# Costco Fuel Center and Rowland Boulevard Public Works Project

## Initial Study – Mitigated Negative Declaration

*prepared by*

**City of Novato**
Community Development Department
922 Machin Avenue
Novato, California 94945
Contact: Brett Walker, Senior Planner

*prepared with the assistance of*

**Rincon Consultants, Inc.**
4825 J Street, Suite 200
Sacramento, California 95819

**January 2021**

RINCON CONSULTANTS, INC.
Environmental Scientists | Planners | Engineers
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# Initial Study

## 1. Project Title

Costco Fuel Center Project and Rowland Boulevard Public Works Project

## 2. Lead Agency Name and Address

City of Novato
Community Development Department
922 Machin Avenue
Novato, California 94945

## 3. Contact Person and Phone Number

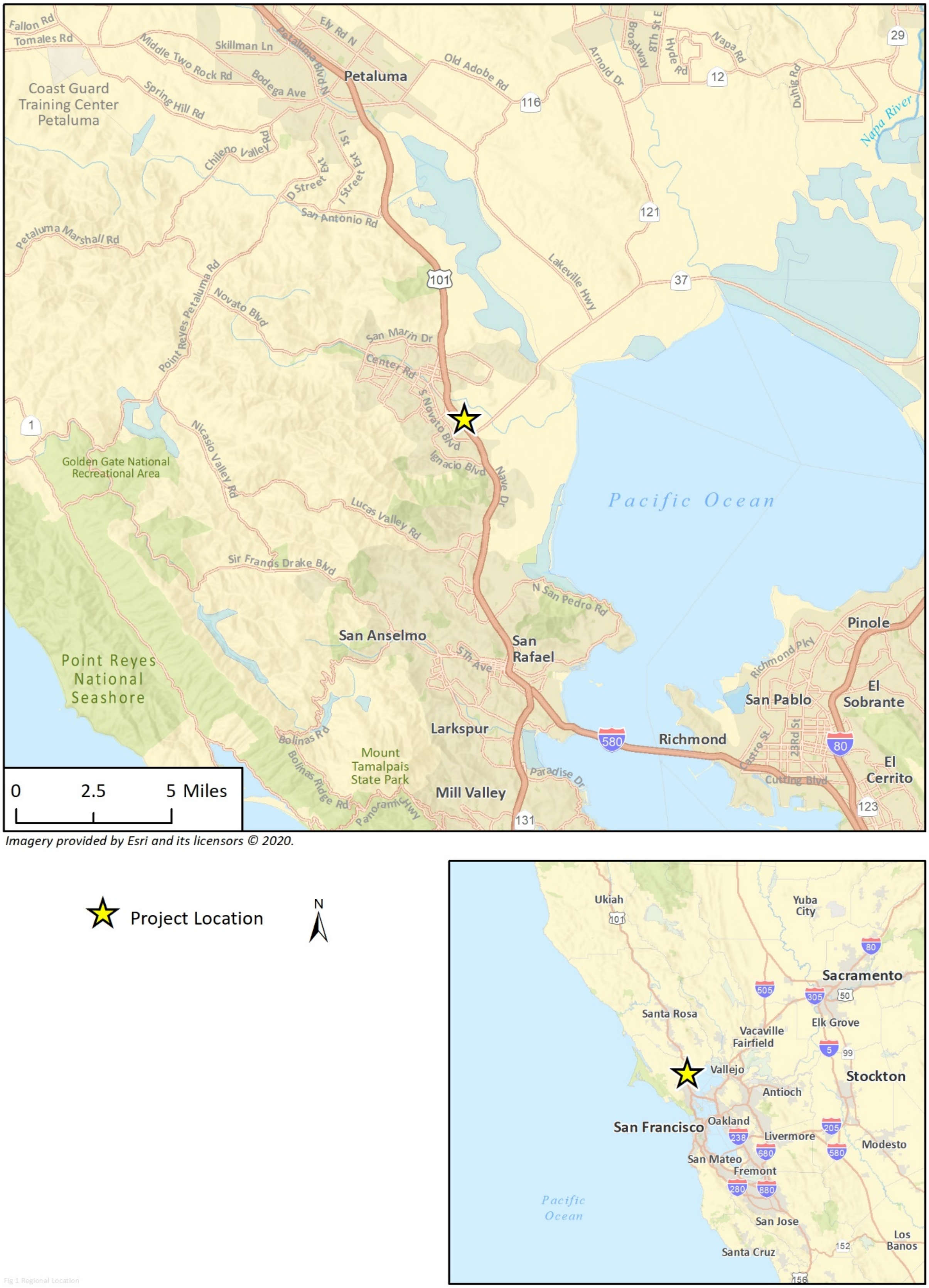
Brett Walker, AICP
Senior Planner
(415) 493-4711
bwalker@novato.org

## 4. 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 project is located within and adjacent to the Vintage Oaks Shopping Center in Novato, Marin County, California. Vintage Oaks is located southeast of the Highway 101 (US 101) and Rowland Boulevard freeway interchange. The project proposes to construct a fuel facility (gas station) at an existing Costco Wholesale (Costco) at 300 Vintage Way, and encompasses a portion of an existing parking lot, located southwest of the existing Costco building and includes approximately 1.15 acres of Assessor's Parcel Number 153-340-36 (fuel facility site). Costco would also modify Vintage Way to accommodate a left-turn pocket providing access to a driveway serving the fuel facility. In addition to the fuel facility, the proposed project includes improvements to an approximately 1.0-mile stretch of Rowland Boulevard between Redwood Boulevard and its south intersection with Vintage Way (Rowland Boulevard improvements site). Figure 1 shows the regional location of the project area, and Figure 2 shows the proposed project locations and surrounding uses.

## Figure 1 Regional Location



*Imagery provided by Esri and its licensors © 2020.*

## Figure 2 Project Location

*Imagery provided by Microsoft Bing and its licensors © 2020.*

Fig 2 Project Location

### Fuel Facility

The fuel facility site is an approximately 1.15-acre site located in the southern portion of the Vintage Oaks Shopping Center in the City of Novato. The fuel facility site is paved with several trees located throughout the parking areas and a vegetated area located along the Vintage Way frontage. Existing lighting poles are located throughout the fuel facility site. The fuel facility site contains a 10-foot easement for public utilities and a 10-foot PG&E easement, both of which follow Vintage Way along the southern fuel facility site boundary. No structures are located or would be placed in these easements. The fuel facility site is currently developed with a surface parking lot that serves the adjacent Costco within the Vintage Oaks Shopping Center. The existing parking lot is accessed via several driveways along Vintage Way, the main driveway of which is located approximately 830 feet from the southern Rowland Boulevard and Vintage Way intersection.

### Rowland Boulevard Improvements

The Rowland Boulevard site extends from Redwood Boulevard to Vintage Way at the south end of Vintage Oaks Shopping Center. This segment of Rowland Boulevard provides access to US 101 and to the commercial area in and around the Vintage Oaks Shopping Center. The Rowland improvements include:

1) Removing a median near Rowland Way, restriping lanes, and synchronizing traffic signals between Redwood Boulevard and Vintage Way (north). This segment of Rowland Boulevard is fully paved and features sidewalks, vehicle travel lanes, and bicycle lanes. All proposed improvements in this area occur within the paved width of the existing roadway; and
2) Adding a sidewalk, multi-use path, wildlife observation areas, diagonal parking, and landscape ”fingers” with street trees along the western side of the roadway between its two intersections with Vintage Way This segment of the Rowland Boulevard site is currently paved and includes two northbound lanes, two southbound lanes, one merging lane, and two bike lanes. Sidewalks are only present along the western side of Rowland Boulevard. The two southbound lanes merge into one lane approximately 900 feet from the southern Rowland Boulevard and Vintage Way intersection. A portion of the proposed multi-use path would be located east of the existing concrete curb, and west of the Sonoma Marin Area Rail Transit (SMART) railroad tracks.

## 5. Project Sponsor’s Name and Address

### Costco Fuel Facility

Sean Anderson
Costco
18215 72nd Avenue South
Kent, Washington 98032

### Rowland Boulevard Improvements

City of Novato Public Works Department
Chris Blunk, Public Works Director/City Engineer
922 Machin Avenue
Novato, California 94945

# 6. General Plan Designation

General Commercial (CG)

**Zoning**

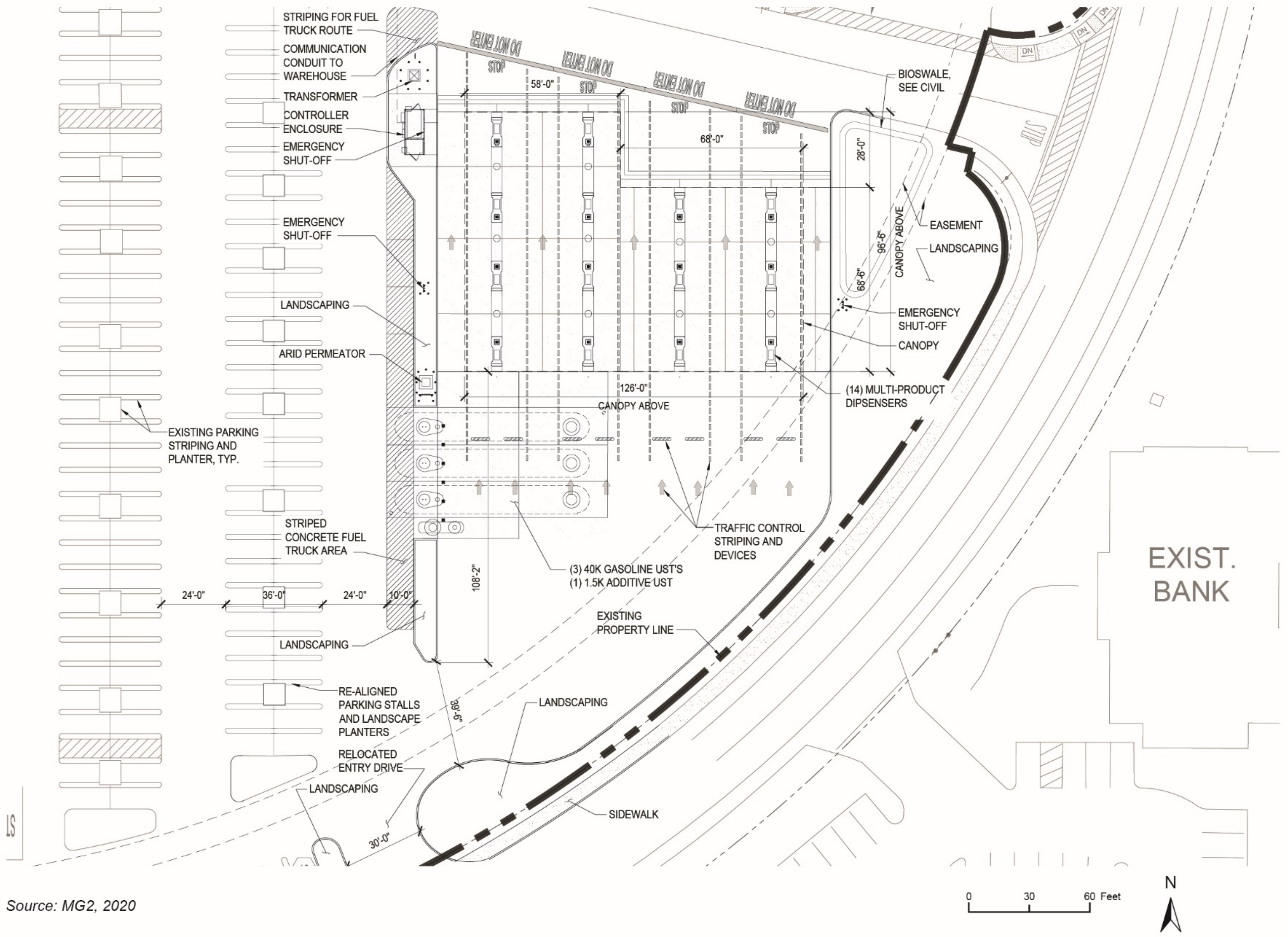
Planned Development (PD); Vintage Oaks Precise Development Plan (PDP)

# 7. Description of Project

## Fuel Facility

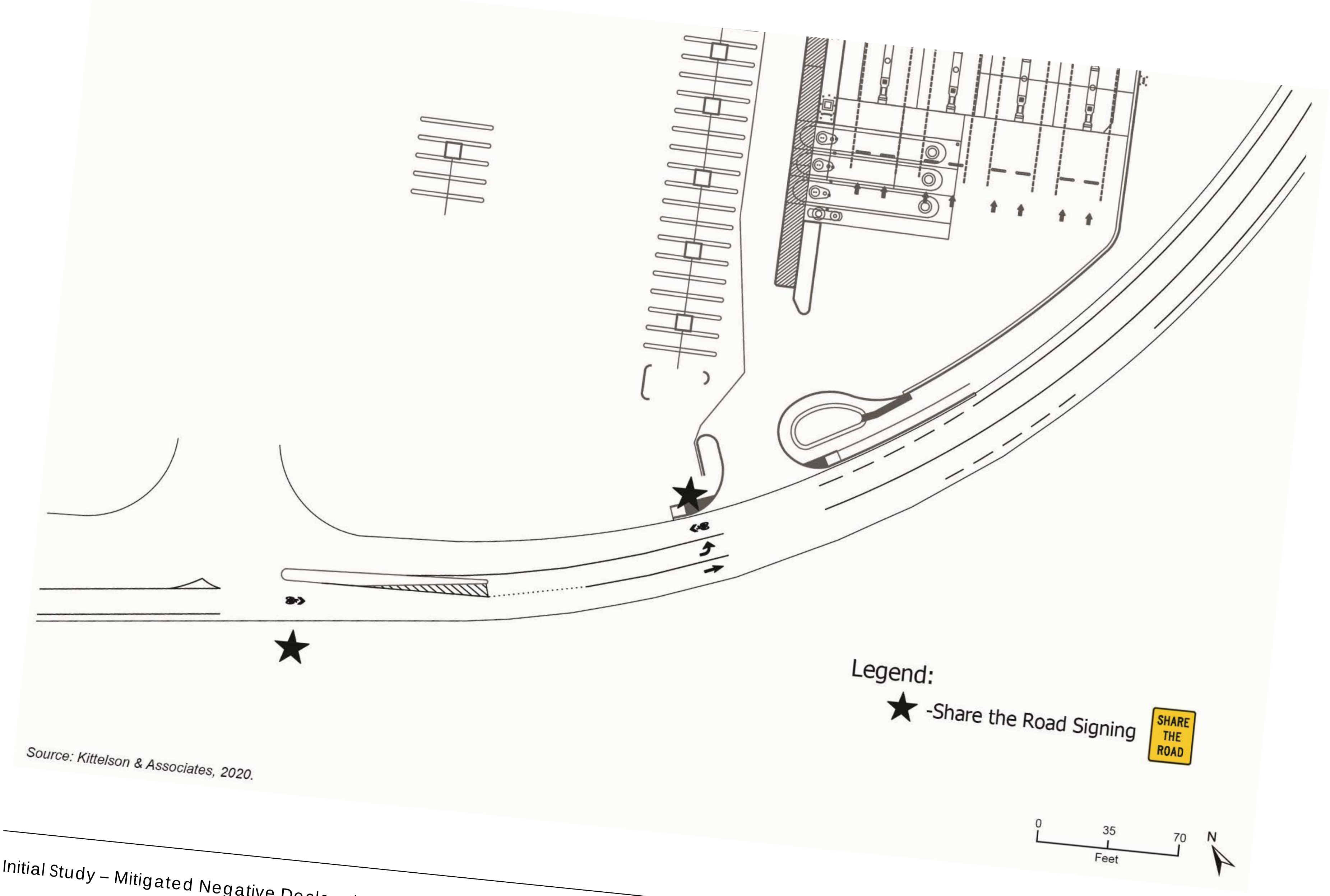
The project would develop a new fuel facility in place of an existing parking area adjacent to an existing Costco Wholesale store (Costco), on an approximately 1.15-acre portion of the Costco parking lot site. Costco is a membership-only store and the proposed fuel facility would be for use by Costco members, and not open to the general public who are not members. The project includes a 10,244-square-foot fuel dispenser canopy, 14 dispensers (28 fueling positions), three 40,000-gallon gasoline underground storage tanks (UST), one 1,500-gallon additive UST, an approximately 125 square-foot controller enclosure, a vapor processing unit, directional striping, and an approximately 6,086 square-foot net increase in landscaped areas. Costco's Fueling Facility Program (Appendix FP) provides details on proposed safety and design features intended to provide environmental safeguards and prevent public health or hazardous materials issues. Such features include monitoring during operational hours, emergency and automatic shut-offs, video surveillance, alarm systems, leak detection systems, the use of joint sealers, an oil/water separator, double-walled tanks, anchoring straps and reinforced concrete slabs, flexible piping connections, and Phase I and II Enhanced Vapor Recovery (EVR) systems (98 and 95 percent effective, respectively). The project would remove 129 existing parking spaces from the Costco warehouse development. Additionally, one row of 62 parking spaces and associated tree planters would be relocated two (2) feet to the northwest to allow for adequate drive aisle spacing between the parking row and fuel facility. The project would also relocate an existing driveway on Vintage Way from approximately 320 feet south to approximately 260 feet south of the existing Men's Wearhouse clothing store. Costco would modify a segment of Vintage Way to provide a left-turn pocket providing access to the relocated driveway. Adding the left-turn pocket would involve modifying lane striping to accommodate two vehicle travel lanes and the left turn-pocket within the existing curb-to-curb width of Vintage Way. This lane reconfiguration would result in the replacement of an approximately 200-foot segment of Class II bike lane with a Class III bicycle route (i.e., bicycles and vehicles share the same lane) and associated pavement markings and signs. See Figure 3 for the fuel facility site plan and Figure 4 for the proposed Vintage Way striping improvements.

## Figure 3 Fuel Facility Site Plan



*Source: MG2, 2020*

Figure 4 Vintage Way Striping Modification



Source: Kittelson & Associates, 2020.

The fuel canopy would be designed consistent with the architecture of the existing Costco Wholesale, with a flat roof, metal-wrapped canopy fascia, and painted metal columns. The materials and colors would be similar to those used at the existing Costco Wholesale building. The design would also be consistent with the Vintage Oaks Design Manual description for the Costco Wholesale. Under-canopy lighting would consist of Costco's standard Cree light emitting diode (LED) lighting fixtures, focused downward and/or shielded per City Council Resolution No. 128-90, which is the Vintage Oaks Precise Development Plan approval document. Signage is proposed on each side of the fuel canopy, consistent with the Vintage Oaks Master Sign Plan, including maximum letter height and painted metal sign type requirements. Signage lighting will include downward 'gooseneck' fixtures. The maximum height of the fuel canopy would be approximately 18.5 feet above finished grade.

The project would reduce the total existing impervious surface area by approximately 1,796 square feet, from 62,061 square feet to 60,265 square feet. The project would remove 27 trees and install 6,086 square feet of new landscaping.

The existing fuel facility site currently does not use low impact development (LID) strategies. The project would install two bioretention areas sized to retain stormwater runoff from the entire fuel facility site. The drainage management area (DMA #09, 12,936 square feet in size) that collects runoff from the proposed fueling area would drain to the existing sanitary sewer and be treated by an oil/water separator, consistent with Section SC-20 of the California Stormwater Quality Association (CASQA) Stormwater Best Management Practice Handbook. Runoff from one drainage management area (DMA #10, 1,729 square feet in size) that encompasses the proposed driveway, would remain untreated. Additionally, the project includes several permanent source control and operational source control BMPs, specified in the Stormwater Control Plan for the project.

## Rowland Boulevard Improvements

Concurrent with the above-described Costco Fuel Facility improvements, the City of Novato has proposed, as a Capital Improvement Program, to improve and reconfigure components of Rowland Boulevard along the east side of the Vintage Oaks shopping center and from Vintage Way (north) to Redwood Boulevard. The purpose of the Rowland Boulevard improvements is for traffic-calming and improved traffic flow, to improve pedestrian and bicycle transportation modes of travel, enhance aesthetics, and to provide for additional vehicle parking in proximity to Vintage Oaks. The proposed Rowland Boulevard improvements are being analyzed with the Costco fuel facility due to the timing of project construction, proximity of the improvements, and so that potential cumulative impacts can be more accurately analyzed.

The Rowland Boulevard site is located between Redwood Boulevard and Vintage Way (south). The section of Rowland Boulevard between the north and south intersections of Vintage Way (approximately 0.5 mile in length) would be reconfigured to include 195 60-degree diagonal parking stalls (northbound direction), two travel lanes (one southbound, one northbound), a northbound "backup" area for safe exiting of parking stalls before traveling on the street, a 4-foot wide sidewalk along the eastern side of Rowland Boulevard, pedestrian crosswalks, pedestrian bulb-outs at each crosswalk on the eastern side of Rowland Boulevard, and a 10-foot wide two-way multi-use path (replacing the existing Class II bicycle lanes). Four new crosswalks would provide pedestrian access across Rowland Boulevard from the new parking stalls and sidewalk. A total of 28 trees are proposed in landscape median "fingers," evenly spaced along the east side of the street. Additionally, three 12-foot by 8-foot (96 square feet) seating areas are proposed on the east side of the proposed multi-use path. Most of these improvements would be located within the existing paved area of Rowland Boulevard, however, the three seating areas would be located on the east side of the improved street and extend 8 feet beyond the existing vertical curb. Additionally, for the northern 400 feet, a portion of or all of the multi-use path would be located east of the existing vertical curb. The new multi-use path would connect to existing pedestrian facilities at the northerly Rowland Boulevard/Vintage Way intersection. The area east of the existing vertical curb is currently improved with 10 stormwater drop inlets that collect stormwater from Rowland Boulevard. Figure 5 through Figure 7 provide the site plans for the proposed Rowland Boulevard improvements along the boundary of the Vintage Oaks shopping center.

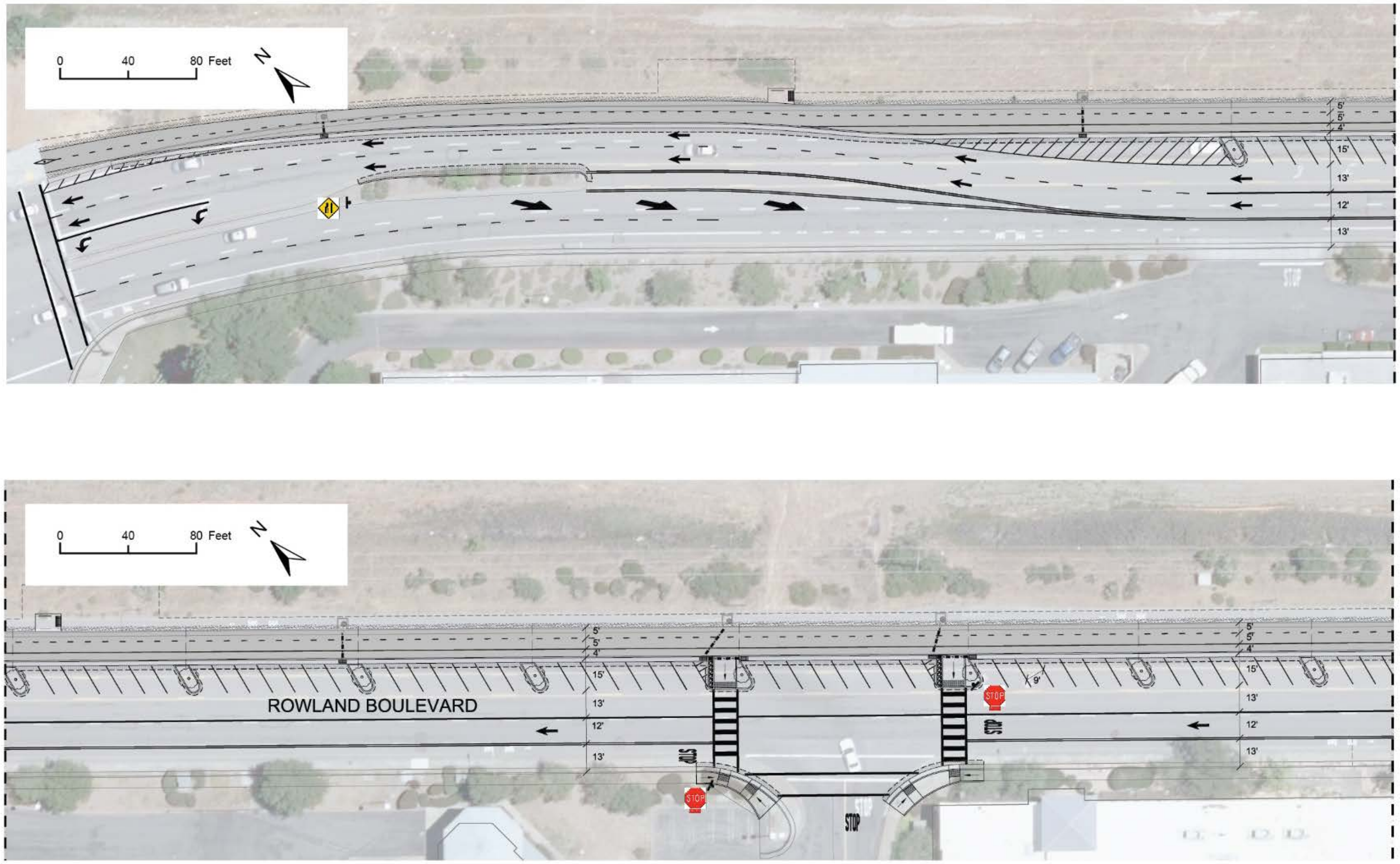
In addition to the improvements detailed above, the City has also identified traffic signal coordination/timing optimization and lane configuration optimization modifications within the existing improved curb faces on Rowland Boulevard between Redwood Boulevard and Vintage Way (north). Figure 8 details the street modifications listed below, which are also described in Appendix OPS. The following is a list of changes included in this component of the Rowland Boulevard improvements project:

- Update the signal coordination along the Rowland Boulevard corridor between Redwood Boulevard and Vintage Way (north).
- Re-stripe westbound Rowland Boulevard on the US 101 overpass so that drivers in the center (#2) lane can access either the through or left-turn lanes at the US 101 Southbound On-Ramp intersection. This modification allows westbound drivers destined to US 101 south to use two lanes on Rowland Boulevard all the way to the Rowland Way intersection.
- On the westbound approach at the Rowland Way intersection, eliminate the existing median and replace with an approximately 150-foot long third westbound through lane.
- Shift the existing eastbound lanes on Rowland Boulevard slightly southward between the US 101 South and Rowland Way intersections by narrowing the existing through lanes (currently 13 feet wide) to 11 feet wide. This modification would ensure that the new westbound through lane on Rowland Boulevard at the Rowland Way intersection aligns with the receiving lane on the east side of the intersection.
- Restripe the “cat track” markings for the dual southbound right-turn movements on Rowland Way at Rowland Boulevard to target the #1 and #2 lanes instead of the #2 and #3 lanes; this change would improve lane utilization and improve signal timing to reduce the amount of time the light is green for southbound traffic on Rowland Way.

## Construction

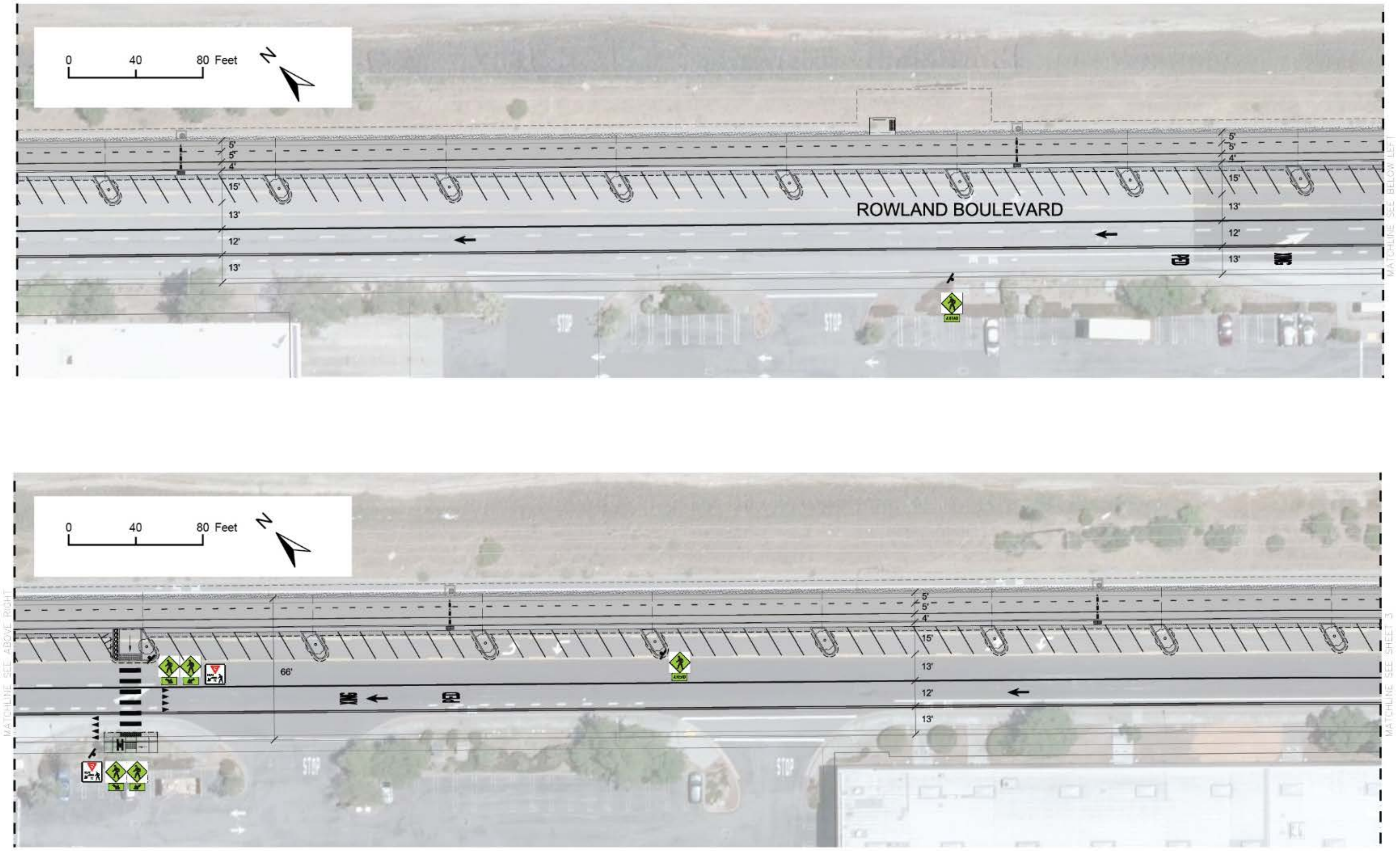
Rowland Boulevard project construction is anticipated to begin as early as April 2021 and be completed by June 2021 (approximately two months). Costco Fuel Facility construction is anticipated to begin in June 2021 and be completed by September 2021 (approximately three months). Construction would last a total of approximately five to six months for both project components. Grading is required for the installation of canopy footings, USTs, product piping, stormwater improvements, and utility installation. Construction of the fuel facility and the Rowland Boulevard improvements will occur in separate phases. The Rowland Boulevard improvements would be completed prior to construction of the fuel facility.

## Figure 5 Rowland Boulevard Improvements Site Plan – Sheet 1 of 3



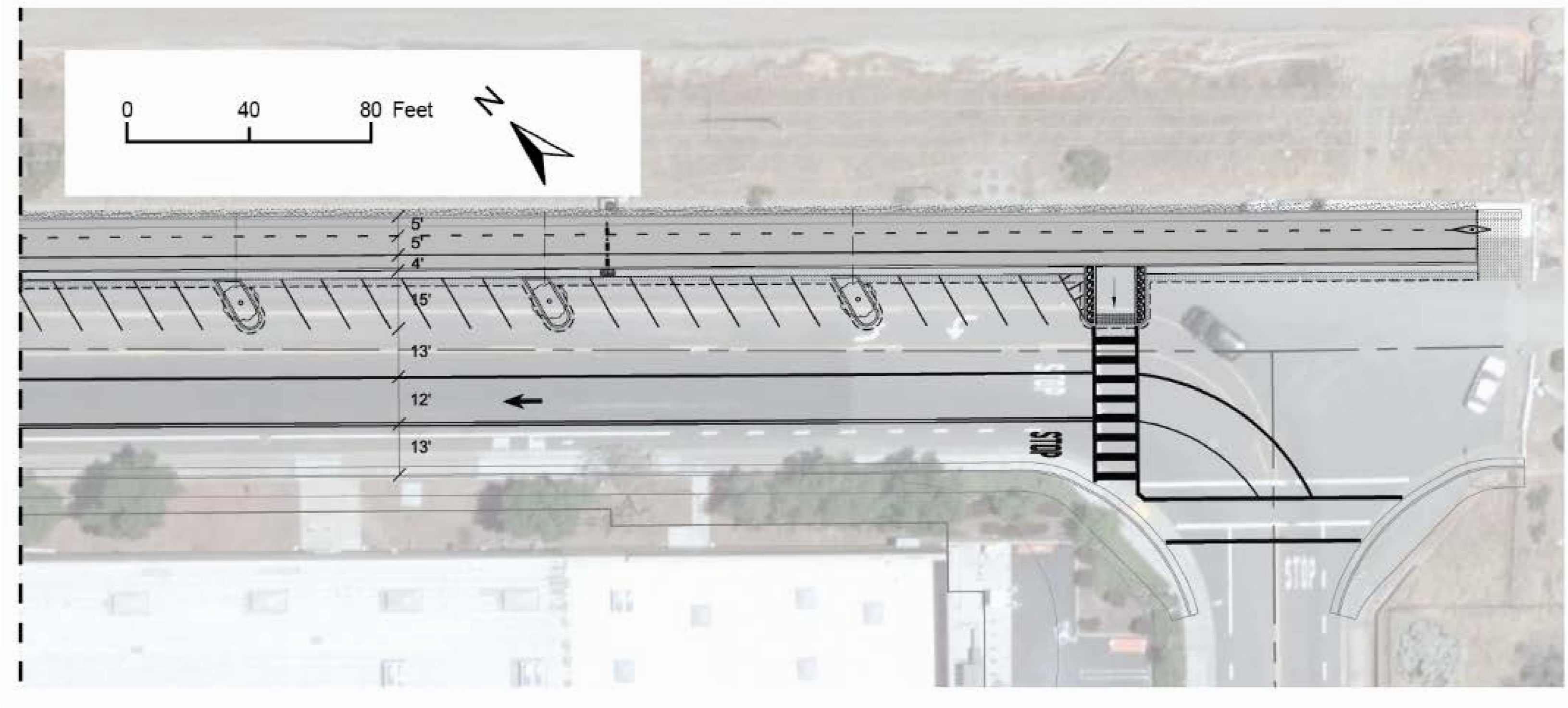
*Source: City of Novato Public Works, 2020*

## Figure 6 Rowland Boulevard Improvements Site Plan – Sheet 2 of 3



*Source: City of Novato Public Works, 2020*

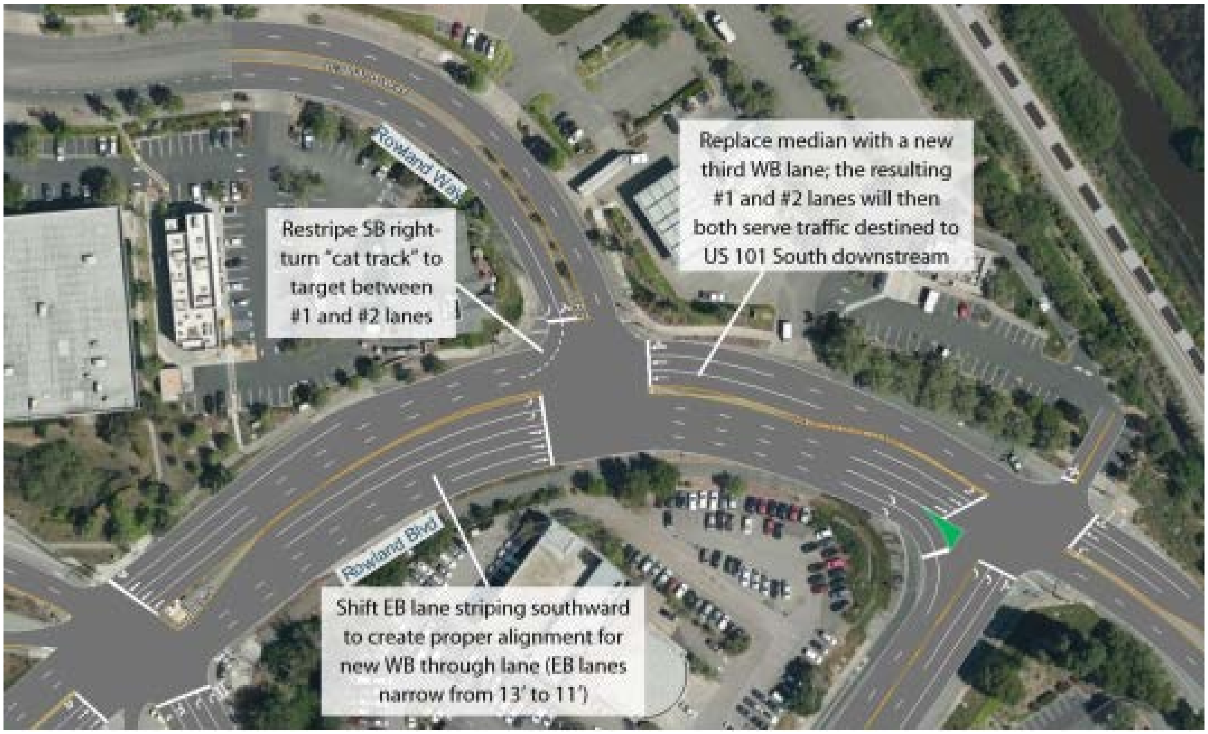
**Figure 7 Rowland Boulevard Improvements Site Plan – Sheet 3 of 3**



Source: City of Novato Public Works, 2020

## Figure 8 Rowland Boulevard Improvements Between Vintage Way (North) and US 101 Southbound Ramps

Modification on US 101 Overpass.



Modifications between US 101 and Vintage Way (north).

### Operation

The fuel facility would operate between the hours of 5:30 a.m. and 10:00 p.m. A minimum of one trained Costco employee would be present during these operational hours to assist customers, accept fuel deliveries, and implement safety and emergency procedures, if necessary. As shown on Figure 3, vehicles would travel one way through the fuel facility, entering from the southwest and exiting to the northeast, following the proposed striping and signage. Vehicles would enter the fuel facility site via the relocated driveway along Vintage Way to the southwest, or other driveways along Vintage Way to the northwest or southeast, and would exit south via the southeast driveway along Vintage Way or exit north into the existing parking area for the Vintage Oaks Shopping Center.

Electricity is provided by Pacific Gas and Electric (PG&E) distribution system. The project would not utilize natural gas as a source of energy.

## 8. Surrounding Land Uses and Setting

As shown in Figure 2, the project sites are surrounded by similar commercial uses associated with the Vintage Oaks Shopping Center and other areas east of US 101. An additional commercial building, currently occupied by a bank, is located immediately across Vintage Way from the fuel facility site to the south. The 0.3-mile stretch of Rowland Boulevard from Redwood Boulevard to the US 101 northbound ramps is adjacent to open space areas and the Novato Park and Ride. Open space and wetland areas are also located to the northeast, east, and southeast of the portion of Rowland Boulevard adjacent to the Vintage Oaks Shopping Center, as well as south of Vintage Way (the Beverly Ehreth Ecological Preserve). South of the Beverly Ehreth Ecological Preserve is the currently undeveloped Hanna Ranch property. Across US 101 to the southwest are single family and multi-family residential uses, approximately 450 feet from the fuel facility site.

Surrounding General Plan land use designations include General Commercial (GC) within the entirety of Vintage Oaks Shopping Center, areas north and south of Rowland Boulevard between the US-101 northbound ramps and Vintage Way (north), as well as the parcel located south of Vintage Way occupied by the Chase Bank. The Beverly Ehreth Ecological Preserve and area east of Rowland Boulevard (between Vintage Way [north] and Vintage Way [south]) are designated as Open Space (OS). Additionally, the areas surrounding Rowland Boulevard between US 101 and Redwood Boulevard are also designated OS. Similarly, surrounding zoning designations include Planned District (PD) in the above-mentioned GC-designated areas and Open Space (OS) in the above-mentioned OS-designated areas.

The site is located approximately 500 feet south of a bus stop served by Marin Transit line 251. A park and ride facility is located at the US 101 and Rowland Boulevard ramps, adjacent to additional Marin Transit lines 35, 71x, 171 and 251. Golden Gate Bridge, Highway, and Transportation District (GGT) bus routes 54 and 70 also serve the US 101/Rowland Boulevard ramps. GGT bus routes 56 and 58, which typically serve the park and ride and US 101 ramps, are currently suspended due to COVID-19. Sonoma-Marin Area Rail Transit (SMART) uses the railroad tracks located east of Rowland Boulevard and west of the open space and wetland areas. While no SMART stop is located in proximity to the project sites, trains pass by the site approximately once per hour. Similar to GGT, some daily trips have been canceled indefinitely due to COVID-19. The SMART rail line also serves overnight freight rail service operated by Northwestern Pacific Railroad Company (NWPR) between the City of Windsor in Sonoma County to the north and Schellville, an unincorporated Sonoma County community, east of Novato.

# 9. Other Public Agencies Whose Approval is Required

The City of Novato is the sole agency with the authority to approve the proposed project's land use entitlements, including:

## Costco Fuel Facility

- **Use Permit.** The Vintage Oaks Precise Development Plan (PDP), the primary zoning/land use regulatory document applicable to the site, requires approval of a Use Permit for gas stations.
- **Design Review**. Design Review is required for new commercial development projects. A recommendation from the Design Review Commission on the project's design, architecture, and landscaping is required. The Design Review Commission is tasked with making a recommendation regarding the project's design aspects to the Planning Commission and City Council, the ultimate review authority for the project.

## Rowland Blvd Improvements

- **General Plan Consistency**. The Novato Planning Commission will need to make a determination regarding the Rowland Boulevard improvements project consistency with the Novato General Plan, pursuant to Government Code Section 65402.
- **Capital Improvement Program**. The City Council will need to approve the Rowland Boulevard improvements for inclusion in the Capital Improvement Program (CIP) and approve the funding for the improvements.
- **License Agreement**. Vintage Oaks Shopping Center ownership has requested that the new vehicle parking spaces on Rowland Boulevard be reserved for shopping center employee parking. The City Council will need to approve a license agreement with Vintage Oaks to allow for exclusive use of the parking spaces and a maintenance agreement requiring Vintage Oaks to maintain the parking spaces and ancillary improvements long-term.
- **Reimbursement Agreement**. The City Council will need to approve a reimbursement agreement with Vintage Oaks for 50 percent of the cost, up to a maximum of $400,000, of the proposed Rowland Boulevard improvements described in the project description.

The following service districts require their own permits to approve the construction detail design and inspection and acceptance of various project serving improvements:

- **Novato Fire Protection District (NFPD)** would determine compliance with local fire code requirements for emergency access and life safety systems (e.g., fire sprinklers).
- **Novato Sanitary District (NSD)** is the wastewater utility at the fuel facility site. The sanitary district will review the project design and construction of new wastewater infrastructure associated with the project.
- **North Marin Water District (NMWD)** is the domestic and recycled water provider at the site. New domestic and recycled water connections will need to be designed to NMWD standards and approved by NMWD.

The following regional, state, and federal agencies would require their own permits, inspections, reporting and/or certifications prior to construction and/or operation of the gas station:

- **United States Environmental Protection Agency (U.S. EPA)**
  - U.S. EPA National Emissions Standards for Hazardous Air Pollutants Subpart CCCCCC (National Emission Standards for Hazardous Air Pollutants [NESHAP] 6C)
    - 120-Day Initial Notification for Gasoline Dispensing Facilities
    - 60-Day Notification of Performance Test
    - 180-Day Notification of Compliance Status/ Testing and Reports for Gasoline Dispensing Facilities
  - Tier II Chemical Reporting
  - Emergency Planning and Community Right-to-Know Act Hazardous Chemical Inventory Reporting
  - Class A/B Operator Training
- **California Department of Industrial Relations**
  - Trench/Excavation Permit
- **Marin County Certified Unified Program Agency (CUPA)**
  - Hazardous Materials/Waste Management Plan
  - Underground Storage Tank Permit to Install
- **Marin County Department of Agriculture, Weights, and Measures**
  - Gas Pump Inspection/Certification
- **Bay Area Air Quality Management District**
  - Authority to Construct/Permit to Operate
- **Regional Water Quality Control Board**
  - NPDES Construction General Permit

# Environmental Factors Potentially Affected

This project would potentially affect the environmental factors checked below, involving at least one impact that is “Potentially Significant” or “Less than Significant with Mitigation Incorporated” as indicated by the checklist on the following pages.

☐ Aesthetics
☐ Agriculture and Forestry Resources
☐ Air Quality
■ Biological Resources
■ Cultural Resources
☐ Energy
■ Geology/Soils
☐ Greenhouse Gas Emissions
☐ Hazards & Hazardous Materials
☐ Hydrology/Water Quality
☐ Land Use/Planning
☐ Mineral Resources
☐ Noise
☐ Population/Housing
☐ Public Services
☐ Recreation
☐ Transportation
■ Tribal Cultural Resources
☐ Utilities/Service Systems
☐ Wildfire
■ Mandatory Findings of Significance

# Determination

Based on this initial evaluation:

☐ I find that the proposed project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.

■ I find that although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because revisions to the project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.

☐ I find that the proposed project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.

☐ I find that the proposed project MAY have a "potentially significant impact" or "less than significant with mitigation incorporated" impact on the environment, but at least one effect (1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and (2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.

