plan, and City staff will be preparing a draft General Plan Update this summer. The City expects to release a public review document in the fall of 2015. You will be noticed during the steps in the process, which will provide a further opportunity for review and comment.

Please indicate, in writing, if the Federated Indians of the Graton Rancheria desires to consult with the City of Novato regarding the proposed general plan update. A request for consultation is encouraged to be sent to the City as soon as possible, but in no case later than ninety (90) days from the date of this letter pursuant to Government Code §65352.3(a)(2).

Should you have any questions regarding the General Plan Update, please feel free to contact Elizabeth Dunn at (415) 493-4711 or edunn@cityofnovato.org.

Sincerely,

Robert M. Brown
Community Development Director

THE CITY OF
NOVATO
CALIFORNIA

922 Machin Avenue
Novato, CA 94945
415/899-8900
FAX 415/899-8213
*www.novato.org*



August 22, 2016

The Federated Indians of the Graton Rancheria
Attn: Nick Tipon
6400 Redwood Drive, Suite 300
Rohnert Park, CA 94928

RE: City of Novato General Plan Update

Dear Mr. Tipon:

The City of Novato has released a Draft City of Novato General Plan 2035 for public review. The Plan is a comprehensive update of the City's 1996 General Plan. The overall purpose of the Novato General Plan 2035 is to create a policy framework that articulates a vision for the city's long-term physical form and development, while preserving and enhancing the quality of life for Novato residents, and increasing opportunities for high-quality local job growth balanced with robust environmental sustainability principles.

The key components of the General Plan include broad goals for the future of Novato. The State requires that the General Plan contain seven mandatory elements: Land Use, Circulation, Housing, Open Space, Noise, Safety, and Conservation. The Novato General Plan contains these mandatory elements within the six chapters and appendices. Please note that the Housing Element was separately adopted by the City pursuant to a previous public process on November 18, 2014. No amendments to the Housing Element as adopted previously are proposed.

The Draft General Plan 2035 is available online at novato.org/generalplan.

Should you have any questions regarding the Draft City of Novato General Plan 2035, please feel free to contact General Plan Manager Christine O'Rourke at (415) 613-2907. Written comments may be submitted to Christine O'Rourke at corourke@cityofnovato.org. In order to permit time for consideration of comments received prior to the formal public hearing process, comments should be submitted by November 30, 2016.

Sincerely,

Robert M. Brown
Community Development Director

RECEIVED 8/23/16

**Rincon Consultants, Inc.**
449 15th Street, Suite 303
Oakland, California 94612

510 834 4455 OFFICE AND FAX

info@rinconconsultants.com
www.rinconconsultants.com

November 17, 2016
Project No: 16-02712

Gene Buvelot
6400 Redwood Drive, Suite 300
Rohnert, CA, 94928

Subject: Cultural Resources Study for the Novato General Plan Environmental Impact Report
City of Novato, Marin County, California

Dear Mr. Buvelot:

Rincon Consultants, Inc. (Rincon) has been retained to conduct a cultural resources study for the Novato General Plan Environmental Impact Report (EIR) for the City of Novato, Marin County, California. The EIR will examine the potential environmental effects of the proposed City of Novato 2035 General Plan, which includes various policies directing land use changes, addresses land use compatibility and development intensities, establishes impact thresholds for future development projects, and implements programs focusing on the development of design guidelines and new zoning provisions.

This anticipatory letter serves to inform you of our understanding of the project, and to inquire about your knowledge of potential cultural resources within the City of Novato that may be impacted by project development. A Project Location Map is enclosed with this letter for your reference.

If you have knowledge of cultural resources that may exist within or near the project area, please contact me at (805) 644 4455 extension 165, or at mszromba@rinconconsultants.com. Thank you for your assistance.

Sincerely,

Rincon Consultants, Inc.

M. Szromba

Meagan Szromba, M.A., RPA
Associate Archaeologist


Imagery provided by ESRI and its licensors © 2016.