☐ I find that although the proposed project could have a significant effect on the environment, because all potential significant effects (a) have been analyzed adequately in an earlier EIR or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the proposed project, nothing further is required.

| | |
|---|---|
| Brett Walker | January 14, 2021 |
| Signature | Date |
| Brett Walker | Senior Planner |
| Printed Name | Title |

# Environmental Checklist

## 1 Aesthetics

| | Potentially Significant Impact | Less than Significant with Mitigation Incorporated | Less than Significant Impact | No Impact |
|---|---|---|---|---|
| Except as provided in Public Resources Code Section 21099, would the project: | | | | |
| a. Have a substantial adverse effect on a scenic vista? | ☐ | ☐ | ■ | ☐ |
| b. Substantially damage scenic resources, including but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway? | ☐ | ☐ | ☐ | ■ |
| c. In non-urbanized areas, substantially degrade the existing visual character or quality of public views of the site and its surroundings? (Public views are those that are experienced from a publicly accessible vantage point). If the project is in an urbanized area, would the project conflict with applicable zoning and other regulations governing scenic quality? | ☐ | ☐ | ■ | ☐ |
| d. Create a new source of substantial light or glare that would adversely affect daytime or nighttime views in the area? | ☐ | ☐ | ■ | ☐ |

*a. Would the project have a substantial adverse effect on a scenic vista?*

A scenic vista can generally be defined as a viewpoint that provides expansive views of a highly valued landscape for the benefit of the general public. The City of Novato General Plan identifies hillsides and ridgelines surrounding Novato as scenic resources which generally enhance the community’s visual character. The project sites are not within a scenic hill or ridge area or a scenic conservation area, per General Plan Figure ES-6 (City of Novato 2020a). From the fuel facility site looking to the west, distant views of hills can be seen. Views of scenic areas are generally obstructed by existing buildings, topography, and trees in the vicinity of the site. The Rowland Boulevard improvements are adjacent to wetland areas to the east of Vintage Oaks that are designated “Scenic Conservation Area” on General Plan Figure ES-6 (City of Novato 2020a).

The project includes the development of a fuel facility on an existing parking lot and roadway improvements to Rowland Boulevard. The scale and massing for the proposed fuel facility is similar to the existing commercial uses in the Vintage Oaks Shopping Center, an area that is not designated as a scenic resource. The Rowland Boulevard improvements consist of lane striping modifications, traffic signal synchronization, and installing paved surfaces at-grade and include the creation of observation points where the public may take views of the wetland areas to the east of Vintage Oaks. Accordingly, the Rowland Boulevard improvements do not alter views of scenic lands, but rather enhance opportunities to view the wetlands and open space to the east of Vintage Oaks. The project would not have an adverse effect on an identified scenic resource, nor would the project improvements substantially block views of the surrounding hillsides and ridgelines. Therefore, impacts to scenic vistas would be less than significant.

**LESS THAN SIGNIFICANT IMPACT**

*b. Would the project substantially damage scenic resources, including but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?*

There are no officially designated State Scenic Highways in Marin County (California Department of Transportation [Caltrans] 2019). Therefore, the project would not cause substantial damage to scenic resources within a state scenic highway. There would be no impact.

**NO IMPACT**

*c. Would the project, in non-urbanized areas, substantially degrade the existing visual character or quality of public views of the site and its surroundings? (Public views are those that are experienced from a publicly accessible vantage point). If the project is in an urbanized area, would the project conflict with applicable zoning and other regulations governing scenic quality?*

The project sites are developed and located within and adjacent to commercial development in the Vintage Oaks Shopping Center to the north; a commercial building to the south (Chase Bank); open space and wetland areas to the northeast, east, and southeast of Rowland Boulevard, as well as south of Vintage Way; and residences across US 101 to the southwest.

The project would not alter the General Plan land use designation or zoning designation of the fuel facility site. The project would develop a fuel facility in place of a portion of an existing surface parking lot. The fuel facility design would be consistent with the Vintage Oaks Design Manual description for the Costco Wholesale. The project would remove 41 trees, 39 due to construction and 2 due to poor health, at the fuel facility site and 4 trees at the Rowland Boulevard improvements site, install 6,086 square feet of new landscaping, and construct two bioretention areas. Thirty-seven (37) trees would be planted at the fuel facility site to replace the 41 trees proposed for removal.

The proposed fuel facility is subject to the City's Design Review process, which includes an assessment of site design, architecture, and landscaping to, in part, consider the project's compliance with applicable design standards and aesthetic compatibility. The project was presented to the Novato Design Review Commission on August 19, 2020, and October 7, 2020. The Design Review Commission found the site, architectural, and landscape design of the fuel facility to be consistent with the Vintage Oaks Design Manual and the Costco Wholesale warehouse. Accordingly, the Design Review Commission voted to recommend that the Planning Commission and City Council approve the fuel facility design.

The proposed modifications to Vintage Way, including the new left-turn pocket, would involve lane striping modifications and new pavement markings and signs to identify shared bicycle use of travel lanes. These modifications would not impede scenic views or alter the visual character of the area since the noted features are primarily at-grade and already exist along Vintage Way.

The Rowland Boulevard improvements between Vintage Way (north) and Vintage Way (south) consists of lane striping modifications within the existing paved section of the roadway to reduce the number of travel lanes to calm traffic and add diagonal parking. In addition, a new sidewalk, multi-use path, and street trees would be added along the eastern side of the street along the Vintage Oaks Shopping Center boundary to calm traffic, improve pedestrian and bicycle travel, and enhance the appearance of the roadway.

The Novato General Plan identifies scenic resources under Environmental Stewardship policy ES-15 (Scenic Resources) and programs ES-15a (Hillside and Ridgeline Protection), ES-15b (Ridgeline Map), and ES-15c (Allowances for Pre-Existing Homes). General Plan Figure ES-6 (City of Novato 2020a) identifies scenic lands. Policy ES-15 and its accompanying programs are intended to protect visual values on hillsides, ridgelines, and other scenic resources. The project sites are not located in a scenic area identified on Figure ES-6 of the General Plan, and Section 19.26 of the Hillside and Ridgeline Protection ordinance found in the Novato Municipal Code (NMC) does not apply. As noted above, a portion of the Rowland Boulevard improvements would occur adjacent to scenic lands to the east as shown on Figure ES-6 (City of Novato 2020a).

The improvements to Rowland Boulevard would consist of at-grade striping and hardscape changes that would not impair views of the scenic area to the east. In fact, the improvements include the creation of observation platforms to allow viewing of the scenic area from Rowland Boulevard between Vintage Way (north) and Vintage Way (south). The street trees included in the improvement plans would enhance the appearance of Rowland Boulevard.

Overall, no zoning and General Plan regulations governing scenic quality apply to this project. Further, the project would not impair views of the scenic lands to the east of Rowland Boulevard. Therefore, there is a less than significant impact on scenic quality.

**LESS THAN SIGNIFICANT IMPACT**

*d. Would the project create a new source of substantial light or glare that would adversely affect daytime or nighttime views in the area?*

The fuel facility and Rowland Boulevard sites are in a developed area with high levels of existing lighting and currently include standard exterior parking lot lighting and street lighting, respectively. Existing light sources also include lighting from adjacent commercial buildings and parking areas, as well as headlights from the SMART commuter trains, NWPR freight trains, and vehicles travelling on Rowland Boulevard, Vintage Way, and within Vintage Oaks Shopping Center. The primary source of glare in the project area is the sun’s reflection off of light colored and reflective building materials and finishes, and from metallic and glass surfaces of parked vehicles.

Vehicle use of the project sites would generate glare from reflected sunlight during certain times of the day. Such glare currently exists at the Costco Warehouse parking lot and would be somewhat reduced as a result of vehicles temporarily parking under the fuel facility canopy. In addition, the fuel facility itself does not propose to introduce materials into the design that would create substantial glare. Proposed materials would be consistent with the design and materials used for the existing Costco Wholesale building, which include non-reflective finishes. Proposed canopy lighting would consist of Costco’s standard Cree LED lighting fixtures, focused downward and/or shielded per City Council Resolution No. 128-90 and Novato Zoning Code Section 19.22.060. Headlights of vehicles entering and exiting the fuel facility site or traveling along the Rowland Boulevard site at night would be downcast and shielded by both existing and proposed structures and vegetation.

The project sites are in a generally urban environment with numerous existing sources of light and glare. The project would not substantially alter this condition. Therefore, impacts related to light and glare would be less than significant.

**LESS THAN SIGNIFICANT IMPACT**

# 2 Agriculture and Forestry Resources

| | Potentially Significant Impact | Less than Significant with Mitigation Incorporated | Less than Significant Impact | No Impact |
|---|---|---|---|---|
| Would the project: | | | | |
| a. Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on 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? | ☐ | ☐ | ☐ | ■ |

*a. Would the project convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?*

*b. Would the project conflict with existing zoning for agricultural use or a Williamson Act contract?*

*c. Would the project 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. Would the project result in the loss of forest land or conversion of forest land to non-forest use?*

*e. Would the project 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?*

There are no areas of Prime Farmland, Unique Farmland, or Farmland of Statewide Importance within Novato (California Department of Conservation 2018), and the project sites are not under a Williamson Act contract (County of Marin 2019). The site is designated as General Commercial in the Novato General Plan, zoned Planned Development, and in the Vintage Oaks Precise Development Plan. The site does not contain forestland or timberland. Therefore, the proposed project would not result in the conversion of agriculture use to non-agriculture uses, conflict with a Williamson Act contract, or existing zoning for agriculture, forest or timberland or result in the loss of such lands and there would be no impact on agricultural and forestry resources.

**NO IMPACT**

# 3 Air Quality

| | Potentially Significant Impact | Less than Significant with Mitigation Incorporated | Less than Significant Impact | No Impact |
|---|---|---|---|---|
| Would the project: | | | | |
| a. Conflict with or obstruct implementation of the applicable air quality plan? | ☐ | ☐ | ■ | ☐ |
| b. Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard? | ☐ | ☐ | ■ | ☐ |
| c. Expose sensitive receptors to substantial pollutant concentrations? | ☐ | ☐ | ■ | ☐ |
| d. Result in other emissions (such as those leading to odors) adversely affecting a substantial number of people? | ☐ | ☐ | ■ | ☐ |

## Air Quality Standards and Attainment

Novato is located in Marin County, which is a subregion of the San Francisco Bay Area Air Basin (SFBAAB) and under the jurisdiction of the Bay Area Air Quality Management District (BAAQMD). 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.

As the local air quality management agency, 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 them. Depending on whether or not standards are met or exceeded, a local air basin is classified as in “attainment” or “non-attainment.” The SFBAAB is in non-attainment for the national standards for ozone ($O_3$) and particulate matter smaller than 2.5 microns in diameter ($PM_{2.5}$) and in non-attainment for the state standard for $O_3$, $PM_{2.5}$, and particulate matter smaller than 10 microns in diameter ($PM_{10}$) (BAAQMD 2017a).

## Air Quality Management

BAAQMD is primarily responsible for assuring national and state ambient air quality standards are attained and maintained in the Bay Area. 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. BAAQMD has jurisdiction over much of the nine-county Bay Area, including Marin County.

BAAQMD adopted the 2017 Clean Air Plan (2017 Plan) as an update to the 2010 Clean Air Plan. The 2017 Plan provides a regional strategy to protect public health and the climate. Consistent with the greenhouse gas (GHG) reduction targets adopted by the state, the 2017 Plan lays the groundwork for a long-term effort to reduce Bay Area GHG emissions to 40 percent below 1990 levels by 2030 and 80 percent below 1990 levels by 2050. To fulfill state $O_3$ planning requirements, the 2017 control strategy includes all feasible measures to reduce emissions of $O_3$ precursors—reactive organic gases (ROG) and nitrogen oxides ($NO_X$)—and reduce transport of $O_3$ and its precursors to neighboring air basins. In addition, the 2017 Plan builds upon and enhances the BAAQMD's efforts to reduce emissions of fine particulate matter and toxic air contaminants (TAC) (BAAQMD 2017b).

## BAAQMD Air Emissions Thresholds

BAAQMD recommends that lead agencies determine appropriate air quality emissions thresholds of significance based on substantial evidence in the record. The BAAQMD's significance thresholds in the updated May 2017 CEQA Air Quality Guidelines for project operations within the SFBAAB are the most appropriate thresholds for use in determining air quality impacts of the proposed project. BAAQMD developed screening criteria to provide lead agencies and project applicants with a conservative indication of whether a project could result in potentially significant air quality impacts.

Table 1 presents the significance thresholds for construction and operational-related criteria air pollutant and precursor emissions used for the purposes of this analysis. These represent the levels at which a projects individual emissions of criteria air pollutants or precursors would result in a cumulatively considerable contribution to the SFBAAB's existing air quality conditions. For the purposes of this analysis, the proposed project would result in a significant impact if construction or operational emissions would exceed any of the thresholds shown in Table 1.

### Table 1 Air Quality Thresholds of Significance

| Pollutant/Precursor | Construction: Average Daily Emissions (lbs/day) | Operation: Maximum Annual Emissions (tpy) | Operation: Average Daily Emissions (lbs/day) |
|---|---|---|---|
| ROG | 54 | 10 | 54 |
| $NO_X$ | 54 | 10 | 54 |
| $PM_{10}$ | 82 (exhaust) | 15 | 82 |
| $PM_{2.5}$ | 54 (exhaust) | 10 | 54 |

Notes: lbs/day = pounds per day; tpy = tons per year; ROG = reactive organic gases; $NO_X$ = oxides of nitrogen; $PM_{10}$ = respirable particulate matter with an aerodynamic resistance diameter of 10 micrometers or less.; $PM_{2.5}$ = fine particulate matter with an aerodynamic resistance diameter of 2.5 micrometers or less

Source: BAAQMD 2017a: Table 2-1.

Additionally, BAAQMD's CEQA Air Quality Guidelines include risk and hazard significance thresholds to assess potential health risk impacts associated with a project's emissions of TACs. In accordance with these guidelines, a significant impact would occur if a project would result in:

- Non-compliance with a qualified risk reduction plan;
- An excess cancer risk level of more than 10 in one million, or a non-cancer (i.e., chronic or acute) hazard index greater than 1.0; or

- An incremental increase of greater than 0.3 micrograms per cubic meter (μg/$m^3$) annual average $PM_{2.5}$ concentration.

Additionally, a project would have a cumulatively considerable impact if the aggregate total of all past, present, and foreseeable future sources within a 1,000-foot radius from the fence line of the source or receptor plus the contribution from the project, exceeds the following:

- Non-compliance with a qualified risk reduction plan;
- An excess cancer risk level of more than 100 in one million or a chronic non-cancer hazard index (from all local sources) greater than 10.0; or
- 0.8 μg/$m^3$ $PM_{2.5}$ concentration.

*a. Would the project conflict with or obstruct implementation of the applicable air quality plan?*

The California Clean Air Act requires that air districts create a clean air plan that describes how the jurisdiction will meet air quality standards. The most recently adopted air quality plan for BAAQMD is the 2017 Plan. As described in the *Air Quality Management* Section above, the 2017 Plan updates the most recent Bay Area $O_3$ plan, the 2010 Clean Air Plan, pursuant to air quality planning requirements defined in the California Health and Safety Code. The 2017 Plan builds upon and enhances the BAAQMD's efforts to reduce emissions of fine particulate matter and TACs. The 2017 Plan does not include control measures that apply directly to individual development projects. Instead, the control strategy includes control measures related to stationary sources, transportation, energy, buildings, agriculture, natural and working lands, waste management, water, and super-GHG pollutants.

The 2017 Plan focuses on two paramount goals:

- Protect air quality and health at the regional and local scale by attaining all national and state air quality standards and eliminating disparities among Bay Area communities in cancer health risk from TACs
- Protect the climate by reducing Bay Area GHG emissions to 40 percent below 1990 levels by 2030, and 80 percent below 1990 levels by 2050

Under BAAQMD's methodology, a determination of consistency with the 2017 Plan should demonstrate that a project:

- Supports the primary goals of the air quality plan
- Includes applicable control measures from the air quality plan
- Does not disrupt or hinder implementation of any air quality plan control measures

A project that would not support the 2017 Plan's 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. As shown in the response to checklist item b (see below), the project would not result in exceedances of BAAQMD thresholds for criteria air pollutants and thus would not conflict with the 2017 Plan's goal to attain air quality standards. In addition, the project is consistent with the site's existing land use designation, would not increase the population of the city, and would not require a general plan amendment. Therefore, the project would not conflict with or obstruct the implementation of an applicable air quality plan and the project would have a less than significant impact.

**LESS THAN SIGNIFICANT IMPACT**

*b. Would the project result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard?*

## Construction

Project construction would result in temporary construction emissions. Construction activities such as the operation of construction vehicles and equipment over unpaved areas, grading, trenching, and disturbance of stockpiled soils have the potential to generate fugitive dust ($PM_{10}$) through the exposure of soil to wind erosion and dust entrainment. In addition, exhaust emissions associated with heavy-duty construction equipment would potentially degrade regional air quality.

Project construction would meet the BAAQMD construction screening criteria; however, emissions were modeled for informational purposes. Construction emissions were estimated using the California Emissions Estimator Model (CalEEMod) version 2016.3.2 (Appendix AQ), based on parameters that include the duration of construction activity, area of disturbance, and anticipated equipment used during construction. [1] CalEEMod defaults were used to determine construction equipment, while construction phase modeling was based on the schedule information provided by the applicant. Construction would occur in two phases, Phase I for Rowland Boulevard improvements and Phase II for construction of the service station. Phase I would include site preparation and grading during March 2021 and paving in May 2021. Phase II would begin in May 2021 with building construction with asphalt paving in August 2021. The project would be operational by late 2021. Additionally, project construction would be required to comply with BAAQMD rules and regulations, including standard dust control measures such as watering disturbed open areas and unpaved roads.

Table 2 summarizes the estimated maximum daily emissions ROG, $NO_X$, $PM_{10}$ and $PM_{2.5}$ during project construction. As shown therein, the project would not exceed BAAQMD construction air quality emission thresholds. Impacts would be less than significant.

### Table 2 Project Construction Emissions

| | Daily Emissions (lbs/day) | | | | | |
|---|---|---|---|---|---|---|
| Year | ROG | $NO_X$ | CO | $PM_{10}$ (exhaust) | $PM_{2.5}$ (exhaust) | $SO_X$ |
| 2020 | 4.9 | 51.2 | 31.3 | 2.5 | 2.3 | 0.1 |
| 2021 | 6.9 | 42.4 | 40.3 | 2.0 | 1.9 | 0.1 |
| BAAQMD Threshold | 54 | 54 | N/A | 82 | 54 | N/A |
| Threshold Exceeded? | No | No | N/A | No | No | N/A |

See Table 2.0 “Overall Construction-mitigated” emissions. Highest of winter and summer emissions results shown for all emissions. See CalEEMod worksheets in Appendix AQ.

## Operational Emissions

Operational emissions were estimated using CalEEMod for 28 fuel dispensers and roadway improvements. Modeling assumptions are included in Appendix AQ. Long-term emissions associated

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[1] The CalEEMod run provides a conservative estimate of soil-hauling trips during construction, as 310 cubic yards of soil was originally anticipated to be exported from the Rowland Boulevard improvements site; however, the Rowland Boulevard improvements would only require a total of 52 cubic yards of soil export. Therefore, the CalEEMod outputs used for this project conservatively overestimate emissions from soil hauling trips.

with project operation are shown in Table 3 and Table 4. Emissions would not exceed BAAQMD daily or annual thresholds for any criteria pollutant. Since project emissions would not exceed BAAQMD thresholds for operation, the project would not violate an air quality standard or result in a cumulatively considerable net increase in criteria pollutants and impacts would be less than significant.

### Table 3 Project Operational Average Daily Emissions

| | Average Daily Emissions (pounds/day) | | | | | |
|---|---|---|---|---|---|---|
| Sources | ROG | $NO_X$ | CO | $PM_{10}$ | $PM_{2.5}$ | $SO_X$ |
| Area | 0.3 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Energy | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Mobile | 1.5 | 5.9 | 11.7 | 1.7 | 0.5 | <0.1 |
| **Total Project Emissions** | **1.8** | **5.9** | **11.8** | **1.7** | **0.5** | **<0.1** |
| BAAQMD Thresholds | 54 | 54 | N/A | 82 | 54 | N/A |
| Threshold Exceeded? | No | No | N/A | No | No | N/A |

See Table 2.2 "Overall operational-mitigated" Highest of winter and summer emissions shown. See CalEEMod worksheets in Appendix AQ. Numbers may not add up due to rounding. It should be noted that there is no difference between the mitigated and unmitigated results, because operational mitigations were not included in the model run.

N/A = not applicable; there is no BAAQMD threshold for CO or $SO_X$

### Table 4 Project Operational Maximum Annual Emissions

| | Maximum Annual Emissions (tons/year) | | | | | |
|---|---|---|---|---|---|---|
| Sources | ROG | $NO_X$ | CO | $PM_{10}$ | $PM_{2.5}$ | $SO_X$ |
| Area | <0.1 | <0.1 | 0.7 | <0.1 | <0.1 | <0.1 |
| Energy | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Mobile | 0.2 | 0.8 | 1.1 | 0.3 | 0.1 | <0.1 |
| **Total Project Emissions** | **0.2** | **0.8** | **1.1** | **0.1** | **0.1** | **<0.1** |
| BAAQMD Thresholds | 10 | 10 | N/A | 15 | 10 | N/A |
| Threshold Exceeded? | No | No | N/A | No | No | N/A |

See Table 2.0 "Overall operational-mitigated." See CalEEMod worksheets in Appendix AQ. Numbers may not add up due to rounding. It should be noted that there is no difference between the mitigated and unmitigated results, because operational mitigations were not included in the model run.

N/A = not applicable; there is no BAAQMD threshold for CO or $SO_X$

**LESS THAN SIGNIFICANT IMPACT**

*c. Would the project expose sensitive receptors to substantial pollutant concentrations?*

Certain population groups, such as children, the elderly, and people with health problems, are particularly sensitive to air pollution. Per BAAQMD's CEQA Air Quality Guidelines, sensitive receptors are defined as population groups that are more susceptible to exposure to pollutants and examples include health care facilities, retirement homes, school and playground facilities, residential areas, and other places where people reside for long periods of time (BAAQMD 2017c). As such, the project's fuel facility would create additional sources of emissions that may impact these receptors. Sensitive receptors nearest to the fuel facility site include residences approximately 450 feet[2] west of the fuel facility site across US 101.

## Carbon Monoxide Hotspots

BAAQMD recommends comparing a project's attributes with the following screening criteria as a first step to evaluating whether the project would result in the generation of CO concentrations that would substantially contribute to an exceedance of the *Thresholds of Significance*. The project would result in a less than significant impact to localized CO concentrations if:

1. The project is consistent with an applicable congestion management program for designated roads or highways, regional transportation plan, and local congestion management agency plans;
2. The project would not increase traffic volumes at affected intersections to more than 44,000 vehicles per hour; and
3. The project traffic would not increase traffic volumes at the affected intersections to more than 24,000 vehicles per hour where vertical and/or horizontal mixing is substantially limited (e.g., tunnel, parking garage).

Rowland Boulevard and Vintage Way would serve the proposed fuel facility. These roadways are not monitored in the Marin County Congestion Management Plan (2019).

The project would generate 117 net new weekday PM peak hour trips and 172 net new Saturday midday peak hour trips (Appendix TIS). The project trip generation is far below the screening thresholds (nos. 2 and 3) listed above, and would not cause any nearby roadways to exceed 44,000 vehicles per hour or nearby intersections to exceed 24,000 vehicles per hour. The fuel station is anticipated to generate queuing as customers wait to fuel their vehicles. Proposed queuing would be accommodated within the designated queuing areas and would not spill into the internal drive aisle or off-site. Because queuing would be temporary as vehicles move through the fuel facility, the concentration of CO emissions would be low and rapidly disperse. Therefore, the impact of localized CO emissions would be less than significant.

## Toxic Air Contaminants

Health impacts associated with TACs are generally due to long-term (i.e., 30-year residence or 70-year lifetime) exposure. Typical sources of TACs include industrial processes such as petroleum refining operations, commercial operations such as gasoline stations and dry cleaners, and diesel exhaust. Additionally, BAAQMD recommends that lead agencies should review risks from nearby roadways, freeways, and stationary sources for new receptor projects (BAAQMD 2012). Project construction would involve the use of diesel-fueled equipment during the approximately 5- to 6-month total construction period (for Phase I and Phase 2 of construction), which would result in emissions of TACs during construction. Operation of the proposed project would create a new source of TAC emissions from the proposed gasoline station.

### *Construction TACs*

BAAQMD identifies construction activities as a common source of TAC and $PM_{2.5}$ emissions due to the operation of diesel-powered equipment and heavy-duty trucks that emit diesel particulate

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[2] Measured from the fuel facility site boundary to the nearest residential building.

matter (DPM) (BAAQMD 2017b). Although construction activity is short-lived, it may increase TAC concentrations in the short term at nearby sensitive receptors. DPM is the primary contaminant of concern for the project and would be the TAC emitted in the largest quantity, thus health risks were assessed as they relate to DPM exposure. The nearest sensitive receptors to the project sites are single and multi-family residences located approximately 450 feet[3] west of the fuel facility site across US 101. Due to the short-term duration of project construction, less than twelve months, and distance to the nearest receptors, residents would not be exposed to significant amounts of TACs from project construction. Additionally, Table 2 provides estimated construction emissions, which are below BAAQMD thresholds. Construction impacts would be less than significant.

### *Stationary Source TAC Impacts*

BAAQMD provides community risk and hazards screening tools for agencies to use in deciding whether there should be further environmental review of a project. According to the BAAQMD, the screening tools provide conservative estimates of health risk and $PM_{2.5}$ concentrations (BAAQMD 2012). BAAQMD defines sensitive receptors as facilities or land uses that include members of the population that are particularly sensitive to the effects of air pollutants, such as children, the elderly, and the chronically ill. Because the project would not involve any of these uses, the project would not include sensitive receptors. However, the project includes a new fuel station, a new stationary source that may expose sensitive receptors west of US 101 to TACs from fuel emissions.

Per guidance in BAAQMD's *Recommended Methods for Screening and Modeling Local Risks and Hazards* (2012), there is no project radius recommended for new sources. Rather the location of the maximum risk, hazard, and $PM_{2.5}$ concentration from the new source affecting a receptor should be identified. Refueling activities at the proposed gas station would potentially release benzene into the air; however, benzene emissions can be reduced by 95 to 98 percent by the vapor recovery systems required at fuel pumps. Nevertheless, benzene emissions may result in near source health risk (CARB 2005). CARB recommends siting sensitive land uses, such as residences, at least 50 feet from typical gasoline dispensing facilities and at least 300 feet from large gasoline dispensing facilities to adequately reduce health risks (i.e., facilities with a throughput of 3.6 million gallons per year or greater; CARB 2005a). This recommended separation distance is based on data showing the health risk attenuation of gasoline dispensing facilities as distance increases. The proposed fuel station would have a throughput of 36 million gallons per year and would be considered a large gasoline dispensing facility. The nearest residences would be located approximately 640 feet southwest of the proposed gasoline dispensing facility (measured from the center of the proposed fueling/tank storage area, from which TAC emissions would emanate). Therefore, the project would exceed the recommended siting distance between large gasoline dispensing facilities and sensitive receptors and impacts from new stationary TAC sources would be less than significant.

Although determined to be less than significant according to the CARB's criteria discussed above, given that the throughput of the proposed fuel facility would be substantially greater than CARB's defined large gasoline dispensing facility, additional data from similarly sized Costco fueling facilities is provided below to demonstrate that the proposed project would not result in significant impacts. BAAQMD offers screening tools to analyze potential health risks associated with permitted stationary sources, including gasoline dispensing facilities. To provide an estimate of the potential health risk associated with the proposed project, screening-level health risk values were obtained for similarly sized Costco gasoline dispensing facilities in the nearby communities of Rohnert Park, Vallejo, and Richmond using BAAQMD's Permitted Stationary Source Risks and Hazards Screening

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[3] Measured from the fuel facility site boundary to the nearest residential building.

Tool (BAAQMD 2018). These screening health risk values were then adjusted using BAAQMD's Gasoline Dispensing Facility Distance Multiplier Tool to reflect the potential risk at receptors near the proposed project based on these similar facilities. Table 5 summarizes potential health risk at residences southwest of the fuel facility site based on this screening methodology. The screening-level health risk values reported in Table 5 are inherently conservative; they rely on worst-case assumptions and do not necessarily account for localized conditions, such as prevailing winds, that may enhance dispersion of pollutants. For example, prevailing winds in Novato average approximately 5.1 miles per hour (mph) and originate from the northwest and southwest. As such, TAC emissions associated with the project would generally disperse to largely undeveloped land to the east, instead of toward the residential uses located to the west, and site-specific health risk would likely be substantially lower for the project than the conservative screening health risk values presented for similarly sized gasoline dispensing facilities below (Iowa Environmental Mesonet 2020; BAAQMD 2018).

### Table 5 Screening Health Risk Values for Similarly Sized Gasoline Dispensing Facilities

| Gasoline Dispensing Facility | Cancer Risk at 640 feet[1] | Hazard Index at 640 feet[1] | Annual $PM_{2.5}$ ($\mu g/m^3$)[2] |
|---|---|---|---|
| Richmond (Costco Gasoline #482) | 8.27 in 1 million | 0.04 | 0.0 |
| Rohnert Park (Costco Gasoline #659) | 7.75 in 1 million | 0.03 | 0.0 |
| Vallejo (Costco Wholesale #132) | 7.96 in 1 million | 0.04 | 0.0 |
| *BAAQMD Significance Threshold* | *10 in 1 million* | *1.0* | *0.3* |
| **Exceeds Threshold?** | **No** | **No** | **No** |

[1] Based on BAAQMD Permitted Stationary Source Risks and Hazards Screening Tool and Gasoline Dispensing Facility Distance Multiplier Tool. Assumes a distance of 640 feet from center of fuel canopy/tank storage area to nearest receptor. This is consistent with the Permitted Stationary Source Risks and Hazard Screening Tool, which reports risk levels from centroid of permitted facilities.

[2] Gasoline dispensing facilities are not associated with emissions of $PM_{2.5}$. No $PM_{2.5}$ concentrations reported in BAAQMD health risk screening values.

Source: BAAQMD 2018

As summarized in Table 5, the conservatively-estimated health risks at the nearest residences to the proposed project would remain below BAAQMD's health risk and hazard thresholds based on the analysis using BAAQMD's screening tools and other nearby, similarly sized gasoline dispensing facilities. Furthermore, newly modified or constructed stationary sources subject to BAAQMD permitting may be required to implement Best Available Control Technology (BACT), which may include the installation of emissions control equipment or the implementation of administrative practices that would result in the lowest achievable emission rate (BAAQMD 2017b). This impact would be less than significant.

The proposed fueling facility exceeds the CARB-recommended separation distance for sensitive receptors and large gasoline stations. This recommended separation distance is intended to be protective of public health with respect to emissions of TACs associated with gasoline station operations. Additionally, based on available, conservative screening health risk values provided by BAAQMD for other Costco gasoline stations in Richmond, Rohnert Park, and Vallejo, the conservative estimate of cancer risk, hazard index, and annual $PM_{2.5}$ concentrations would remain below BAAQMD health risk significance thresholds. This impact would be less than significant.

### *Cumulative Stationary Source TAC Impacts*

BAAQMD recommends that the cumulative impact of a project be assessed by evaluating current and proposed substantial sources of TACs, including roadways and stationary sources, within a 1,000-foot radius of the identified Maximally Exposed Individual Receptor (MEIR) (BAAQMD 2017c). Existing potential sources within 1,000 feet of the MEIR include US 101 and nearby major streets. There are no permitted stationary sources within 1,000 feet of the MEIR[4] (BAAQMD 2018). Cumulative risk impacts to the MEIR from freeway and roadway sources were based on health risk and $PM_{2.5}$ concentrations obtained from raster data files of health risks associated with major roadways and highways provided by BAAQMD (BAAQMD 2019a; 2019b). Table 6 summarizes cumulative health risk at the MEIR. As shown in Table 6, cumulative sources of TACs would not exceed BAAQMD's cumulative health risk thresholds at the MEIR. Therefore, the health risk to nearby residents due to cumulative impacts would be less than significant.

**Table 6 Cumulative Health Risk at Maximally Exposed Individual Receptor**

| Source | Cancer Risk at MEIR | Annual $PM_{2.5}$ (μg/m$^3$) at MEIR |
|---|---|---|
| Project Health Risk[1] | 8.27 in 1 million | 0.0 |
| US 101[2] | 26.62 in 1 million | 0.6 |
| Major Streets[2] | 0.09 in 1 million | <0.01 |
| **Cumulative Health Risk Total** | **34.98 in 1 million** | **0.6** |
| *BAAQMD Significance Threshold* | *100 in 1 million* | *0.8* |
| **Exceeds Threshold?** | **No** | **No** |

[1] Based on maximum cancer risk for similar facilities presented in Table 5. Note this health risk is for the Richmond Costco gas station, not the proposed Novato gas station, and is provided as the most conservative estimate of cancer risk.

[2] BAAQMD Highway and Major Streets raster files do not provide a chronic health risk value for these sources.

Source: BAAQMD 2019a, 2019b

**LESS THAN SIGNIFICANT IMPACT**

*d. Would the project result in other emissions (such as those leading to odors) adversely affecting a substantial number of people?*

Table 3-3 in the BAAQMD's 2017 CEQA Air Quality Guidelines provides odor screening distances for land uses that have the potential to generate substantial odor complaints. These uses include wastewater treatment plants, landfills or transfer stations, refineries, composting facilities, confined animal facilities, food manufacturing, smelting plants, and chemical plants (BAAQMD 2017b). The project would involve development of a 28-pump gas station and roadway improvements to Rowland Boulevard. Although gasoline fumes from the fueling station may be considered a nuisance odor, this use is not identified by BAAQMD as a significant odor-generating use, and fuel pumps would be located approximately 640 feet away from the nearest residences. CARB recommends siting sensitive land uses, such as residences, at least 300 feet from large gasoline dispensing facilities, and the proposed fuel pumps would be located outside the recommended buffer of 300

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[4] One permitted stationary source, Target Corporation – Store T-692 (Facility ID 15851) is located within 1,000 feet of the project site fence line. However, this source is not associated with any cancer, non-cancer, or $PM_{2.5}$ risk (BAAQMD 2018).

feet, which would meet CARB-recommended setbacks of gasoline dispensing facilities from nearby sensitive receptors (CARB 2005b). Furthermore, implementation of required vapor recovery systems, which can reduce emissions of certain odor-generating compounds (i.e., benzene) by 95 to 98 percent, would further reduce any potential odor impacts associated with the project. Therefore, the proposed project would not generate objectionable odors affecting a substantial number of people during operation.

During construction activities, heavy equipment and vehicles would emit odors associated with vehicle and engine exhaust both during normal use and when idling. However, such emissions would be intermittent in nature and would dissipate rapidly with increasing distance from the source to the nearest receptors approximately 450 feet[5] west. Furthermore, prevailing winds in Novato average approximately 5.1 mph and originate from the northwest and southwest, pushing potential odorous emissions toward largely undeveloped land to the east. Therefore, the proposed project would not generate objectionable odors affecting a substantial number of people. This impact would be less than significant.

**LESS THAN SIGNIFICANT IMPACT**

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[5] Measured from the fuel facility site boundary to the nearest residential building.

# 4 Biological Resources

| | Potentially Significant Impact | Less than Significant with Mitigation Incorporated | Less than Significant Impact | No Impact |
|---|---|---|---|---|
| Would the project: | | | | |
| a. 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, or regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service? | ☐ | ■ | ☐ | ☐ |
| b. Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service? | ☐ | ☐ | ☐ | ■ |
| c. Have a substantial adverse effect on state or federally protected wetlands (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means? | ☐ | ☐ | ■ | ☐ |
| d. 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? | ☐ | ☐ | ■ | ☐ |
| e. Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance? | ☐ | ☐ | ■ | ☐ |
| f. Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan? | ☐ | ☐ | ☐ | ■ |

Ornamental landscaped vegetation, including several trees, occurs within the parking lot area of the fuel facility site. The rest of the fuel facility site is fully paved. The Rowland Boulevard site is currently paved with no vegetation in the roadway, with the exception of the median between Vintage Way (north) and Rowland Way, which contains four trees, two small shrubs, and ground cover. Ruderal vegetation and a 6-foot tall chain-link fence is present along the eastern boundary of the roadway, and ornamental landscaping is present along the western boundary within the segment adjacent to Vintage Oaks. No wetlands or potentially jurisdictional features are present on site.

*a. 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, or regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?*

The fuel facility site is a fully developed parking lot that is paved and landscaped, and the Rowland Boulevard site is a fully developed paved roadway with areas of unpaved shoulders and a vegetated median. There are no native vegetation communities or habitats on either site. The ruderal and ornamental vegetation at the sites is not suitable habitat for any species listed under the Federal Endangered Species Act or California Endangered Species Act. There is very low potential for any of the identified special status species to occur in ruderal or ornamental vegetation on site.

### *Special Status Plants*

A review of resource agency databases and lists for known special status plant species occurrences in the United States Geological Survey (USGS) quadrangle containing and surrounding the project sites identified 19 special status plant species (Appendix BIO). Based on the fully developed nature of the sites and each species' specific habitat requirements, all of these species were eliminated from the evaluation. Impacts to California Rare Plant Rank 1B.1 or 1B.2 species would only be considered significant under CEQA if the loss of individuals on the project sites represented a population-level impact that resulted in a loss of or risk to the entire regional population. Given the small size of the project area and ruderal habitat, as well as the very low potential for special-status plants to occur, impacts would be less than significant, as even if a special-status plant did occur on-site, the project would not create a population-level impact.

### *Special Status Wildlife and Nesting Birds*

A review of resource agency databases for known special status wildlife species occurrences in the USGS quadrangle containing and surrounding the project sites identified 32 special status wildlife species (Appendix BIO). Based on the disturbed nature of the sites and species-specific habitat requirements, all 32 of these species could be eliminated from the evaluation. Special status species in the vicinity are associated generally with coastal, grassland, riparian, and aquatic habitats. The sites are fully developed and do not contain these habitat types, while surrounding open space areas to the east and southeast may contain suitable habitat types for some of these species.

There is potentially suitable habitat (on and adjacent to the project sites) for nesting birds protected under Section 3503 of the California Fish and Game Code (CFGC). Ornamental landscaping and the existing trees within the fuel facility site may provide nesting habitat for common species such as mourning dove, house finch, and Brewer's blackbird.

Development of the sites could indirectly impact nesting birds by noise generated through general construction activity on-site. Direct impacts on nesting birds could occur if construction activities take place during the nesting season (February 1st through August 31st) and could include the destruction of active bird nests if they occur on the project sites or forced abandonment of nests due to construction-related noise. To avoid or reduce potential adverse impacts on nesting birds, implementation of Mitigation Measure BIO-1 would be required. Impacts on nesting birds would be less than significant with implementation of this measure.

## Mitigation Measures

The following mitigation measure would be required to avoid or reduce the project's potentially significant impacts on nesting birds and special status wildlife.

### *BIO-1 Nesting Bird Surveys and Avoidance*

To avoid impacts to nesting birds and other special-status bird species, ground disturbing activities during construction of the project shall be limited to the period between September 1 and January 31 (i.e., outside the nesting season), if feasible. If initial site disturbance, grading, and vegetation removal cannot be conducted during this period, a qualified biologist shall conduct a pre-construction survey for active nests in and around the project sites, no more than two weeks prior to any construction activities. The nesting bird pre-construction survey shall be conducted on foot inside the project boundaries, including a 300-foot buffer (500-foot for raptors), and in inaccessible areas (e.g., private lands) from afar using binoculars to the extent practical.

If active nests are identified, the extent of the survey buffer area surrounding the site shall be established by the qualified biologist to ensure that direct and indirect impacts to nesting birds are avoided. The buffer distance shall take into consideration existing disturbances, such as from roadway and railroad traffic adjacent to the project sites.

If active nests are identified, species-specific exclusion buffers shall be determined by the biologist (i.e., 500 feet for raptor nests), and construction timing and location adjusted accordingly. The buffer shall be adhered to until the adults and young no longer rely on the nest site, as determined by the biologist. Limits of construction to avoid a nest should be established in the field with flagging and stakes or construction fencing. Construction personnel shall be instructed on the sensitivity of the area. An on-site biological monitor shall be present during all grubbing and clearing of vegetation to ensure that these activities remain within the project footprint (i.e., outside the demarcated buffer) and that the flagging/stakes/fencing is being maintained, and to minimize the likelihood that active nests are abandoned or fail due to project activities.

Implementation of Mitigation Measure BIO-1 would reduce impacts on special status species to a less than significant level.

**LESS THAN SIGNIFICANT WITH MITIGATION INCORPORATED**

*b. Would the project have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?*

Due to the developed and paved nature of the sites, no sensitive natural communities defined by CDFW on their Natural Communities list and Vegetation Alliances and Associations lists occur on the project sites. No riparian habitat occurs on site and riparian habitat occurring off site to the east would not be directly or indirectly altered by the project. No impacts on sensitive natural communities would occur as a result of the project.

**NO IMPACT**

*c. Would the project have a substantial adverse effect on state or federally protected wetlands (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?*

No wetlands occur on the fuel facility or Rowland Boulevard sites (USFWS 2020). However, east of the Rowland Boulevard site there is a riverine feature, freshwater emergent wetlands, and a lake (USFWS 2020).

Construction of the Rowland Boulevard improvements would take place within the existing Rowland Boulevard roadway, with the exception of the added three pedestrian seating areas and the northern 400-feet of the multi-use path along the eastern edge of the roadway behind Vintage Oaks Shopping Center. A portion of the multi-use path would extend approximately 5 feet from the existing back of curb to the existing 6-foot chain-link fence running along the SMART commuter rail line. While this would expand the total width of Rowland Boulevard improvements behind Vintage Oaks Shopping Center, construction would occur entirely outside of the wetland features to the east.

As described in more detail in Section 10, *Hydrology and Water Quality*, the project would be required to comply with National Pollutant Discharge Elimination System (NPDES) Construction General Permit requirements and prepare a Stormwater Pollution Prevention Plan (SWPPP), which includes BMPs for erosion control. This would ensure any pollutants carried in stormwater runoff do not enter nearby wetland features. Construction would not involve direct or cause indirect removal, filling, or hydrological interruption of these features.

Rowland Boulevard site drainage would continue to discharge into existing stormwater systems within Rowland Boulevard, with no operational runoff from the site traveling into the nearby wetland features. Therefore, impacts to jurisdictional wetlands or waters would be less than significant.

Approximately 150 feet southeast of the fuel facility site there is a freshwater emergent wetland and freshwater pond (USFWS 2020), locally known as the Beverly Ehreth Ecological Preserve. Construction of the fuel facility site would take place north of Vintage Way and entirely outside of the wetlands and freshwater pond to the southeast. The project would not involve direct or cause indirect removal, filling, or hydrological interruption of these features. As described in more detail in Section 10, *Hydrology and Water Quality*, the fuel facility site drainage would be contained within the site itself, and stormwater would be directed to bioretention basins for filtration before being discharged into existing stormwater systems within Vintage Oaks Shopping Center and Vintage Way. In addition, drainage collected near the canopy structure would be directed to an oil/water separator before being discharged into the sanitary sewer system. This drainage design would ensure no operational runoff from the site travels into the nearby wetland and pond features. Therefore, impacts to jurisdictional wetlands or waters would be less than significant.

**LESS THAN SIGNIFICANT IMPACT**

*d. Would the project 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?*

Wildlife movement includes migration (i.e., usually one way per season), inter-population movement (i.e., long-term genetic flow) and small travel pathways (i.e., daily movement corridors within an animal’s territory). While small travel pathways usually facilitate movement for daily home range activities such as foraging or escape from predators, they also provide connection between outlying populations and the main corridor, permitting an increase in gene flow among populations. The fuel facility site and Rowland Boulevard site are adjacent to open space areas to the east and southeast. These areas provide areas for wildlife movement in eastern Novato. While the project would result in construction activities within the project sites, the project sites themselves are currently developed with urban uses and do not provide wildlife movement corridors. Construction and operation of the project would be limited to these developed, urban areas, and would not expand urban uses into adjacent open space areas. Further, the project sites are bounded by the SMART commuter rail line and US 101, which are lined with chain link fencing creating an existing barrier to wildlife entering the project sites. In addition, the freshwater pond to the southeast has a 4-foot chain link fence to control access to this area. These existing fence features constrain wildlife movement into the project sites. Therefore, the proposed project would not result in any significant impacts that would 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.

**LESS THAN SIGNIFICANT IMPACT**

*e. Would the project conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?*

Novato General Plan 2035 and the Novato Municipal Code contain policies, development standards, and permitting procedures applicable to sites hosting wetlands, waterways and riparian habitat, hillsides, and woodland resources. None of these policies, development standards, and permitting procedures apply to the project since the project sites are developed with urban uses and there are no wetlands, waterways, riparian habitat, or woodland resources located therein.

The NMC Chapter XVII (Trees and Shrubs), Section 17-1.3 makes it unlawful for any person or group of persons to alter or remove or cause to be altered or removed, any heritage tree on any parcel in the City of Novato without a permit from the City. A heritage tree is defined as any native or non-native woody plant with a diameter of 24 inches or more measured at 24 inches above existing grade, or any tree designated as such by the city council.

The project would remove 41 trees from the fuel facility site and four (4) trees from the Rowland Boulevard median between Vintage Way (north) and Rowland Way. The 41 trees in the fuel facility site are located within the existing parking lot and were planted as typical parking lot landscaping and were not native to the fuel facility site prior to the development of the Costco Wholesale building and associated parking lot. Similarly, the four trees present in the median were planted as roadway landscaping and were not native to the median location prior to the development of Rowland Boulevard. These 45 trees do not meet the NMC definition of heritage trees, as their sizes are considerably smaller the 24-inch minimum diameter. Additionally, the proposed fuel facility includes the installation of new landscaping, including 37 new trees, at the fuel facility site and along Vintage Way and the Rowland Boulevard improvements include the addition of 28 street trees along the east side of Rowland Boulevard. The 45 removed trees would be replaced with 65 new trees, at a greater than 1:1 ratio, and increased on-site landscaping.

Therefore, the project would not conflict with local policies and ordinances and impacts would be less than significant.

**LESS THAN SIGNIFICANT IMPACT**

*f. Would the project conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?*

The project sites are not located within the boundaries of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan. As such, the project would not conflict with the provisions of an applicable plan, and no impact would occur.

**NO IMPACT**

# 5 Cultural Resources

| | Potentially Significant Impact | Less than Significant with Mitigation Incorporated | Less than Significant Impact | No Impact |
|---|---|---|---|---|
| Would the project: | | | | |
| a. Cause a substantial adverse change in the significance of a historical resource pursuant to §15064.5? | ☐ | ■ | ☐ | ☐ |
| b. Cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5? | ☐ | ■ | ☐ | ☐ |
| c. Disturb any human remains, including those interred outside of formal cemeteries? | ☐ | ■ | ☐ | ☐ |

This section provides an analysis of the project’s impacts on cultural resources, including historical and archaeological resources, as well as human remains, and is based on the cultural resource assessment attached as Confidential Appendix CRS.

CEQA requires a lead agency determine whether a project may have a significant effect on historical resources (Public Resources Code [PRC] Section 21084.1) and tribal cultural resources (PRC Section 21074 [a][1][A]-[B]). A historical resource is a resource listed in, or determined to be eligible for listing, in the California Register of Historical Resources (CRHR), a resource included in a local register of historical resources, or any object, building, structure, site, area, place, record, or manuscript that a lead agency determines to be historically significant (*CEQA Guidelines* Section 15064.5[a][1-3]).

A resource shall be considered historically significant if it:

1. Is associated with events that have made a significant contribution to the broad patterns of California’s history and cultural heritage;
2. Is associated with the lives of persons important in our past;
3. 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. Has yielded, or may be likely to yield, information important in prehistory or history.

In addition, if it can be demonstrated that a project would cause damage to a unique archaeological resource, the lead agency may require reasonable efforts be made 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]).

PRC Section 21083.2(g) defines a unique archaeological resource as an archaeological 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:

1. Contains information needed to answer important scientific research questions and that there is a demonstrable public interest in that information;
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.

*a. Would the project cause a substantial adverse change in the significance of a historical resource pursuant to §15064.5?*

*b. Would the project cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5?*

Rincon received search results of the California Historical Resources Information System (CHRIS) at the Northwestern Information Center (NWIC) located at Sonoma State University on July 30, 2020. The search was performed to identify all previously conducted cultural resources studies, as well as previously recorded cultural resources within the project sites and a 0.5-mile radius. The CHRIS search included a review of the National Register of Historic Places (NRHP), the California Register of Historical Resources (CRHR), the Office of Historic Preservation Historic Properties Directory, the California Inventory of Historic Resources, and the Archaeological Determinations of Eligibility list.

The NWIC records search identified that 68 previously conducted cultural resources studies within the 0.5-mile radius of the project sites. Of these, 23 studies have been completed within a portion of the current project sites. Additionally, the NWIC search identified one previously recorded cultural resource within the fuel facility site (Confidential Appendix CRS).

A Sacred Lands File (SLF) search was completed by the Native American Heritage Commission (NAHC) for the project sites. The results of the SLF search were positive for the project vicinity, and the NAHC instructed Rincon to contact the Federated Indians of Graton Rancheria (FIGR). As such, Rincon contacted the two local tribes in the region listed by the NAHC: FIGR and the Guidiville Indian Rancheria. The only reply received was from the Guidiville Indian Rancheria that indicated the tribe has no knowledge of specific resources within the project sites. SLF results do not provide specific details on the nature or precise location of Sacred Lands, thus additional detail cannot be provided.

Rincon Archaeologist Elaine Foster, BA, conducted a pedestrian field survey of the project sites on August 4, 2020. Surrounding areas of exposed ground were inspected for prehistoric artifacts (e.g. flaked stone tools, tool-making debris, stone milling tools, ceramics, fire-affected rock), ecofacts (marine shell and bone), soil discoloration that might indicate the presence of a cultural midden, soil depressions, and features indicative of the former presence of structures or buildings (e.g. standing exterior walls, postholes, foundations) or historic debris (e.g. metal, glass, ceramics). Ground disturbances such as burrows and drainages were also visually inspected. Vegetation and the existing pavement reduced visibility to less than 10 percent of the accessible project sites.

Most of the fuel facility site has been previously disturbed by the construction of the paved parking area and commercial development. Ground visibility was limited (less than 10 percent) due to the presence of paved parking lot and associated Costco building. Exposed portions of the fuel facility site contained ornamental tree planters, occasionally with bushes or other vegetation, and were generally covered with woodchips. The Rowland Boulevard site had exposed ground on the roadway shoulder behind Vintage Oaks that is dominated by non-native weeds. No cultural resources were identified on the project sites during the pedestrian survey.

Based on the results of the cultural resources records search and Native American scoping, cultural resources are recorded within an area of one project site; however, no resources were observed during the pedestrian survey. Additionally, the project sites have been heavily disturbed by the construction of commercial development within and around the sites. Based on previous cultural resources studies in the area, resources present are reported to have been destroyed. However, the potential unanticipated discovery of archaeological resources, that may also be considered historical resources, during construction of the project remains high, particularly for the fuel facility site, and impacts to unanticipated resources are potentially significant. The following mitigation would reduce archaeological impacts to less than significant levels by requiring archaeological monitoring during ground disturbing activities on both sites, halting construction in the vicinity of any cultural resources found during construction, and evaluating and treating potentially eligible resources through data recovery or other work as recommended by a qualified archaeologist and consulting tribes.

## Mitigation Measure

### *CUL-1 Archaeological Monitoring*

A qualified archaeological monitor shall be retained by the City of Novato and Costco to observe all project-related ground disturbing activities on both the fuel facility site and Rowland Boulevard improvements site, respectively. Ground disturbing activities include, but are not limited to, asphalt removal, hand excavation, clearing, grubbing, and removing and/or recompacting unconsolidated soils near the ground surface. Archaeological monitoring shall be performed under the direction of an archaeologist meeting the Secretary of the Interior’s Professional Qualification Standards for archaeology (National Park Service 1983).

The archaeological monitor shall be present for all pavement removal on the fuel facility site. After pavement is removed, the archaeologist shall inspect all exposed ground surfaces for the presence of surficial cultural resources prior to initiation of project grading and/or excavation.

If suspected archaeological resources are encountered at any point during project construction on either project site, work within a minimum of 60 feet of the suspected resource must halt and the find evaluated for listing in the CRHR. If a resource is determined to be a tribal cultural resource then the provisions of Mitigation Measures TCR-1 and TCR-2 shall control. The 60-foot radius may be reduced or expanded at the discretion of the qualified archaeologist if the potential resource is not determined to be a tribal cultural resource subject to Mitigation Measures TCR-1 and TCR-2. Archaeological monitoring may be reduced to spot-checking or eliminated at the discretion of the monitor, in consultation with the qualified archaeologist, Native American monitor required pursuant to TCR-3, and lead agency, as warranted by conditions such as encountering bedrock, sediments being excavated are fill, or negative findings during the first 60 percent of rough grading. If monitoring is reduced to spot-checking, spot-checking shall occur when ground-disturbance moves to a new location within the project sites and when ground disturbance will extend to depths not previously reached (unless those depths are within bedrock).

### *CUL-2 Unanticipated Discovery of Archaeological Resources*

If archaeological resources are encountered during ground-disturbing activities, work within a minimum of 60 feet shall be halted and an archaeologist meeting the Secretary of the Interior’s Professional Qualification Standards for archaeology (National Park Service 1983) shall be contacted immediately to evaluate the find. If necessary, the evaluation may require preparation of a treatment plan and archaeological testing for CRHR eligibility. If the discovery proves to be eligible for the CRHR and cannot be avoided by the project, additional work, such as data and/or heritage recovery excavation, may be required. Treatment of the resource(s) shall be determined on a case by case basis based on the nature of the find between the qualified archaeologist, and lead agency. If a resource is determined to be a tribal cultural resource then the provisions of Mitigation Measures TCR-1 and TCR-2 shall control.

**LESS THAN SIGNIFICANT WITH MITIGATION INCORPORATED**

*c. Would the project disturb any human remains, including those interred outside of formal cemeteries?*

No human remains have been identified within the project sites; however, the discovery of human remains is always a possibility during ground disturbing activities. If human remains are found, the State of California Health and Safety Code Section 7050.5 states no further disturbance shall occur until the County Coroner has made a determination of origin and disposition pursuant to Public Resources Code Section 5097.98. In the event of an unanticipated discovery of human remains, the County Coroner must be notified immediately. If the human remains are determined to be prehistoric, the Coroner would notify the Native American Heritage Commission, which would determine and notify a most likely descendant (MLD). The MLD has 48 hours from being granted site access to make recommendations for the disposition of the remains. If the MLD does not make recommendations within 48 hours, the landowner shall reinter the remains in an area of the property secure from subsequent disturbance. With adherence to State law and incorporation of Mitigation Measure CUL-1, impacts related to the discovery of human remains would be less than significant.

**LESS THAN SIGNIFICANT WITH MITIGATION INCORPORATED**

# 6 Energy

| | Potentially Significant Impact | Less than Significant with Mitigation Incorporated | Less than Significant Impact | No Impact |
|---|---|---|---|---|
| Would the project: | | | | |
| a. Result in a potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources, during project construction or operation? | ☐ | ☐ | ■ | ☐ |
| b. Conflict with or obstruct a state or local plan for renewable energy or energy efficiency? | ☐ | ☐ | ■ | ☐ |

*a. Would the project result in a potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources, during project construction or operation?*

## Construction

During project construction, petroleum-based fuels would be used for construction vehicles and equipment on the project sites, travel by construction workers to and from the project sites, and vehicles used to deliver materials to the site. The project would involve demolition of existing asphalt; utilities trenching and grading; pavement and asphalt installation; fuel facility construction; architectural coating; and installation of landscaping and hardscaping.

The total consumption of gasoline and diesel fuel during project construction was estimated using the assumptions and factors from CalEEMod used to estimate construction air emissions for the air quality analysis (Appendix AQ). Table 7 presents the estimated construction phase energy consumption, indicating construction equipment, vendor trips, and worker trips would consume approximately 50,049 gallons of fuel over the project construction period.

Construction activity and associated fuel consumption and energy use would be temporary and typical for the development of a new fuel facility and roadway improvements. Additionally, the NMC incorporates the California Green Building Standards Code (refer to Section 4-17). This code includes specific requirements related to recycling, construction materials, and energy efficiency standards that would apply to project construction to minimize wasteful, inefficient, and unnecessary energy consumption. Therefore, the project would not involve the inefficient, wasteful, and unnecessary use of energy during construction, and the construction-phase impact related to energy consumption would be less than significant.

## Table 7 Estimated Fuel Consumption During Construction

| Fuel Type | Gallons of Fuel | MMBtu[4] |
|---|---|---|
| Diesel Fuel (Construction Equipment)[1,2] | 43,906 | 5,596 |
| Other Petroleum Fuel (Worker Trips)[3] | 6,143 | 674 |
| **Total** | **50,049** | **6,271** |

Note: Totals may not add due to rounding.

[1] Fuel demand rate for construction equipment is derived from the total hours of operation, the equipment's horsepower, and the equipment's fuel usage per horsepower per hour of operation, which are taken from CalEEMod outputs (see Appendix AQ). Fuel consumed for construction equipment is assumed to be diesel fuel.

[2] Fuel demand rates for hauling and vendor trips (cut material imports) are derived from vendor trip number, vendor trip length, and vendor vehicle class from "Trips and VMT" Table contained in Section 3.0, *Construction Detail*, of the CalEEMod results (see Appendix AQ). The fuel economy for vendor trip vehicles is derived from the United States Department of Transportation (United States Department of Transportation 2020). Fuel consumed for hauling trucks is assumed to be diesel fuel.

[3] The fuel economy for worker trip vehicles is derived from derived from U.S. Department of Transportation National Transportation Statistics (24.4 mpg) (United States Department of Transportation 2020). Fuel consumed for worker trips is assumed to be gasoline fuel.

[4] CaRFG CA-GREET 3.0 fuel specification of 109,786 Btu/gallon used to identify conversion rate for fuel energy consumption for worker trips specified above (California Air Resources Board [CARB] 2018). Low-sulfur Diesel CA-GREET 3.0 fuel specification of 127,460 Btu/gallon used to identify conversion rate for fuel energy consumption for construction equipment specified above (CARB 2018a). Due to rounding, numbers may not add up precisely to the totals indicated.

Source: Appendix EN

## Operation

Operation of the project would result in energy demand from electricity consumption for lighting, fuel dispenser operation, and energy demand from gasoline consumption attributed to the daily trips to the fuel facility. However, the estimated number of daily vehicle miles travelled (VMT) is used to determine the energy consumption associated with fuel use from the operation of the project, and as described in Section 17, *Transportation*, the project would result in a net increase in daily trips but a net decrease of 458 VMT. Because total fuel usage is based on fuel efficiency (miles per gallon) and total mileage traveled, a reduction in VMT is associated with a reduction in fuel use. Therefore, the project would not result in increased gasoline or diesel fuel use. The project would not use natural gas as an energy source, therefore no increase in natural gas usage would occur as a result of the project. Project operation would require permanent grid connections for electricity. Approximately 43,324 kilowatt-hours of electricity per year, or 148 MMBtu, would be required from PG&E and would be used for lighting and fuel dispenser operation. The proposed fuel canopy would total approximately 10,244 square feet, which is an average energy use intensity (EUI) of 0.0144 MMBtu per square foot[6].

The project would comply with standards set in California Building Code (CBC) Title 24, which would minimize the wasteful, inefficient, or unnecessary consumption of energy resources during operation**.** California's Green Building Standards Code (CALGreen; California Code of Regulations, Title 24, Part 11) requires implementation of energy efficient light fixtures and building materials into the design of new construction projects. These standards ensure new construction does not result in wasteful, inefficient, or unnecessary consumption of energy.

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[6] Calculation: 148 MMBtu divided by 10,244 square feet = 0.0144 MMBtu per square foot.

Due to the large number of materials and manufacturers involved in the production of construction materials, including manufacturers in other states and countries, upstream energy use cannot be estimated reasonably or accurately.

Overall, project operation would result in consumption of fuels from vehicle trips and electricity from the fuel facility. Project energy consumed would represent an incremental increase in energy usage compared to existing conditions, but the project would implement energy-efficient components to reduce energy demand, including the installation of CREE LED lighting fixtures, as described in Section 8, *Description of Project*. Therefore, operational energy impacts would be less than significant.

## Conclusion

Construction of the project would be temporary and typical of similar projects, and not result in wasteful energy use. Project operation would increase energy use on the site compared to existing conditions. However, the energy use would be in conformance with the latest version of California's Green Building Standards Code and the California Building Code, and the project is not anticipated to increase overall demand for gasoline in the region, but rather redistribute demand from existing gas stations. Therefore, the project would not result in wasteful or unnecessary energy consumption, and impacts would be less than significant.

**LESS THAN SIGNIFICANT IMPACT**

*b. Would the project conflict with or obstruct a state or local plan for renewable energy or energy efficiency?*

Table 8 lists applicable Novato Climate Change Action Plan Greenhouse Gas Reduction Measures that are included as Appendix E to the City's General Plan 2035 energy efficiency goals and policies and summarizes the project's compliance with these policies.

As shown in Table 8, the project would be compliant with applicable energy efficiency goals and policies from the Novato Climate Change Action Plan (included as Appendix E to the City's General Plan). Therefore, potential impacts associated with renewable energy and energy efficiency would be less than significant.

### Table 8 Project Compliance with Energy Efficiency Goals and Policies

| Energy Efficiency Goal or Policy | Project Consistency |
|---|---|
| **Reduction Measure 11.** *Cool Paving*: Require the use of high "albedo" material for future outdoor surfaces such as parking lots, median barriers, roadway improvements, and sidewalks in order to reduce the urban heat island effect and save energy. | **Consistent.** The fuel facility canopy would be lightly colored material, replacing the existing darker asphalt parking area. This would increase the albedo of the fuel facility site, consistent with this policy. |
| **Reduction Measure 12.** *Urban Forest*: Update landscaping requirements to ensure strategic placement of plantings to shade east and west walls of structures. Revise parking lot standards to maximize tree size, cover and growth to reduce heat gain and maximize greenhouse gas sequestration. Consider amending tree removal and replacement requirements to maximize tree cover and tree growth. Consider prohibiting trees with high biogenic emissions. | **Consistent.** While the project will remove 45 existing trees, the project would plant 65replacement trees and the total amount of landscaping would increase by 6,086 square feet, including new vegetation and drainage management areas. The new landscaped area would be located along the southern and western boundary of the fuel facility site. Additionally, the Rowland Boulevard improvements will install new street trees, providing shading and reducing pavement heat along the adjacent sidewalk and multi-use path. |
| **Reduction Measure 15.** *Vehicle Idling:* Improve traffic flow and reduce VMT within the City. | **Consistent.** The Rowland Boulevard improvements would improve vehicle flow by reducing vehicle speeds, improving vehicle queues, improving traffic signal synchronization, and installing traffic calming measures. These improvements would also involve the improvement of pedestrian and bicycle facilities along this segment of Rowland Boulevard.<br>Operation of the fuel facility would reduce overall VMT associated with Costco members who are currently purchasing fuel at other fuel stations, including Costco fuel centers located outside Novato. Further, many Costco members will combine a stop at the fuel center with a trip already destined for the Costco Warehouse or Vintage Oaks Shopping Center thereby further reducing VMT. |
| **Reduction Measure 22.** *Pedestrian Infrastructure*: Promote walking through design standards and amenities that concentrate uses, reduce the need for vehicular travel, and enhance the pedestrian experience. | **Consistent.** The Rowland Boulevard improvements would install a new pedestrian sidewalk and multi-use path along the eastern side of the road, as well as multiple crosswalks and bulb-outs to ensure safe pedestrian crossing of Rowland Boulevard. |
| **Reduction Measure 25.** *Complete Streets:* Adopt "Complete Street" standards to facilitate multi-modal access for those trips that cannot be completed by walking alone. | **Consistent.** The Rowland Boulevard improvements involve the improvement of pedestrian and bicycle facilities along this segment of Rowland Boulevard, including a new pedestrian sidewalk and multi-use path along the eastern side of the road, and four pedestrian crosswalks and bulb-outs across Rowland Boulevard. |

Source: City of Novato 2009

## LESS THAN SIGNIFICANT IMPACT

# 7 Geology and Soils

| | Potentially Significant Impact | Less than Significant with Mitigation Incorporated | Less than Significant Impact | No Impact |
|---|---|---|---|---|
| Would the project: | | | | |
| a. Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving: | | | | |
| 1. 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? | ☐ | ☐ | ■ | ☐ |
| 2. Strong seismic ground shaking? | ☐ | ☐ | ■ | ☐ |
| 3. Seismic-related ground failure, including liquefaction? | ☐ | ☐ | ■ | ☐ |
| 4. Landslides? | ☐ | ☐ | ■ | ☐ |
| b. Result in substantial soil erosion or the loss of topsoil? | ☐ | ☐ | ■ | ☐ |
| c. 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? | ☐ | ☐ | ■ | ☐ |
| d. Be located on expansive soil, as defined in Table 1-B of the Uniform Building Code (1994), creating substantial direct or indirect risks to life or property? | ☐ | ☐ | ■ | ☐ |
| e. 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? | ☐ | ☐ | ☐ | ■ |
| f. Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature? | ☐ | ■ | ☐ | ☐ |

*a.1. Would the project directly or indirectly cause 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?*

*a.2. Would the project directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving strong seismic ground shaking?*

The project sites are located in a seismically active region due to its proximity to the active margin of the North American and Pacific Plates. The nearest fault is the Burdell Mountain fault, located approximately 1.7 miles northeast of the project sites (USGS 2019). No known active faults run through the project sites; therefore, the potential for surface rupture resulting from the movement of nearby major faults is considered low.

Ground shaking refers to movement of the Earth's surface during a seismic event. Ground shaking is normally the major cause of structural damage in earthquakes. The project includes construction of a controller structure and fuel canopy, fuel dispensers, as well as the placement of underground fuel storage tanks. The buildings would not expose people to adverse effects of seismic ground shaking since they are required to be designed to meet the requirements of the California Building Code, including seismic design criteria providing the minimum standards for structure foundations, anchoring, and bracing to resist ground shaking and collapse. Compliance with the California Building Code is mandatory by state and local law and will be confirmed via plan checks performed upon submittal of a building permit application for the fuel center and inspections performed during its construction.

The underground fuel storage tanks are proposed to be designed to withstand ground movement, including being secured in place with anchoring straps (tie-downs) connected to concrete hold downs (deadmen), backfilled with pea gravel, and capped with an 8-inch thick reinforced concrete slab. Further, the tank systems will feature flexible pipe joints and flexible fiberglass double walled tank construction. The tank system also includes leak detection equipment to immediately identify any fuel escaping from a tank(s), which is considered a low probability given the redundancies built into the system. The fuel dispenser system is designed with break-away connections that include cut-off valves immediately stopping the flow of fuel through the dispenser if it is knocked off its anchoring or a hose is pulled from a unit. These features are mandated by federal and state design and construction standards for fuel facilities by the agencies noted in Section 10 of this Initial Study and subject to associated permits and inspections during construction to determine compliance with such standards. Please refer to Section 9, *Hazards and Hazardous Materials*, regarding potential impacts from leaks from the gasoline storage tanks. Therefore, impacts would be less than significant.

**LESS THAN SIGNIFICANT IMPACT**

*a.3. Would the project directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving seismic-related ground failure, including liquefaction?*

Liquefaction is the process by which soil is temporarily transformed to fluid form during intense and prolonged ground shaking or because of a sudden shock or strain. Liquefaction typically occurs in areas where the groundwater is less than 30 feet from the surface and where the soils are composed of poorly consolidated fine to medium sand. The fuel facility site is located partially on an area of high liquefaction potential and partially on an area with very low liquefaction potential, while the Rowland Boulevard site is entirely in an area of high liquefaction potential (City of Novato

2020a). The fuel canopy would be designed as required by the CBC. Sections 1804 through 1812 of the CBC contain information for the design and verification of adequate soils and foundation support for individual elements of the project. Section 1802 of the CBC requires the use of this information in the seismic analyses prepared for the site-specific investigations that must be prepared in connection with the permits for individual elements of the Project. Additionally, Novato's grading permit requirements mandate a geotechnical report to be submitted with the grading permit application when projects require grading equal to or exceeding 100 cubic yards (CY). The project would include 2,004 CY of cut soil and would be required to adhere to this requirement. The required geotechnical report would recommend standard construction techniques to ensure liquefaction does not pose a risk to project components, including the underground storage tanks. Please refer to Section 9, *Hazards and Hazardous Materials*, regarding potential impacts from leaks from the gasoline storage tanks. The improvements on Rowland Boulevard would not increase the risk of loss, injury, or death due to liquefaction.

**LESS THAN SIGNIFICANT IMPACT**

*a.4. Would the project directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving landslides?*

The project sites are relatively flat, and it is not located in an identified landslide hazard zone (City of Novato 2020a). Therefore, the project would not expose people or structures to risk of loss, injury, or death involving landslides or liquefaction; impacts would be less than significant.

**LESS THAN SIGNIFICANT IMPACT**

*b. Would the project result in substantial soil erosion or the loss of topsoil?*

The project sites are relatively flat and therefore at lower risk of soil erosion as there would be less runoff to cause erosion. Proposed construction activities would be required to comply with NMC 7-4.10(c), which requires construction plans to include erosion control best management practices (BMPs). Additionally, as described in more detail in Section 10, *Hydrology and Water Quality*, the project would be required to comply with National Pollutant Discharge Elimination System (NPDES) Construction General Permit requirements and prepare a Stormwater Pollution Prevention Plan (SWPPP), which includes BMPs for erosion control. Impacts from soil erosion or loss of topsoil would be less than significant.

**LESS THAN SIGNIFICANT IMPACT**

*c. 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?*

As discussed under threshold *a.3* and *a.4* of this section, the project would have less than significant impacts regarding landslides as the project is located on relatively level sites and is not located in a designated landslide hazard zone. While the fuel facility site is partially in an area of high liquefaction potential and the Rowland Boulevard improvements are fully located in such an area, adherence to applicable regulations and requirements, including the preparation of a geotechnical report to address site grading, would result in less than significant impacts. In addition, the construction and operation of the project itself would not generate ground movement or vibration capable of inducing liquefaction or associated lateral spreading of the ground. The project does not involve ground-based resource extraction activities, such as mining or pumping ground water, that could result in ground subsidence. The project in and of itself has a low risk of causing any on- or off-site structure collapse based on the observations above. Impacts would be less than significant.

**LESS THAN SIGNIFICANT IMPACT**

*d. Would the project be located on expansive soil, as defined in Table 1-B of the Uniform Building Code (1994), creating substantial direct or indirect risks to life or property?*

Expansive soils are soils that due to their composition and moisture content have a potential to undergo significant changes in volume, in the form of either shrinking or swelling. Periodic shrinking and swelling of expansive soils can cause extensive damage to buildings, other structures and roads. The fuel facility site and the Rowland Boulevard site are both located partially in an area of high potential for soil expansion (City of Novato 2014). As discussed under thresholds *a.1*, *a.2*, *a.3* and *a.4*, above, the project would be subject to applicable regulations and requirements regarding soil hazards , including the preparation of a geotechnical report to address site grading and the structural design of the controller building, canopy, fuel dispensers, and underground storage tanks. Impacts would be less than significant.

**LESS THAN SIGNIFICANT IMPACT**

*e. 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?*

No septic tanks or alternative wastewater disposal systems are proposed as part of the project. No impact would occur.

**NO IMPACT**

*f. Would the project directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?*

The project sites are in an area of low to no paleontological sensitivity (Graymer et al. 2006). As the project sites are located in a low sensitivity geologic unit, the project is unlikely to encounter paleontological resources. However, the possibility exists that construction may uncover previously undiscovered paleontological resources. Impacts would be less than significant with incorporation of Mitigation Measure GEO-1.

## Mitigation Measure

### *GEO-1 Discovery of Previously Unidentified Paleontological Resources*

In the event a previously unknown fossil is uncovered during construction, all work shall cease until a certified paleontologist can investigate the finds and make appropriate recommendations. Any artifacts uncovered shall be recorded and removed for storage at a location to be determined by the paleontologist.

**LESS THAN SIGNIFICANT WITH MITIGATION INCORPORATED**

# 8 Greenhouse Gas Emissions

| | Potentially Significant Impact | Less than Significant with Mitigation Incorporated | Less than Significant Impact | No Impact |
|---|---|---|---|---|
| Would the project: | | | | |
| a. Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment? | ☐ | ☐ | ■ | ☐ |
| b. Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of greenhouse gases? | ☐ | ☐ | ■ | ☐ |

## Climate Change and Greenhouse Gases

Project implementation would generate greenhouse gas (GHG) emissions through the burning of fossil fuels or other emissions of GHGs, thus potentially contributing to cumulative impacts related to climate change. In response to an increase in man-made GHG concentrations over the past 150 years, California has implemented Assembly Bill (AB) 32, the “California Global Warming Solutions Act of 2006.” AB 32 codifies the Statewide goal of reducing emissions to 1990 levels by 2020 (essentially a 15 percent reduction below 2005 emission levels) and the adoption of regulations to require reporting and verification of statewide GHG emissions. Furthermore, on September 8, 2016, the governor signed Senate Bill (SB) 32 into law, which requires the state to further reduce GHGs to 40 percent below 1990 levels by 2030. SB 32 extends AB 32, directing CARB to ensure that GHGs are reduced to 40 percent below the 1990 level by 2030.

On December 14, 2017, CARB adopted the 2017 Scoping Plan, which provides a framework for achieving the 2030 target. 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 six metric tons (MT) $CO_2e$ by 2030 and two MT $CO_2e$ 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.

The vast majority of individual projects do not generate sufficient GHG emissions to directly influence 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 would be 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]).

## City of Novato Climate Change Action Plan

The City of Novato's Climate Action Plan (CAP) is incorporated into General Plan 2035 and Appendix E to the General Plan includes the specific GHG reduction measures. General Plan 2035 provides goals and associated measures, also referred to as climate change mitigation measures, in the sectors of energy use, transportation, water conservation, land use, and solid waste. In addition, Appendix E of General Plan 2035 includes reduction measures and an emissions reduction summary with the anticipated reduction in emissions for each local action. The intent of the CAP is to guide Novato towards achieving or exceeding the State's emissions reductions targets. The CAP documents and forecasts 2015, 2020, and 2035 GHG emissions (City of Novato 2020a).

## Significance Thresholds

Pursuant to the requirements of SB 97, the California Natural Resources Agency adopted amendments to the *CEQA Guidelines* for the feasible mitigation of GHG emissions and analysis of the effects of GHG emissions. The adopted *CEQA Guidelines* provide 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 evaluate whether a project may generate a quantity of GHG emissions that may have a significant impact on the environment, state agencies have developed a number of operational bright-line significance thresholds. Significance thresholds are numeric mass emissions thresholds that identify the level at which additional analysis of project GHG emissions is necessary. Projects that attain the significance target, with or without mitigation, would result in less than significant GHG emissions.

In the 2017 CEQA Air Quality Guidelines, BAAQMD outlines an approach to determine the significance of projects. For residential, commercial, industrial, and public land use development projects, the thresholds of significance for operational-related GHG emissions are as follows:

- Compliance with a qualified GHG reduction strategy
- Annual emissions less than 1,100 metric tons (MT) of carbon dioxide equivalent ($CO_2e$) per year (MT $CO_2e$/yr)
- Service person threshold of 4.6 MT $CO_2e$/service person/year (residents + employees)

The BAAQMD's thresholds of significance were established based on achieving the 2020 GHG emission reduction targets set forth in the AB 32 Scoping Plan, and not the 2030 reduction targets of the SB 32 Scoping Plan. Therefore, although the BAAQMD has not yet quantified a threshold for 2030, reduction of the annual emissions thresholds by 40 percent would be consistent with state goals detailed in SB 32. As such, for the 1,100 MT $CO_2e$/yr threshold, the adjusted (reduced by 40 percent) annual emissions project-level threshold for this project analysis would be 660 MT $CO_2e$ per year.

The Novato CAP is considered a qualified GHG reduction strategy per Section 15183.5(b)(1) of the CEQA Guidelines and the May 2017 BAAQMD CEQA 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.

As discussed above, General Plan 2035 serves as the City's CAP and quantifies 2005, 2015, 2020, and 2035 GHG emissions for all sectors in the City. Figure ES-9 of General Plan 2035 shows projected community emissions through the year 2035. Appendix E of General Plan 2035 includes an emissions reduction summary including local and state actions. Additionally, Appendix E establishes a community wide emissions level of 191,003 MT $CO_2e$/yr as the City's cumulative contribution to GHG emissions in 2035. An emissions level of 191,003 MT $CO_2e$/yr in 2035 is a 48 percent reduction from the City's 2005 emissions baseline. This reduction would be achieved through actions 1 through 30 that would reduce emissions by approximately 48,408 MT $CO_2e$/yr by 2035. Compliance with specific GHG reduction policies in General Plan 2035, denoted with a leaf symbol in the General Plan, would ensure compliance and monitoring of the local GHG reduction actions. Finally, General Plan 2035, incorporated CAP, and Environmental Impact Report for the General Plan were adopted and certified at the October 27, 2020, City Council hearing. Therefore, the Novato CAP is considered a qualified CAP. Project consistency with the Novato CAP is used to determine GHG impacts of the proposed project.

## Methodology

This analysis compares the estimated project emissions with the 660 MT $CO_2e$ per year adjusted BAAQMD threshold. Additionally, this analysis evaluates the project's consistency with the applicable GHG reduction measures and actions outlined in the CAP and shows the proposed project would be consistent with relevant measures. CalEEMod was used to model GHG emission associated with the proposed project. Please refer to Section 3, *Air Quality*, for a discussion of model inputs and assumptions. Because CalEEMod does not calculate $N_2O$ emissions from mobile sources, $N_2O$ emissions were quantified using guidance from CARB and the EMFAC2017 Emissions Inventory for the BAAQMD region for the year 2030 (the next State milestone target year for GHG emission reductions) using the EMFAC2011 categories (CARB 2018b and 2019; see Appendix AQ for calculations).

*a. Would the project generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment?*

*b. Would the project conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of greenhouse gases?*

Estimated project emissions are shown in Table 9 and compared to the 660 MT $CO_2e$ per year adjusted BAAQMD numeric threshold. Table 9 provides the project's estimated construction and operational GHG emissions. Because CalEEMod does not calculate $N_2O$ emissions from mobile sources, $N_2O$ emissions were quantified using guidance from CARB and the EMFAC2017 Emissions Inventory for the BAAQMD region for the year 2021 (the project operational year) using the

EMFAC2011 categories (CARB 2018b and 2019; see Appendix AQ for calculations). Estimated GHG emissions would be approximately 376 MT $CO_2e$ per year with the primary source of emissions from mobile sources and energy use (Appendix AQ). This is below the 660 MT $CO_2e$ per year adjusted BAAQMD numeric threshold; therefore, impacts would be less than significant.

### Table 9 Combined Annual Emissions of Greenhouse Gases

| Emission Source | Annual Emissions ($CO_2e$ in metric tons) |
|---|---|
| Construction | 13.7[1] |
| **Operational** | |
| Area | <0.1 |
| Energy | 13.5 |
| Solid Waste | 7.6 |
| Water | 1.0 |
| **Mobile** | |
| $CO_2$ and $CH_4$ | 324.9 |
| $N_2O$ | 15.1 |
| **Total** | **375.8** |
| BAAQMD Threshold (Adjusted for SB 32) | 660 |
| **Exceed BAAQMD Threshold?** | **No** |

[1] Construction activity would generate 412 MT $CO_2e$ over the entire five to six-month construction period. Construction emissions were amortized over 30 years consistent with South Coast AQMP guidance, as BAAQMD has no guidance for no construction emissions.

Source: Appendix AQ

In addition to comparison with the BAAQMD adjusted threshold, Table 10 evaluates the project's consistency with the applicable GHG reduction actions outlined in General Plan 2035 and CAP and shows the proposed project would be consistent with relevant measures. The CAP includes specific actions to meet estimated reductions for compliance with state GHG reduction goals, and the project complies with these local actions and reduction measures.

### Table 10 Project Consistency with the Novato Climate Action Plan

| Novato CAP Reduction Measures (RM) | Project Consistency |
|---|---|
| **RM 1**: *Energy Efficient Streetlights*. Minimize energy used for streetlights. | **Consistent.** While the project does not include any new streetlights, under canopy lighting for the proposed project would be Cree light emitting diode (LED) lighting fixtures that would reduce energy use. |
| **RM 4**: *Energy Efficient Programs (Community)*. Continue and expand residential and commercial energy efficiency programs. | **Consistent.** The project would be served by Pacific Gas & Electric and under canopy lighting would include LED lighting fixtures to reduce energy use. The project would not utilize natural gas as a source of energy. |

| Novato CAP Reduction Measures (RM) | Project Consistency |
|---|---|
| **RM 6**: *Clean Electricity.* Encourage residences and businesses to switch to GHG-free electricity and encourage MCE Clean Energy to reach its goal to provide 100 percent GHG-free by 2025. | **Consistent.** While the project would not be served by Marin Clean Energy, under canopy lighting would include LED lighting fixtures to reduce energy use. The project would not utilize natural gas as a source of energy. |
| **RM 11**: *Cool Paving.* Reduce summertime air temperatures by increasing urban albedo. | **Consistent.** The fuel facility canopy would be lightly colored material, replacing the existing darker asphalt parking area. This would increase the albedo of the fuel facility site, consistent with this RM. |
| **RM 12**: *Urban Forest.* Increase tree cover and increase shade of structures and other improvements within the City. | **Consistent.** While the project will remove 45 existing trees, the project would plant 65 replacement trees and the total amount of landscaping would increase by 6,086 square feet, including new vegetation and drainage management areas. The new landscaped area would be located along the southern and western boundary of the fuel facility site. Additionally, the Rowland Boulevard improvements will install new street trees, providing shading and reducing pavement heat along the adjacent sidewalk and multi-use path. |
| **RM 13**: *Water Conservation.* Conserve water through improved efficiency. | **Consistent.** The project would be a service station and would thus require minimal water supply and produce minimal wastewater. Additionally, landscaping at the fuel facility site will include primarily low-water use plants, drip irrigation, and compliance with North Marin Water District Regulation No. 15 addressing water use efficiency. |
| **RM 15**: *Vehicle Idling.* Improve traffic flow and reduce VMT within the City. | **Consistent.** The Rowland Boulevard improvements would improve vehicle flow by better synchronizing traffic signals, modifying lane striping, reducing vehicle speeds, and installing traffic calming measures. These improvements would also involve the improvement of pedestrian and bicycle facilities along this segment of Rowland Boulevard. As discussed in Section 17, *Transportation*, the project would result in a total reduction of 458 daily VMT.<br>Operation of the fuel facility would reduce overall VMT associated with Costco members who are currently purchasing fuel at other fuel stations, including Costco fuel centers located outside Novato. Further, many Costco members will combine a stop at the fuel center with a trip already destined for the Costco Warehouse or Vintage Oaks Shopping Center thereby further reducing VMT. |
| **RM 16**: *Commute Alternatives.* Facilitate programs aimed at reducing vehicle trips. | **Consistent.** The Rowland Boulevard improvements would involve the improvement of pedestrian and bicycle facilities along this segment of Rowland Boulevard. |
| **RM 22**: *Pedestrian Infrastructure.* Promote walking through design standards and amenities that concentrate uses, reduce the need for vehicular travel, and enhance the pedestrian experience. | **Consistent.** The Rowland Boulevard improvements would involve the improvement of pedestrian and bicycle facilities along this segment of Rowland Boulevard. |
| **RM 23**: *Bicycle Infrastructure.* Increase the number of Novato workers who commute by bicycle. | **Consistent.** The Rowland Boulevard improvements would involve the improvement of pedestrian and bicycle facilities along this segment of Rowland Boulevard. |
| **RM 25**: *Complete Streets.* Adopt "Complete Street" standards to facilitate multi-modal access for those trips that cannot be completed by walking alone. | **Consistent.** The Rowland Boulevard improvements involve the improvement of pedestrian and bicycle facilities along this segment of Rowland Boulevard, including a new pedestrian sidewalk and multi-use path along the eastern side of the road, and four pedestrian crosswalks and bulb-outs across Rowland Boulevard. |

| Novato CAP Reduction Measures (RM) | Project Consistency |
|---|---|
| **RM 30**: *Zero Waste.* Achieve Zero Waste diversion goals. | **Consistent.** The project would comply with state and local statues and regulations related to solid waste regarding increased recycling efforts per Assembly Bill 341 and the City's General Plan policy ES-27f by providing recycling services. |

Source: City of Novato 2020a, Appendix E

In addition to the reduction measures above the project would be required to comply with the NMC Chapter 4, which incorporates the California Green Building Standards Code This code includes specific requirements related to recycling, construction materials, and energy efficiency standards that would apply to project construction to minimize wasteful, inefficient, and unnecessary energy consumption.

The project would also comply with the City's General Plan goals and policies. For example, it would comply with program PF-3a which encourages water conservation measures and various mobility policies by providing access to alternate modes of transportation, including transit (bus stops within 0.5 mile), bicycling (parking and lanes), and pedestrian facilities (walkways provided on site).

Therefore, the project would not exceed the BAAQMD thresholds of significance, the proposed project would be consistent with the Novato CAP and would not conflict with state regulations intended to reduce GHG emissions statewide. Impacts related to GHG emissions would be less than significant.

**LESS THAN SIGNIFICANT IMPACT**

# 9 Hazards and Hazardous Materials

| | Potentially Significant Impact | Less than Significant with Mitigation Incorporated | Less than Significant Impact | No Impact |
|---|---|---|---|---|
| Would the project: | | | | |
| a. Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials? | ☐ | ☐ | ■ | ☐ |
| b. 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? | ☐ | ☐ | ■ | ☐ |
| c. Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within 0.25 mile of an existing or proposed school? | ☐ | ☐ | ☐ | ■ |
| d. Be located on a site that is included on a list of hazardous material sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment? | ☐ | ☐ | ■ | ☐ |
| e. For a project located in 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 or excessive noise for people residing or working in the project area? | ☐ | ☐ | ☐ | ■ |
| f. Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan? | ☐ | ☐ | ■ | ☐ |
| g. Expose people or structures, either directly or indirectly, to a significant risk of loss, injury, or death involving wildland fires? | ☐ | ☐ | ■ | ☐ |

*a. Would the project create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?*

*b. 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?*

Project construction would require the use of heavy equipment and machinery, such as trucks and pavers, the operation of which could result in a spill or accidental release of hazardous materials, including fuels, engine oil, engine coolant, and lubricants. The transport, storage, labeling, use and disposal of any hazardous materials would be subject to federal, state, and local regulations, which would minimize risks associated with hazardous materials used during construction. Therefore, the potential to create a significant hazard to the public or environment from the use of fuels, engine oil, engine coolant, and lubricants during construction would be less than significant. Additionally, the NPDES permit requirements would ensure that impacts related to hazardous materials from spills would be reduced through the Construction General Permit BMPs, including use of straw wattles and other features.

Operation of the gas station would include the use, transport, and handling of hazardous materials. Specifically, operation would include the regular transportation of gasoline, refilling USTs, pumping gasoline to fuel dispensers, and use of the fuel dispensers by motorists. As a result, the proposed project could result in potentially adverse impacts to people and the environment as a result of hazardous materials being accidentally released into the environment (e.g. operators or motorists could spill gasoline while refueling, USTs or pipes dispensing fuel from USTs could leak, automobiles could crash into fuel dispensers, or motorists could refuel while having engine running causing a fire hazard).

However, the proposed project would be required to operate in compliance with all with applicable federal, state, and local requirements which lessen the potential for these impacts. Some of these regulations include:

- SWRCB Health and Safety Code, Section 25280, USTs installed after 1988 are required to have a leak detection system consisting of at least one of the following detection methods: secondary containment with interstitial monitoring, automatic tank gauging systems (including continuous automatic tank gauging systems), vapor monitoring (including tracer compound analysis), groundwater monitoring, statistical inventory reconciliation, or other method meeting established performance standards.
- Efficacy requirements established by USEPA require that leak detection methods be able to detect certain leak rates and that they also give the correct answer consistently. In general, methods must detect the specified leak rate with a probability of detection of at least 95 percent and a probability of false alarm of no more than 5 percent. USEPA found that, with effective leak detection, operators can respond quickly to signs of leaks and minimize the extent of environmental damage and the threat to human health and safety.
- USTs and associated fuel delivery infrastructure (i.e., fuel dispensers) would be required to comply with applicable federal, state, and local regulations, including those provisions established by Section 2540.7, Gasoline Dispensing and Service Stations, of the California OSHA Regulations; Chapter 38, Liquefied Petroleum Gases, of the California Fire Code; and the Resource Conservation and Recovery Act.
- The proposed project would also be required to incorporate high-efficiency Phase I and Phase II enhanced vapor recovery (EVR) systems to capture and control gasoline fumes. EVR refers to a new generation of equipment to control emissions at gasoline dispensing facilities in California.

EVR systems collect gasoline vapors that would otherwise escape into the atmosphere during bulk fuel delivery (Phase I) or fuel storage and vehicle refueling (Phase II). Since 2009, the installation of Phase I and Phase II EVR systems has been required for gasoline dispensing facilities.

- The fuel dispensers, USTs, and associated fuel delivery infrastructure would be subject to routine inspection by federal, state, and local regulatory agencies with jurisdiction over service station facilities.
- The handling, transport, use, and disposal of hazardous materials must comply with applicable federal, state, and local agencies and regulations.

In addition, the project, as presented in Costco's Fueling Facility Program (Appendix FP), includes environmental safeguards/design features including:

- Employees are trained to identify maintenance requirements and physically inspect the fuel islands regularly during operating hours. Their training includes the proper spill clean up and emergency response procedures. Trained employees check for leaking hoses, malfunctioning nozzles, fuel spills, and physical damage to the dispensers and controller enclosure. During non-operating hours, the power to the dispensers is turned off and each nozzle pad is locked. Should the system require attention beyond what the trained site person could handle, the local authorized and certified service contractor would be contacted and dispatched to repair the equipment.
- Emergency shutoff switches are installed next to the controller enclosure and in locations near the dispensers, as dictated by the fire code.
- The tank and piping monitoring system is programmed to activate visual/audible alarms in the event of an alarm condition. A visual/audible alarm is located on the outside of the controller enclosure and a visual/audible alarm is located in the Costco Warehouse entry/exit area. Further, the monitoring system is designed so that if power is lost to the monitoring console the facility is shut down and will not operate.
- Costco Wholesale's tank and piping system is certified to meet the Federal UST leak detection standards of 95 percent probability of detection and five percent probability of false alarm. California State Water Resources Control Board also certifies the system under LG-113.
- Costco Wholesale utilizes durable joint sealers to seal concrete control joints. Prevention Technologies, Inc (PTi) sealer is a petroleum-resistant sealant developed by PTi. The sealer is used to prevent petroleum products from entering the underlying soil at the concrete joints. This product is used for its superior elasticity and user-friendly application. The elasticity allows the product to maintain a tight seal even with concrete expansion. The easy application ensures a proper seal whether it is applied by a contractor or maintenance personnel. Costco Wholesale is one of the few, if not only companies, to have a nationwide standard to seal control joints and other areas to prevent product spills from reaching the soil.
- The underground tank and piping control units are housed inside the controller enclosure. The enclosure will contain the power console, the dispenser interface unit, the submersible pump variable speed controllers, and the monitoring system console. An air conditioner mounted on the side of the enclosure will have a preset thermostat to maintain a safe operating temperature.
- The USTs and all containment sumps, including the dispenser sumps are all double-walled fiberglass. Fiberglass is used for its corrosion resistance and plasticity. The double-walled storage tank system includes a hydrostatic interstitial space sensor that monitors the primary

and secondary tank walls. If a tank wall is compromised, the interstitial sensor will immediately shut down the product delivery system and activate a visual/audible alarm.