Project Location

N

**Steve Marshall**

| | |
|---|---|
| **From:** | Bob Brown |
| **Sent:** | Monday, November 21, 2016 5:01 PM |
| **To:** | Christine O'Rourke; Steve Marshall; Veronica Nebb |
| **Subject:** | FW: City of Novato, General Plan Update |
| **Attachments:** | City of Novato General Plan Update.pdf |

FYI…

**Bob Brown**
Community Development Director
922 Machin Avenue
Novato, CA 94945
415-899-8938

---

**From:** THPO@gratonrancheria.com [mailto:THPO@gratonrancheria.com]
**Sent:** Monday, November 21, 2016 4:25 PM
**To:** Bob Brown <bbrown@novato.org>
**Subject:** City of Novato, General Plan Update

Dear Robert Brown,

Thank you for notifying the Federated Indians of Graton Rancheria regarding City of Novato, General Plan Update, a project within the Tribe's Ancestral Territory. We appreciate being notified and will review your project within 10 business days. If you have an immediate request please contact the Tribal Heritage Preservation Office for assistance by phone at (707) 566-2288 or by email at thpo@gratonrancheria.com.

Sincerely,

Buffy McQuillen
Tribal Heritage Preservation Officer (THPO)
Native American Graves Protection and Repatriation Act (NAGPRA)
Office: 707.566.2288; ext. 137
Cell: 707.318.0485
FAX: 707.566.2291

**Antonette Tomic**
THPO Administrative Assistant
**Federated Indians of Graton Rancheria**
6400 Redwood Drive, Suite 300
Rohnert Park, CA 94928
Office: 707.566.2288, ext. 143
Fax: 707.566.2291
atomic@gratonrancheria.com

## Steve Marshall

| | |
|---|---|
| **From:** | Bob Brown |
| **Sent:** | Tuesday, November 22, 2016 11:47 AM |
| **To:** | Steve Marshall; Christine O'Rourke; Veronica Nebb |
| **Subject:** | FW: City of Novato General Plan Update |

I'm stunned!

**Bob Brown**
Community Development Director
922 Machin Avenue
Novato, CA 94945
415-899-8938

---

**From:** THPO@gratonrancheria.com [mailto:THPO@gratonrancheria.com]
**Sent:** Tuesday, November 22, 2016 11:46 AM
**To:** Bob Brown <bbrown@novato.org>
**Subject:** City of Novato General Plan Update

Dear Robert Brown,

The Tribe has received the project notification letter dated August 22, 2016, requesting interest and input regarding the project, Cultural Resources Study for the City of Novato General Plan Update. We appreciate your effort to contact the Tribe. The Tribal Heritage Preservation Office staff has reviewed the project information. Based on the project details, the Tribe does not have any comments to provide at this time. Should the project be modified the Tribe respectfully requests project notification and the opportunity to review the project. Thank you for contacting the Tribe with this notice and the opportunity to provide comment.

Sincerely,

Buffy McQuillen
Tribal Heritage Preservation Officer (THPO)
Native American Graves Protection and Repatriation Act (NAGPRA)
Office: 707.566.2288; ext. 137
Cell: 707.318.0485
FAX: 707.566.2291

**Antonette Tomic**
THPO Administrative Assistant
**Federated Indians of Graton Rancheria**
6400 Redwood Drive, Suite 300
Rohnert Park, CA 94928
Office: 707.566.2288, ext. 143
Fax: 707.566.2291
atomic@gratonrancheria.com

please consider our environment before printing this email.

## Steve Marshall

| | |
|---|---|
| **From:** | Buffy McQuillen <BMcQuillen@gratonrancheria.com> |
| **To:** | Steve Marshall |
| **Sent:** | Monday, December 19, 2016 2:21 PM |
| **Subject:** | Read: Draft Novato General Plan 2035 - Notice of Preparation of Environmental Impact Report |

Your message

To: Buffy McQuillen
Subject: Draft Novato General Plan 2035 - Notice of Preparation of Environmental Impact Report
Sent: Monday, December 19, 2016 2:16:23 PM (UTC-08:00) Pacific Time (US & Canada)

was read on Monday, December 19, 2016 2:20:56 PM (UTC-08:00) Pacific Time (US & Canada).