- The tanks are secured in place with anchoring straps (tie-downs) connected to concrete hold down deadmen. The entire tank excavation hole is backfilled with pea gravel and capped with an 8-inch-thick reinforced concrete slab (overburden). The tie-downs, together with the overburden, overcome any possible buoyancy factors and resist buckling under hydrostatic pressures.
- All product, vapor and vent piping is non-corrosive and provides three levels of protection. First, all product piping is monitored with pressure line leak detection. Second, all piping is double wall to provide secondary containment. Third, all fiberglass piping is additionally monitored under vacuum per California 2481 regulations such that if a breach is detected in the vacuum, the product delivery system will shut down and system will sound audible alarm.
- All piping connections to the tanks and dispensers are flexible. Flexible connectors are used to prevent rupture from any form of ground movement.
- All piping slopes to the sumps at the USTs. If a piping leak occurs, the gasoline will flow through the secondary pipe to the sump, where a sensor is triggered to immediately shut down the system and activate an audible/visual alarm.
- All tanks and dispensers are equipped with latest Phase I and Phase II Enhanced Vapor Recovery (EVR) vapor recovery air pollution control equipment technology per CARB regulations and associated Executive Orders. The Phase I EVR equipment controls the vapors in the return path from the tanks back to the tanker truck during offloading filling operations. The Stage I EVR systems are 98 percent effective in controlling fugitive emissions from escaping into the environment. The Phase II EVR equipment controls the vapors in the return path from the vehicles back to the tanks and are 95 percent effective in controlling fugitive emissions from escaping into the environment.
- The UST monitoring system incorporates automatic shutoffs. If gasoline is detected in the sump at the fuel dispenser, the dispenser shuts down automatically and an alarm is sounded. If a problem is detected with a tank, the tank is automatically shut down and an alarm is sounded. If the product piping system detects a failure of the 0.1 gallons per hour (GPH) test, the line is automatically shut down and the alarm is sounded. Pursuant to federal requirements, monitoring equipment must be able to detect a minimum leak of 3 GPH (equivalent to the accuracy of a mechanical leak detector). By providing monitoring to a higher standard (0.1 vs. 3), Costco maintains a higher degree of safety than required by current federal requirements.
- Each fuel dispenser includes several safety devices. Specifically, each dispenser sump is equipped with an automatic shutoff valve to protect against vehicle impact. In addition, each fuel hose includes a poppeted breakaway device that will stop the flow of fuel at both ends of the hose in the event of an accidental drive-off. Also, each dispenser is equipped with internal fire extinguishers. Lastly, all dispensers include leak detection sensors connected to the alarm console inside the controller enclosure.

Therefore, the environmental safeguards, design features, and compliance with applicable regulations would result in a less than significant impact.

**LESS THAN SIGNIFICANT IMPACT**

*c. Would the project emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within 0.25 mile of an existing or proposed school?*

The nearest public school is Lynnwood Elementary School, 2,800 feet west of the fuel facility site and 850 feet south of the Redwood Boulevard and Rowland Boulevard intersection. Private schools near the project sites include Good Shepherd Lutheran School, 2,400 feet southwest of the fuel facility site; and North Bay Christian Academy, 2,400 feet northwest of the Rowland Boulevard site. As described above under threshold (a) and (b), the project would not result in a hazard to the public or environment. Therefore, there would be no impact.

**NO IMPACT**

*d. Would the project be located on a site that is included on a list of hazardous material sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?*

The fuel center site is listed as Costco Wholesale #141, Novato (ID: 71003434), an inactive site on the EnviroStor database. The site type is listed as “tiered permit,” and Costco Wholesale is listed as a large-quantity generator (1,000 kilograms or more of hazardous waste produced per month) (City of Novato 2014). In 2018, Costco generated 2.3 tons of hazardous waste (DTSC 2020a). As a large-quantity generator, Costco is required to comply with hazardous waste management requirements in 40 CFR 262.17(a)(1-4), 40 CFR 265(W), and 40 CFR 265 (DD); hazardous waste manifest requirements in 40 CFR 262 (B) and 40 CFR (262.30-33); and hazardous waste emergency procedure requirements in 40 CFR 262(M) and 40 CFR 268. The database listing associated with the permit does not indicate a known or suspected release of hazardous substances (DTSC 2020b). The site (300 Vintage Way) is also listed as an area where illegal dumping occurred; however, the record has been inactive as of October 2019, three months after the action was reported (DTSC 2020c). It can be reasonably assumed that the issue was abated in 2019 and no residual hazardous materials are present.

The Rowland Boulevard improvement area is not listed as hosting any contaminants in the EnviroStor database (DTSC 2020b).

A search of the State Water Resources Control Board (SWRCB) GeoTracker and California Department of Toxic Substances Control (DTSC) EnviroStor databases was performed in August 2020 and revealed that no other hazardous materials sites are within 1,000 feet of the project sites (SWRCB 2020, DTSC 2020b). Impacts would be less than significant.

**LESS THAN SIGNIFICANT IMPACT**

*e. 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 or excessive noise for people residing or working in the project area?*

Gnoss Field, the nearest airport, is located approximately 3.2 miles north of the project sites. The project sites are not within the Gnoss Field area of influence identified in the airport land use plan (County of Marin 1991). Therefore, the project would not expose people residing or working in the project area to airport-related safety hazards or excessive noise. There would be no impact.

**NO IMPACT**

*f. Would the project impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?*

Novato is a participant in the Marin County Multi-Jurisdictional Hazard Plan (2018). The project would not interfere with this adopted emergency response plan or the City's emergency evacuation plan since the project site and surrounding roads (including Rowland Boulevard and Vintage Way) is not an element of plan or any evacuation route. The fuel center would be completely located on private property and would not impair movement on Vintage Way or Rowland Boulevard. Rowland Boulevard would not be fully closed during the construction of the improvements, though some lane closures may occur. No roads in the vicinity of the project would be closed as a result of the project, and the Rowland Boulevard improvements are intended to improve traffic flow and pedestrian and bicycle transportation modes. All construction would occur on the site. Impacts would be less than significant.

**LESS THAN SIGNIFICANT IMPACT**

*g. Would the project expose people or structures, either directly or indirectly, to a significant risk of loss, injury, or death involving wildland fires?*

The project sites are adjacent to existing urban development in Novato and it is classified as a Local Responsibility Area, where responsibility for fire protection falls on the NFPD, rather than the state or federal government. Refer to Section 20, *Wildfire*, for additional detail regarding wildfire risks at the project sites. The project would not expose people or structures to a significant risk involving wildland fires. Furthermore, the proposed project would comply with the applicable fire safety provisions of the California Building Code, thereby reducing the risk of damage from fire to the maximum extent practicable. Impacts would be less than significant.

**LESS THAN SIGNIFICANT IMPACT**

# 10 Hydrology and Water Quality

| | Potentially Significant Impact | Less than Significant with Mitigation Incorporated | Less than Significant Impact | No Impact |
|---|---|---|---|---|
| Would the project: | | | | |
| a. Violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface or ground water quality? | ☐ | ☐ | ■ | ☐ |
| b. Substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the project may impede sustainable groundwater management of the basin? | ☐ | ☐ | ■ | ☐ |
| c. Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surfaces, in a manner which would: | | | | |
| (i) Result in substantial erosion or siltation on- or off-site; | ☐ | ☐ | ■ | ☐ |
| (ii) Substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site; | ☐ | ☐ | ■ | ☐ |
| (iii) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff; or | ☐ | ☐ | ■ | ☐ |
| (iv) Impede or redirect flood flows? | ☐ | ☐ | ■ | ☐ |
| d. In flood hazard, tsunami, or seiche zones, risk release of pollutants due to project inundation? | ☐ | ☐ | ■ | ☐ |
| e. Conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan? | ☐ | ☐ | ■ | ☐ |

a. *Would the project violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface or ground water quality?*

Temporary site preparation, grading, and paving activities associated with construction of the project could result in limited soil erosion that may degrade water quality. However, such construction activities would be required to comply with the requirements of NMC Chapter 7-4 (the City's Urban Runoff Pollution Prevention Ordinance) and NPDES permit requirements. NMC Chapter 7-4 is enforced by City officials to ensure compliance with the City's requirements and ensure no discharge of non-stormwater to the City's storm drain system. This chapter includes various recommended best management practices (BMP) for construction activity, and allows the requirement of a condition of approval to ensure permanent structural controls to remove sediment and other pollutants from stormwater runoff. An erosion and sediment control plan is required for projects subject to grading, building, or other City permits. Compliance with the NDPES permit also includes implementation of construction BMPs, such as erosion and sediment control measures. In addition, the City adheres to the Marin County Stormwater Pollution Prevention Program (MCSTOPPP) to minimize the negative impacts of stormwater runoff.

Operation of the fuel center would also be subject to the City's Urban Runoff Pollution Prevention Ordinance. Specifically, proposed construction activities would be required to comply with NMC 7-4.10(b), which requires frequent cleaning of gas station structures to prevent discharge of pollutants into the City storm drain system or watercourse, and NMC 7-4.10(c), which requires construction plans to include construction, erosion, and sediment control BMPs. Because the project would disturb more than one acre of area, the applicant would be required to obtain coverage under the NPDES Construction General Permit and prepare a SWPPP, which includes BMPs for erosion control.

The project includes the construction of two bioretention areas, sized to retain stormwater runoff from the entire fuel facility site. The drainage management area (DMA #09, 12,936 square feet in size) that collects runoff from the proposed fueling area would drain to the existing sanitary sewer and be treated by an oil/water separator, consistent with Section SC-20 of the California Stormwater Quality Association (CASQA) Stormwater Best Management Practice Handbook. Runoff from one drainage management area (DMA #10, 1,729 square feet in size) that encompasses the proposed driveway, would remain untreated. Additionally, per the project's Stormwater Control Plan, the project will implement the following permanent and operational source control best management practices (BMP):

- All inlets will be marked with "No Dumping! Flows to Local Waterways" or similar.
- Landscaping will minimize irrigation and runoff and be selected for pest resistance, and will minimize the need for fertilizers and pesticides.
- Plants will be selected appropriate to site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions.
- Fueling areas have impermeable floors that are graded at the minimum slope necessary to prevent ponding. This area is separated from the rest of the site by a grade break that prevents run-on of stormwater. The fueling area is covered by a canopy that extends the area within the grade break. The canopy does not drain into the fueling area.
- Maintain and periodically repaint or replace inlet markings.
- Provide stormwater pollution prevention information to new site owners, lessees, or operators.
- Lease agreements will include the following provision: "Tenant shall not allow anyone to discharge anything to storm drains or to store or deposit materials so as to create a potential discharge to storm drains."
- Inspect and maintain drains to prevent blockages and overflow.

- Landscaping will be maintained using minimum or no pesticides.
- Integrated pest management information will be provided to new owners, lessees, and operators.
- The property owner shall dry sweep the fueling area routinely.
- Plazas, sidewalks, and parking lots will be regularly swept to prevent accumulation of litter and debris. Debris from pressure washing will be collected to prevent entry to storm drain system. Washwater containing any cleaning agent or degreaser will be collected and discharged into the sanitary sewer and NOT storm drain.

The project would reduce the total existing impervious surface area from 62,061 square feet to 60,265 square feet (an approximately 1,796 square feet reduction) on the fuel facility site and would remove a vegetated median along Rowland Boulevard. In addition to this decrease in impervious surfaces, the previously mentioned stormwater management features would control and treat stormwater drainage. These proposed features would comply with the City of NMC 7-4.6 and 7-4.10(d), which require the project sites to be designed to control pollutants, pollutant loads, and runoff volume to the maximum extent feasible by minimizing impervious surface area and controlling runoff from impervious surfaces through infiltration, evapotranspiration, bioretention, and/or rainfall harvest and use. Adherence to these regulations would ensure that pollutants do not affect water quality.

The Rowland Boulevard improvements would construct a new sidewalk and multi-use path along the eastern side of Rowland Boulevard behind Vintage Oaks, increasing the impervious surfaces at the Rowland Boulevard site. The Rowland Boulevard site contains existing stormwater drop inlets that collect stormwater from the roadway. The Rowland Boulevard improvements would also be required to comply with the City of NMC 7-4.6 and 7-4.10(d), which would ensure that pollutants do not affect water quality. Compliance with applicable regulations would ensure that impacts to water quality would be less than significant.

**LESS THAN SIGNIFICANT IMPACT**

b. *Would the project substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the project may impede sustainable groundwater management of the basin?*

The North Marin Water District (NMWD) supplies water to the City of Novato from the Russian River, Stafford Lake and recycled water. The NMWD has no local, developed groundwater supply source (NMWD 2016). The project does not propose the use of groundwater, and as discussed in Section 19, *Utilities and Service Systems,* the NMWD has an existing water supply available to serve the proposed project. Additionally, while the Rowland Boulevard improvements would incrementally increase impervious surfaces to accommodate a portion of a new multi-use path, the fuel facility project would reduce impervious surfaces by 1,796 square feet and construct bioretention basins, which would allow groundwater recharge. Impacts would be less than significant.

**LESS THAN SIGNIFICANT IMPACT**

*c.(i) 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 through the addition of impervious surfaces, in a manner which would result in substantial erosion or siltation on- or off-site?*

*c.(ii) 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 through the addition of impervious surfaces, in a manner which would substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?*

*c.(iii) 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 through the addition of impervious surfaces, in a manner that would create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?*

*c.(iv) 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 through the addition of impervious surfaces, in a manner which would impede or redirect flood flows?*

The project would not alter the course of a stream or river as no such water bodies exist on the fuel facility or Rowland Boulevard sites. The project would not substantially alter the drainage pattern of the area, and the project includes bioretention facilities and stormwater treatment at the fuel facility site. The proposed project would include the development of storm drainage systems throughout the fuel facility site to connect to the existing storm drain along the east side of the fuel facility site, adjacent to the Costco warehouse building, and southwest of the fuel facility site along Vintage Way. The stormwater control plan provides the square footage of each drainage management area and square footage of bioretention areas provided to capture the runoff. In addition to compliance with the City's urban runoff programs, implementation of these project design features would capture and treat stormwater runoff, reduce the quantity and level of pollutants in runoff leaving the site, and would ensure project runoff does not exceed the capacity of stormwater drainage systems. The project would not increase the rate or amount of surface runoff in a manner that would result in on- or off-site flooding or exceed the capacity of the stormwater drainage system, nor that would impede or redirect flood flows. This impact would be less than significant.

**LESS THAN SIGNIFICANT IMPACT**

*d. In flood hazard, tsunami, or seiche zones, would the project risk release of pollutants due to project inundation?*

The project sites are located approximately 3.6 miles from San Pablo Bay and 5.0 miles from Stafford Lake, the nearest large bodies of water. Although a seiche could form on Stafford Lake during a seismic event, there would be no risk of inundation from seiche at the project sites due to the relatively small size of Stafford Lake and distance of 5.0 miles from Stafford Lake to the project sites. However, failure of the Stafford Lake Dam could result in inundation of the fuel facility site up to approximately 2 feet (City of Novato 2020a). The proposed gasoline USTs and associated infrastructure would be watertight and installed with various leak protection safeguards. Inundation of the fuel facility site would not be expected to infiltrate the USTs or associated infrastructure; therefore, the project would not risk release of pollutants as a result of fuel facility site inundation.

Although an earthquake on the Hayward and Rodgers Creek fault complex, which runs under the bay, could create a tsunami, the potential for a tsunami to impact the City of Novato and the project sites are low (City of Novato 2020a), and the project sites are located 1.2 miles from the nearest tsunami zone (DOC 2009).

The fuel facility site is located in Flood Zone X, with the northeastern portion of the site also in the 500-year floodplain and has a low probability of inundation with potential flood depths of less than one foot. Additionally, the proposed gasoline USTs and associated infrastructure would be watertight and installed with various leak protection safeguards. Flooding of the fuel facility site would not be expected to infiltrate the USTs or associated infrastructure; therefore, the project would not risk release of pollutants as a result of fuel facility site inundation.

The Rowland Boulevard site is located partially in Flood Zone X, with approximately half of the site within the 500-year floodplain. The remainder of Rowland Boulevard is within Zone AE and within the 100-year floodplain (FEMA 2016). However, construction of the project would not alter the overall grade or elevation of the existing sites, and no change in the floodplain elevation would occur. Additionally, the proposed bioretention areas and on-site stormwater treatment would ensure no off-site pollution occurs during project inundation. Therefore, impacts resulting in flood hazard, tsunami, or seiche release of pollutants due to project inundation would be less than significant.

**LESS THAN SIGNIFICANT IMPACT**

*e. Would the project conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan?*

The project sites are located within the Novato Valley Groundwater Basin, which is a low priority basin according to the Department of Water Resources (DWR) Sustainable Groundwater Management Act Basin Prioritization dashboard (DWR 2020). Low priority basins are not required to adopt a groundwater sustainability plan.

The proposed project would be subject to the San Francisco Bay Basin Water Quality Control Plan (Basin Plan) (SWRCB 2018). The San Francisco Bay RWQCB is responsible for adopting and updating the Basin Plan, which establishes water quality control measures and flow requirements needed to provide reasonable protection of beneficial uses in the watershed. As discussed in criterion (a), the project would be required to comply with NPDES requirements and portions of the NMC relevant to water quality. The project would therefore not conflict with or obstruct implementation of the Basin Plan.

As discussed in Section 19, *Utilities and Service Systems,* the City of Novato is served by the NMWD which provides potable and recycled water service to the City, surrounding unincorporated areas, and portions of West Marin. Approximately 80 percent of the Novato water supply comes from the Russian River through the NMWD wholesale water supplier, the Sonoma County Water Agency. The remaining 20 percent comes from local runoff into Stafford Lake. The District has no local, developed groundwater sources (NMWD 2016).

Additionally, as discussed under criterion (a), the project includes features that comply with NMC Sections 7-4.6 and 7-4.10(d), which require the project sites to be designed to control pollutants, pollutant loads, and runoff volume to the maximum extent feasible by minimizing impervious surface area and controlling runoff from impervious surfaces through infiltration, evapotranspiration, bioretention, and/or rainfall harvest and use, which would decrease the amount of runoff from the site, allowing for more infiltration. The project would not use groundwater and would not conflict with a sustainable groundwater management plan. Impacts would be less than significant.

**LESS THAN SIGNIFICANT IMPACT**

# 11 Land Use and Planning

| | Potentially Significant Impact | Less than Significant with Mitigation Incorporated | Less than Significant Impact | No Impact |
|---|---|---|---|---|
| Would the project: | | | | |
| a. Physically divide an established community? | ☐ | ☐ | ☐ | ■ |
| b. Cause a significant environmental impact due to a conflict with any land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect? | ☐ | ☐ | ■ | ☐ |

*a. Would the project physically divide an established community?*

The project sites are located in an area with similar commercial uses, with the closest residences located across US 101 to the southwest. The project would not result in the removal of any existing roadways or the construction of barriers that could prevent access within an established community. Therefore, the project would not physically divide an established community and no impact would occur.

**NO IMPACT**

*b. Would the project cause a significant environmental impact due to a conflict with any land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect?*

The fuel facility site has a Novato General Plan designation of General Commercial (GC). The City of Novato zones the fuel facility site as Planned Development (PD). The site is also located in the Vintage Oaks Precise Development Plan (PDP) area and involves striping modifications to a segment of Vintage Way. The project would include approval of a use permit to allow a fueling station under the PDP. The project would also go through the design review process. The Rowland Boulevard improvements are located within existing public right-of-way and would be added to the City's capital improvement program. The project would be consistent with General Plan 2035, and consistency with relevant General Plan policies has been analyzed throughout this document.

The project's traffic calming features, new parking stalls, and addition of the sidewalks and crosswalks are consistent with General Plan 2035 Mobility policies MO-7 (Design for Complete Streets), MO-8b (Pedestrian and Bicycle Facilities), MO-9 (Traffic Safety), MO-10 (Vehicle Parking), MO-18 (Comprehensive Bicycle Network), and MO-20 (Safe and Convenient Pedestrian Facilities).

The project would be consistent with General Plan policy PF-3a, regarding water conservation and water-efficient landscaping, and policy ES-27f regarding provision of recycling services, as discussed in Section 8, *Greenhouse Gas Emissions*, and Section 19, *Utilities and Service Systems*. While the proposed fuel facility would not include recycling bins, the associated Costco Wholesale does provide recycling facilities that would be available to customers.

As discussed in Section 13, *Noise,* the addition of the project would not result in noise levels greater than the maximum normally acceptable exterior sound levels described in Chapter 4 of the General Plan.

Additionally, as discussed in Section 8, *Greenhouse Gas Emissions*, the project is consistent with the City's CAP, adopted as part of General Plan 2035. With mitigation, all impacts would be less than significant, and no physical impact would be created through inconsistency with any applicable City land use plan, policy, or regulation. Impacts would be less than significant.

**LESS THAN SIGNIFICANT IMPACT**

# 12 Mineral Resources

| | Potentially Significant Impact | Less than Significant with Mitigation Incorporated | Less than Significant Impact | No Impact |
|---|---|---|---|---|
| Would the project: | | | | |
| a. Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state? | ☐ | ☐ | ☐ | ■ |
| b. 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? | ☐ | ☐ | ☐ | ■ |

*a. Would the project result in the loss of availability of a known mineral resource that would be of value to the region and the 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 project would occur in a developed area of Novato where there are no active mining operations or known mineral resources present. The project sites do not fall within a Mineral Resource Zone (Stinson et al. 1982). In addition, the General Plan does not identify mineral resources within the vicinity of the project area (City of Novato 2020a). No mineral resources would be altered or displaced by the project. There would be no impact.

**NO IMPACT**

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# 13 Noise

| | Potentially Significant Impact | Less than Significant with Mitigation Incorporated | Less than Significant Impact | No Impact |
|---|---|---|---|---|
| Would the project result in: | | | | |
| a. Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies? | ☐ | ☐ | ■ | ☐ |
| b. Generation of excessive groundborne vibration or groundborne noise levels? | ☐ | ☐ | ■ | ☐ |
| c. For a project located within the vicinity of a private airstrip or 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 expose people residing or working in the project area to excessive noise levels? | ☐ | ☐ | ☐ | ■ |

## Noise Setting

The unit of measurement used to describe a noise level is the decibel (dB). However, the human ear is not equally sensitive to all frequencies within the sound spectrum. Therefore, a method called “A-weighting” is used to filter noise frequencies that are not audible to the human ear. A-weighting approximates the frequency response of the average young ear when listening to most ordinary everyday sounds. When people make relative judgments of the loudness or annoyance of a sound, their judgments correlate well with the “A-weighted” levels of those sounds. Therefore, the A-weighted noise scale is used for measurements and standards involving the human perception of noise. In this analysis, all noise levels are A-weighted, and the abbreviation “dBA” is understood to identify the A weighted decibel.

Decibels are measured on a logarithmic scale that quantifies sound intensity in a manner similar to the Richter scale used for earthquake magnitudes. A 10 dB increase represents a 10-fold increase in sound intensity, a 20 dB increase is a 100-fold intensity increase, a 30 dB increase is a 1,000-fold intensity increase, etc. Similarly, a doubling of a noise source, such as doubling of traffic volume, would increase the noise level by 3 dB; a halving of the noise source would result in a 3 dB decrease.

Human perception of noise has no simple correlation with acoustical energy. The perception of noise is not linear in terms of dBA or in terms of acoustical energy. Two equivalent noise sources combined do not sound twice as loud as one source. It is widely accepted that the average healthy ear can barely perceive changes of 3 dBA (increase or decrease); that a change of 5 dBA is readily perceptible; and that an increase (or decrease) of 10 dBA sounds twice (half) as loud (California Department of Transportation [Caltrans] 2013a).

### *Descriptors*

The impact of noise is not a function of loudness alone. The time of day when noise occurs and the duration of the noise are also important. In addition, most noise that lasts for more than a few seconds is variable in its intensity. Consequently, a variety of noise descriptors has been developed. The noise descriptors used for this analysis are the one-hour equivalent noise level ($L_{eq}$) and the community noise equivalent level (CNEL). The $L_{max}$ is the maximum noise level reached during a single noise event.

The $L_{eq}$ is the level of a steady sound that, in a specific time period and at a specific location, has the same A-weighted sound energy as the time-varying sound. For example, $L_{eq(1h)}$ is the equivalent noise level over a 1-hour period and $L_{eq(8h)}$ is the equivalent noise level over an 8-hour period. $L_{eq(1h)}$ is a common metric for limiting nuisance noise, whereas $L_{eq(8h)}$ is a common metric for evaluating construction noise.

The CNEL is a 24-hour equivalent sound level. The CNEL calculation applies an additional 5 dBA penalty to noise occurring during evening hours (between 7:00 p.m. and 10:00 p.m.) and an additional 10 dBA penalty to noise occurring during the night (between 10:00 p.m. and 7:00 a.m.). These increases for certain times are intended to account for the added sensitivity of humans to noise during the evening and night.

### *Propagation*

Sound from a small, localized source (approximating a “point” source) radiates uniformly outward as it travels away from the source in a spherical pattern, known as geometric spreading. The sound level decreases or drops off at a rate of 6 dBA for each doubling of distance.

Traffic noise is not a single, stationary point source of sound. Over some time interval, the movement of vehicles makes the source of the sound appear to emanate from a line (line source) rather than a point. The drop-off rate for a line source is 3 dBA for each doubling of distance.

## Vibration

Groundborne vibration of concern in environmental analysis consists of the oscillatory waves that move from a source through the ground to adjacent structures. The number of cycles per second of oscillation makes up the vibration frequency, described in terms of hertz (Hz). The frequency of a vibrating object describes how rapidly it oscillates. The normal frequency range of most groundborne vibration that can be felt by the human body is from a low of less than 1 Hz up to a high of about 200 Hz (Crocker 2007).

While people have varying sensitivities to vibrations at different frequencies, in general they are most sensitive to low-frequency vibration. Vibration in buildings, such as from nearby construction activities, may cause windows, items on shelves, and pictures on walls to rattle. Vibration of building components can also take the form of an audible low-frequency rumbling noise, referred to as groundborne noise. Groundborne noise may result in adverse effects, such as building damage, when the originating vibration spectrum is dominated by frequencies in the upper end of the range (60 to 200 Hz). Vibration may also damage infrastructure when foundations or utilities, such as sewer and water pipes, physically connect the structure and the vibration source (Federal Transit Administration [FTA] 2018). Although groundborne vibration is sometimes noticeable in outdoor environments, it is almost never annoying to people who are outdoors. The primary concern from vibration is that it can be intrusive and annoying to building occupants and vibration-sensitive land uses.

### *Descriptors*

Vibration amplitudes are usually expressed in peak particle velocity (PPV) or root mean square (RMS) vibration velocity. Particle velocity is the velocity at which the ground moves. The PPV and RMS velocity are normally described in inches per second (in/sec). PPV is defined as the greatest magnitude of particle velocity associated with a vibration event. PPV is often used in monitoring of blasting vibration because it is related to the stresses that are experienced by buildings (Caltrans 2020).

Although PPV is appropriate for evaluating the potential for building damage, it is not always suitable for evaluating human response. It takes some time for the human body to respond to vibration signals. As with airborne sound, the RMS velocity is often expressed in decibel notation as vibration decibels (VdB), which serves to compress the range of numbers required to describe vibration (FTA 2018). Vibration significance ranges from approximately 50 VdB (the typical background vibration-velocity level) to 100 VdB, the general threshold where minor damage can occur in fragile buildings (FTA 2018). The general human response to different levels of groundborne vibration velocity levels is described in Table 11.

**Table 11 Human Response to Different Levels of Groundborne Vibration**

| Vibration Velocity Level | Human Reaction |
|---|---|
| 65 VdB | Approximate threshold of perception for many people |
| 75 VdB | Approximate dividing line between barely perceptible and distinctly perceptible. Many people find that transportation-related vibration at this level is unacceptable |
| 85 VdB | Vibration acceptable only if there are an infrequent number of events per day |

Source: FTA 2018

Damage to structures occurs when vibration levels range from 2 to 6 in/sec PPV. One half this minimum threshold, or 1 in/sec PPV is considered a safe criterion that would protect against structural damage (Caltrans 2020).

### *Propagation*

Vibration energy spreads out as it travels through the ground, causing the vibration level to diminish with distance away from the source. Variability in the soil strata can also cause diffractions or channeling effects that affect the propagation of vibration over long distances (Caltrans 2020). When a building is impacted by vibration, a ground-to-foundation coupling loss (the loss that occurs when energy is transferred from one medium to another) will usually reduce the overall vibration level. However, under rare circumstances, the ground-to-foundation coupling may actually amplify the vibration level due to structural resonances of the floors and walls.

## Ambient Noise Levels

According to the Citywide existing noise contour map, the fuel facility site is within the 65 dBA $L_{dn}$ noise contour and the Rowland Boulevard site is within the 60 dBA $L_{dn}$ noise contour (City of Novato 2020a). The primary off-site noise sources in the vicinity of the project sites are motor vehicles (e.g., automobiles, buses, and trucks) along Rowland Boulevard, Vintage Way, and US 101 and the Sonoma Marin Area Rail Transit (SMART) commuter train and NWPR freight train. Motor vehicle noise is of concern because it is characterized by a high number of individual events, which often create sustained noise levels. Ambient noise levels are generally highest during the daytime and rush hour unless congestion slows traffic speeds substantially. Other sources of noise in the project vicinity include general conversations from passersby activities associated with the Vintage Oaks Shopping Center.

## Sensitive Receivers

Noise exposure goals for various types of land uses reflect the varying noise sensitivities associated with those uses. Noise-sensitive receivers generally include schools, hospitals, libraries, group care facilities, and convalescent homes (City of Novato 2020a). For the purposes of this analysis, single- and multi-family residences are also considered to be noise sensitive. The predominant noise-sensitive land uses in the area of the project sites are residences. The nearest residences are approximately 450 feet[7] southwest of the fuel facility site.

## Regulatory Setting

Chapter 4, *Living Well*, of the Novato General Plan addresses noise. The General Plan permits a maximum normally acceptable exterior sound level of 60 dBA CNEL for residential areas. The maximum allowable interior noise level is 45 dBA CNEL.

NMC Section 19.22.070 prohibits exterior noise that exceeds 45 dBA between 10:00 p.m. and 6:00 a.m. and exterior noise that exceeds 60 dBA between 6:00 a.m. and 10:00 p.m. at residential land uses and interior noise that exceeds 60 dBA between 10:00 p.m. and 6:00 a.m. and exterior noise that exceeds 70 dBA between 6:00 a.m. and 10:00 p.m. at commercial land uses, as shown in Table 12. These 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. Section 19.22.070(B) exempts authorized construction activities from these noise level requirements between 7:00 a.m. and 6:00 p.m. on weekdays and between 10:00 a.m. and 5:00 p.m. on Saturdays. Construction is not permitted on Sundays or federal national holidays, unless authorized by the City.

### Table 12 City of Novato Allowable Exterior Noise Levels[1]

| Type of Land Use | Time Interval | Maximum Noise Level (dBA)[2] |
|---|---|---|
| Residential | 10:00 p.m. to 6:00 a.m. | 45 |
| | 6:00 a.m. to 10:00 p.m. | 60 |
| Commercial | 10:00 p.m. to 6:00 a.m. | 60 |
| | 6:00 a.m. to 10:00 p.m. | 70 |
| Industrial or Manufacturing | Any time | 70 |

[1] Each of the noise limits specified 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.

Source: NMC Section 19.22.070, Table 3-5

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[7] Measured from the fuel facility site boundary to the nearest residential building.

NMC Section 19.22.090 prohibits groundborne vibration that is perceptible without instruments to the average person along or beyond the property line of a subject parcel, and exempts vibrations from temporary construction, demolition, and vehicles that enter or leave the parcel.

a. *Would the project result in generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?*

## Construction

### *Methodology*

Construction noise was estimated using the Federal Highway Transit Administration Roadway Construction Noise Model (RCNM) (2006). RCNM predicts construction noise levels for a variety of construction operations based on empirical data and the application of acoustical propagation formulas. Using RCNM, construction noise levels were estimated at noise-sensitive receivers near the project sites. RCNM provides reference noise levels for standard construction equipment, with an attenuation of 6 dBA per doubling of distance for stationary equipment.

For construction noise assessment, construction equipment can be considered to operate in two modes: stationary and mobile. As a rule, stationary equipment operates in a single location for one or more days at a time, with either fixed-power operation (e.g., pumps, generators, and compressors) or variable-power operation (e.g., pile drivers, rock drills, and pavement breakers). Mobile equipment moves around the construction site with power applied in cyclic fashion, such as bulldozers, graders, and loaders (FTA 2018). Noise impacts from stationary equipment are assessed from the center of the equipment, while noise impacts from mobile construction equipment are assessed from the center of the equipment activity area (e.g., construction site).

Variation in power imposes additional complexity in characterizing the noise source level from construction equipment. Power variation is accounted for by describing the noise at a reference distance from the equipment operating at full power and adjusting it based on the duty cycle, or percent of operational time, of the activity to determine the $L_{eq}$ of the operation (FTA 2018).

Each phase of construction has a specific equipment mix, depending on the work to be accomplished during that phase. Each phase also has its own noise characteristics; some will have higher continuous noise levels than others, and some may have high-impact noise levels. The maximum hourly $L_{eq}$ of each phase is determined by combining the $L_{eq}$ contributions from each piece of equipment used in that phase (FTA 2018). In typical construction projects, grading activities generate the highest noise levels because grading involves the largest equipment and covers the greatest area.

Project construction is estimated to occur over approximately 5- to 6-months total for both phases. Construction phases would include site preparation and grading, trenching and utilities, building construction, architectural coating, and paving. Construction would not require any blasting or pile driving. It is assumed that diesel engines would power all construction equipment. For assessment purposes, and to be conservative, the loudest hour has been used for assessment. Noise levels are based on a potential construction scenario of one backhoe, one excavator, and one bulldozer operating simultaneously during the fuel facility grading phase. At a distance of 580 feet (distance from the center of the fuel facility site construction area to the nearest residential receiver) one backhoe, one generator, and one crane would generate a noise level of approximately 60 dBA $L_{max}$ (RCNM Calculations are included in Appendix NOI). At a distance of 160 feet (distance from the center of the construction area to the nearest commercial receiver) one backhoe, one excavator, and one bulldozer would generate a noise level of approximately 72 dBA $L_{max}$ (RCNM Calculations are included in Appendix NOI).

### *Analysis*

Construction activity would result in temporary increases in ambient noise levels in the project area on an intermittent basis and, as such, would expose surrounding sensitive receivers to increased noise levels. Increases in noise levels at off-site receivers during construction of the proposed project would be temporary in nature and would not generate continuously high noise levels, although occasional single-event disturbances from construction would be possible. Noise levels would fluctuate depending on the construction phase, equipment type and duration of use, distance between the noise source and receptor, and presence or absence of noise attenuation barriers.

As described above, at a distance of 580 feet, one backhoe, one generator, and one crane would generate a noise level of approximately 60 dBA $L_{max}$ and a noise level of approximately 72 dBA $L_{max}$ at a distance of 160 feet. Additional factors to consider are that the estimated construction noise level does not take into account that equipment would be dispersed in various areas of the site in both time and space. Therefore, the calculated noise levels represent a conservative estimate of construction noise.

The estimated construction noise of approximately 60 dBA $L_{max}$ at the nearest residential receivers would not exceed the daytime exterior noise level thresholds for residential land uses provided in the NMC. The estimated construction noise of approximately 72 dBA $L_{max}$ at the nearest commercial receivers would exceed the daytime exterior noise level thresholds for commercial land uses (refer to Table 12). However, as stated in Section 19.22.070(B) of the NMC, authorized construction activities are exempt when construction occurs between 7:00 a.m. and 6:00 p.m. on weekdays, 10:00 a.m. and 5:00 p.m. on Saturdays. Construction is not permitted anytime on Sundays or federal holidays. As a standard condition of approval, project construction would occur within construction hours specified in the NMC Section 19.22.070. Therefore, construction noise would be compliant with the regulations in the NMC and impacts would be less than significant.

## Operation

The project would generate operational noise that would be typical of fuel facilities, including vehicle and parking lot noise. Noise produced by the project would be similar in character to the existing noise environment associated with surrounding commercial uses.

### *Off-site Traffic Noise*

The proposed project would generate new vehicle trips and increase traffic on area roadways. As noted in Section 17, *Transportation*, the project would add approximately 172 Saturday peak hour trips to nearby roadways (the project would result in 117 new weekday peak hour trips; therefore, the Saturday peak hour trips are considered here to provide a conservative noise analysis). Entrances to the fuel facility is provided along Vintage Way; therefore, all new trips were added to Vintage Way. The Saturday peak hour traffic volume along Vintage Way is estimated at approximately 2,726 trips.

The project’s contribution to roadway noise was evaluated by comparing existing traffic noise levels to traffic noise levels with operation of the project. Generally, a doubling of traffic (i.e., 100 percent traffic increase) would increase noise levels by approximately 3 dBA, which is the human level of perception for an increase in noise (FTA 2018). Therefore, a 10 percent increase in the number of vehicles on a roadway would result in a noise increase of approximately 0.4 dBA. The 172 Saturday peak hour trips added by the project would constitute an approximately 6 percent increase in traffic volume along Vintage Way, resulting in a noise increase of less than 0.4 dBA. Such an increase would be imperceptible and would not result in a substantial permanent increase in ambient noise levels.

The Rowland Boulevard improvements would not generate new traffic, therefore no change in traffic noise would occur as a result.

### *On-site Parking Lot and Conversational Noise*

The fuel facility site would replace existing parking spaces with the fueling facility and associated dispenser queuing area. Parking lot and conversational noise at the fuel facility site is not anticipated to substantially change.

The Rowland Boulevard improvements would construct street parking along the east side of the roadway, comprising 195 new parking spaces. Noise associated with parking areas would include vehicle circulation, engines, car alarms, door slams, and human voices. The maximum sound of a passing car at 15 miles per hour (mph) typically ranges from 52 to 62 dBA $L_{max}$ at 50 feet (City of Novato 2018). The noise generated during an engine start is similar and door slams create lower noise levels.

The nearest property line to the new surface parking area on Rowland Boulevard are commercial uses in the Vintage Oaks Shopping Center approximately 15 feet to the southwest of Rowland Boulevard. Maximum instantaneous noise levels from parking area noise would be approximately 62 dBA $L_{max}$ at 50 feet and 73 dBA $L_{max}$ at 15 feet, which would be below the City's 75 dBA $L_{max}$ threshold for instantaneous noise. Parking area noise at Rowland Boulevard would be less than significant.

**LESS THAN SIGNIFICANT IMPACT**

b. *Would the project result in generation of excessive groundborne vibration or groundborne noise levels?*

The project does not include substantial vibration sources associated with its operation, including continued vehicle use of Rowland Boulevard as improved and vehicle and fueling truck movements at the fuel facility. Thus, construction activities have the greatest potential to generate groundborne vibration affecting nearby sensitive receivers, especially during grading of the project sites.

Certain types of construction equipment can generate high levels of groundborne vibration. The City of Novato uses a vibration impact threshold of perceptibility at the receiving parcel's property line. As shown in Table 11, the threshold for vibration perception is 75 VdB for distinct perception.

Construction of the proposed project would potentially utilize vibratory equipment including loaded trucks, bulldozers, and rollers throughout the duration of project construction. The nearest structures to the Rowland Boulevard improvements site are commercial buildings in the Vintage Oaks Shopping Center located approximately 25 feet to the west from the Rowland Boulevard improvements site and the closest building at the fuel facility site is the existing Costco Warehouse at approximately 37 feet from the facility. Groundborne vibration from construction equipment is shown in Table 13. While the commercial buildings in the Vintage Oaks Shopping Center would not be considered fragile, the threshold for fragile buildings (1 in/sec PPV) was used for structural damage to provide a conservative analysis.

### Table 13 Vibration Levels at Sensitive Receptors

| Equipment | VdB at 25 feet | PPV (in/sec) at 25 feet |
|---|---|---|
| Large bulldozer | 87 | 0.089 |
| Loaded trucks | 86 | 0.076 |
| Jackhammer | 79 | 0.035 |
| Vibratory Roller | 94 | 0.210 |
| Small bulldozer | 58 | 0.003 |

Source: FTA 2018

The NMC Section 19.22.090 states that vibration from temporary construction, demolition, and vehicles that enter and leave the subject parcel for construction are exempt from NMC requirements regarding perceptible groundborne vibration. The nearest sensitive receivers (existing homes west of the fuel facility across US 101) would be approximately 450 feet at the nearest property line to the fuel facility and significantly further from the area of Rowland Boulevard to be improved. At these distances, there would be no perceptible groundborne vibration or noise at the closest sensitive receptors, and no nearby buildings would be damaged from construction equipment vibration. Therefore, vibration impacts would be less than significant.

**LESS THAN SIGNIFICANT IMPACT**

*c. For a project located within the vicinity of a private airstrip or 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 expose people residing or working in the project area to excessive noise levels?*

Gnoss Field, the nearest airport, is located approximately 3.2 miles north of the project sites. The project sites are not within the Gnoss Field area of influence identified in the airport land use plan (County of Marin 1991). Therefore, the project sites are not located within two miles of a public airport, public use airport, or private airstrip. The project would not expose people residing or working in the project area to excessive noise levels generated by aircraft activities. There would be no impact.

**NO IMPACT**

# 14 Population and Housing

| | Potentially Significant Impact | Less than Significant with Mitigation Incorporated | Less than Significant Impact | No Impact |
|---|---|---|---|---|
| Would the project: | | | | |
| a. Induce substantial unplanned population growth in an area, either directly (e.g., by proposing new homes and businesses) or indirectly (e.g., through extension of roads or other infrastructure)? | ☐ | ☐ | ■ | ☐ |
| b. Displace substantial numbers of existing people or housing, necessitating the construction of replacement housing elsewhere? | ☐ | ☐ | ☐ | ■ |

*a. Would the project induce substantial unplanned population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?*

The proposed project would not directly induce population growth in the area as no housing units are proposed. The fuel facility would be typically staffed by at least one Costco employee. This level of employment generation would not lead to substantial population growth. The project would not indirectly induce population growth through the extension of roads or infrastructure, as the Rowland Boulevard improvements would improve an existing roadway, and infrastructure connections are already readily available in the vicinity of the project sites. Therefore, the proposed project would not induce directly nor indirectly substantial, unplanned population growth.

**LESS THAN SIGNIFICANT IMPACT**

*b. Would the project displace substantial numbers of existing people or housing, necessitating the construction of replacement housing elsewhere?*

The project sites do not contain housing or habitable structures, and the project would not result in the removal of housing from the City. Therefore, the project would not displace existing people or housing and there would be no impact.

**NO IMPACT**

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# 15 Public Services

| | Potentially Significant Impact | Less than Significant with Mitigation Incorporated | Less than Significant Impact | No Impact |
|---|---|---|---|---|
| a. Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, or the 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 performance objectives for any of the public services: | | | | |
| 1 Fire protection? | ☐ | ☐ | ■ | ☐ |
| 2 Police protection? | ☐ | ☐ | ■ | ☐ |
| 3 Schools? | ☐ | ☐ | ☐ | ■ |
| 4 Parks? | ☐ | ☐ | ☐ | ■ |
| 5 Other public facilities? | ☐ | ☐ | ☐ | ■ |

*a.1. Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered fire protection facilities, or the need for new or physically altered fire protection facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives?*

The City of Novato is served by the Novato Fire Protection District (NFPD). The NFPD provides fire protection services, emergency medical services, and fire and rescue response for vehicle and hazardous materials incidents. The nearest fire station to the project sites is located approximately 1.8 driving-miles to the northwest, at Station 61 located at 7025 Redwood Boulevard. Based on the 2009/2013 NFPD Strategic Plan, the district provides emergency services to the district from five stations, comprising 88 personnel (66 firefighters, 9 command staff and 13 administrative staff) (NFPD 2009). Station 61 accommodates 6 firefighting personnel, including two paramedics, one captain, one engineer, one firefighter/paramedic from the Paramedic Engine Company, and one battalion chief. Station 61 is the largest station in the district. Per the City of Novato Emergency Operations Plan, the NFPD's goal is to maintain overall total response time of 8 minutes or less 90 percent of the time for all dispatch emergencies and have five fire stations with adequate equipment to meet local needs (City of Novato 2019a). No future plans for expansion or renovation of NFPD facilities exist.

As discussed in Section 14, *Population and Housing*, the proposed project would not directly or indirectly induce population growth. Service demands associated with the project would be within the current service area and would be adequately served by NFPD. It is not anticipated that the project would increase response times for the NFPD and would meet NFPD standards. The project would not require the construction of additional fire protection facilities, and impacts would be less than significant.

**LESS THAN SIGNIFICANT IMPACT**

*a.2. Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered police protection facilities, or the need for new or physically altered police protection facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives?*

The City of Novato is served by the Novato Police Department (NPD), which provides professional and proactive street patrol, investigative services, traffic enforcement, narcotics enforcement, a 911 dispatch center, and emergency and preparedness services. The police department is staffed by approximately 80 staff, including 60 sworn personnel and a volunteer program (City of Novato 2020b). The project sites would be served by the NPD and receive auxiliary services from the Marin County Sheriff's Office and California Highway Patrol (City of Novato 2020c). The nearest police station is located approximately 2.5 driving-miles northwest of the project sites at 909 Machin Avenue.

As discussed in Section 14, *Population and Housing*, the proposed project would not directly or indirectly induce population growth. Service demands associated with the project would be within the current service area and would be adequately served by NPD. It is not anticipated that the project would increase response times for the NPD and would not increase the demand for services from NPD. The project would not require the construction of additional police protection facilities, and impacts would be less than significant.

**LESS THAN SIGNIFICANT IMPACT**

*a.3. Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered schools, or the need for new or physically altered schools, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios or other performance objectives?*

The nearest public school is Lynnwood Elementary School, 2,800 feet west of the fuel facility site and 850 feet south of the Redwood Boulevard and Rowland Boulevard intersection. Private schools near the project sites include Good Shepherd Lutheran School, 2,400 feet southwest of the fuel facility site; and North Bay Christian Academy, 2,400 feet northwest of the Rowland Boulevard site. As discussed in Section 14, *Population and Housing*, the proposed project would not directly or indirectly induce population growth, and thus would not increase the student population in the city. Because the project would not increase the number of students in Novato schools, no alterations or expansions of schools would be required. The project would have no impact.

**NO IMPACT**

*a.4. Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered parks, or the need for new or physically altered parks, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios or other performance objectives?*

Project-related impacts to parks are discussed in Section 16, *Recreation.* As discussed in Section 14, *Population and Housing*, the proposed project would not directly or indirectly induce population growth, and thus would not increase the demand for park facilities in the city. The project would not require the construction of a new park or require the physical alteration of an existing park or public facility. The project would have no impact.

**NO IMPACT**

*a.5. Would the project result in substantial adverse physical impacts associated with the provision of other new or physically altered public facilities, or the need for other new or physically altered public facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives?*

Libraries for the City of Novato are provided by the Marin County Free Library District. The Marin County Free Library (MCFL) District also services unincorporated areas of Marin County as well as the cities of Corte Madera, Ross, and Fairfax. There are a total of 11 facilities and one bookmobile in the District. As discussed in Section 14, *Population and Housing*, the proposed project would not directly or indirectly induce population growth, and thus would not increase the demand for library facilities in the city. The project would not require the construction of a new library or other public facility. The project would have no impact.

**NO IMPACT**

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# 16 Recreation

| | Potentially Significant Impact | Less than Significant with Mitigation Incorporated | Less than Significant Impact | No Impact |
|---|---|---|---|---|
| a. 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? | ☐ | ☐ | ☐ | ■ |
| b. Does the project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment? | ☐ | ☐ | ☐ | ■ |

*a. 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?*

*b. Does the project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?*

The City of Novato manages and operates 28 parks totaling approximately 317 acres, or approximately 5.8 acres per one thousand residents (City of Novato 2020a). Parks in Novato feature hiking trails, playground, playing fields, outdoor courts, an amphitheater, a skate park, a dog park, a community swimming pool, and picnic areas. The City also operates recreational and cultural facilities such as history museums, child and senior centers, and a gymnastic center.

The proposed project would not include any residential or other land uses typically associated with an increased usage of existing park and recreational facilities. As discussed in Section 13, *Population and Housing*, the project would not increase the City's population; therefore, the project would not generate new demand for existing or planned parks. The project would not substantially alter citywide demand for parks nor would it result in a substantial physical deterioration of existing recreational facilities. No impact would occur.

**NO IMPACT**

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# 17 Transportation

| | Potentially Significant Impact | Less than Significant with Mitigation Incorporated | Less than Significant Impact | No Impact |
|---|---|---|---|---|
| Would the project: | | | | |
| a. Conflict with a program, plan, ordinance or policy addressing the circulation system, including transit, roadway, bicycle and pedestrian facilities? | ☐ | ☐ | ■ | ☐ |
| b. Conflict or be inconsistent with CEQA Guidelines section 15064.3, subdivision (b)? | ☐ | ☐ | ■ | ☐ |
| c. Substantially increase hazards due to a geometric design feature (e.g., sharp curves or dangerous intersections) or incompatible use (e.g., farm equipment)? | ☐ | ☐ | ■ | ☐ |
| d. Result in inadequate emergency access? | ☐ | ☐ | ■ | ☐ |

The transportation analysis provided herein is based on the Transportation Impact Study completed by Kittelson and Associates in December 2020, which is included as Appendix TIS, and the Rowland Boulevard Focused Operational Analysis completed by W-Trans in December 2020, which is included as Appendix OPS. The road network surrounding the fuel facility site includes the following intersections:

1. *Rowland Boulevard/Redwood Boulevard*
2. *Rowland Boulevard/US 101 Southbound (SB) Ramps*
3. *Rowland Boulevard/US 101 Northbound (NB) Ramps*
4. *Rowland Boulevard/Rowland Way*
5. *Rowland Boulevard/Vintage Way (north)*
6. *Rowland Boulevard/Vintage Way (south)*

Additionally, the following streets provide alternative modes of transportation in the form of pedestrian and bicycle facilities:

- Pedestrian sidewalks are present on the inside loop around the Vintage Oaks Shopping Center, with crosswalks at the intersections of Rowland Boulevard/Rowland Way and Rowland Boulevard/Vintage Way and at all except one driveway on Rowland Boulevard that provide access to the rear of the Vintage Oaks Shopping Center.
- Class I bicycle path (separated facility) on Novato Boulevard south of Rowland Boulevard and on Rowland Boulevard between US 101 northbound ramps and Vintage Way (north).
- Class II bicycle lanes (on-street right-of-way lane) on Rowland Boulevard from Novato Boulevard to US 101 northbound ramps, on Redwood Boulevard north of Rowland Boulevard, on Novato

Boulevard north of Rowland Boulevard, and on Vintage Way between Rowland Boulevard (south) and Rowland Boulevard (north).
- Class III bicycle route (signage or markings) on Redwood Boulevard south of Rowland Boulevard.

Transit service is provided by Marin County Transit (MCT) and Golden Gate Transit (GGT), including five bus stops surrounding the Vintage Oaks Shopping Center, served by MCT 251. Additionally, the Novato Park & Ride is located between US 101 NB and the Rowland Boulevard offramp, north of the project sites. The Park & Ride lot provides access to the GGT 56X. The US 101 NB onramp also has a bus stop served by GGT 70, MCT 35, and MCT 71X.

*a. Would the project conflict with a program, plan, ordinance or policy addressing the circulation system, including transit, roadway, bicycle and pedestrian facilities?*

## Roadway Facilities

The City of Novato strives to maintain a level of service (LOS) D for signalized and all-way stop intersections (General Plan Policy MO 2), and Marin County has a standard of LOS E for US 101 (Marin Countywide Plan Policy TR-1.e). The project is anticipated to result in an estimated 1,405 daily trips, as shown in Table 14. As discussed in the Transportation Impact Study prepared by Kittelson (Appendix TIS), all study intersections for the project currently operate at LOS C or better under existing and LOS D or better under future conditions. The addition of 1,405 daily trips and up to 172 peak hour trips to study intersections would not cause a conflict with the City's LOS standards under existing conditions (refer to Tables 4, 8, 10, and 11 in Appendix TIS for detailed information). The project's trip generation would not substantially impact or decrease the existing LOS of nearby intersections.

**Table 14 Estimated Project Vehicle Trip Generation**

| Fuel Station | Daily Trips | Weekday PM Peak Hour | Saturday Midday Peak Hour |
|---|---|---|---|
| Total Trips | 6,870 | 576 | 696 |
| *Warehouse + Gas Trips* | *-2,250* | *-189* | *-250* |
| Total Gas-Only Trips | 4,620 | 387 | 446 |
| *Pass-by Trips* | *-1,655* | *-139* | *-133* |
| *Diverted Trips* | *-1,560* | *-131* | *-141* |
| **Net New Gas-Only Trips** | **1,405** | **117** | **172** |

Source: Appendix TIS

## Pedestrian and Bicycle Facilities

In the project area, Class II bike lanes and pedestrian sidewalks exist on Rowland Boulevard and Vintage Way around the Vintage Oaks Shopping Center. The project would not generate pedestrian or bicycle trips, as it involves the installation of a fuel facility, which only results in vehicle trips, but the project would improve the pedestrian and bicycle facilities along Rowland Boulevard between its intersections with Vintage Way (south) and Vintage Way (north). The new facility comprises a multi-use path on the eastern side of Rowland Boulevard, removing the on-street Class II bicycle lanes and providing increased bicycle safety. No modifications from lane restriping would be made to the bicycle facilities located on Rowland Boulevard between Redwood Boulevard and Vintage Way (north). Pedestrian improvements include the addition of a pedestrian sidewalk along the eastern side of Rowland Boulevard between Vintage Way (north) and Vintage Way (south), where no pedestrian sidewalk currently exists; and four pedestrian crosswalks and bulb-outs. These features would provide increased pedestrian access along Rowland Boulevard at the Vintage Oaks Shopping Center as well as provide safety features to ensure safe pedestrian crossings along Rowland Boulevard.

Costco would modify a segment of Vintage Way to provide a left-turn pocket providing access to a relocated driveway. Adding the left-turn pocket would involve modifying lane striping to accommodate two vehicle travel lanes and the left turn-pocket within the existing curb-to-curb width of Vintage Way. This lane reconfiguration would result in the replacement of an approximately 200-foot segment of Class II bike lane with a Class III bicycle route (i.e., bicycles and vehicles share the same lane) and associated pavement markings and signs.

Class III bicycle routes are a recognized form of bicycle facility in the City of Novato Bicycle/Pedestrian Plan (2015) and are subject to engineering standards related to pavement markings and signs to alert drivers to the potential presence of bicyclists. The proposed Class III would comply with all applicable engineering standards, including “sharrow” pavement markings, signs noting the presence of the bicycle route and the end and beginning of the Class II bicycle lanes that will remain along Vintage Way. Accordingly, these modifications would be consistent with General Plan Program MO 8b directing the design of bicycle and pedestrian facilities based on the guidance of the Bicycle/Pedestrian Plan and accepted engineering standards.

The project would have no significant impact on pedestrian or bicycle facilities.

## Transit Facilities

MCT and GGT provide fixed route bus service in the vicinity of the project sites. The project would not generate increased transit demand, as it involves the installation of a fuel facility, which only results in vehicle trips to the fuel facility site. Additionally, the improvements to Rowland Boulevard would provide traffic-calming features and improve traffic flow, which would not impede transit usage of the roadway. Rowland Boulevard improvements would maintain the existing transit stops at the Vintage Oaks entrance between Nordstrom Rack and Marshalls and between the US 101 northbound ramps and Rowland Way. The project would have no significant impact on transit facilities.

Development of the fuel facility and construction of the Rowland Boulevard improvements would not impair roadways or conflict with planned pedestrian, bicycle, and transit facilities in the vicinity. This impact would be less than significant.

**LESS THAN SIGNIFICANT IMPACT**

b. *Would the project conflict or be inconsistent with CEQA Guidelines section 15064.3, subdivision (b)?*

The City of Novato has not yet adopted a standard of significance for evaluating VMT; therefore, the City of San Jose’s standard of significance and the Governor’s Office of Planning and Research’s (OPR) recommended VMT threshold for retail projects is used for the purposes of this analysis. Therefore, a net increase in the existing regional total VMT would be considered a significant impact.

The analysis included in Appendix TIS uses five types of trips associated with the proposed fuel station:

- **Net new gas-only trips**: The destination of these trips is the fuel facility only. Costco members making these trips would be replacing current fuel trips to other gas stations with these trips. VMT associated with these trips is calculated based on the difference between VMT from members' residences to the proposed fuel station less from members' residences to existing fuel stations. These trips would result in a net reduction of 409 daily VMT (please refer to Table 15 in Appendix TIS).
- **Gas-only diverted trips**: These trips are made by Costco members currently travelling on surrounding streets for another primary purpose, and that would stop by the proposed fuel facility during those trips. VMT associated with these trips was based on four typical routes from which members would be diverted (US 101 exiting at De Long, Rowland Boulevard, or Ignacio Boulevard; and Redwood Boulevard). These trips would result in a net increase of 2,633 daily VMT (please refer to Table 16 in Appendix TIS).
- **Gas-only pass-by trips from the shopping center**: These trips are made by Costco members that are currently traveling on the surrounding streets (Vintage Way and Rowland Boulevard) for another primary purpose, and would stop by the proposed fuel facility during those trips. VMT associated with these trips was estimated to add an additional 0.25-mile roundtrip. These trips would result in a net increase of 414 daily VMT (please refer to Table 17 in Appendix TIS).
- **New warehouse and gas (shared) trips**: These trips are made by Costco members that currently shop at the Costco warehouse and purchase gas elsewhere. These members would combine these existing trips into a single shared future trip, which would reduce total VMT by eliminating separate gas station trips. These trips would result in a net reduction of 1,496 daily VMT (please refer to Table 18 in Appendix TIS).
- **Warehouse and gas trips shifting to Novato from existing Costco warehouses with fuel stations**: These trips are made by Costco members that are currently traveling to other Costco gas stations to purchase fuel. These members would replace these existing trips with a trip to the Novato Costco warehouse and proposed fuel station, which would reduce total VMT by reducing the total distance traveled to another Costco fuel facility. These trips would result in a net reduction of 1,600 daily VMT (please refer to Table 19 in Appendix TIS).

Based on the above VMT calculations, the project would result in a total reduction of 458 daily VMT.[8] This net reduction in daily VMT would be considered a less than significant impact, as it would not result in a net increase in VMT.

**LESS THAN SIGNIFICANT IMPACT**

c. *Would the project substantially increase hazards due to a geometric design feature (e.g., sharp curves or dangerous intersections) or incompatible use (e.g., farm equipment)?*

Changes to the geometric design of the fuel facility site would be to ensure efficient, safe, and adequate access to the fueling stations when entering and exiting the facility. The project would be accessed by vehicles via existing driveways from Vintage Way to the parking area, one of which would be relocated approximately 60 feet north of its current location. One row of existing parking spaces would be relocated 2 feet northwest to allow for adequate drive aisle spacing. A southbound left-turn pocket would be added on Vintage Way at the fuel station driveway and would require the replacement of an approximately 200-foot segment of Class II bike lane with a Class III bicycle route

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[8] -409 VMT + 2,633 VMT + 414 - 1,496 - 1,600 = -458 VMT (please refer to Table 20 in Appendix TIS).

(i.e., bicycles and vehicles share the same lane) and associated pavement markings and signs. The proposed Class III would comply with all applicable engineering standards, including “sharrow” pavement markings, signs noting the presence of the bicycle route and the end and beginning of the Class II bicycle lanes that will remain along Vintage Way.

The Rowland Boulevard improvements would not introduce new design features that would be considered hazardous; instead these improvements would implement traffic-calming measures to reduce vehicle speeds along Rowland Boulevard between Vintage Way (north) and Vintage Way (south) and improved traffic flow along Rowland Boulevard between Redwood Boulevard and Vintage Way (north).

Traffic generated by the project would add to queuing lengths at study intersections; however, proposed improvements to Rowland Boulevard between Redwood Boulevard and Vintage Way (north) would reduce vehicle queuing in this location. Intersection queues are expected to fit within the available storage capacity. Excessive queue lengths would not result as a result of the project, and project impacts would be less than significant.

**LESS THAN SIGNIFICANT IMPACT**

*d. Would the project result in inadequate emergency access?*

The fuel facility would be accessed by vehicles via existing driveways from Vintage Way, one of which would be relocated approximately 60 feet north. This modification would not alter the width or accessibility of the driveway to emergency vehicles. In particular, these are commercially-sized driveways that are intended to accommodate passenger vehicles and larger vehicles, such as ambulances, fire engines, and delivery trucks. A southbound left-turn pocket would be added on Vintage Way at the fuel station driveway, which would involve restriping the lanes within a 200-foot segment of the roadway. The resulting lane widths would be 11-feet each, which would conform to applicable engineering standards. Additionally, the improvements to Rowland Boulevard would not impede emergency access in the vicinity as sufficiently sized lanes would be available for emergency vehicles. Impacts would be less than significant.

**LESS THAN SIGNIFICANT IMPACT**

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# 18 Tribal Cultural Resources

| | Potentially Significant Impact | Less than Significant with Mitigation Incorporated | Less than Significant Impact | No Impact |
|---|---|---|---|---|
| Would the project cause a substantial adverse change in the significance of a tribal cultural resource, defined in a Public Resources Code Section 21074 as either a site, feature, place, or 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 Resources Code Section 5024.1, the lead agency shall consider the significance of the resource to a California Native American tribe. | ☐ | ■ | ☐ | ☐ |

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 is:

1. 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
2. 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 these criteria, 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. Under AB 52, lead agencies are required to “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.

a. *Would the project cause a substantial adverse change in the significance of a tribal cultural resource as defined in Public Resources Code Section 21074 that is 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)?*

b. *Would the project cause a substantial adverse change in the significance of a tribal cultural resource as defined in Public Resources Code 21074 that is 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?*

The City of Novato prepared and mailed notification letters to the tribal organizations noted in the NAHC's recommended list of tribes on May 8, 2020, pursuant to AB 52. These tribal organizations are Federated Indians of Graton Rancheria (FIGR) and the Guidiville Indian Rancheria. A response was received from FIGR on July 16, 2020, requesting consultation for the project. Guidiville Indian Rancheria did not request consultation.

The City initiated consultation with FIGR. The City and FIGR met via conference call to discuss the project on July 20, 2020. On August 12, 2020, the City provided FIGR with the results of the NWIC request and cultural resources memorandum prepared by Rincon Consultants, Inc. The FIGR provided comments via email on draft mitigation measures on October 19, 2020. The City agreed to FIGR's requested revisions on November 20, 2020 and concluded consultation. The impact analysis and mitigation measures included in this section incorporate requests from FIGR. As discussed in Section 5, *Cultural Resources*, there are cultural resources recorded on one project site. Additionally, because the project involves ground disturbance, there is the possibility of encountering undisturbed subsurface tribal cultural resources during construction of the project. Therefore, the project could result in potentially significant impacts to tribal cultural resources.

The following mitigation measures were developed in consultation with FIGR to avoid or minimize potentially significant impacts to tribal cultural resources. Accordingly, Mitigation Measures TCR-1 through TCR-3 are required to reduce impacts to a less than significant level.

## Mitigation Measure

### *TCR-1 Avoidance of Tribal Cultural Resources*

When feasible, project construction shall avoid tribal cultural resources.

### *TCR-2 Tribal Cultural Resources Treatment Plan*

Prior to construction of the Rowland Boulevard or Costco fuel facility portions of the project, the City of Novato, Costco, or its consultant(s), shall prepare a tribal cultural resources treatment plan to be implemented in the event an unanticipated archaeological resource that may be considered a tribal cultural resource is identified during construction, subject to review and acceptance by the City of Novato. The plan would include suspension of all earth-disturbing work in the vicinity of the find, avoidance of the resource or, if avoidance of the resource is infeasible, the plan would outline the appropriate treatment of the resource in coordination with the FIGR and, if applicable, a qualified archaeologist. Examples of appropriate treatment for tribal cultural resources include, but are not limited to, protecting the cultural character and integrity of the resource, protecting traditional use of the resource, protecting the confidentiality of the resource, or heritage recovery.

### *TCR-3 Native American Monitoring*

All earth-disturbing work, including archaeological excavation, associated with the Rowland Boulevard or Costco fuel facility portions of the project shall be observed by a local Native American monitor affiliated with the FIGR. In the event of a discovery of tribal cultural resources, the steps identified in the tribal cultural resources plan prepared under measure TCR-2 shall be implemented.

**LESS THAN SIGNIFICANT WITH MITIGATION INCORPORATED**

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# 19 Utilities and Service Systems

| | Potentially Significant Impact | Less than Significant with Mitigation Incorporated | Less than Significant Impact | No Impact |
|---|---|---|---|---|
| Would the project: | | | | |
| a. Require or result in the relocation or construction of new or expanded water, wastewater treatment or storm water drainage, electric power, natural gas, or telecommunications facilities, the construction or relocation of which could cause significant environmental effects? | ☐ | ☐ | ■ | ☐ |
| b. Have sufficient water supplies available to serve the project and reasonably foreseeable future development during normal, dry and multiple dry years? | ☐ | ☐ | ■ | ☐ |
| c. 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? | ☐ | ☐ | ■ | ☐ |
| d. Generate solid waste in excess of State or local standards, or in excess of the capacity of local infrastructure, or otherwise impair the attainment of solid waste reduction goals? | ☐ | ☐ | ■ | ☐ |
| e. Comply with federal, state, and local management and reduction statutes and regulations related to solid waste? | ☐ | ☐ | ■ | ☐ |

*a. Would the project require or result in the relocation or construction of new or expanded water, wastewater treatment or storm water drainage, electric power, natural gas, or telecommunications facilities, the construction or relocation of which could cause significant environmental effects?*

## Water

Water for the project would be provided by the North Marin Water District (NMWD) via existing utilities on and adjacent to the project sites. Approximately 80 percent of the Novato water supply is sourced from the Russian River, and the remaining 20 percent comes from local runoff into

Stafford Lake that is treated at the NMWD Stafford Water Treatment Plant (NMWD 2016). Water supply is discussed further under criterion (b) below.

Novato's water supply system includes roughly 6,034 AF (acre feet) of imported water, a storage capacity of 37 million gallons, and two water rights permits for diversion of surface water from Stafford Lake for the annual diversion of 8,454 AF (acre feet), with a total of 8,461 AF diverted in 2015. Novato's total water supply contracted volume is 14,100 AF per year. NMWD projects that future supplies would be sufficient to meet forecasted demand under normal year and multiple-dry year scenarios.

The proposed project would incrementally increase demand for water above existing conditions on the project sites as a result of new landscaping, including new street trees along Rowland Boulevard. The project's estimated water demand would be approximately 0.23 million gallons per year for fuel facility site use, including landscaping water use (Appendix AQ, outdoor water use), or approximately 630 gallons per day, which is approximately 0.005 percent of Novato's water supply during a normal year and approximately 0.6 percent of Novato's water supply system surplus capacity by 2040. Existing supplies may be insufficient to meet forecasted demand for a single dry year scenario; however, the NMWD contingency plan would allow for the reduction of water supplied by up to 50 percent if needed (NMWD 2016). New development would offset new water demand through NMWD's water connection rate structure, which funds water infrastructure maintenance. In addition, the project would comply with the City's General Plan policy PF-3a and NMWD Regulation No. 15, which require water-saving landscaping and related water conservation measures. Therefore, impacts would be less than significant.

## Wastewater

The Novato Sanitary District (NSD) provides wastewater collection, treatment, and disposal services for the Novato Community. 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. The NTP is designed for an average dry weather flow of 7.0 million gallons per day (MGD) and peak wet weather flow of 30.7 MGD. The NTP has remaining processing capacity of approximately 3.5 MGD for dry weather flow and 17.9 MGD for peak wet weather flow (NSD 2019a).

The project's estimated wastewater generation would be approximately 0.19 million gallons per year (assuming water use is approximately 120 percent of wastewater generation), or approximately 525 gallons per day. This estimate is considered to be conservative because the majority of water used on site would be for landscape irrigation, which would percolate through the site soils or overflow into the bioretention basins or stormwater drainage system. This would represent approximately 0.02 percent of the NTP wastewater treatment plant remaining capacity for average dry weather flow and 0.003 percent remaining capacity for peak wet weather flow. Therefore, the NTP has capacity to meet the wastewater treatment demands that would be generated from the proposed project. Additionally, NSD has indicated that the existing sewer force main in Rowland Boulevard is not anticipated to have capacity deficiency issues and none of the sewer gravity pipelines in the area have a risk priority above "very low" (NSD 2019b). Therefore, impacts associated with project's incremental wastewater generation would be less than significant.

## Stormwater

The project would be designed and engineered with drainage features appropriate to accommodate the needs of the proposed project. On-site stormwater generated by the fuel facility impervious surfaces will drain to two bioretention areas and undergo treatment from an oil/water separator prior to discharge into the existing sanitary sewer. As discussed in Section 10, *Hydrology and Water Quality*, the project would not require an expansion of existing or new stormwater infrastructure aside from those features proposed within the fuel center. The Rowland Boulevard improvements will be served by existing drainage infrastructure. Pursuant to NMC Section 7-5, owners of real property in the City are required to pay an annual parcel tax to the City for clean stormwater activities, which include capital improvements to the City's storm drainage system. The proposed project would not require the construction of new off-site stormwater drainage facilities or expansion of existing facilities. Impacts would be less than significant.

## Electricity, Natural Gas, and Telecommunications

The project would not connect to or utilize natural gas as a source of energy and would use electricity provided by PG&E. A significant impact to electricity and telecommunications facilities may occur if a project's demand for these services exceeds the capacity of local providers. PG&E maintains the electricity distribution lines and substations that serve the project area. Telecommunications are generally available in the project area, and facility upgrades would not likely be necessary.

As described in Section 6, *Energy*, the project would require approximately 43,324 kilowatt-hours of electricity per year. PG&E maintains power lines along eastern Rowland Boulevard, which serve the project sites. The substation that powers lines in the vicinity of the project sites has a capacity of 29.7 megawatts (MW) and a peak load of 20 MW, with a remaining capacity of 22.0 MW (PG&E 2020a, 2020b). The project would require approximately 0.043 MW, less than 0.2 percent of the remaining capacity of the PG&E substation that serves the project sites. Accordingly, the project would be accommodated adequately by existing electricity and telecommunication facilities and would not require improvements to existing facilities, or the provision of new facilities, that would cause significant environmental effects. This impact would be less than significant.

**LESS THAN SIGNIFICANT IMPACT**

*b. Would the project have sufficient water supplies available to serve the project and reasonably foreseeable future development during normal, dry and multiple dry years?*

As described above under criterion (a), the City of Novato is serviced by the NMWD, which provides potable and recycled water service to the City, the surrounding unincorporated areas. Approximately 80 percent of the Novato water supply comes from the Russian River through the NMWD wholesale water supplier, the Sonoma County Water Agency. The remaining 20 percent comes from local runoff into Stafford Lake. The District has no local, developed groundwater sources (NMWD 2016).

The NMWD's 2015 Urban Water Management Plan (UWMP) addresses the District's water system and includes descriptions of water supply sources, water use, comparisons of supply and demand during dry years, etc. Per the UWMP, normal year, single dry year, and multiple dry year supply and demand comparisons are shown below in Table 15.

## Table 15 NMWD Water Supply and Demand in Acre-Feet for Normal, Single Dry, and Multiple Dry Year

| | Year | | | | |
|---|---|---|---|---|---|
| | **2020** | **2025** | **2030** | **2035** | **2040 (Opt)** |
| **Normal Year** | | | | | |
| Supply Totals | 12,067 | 11,828 | 11,531 | 11,271 | 11,046 |
| Demand Totals | 10,662 | 10,708 | 10,713 | 10,805 | 10,930 |
| Difference | 1,405 | 1,120 | 818 | 466 | 116 |
| **Single Dry Year** | | | | | |
| Supply Totals | 12,067 | 10,459 | 10,034 | 9,647 | 9,339 |
| Demand Totals | 10,662 | 10,708 | 10,713 | 10,805 | 10,930 |
| Difference | 1,405 | (249) | (679) | (1,158) | (1,591) |
| | **Year** | | | | |
| **Multiple Dry Years** | **2020** | **2025** | **2030** | **2035** | **2040 (Opt)** |
| **First Year** | | | | | |
| Supply Totals | 12,067 | 11,828 | 11,531 | 11,271 | 11,046 |
| Demand Totals | 10,662 | 10,708 | 10,713 | 10,805 | 10,930 |
| Difference | 1,405 | 1,120 | 818 | 466 | 116 |
| **Second Year** | | | | | |
| Supply Totals | 12,067 | 11,828 | 11,531 | 11,271 | 11,046 |
| Demand Totals | 10,662 | 10,708 | 10,713 | 10,805 | 10,930 |
| Difference | 1,405 | 1,120 | 818 | 466 | 116 |
| **Third Year** | | | | | |
| Supply Totals | 12,067 | 11,828 | 11,531 | 11,271 | 11,046 |
| Demand Totals | 10,662 | 10,708 | 10,713 | 10,805 | 10,930 |
| Difference | 1,405 | 1,120 | 818 | 466 | 116 |

Notes: Parentheses denote a negative number

Source: NMWD 2016

Table 15 shows that the District’s projected water supplies are sufficient to meet projected demands during normal and multiple dry year conditions. During a single dry year scenario, the District would not have adequate supplies and would need to impose mandatory water use restrictions (NMWD 2016).

NMWD currently serves the project sites through existing utilities and services would continue to do so during project operation. The project would include a fuel station and new landscaping on the fuel facility site and new street tree plantings with the Rowland Boulevard improvements. The project’s estimated water demand would be approximately 630 gallons per day, or 0.23 million gallons per year (Appendix AQ).

The project’s water demand would represent less than 0.005 percent of projected available NMWD supply. Based on the project’s incremental contribution to future demand, new sources of water supply would not be required to meet project water needs. This impact would be less than significant.

**LESS THAN SIGNIFICANT IMPACT**

c. *Would the project 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?*

As described in response to criterion (a), above, the project's estimated wastewater generation would be approximately 0.19 million gallons per year (assuming water use is approximately 120 percent of wastewater generation), or approximately 525 gallons per day. This would represent approximately 0.02 percent of the NTP wastewater treatment plant remaining capacity for average dry weather flow and 0.003 percent remaining capacity for peak wet weather flow. Therefore, the NTP has capacity to meet the wastewater treatment demands that would be generated from the proposed project. As discussed under criterion (a), NSD has indicated that the existing sewer force main in Rowland Boulevard is not anticipated to have capacity deficiency issues and none of the sewer gravity pipelines in the area have a risk priority above "very low" (NSD 2019b). Therefore, impacts associated with project's incremental wastewater generation would be less than significant.

**LESS THAN SIGNIFICANT IMPACT**

d. *Would the project generate solid waste in excess of State or local standards, or in excess of the capacity of local infrastructure, or otherwise impair the attainment of solid waste reduction goals?*

e. *Would the project comply with federal, state, and local management and reduction statutes and regulations related to solid waste?*

Solid waste from the City of Novato is taken to the Redwood Landfill and Recycling Center located north of the Novato city limit. The landfill is permitted to accept 2,300 tons of material per day and has a design capacity of about 26 million cubic yards (CalRecycle 2020a). The estimated closure date of the landfill is 2036 (City of Novato 2016).

The Novato Sanitary District and its franchise service provider Recology provide solid waste and recycling disposal services in the project vicinity for the provision of trash, recycling and organics services to the proposed project. In 2011, NSD amended its franchise agreement to make major progress toward achieving zero waste goals. The contract requires Recology (the recycling, composting, and garbage collection provider) to achieve an 80 percent diversion of waste to recycling by 2025 (NSD 2011).

The Rowland Boulevard improvements involve lane restriping, removal of a portion of an existing median, new landscape fingers with street trees, wildlife observation areas, and the installation of a new sidewalk and multi-use path for cyclists. These improvements will result in the generation of construction related solid waste; however, this generated waste would result in a one-time waste disposal at the landfill, and no long-term impacts would occur that would substantially reduce the capacity of the landfill. The operation of the Rowland Boulevard improvements will not generate solid waste.

Using an estimated solid waste generation rate provided by CalRecycle for general commercial land uses, the fuel facility would result in an increase of approximately 11 pounds of solid waste per day, or 1.9 tons per year (using a rate of 10.53 pounds per employee per day) (CalRecycle 2020b). This represents approximately 0.0002 percent of the permitted daily throughput of the Redwood Landfill and Recycling Center. This does not represent a substantial increase in the waste stream, and the project would be served by a landfill with sufficient capacity. The project would comply with state and local statues and regulations related to solid waste regarding increased recycling efforts per Assembly Bill 341 and the City's General Plan policy ES-27f by providing recycling services. While the proposed fuel facility would not include recycling bins, the associated Costco Wholesale does provide recycling facilities that would be available to customers. Therefore, impacts would be less than significant.

**LESS THAN SIGNIFICANT IMPACT**

# 20 Wildfire

| | Potentially Significant Impact | Less than Significant with Mitigation Incorporated | Less than Significant Impact | No Impact |
|---|---|---|---|---|
| If located in or near state responsibility areas or lands classified as very high fire hazard severity zones, would the project: | | | | |
| a. Substantially impair an adopted emergency response plan or emergency evacuation plan? | ☐ | ☐ | ■ | ☐ |
| b. Due to slope, prevailing winds, and other factors, exacerbate wildfire risks and thereby expose project occupants to pollutant concentrations from a wildfire or the uncontrolled spread of a wildfire? | ☐ | ☐ | ■ | ☐ |
| c. Require the installation or maintenance of associated infrastructure (such as roads, fuel breaks, emergency water sources, power lines or other utilities) that may exacerbate fire risk or that may result in temporary or ongoing impacts to the environment? | ☐ | ☐ | ■ | ☐ |
| d. Expose people or structures to significant risks, including downslopes or downstream flooding or landslides, as a result of runoff, post-fire slope instability, or drainage changes? | ☐ | ☐ | ■ | ☐ |

*a. If located in or near state responsibility areas or lands classified as very high fire hazard severity zones, would the project substantially impair an adopted emergency response plan or emergency evacuation plan?*

*b. If located in or near state responsibility areas or lands classified as very high fire hazard severity zones, would the project, due to slope, prevailing winds, and other factors, exacerbate wildfire risks and thereby expose project occupants to pollutant concentrations from a wildfire or the uncontrolled spread of a wildfire?*

*c. If located in or near state responsibility areas or lands classified as very high fire hazard severity zones, would the project require the installation or maintenance of associated infrastructure (such as roads, fuel breaks, emergency water sources, power lines or other utilities) that may exacerbate fire risk or that may result in temporary or ongoing impacts to the environment?*

*d. If located in or near state responsibility areas or lands classified as very high fire hazard severity zones, would the project expose people or structures to significant risks, including downslopes or downstream flooding or landslides, as a result of runoff, post-fire slope instability, or drainage changes?*

The project sites are adjacent to existing urban development in Novato and are classified as a Local Responsibility Area, where responsibility for fire protection falls on the NFPD, rather than the state or federal government. The project sites do not fall within in a very high fire hazard severity zone (VHFHSZ). The nearest VHFHSZ is located approximately 1.4 miles southwest of the site (CAL FIRE 2008). The project sites are not located in the wildland-urban interface (WUI), an area subject to high fire hazard, as mapped by the NFPD (NFPD 2020). Furthermore, the proposed construction areas are generally flat and this topography would not enhance the spread of wildfire. The project would not involve the construction of new utility infrastructure that could exacerbate fire risk, such as overhead power lines. Emergency vehicle access would remain available to the project area via Rowland Boulevard and Vintage Way, and direct access to the fuel center would be provided through existing driveways and the relocated driveway along Vintage Way. Therefore, the project would not expose people or structures to a significant risk involving wildfire, nor would it exacerbate the risk of wildfire. Impacts would be less than significant.

**LESS THAN SIGNIFICANT IMPACT**

# 21 Mandatory Findings of Significance

| | Potentially Significant Impact | Less than Significant with Mitigation Incorporated | Less than Significant Impact | No Impact |
|---|---|---|---|---|
| Does the project: | | | | |
| a. Have the potential to substantially degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, substantially reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory? | ☐ | ■ | ☐ | ☐ |
| b. Have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)? | ☐ | ■ | ☐ | ☐ |
| c. Have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly? | ☐ | ■ | ☐ | ☐ |

*a. Does the project have the potential to substantially degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, substantially reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?*

The project would be constructed within an existing roadway and existing paved parking lot that do not contain suitable habitat for fish and wildlife species. Therefore, the project would not substantially reduce the habitat of fish and wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, eliminate a plant or animal community, or reduce the number or restrict the range of a rare or endangered plant or animal. In addition, as discussed in Section 4, *Biological Resources*, Mitigation Measure BIO-1 is recommended to address potential direct and indirect impacts to nesting birds that may be present on or near the project sites.

As stated in Section 5, *Cultural Resources*, a previously recorded cultural resource was mapped within one of the project site's; this site has been heavily disturbed by the construction of the existing development thereon. Potential impacts to known and unknown prehistoric archeological sites in the vicinity of the project sites would be reduced to a less than significant level with implementation of Mitigation Measure CUL-1 and CUL-2, which would require archaeological monitoring and appropriate protective and treatment measures in the event of an unanticipated discovery of cultural resources.

The Rowland Boulevard improvements would be constructed within an existing roadway right-of-way that does not contain important examples of the major periods of California history or prehistory. Therefore, the project would not eliminate such resources. In addition, as discussed in Section 5, *Cultural Resources*, Mitigation Measure CUL-1 requires archaeological monitoring during ground disturbing activities and Mitigation Measure CUL-2 requires appropriate protective measures in the event of an unanticipated discovery of cultural resources.

**LESS THAN SIGNIFICANT WITH MITIGATION INCORPORATED**

*b. Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)?*

The proposed project was determined to have no impact in comparison to existing conditions for Agriculture and Forestry Resources, and Mineral Resources. Therefore, as there would be no direct or indirect impacts, the proposed project would not contribute to cumulative impacts to these issue areas.

For all other issue areas, the proposed project would have either direct or indirect impacts that have been determined to be less than significant, or less than significant with mitigation incorporated. The project would involve the construction of a fuel facility on a site that is currently a paved surface parking lot and improvements to Rowland Boulevard, which is currently a fully paved roadway. The project would not adversely affect biological, cultural, or other physical resources outside of the project sites. Other impacts, such as air quality, noise, transportation, GHG emissions, and utilities impacts would be minor and would not be cumulatively considerable. Construction of the project is not anticipated to overlap with nearby proposed projects, including the Hannah Ranch project to the south, for which construction has not begun, as the revised project has not yet been approved. Therefore, construction equipment exhaust emissions, GHG emissions, and noise would not overlap during construction. The effects of the project would not combine with impacts from other projects in the vicinity to result in a significant cumulative impact.

**LESS THAN SIGNIFICANT WITH MITIGATION INCORPORATED**

*c. Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?*

Effects on human beings are generally associated with impacts related to issue areas such as air quality, geology and soils, hazards and hazardous materials, hydrology and water quality, and noise. As discussed in this Initial Study, the project would have a less than significant impact or a less than significant impact with mitigation in each of these resource areas. Therefore, the project would not cause substantial adverse effects on human beings, either directly or indirectly and impacts associated with the project would be less than significant with mitigation incorporated.

**LESS THAN SIGNIFICANT WITH MITIGATION INCORPORATED**

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# References

## Bibliography

Bay Area Air Quality Management District (BAAQMD). 2012. Recommended Methods for Screening and Modeling Local Risks and Hazards. Version 3.0. May 2012. https://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/risk-modeling-approach-may-2012.pdf?la=en (accessed June 2020).

_______. 2017a. Air Quality Standards and Attainment Status. Last updated January 5, 2017. http://www.baaqmd.gov/about-air-quality/research-and-data/air-quality-standards-and-attainment-status (accessed June 2020).

_______. 2017b. Final 2017 Clean Air Plan. Adopted April 18, 2017. http://www.baaqmd.gov/~/media/files/planning-and-research/plans/2017-clean-air-plan/attachment-a_-proposed-final-cap-vol-1-pdf.pdf?la=en (accessed June 2020).

_______. 2017c. CEQA Air Quality Guidelines. May 2017. http://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/ceqa_guidelines_may2017-pdf.pdf?la=en (accessed June 2020).

_______. 2018. Permitted Stationary Source Risks and Hazards Screening Tool. https://baaqmd.maps.arcgis.com/apps/webappviewer/index.html?id=2387ae674013413f987b1071715daa65 (accessed November 2020).

_______. 2019a. Highway Rasters. Provided by Areana Flores, Environmental Planner, BAAQMD via e-mail. August 22, 2019.

_______. 2019b. Major Street Rasters. Provided by Areana Flores, Environmental Planner, BAAQMD via e-mail. August 22, 2019

California Air Resources Board (CARB). 2005a. Air Quality and Land Use Handbook: A Community Health Perspective. April 2005. https://www.arb.ca.gov/ch/handbook.pdf (accessed July 2020).

_______. 2005b. Air Quality and Land Use Handbook: A Community Health Perspective. April 2005.

_______. 2017. California's 2017 Climate Change Scoping Plan. December 14, 2017. https://www.arb.ca.gov/cc/scopingplan/scoping_plan_2017.pdf (accessed June 2020).

_______. 2018a. CA-Greet 3.0. Released August 13, 2018. Effective January 4, 2019. https://www.arb.ca.gov/fuels/lcfs/ca-greet/ca-greet.htm (accessed February 2020).

_______. 2018b. EMFAC2017 Volume III – Technical Documentation v.1.0.2. July 20, 2018. https://ww3.arb.ca.gov/msei/downloads/emfac2017-volume-iii-technical-documentation.pdf (accessed July 2020).

_______. 2019. EMFAC2017 Web Database. https://arb.ca.gov/emfac/2017/ (accessed July 2020).

California Department of Conservation (DOC). 2009. Tsunami Inundation Map for Emergency Planning. Novato Quadrangle, Petaluma Point Quadrangle. July 1, 2009. https://www.conservation.ca.gov/cgs/Documents/Publications/Tsunami-Maps/Tsunami_Inundation_NovatoPetalumaPoint_Quads_Marin.pdf (accessed July 2020).

_______. 2018. Marin County Important Farmland 2016. April 2018. https://www.conservation.ca.gov/dlrp/fmmp/Pages/Marin.aspx (accessed July 2020).

California Department of Forestry and Fire Protection (CAL FIRE). 2008. Novato: Very High Fire Hazard Severity Zones in LRA. Sacramento, CA. October 16, 2008. https://osfm.fire.ca.gov/media/5859/novato.pdf (accessed July 2020).

California Department of Resources Recycling and Recovery (CalRecycle). 2020a. SWIS Facility/Site Activity Details. Redwood Landfill (21-AA-0001). https://www2.calrecycle.ca.gov/SolidWaste/SiteActivity/Details/3054?siteID=1727 (accessed July 2020).

_______. 2020b. Estimated Solid Waste Generation Rates. https://www2.calrecycle.ca.gov/WasteCharacterization/General/Rates (accessed July 2020).

California Department of Toxic Substances Control (DTSC). 2020a. EPA ID Profile: CAR000005512. Last Updated August 6, 2020. https://hwts.dtsc.ca.gov/hwts_Reports/ReportPages/Report03.aspx?epaid=CAR000005512 (accessed January 2021).

_______. 2020b. EnviroStor. Sacramento, CA. https://www.envirostor.dtsc.ca.gov/public/map/?myaddress=300+vintage+way+novato (accessed August 2020).

_______. 2020c. EPA ID Profile: CAC003024914. Last Updated September 18, 2020. https://hwts.dtsc.ca.gov/hwts_Reports/ReportPages/Report03.aspx?epaid=CAC003024914 (accessed January 2021).

California Department of Transportation (Caltrans). 2013. Technical Noise Supplement to the Traffic Noise Analysis Protocol. September 2013. https://dot.ca.gov/-/media/dot-media/programs/environmental-analysis/documents/env/tens-sep2013-a11y.pdf (accessed July 2020).

_______. 2017. Designated and Eligible State Scenic Highways. August 2019. https://dot.ca.gov/programs/design/lap-landscape-architecture-and-community-livability/lap-liv-i-scenic-highways (accessed July 2020).

_______. 2020. Transportation and Construction Vibration Guidance Manual. April 2020. https://dot.ca.gov/-/media/dot-media/programs/environmental-analysis/documents/env/tcvgm-apr2020-a11y.pdf (accessed July 2020).

California Department of Water Resources (DWR). 2020. SGMA Basin Prioritization Dashboard. https://gis.water.ca.gov/app/bp-dashboard/final/ (accessed July 2020).

Crocker, Malcolm J. Crocker (Editor). 2007. Handbook of Noise and Vibration Control Book, ISBN: 978-0-471-39599-7, Wiley-VCH, October.

Energy Star. 2020. Buildings & Plants: Median EUIs in the United States. https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/use-portfolio-manager/understand-metrics/what-energy (accessed July 2020).

Federal Emergency Management Agency (FEMA). 2016. Flood Insurance Rate Map 06041C0283E. March 16, 2016.

Federal Transit Administration (FTA). 2018. Transit Noise and Vibration Impact Assessment Manual. September 2018. https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/research-innovation/118131/transit-noise-and-vibration-impact-assessment-manual-fta-report-no-0123_0.pdf (accessed July 2020).

Graymer, R.W., B.C. Moring, G.J. Saucedo, C.M. Wentworth, E.E. Brabb, and K.L. Knudsen. 2006. Geologic map of the San Francisco Bay Region. U.S. Geological Survey, Scientific Investigations Map 2918. Map scale 1:275,000.

Iowa Environmental Mesonet. 2020. Custom Wind Rose Plots – Novato [DVO] Station. December 1, 2007 – December 1, 2020. Iowa State University. Available online at: https://mesonet.agron.iastate.edu/sites/dyn_windrose.phtml?station=DVO&network=CA_ASOS&bin0=2&bin1=5&bin2=7&bin3=10&bin4=15&bin5=20&units=mph&nsector=36&fmt=png&dpi=100&year1=2007&month1=12&day1=1&hour1=12&minute1=0&year2=2020&month2=12&day2=1&hour2=12&minute2=0 (accessed December 2020).

Marin, County of. 1991. Airport Land Use Plan: Marin County Airport Gnoss Field. June 10, 1991. https://www.marincounty.org/~/media/files/departments/cd/planning/currentplanning/publications/landuseplan/airport-land-use-plan--marin-county-airport-gnoss-field.pdf (accessed July 2020).

_______. 2019. Marin GeoHub: Williamson Act Parcel. August 27, 2019. https://gisopendata.marincounty.org/datasets/1adc88017cd84b4a9a70f360d872eb9f_36/data?geometry=-123.609%2C37.908%2C-121.540%2C38.286&where=Jurisdiction%20%3D%20%27Novato%27 (accessed July 2020).

North Marin Water District (NMWD). 2016. 2015 Urban Water Management Plan. June 2016. https://nmwd.com/wp-content/uploads/2020/05/FINAL-North-Marin-UWMP-Master-2015.pdf (accessed July 2020).

Novato, City of. 2009. Climate Change Action Plan. December 2009. https://www.novato.org/home/showdocument?id=29116 (accessed July 2020).

_______. 2014. Existing Conditions Report. April 1, 2014. https://www.novato.org/government/community-development/general-plan-update/existing-conditions-report (accessed July 2020).