Hi Buffy,

I am writing to see if we can schedule a consultation call to discuss the draft Novato General Plan 2035. Unlike last time, I have the city's conference call line ready to go.

I noticed the letter requesting consultation seemed to be geared toward a project level review of a new development proposal. Since the General Plan update doesn't go into project level detail or authorize any development projects I am wondering if our conversation can focus on general policy and program statements related to the protection of cultural resources?

With respect to the level of environmental review for the draft General Plan, the City has Rincon Consultants under contract to prepare a program EIR. The program EIR won't attempt to determine the significance of any cultural resources or specific impacts. Rather the EIR will look more broadly at the issue of cultural resources, their presence in Novato, and, if appropriate, provide recommendations for program level mitigations taking the form of policies applicable to future development projects. Since the program EIR is in-process and it is the customary type of EIR for a general plan update, is it possible to forego a discussion about the EIR until the draft document is released for public and agency review?

Please let me know what dates and times you are available for a conference call.

Thanks, Steve

Steve Marshall, AICP
Planning & Environmental Services Manager

City of Novato
Community Development Department
922 Machin Avenue
Novato, CA 94945

Main: (415)899-8989
Direct: (415)899-8942
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THE CITY OF
NOVATO
CALIFORNIA

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May 22, 2017

Ms. Buffy McQuillen
Federated Indians of Graton Rancheria
Tribal Heritage Preservation Office
6400 Redwood Drive, Suite 300
Rohnert Park, CA 94928

RE: AB 52 Consultation - Novato General Plan 2035, Novato, Marin County

Dear Buffy:

On April 24, 2017, the City of Novato ("City") received a letter from Federated Indians of Graton Rancheria ("FIGR") indicating a desire to consult with the City regarding the draft Novato General Plan 2035. Based on this request, I sent an email to you on May 2, 2017, seeking to schedule a conference call to consult regarding the draft General Plan. I have not received a response to this email to date.

In the interest of starting consultation on the draft General Plan, I would like to invite you and any other representative of the Graton Rancheria to participate in a conference call regarding the draft General Plan on Tuesday, May 30, 2017, from 11 AM to 12 PM.

I understand you to prefer in-person meetings at FIGR's offices in Rohnert Park. However, I am proposing a conference call since my work load and schedule can't accommodate travel time to and from Rohnert Park. I assume your work load likely doesn't permit travel time to Novato recognizing you are certainly handling many consultation requests from numerous agencies in Marin and Sonoma.

Please let me know if you can participate in the call noted above. If so, I will send call-in information to you. If not, please provide alternative dates and times when you would be available for a consultation call. Please feel free to contact me via email at: smarshall@novato.org

Sincerely,

Steve Marshall
Planning Manager

## Steve Marshall

**From:** Buffy McQuillen <BMcQuillen@gratonrancheria.com>
**Sent:** Friday, June 09, 2017 10:10 AM
**To:** Steve Marshall
**Subject:** RE: Draft Novato General Plan 2035 - EIR & Cultural Resources

Hi Steve,
Agree, both our schedules are quite impacted. However, we should give our Tribal Council Members who wish to participate in this meeting with the City the opportunity to meet in person. Given the number of cultural resources in the City it would be great to discuss treatment of TCR's in the General Plan, how consultation will occur on project specific actions, etc. Could June 28th or 30th work for your schedule?

Respectfully,
Buffy McQuillen
Tribal Heritage Preservation Officer (THPO)
Native American Graves Protection and Repatriation Act (NAGPRA)
Federated Indians of Graton Rancheria
6400 Redwood Drive, Suite 300
Rohnert Park, CA 94928
Office: 707.566.2288; ext. 137
Cell: 707.318.0485
FAX: 707.566.2291
bmcquillen@gratonrancheria.com



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**From:** Steve Marshall [mailto:smarshall@novato.org]
**Sent:** Tuesday, May 02, 2017 3:44 PM
**To:** Buffy McQuillen <BMcQuillen@gratonrancheria.com>
**Subject:** Draft Novato General Plan 2035 - EIR & Cultural Resources

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