_______. 2018. Hill Recreation Area Master Plan Project Initial Study/Proposed Mitigated Negative Declaration. December 13, 2018.

_______. 2020a. General Plan 2035, February 2020. https://www.novato.org/government/community-development/general-plan-update (accessed November 2020).

_______. 2020b. Police Department: About Us. https://www.novato.org/government/police-department/about-us (accessed July 2020).

_______. 2020c. Novato Police Department Policy Manual. July 14, 2020. https://www.novato.org/home/showdocument?id=31200 (accessed July 2020).

Novato Fire Protection District (NFPD). 2019. Novato Fire Protection District: Comprehensive Annual Financial Report for the Year Ended June 30, 2019. https://www.novatofire.org/home/showdocument?id=9160 (accessed July 2020).

_______. 2020. WUI Map. https://www.novatofire.org/prevention/wildland-urban-interface-wui/wui-map (accessed July 2020).

Novato Sanitary District (NSD). 2011. Current Franchise Agreement for Solid Waste. March 2011. https://www.novatosan.com/newsletters-press-documents/documents/#solid-waste (accessed July 2020).

_______. 2019a. Annual Operations and Maintenance Report 2019. https://www.novatosan.com/newsletters-press-documents/documents/#treatment-plant (accessed July 2020).

_______. 2019b. Draft Report Collection System Master Plan. August 2019. https://www.novatosan.com/newsletters-press-documents/documents/#treatment-plant (accessed July 2020).

Pacific Gas & Electric Company (PG&E). 2020a. Solar Photovoltaic (PV) and Renewalbe Auction Mechanism (RAM) Program Map. https://www.pge.com/b2b/energysupply/wholesaleelectricsuppliersolicitation/PVRFO/PVRAMMap/index.shtml (accessed July 2020).

_______. 2020b. Distribution Investment Deferral Framework (DIDF) Map. https://www.pge.com/b2b/distribution-resource-planning/grid-needs-assessment-map.html (accessed July 2020).

State Water Resources Control Board (SWRCB). 2018. San Francisco Bay Basin Water Quality Control Plan (Basin Plan). https://www.waterboards.ca.gov/sanfranciscobay/basin_planning.html (accessed December 2020).

_______. 2019. Geotracker. Sacramento, CA. https://geotracker.waterboards.ca.gov/map/?CMD=runreport&myaddress=300+vintage+way+novato (accessed August 2020).

Stinson, Melvin C., Manson Michael, W. and Plappert John, J. 1982. Mineral land classification map, special report 146, plate 3.8. California department of conservation. Sacramento, CA. https://maps.conservation.ca.gov/cgs/informationwarehouse/index.html?map=regulatorymaps (accessed July 2020).

United States Department of Transportation, Bureau of Transportation Statistics. 2020. National Transportation Statistics. Available at: https://www.bts.gov/topics/national-transportation-statistics (accessed July 2020).

United States Energy Information Administration. 2016. Table C3. Sum of major fuel consumption and expenditures, 2012. Released May 2016. https://www.eia.gov/consumption/commercial/data/2012/c&e/cfm/c3.php (accessed July 2020).

United States Fish and Wildlife Service (USFWS). 2020. National Wetlands Inventory: Wetlands Mapper. https://www.fws.gov/wetlands/data/Mapper.html (accessed July 2020).

United States Geological Survey. 2019. Quaternary Faults Web Application. Geologic Hazards Science Center – Earthquake Hazards. Available online at: https://usgs.maps.arcgis.com/apps/webappviewer/index.html?id=5a6038b3a1684561a9b0aadf88412fcf (accessed August 2020).

## List of Preparers

Rincon Consultants, Inc. prepared this IS-MND under contract to the City of Novato. Persons involved in data gathering analysis, project management, and quality control are listed below.

### RINCON CONSULTANTS, INC.

Matthew Maddox, AICP, MESM, Principal and Project Manager
Aileen Mahoney, Associate Planner
Katherine Green, AICP, Associate Planner
Kari Zajac, MESM, Associate Planner
John Sisser, MESM, Associate Planner

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# Appendix AQ

CalEEMod Output Files

# Novato Costco Fuel Project

## Bay Area AQMD Air District, Annual

## 1.0 Project Characteristics

### 1.1 Land Usage

| Land Uses | Size | Metric | Lot Acreage | Floor Surface Area | Population |
|---|---|---|---|---|---|
| Other Asphalt Surfaces | 287.60 | 1000sqft | 6.60 | 287,600.00 | 0 |
| Parking Lot | 96.00 | Space | 0.86 | 38,400.00 | 0 |
| Gasoline/Service Station | 28.00 | Pump | 0.29 | 3,952.90 | 0 |

### 1.2 Other Project Characteristics

| | | | | | |
|---|---|---|---|---|---|
| **Urbanization** | Urban | **Wind Speed (m/s)** | 2.2 | **Precipitation Freq (Days)** | 64 |
| **Climate Zone** | 5 | | | **Operational Year** | 2030 |
| **Utility Company** | Pacific Gas & Electric Company | | | | |
| **CO2 Intensity (lb/MWhr)** | 417.62 | **CH4 Intensity (lb/MWhr)** | 0.019 | **N2O Intensity (lb/MWhr)** | 0.004 |

### 1.3 User Entered Comments & Non-Default Data

Project Characteristics - Updated per PGE energy intensity factors

Land Use - Service station and parking = 1.15 acres per Costco

Construction Phase - Per applicant supplied info.

Grading - 310 CY exported during grading and 2004 during site prep per applicant info

Architectural Coating - 100 per BAAQMD rules and regs.

Vehicle Trips - Per Kittelson traffic study. 1,405 daily trips and 28 positions

Energy Use -

Construction Off-road Equipment Mitigation - Water as needed per applicant supplied information

| Table Name | Column Name | Default Value | New Value |
|---|---|---|---|
| tblArchitecturalCoating | EF_Nonresidential_Exterior | 150.00 | 100.00 |
| tblArchitecturalCoating | EF_Parking | 150.00 | 100.00 |
| tblArchitecturalCoating | EF_Residential_Exterior | 150.00 | 100.00 |
| tblConstructionPhase | NumDays | 20.00 | 63.00 |
| tblConstructionPhase | NumDays | 230.00 | 78.00 |
| tblConstructionPhase | NumDays | 20.00 | 7.00 |
| tblConstructionPhase | NumDays | 20.00 | 21.00 |
| tblGrading | AcresOfGrading | 10.00 | 0.00 |
| tblGrading | MaterialExported | 0.00 | 310.00 |
| tblGrading | MaterialExported | 0.00 | 2,004.00 |
| tblLandUse | LotAcreage | 0.09 | 0.29 |
| tblOffRoadEquipment | OffRoadEquipmentUnitAmount | 1.00 | 3.00 |
| tblOffRoadEquipment | OffRoadEquipmentUnitAmount | 3.00 | 2.00 |
| tblOffRoadEquipment | OffRoadEquipmentUnitAmount | 3.00 | 4.00 |
| tblProjectCharacteristics | CH4IntensityFactor | 0.029 | 0.019 |
| tblProjectCharacteristics | CO2IntensityFactor | 641.35 | 417.62 |
| tblProjectCharacteristics | N2OIntensityFactor | 0.006 | 0.004 |
| tblTripsAndVMT | HaulingTripNumber | 251.00 | 0.00 |
| tblTripsAndVMT | HaulingTripNumber | 39.00 | 0.00 |
| tblTripsAndVMT | WorkerTripNumber | 25.00 | 15.00 |
| tblTripsAndVMT | WorkerTripNumber | 23.00 | 18.00 |
| tblTripsAndVMT | WorkerTripNumber | 30.00 | 15.00 |
| tblVehicleTrips | ST_TR | 168.56 | 50.17 |
| tblVehicleTrips | SU_TR | 168.56 | 50.17 |
| tblVehicleTrips | WD_TR | 168.56 | 50.17 |

## 2.0 Emissions Summary

### 2.1 Overall Construction

**Unmitigated Construction**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | tons/yr | | | | | | | | | | MT/yr | | | | | |
| 2020 | 0.0696 | 0.7203 | 0.4266 | 7.7000e-004 | 0.2430 | 0.0361 | 0.2792 | 0.1330 | 0.0333 | 0.1663 | 0.0000 | 68.0200 | 68.0200 | 0.0208 | 0.0000 | 68.5393 |
| 2021 | 0.3065 | 2.0821 | 1.9219 | 3.8700e-003 | 0.0650 | 0.1002 | 0.1652 | 0.0176 | 0.0940 | 0.1116 | 0.0000 | 341.9726 | 341.9726 | 0.0657 | 0.0000 | 343.6153 |
| **Maximum** | **0.3065** | **2.0821** | **1.9219** | **3.8700e-003** | **0.2430** | **0.1002** | **0.2792** | **0.1330** | **0.0940** | **0.1663** | **0.0000** | **341.9726** | **341.9726** | **0.0657** | **0.0000** | **343.6153** |

**Mitigated Construction**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | tons/yr | | | | | | | | | | MT/yr | | | | | |
| 2020 | 0.0696 | 0.7203 | 0.4266 | 7.7000e-004 | 0.1105 | 0.0361 | 0.1466 | 0.0601 | 0.0333 | 0.0935 | 0.0000 | 68.0199 | 68.0199 | 0.0208 | 0.0000 | 68.5392 |
| 2021 | 0.3065 | 2.0821 | 1.9219 | 3.8700e-003 | 0.0650 | 0.1002 | 0.1652 | 0.0176 | 0.0940 | 0.1116 | 0.0000 | 341.9723 | 341.9723 | 0.0657 | 0.0000 | 343.6151 |
| **Maximum** | **0.3065** | **2.0821** | **1.9219** | **3.8700e-003** | **0.1105** | **0.1002** | **0.1652** | **0.0601** | **0.0940** | **0.1116** | **0.0000** | **341.9723** | **341.9723** | **0.0657** | **0.0000** | **343.6151** |

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio-CO2 | Total CO2 | CH4 | N20 | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Percent Reduction** | **0.00** | **0.00** | **0.00** | **0.00** | **43.04** | **0.00** | **29.83** | **48.37** | **0.00** | **26.21** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** |

| Quarter | Start Date | End Date | Maximum Unmitigated ROG + NOX (tons/quarter) | Maximum Mitigated ROG + NOX (tons/quarter) |
|---|---|---|---|---|
| **1** | **11-16-2020** | **2-15-2021** | 1.4608 | 1.4608 |
| **2** | **2-16-2021** | **5-15-2021** | 1.3415 | 1.3415 |
| **3** | **5-16-2021** | **8-15-2021** | 0.3054 | 0.3054 |
| | | **Highest** | 1.4608 | 1.4608 |

## 2.2 Overall Operational

### Unmitigated Operational

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Area | 0.0457 | 3.0000e-005 | 3.7600e-003 | 0.0000 | | 1.0000e-005 | 1.0000e-005 | | 1.0000e-005 | 1.0000e-005 | 0.0000 | 7.3500e-003 | 7.3500e-003 | 2.0000e-005 | 0.0000 | 7.8300e-003 |
| Energy | 5.3000e-004 | 4.8000e-003 | 4.0300e-003 | 3.0000e-005 | | 3.6000e-004 | 3.6000e-004 | | 3.6000e-004 | 3.6000e-004 | 0.0000 | 13.4276 | 13.4276 | 4.7000e-004 | 1.7000e-004 | 13.4914 |
| Mobile | 0.1602 | 0.8169 | 1.0881 | 3.5000e-003 | 0.3010 | 2.7000e-003 | 0.3037 | 0.0807 | 2.5000e-003 | 0.0833 | 0.0000 | 324.5417 | 324.5417 | 0.0148 | 0.0000 | 324.9123 |
| Waste | | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 3.0631 | 0.0000 | 3.0631 | 0.1810 | 0.0000 | 7.5888 |
| Water | | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.1180 | 0.5323 | 0.6503 | 0.0121 | 2.9000e-004 | 1.0406 |
| **Total** | **0.2064** | **0.8217** | **1.0959** | **3.5300e-003** | **0.3010** | **3.0700e-003** | **0.3041** | **0.0807** | **2.8700e-003** | **0.0836** | **3.1811** | **338.5090** | **341.6901** | **0.2085** | **4.6000e-004** | **347.0410** |

## 2.2 Overall Operational

**Mitigated Operational**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Area | 0.0457 | 3.0000e-005 | 3.7600e-003 | 0.0000 | | 1.0000e-005 | 1.0000e-005 | | 1.0000e-005 | 1.0000e-005 | 0.0000 | 7.3500e-003 | 7.3500e-003 | 2.0000e-005 | 0.0000 | 7.8300e-003 |
| Energy | 5.3000e-004 | 4.8000e-003 | 4.0300e-003 | 3.0000e-005 | | 3.6000e-004 | 3.6000e-004 | | 3.6000e-004 | 3.6000e-004 | 0.0000 | 13.4276 | 13.4276 | 4.7000e-004 | 1.7000e-004 | 13.4914 |
| Mobile | 0.1602 | 0.8169 | 1.0881 | 3.5000e-003 | 0.3010 | 2.7000e-003 | 0.3037 | 0.0807 | 2.5000e-003 | 0.0833 | 0.0000 | 324.5417 | 324.5417 | 0.0148 | 0.0000 | 324.9123 |
| Waste | | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 3.0631 | 0.0000 | 3.0631 | 0.1810 | 0.0000 | 7.5888 |
| Water | | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.1180 | 0.5323 | 0.6503 | 0.0121 | 2.9000e-004 | 1.0406 |
| **Total** | **0.2064** | **0.8217** | **1.0959** | **3.5300e-003** | **0.3010** | **3.0700e-003** | **0.3041** | **0.0807** | **2.8700e-003** | **0.0836** | **3.1811** | **338.5090** | **341.6901** | **0.2085** | **4.6000e-004** | **347.0410** |

| | **ROG** | **NOx** | **CO** | **SO2** | **Fugitive PM10** | **Exhaust PM10** | **PM10 Total** | **Fugitive PM2.5** | **Exhaust PM2.5** | **PM2.5 Total** | **Bio- CO2** | **NBio-CO2** | **Total CO2** | **CH4** | **N20** | **CO2e** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Percent Reduction** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** |

## 3.0 Construction Detail

**Construction Phase**

| Phase Number | Phase Name | Phase Type | Start Date | End Date | Num Days Week | Num Days | Phase Description |
|---|---|---|---|---|---|---|---|
| 1 | Site Prep - Rowland Blvd | Site Preparation | 11/16/2020 | 11/27/2020 | 5 | 10 | |
| 2 | Grading - Rowland Blvd | Grading | 11/30/2020 | 12/25/2020 | 5 | 20 | |
| 3 | Building Construction - Fuel Station | Building Construction | 1/1/2021 | 4/20/2021 | 5 | 78 | |
| 4 | Architectural Coating | Architectural Coating | 4/5/2021 | 6/30/2021 | 5 | 63 | |
| 5 | Paving - Fuel Station | Paving | 4/21/2021 | 4/29/2021 | 5 | 7 | |
| 6 | Paving - Rowland Blvd | Paving | 5/3/2021 | 5/31/2021 | 5 | 21 | |

**Acres of Grading (Site Preparation Phase): 0**

**Acres of Grading (Grading Phase): 0**

**Acres of Paving: 7.46**

**Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 5,929; Non-Residential Outdoor: 1,976; Striped Parking Area: 19,560 (Architectural Coating – sqft)**

## OffRoad Equipment

| Phase Name | Offroad Equipment Type | Amount | Usage Hours | Horse Power | Load Factor |
|---|---|---|---|---|---|
| Site Prep - Rowland Blvd | Concrete/Industrial Saws | 1 | 8.00 | 81 | 0.73 |
| Site Prep - Rowland Blvd | Excavators | 3 | 8.00 | 158 | 0.38 |
| Site Prep - Rowland Blvd | Rubber Tired Dozers | 2 | 8.00 | 247 | 0.40 |
| Site Prep - Rowland Blvd | Tractors/Loaders/Backhoes | 4 | 8.00 | 97 | 0.37 |
| Grading - Rowland Blvd | Excavators | 1 | 8.00 | 158 | 0.38 |
| Grading - Rowland Blvd | Graders | 1 | 8.00 | 187 | 0.41 |
| Grading - Rowland Blvd | Rubber Tired Dozers | 3 | 8.00 | 247 | 0.40 |
| Grading - Rowland Blvd | Tractors/Loaders/Backhoes | 4 | 8.00 | 97 | 0.37 |
| Building Construction - Fuel Station | Cranes | 1 | 7.00 | 231 | 0.29 |
| Building Construction - Fuel Station | Cranes | 1 | 7.00 | 231 | 0.29 |

| | | | | | |
|---|---|---|---|---|---|
| Building Construction - Fuel Station | Forklifts | 3 | 8.00 | 89 | 0.20 |
| Building Construction - Fuel Station | Forklifts | 3 | 8.00 | 89 | 0.20 |
| Building Construction - Fuel Station | Generator Sets | 1 | 8.00 | 84 | 0.74 |
| Building Construction - Fuel Station | Generator Sets | 1 | 8.00 | 84 | 0.74 |
| Building Construction - Fuel Station | Tractors/Loaders/Backhoes | 3 | 7.00 | 97 | 0.37 |
| Building Construction - Fuel Station | Tractors/Loaders/Backhoes | 3 | 7.00 | 97 | 0.37 |
| Building Construction - Fuel Station | Welders | 1 | 8.00 | 46 | 0.45 |
| Building Construction - Fuel Station | Welders | 1 | 8.00 | 46 | 0.45 |
| Architectural Coating | Air Compressors | 1 | 6.00 | 78 | 0.48 |
| Paving - Fuel Station | Pavers | 2 | 8.00 | 130 | 0.42 |
| Paving - Fuel Station | Paving Equipment | 2 | 8.00 | 132 | 0.36 |
| Paving - Fuel Station | Rollers | 2 | 8.00 | 80 | 0.38 |
| Paving - Rowland Blvd | Excavators | 1 | 8.00 | 158 | 0.38 |
| Paving - Rowland Blvd | Graders | 1 | 8.00 | 187 | 0.41 |
| Paving - Rowland Blvd | Pavers | 2 | 8.00 | 130 | 0.42 |
| Paving - Rowland Blvd | Paving Equipment | 2 | 8.00 | 132 | 0.36 |
| Paving - Rowland Blvd | Rollers | 2 | 8.00 | 80 | 0.38 |
| Paving - Rowland Blvd | Rubber Tired Dozers | 1 | 8.00 | 247 | 0.40 |
| Paving - Rowland Blvd | Tractors/Loaders/Backhoes | 3 | 8.00 | 97 | 0.37 |

## Trips and VMT

| Phase Name | Offroad Equipment Count | Worker Trip Number | Vendor Trip Number | Hauling Trip Number | Worker Trip Length | Vendor Trip Length | Hauling Trip Length | Worker Vehicle Class | Vendor Vehicle Class | Hauling Vehicle Class |
|---|---|---|---|---|---|---|---|---|---|---|
| Site Prep - Rowland Blvd | 10 | 15.00 | 0.00 | 0.00 | 10.80 | 7.30 | 20.00 | LD_Mix | HDT_Mix | HHDT |
| Grading - Rowland Blvd | 9 | 18.00 | 0.00 | 0.00 | 10.80 | 7.30 | 20.00 | LD_Mix | HDT_Mix | HHDT |
| Building Construction - Fuel Station | 18 | 138.00 | 54.00 | 0.00 | 10.80 | 7.30 | 20.00 | LD_Mix | HDT_Mix | HHDT |
| Architectural Coating | 1 | 28.00 | 0.00 | 0.00 | 10.80 | 7.30 | 20.00 | LD_Mix | HDT_Mix | HHDT |
| Paving - Fuel Station | 6 | 15.00 | 0.00 | 0.00 | 10.80 | 7.30 | 20.00 | LD_Mix | HDT_Mix | HHDT |
| Paving - Rowland Blvd | 12 | 15.00 | 0.00 | 0.00 | 10.80 | 7.30 | 20.00 | LD_Mix | HDT_Mix | HHDT |

## 3.1 Mitigation Measures Construction

Water Exposed Area

## 3.2 Site Prep - Rowland Blvd - 2020

**Unmitigated Construction On-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Fugitive Dust | | | | | 0.0603 | 0.0000 | 0.0603 | 0.0331 | 0.0000 | 0.0331 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Off-Road | 0.0208 | 0.2081 | 0.1544 | 2.6000e-004 | | 0.0110 | 0.0110 | | 0.0102 | 0.0102 | 0.0000 | 22.4564 | 22.4564 | 6.5600e-003 | 0.0000 | 22.6205 |
| **Total** | **0.0208** | **0.2081** | **0.1544** | **2.6000e-004** | **0.0603** | **0.0110** | **0.0713** | **0.0331** | **0.0102** | **0.0433** | **0.0000** | **22.4564** | **22.4564** | **6.5600e-003** | **0.0000** | **22.6205** |

## 3.2 Site Prep - Rowland Blvd - 2020

### Unmitigated Construction Off-Site

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Hauling | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Vendor | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Worker | 2.5000e-004 | 1.8000e-004 | 1.8400e-003 | 1.0000e-005 | 5.9000e-004 | 0.0000 | 6.0000e-004 | 1.6000e-004 | 0.0000 | 1.6000e-004 | 0.0000 | 0.5192 | 0.5192 | 1.0000e-005 | 0.0000 | 0.5195 |
| **Total** | **2.5000e-004** | **1.8000e-004** | **1.8400e-003** | **1.0000e-005** | **5.9000e-004** | **0.0000** | **6.0000e-004** | **1.6000e-004** | **0.0000** | **1.6000e-004** | **0.0000** | **0.5192** | **0.5192** | **1.0000e-005** | **0.0000** | **0.5195** |

### Mitigated Construction On-Site

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Fugitive Dust | | | | | 0.0272 | 0.0000 | 0.0272 | 0.0149 | 0.0000 | 0.0149 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Off-Road | 0.0208 | 0.2081 | 0.1544 | 2.6000e-004 | | 0.0110 | 0.0110 | | 0.0102 | 0.0102 | 0.0000 | 22.4563 | 22.4563 | 6.5600e-003 | 0.0000 | 22.6204 |
| **Total** | **0.0208** | **0.2081** | **0.1544** | **2.6000e-004** | **0.0272** | **0.0110** | **0.0381** | **0.0149** | **0.0102** | **0.0251** | **0.0000** | **22.4563** | **22.4563** | **6.5600e-003** | **0.0000** | **22.6204** |

## 3.2 Site Prep - Rowland Blvd - 2020

**Mitigated Construction Off-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Hauling | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Vendor | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Worker | 2.5000e-004 | 1.8000e-004 | 1.8400e-003 | 1.0000e-005 | 5.9000e-004 | 0.0000 | 6.0000e-004 | 1.6000e-004 | 0.0000 | 1.6000e-004 | 0.0000 | 0.5192 | 0.5192 | 1.0000e-005 | 0.0000 | 0.5195 |
| **Total** | **2.5000e-004** | **1.8000e-004** | **1.8400e-003** | **1.0000e-005** | **5.9000e-004** | **0.0000** | **6.0000e-004** | **1.6000e-004** | **0.0000** | **1.6000e-004** | **0.0000** | **0.5192** | **0.5192** | **1.0000e-005** | **0.0000** | **0.5195** |

## 3.3 Grading - Rowland Blvd - 2020

**Unmitigated Construction On-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Fugitive Dust | | | | | 0.1807 | 0.0000 | 0.1807 | 0.0993 | 0.0000 | 0.0993 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Off-Road | 0.0480 | 0.5116 | 0.2660 | 5.0000e-004 | | 0.0252 | 0.0252 | | 0.0232 | 0.0232 | 0.0000 | 43.7983 | 43.7983 | 0.0142 | 0.0000 | 44.1525 |
| **Total** | **0.0480** | **0.5116** | **0.2660** | **5.0000e-004** | **0.1807** | **0.0252** | **0.2059** | **0.0993** | **0.0232** | **0.1225** | **0.0000** | **43.7983** | **43.7983** | **0.0142** | **0.0000** | **44.1525** |

## 3.3 Grading - Rowland Blvd - 2020

### Unmitigated Construction Off-Site

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Hauling | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Vendor | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Worker | 6.0000e-004 | 4.3000e-004 | 4.4200e-003 | 1.0000e-005 | 1.4200e-003 | 1.0000e-005 | 1.4300e-003 | 3.8000e-004 | 1.0000e-005 | 3.9000e-004 | 0.0000 | 1.2461 | 1.2461 | 3.0000e-005 | 0.0000 | 1.2469 |
| **Total** | **6.0000e-004** | **4.3000e-004** | **4.4200e-003** | **1.0000e-005** | **1.4200e-003** | **1.0000e-005** | **1.4300e-003** | **3.8000e-004** | **1.0000e-005** | **3.9000e-004** | **0.0000** | **1.2461** | **1.2461** | **3.0000e-005** | **0.0000** | **1.2469** |

### Mitigated Construction On-Site

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Fugitive Dust | | | | | 0.0813 | 0.0000 | 0.0813 | 0.0447 | 0.0000 | 0.0447 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Off-Road | 0.0480 | 0.5116 | 0.2660 | 5.0000e-004 | | 0.0252 | 0.0252 | | 0.0232 | 0.0232 | 0.0000 | 43.7983 | 43.7983 | 0.0142 | 0.0000 | 44.1524 |
| **Total** | **0.0480** | **0.5116** | **0.2660** | **5.0000e-004** | **0.0813** | **0.0252** | **0.1065** | **0.0447** | **0.0232** | **0.0678** | **0.0000** | **43.7983** | **43.7983** | **0.0142** | **0.0000** | **44.1524** |

## 3.3 Grading - Rowland Blvd - 2020

### Mitigated Construction Off-Site

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Hauling | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Vendor | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Worker | 6.0000e-004 | 4.3000e-004 | 4.4200e-003 | 1.0000e-005 | 1.4200e-003 | 1.0000e-005 | 1.4300e-003 | 3.8000e-004 | 1.0000e-005 | 3.9000e-004 | 0.0000 | 1.2461 | 1.2461 | 3.0000e-005 | 0.0000 | 1.2469 |
| **Total** | **6.0000e-004** | **4.3000e-004** | **4.4200e-003** | **1.0000e-005** | **1.4200e-003** | **1.0000e-005** | **1.4300e-003** | **3.8000e-004** | **1.0000e-005** | **3.9000e-004** | **0.0000** | **1.2461** | **1.2461** | **3.0000e-005** | **0.0000** | **1.2469** |

## 3.4 Building Construction - Fuel Station - 2021

### Unmitigated Construction On-Site

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Off-Road | 0.1483 | 1.3597 | 1.2929 | 2.1000e-003 | | 0.0748 | 0.0748 | | 0.0703 | 0.0703 | 0.0000 | 180.6771 | 180.6771 | 0.0436 | 0.0000 | 181.7668 |
| **Total** | **0.1483** | **1.3597** | **1.2929** | **2.1000e-003** | | **0.0748** | **0.0748** | | **0.0703** | **0.0703** | **0.0000** | **180.6771** | **180.6771** | **0.0436** | **0.0000** | **181.7668** |

## 3.4 Building Construction - Fuel Station - 2021

### Unmitigated Construction Off-Site

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Hauling | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Vendor | 6.6900e-003 | 0.2200 | 0.0549 | 5.7000e-004 | 0.0138 | 4.8000e-004 | 0.0143 | 3.9900e-003 | 4.6000e-004 | 4.4500e-003 | 0.0000 | 54.6178 | 54.6178 | 2.6900e-003 | 0.0000 | 54.6850 |
| Worker | 0.0165 | 0.0114 | 0.1207 | 4.0000e-004 | 0.0425 | 2.8000e-004 | 0.0428 | 0.0113 | 2.6000e-004 | 0.0116 | 0.0000 | 35.9512 | 35.9512 | 8.1000e-004 | 0.0000 | 35.9714 |
| **Total** | **0.0232** | **0.2314** | **0.1756** | **9.7000e-004** | **0.0563** | **7.6000e-004** | **0.0571** | **0.0153** | **7.2000e-004** | **0.0160** | **0.0000** | **90.5691** | **90.5691** | **3.5000e-003** | **0.0000** | **90.6563** |

### Mitigated Construction On-Site

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Off-Road | 0.1483 | 1.3597 | 1.2929 | 2.1000e-003 | | 0.0748 | 0.0748 | | 0.0703 | 0.0703 | 0.0000 | 180.6769 | 180.6769 | 0.0436 | 0.0000 | 181.7666 |
| **Total** | **0.1483** | **1.3597** | **1.2929** | **2.1000e-003** | | **0.0748** | **0.0748** | | **0.0703** | **0.0703** | **0.0000** | **180.6769** | **180.6769** | **0.0436** | **0.0000** | **181.7666** |

## 3.4 Building Construction - Fuel Station - 2021

**Mitigated Construction Off-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Hauling | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Vendor | 6.6900e-003 | 0.2200 | 0.0549 | 5.7000e-004 | 0.0138 | 4.8000e-004 | 0.0143 | 3.9900e-003 | 4.6000e-004 | 4.4500e-003 | 0.0000 | 54.6178 | 54.6178 | 2.6900e-003 | 0.0000 | 54.6850 |
| Worker | 0.0165 | 0.0114 | 0.1207 | 4.0000e-004 | 0.0425 | 2.8000e-004 | 0.0428 | 0.0113 | 2.6000e-004 | 0.0116 | 0.0000 | 35.9512 | 35.9512 | 8.1000e-004 | 0.0000 | 35.9714 |
| **Total** | **0.0232** | **0.2314** | **0.1756** | **9.7000e-004** | **0.0563** | **7.6000e-004** | **0.0571** | **0.0153** | **7.2000e-004** | **0.0160** | **0.0000** | **90.5691** | **90.5691** | **3.5000e-003** | **0.0000** | **90.6563** |

## 3.5 Architectural Coating - 2021

**Unmitigated Construction On-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Archit. Coating | 0.0637 | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Off-Road | 6.9000e-003 | 0.0481 | 0.0573 | 9.0000e-005 | | 2.9600e-003 | 2.9600e-003 | | 2.9600e-003 | 2.9600e-003 | 0.0000 | 8.0428 | 8.0428 | 5.5000e-004 | 0.0000 | 8.0566 |
| **Total** | **0.0706** | **0.0481** | **0.0573** | **9.0000e-005** | | **2.9600e-003** | **2.9600e-003** | | **2.9600e-003** | **2.9600e-003** | **0.0000** | **8.0428** | **8.0428** | **5.5000e-004** | **0.0000** | **8.0566** |

## 3.5 Architectural Coating - 2021

### Unmitigated Construction Off-Site

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Hauling | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Vendor | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Worker | 2.7100e-003 | 1.8700e-003 | 0.0198 | 7.0000e-005 | 6.9700e-003 | 5.0000e-005 | 7.0100e-003 | 1.8500e-003 | 4.0000e-005 | 1.9000e-003 | 0.0000 | 5.8917 | 5.8917 | 1.3000e-004 | 0.0000 | 5.8950 |
| **Total** | **2.7100e-003** | **1.8700e-003** | **0.0198** | **7.0000e-005** | **6.9700e-003** | **5.0000e-005** | **7.0100e-003** | **1.8500e-003** | **4.0000e-005** | **1.9000e-003** | **0.0000** | **5.8917** | **5.8917** | **1.3000e-004** | **0.0000** | **5.8950** |

### Mitigated Construction On-Site

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Archit. Coating | 0.0637 | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Off-Road | 6.9000e-003 | 0.0481 | 0.0573 | 9.0000e-005 | | 2.9600e-003 | 2.9600e-003 | | 2.9600e-003 | 2.9600e-003 | 0.0000 | 8.0427 | 8.0427 | 5.5000e-004 | 0.0000 | 8.0565 |
| **Total** | **0.0706** | **0.0481** | **0.0573** | **9.0000e-005** | | **2.9600e-003** | **2.9600e-003** | | **2.9600e-003** | **2.9600e-003** | **0.0000** | **8.0427** | **8.0427** | **5.5000e-004** | **0.0000** | **8.0565** |

## 3.5 Architectural Coating - 2021

**Mitigated Construction Off-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Hauling | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Vendor | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Worker | 2.7100e-003 | 1.8700e-003 | 0.0198 | 7.0000e-005 | 6.9700e-003 | 5.0000e-005 | 7.0100e-003 | 1.8500e-003 | 4.0000e-005 | 1.9000e-003 | 0.0000 | 5.8917 | 5.8917 | 1.3000e-004 | 0.0000 | 5.8950 |
| **Total** | **2.7100e-003** | **1.8700e-003** | **0.0198** | **7.0000e-005** | **6.9700e-003** | **5.0000e-005** | **7.0100e-003** | **1.8500e-003** | **4.0000e-005** | **1.9000e-003** | **0.0000** | **5.8917** | **5.8917** | **1.3000e-004** | **0.0000** | **5.8950** |

## 3.6 Paving - Fuel Station - 2021

**Unmitigated Construction On-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Off-Road | 4.3900e-003 | 0.0452 | 0.0513 | 8.0000e-005 | | 2.3700e-003 | 2.3700e-003 | | 2.1800e-003 | 2.1800e-003 | 0.0000 | 7.0082 | 7.0082 | 2.2700e-003 | 0.0000 | 7.0649 |
| Paving | 9.7700e-003 | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| **Total** | **0.0142** | **0.0452** | **0.0513** | **8.0000e-005** | | **2.3700e-003** | **2.3700e-003** | | **2.1800e-003** | **2.1800e-003** | **0.0000** | **7.0082** | **7.0082** | **2.2700e-003** | **0.0000** | **7.0649** |

## 3.6 Paving - Fuel Station - 2021

### Unmitigated Construction Off-Site

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Hauling | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Vendor | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Worker | 1.6000e-004 | 1.1000e-004 | 1.1800e-003 | 0.0000 | 4.1000e-004 | 0.0000 | 4.2000e-004 | 1.1000e-004 | 0.0000 | 1.1000e-004 | 0.0000 | 0.3507 | 0.3507 | 1.0000e-005 | 0.0000 | 0.3509 |
| **Total** | **1.6000e-004** | **1.1000e-004** | **1.1800e-003** | **0.0000** | **4.1000e-004** | **0.0000** | **4.2000e-004** | **1.1000e-004** | **0.0000** | **1.1000e-004** | **0.0000** | **0.3507** | **0.3507** | **1.0000e-005** | **0.0000** | **0.3509** |

### Mitigated Construction On-Site

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Off-Road | 4.3900e-003 | 0.0452 | 0.0513 | 8.0000e-005 | | 2.3700e-003 | 2.3700e-003 | | 2.1800e-003 | 2.1800e-003 | 0.0000 | 7.0082 | 7.0082 | 2.2700e-003 | 0.0000 | 7.0649 |
| Paving | 9.7700e-003 | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| **Total** | **0.0142** | **0.0452** | **0.0513** | **8.0000e-005** | | **2.3700e-003** | **2.3700e-003** | | **2.1800e-003** | **2.1800e-003** | **0.0000** | **7.0082** | **7.0082** | **2.2700e-003** | **0.0000** | **7.0649** |

## 3.6 Paving - Fuel Station - 2021

**Mitigated Construction Off-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Hauling | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Vendor | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Worker | 1.6000e-004 | 1.1000e-004 | 1.1800e-003 | 0.0000 | 4.1000e-004 | 0.0000 | 4.2000e-004 | 1.1000e-004 | 0.0000 | 1.1000e-004 | 0.0000 | 0.3507 | 0.3507 | 1.0000e-005 | 0.0000 | 0.3509 |
| **Total** | **1.6000e-004** | **1.1000e-004** | **1.1800e-003** | **0.0000** | **4.1000e-004** | **0.0000** | **4.2000e-004** | **1.1000e-004** | **0.0000** | **1.1000e-004** | **0.0000** | **0.3507** | **0.3507** | **1.0000e-005** | **0.0000** | **0.3509** |

## 3.7 Paving - Rowland Blvd - 2021

**Unmitigated Construction On-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Off-Road | 0.0372 | 0.3954 | 0.3204 | 5.5000e-004 | | 0.0193 | 0.0193 | | 0.0178 | 0.0178 | 0.0000 | 48.3810 | 48.3810 | 0.0157 | 0.0000 | 48.7722 |
| Paving | 9.7700e-003 | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| **Total** | **0.0470** | **0.3954** | **0.3204** | **5.5000e-004** | | **0.0193** | **0.0193** | | **0.0178** | **0.0178** | **0.0000** | **48.3810** | **48.3810** | **0.0157** | **0.0000** | **48.7722** |

## 3.7 Paving - Rowland Blvd - 2021

### Unmitigated Construction Off-Site

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Hauling | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Vendor | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Worker | 4.8000e-004 | 3.3000e-004 | 3.5300e-003 | 1.0000e-005 | 1.2400e-003 | 1.0000e-005 | 1.2500e-003 | 3.3000e-004 | 1.0000e-005 | 3.4000e-004 | 0.0000 | 1.0521 | 1.0521 | 2.0000e-005 | 0.0000 | 1.0527 |
| **Total** | **4.8000e-004** | **3.3000e-004** | **3.5300e-003** | **1.0000e-005** | **1.2400e-003** | **1.0000e-005** | **1.2500e-003** | **3.3000e-004** | **1.0000e-005** | **3.4000e-004** | **0.0000** | **1.0521** | **1.0521** | **2.0000e-005** | **0.0000** | **1.0527** |

### Mitigated Construction On-Site

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Off-Road | 0.0372 | 0.3954 | 0.3204 | 5.5000e-004 | | 0.0193 | 0.0193 | | 0.0178 | 0.0178 | 0.0000 | 48.3810 | 48.3810 | 0.0157 | 0.0000 | 48.7722 |
| Paving | 9.7700e-003 | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| **Total** | **0.0470** | **0.3954** | **0.3204** | **5.5000e-004** | | **0.0193** | **0.0193** | | **0.0178** | **0.0178** | **0.0000** | **48.3810** | **48.3810** | **0.0157** | **0.0000** | **48.7722** |

## 3.7 Paving - Rowland Blvd - 2021

**Mitigated Construction Off-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Hauling | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Vendor | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Worker | 4.8000e-004 | 3.3000e-004 | 3.5300e-003 | 1.0000e-005 | 1.2400e-003 | 1.0000e-005 | 1.2500e-003 | 3.3000e-004 | 1.0000e-005 | 3.4000e-004 | 0.0000 | 1.0521 | 1.0521 | 2.0000e-005 | 0.0000 | 1.0527 |
| **Total** | **4.8000e-004** | **3.3000e-004** | **3.5300e-003** | **1.0000e-005** | **1.2400e-003** | **1.0000e-005** | **1.2500e-003** | **3.3000e-004** | **1.0000e-005** | **3.4000e-004** | **0.0000** | **1.0521** | **1.0521** | **2.0000e-005** | **0.0000** | **1.0527** |

# 4.0 Operational Detail - Mobile

## 4.1 Mitigation Measures Mobile

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Mitigated | 0.1602 | 0.8169 | 1.0881 | 3.5000e-003 | 0.3010 | 2.7000e-003 | 0.3037 | 0.0807 | 2.5000e-003 | 0.0833 | 0.0000 | 324.5417 | 324.5417 | 0.0148 | 0.0000 | 324.9123 |
| Unmitigated | 0.1602 | 0.8169 | 1.0881 | 3.5000e-003 | 0.3010 | 2.7000e-003 | 0.3037 | 0.0807 | 2.5000e-003 | 0.0833 | 0.0000 | 324.5417 | 324.5417 | 0.0148 | 0.0000 | 324.9123 |

## 4.2 Trip Summary Information

| | Average Daily Trip Rate | | | Unmitigated | Mitigated |
|---|---|---|---|---|---|
| Land Use | Weekday | Saturday | Sunday | Annual VMT | Annual VMT |
| Gasoline/Service Station | 1,404.76 | 1,404.76 | 1404.76 | 809,378 | 809,378 |
| Other Asphalt Surfaces | 0.00 | 0.00 | 0.00 | | |
| Parking Lot | 0.00 | 0.00 | 0.00 | | |
| Total | 1,404.76 | 1,404.76 | 1,404.76 | 809,378 | 809,378 |

## 4.3 Trip Type Information

| | Miles | | | Trip % | | | Trip Purpose % | | |
|---|---|---|---|---|---|---|---|---|---|
| Land Use | H-W or C-W | H-S or C-C | H-O or C-NW | H-W or C-W | H-S or C-C | H-O or C-NW | Primary | Diverted | Pass-by |
| Gasoline/Service Station | 9.50 | 7.30 | 7.30 | 2.00 | 79.00 | 19.00 | 14 | 27 | 59 |
| Other Asphalt Surfaces | 9.50 | 7.30 | 7.30 | 0.00 | 0.00 | 0.00 | 0 | 0 | 0 |
| Parking Lot | 9.50 | 7.30 | 7.30 | 0.00 | 0.00 | 0.00 | 0 | 0 | 0 |

## 4.4 Fleet Mix

| Land Use | LDA | LDT1 | LDT2 | MDV | LHD1 | LHD2 | MHD | HHD | OBUS | UBUS | MCY | SBUS | MH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Gasoline/Service Station | 0.585795 | 0.036515 | 0.193581 | 0.106455 | 0.012789 | 0.005274 | 0.019465 | 0.028415 | 0.002699 | 0.001789 | 0.005626 | 0.000921 | 0.000676 |
| Other Asphalt Surfaces | 0.585795 | 0.036515 | 0.193581 | 0.106455 | 0.012789 | 0.005274 | 0.019465 | 0.028415 | 0.002699 | 0.001789 | 0.005626 | 0.000921 | 0.000676 |
| Parking Lot | 0.585795 | 0.036515 | 0.193581 | 0.106455 | 0.012789 | 0.005274 | 0.019465 | 0.028415 | 0.002699 | 0.001789 | 0.005626 | 0.000921 | 0.000676 |

## 5.0 Energy Detail

Historical Energy Use: N

### 5.1 Mitigation Measures Energy

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Electricity Mitigated | | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 8.2068 | 8.2068 | 3.7000e-004 | 8.0000e-005 | 8.2396 |
| Electricity Unmitigated | | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 8.2068 | 8.2068 | 3.7000e-004 | 8.0000e-005 | 8.2396 |
| NaturalGas Mitigated | 5.3000e-004 | 4.8000e-003 | 4.0300e-003 | 3.0000e-005 | | 3.6000e-004 | 3.6000e-004 | | 3.6000e-004 | 3.6000e-004 | 0.0000 | 5.2208 | 5.2208 | 1.0000e-004 | 1.0000e-004 | 5.2518 |
| NaturalGas Unmitigated | 5.3000e-004 | 4.8000e-003 | 4.0300e-003 | 3.0000e-005 | | 3.6000e-004 | 3.6000e-004 | | 3.6000e-004 | 3.6000e-004 | 0.0000 | 5.2208 | 5.2208 | 1.0000e-004 | 1.0000e-004 | 5.2518 |

## 5.2 Energy by Land Use - NaturalGas

**Unmitigated**

| | NaturalGas Use | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Land Use | kBTU/yr | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Gasoline/Service Station | 97834.3 | 5.3000e-004 | 4.8000e-003 | 4.0300e-003 | 3.0000e-005 | | 3.6000e-004 | 3.6000e-004 | | 3.6000e-004 | 3.6000e-004 | 0.0000 | 5.2208 | 5.2208 | 1.0000e-004 | 1.0000e-004 | 5.2518 |
| Other Asphalt Surfaces | 0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Parking Lot | 0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| **Total** | | **5.3000e-004** | **4.8000e-003** | **4.0300e-003** | **3.0000e-005** | | **3.6000e-004** | **3.6000e-004** | | **3.6000e-004** | **3.6000e-004** | **0.0000** | **5.2208** | **5.2208** | **1.0000e-004** | **1.0000e-004** | **5.2518** |

**Mitigated**

| | NaturalGas Use | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Land Use | kBTU/yr | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Gasoline/Service Station | 97834.3 | 5.3000e-004 | 4.8000e-003 | 4.0300e-003 | 3.0000e-005 | | 3.6000e-004 | 3.6000e-004 | | 3.6000e-004 | 3.6000e-004 | 0.0000 | 5.2208 | 5.2208 | 1.0000e-004 | 1.0000e-004 | 5.2518 |
| Other Asphalt Surfaces | 0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Parking Lot | 0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| **Total** | | **5.3000e-004** | **4.8000e-003** | **4.0300e-003** | **3.0000e-005** | | **3.6000e-004** | **3.6000e-004** | | **3.6000e-004** | **3.6000e-004** | **0.0000** | **5.2208** | **5.2208** | **1.0000e-004** | **1.0000e-004** | **5.2518** |

## 5.3 Energy by Land Use - Electricity

**Unmitigated**

| | Electricity Use | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|
| Land Use | kWh/yr | MT/yr | | | |
| Gasoline/Service Station | 29883.9 | 5.6609 | 2.6000e-004 | 5.0000e-005 | 5.6835 |
| Other Asphalt Surfaces | 0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Parking Lot | 13440 | 2.5459 | 1.2000e-004 | 2.0000e-005 | 2.5561 |
| **Total** | | **8.2068** | **3.8000e-004** | **7.0000e-005** | **8.2396** |

**Mitigated**

| | Electricity Use | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|
| Land Use | kWh/yr | MT/yr | | | |
| Gasoline/Service Station | 29883.9 | 5.6609 | 2.6000e-004 | 5.0000e-005 | 5.6835 |
| Other Asphalt Surfaces | 0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Parking Lot | 13440 | 2.5459 | 1.2000e-004 | 2.0000e-005 | 2.5561 |
| **Total** | | **8.2068** | **3.8000e-004** | **7.0000e-005** | **8.2396** |

# 6.0 Area Detail

---

## 6.1 Mitigation Measures Area

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Mitigated | 0.0457 | 3.0000e-005 | 3.7600e-003 | 0.0000 | | 1.0000e-005 | 1.0000e-005 | | 1.0000e-005 | 1.0000e-005 | 0.0000 | 7.3500e-003 | 7.3500e-003 | 2.0000e-005 | 0.0000 | 7.8300e-003 |
| Unmitigated | 0.0457 | 3.0000e-005 | 3.7600e-003 | 0.0000 | | 1.0000e-005 | 1.0000e-005 | | 1.0000e-005 | 1.0000e-005 | 0.0000 | 7.3500e-003 | 7.3500e-003 | 2.0000e-005 | 0.0000 | 7.8300e-003 |

## 6.2 Area by SubCategory

**Unmitigated**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SubCategory | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Architectural Coating | 8.8600e-003 | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Consumer Products | 0.0365 | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Landscaping | 3.4000e-004 | 3.0000e-005 | 3.7600e-003 | 0.0000 | | 1.0000e-005 | 1.0000e-005 | | 1.0000e-005 | 1.0000e-005 | 0.0000 | 7.3500e-003 | 7.3500e-003 | 2.0000e-005 | 0.0000 | 7.8300e-003 |
| **Total** | **0.0457** | **3.0000e-005** | **3.7600e-003** | **0.0000** | | **1.0000e-005** | **1.0000e-005** | | **1.0000e-005** | **1.0000e-005** | **0.0000** | **7.3500e-003** | **7.3500e-003** | **2.0000e-005** | **0.0000** | **7.8300e-003** |

**Mitigated**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SubCategory | tons/yr | | | | | | | | | | MT/yr | | | | | |
| Architectural Coating | 8.8600e-003 | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Consumer Products | 0.0365 | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Landscaping | 3.4000e-004 | 3.0000e-005 | 3.7600e-003 | 0.0000 | | 1.0000e-005 | 1.0000e-005 | | 1.0000e-005 | 1.0000e-005 | 0.0000 | 7.3500e-003 | 7.3500e-003 | 2.0000e-005 | 0.0000 | 7.8300e-003 |
| **Total** | **0.0457** | **3.0000e-005** | **3.7600e-003** | **0.0000** | | **1.0000e-005** | **1.0000e-005** | | **1.0000e-005** | **1.0000e-005** | **0.0000** | **7.3500e-003** | **7.3500e-003** | **2.0000e-005** | **0.0000** | **7.8300e-003** |

## 7.0 Water Detail

### 7.1 Mitigation Measures Water

| | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|
| Category | MT/yr | | | |
| Mitigated | 0.6503 | 0.0121 | 2.9000e-004 | 1.0406 |
| Unmitigated | 0.6503 | 0.0121 | 2.9000e-004 | 1.0406 |

## 7.2 Water by Land Use

### **Unmitigated**

| | Indoor/Outdoor Use | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|
| Land Use | Mgal | MT/yr | | | |
| Gasoline/Service Station | 0.371893 / 0.227934 | 0.6503 | 0.0121 | 2.9000e-004 | 1.0406 |
| Other Asphalt Surfaces | 0 / 0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Parking Lot | 0 / 0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| **Total** | | **0.6503** | **0.0121** | **2.9000e-004** | **1.0406** |

### **Mitigated**

| | Indoor/Outdoor Use | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|
| Land Use | Mgal | MT/yr | | | |
| Gasoline/Service Station | 0.371893 / 0.227934 | 0.6503 | 0.0121 | 2.9000e-004 | 1.0406 |
| Other Asphalt Surfaces | 0 / 0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Parking Lot | 0 / 0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| **Total** | | **0.6503** | **0.0121** | **2.9000e-004** | **1.0406** |

## 8.0 Waste Detail

### 8.1 Mitigation Measures Waste

**Category/Year**

| | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|
| | MT/yr | | | |
| Mitigated | 3.0631 | 0.1810 | 0.0000 | 7.5888 |
| Unmitigated | 3.0631 | 0.1810 | 0.0000 | 7.5888 |

## 8.2 Waste by Land Use

**Unmitigated**

| | Waste Disposed | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|
| Land Use | tons | MT/yr | | | |
| Gasoline/Service Station | 15.09 | 3.0631 | 0.1810 | 0.0000 | 7.5888 |
| Other Asphalt Surfaces | 0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Parking Lot | 0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| **Total** | | **3.0631** | **0.1810** | **0.0000** | **7.5888** |

**Mitigated**

| | Waste Disposed | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|
| Land Use | tons | MT/yr | | | |
| Gasoline/Service Station | 15.09 | 3.0631 | 0.1810 | 0.0000 | 7.5888 |
| Other Asphalt Surfaces | 0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Parking Lot | 0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| **Total** | | **3.0631** | **0.1810** | **0.0000** | **7.5888** |

## 9.0 Operational Offroad

| Equipment Type | Number | Hours/Day | Days/Year | Horse Power | Load Factor | Fuel Type |
|---|---|---|---|---|---|---|

## 10.0 Stationary Equipment

### Fire Pumps and Emergency Generators

| Equipment Type | Number | Hours/Day | Hours/Year | Horse Power | Load Factor | Fuel Type |
|---|---|---|---|---|---|---|

### Boilers

| Equipment Type | Number | Heat Input/Day | Heat Input/Year | Boiler Rating | Fuel Type |
|---|---|---|---|---|---|

### User Defined Equipment

| Equipment Type | Number |
|---|---|

## 11.0 Vegetation

# Novato Costco Fuel Project

## Bay Area AQMD Air District, Winter

## 1.0 Project Characteristics

### 1.1 Land Usage

| Land Uses | Size | Metric | Lot Acreage | Floor Surface Area | Population |
|---|---|---|---|---|---|
| Other Asphalt Surfaces | 287.60 | 1000sqft | 6.60 | 287,600.00 | 0 |
| Parking Lot | 96.00 | Space | 0.86 | 38,400.00 | 0 |
| Gasoline/Service Station | 28.00 | Pump | 0.29 | 3,952.90 | 0 |

### 1.2 Other Project Characteristics

| | | | | | |
|---|---|---|---|---|---|
| **Urbanization** | Urban | **Wind Speed (m/s)** | 2.2 | **Precipitation Freq (Days)** | 64 |
| **Climate Zone** | 5 | | | **Operational Year** | 2021 |
| **Utility Company** | Pacific Gas & Electric Company | | | | |
| **CO2 Intensity (lb/MWhr)** | 417.62 | **CH4 Intensity (lb/MWhr)** | 0.019 | **N2O Intensity (lb/MWhr)** | 0.004 |

### 1.3 User Entered Comments & Non-Default Data

Project Characteristics - Updated per PGE energy intensity factors

Land Use - Service station and parking = 1.15 acres per Costco

Construction Phase - Per applicant supplied info.

Grading - 310 CY exported during grading and 2004 during site prep per applicant info

Architectural Coating - 100 per BAAQMD rules and regs.

Vehicle Trips - Per Kittelson traffic study. 1,405 daily trips per 28 fuel pumps

Energy Use -

Construction Off-road Equipment Mitigation - Water as needed per applicant supplied information

| Table Name | Column Name | Default Value | New Value |
|---|---|---|---|
| tblArchitecturalCoating | EF_Nonresidential_Exterior | 150.00 | 100.00 |
| tblArchitecturalCoating | EF_Parking | 150.00 | 100.00 |
| tblArchitecturalCoating | EF_Residential_Exterior | 150.00 | 100.00 |
| tblConstructionPhase | NumDays | 20.00 | 63.00 |
| tblConstructionPhase | NumDays | 230.00 | 78.00 |
| tblConstructionPhase | NumDays | 20.00 | 7.00 |
| tblConstructionPhase | NumDays | 20.00 | 21.00 |
| tblGrading | AcresOfGrading | 10.00 | 0.00 |
| tblGrading | MaterialExported | 0.00 | 310.00 |
| tblGrading | MaterialExported | 0.00 | 2,004.00 |
| tblLandUse | LotAcreage | 0.09 | 0.29 |
| tblOffRoadEquipment | OffRoadEquipmentUnitAmount | 1.00 | 3.00 |
| tblOffRoadEquipment | OffRoadEquipmentUnitAmount | 3.00 | 2.00 |
| tblOffRoadEquipment | OffRoadEquipmentUnitAmount | 3.00 | 4.00 |
| tblProjectCharacteristics | CH4IntensityFactor | 0.029 | 0.019 |
| tblProjectCharacteristics | CO2IntensityFactor | 641.35 | 417.62 |
| tblProjectCharacteristics | N2OIntensityFactor | 0.006 | 0.004 |
| tblTripsAndVMT | HaulingTripNumber | 251.00 | 0.00 |
| tblTripsAndVMT | HaulingTripNumber | 39.00 | 0.00 |
| tblTripsAndVMT | WorkerTripNumber | 25.00 | 15.00 |
| tblTripsAndVMT | WorkerTripNumber | 23.00 | 18.00 |
| tblTripsAndVMT | WorkerTripNumber | 30.00 | 15.00 |
| tblVehicleTrips | ST_TR | 168.56 | 50.17 |
| tblVehicleTrips | SU_TR | 168.56 | 50.17 |
| tblVehicleTrips | WD_TR | 168.56 | 50.17 |

## 2.0 Emissions Summary

### 2.1 Overall Construction (Maximum Daily Emission)

**Unmitigated Construction**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | lb/day | | | | | | | | | | lb/day | | | | | |
| 2020 | 4.8635 | 51.2023 | 31.2500 | 0.0524 | 18.2159 | 2.5175 | 20.7333 | 9.9702 | 2.3161 | 12.2862 | 0.0000 | 5,064.1888 | 5,064.1888 | 1.5648 | 0.0000 | 5,100.4343 |
| 2021 | 6.8626 | 42.4047 | 40.2953 | 0.0833 | 1.7292 | 2.0324 | 3.7616 | 0.4669 | 1.9165 | 2.3834 | 0.0000 | 8,119.9933 | 8,119.9933 | 1.6691 | 0.0000 | 8,153.9427 |
| **Maximum** | **6.8626** | **51.2023** | **40.2953** | **0.0833** | **18.2159** | **2.5175** | **20.7333** | **9.9702** | **2.3161** | **12.2862** | **0.0000** | **8,119.9933** | **8,119.9933** | **1.6691** | **0.0000** | **8,153.9427** |

**Mitigated Construction**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | lb/day | | | | | | | | | | lb/day | | | | | |
| 2020 | 4.8635 | 51.2023 | 31.2500 | 0.0524 | 8.2785 | 2.5175 | 10.7959 | 4.5082 | 2.3161 | 6.8242 | 0.0000 | 5,064.1888 | 5,064.1888 | 1.5648 | 0.0000 | 5,100.4343 |
| 2021 | 6.8626 | 42.4047 | 40.2953 | 0.0833 | 1.7292 | 2.0324 | 3.7616 | 0.4669 | 1.9165 | 2.3834 | 0.0000 | 8,119.9933 | 8,119.9933 | 1.6691 | 0.0000 | 8,153.9427 |
| **Maximum** | **6.8626** | **51.2023** | **40.2953** | **0.0833** | **8.2785** | **2.5175** | **10.7959** | **4.5082** | **2.3161** | **6.8242** | **0.0000** | **8,119.9933** | **8,119.9933** | **1.6691** | **0.0000** | **8,153.9427** |

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio-CO2 | Total CO2 | CH4 | N20 | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Percent Reduction** | 0.00 | 0.00 | 0.00 | 0.00 | 49.82 | 0.00 | 40.57 | 52.33 | 0.00 | 37.23 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

## 2.2 Overall Operational

### Unmitigated Operational

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Area | 0.2526 | 3.9000e-004 | 0.0422 | 0.0000 | | 1.5000e-004 | 1.5000e-004 | | 1.5000e-004 | 1.5000e-004 | | 0.0901 | 0.0901 | 2.4000e-004 | | 0.0961 |
| Energy | 2.8900e-003 | 0.0263 | 0.0221 | 1.6000e-004 | | 2.0000e-003 | 2.0000e-003 | | 2.0000e-003 | 2.0000e-003 | | 31.5340 | 31.5340 | 6.0000e-004 | 5.8000e-004 | 31.7214 |
| Mobile | 1.4959 | 5.8986 | 11.7272 | 0.0236 | 1.7196 | 0.0253 | 1.7449 | 0.4601 | 0.0236 | 0.4837 | | 2,387.1287 | 2,387.1287 | 0.1535 | | 2,390.9663 |
| **Total** | **1.7514** | **5.9253** | **11.7915** | **0.0238** | **1.7196** | **0.0274** | **1.7470** | **0.4601** | **0.0258** | **0.4859** | | **2,418.7528** | **2,418.7528** | **0.1543** | **5.8000e-004** | **2,422.7837** |

### Mitigated Operational

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Area | 0.2526 | 3.9000e-004 | 0.0422 | 0.0000 | | 1.5000e-004 | 1.5000e-004 | | 1.5000e-004 | 1.5000e-004 | | 0.0901 | 0.0901 | 2.4000e-004 | | 0.0961 |
| Energy | 2.8900e-003 | 0.0263 | 0.0221 | 1.6000e-004 | | 2.0000e-003 | 2.0000e-003 | | 2.0000e-003 | 2.0000e-003 | | 31.5340 | 31.5340 | 6.0000e-004 | 5.8000e-004 | 31.7214 |
| Mobile | 1.4959 | 5.8986 | 11.7272 | 0.0236 | 1.7196 | 0.0253 | 1.7449 | 0.4601 | 0.0236 | 0.4837 | | 2,387.1287 | 2,387.1287 | 0.1535 | | 2,390.9663 |
| **Total** | **1.7514** | **5.9253** | **11.7915** | **0.0238** | **1.7196** | **0.0274** | **1.7470** | **0.4601** | **0.0258** | **0.4859** | | **2,418.7528** | **2,418.7528** | **0.1543** | **5.8000e-004** | **2,422.7837** |

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio-CO2 | Total CO2 | CH4 | N20 | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Percent Reduction** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

## 3.0 Construction Detail

### Construction Phase

| Phase Number | Phase Name | Phase Type | Start Date | End Date | Num Days Week | Num Days | Phase Description |
|---|---|---|---|---|---|---|---|
| 1 | Site Prep - Rowland Blvd | Site Preparation | 11/16/2020 | 11/27/2020 | 5 | 10 | |
| 2 | Grading - Rowland Blvd | Grading | 11/30/2020 | 12/25/2020 | 5 | 20 | |
| 3 | Building Construction - Fuel Station | Building Construction | 1/1/2021 | 4/20/2021 | 5 | 78 | |
| 4 | Architectural Coating | Architectural Coating | 4/5/2021 | 6/30/2021 | 5 | 63 | |
| 5 | Paving - Fuel Station | Paving | 4/21/2021 | 4/29/2021 | 5 | 7 | |
| 6 | Paving - Rowland Blvd | Paving | 5/3/2021 | 5/31/2021 | 5 | 21 | |

**Acres of Grading (Site Preparation Phase): 0**

**Acres of Grading (Grading Phase): 0**

**Acres of Paving: 7.46**

**Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 5,929; Non-Residential Outdoor: 1,976; Striped Parking Area: 19,560 (Architectural Coating – sqft)**

### OffRoad Equipment

| Phase Name | Offroad Equipment Type | Amount | Usage Hours | Horse Power | Load Factor |
|---|---|---|---|---|---|
| Building Construction - Fuel Station | Cranes | 1 | 7.00 | 231 | 0.29 |
| Building Construction - Fuel Station | Forklifts | 3 | 8.00 | 89 | 0.20 |
| Building Construction - Fuel Station | Generator Sets | 1 | 8.00 | 84 | 0.74 |
| Building Construction - Fuel Station | Tractors/Loaders/Backhoes | 3 | 7.00 | 97 | 0.37 |

| | | | | | |
|---|---|---|---|---|---|
| Building Construction - Fuel Station | Welders | 1 | 8.00 | 46 | 0.45 |
| Site Prep - Rowland Blvd | Concrete/Industrial Saws | 1 | 8.00 | 81 | 0.73 |
| Site Prep - Rowland Blvd | Excavators | 3 | 8.00 | 158 | 0.38 |
| Site Prep - Rowland Blvd | Rubber Tired Dozers | 2 | 8.00 | 247 | 0.40 |
| Site Prep - Rowland Blvd | Tractors/Loaders/Backhoes | 4 | 8.00 | 97 | 0.37 |
| Grading - Rowland Blvd | Excavators | 1 | 8.00 | 158 | 0.38 |
| Grading - Rowland Blvd | Graders | 1 | 8.00 | 187 | 0.41 |
| Grading - Rowland Blvd | Rubber Tired Dozers | 3 | 8.00 | 247 | 0.40 |
| Grading - Rowland Blvd | Tractors/Loaders/Backhoes | 4 | 8.00 | 97 | 0.37 |
| Paving - Rowland Blvd | Excavators | 1 | 8.00 | 158 | 0.38 |
| Paving - Rowland Blvd | Graders | 1 | 8.00 | 187 | 0.41 |
| Paving - Rowland Blvd | Pavers | 2 | 8.00 | 130 | 0.42 |
| Paving - Rowland Blvd | Paving Equipment | 2 | 8.00 | 132 | 0.36 |
| Paving - Rowland Blvd | Rollers | 2 | 8.00 | 80 | 0.38 |
| Paving - Rowland Blvd | Rubber Tired Dozers | 1 | 8.00 | 247 | 0.40 |
| Paving - Rowland Blvd | Tractors/Loaders/Backhoes | 3 | 8.00 | 97 | 0.37 |
| Building Construction - Fuel Station | Cranes | 1 | 7.00 | 231 | 0.29 |
| Building Construction - Fuel Station | Forklifts | 3 | 8.00 | 89 | 0.20 |
| Building Construction - Fuel Station | Generator Sets | 1 | 8.00 | 84 | 0.74 |
| Building Construction - Fuel Station | Tractors/Loaders/Backhoes | 3 | 7.00 | 97 | 0.37 |
| Building Construction - Fuel Station | Welders | 1 | 8.00 | 46 | 0.45 |
| Paving - Fuel Station | Pavers | 2 | 8.00 | 130 | 0.42 |
| Paving - Fuel Station | Paving Equipment | 2 | 8.00 | 132 | 0.36 |
| Paving - Fuel Station | Rollers | 2 | 8.00 | 80 | 0.38 |
| Architectural Coating | Air Compressors | 1 | 6.00 | 78 | 0.48 |

## Trips and VMT

| Phase Name | Offroad Equipment Count | Worker Trip Number | Vendor Trip Number | Hauling Trip Number | Worker Trip Length | Vendor Trip Length | Hauling Trip Length | Worker Vehicle Class | Vendor Vehicle Class | Hauling Vehicle Class |
|---|---|---|---|---|---|---|---|---|---|---|
| Site Prep - Rowland Blvd | 10 | 15.00 | 0.00 | 0.00 | 10.80 | 7.30 | 20.00 | LD_Mix | HDT_Mix | HHDT |
| Grading - Rowland Blvd | 9 | 18.00 | 0.00 | 0.00 | 10.80 | 7.30 | 20.00 | LD_Mix | HDT_Mix | HHDT |
| Paving - Rowland Blvd | 12 | 15.00 | 0.00 | 0.00 | 10.80 | 7.30 | 20.00 | LD_Mix | HDT_Mix | HHDT |
| Building Construction - Fuel Station | 18 | 138.00 | 54.00 | 0.00 | 10.80 | 7.30 | 20.00 | LD_Mix | HDT_Mix | HHDT |
| Paving - Fuel Station | 6 | 15.00 | 0.00 | 0.00 | 10.80 | 7.30 | 20.00 | LD_Mix | HDT_Mix | HHDT |
| Architectural Coating | 1 | 28.00 | 0.00 | 0.00 | 10.80 | 7.30 | 20.00 | LD_Mix | HDT_Mix | HHDT |

## 3.1 Mitigation Measures Construction

Water Exposed Area

## 3.2 Site Prep - Rowland Blvd - 2020

**Unmitigated Construction On-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Fugitive Dust | | | | | 12.0668 | 0.0000 | 12.0668 | 6.6239 | 0.0000 | 6.6239 | | | 0.0000 | | | 0.0000 |
| Off-Road | 4.1501 | 41.6216 | 30.8720 | 0.0512 | | 2.1912 | 2.1912 | | 2.0317 | 2.0317 | | 4,950.7790 | 4,950.7790 | 1.4471 | | 4,986.9551 |
| **Total** | **4.1501** | **41.6216** | **30.8720** | **0.0512** | **12.0668** | **2.1912** | **14.2580** | **6.6239** | **2.0317** | **8.6556** | | **4,950.7790** | **4,950.7790** | **1.4471** | | **4,986.9551** |

## 3.2 Site Prep - Rowland Blvd - 2020

### Unmitigated Construction Off-Site

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Hauling | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | | 0.0000 |
| Vendor | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | | 0.0000 |
| Worker | 0.0552 | 0.0390 | 0.3780 | 1.1400e-003 | 0.1232 | 8.0000e-004 | 0.1240 | 0.0327 | 7.4000e-004 | 0.0334 | | 113.4098 | 113.4098 | 2.7700e-003 | | 113.4792 |
| **Total** | **0.0552** | **0.0390** | **0.3780** | **1.1400e-003** | **0.1232** | **8.0000e-004** | **0.1240** | **0.0327** | **7.4000e-004** | **0.0334** | | **113.4098** | **113.4098** | **2.7700e-003** | | **113.4792** |

### Mitigated Construction On-Site

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Fugitive Dust | | | | | 5.4301 | 0.0000 | 5.4301 | 2.9808 | 0.0000 | 2.9808 | | | 0.0000 | | | 0.0000 |
| Off-Road | 4.1501 | 41.6216 | 30.8720 | 0.0512 | | 2.1912 | 2.1912 | | 2.0317 | 2.0317 | 0.0000 | 4,950.7790 | 4,950.7790 | 1.4471 | | 4,986.9551 |
| **Total** | **4.1501** | **41.6216** | **30.8720** | **0.0512** | **5.4301** | **2.1912** | **7.6213** | **2.9808** | **2.0317** | **5.0125** | **0.0000** | **4,950.7790** | **4,950.7790** | **1.4471** | | **4,986.9551** |

## 3.2 Site Prep - Rowland Blvd - 2020

**Mitigated Construction Off-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Hauling | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | | 0.0000 |
| Vendor | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | | 0.0000 |
| Worker | 0.0552 | 0.0390 | 0.3780 | 1.1400e-003 | 0.1232 | 8.0000e-004 | 0.1240 | 0.0327 | 7.4000e-004 | 0.0334 | | 113.4098 | 113.4098 | 2.7700e-003 | | 113.4792 |
| **Total** | **0.0552** | **0.0390** | **0.3780** | **1.1400e-003** | **0.1232** | **8.0000e-004** | **0.1240** | **0.0327** | **7.4000e-004** | **0.0334** | | **113.4098** | **113.4098** | **2.7700e-003** | | **113.4792** |

## 3.3 Grading - Rowland Blvd - 2020

**Unmitigated Construction On-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Fugitive Dust | | | | | 18.0680 | 0.0000 | 18.0680 | 9.9310 | 0.0000 | 9.9310 | | | 0.0000 | | | 0.0000 |
| Off-Road | 4.7973 | 51.1555 | 26.5959 | 0.0498 | | 2.5165 | 2.5165 | | 2.3152 | 2.3152 | | 4,827.9387 | 4,827.9387 | 1.5615 | | 4,866.9750 |
| **Total** | **4.7973** | **51.1555** | **26.5959** | **0.0498** | **18.0680** | **2.5165** | **20.5845** | **9.9310** | **2.3152** | **12.2461** | | **4,827.9387** | **4,827.9387** | **1.5615** | | **4,866.9750** |

## 3.3 Grading - Rowland Blvd - 2020

### Unmitigated Construction Off-Site

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Hauling | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | | 0.0000 |
| Vendor | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | | 0.0000 |
| Worker | 0.0662 | 0.0468 | 0.4536 | 1.3700e-003 | 0.1479 | 9.6000e-004 | 0.1488 | 0.0392 | 8.8000e-004 | 0.0401 | | 136.0918 | 136.0918 | 3.3300e-003 | | 136.1750 |
| **Total** | **0.0662** | **0.0468** | **0.4536** | **1.3700e-003** | **0.1479** | **9.6000e-004** | **0.1488** | **0.0392** | **8.8000e-004** | **0.0401** | | **136.0918** | **136.0918** | **3.3300e-003** | | **136.1750** |

### Mitigated Construction On-Site

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Fugitive Dust | | | | | 8.1306 | 0.0000 | 8.1306 | 4.4689 | 0.0000 | 4.4689 | | | 0.0000 | | | 0.0000 |
| Off-Road | 4.7973 | 51.1555 | 26.5959 | 0.0498 | | 2.5165 | 2.5165 | | 2.3152 | 2.3152 | 0.0000 | 4,827.9387 | 4,827.9387 | 1.5615 | | 4,866.9750 |
| **Total** | **4.7973** | **51.1555** | **26.5959** | **0.0498** | **8.1306** | **2.5165** | **10.6471** | **4.4689** | **2.3152** | **6.7841** | **0.0000** | **4,827.9387** | **4,827.9387** | **1.5615** | | **4,866.9750** |

## 3.3 Grading - Rowland Blvd - 2020

**Mitigated Construction Off-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Hauling | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | | 0.0000 |
| Vendor | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | | 0.0000 |
| Worker | 0.0662 | 0.0468 | 0.4536 | 1.3700e-003 | 0.1479 | 9.6000e-004 | 0.1488 | 0.0392 | 8.8000e-004 | 0.0401 | | 136.0918 | 136.0918 | 3.3300e-003 | | 136.1750 |
| **Total** | **0.0662** | **0.0468** | **0.4536** | **1.3700e-003** | **0.1479** | **9.6000e-004** | **0.1488** | **0.0392** | **8.8000e-004** | **0.0401** | | **136.0918** | **136.0918** | **3.3300e-003** | | **136.1750** |

## 3.4 Building Construction - Fuel Station - 2021

**Unmitigated Construction On-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Off-Road | 3.8019 | 34.8642 | 33.1504 | 0.0538 | | 1.9172 | 1.9172 | | 1.8026 | 1.8026 | | 5,106.7278 | 5,106.7278 | 1.2320 | | 5,137.5285 |
| **Total** | **3.8019** | **34.8642** | **33.1504** | **0.0538** | | **1.9172** | **1.9172** | | **1.8026** | **1.8026** | | **5,106.7278** | **5,106.7278** | **1.2320** | | **5,137.5285** |

## 3.4 Building Construction - Fuel Station - 2021

**Unmitigated Construction Off-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Hauling | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | | 0.0000 |
| Vendor | 0.1774 | 5.6284 | 1.5125 | 0.0144 | 0.3655 | 0.0125 | 0.3780 | 0.1052 | 0.0120 | 0.1172 | | 1,520.7866 | 1,520.7866 | 0.0792 | | 1,522.7674 |
| Worker | 0.4701 | 0.3203 | 3.1714 | 0.0101 | 1.1336 | 7.1300e-003 | 1.1408 | 0.3007 | 6.5700e-003 | 0.3073 | | 1,006.7606 | 1,006.7606 | 0.0228 | | 1,007.3301 |
| **Total** | **0.6475** | **5.9487** | **4.6839** | **0.0245** | **1.4992** | **0.0196** | **1.5188** | **0.4059** | **0.0185** | **0.4245** | | **2,527.5472** | **2,527.5472** | **0.1020** | | **2,530.0974** |

**Mitigated Construction On-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Off-Road | 3.8019 | 34.8642 | 33.1504 | 0.0538 | | 1.9172 | 1.9172 | | 1.8026 | 1.8026 | 0.0000 | 5,106.7278 | 5,106.7278 | 1.2320 | | 5,137.5285 |
| **Total** | **3.8019** | **34.8642** | **33.1504** | **0.0538** | | **1.9172** | **1.9172** | | **1.8026** | **1.8026** | **0.0000** | **5,106.7278** | **5,106.7278** | **1.2320** | | **5,137.5285** |

## 3.4 Building Construction - Fuel Station - 2021

### Mitigated Construction Off-Site

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Hauling | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | | 0.0000 |
| Vendor | 0.1774 | 5.6284 | 1.5125 | 0.0144 | 0.3655 | 0.0125 | 0.3780 | 0.1052 | 0.0120 | 0.1172 | | 1,520.7866 | 1,520.7866 | 0.0792 | | 1,522.7674 |
| Worker | 0.4701 | 0.3203 | 3.1714 | 0.0101 | 1.1336 | 7.1300e-003 | 1.1408 | 0.3007 | 6.5700e-003 | 0.3073 | | 1,006.7606 | 1,006.7606 | 0.0228 | | 1,007.3301 |
| **Total** | **0.6475** | **5.9487** | **4.6839** | **0.0245** | **1.4992** | **0.0196** | **1.5188** | **0.4059** | **0.0185** | **0.4245** | | **2,527.5472** | **2,527.5472** | **0.1020** | | **2,530.0974** |

## 3.5 Architectural Coating - 2021

### Unmitigated Construction On-Site

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Archit. Coating | 2.0206 | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | | 0.0000 | | | 0.0000 |
| Off-Road | 0.2189 | 1.5268 | 1.8176 | 2.9700e-003 | | 0.0941 | 0.0941 | | 0.0941 | 0.0941 | | 281.4481 | 281.4481 | 0.0193 | | 281.9309 |
| **Total** | **2.2395** | **1.5268** | **1.8176** | **2.9700e-003** | | **0.0941** | **0.0941** | | **0.0941** | **0.0941** | | **281.4481** | **281.4481** | **0.0193** | | **281.9309** |

## 3.5 Architectural Coating - 2021

### Unmitigated Construction Off-Site

|  | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Hauling | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |  | 0.0000 | 0.0000 | 0.0000 |  | 0.0000 |
| Vendor | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |  | 0.0000 | 0.0000 | 0.0000 |  | 0.0000 |
| Worker | 0.0954 | 0.0650 | 0.6435 | 2.0500e-003 | 0.2300 | 1.4500e-003 | 0.2315 | 0.0610 | 1.3300e-003 | 0.0623 |  | 204.2703 | 204.2703 | 4.6200e-003 |  | 204.3858 |
| **Total** | **0.0954** | **0.0650** | **0.6435** | **2.0500e-003** | **0.2300** | **1.4500e-003** | **0.2315** | **0.0610** | **1.3300e-003** | **0.0623** |  | **204.2703** | **204.2703** | **4.6200e-003** |  | **204.3858** |

### Mitigated Construction On-Site

|  | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Archit. Coating | 2.0206 |  |  |  |  | 0.0000 | 0.0000 |  | 0.0000 | 0.0000 |  |  | 0.0000 |  |  | 0.0000 |
| Off-Road | 0.2189 | 1.5268 | 1.8176 | 2.9700e-003 |  | 0.0941 | 0.0941 |  | 0.0941 | 0.0941 | 0.0000 | 281.4481 | 281.4481 | 0.0193 |  | 281.9309 |
| **Total** | **2.2395** | **1.5268** | **1.8176** | **2.9700e-003** |  | **0.0941** | **0.0941** |  | **0.0941** | **0.0941** | **0.0000** | **281.4481** | **281.4481** | **0.0193** |  | **281.9309** |

## 3.5 Architectural Coating - 2021

**Mitigated Construction Off-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Hauling | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | | 0.0000 |
| Vendor | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | | 0.0000 |
| Worker | 0.0954 | 0.0650 | 0.6435 | 2.0500e-003 | 0.2300 | 1.4500e-003 | 0.2315 | 0.0610 | 1.3300e-003 | 0.0623 | | 204.2703 | 204.2703 | 4.6200e-003 | | 204.3858 |
| **Total** | **0.0954** | **0.0650** | **0.6435** | **2.0500e-003** | **0.2300** | **1.4500e-003** | **0.2315** | **0.0610** | **1.3300e-003** | **0.0623** | | **204.2703** | **204.2703** | **4.6200e-003** | | **204.3858** |

## 3.6 Paving - Fuel Station - 2021

**Unmitigated Construction On-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Off-Road | 1.2556 | 12.9191 | 14.6532 | 0.0228 | | 0.6777 | 0.6777 | | 0.6235 | 0.6235 | | 2,207.2109 | 2,207.2109 | 0.7139 | | 2,225.0573 |
| Paving | 2.7922 | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | | 0.0000 | | | 0.0000 |
| **Total** | **4.0477** | **12.9191** | **14.6532** | **0.0228** | | **0.6777** | **0.6777** | | **0.6235** | **0.6235** | | **2,207.2109** | **2,207.2109** | **0.7139** | | **2,225.0573** |

## 3.6 Paving - Fuel Station - 2021

### Unmitigated Construction Off-Site

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Hauling | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | | 0.0000 |
| Vendor | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | | 0.0000 |
| Worker | 0.0511 | 0.0348 | 0.3447 | 1.1000e-003 | 0.1232 | 7.8000e-004 | 0.1240 | 0.0327 | 7.1000e-004 | 0.0334 | | 109.4305 | 109.4305 | 2.4800e-003 | | 109.4924 |
| **Total** | **0.0511** | **0.0348** | **0.3447** | **1.1000e-003** | **0.1232** | **7.8000e-004** | **0.1240** | **0.0327** | **7.1000e-004** | **0.0334** | | **109.4305** | **109.4305** | **2.4800e-003** | | **109.4924** |

### Mitigated Construction On-Site

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Off-Road | 1.2556 | 12.9191 | 14.6532 | 0.0228 | | 0.6777 | 0.6777 | | 0.6235 | 0.6235 | 0.0000 | 2,207.2109 | 2,207.2109 | 0.7139 | | 2,225.0573 |
| Paving | 2.7922 | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | | 0.0000 | | | 0.0000 |
| **Total** | **4.0477** | **12.9191** | **14.6532** | **0.0228** | | **0.6777** | **0.6777** | | **0.6235** | **0.6235** | **0.0000** | **2,207.2109** | **2,207.2109** | **0.7139** | | **2,225.0573** |

## 3.6 Paving - Fuel Station - 2021

**Mitigated Construction Off-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Hauling | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | | 0.0000 |
| Vendor | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | | 0.0000 |
| Worker | 0.0511 | 0.0348 | 0.3447 | 1.1000e-003 | 0.1232 | 7.8000e-004 | 0.1240 | 0.0327 | 7.1000e-004 | 0.0334 | | 109.4305 | 109.4305 | 2.4800e-003 | | 109.4924 |
| **Total** | **0.0511** | **0.0348** | **0.3447** | **1.1000e-003** | **0.1232** | **7.8000e-004** | **0.1240** | **0.0327** | **7.1000e-004** | **0.0334** | | **109.4305** | **109.4305** | **2.4800e-003** | | **109.4924** |

## 3.7 Paving - Rowland Blvd - 2021

**Unmitigated Construction On-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Off-Road | 3.5459 | 37.6558 | 30.5107 | 0.0524 | | 1.8376 | 1.8376 | | 1.6906 | 1.6906 | | 5,079.1394 | 5,079.1394 | 1.6427 | | 5,120.2068 |
| Paving | 0.9307 | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | | 0.0000 | | | 0.0000 |
| **Total** | **4.4766** | **37.6558** | **30.5107** | **0.0524** | | **1.8376** | **1.8376** | | **1.6906** | **1.6906** | | **5,079.1394** | **5,079.1394** | **1.6427** | | **5,120.2068** |

## 3.7 Paving - Rowland Blvd - 2021

**Unmitigated Construction Off-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Hauling | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | | 0.0000 |
| Vendor | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | | 0.0000 |
| Worker | 0.0511 | 0.0348 | 0.3447 | 1.1000e-003 | 0.1232 | 7.8000e-004 | 0.1240 | 0.0327 | 7.1000e-004 | 0.0334 | | 109.4305 | 109.4305 | 2.4800e-003 | | 109.4924 |
| **Total** | **0.0511** | **0.0348** | **0.3447** | **1.1000e-003** | **0.1232** | **7.8000e-004** | **0.1240** | **0.0327** | **7.1000e-004** | **0.0334** | | **109.4305** | **109.4305** | **2.4800e-003** | | **109.4924** |

**Mitigated Construction On-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Off-Road | 3.5459 | 37.6558 | 30.5107 | 0.0524 | | 1.8376 | 1.8376 | | 1.6906 | 1.6906 | 0.0000 | 5,079.1394 | 5,079.1394 | 1.6427 | | 5,120.2068 |
| Paving | 0.9307 | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | | 0.0000 | | | 0.0000 |
| **Total** | **4.4766** | **37.6558** | **30.5107** | **0.0524** | | **1.8376** | **1.8376** | | **1.6906** | **1.6906** | **0.0000** | **5,079.1394** | **5,079.1394** | **1.6427** | | **5,120.2068** |

## 3.7 Paving - Rowland Blvd - 2021

**Mitigated Construction Off-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Hauling | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | | 0.0000 |
| Vendor | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | | 0.0000 |
| Worker | 0.0511 | 0.0348 | 0.3447 | 1.1000e-003 | 0.1232 | 7.8000e-004 | 0.1240 | 0.0327 | 7.1000e-004 | 0.0334 | | 109.4305 | 109.4305 | 2.4800e-003 | | 109.4924 |
| **Total** | **0.0511** | **0.0348** | **0.3447** | **1.1000e-003** | **0.1232** | **7.8000e-004** | **0.1240** | **0.0327** | **7.1000e-004** | **0.0334** | | **109.4305** | **109.4305** | **2.4800e-003** | | **109.4924** |

## 4.0 Operational Detail - Mobile

### 4.1 Mitigation Measures Mobile

|  | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day |  |  |  |  |  |  |  |  |  | lb/day |  |  |  |  |  |
| Mitigated | 1.4959 | 5.8986 | 11.7272 | 0.0236 | 1.7196 | 0.0253 | 1.7449 | 0.4601 | 0.0236 | 0.4837 |  | 2,387.1287 | 2,387.1287 | 0.1535 |  | 2,390.9663 |
| Unmitigated | 1.4959 | 5.8986 | 11.7272 | 0.0236 | 1.7196 | 0.0253 | 1.7449 | 0.4601 | 0.0236 | 0.4837 |  | 2,387.1287 | 2,387.1287 | 0.1535 |  | 2,390.9663 |

## 4.2 Trip Summary Information

|  | Average Daily Trip Rate |  |  | Unmitigated | Mitigated |
|---|---|---|---|---|---|
| Land Use | Weekday | Saturday | Sunday | Annual VMT | Annual VMT |
| Gasoline/Service Station | 1,404.76 | 1,404.76 | 1404.76 | 809,378 | 809,378 |
| Other Asphalt Surfaces | 0.00 | 0.00 | 0.00 |  |  |
| Parking Lot | 0.00 | 0.00 | 0.00 |  |  |
| Total | 1,404.76 | 1,404.76 | 1,404.76 | 809,378 | 809,378 |

## 4.3 Trip Type Information

|  | Miles |  |  | Trip % |  |  | Trip Purpose % |  |  |
|---|---|---|---|---|---|---|---|---|---|
| Land Use | H-W or C-W | H-S or C-C | H-O or C-NW | H-W or C-W | H-S or C-C | H-O or C-NW | Primary | Diverted | Pass-by |
| Gasoline/Service Station | 9.50 | 7.30 | 7.30 | 2.00 | 79.00 | 19.00 | 14 | 27 | 59 |
| Other Asphalt Surfaces | 9.50 | 7.30 | 7.30 | 0.00 | 0.00 | 0.00 | 0 | 0 | 0 |
| Parking Lot | 9.50 | 7.30 | 7.30 | 0.00 | 0.00 | 0.00 | 0 | 0 | 0 |

## 4.4 Fleet Mix

| Land Use | LDA | LDT1 | LDT2 | MDV | LHD1 | LHD2 | MHD | HHD | OBUS | UBUS | MCY | SBUS | MH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Gasoline/Service Station | 0.575198 | 0.040076 | 0.193827 | 0.113296 | 0.016988 | 0.005361 | 0.017552 | 0.025197 | 0.002581 | 0.002349 | 0.005904 | 0.000881 | 0.000789 |
| Other Asphalt Surfaces | 0.575198 | 0.040076 | 0.193827 | 0.113296 | 0.016988 | 0.005361 | 0.017552 | 0.025197 | 0.002581 | 0.002349 | 0.005904 | 0.000881 | 0.000789 |
| Parking Lot | 0.575198 | 0.040076 | 0.193827 | 0.113296 | 0.016988 | 0.005361 | 0.017552 | 0.025197 | 0.002581 | 0.002349 | 0.005904 | 0.000881 | 0.000789 |

## 5.0 Energy Detail

Historical Energy Use: N

### 5.1 Mitigation Measures Energy

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| NaturalGas Mitigated | 2.8900e-003 | 0.0263 | 0.0221 | 1.6000e-004 | | 2.0000e-003 | 2.0000e-003 | | 2.0000e-003 | 2.0000e-003 | | 31.5340 | 31.5340 | 6.0000e-004 | 5.8000e-004 | 31.7214 |
| NaturalGas Unmitigated | 2.8900e-003 | 0.0263 | 0.0221 | 1.6000e-004 | | 2.0000e-003 | 2.0000e-003 | | 2.0000e-003 | 2.0000e-003 | | 31.5340 | 31.5340 | 6.0000e-004 | 5.8000e-004 | 31.7214 |

## 5.2 Energy by Land Use - NaturalGas

**Unmitigated**

| | NaturalGas Use | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Land Use | kBTU/yr | lb/day | | | | | | | | | | lb/day | | | | | |
| Gasoline/Service Station | 268.039 | 2.8900e-003 | 0.0263 | 0.0221 | 1.6000e-004 | | 2.0000e-003 | 2.0000e-003 | | 2.0000e-003 | 2.0000e-003 | | 31.5340 | 31.5340 | 6.0000e-004 | 5.8000e-004 | 31.7214 |
| Other Asphalt Surfaces | 0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Parking Lot | 0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| **Total** | | **2.8900e-003** | **0.0263** | **0.0221** | **1.6000e-004** | | **2.0000e-003** | **2.0000e-003** | | **2.0000e-003** | **2.0000e-003** | | **31.5340** | **31.5340** | **6.0000e-004** | **5.8000e-004** | **31.7214** |

**Mitigated**

| | NaturalGas Use | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Land Use | kBTU/yr | lb/day | | | | | | | | | | lb/day | | | | | |
| Gasoline/Service Station | 0.268039 | 2.8900e-003 | 0.0263 | 0.0221 | 1.6000e-004 | | 2.0000e-003 | 2.0000e-003 | | 2.0000e-003 | 2.0000e-003 | | 31.5340 | 31.5340 | 6.0000e-004 | 5.8000e-004 | 31.7214 |
| Other Asphalt Surfaces | 0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Parking Lot | 0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| **Total** | | **2.8900e-003** | **0.0263** | **0.0221** | **1.6000e-004** | | **2.0000e-003** | **2.0000e-003** | | **2.0000e-003** | **2.0000e-003** | | **31.5340** | **31.5340** | **6.0000e-004** | **5.8000e-004** | **31.7214** |

# 6.0 Area Detail

## 6.1 Mitigation Measures Area

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Mitigated | 0.2526 | 3.9000e-004 | 0.0422 | 0.0000 | | 1.5000e-004 | 1.5000e-004 | | 1.5000e-004 | 1.5000e-004 | | 0.0901 | 0.0901 | 2.4000e-004 | | 0.0961 |
| Unmitigated | 0.2526 | 3.9000e-004 | 0.0422 | 0.0000 | | 1.5000e-004 | 1.5000e-004 | | 1.5000e-004 | 1.5000e-004 | | 0.0901 | 0.0901 | 2.4000e-004 | | 0.0961 |

## 6.2 Area by SubCategory

**Unmitigated**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SubCategory | lb/day | | | | | | | | | | lb/day | | | | | |
| Architectural Coating | 0.0486 | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | | 0.0000 | | | 0.0000 |
| Consumer Products | 0.2001 | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | | 0.0000 | | | 0.0000 |
| Landscaping | 3.9400e-003 | 3.9000e-004 | 0.0422 | 0.0000 | | 1.5000e-004 | 1.5000e-004 | | 1.5000e-004 | 1.5000e-004 | | 0.0901 | 0.0901 | 2.4000e-004 | | 0.0961 |
| **Total** | **0.2526** | **3.9000e-004** | **0.0422** | **0.0000** | | **1.5000e-004** | **1.5000e-004** | | **1.5000e-004** | **1.5000e-004** | | **0.0901** | **0.0901** | **2.4000e-004** | | **0.0961** |

**Mitigated**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SubCategory | lb/day | | | | | | | | | | lb/day | | | | | |
| Architectural Coating | 0.0486 | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | | 0.0000 | | | 0.0000 |
| Consumer Products | 0.2001 | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | | 0.0000 | | | 0.0000 |
| Landscaping | 3.9400e-003 | 3.9000e-004 | 0.0422 | 0.0000 | | 1.5000e-004 | 1.5000e-004 | | 1.5000e-004 | 1.5000e-004 | | 0.0901 | 0.0901 | 2.4000e-004 | | 0.0961 |
| **Total** | **0.2526** | **3.9000e-004** | **0.0422** | **0.0000** | | **1.5000e-004** | **1.5000e-004** | | **1.5000e-004** | **1.5000e-004** | | **0.0901** | **0.0901** | **2.4000e-004** | | **0.0961** |

## 7.0 Water Detail

### 7.1 Mitigation Measures Water

## 8.0 Waste Detail

### 8.1 Mitigation Measures Waste

## 9.0 Operational Offroad

| Equipment Type | Number | Hours/Day | Days/Year | Horse Power | Load Factor | Fuel Type |
|---|---|---|---|---|---|---|

## 10.0 Stationary Equipment

**Fire Pumps and Emergency Generators**

| Equipment Type | Number | Hours/Day | Hours/Year | Horse Power | Load Factor | Fuel Type |
|---|---|---|---|---|---|---|

**Boilers**

| Equipment Type | Number | Heat Input/Day | Heat Input/Year | Boiler Rating | Fuel Type |
|---|---|---|---|---|---|

**User Defined Equipment**

| Equipment Type | Number |
|---|---|

## 11.0 Vegetation

# Novato Costco Fuel Project

## Bay Area AQMD Air District, Summer

## 1.0 Project Characteristics

### 1.1 Land Usage

| Land Uses | Size | Metric | Lot Acreage | Floor Surface Area | Population |
|---|---|---|---|---|---|
| Other Asphalt Surfaces | 287.60 | 1000sqft | 6.60 | 287,600.00 | 0 |
| Parking Lot | 96.00 | Space | 0.86 | 38,400.00 | 0 |
| Gasoline/Service Station | 28.00 | Pump | 0.29 | 3,952.90 | 0 |

### 1.2 Other Project Characteristics

| | | | | | |
|---|---|---|---|---|---|
| **Urbanization** | Urban | **Wind Speed (m/s)** | 2.2 | **Precipitation Freq (Days)** | 64 |
| **Climate Zone** | 5 | | | **Operational Year** | 2021 |
| **Utility Company** | Pacific Gas & Electric Company | | | | |
| **CO2 Intensity (lb/MWhr)** | 417.62 | **CH4 Intensity (lb/MWhr)** | 0.019 | **N2O Intensity (lb/MWhr)** | 0.004 |

### 1.3 User Entered Comments & Non-Default Data

Project Characteristics - Updated per PGE energy intensity factors

Land Use - Service station and parking = 1.15 acres per Costco

Construction Phase - Per applicant supplied info.

Grading - 310 CY exported during grading and 2004 during site prep per applicant info

Architectural Coating - 100 per BAAQMD rules and regs.

Vehicle Trips - Per Kittelson traffic study. 1,405 daily trips per 28 fuel pumps

Energy Use -

Construction Off-road Equipment Mitigation - Water as needed per applicant supplied information

| Table Name | Column Name | Default Value | New Value |
|---|---|---|---|
| tblArchitecturalCoating | EF_Nonresidential_Exterior | 150.00 | 100.00 |
| tblArchitecturalCoating | EF_Parking | 150.00 | 100.00 |
| tblArchitecturalCoating | EF_Residential_Exterior | 150.00 | 100.00 |
| tblConstructionPhase | NumDays | 20.00 | 63.00 |
| tblConstructionPhase | NumDays | 230.00 | 78.00 |
| tblConstructionPhase | NumDays | 20.00 | 7.00 |
| tblConstructionPhase | NumDays | 20.00 | 21.00 |
| tblGrading | AcresOfGrading | 10.00 | 0.00 |
| tblGrading | MaterialExported | 0.00 | 310.00 |
| tblGrading | MaterialExported | 0.00 | 2,004.00 |
| tblLandUse | LotAcreage | 0.09 | 0.29 |
| tblOffRoadEquipment | OffRoadEquipmentUnitAmount | 1.00 | 3.00 |
| tblOffRoadEquipment | OffRoadEquipmentUnitAmount | 3.00 | 2.00 |
| tblOffRoadEquipment | OffRoadEquipmentUnitAmount | 3.00 | 4.00 |
| tblProjectCharacteristics | CH4IntensityFactor | 0.029 | 0.019 |
| tblProjectCharacteristics | CO2IntensityFactor | 641.35 | 417.62 |
| tblProjectCharacteristics | N2OIntensityFactor | 0.006 | 0.004 |
| tblTripsAndVMT | HaulingTripNumber | 251.00 | 0.00 |
| tblTripsAndVMT | HaulingTripNumber | 39.00 | 0.00 |
| tblTripsAndVMT | WorkerTripNumber | 25.00 | 15.00 |
| tblTripsAndVMT | WorkerTripNumber | 23.00 | 18.00 |
| tblTripsAndVMT | WorkerTripNumber | 30.00 | 15.00 |
| tblVehicleTrips | ST_TR | 168.56 | 50.17 |
| tblVehicleTrips | SU_TR | 168.56 | 50.17 |
| tblVehicleTrips | WD_TR | 168.56 | 50.17 |

# 2.0 Emissions Summary

## 2.1 Overall Construction (Maximum Daily Emission)

**Unmitigated Construction**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | lb/day | | | | | | | | | | lb/day | | | | | |
| 2020 | 4.8598 | 51.1934 | 31.2745 | 0.0525 | 18.2159 | 2.5175 | 20.7333 | 9.9702 | 2.3161 | 12.2862 | 0.0000 | 5,073.8954 | 5,073.8954 | 1.5650 | 0.0000 | 5,110.1458 |
| 2021 | 6.8544 | 42.2834 | 40.3613 | 0.0847 | 1.7292 | 2.0320 | 3.7612 | 0.4669 | 1.9161 | 2.3830 | 0.0000 | 8,263.2048 | 8,263.2048 | 1.6696 | 0.0000 | 8,297.0539 |
| **Maximum** | **6.8544** | **51.1934** | **40.3613** | **0.0847** | **18.2159** | **2.5175** | **20.7333** | **9.9702** | **2.3161** | **12.2862** | **0.0000** | **8,263.2048** | **8,263.2048** | **1.6696** | **0.0000** | **8,297.0539** |

**Mitigated Construction**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | lb/day | | | | | | | | | | lb/day | | | | | |
| 2020 | 4.8598 | 51.1934 | 31.2745 | 0.0525 | 8.2785 | 2.5175 | 10.7959 | 4.5082 | 2.3161 | 6.8242 | 0.0000 | 5,073.8954 | 5,073.8954 | 1.5650 | 0.0000 | 5,110.1458 |
| 2021 | 6.8544 | 42.2834 | 40.3613 | 0.0847 | 1.7292 | 2.0320 | 3.7612 | 0.4669 | 1.9161 | 2.3830 | 0.0000 | 8,263.2048 | 8,263.2048 | 1.6696 | 0.0000 | 8,297.0539 |
| **Maximum** | **6.8544** | **51.1934** | **40.3613** | **0.0847** | **8.2785** | **2.5175** | **10.7959** | **4.5082** | **2.3161** | **6.8242** | **0.0000** | **8,263.2048** | **8,263.2048** | **1.6696** | **0.0000** | **8,297.0539** |

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio-CO2 | Total CO2 | CH4 | N20 | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Percent Reduction** | **0.00** | **0.00** | **0.00** | **0.00** | **49.82** | **0.00** | **40.57** | **52.33** | **0.00** | **37.23** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** |

## 2.2 Overall Operational

### Unmitigated Operational

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Area | 0.2526 | 3.9000e-004 | 0.0422 | 0.0000 | | 1.5000e-004 | 1.5000e-004 | | 1.5000e-004 | 1.5000e-004 | | 0.0901 | 0.0901 | 2.4000e-004 | | 0.0961 |
| Energy | 2.8900e-003 | 0.0263 | 0.0221 | 1.6000e-004 | | 2.0000e-003 | 2.0000e-003 | | 2.0000e-003 | 2.0000e-003 | | 31.5340 | 31.5340 | 6.0000e-004 | 5.8000e-004 | 31.7214 |
| Mobile | 1.7975 | 5.8009 | 9.8902 | 0.0253 | 1.7196 | 0.0247 | 1.7443 | 0.4601 | 0.0231 | 0.4832 | | 2,561.3721 | 2,561.3721 | 0.1390 | | 2,564.8465 |
| **Total** | **2.0529** | **5.8276** | **9.9545** | **0.0254** | **1.7196** | **0.0269** | **1.7465** | **0.4601** | **0.0252** | **0.4853** | | **2,592.9962** | **2,592.9962** | **0.1398** | **5.8000e-004** | **2,596.6640** |

### Mitigated Operational

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Area | 0.2526 | 3.9000e-004 | 0.0422 | 0.0000 | | 1.5000e-004 | 1.5000e-004 | | 1.5000e-004 | 1.5000e-004 | | 0.0901 | 0.0901 | 2.4000e-004 | | 0.0961 |
| Energy | 2.8900e-003 | 0.0263 | 0.0221 | 1.6000e-004 | | 2.0000e-003 | 2.0000e-003 | | 2.0000e-003 | 2.0000e-003 | | 31.5340 | 31.5340 | 6.0000e-004 | 5.8000e-004 | 31.7214 |
| Mobile | 1.7975 | 5.8009 | 9.8902 | 0.0253 | 1.7196 | 0.0247 | 1.7443 | 0.4601 | 0.0231 | 0.4832 | | 2,561.3721 | 2,561.3721 | 0.1390 | | 2,564.8465 |
| **Total** | **2.0529** | **5.8276** | **9.9545** | **0.0254** | **1.7196** | **0.0269** | **1.7465** | **0.4601** | **0.0252** | **0.4853** | | **2,592.9962** | **2,592.9962** | **0.1398** | **5.8000e-004** | **2,596.6640** |

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio-CO2 | Total CO2 | CH4 | N20 | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Percent Reduction** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

## 3.0 Construction Detail

### Construction Phase

| Phase Number | Phase Name | Phase Type | Start Date | End Date | Num Days Week | Num Days | Phase Description |
|---|---|---|---|---|---|---|---|
| 1 | Site Prep - Rowland Blvd | Site Preparation | 11/16/2020 | 11/27/2020 | 5 | 10 | |
| 2 | Grading - Rowland Blvd | Grading | 11/30/2020 | 12/25/2020 | 5 | 20 | |
| 3 | Building Construction - Fuel Station | Building Construction | 1/1/2021 | 4/20/2021 | 5 | 78 | |
| 4 | Architectural Coating | Architectural Coating | 4/5/2021 | 6/30/2021 | 5 | 63 | |
| 5 | Paving - Fuel Station | Paving | 4/21/2021 | 4/29/2021 | 5 | 7 | |
| 6 | Paving - Rowland Blvd | Paving | 5/3/2021 | 5/31/2021 | 5 | 21 | |

**Acres of Grading (Site Preparation Phase): 0**

**Acres of Grading (Grading Phase): 0**

**Acres of Paving: 7.46**

**Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 5,929; Non-Residential Outdoor: 1,976; Striped Parking Area: 19,560 (Architectural Coating – sqft)**

### OffRoad Equipment

| Phase Name | Offroad Equipment Type | Amount | Usage Hours | Horse Power | Load Factor |
|---|---|---|---|---|---|
| Building Construction - Fuel Station | Cranes | 1 | 7.00 | 231 | 0.29 |
| Building Construction - Fuel Station | Forklifts | 3 | 8.00 | 89 | 0.20 |
| Building Construction - Fuel Station | Generator Sets | 1 | 8.00 | 84 | 0.74 |
| Building Construction - Fuel Station | Tractors/Loaders/Backhoes | 3 | 7.00 | 97 | 0.37 |

| | | | | | |
|---|---|---|---|---|---|
| Building Construction - Fuel Station | Welders | 1 | 8.00 | 46 | 0.45 |
| Site Prep - Rowland Blvd | Concrete/Industrial Saws | 1 | 8.00 | 81 | 0.73 |
| Site Prep - Rowland Blvd | Excavators | 3 | 8.00 | 158 | 0.38 |
| Site Prep - Rowland Blvd | Rubber Tired Dozers | 2 | 8.00 | 247 | 0.40 |
| Site Prep - Rowland Blvd | Tractors/Loaders/Backhoes | 4 | 8.00 | 97 | 0.37 |
| Grading - Rowland Blvd | Excavators | 1 | 8.00 | 158 | 0.38 |
| Grading - Rowland Blvd | Graders | 1 | 8.00 | 187 | 0.41 |
| Grading - Rowland Blvd | Rubber Tired Dozers | 3 | 8.00 | 247 | 0.40 |
| Grading - Rowland Blvd | Tractors/Loaders/Backhoes | 4 | 8.00 | 97 | 0.37 |
| Paving - Rowland Blvd | Excavators | 1 | 8.00 | 158 | 0.38 |
| Paving - Rowland Blvd | Graders | 1 | 8.00 | 187 | 0.41 |
| Paving - Rowland Blvd | Pavers | 2 | 8.00 | 130 | 0.42 |
| Paving - Rowland Blvd | Paving Equipment | 2 | 8.00 | 132 | 0.36 |
| Paving - Rowland Blvd | Rollers | 2 | 8.00 | 80 | 0.38 |
| Paving - Rowland Blvd | Rubber Tired Dozers | 1 | 8.00 | 247 | 0.40 |
| Paving - Rowland Blvd | Tractors/Loaders/Backhoes | 3 | 8.00 | 97 | 0.37 |
| Building Construction - Fuel Station | Cranes | 1 | 7.00 | 231 | 0.29 |
| Building Construction - Fuel Station | Forklifts | 3 | 8.00 | 89 | 0.20 |
| Building Construction - Fuel Station | Generator Sets | 1 | 8.00 | 84 | 0.74 |
| Building Construction - Fuel Station | Tractors/Loaders/Backhoes | 3 | 7.00 | 97 | 0.37 |
| Building Construction - Fuel Station | Welders | 1 | 8.00 | 46 | 0.45 |
| Paving - Fuel Station | Pavers | 2 | 8.00 | 130 | 0.42 |
| Paving - Fuel Station | Paving Equipment | 2 | 8.00 | 132 | 0.36 |
| Paving - Fuel Station | Rollers | 2 | 8.00 | 80 | 0.38 |
| Architectural Coating | Air Compressors | 1 | 6.00 | 78 | 0.48 |

## Trips and VMT

| Phase Name | Offroad Equipment Count | Worker Trip Number | Vendor Trip Number | Hauling Trip Number | Worker Trip Length | Vendor Trip Length | Hauling Trip Length | Worker Vehicle Class | Vendor Vehicle Class | Hauling Vehicle Class |
|---|---|---|---|---|---|---|---|---|---|---|
| Site Prep - Rowland Blvd | 10 | 15.00 | 0.00 | 0.00 | 10.80 | 7.30 | 20.00 | LD_Mix | HDT_Mix | HHDT |
| Grading - Rowland Blvd | 9 | 18.00 | 0.00 | 0.00 | 10.80 | 7.30 | 20.00 | LD_Mix | HDT_Mix | HHDT |
| Paving - Rowland Blvd | 12 | 15.00 | 0.00 | 0.00 | 10.80 | 7.30 | 20.00 | LD_Mix | HDT_Mix | HHDT |
| Building Construction - Fuel Station | 18 | 138.00 | 54.00 | 0.00 | 10.80 | 7.30 | 20.00 | LD_Mix | HDT_Mix | HHDT |
| Paving - Fuel Station | 6 | 15.00 | 0.00 | 0.00 | 10.80 | 7.30 | 20.00 | LD_Mix | HDT_Mix | HHDT |
| Architectural Coating | 1 | 28.00 | 0.00 | 0.00 | 10.80 | 7.30 | 20.00 | LD_Mix | HDT_Mix | HHDT |

## 3.1 Mitigation Measures Construction

Water Exposed Area

## 3.2 Site Prep - Rowland Blvd - 2020

**Unmitigated Construction On-Site**

|  | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day |  |  |  |  |  |  |  |  |  | lb/day |  |  |  |  |  |
| Fugitive Dust |  |  |  |  | 12.0668 | 0.0000 | 12.0668 | 6.6239 | 0.0000 | 6.6239 |  |  | 0.0000 |  |  | 0.0000 |
| Off-Road | 4.1501 | 41.6216 | 30.8720 | 0.0512 |  | 2.1912 | 2.1912 |  | 2.0317 | 2.0317 |  | 4,950.7790 | 4,950.7790 | 1.4471 |  | 4,986.9551 |
| **Total** | **4.1501** | **41.6216** | **30.8720** | **0.0512** | **12.0668** | **2.1912** | **14.2580** | **6.6239** | **2.0317** | **8.6556** |  | **4,950.7790** | **4,950.7790** | **1.4471** |  | **4,986.9551** |

## 3.2 Site Prep - Rowland Blvd - 2020

### Unmitigated Construction Off-Site

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Hauling | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | | 0.0000 |
| Vendor | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | | 0.0000 |
| Worker | 0.0521 | 0.0316 | 0.4025 | 1.2400e-003 | 0.1232 | 8.0000e-004 | 0.1240 | 0.0327 | 7.4000e-004 | 0.0334 | | 123.1165 | 123.1165 | 2.9700e-003 | | 123.1907 |
| **Total** | **0.0521** | **0.0316** | **0.4025** | **1.2400e-003** | **0.1232** | **8.0000e-004** | **0.1240** | **0.0327** | **7.4000e-004** | **0.0334** | | **123.1165** | **123.1165** | **2.9700e-003** | | **123.1907** |

### Mitigated Construction On-Site

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Fugitive Dust | | | | | 5.4301 | 0.0000 | 5.4301 | 2.9808 | 0.0000 | 2.9808 | | | 0.0000 | | | 0.0000 |
| Off-Road | 4.1501 | 41.6216 | 30.8720 | 0.0512 | | 2.1912 | 2.1912 | | 2.0317 | 2.0317 | 0.0000 | 4,950.7790 | 4,950.7790 | 1.4471 | | 4,986.9551 |
| **Total** | **4.1501** | **41.6216** | **30.8720** | **0.0512** | **5.4301** | **2.1912** | **7.6213** | **2.9808** | **2.0317** | **5.0125** | **0.0000** | **4,950.7790** | **4,950.7790** | **1.4471** | | **4,986.9551** |

## 3.2 Site Prep - Rowland Blvd - 2020

**Mitigated Construction Off-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Hauling | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | | 0.0000 |
| Vendor | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | | 0.0000 |
| Worker | 0.0521 | 0.0316 | 0.4025 | 1.2400e-003 | 0.1232 | 8.0000e-004 | 0.1240 | 0.0327 | 7.4000e-004 | 0.0334 | | 123.1165 | 123.1165 | 2.9700e-003 | | 123.1907 |
| **Total** | **0.0521** | **0.0316** | **0.4025** | **1.2400e-003** | **0.1232** | **8.0000e-004** | **0.1240** | **0.0327** | **7.4000e-004** | **0.0334** | | **123.1165** | **123.1165** | **2.9700e-003** | | **123.1907** |

## 3.3 Grading - Rowland Blvd - 2020

**Unmitigated Construction On-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Fugitive Dust | | | | | 18.0680 | 0.0000 | 18.0680 | 9.9310 | 0.0000 | 9.9310 | | | 0.0000 | | | 0.0000 |
| Off-Road | 4.7973 | 51.1555 | 26.5959 | 0.0498 | | 2.5165 | 2.5165 | | 2.3152 | 2.3152 | | 4,827.9387 | 4,827.9387 | 1.5615 | | 4,866.9750 |
| **Total** | **4.7973** | **51.1555** | **26.5959** | **0.0498** | **18.0680** | **2.5165** | **20.5845** | **9.9310** | **2.3152** | **12.2461** | | **4,827.9387** | **4,827.9387** | **1.5615** | | **4,866.9750** |

## 3.3 Grading - Rowland Blvd - 2020

### Unmitigated Construction Off-Site

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Hauling | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | | 0.0000 |
| Vendor | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | | 0.0000 |
| Worker | 0.0626 | 0.0379 | 0.4830 | 1.4800e-003 | 0.1479 | 9.6000e-004 | 0.1488 | 0.0392 | 8.8000e-004 | 0.0401 | | 147.7398 | 147.7398 | 3.5600e-003 | | 147.8288 |
| **Total** | **0.0626** | **0.0379** | **0.4830** | **1.4800e-003** | **0.1479** | **9.6000e-004** | **0.1488** | **0.0392** | **8.8000e-004** | **0.0401** | | **147.7398** | **147.7398** | **3.5600e-003** | | **147.8288** |

### Mitigated Construction On-Site

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Fugitive Dust | | | | | 8.1306 | 0.0000 | 8.1306 | 4.4689 | 0.0000 | 4.4689 | | | 0.0000 | | | 0.0000 |
| Off-Road | 4.7973 | 51.1555 | 26.5959 | 0.0498 | | 2.5165 | 2.5165 | | 2.3152 | 2.3152 | 0.0000 | 4,827.9387 | 4,827.9387 | 1.5615 | | 4,866.9750 |
| **Total** | **4.7973** | **51.1555** | **26.5959** | **0.0498** | **8.1306** | **2.5165** | **10.6471** | **4.4689** | **2.3152** | **6.7841** | **0.0000** | **4,827.9387** | **4,827.9387** | **1.5615** | | **4,866.9750** |

## 3.3 Grading - Rowland Blvd - 2020

**Mitigated Construction Off-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Hauling | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | | 0.0000 |
| Vendor | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | | 0.0000 |
| Worker | 0.0626 | 0.0379 | 0.4830 | 1.4800e-003 | 0.1479 | 9.6000e-004 | 0.1488 | 0.0392 | 8.8000e-004 | 0.0401 | | 147.7398 | 147.7398 | 3.5600e-003 | | 147.8288 |
| **Total** | **0.0626** | **0.0379** | **0.4830** | **1.4800e-003** | **0.1479** | **9.6000e-004** | **0.1488** | **0.0392** | **8.8000e-004** | **0.0401** | | **147.7398** | **147.7398** | **3.5600e-003** | | **147.8288** |

## 3.4 Building Construction - Fuel Station - 2021

**Unmitigated Construction On-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Off-Road | 3.8019 | 34.8642 | 33.1504 | 0.0538 | | 1.9172 | 1.9172 | | 1.8026 | 1.8026 | | 5,106.7278 | 5,106.7278 | 1.2320 | | 5,137.5285 |
| **Total** | **3.8019** | **34.8642** | **33.1504** | **0.0538** | | **1.9172** | **1.9172** | | **1.8026** | **1.8026** | | **5,106.7278** | **5,106.7278** | **1.2320** | | **5,137.5285** |

## 3.4 Building Construction - Fuel Station - 2021

**Unmitigated Construction Off-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Hauling | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | | 0.0000 |
| Vendor | 0.1675 | 5.5804 | 1.3159 | 0.0147 | 0.3655 | 0.0121 | 0.3776 | 0.1052 | 0.0116 | 0.1168 | | 1,560.3761 | 1,560.3761 | 0.0732 | | 1,562.2070 |
| Worker | 0.4437 | 0.2593 | 3.3897 | 0.0110 | 1.1336 | 7.1300e-003 | 1.1408 | 0.3007 | 6.5700e-003 | 0.3073 | | 1,092.9041 | 1,092.9041 | 0.0244 | | 1,093.5149 |
| **Total** | **0.6112** | **5.8397** | **4.7056** | **0.0257** | **1.4992** | **0.0192** | **1.5184** | **0.4059** | **0.0181** | **0.4241** | | **2,653.2803** | **2,653.2803** | **0.0977** | | **2,655.7219** |

**Mitigated Construction On-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Off-Road | 3.8019 | 34.8642 | 33.1504 | 0.0538 | | 1.9172 | 1.9172 | | 1.8026 | 1.8026 | 0.0000 | 5,106.7278 | 5,106.7278 | 1.2320 | | 5,137.5285 |
| **Total** | **3.8019** | **34.8642** | **33.1504** | **0.0538** | | **1.9172** | **1.9172** | | **1.8026** | **1.8026** | **0.0000** | **5,106.7278** | **5,106.7278** | **1.2320** | | **5,137.5285** |

## 3.4 Building Construction - Fuel Station - 2021

**Mitigated Construction Off-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Hauling | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | | 0.0000 |
| Vendor | 0.1675 | 5.5804 | 1.3159 | 0.0147 | 0.3655 | 0.0121 | 0.3776 | 0.1052 | 0.0116 | 0.1168 | | 1,560.3761 | 1,560.3761 | 0.0732 | | 1,562.2070 |
| Worker | 0.4437 | 0.2593 | 3.3897 | 0.0110 | 1.1336 | 7.1300e-003 | 1.1408 | 0.3007 | 6.5700e-003 | 0.3073 | | 1,092.9041 | 1,092.9041 | 0.0244 | | 1,093.5149 |
| **Total** | **0.6112** | **5.8397** | **4.7056** | **0.0257** | **1.4992** | **0.0192** | **1.5184** | **0.4059** | **0.0181** | **0.4241** | | **2,653.2803** | **2,653.2803** | **0.0977** | | **2,655.7219** |

## 3.5 Architectural Coating - 2021

**Unmitigated Construction On-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Archit. Coating | 2.0206 | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | | 0.0000 | | | 0.0000 |
| Off-Road | 0.2189 | 1.5268 | 1.8176 | 2.9700e-003 | | 0.0941 | 0.0941 | | 0.0941 | 0.0941 | | 281.4481 | 281.4481 | 0.0193 | | 281.9309 |
| **Total** | **2.2395** | **1.5268** | **1.8176** | **2.9700e-003** | | **0.0941** | **0.0941** | | **0.0941** | **0.0941** | | **281.4481** | **281.4481** | **0.0193** | | **281.9309** |

## 3.5 Architectural Coating - 2021

**Unmitigated Construction Off-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Hauling | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | | 0.0000 |
| Vendor | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | | 0.0000 |
| Worker | 0.0900 | 0.0526 | 0.6878 | 2.2200e-003 | 0.2300 | 1.4500e-003 | 0.2315 | 0.0610 | 1.3300e-003 | 0.0623 | | 221.7487 | 221.7487 | 4.9600e-003 | | 221.8726 |
| **Total** | **0.0900** | **0.0526** | **0.6878** | **2.2200e-003** | **0.2300** | **1.4500e-003** | **0.2315** | **0.0610** | **1.3300e-003** | **0.0623** | | **221.7487** | **221.7487** | **4.9600e-003** | | **221.8726** |

**Mitigated Construction On-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Archit. Coating | 2.0206 | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | | 0.0000 | | | 0.0000 |
| Off-Road | 0.2189 | 1.5268 | 1.8176 | 2.9700e-003 | | 0.0941 | 0.0941 | | 0.0941 | 0.0941 | 0.0000 | 281.4481 | 281.4481 | 0.0193 | | 281.9309 |
| **Total** | **2.2395** | **1.5268** | **1.8176** | **2.9700e-003** | | **0.0941** | **0.0941** | | **0.0941** | **0.0941** | **0.0000** | **281.4481** | **281.4481** | **0.0193** | | **281.9309** |

## 3.5 Architectural Coating - 2021

**Mitigated Construction Off-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Hauling | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | | 0.0000 |
| Vendor | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | | 0.0000 |
| Worker | 0.0900 | 0.0526 | 0.6878 | 2.2200e-003 | 0.2300 | 1.4500e-003 | 0.2315 | 0.0610 | 1.3300e-003 | 0.0623 | | 221.7487 | 221.7487 | 4.9600e-003 | | 221.8726 |
| **Total** | **0.0900** | **0.0526** | **0.6878** | **2.2200e-003** | **0.2300** | **1.4500e-003** | **0.2315** | **0.0610** | **1.3300e-003** | **0.0623** | | **221.7487** | **221.7487** | **4.9600e-003** | | **221.8726** |

## 3.6 Paving - Fuel Station - 2021

**Unmitigated Construction On-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Off-Road | 1.2556 | 12.9191 | 14.6532 | 0.0228 | | 0.6777 | 0.6777 | | 0.6235 | 0.6235 | | 2,207.2109 | 2,207.2109 | 0.7139 | | 2,225.0573 |
| Paving | 2.7922 | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | | 0.0000 | | | 0.0000 |
| **Total** | **4.0477** | **12.9191** | **14.6532** | **0.0228** | | **0.6777** | **0.6777** | | **0.6235** | **0.6235** | | **2,207.2109** | **2,207.2109** | **0.7139** | | **2,225.0573** |

## 3.6 Paving - Fuel Station - 2021

### Unmitigated Construction Off-Site

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Hauling | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | | 0.0000 |
| Vendor | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | | 0.0000 |
| Worker | 0.0482 | 0.0282 | 0.3685 | 1.1900e-003 | 0.1232 | 7.8000e-004 | 0.1240 | 0.0327 | 7.1000e-004 | 0.0334 | | 118.7939 | 118.7939 | 2.6600e-003 | | 118.8603 |
| **Total** | **0.0482** | **0.0282** | **0.3685** | **1.1900e-003** | **0.1232** | **7.8000e-004** | **0.1240** | **0.0327** | **7.1000e-004** | **0.0334** | | **118.7939** | **118.7939** | **2.6600e-003** | | **118.8603** |

### Mitigated Construction On-Site

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Off-Road | 1.2556 | 12.9191 | 14.6532 | 0.0228 | | 0.6777 | 0.6777 | | 0.6235 | 0.6235 | 0.0000 | 2,207.2109 | 2,207.2109 | 0.7139 | | 2,225.0573 |
| Paving | 2.7922 | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | | 0.0000 | | | 0.0000 |
| **Total** | **4.0477** | **12.9191** | **14.6532** | **0.0228** | | **0.6777** | **0.6777** | | **0.6235** | **0.6235** | **0.0000** | **2,207.2109** | **2,207.2109** | **0.7139** | | **2,225.0573** |

## 3.6 Paving - Fuel Station - 2021

### Mitigated Construction Off-Site

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Hauling | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | | 0.0000 |
| Vendor | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | | 0.0000 |
| Worker | 0.0482 | 0.0282 | 0.3685 | 1.1900e-003 | 0.1232 | 7.8000e-004 | 0.1240 | 0.0327 | 7.1000e-004 | 0.0334 | | 118.7939 | 118.7939 | 2.6600e-003 | | 118.8603 |
| **Total** | **0.0482** | **0.0282** | **0.3685** | **1.1900e-003** | **0.1232** | **7.8000e-004** | **0.1240** | **0.0327** | **7.1000e-004** | **0.0334** | | **118.7939** | **118.7939** | **2.6600e-003** | | **118.8603** |

## 3.7 Paving - Rowland Blvd - 2021

### Unmitigated Construction On-Site

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Off-Road | 3.5459 | 37.6558 | 30.5107 | 0.0524 | | 1.8376 | 1.8376 | | 1.6906 | 1.6906 | | 5,079.1394 | 5,079.1394 | 1.6427 | | 5,120.2068 |
| Paving | 0.9307 | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | | 0.0000 | | | 0.0000 |
| **Total** | **4.4766** | **37.6558** | **30.5107** | **0.0524** | | **1.8376** | **1.8376** | | **1.6906** | **1.6906** | | **5,079.1394** | **5,079.1394** | **1.6427** | | **5,120.2068** |

## 3.7 Paving - Rowland Blvd - 2021

### Unmitigated Construction Off-Site

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Hauling | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | | 0.0000 |
| Vendor | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | | 0.0000 |
| Worker | 0.0482 | 0.0282 | 0.3685 | 1.1900e-003 | 0.1232 | 7.8000e-004 | 0.1240 | 0.0327 | 7.1000e-004 | 0.0334 | | 118.7939 | 118.7939 | 2.6600e-003 | | 118.8603 |
| **Total** | **0.0482** | **0.0282** | **0.3685** | **1.1900e-003** | **0.1232** | **7.8000e-004** | **0.1240** | **0.0327** | **7.1000e-004** | **0.0334** | | **118.7939** | **118.7939** | **2.6600e-003** | | **118.8603** |

### Mitigated Construction On-Site

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Off-Road | 3.5459 | 37.6558 | 30.5107 | 0.0524 | | 1.8376 | 1.8376 | | 1.6906 | 1.6906 | 0.0000 | 5,079.1394 | 5,079.1394 | 1.6427 | | 5,120.2068 |
| Paving | 0.9307 | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | | 0.0000 | | | 0.0000 |
| **Total** | **4.4766** | **37.6558** | **30.5107** | **0.0524** | | **1.8376** | **1.8376** | | **1.6906** | **1.6906** | **0.0000** | **5,079.1394** | **5,079.1394** | **1.6427** | | **5,120.2068** |

### 3.7 Paving - Rowland Blvd - 2021

**Mitigated Construction Off-Site**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Hauling | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | | 0.0000 |
| Vendor | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | | 0.0000 |
| Worker | 0.0482 | 0.0282 | 0.3685 | 1.1900e-003 | 0.1232 | 7.8000e-004 | 0.1240 | 0.0327 | 7.1000e-004 | 0.0334 | | 118.7939 | 118.7939 | 2.6600e-003 | | 118.8603 |
| **Total** | **0.0482** | **0.0282** | **0.3685** | **1.1900e-003** | **0.1232** | **7.8000e-004** | **0.1240** | **0.0327** | **7.1000e-004** | **0.0334** | | **118.7939** | **118.7939** | **2.6600e-003** | | **118.8603** |

## 4.0 Operational Detail - Mobile

### 4.1 Mitigation Measures Mobile

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Mitigated | 1.7975 | 5.8009 | 9.8902 | 0.0253 | 1.7196 | 0.0247 | 1.7443 | 0.4601 | 0.0231 | 0.4832 | | 2,561.3721 | 2,561.3721 | 0.1390 | | 2,564.8465 |
| Unmitigated | 1.7975 | 5.8009 | 9.8902 | 0.0253 | 1.7196 | 0.0247 | 1.7443 | 0.4601 | 0.0231 | 0.4832 | | 2,561.3721 | 2,561.3721 | 0.1390 | | 2,564.8465 |

## 4.2 Trip Summary Information

| | Average Daily Trip Rate | | | Unmitigated | Mitigated |
|---|---|---|---|---|---|
| Land Use | Weekday | Saturday | Sunday | Annual VMT | Annual VMT |
| Gasoline/Service Station | 1,404.76 | 1,404.76 | 1404.76 | 809,378 | 809,378 |
| Other Asphalt Surfaces | 0.00 | 0.00 | 0.00 | | |
| Parking Lot | 0.00 | 0.00 | 0.00 | | |
| Total | 1,404.76 | 1,404.76 | 1,404.76 | 809,378 | 809,378 |

## 4.3 Trip Type Information

| | Miles | | | Trip % | | | Trip Purpose % | | |
|---|---|---|---|---|---|---|---|---|---|
| Land Use | H-W or C-W | H-S or C-C | H-O or C-NW | H-W or C-W | H-S or C-C | H-O or C-NW | Primary | Diverted | Pass-by |
| Gasoline/Service Station | 9.50 | 7.30 | 7.30 | 2.00 | 79.00 | 19.00 | 14 | 27 | 59 |
| Other Asphalt Surfaces | 9.50 | 7.30 | 7.30 | 0.00 | 0.00 | 0.00 | 0 | 0 | 0 |
| Parking Lot | 9.50 | 7.30 | 7.30 | 0.00 | 0.00 | 0.00 | 0 | 0 | 0 |

## 4.4 Fleet Mix

| Land Use | LDA | LDT1 | LDT2 | MDV | LHD1 | LHD2 | MHD | HHD | OBUS | UBUS | MCY | SBUS | MH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Gasoline/Service Station | 0.575198 | 0.040076 | 0.193827 | 0.113296 | 0.016988 | 0.005361 | 0.017552 | 0.025197 | 0.002581 | 0.002349 | 0.005904 | 0.000881 | 0.000789 |
| Other Asphalt Surfaces | 0.575198 | 0.040076 | 0.193827 | 0.113296 | 0.016988 | 0.005361 | 0.017552 | 0.025197 | 0.002581 | 0.002349 | 0.005904 | 0.000881 | 0.000789 |
| Parking Lot | 0.575198 | 0.040076 | 0.193827 | 0.113296 | 0.016988 | 0.005361 | 0.017552 | 0.025197 | 0.002581 | 0.002349 | 0.005904 | 0.000881 | 0.000789 |

## 5.0 Energy Detail

Historical Energy Use: N

### 5.1 Mitigation Measures Energy

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| NaturalGas Mitigated | 2.8900e-003 | 0.0263 | 0.0221 | 1.6000e-004 | | 2.0000e-003 | 2.0000e-003 | | 2.0000e-003 | 2.0000e-003 | | 31.5340 | 31.5340 | 6.0000e-004 | 5.8000e-004 | 31.7214 |
| NaturalGas Unmitigated | 2.8900e-003 | 0.0263 | 0.0221 | 1.6000e-004 | | 2.0000e-003 | 2.0000e-003 | | 2.0000e-003 | 2.0000e-003 | | 31.5340 | 31.5340 | 6.0000e-004 | 5.8000e-004 | 31.7214 |

## 5.2 Energy by Land Use - NaturalGas

**Unmitigated**

| | NaturalGas Use | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Land Use | kBTU/yr | lb/day | | | | | | | | | | lb/day | | | | | |
| Gasoline/Service Station | 268.039 | 2.8900e-003 | 0.0263 | 0.0221 | 1.6000e-004 | | 2.0000e-003 | 2.0000e-003 | | 2.0000e-003 | 2.0000e-003 | | 31.5340 | 31.5340 | 6.0000e-004 | 5.8000e-004 | 31.7214 |
| Other Asphalt Surfaces | 0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Parking Lot | 0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| **Total** | | **2.8900e-003** | **0.0263** | **0.0221** | **1.6000e-004** | | **2.0000e-003** | **2.0000e-003** | | **2.0000e-003** | **2.0000e-003** | | **31.5340** | **31.5340** | **6.0000e-004** | **5.8000e-004** | **31.7214** |

**Mitigated**

| | NaturalGas Use | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Land Use | kBTU/yr | lb/day | | | | | | | | | | lb/day | | | | | |
| Gasoline/Service Station | 0.268039 | 2.8900e-003 | 0.0263 | 0.0221 | 1.6000e-004 | | 2.0000e-003 | 2.0000e-003 | | 2.0000e-003 | 2.0000e-003 | | 31.5340 | 31.5340 | 6.0000e-004 | 5.8000e-004 | 31.7214 |
| Other Asphalt Surfaces | 0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Parking Lot | 0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| **Total** | | **2.8900e-003** | **0.0263** | **0.0221** | **1.6000e-004** | | **2.0000e-003** | **2.0000e-003** | | **2.0000e-003** | **2.0000e-003** | | **31.5340** | **31.5340** | **6.0000e-004** | **5.8000e-004** | **31.7214** |

## 6.0 Area Detail

### 6.1 Mitigation Measures Area

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | lb/day | | | | | | | | | | lb/day | | | | | |
| Mitigated | 0.2526 | 3.9000e-004 | 0.0422 | 0.0000 | | 1.5000e-004 | 1.5000e-004 | | 1.5000e-004 | 1.5000e-004 | | 0.0901 | 0.0901 | 2.4000e-004 | | 0.0961 |
| Unmitigated | 0.2526 | 3.9000e-004 | 0.0422 | 0.0000 | | 1.5000e-004 | 1.5000e-004 | | 1.5000e-004 | 1.5000e-004 | | 0.0901 | 0.0901 | 2.4000e-004 | | 0.0961 |

## 6.2 Area by SubCategory

**Unmitigated**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SubCategory | lb/day | | | | | | | | | | lb/day | | | | | |
| Architectural Coating | 0.0486 | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | | 0.0000 | | | 0.0000 |
| Consumer Products | 0.2001 | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | | 0.0000 | | | 0.0000 |
| Landscaping | 3.9400e-003 | 3.9000e-004 | 0.0422 | 0.0000 | | 1.5000e-004 | 1.5000e-004 | | 1.5000e-004 | 1.5000e-004 | | 0.0901 | 0.0901 | 2.4000e-004 | | 0.0961 |
| **Total** | **0.2526** | **3.9000e-004** | **0.0422** | **0.0000** | | **1.5000e-004** | **1.5000e-004** | | **1.5000e-004** | **1.5000e-004** | | **0.0901** | **0.0901** | **2.4000e-004** | | **0.0961** |

**Mitigated**

| | ROG | NOx | CO | SO2 | Fugitive PM10 | Exhaust PM10 | PM10 Total | Fugitive PM2.5 | Exhaust PM2.5 | PM2.5 Total | Bio- CO2 | NBio- CO2 | Total CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SubCategory | lb/day | | | | | | | | | | lb/day | | | | | |
| Architectural Coating | 0.0486 | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | | 0.0000 | | | 0.0000 |
| Consumer Products | 0.2001 | | | | | 0.0000 | 0.0000 | | 0.0000 | 0.0000 | | | 0.0000 | | | 0.0000 |
| Landscaping | 3.9400e-003 | 3.9000e-004 | 0.0422 | 0.0000 | | 1.5000e-004 | 1.5000e-004 | | 1.5000e-004 | 1.5000e-004 | | 0.0901 | 0.0901 | 2.4000e-004 | | 0.0961 |
| **Total** | **0.2526** | **3.9000e-004** | **0.0422** | **0.0000** | | **1.5000e-004** | **1.5000e-004** | | **1.5000e-004** | **1.5000e-004** | | **0.0901** | **0.0901** | **2.4000e-004** | | **0.0961** |

## 7.0 Water Detail

### 7.1 Mitigation Measures Water

## 8.0 Waste Detail

### 8.1 Mitigation Measures Waste

## 9.0 Operational Offroad

| Equipment Type | Number | Hours/Day | Days/Year | Horse Power | Load Factor | Fuel Type |
|---|---|---|---|---|---|---|

## 10.0 Stationary Equipment

**Fire Pumps and Emergency Generators**

| Equipment Type | Number | Hours/Day | Hours/Year | Horse Power | Load Factor | Fuel Type |
|---|---|---|---|---|---|---|

**Boilers**

| Equipment Type | Number | Heat Input/Day | Heat Input/Year | Boiler Rating | Fuel Type |
|---|---|---|---|---|---|

**User Defined Equipment**

| Equipment Type | Number |
|---|---|

## 11.0 Vegetation

# N2O Operational GHG Emission Mobile Calculations

Novato Costco Fuel Station

| Vehicle Population Breakdown* | |
|---|---|
| 164213 | Gasoline vehicles |
| 12116 | Diesel vehicles |
| 93.1% | Gasoline vehicle % |
| 6.9% | Diesel vehicle % |

| VMT per Vehicle Type | |
|---|---|
| 809378 | Project VMT (CalEEMod output) |
| 753764 | Gasoline vehicle VMT |
| 55614 | Diesel vehicle VMT |

| Gasoline Vehicles | |
|---|---|
| 93.1% | Gasoline vehicle % |
| 0.8217 | Tons per year mobile NOX emissions (annual output in CalEEMod) |
| 0.77 | Gasoline vehicle tons per year NOX emissions |
| 0.0508 | Tons per year N2O emissions for gasoline vehicles** |
| 0.0461 | Metric tons per year N2O emissions for gasoline vehicles |

| Diesel Vehicles | |
|---|---|
| 1.60 | grams N2O per gallon of fuel for diesel vehicles** |
| 19.50 | Diesel average miles per gallon* |
| 0.08205 | grams per mile N2O for diesel vehicles |
| 4563.2 | grams per year N2O for diesel vehicles |
| 0.0045632 | Metric tons per year N2O emissions for diesel vehicles |

| CO2e Emissions from N2O | |
|---|---|
| 0.0506 | Metric tons per year from gasoline + diesel vehicles |
| 298 | GWP of N2O*** |
| **15.1** | **CO2e emissions per year from N2O emissions from gasoline + diesel vehicles** |

### Sources

***Vehicle population source:**
EMFAC2017 (v1.0.2) Emissions Inventory
Region Type: Air District
Region: BAY AREA AQMD
Calendar Year: 2030
Season: Annual
Vehicle Classification: EMFAC2011 Categories

****Methodology source:**
EMFAC2017 Volume III - Technical Documentation
https://www.arb.ca.gov/msei/emfac2011-faq.htm

*****GWP source:**
Intergovernmental Panel on Climate Change (IPCC). 2007.
AR4 Climate Change 2007: The Physical Science Basis.
Contrbution of Working Group I to the Fourth Assessment Report of the
Intergovernmental Panel on Climate Change.

# Appendix BIO

## Special-Status Species Table

## 20-09674: Novato Costco Fuel Center

| Scientific Name<br>Common Name | Status | Habitat Requirements | Potential to Occur in Project Area | Habitat Suitability/ Observations |
|---|---|---|---|---|
| **Plants and Lichens** | | | | |
| *Amsinckia lunaris*<br>bent-flowered fiddleneck | None/None<br>G3 / S3<br>1B.2 | Cismontane woodland, valley and foothill grassland, coastal bluff scrub. 3-795 m. annual herb. Blooms Mar-Jun | Very Low | No suitable habitat on either site |
| *Arabis blepharophylla*<br>coast rockcress | None/None<br>G4 / S4<br>4.3 | Broadleafed upland forest, coastal prairie, coastal scrub, coastal bluff scrub. Rocky sites. 3-1100 m. perennial herb. Blooms Feb-May | Very Low | No suitable habitat on either site |
| *Arctostaphylos montana* ssp. *montana*<br>Mt. Tamalpais manzanita | None/None<br>G3T3 / S3<br>1B.3 | Chaparral, valley and foothill grassland. Serpentine slopes in chaparral and grassland. 150-680 m. perennial evergreen shrub. Blooms Feb-Apr | Very Low | No suitable habitat on either site |
| *Calochortus umbellatus*<br>Oakland star-tulip | None/None<br>G3? / S3?<br>4.2 | Chaparral, lower montane coniferous forest, broadleafed upland forest, valley and foothill grassland, cismontane woodland. Often on serpentine. 100-700 m. perennial bulbiferous herb. Blooms Mar-May | Very Low | No suitable habitat on either site |
| *Castilleja ambigua* var. *ambigua*<br>johnny-nip | None/None<br>G4T4 / S3S4<br>4.2 | Coastal bluff scrub, coastal scrub, coastal prairie, marshes and swamps, valley and foothill grassland, vernal pool margins. 0-435 m. annual herb (hemiparasitic). Blooms Mar-Aug | Very Low | No suitable habitat on either site |
| *Chloropyron maritimum* ssp. *palustre*<br>Point Reyes salty bird's-beak | None/None<br>G4?T2 / S2<br>1B.2 | Coastal salt marsh. Usually in coastal salt marsh with Salicornia, Distichlis, Jaumea, Spartina, etc. 0-115 m. annual herb (hemiparasitic). Blooms Jun-Oct | Very Low | No suitable habitat on either site |
| *Elymus californicus*<br>California bottle-brush grass | None/None<br>G4 / S4<br>4.3 | North coast coniferous forest, cismontane woodland, broadleafed upland forest, riparian woodland. In sandy humus soils. 15-470 m. perennial herb. Blooms May-Aug(Nov) | Very Low | No suitable habitat on either site |
| *Eriogonum luteolum* var. *caninum*<br>Tiburon buckwheat | None/None<br>G5T2 / S2<br>1B.2 | Chaparral, valley and foothill grassland, cismontane woodland, coastal prairie. Serpentine soils; sandy to gravaelly sites. 0-700 m. annual herb. Blooms May-Sep | Very Low | No suitable habitat on either site |
| *Fritillaria liliacea*<br>fragrant fritillary | None/None<br>G2 / S2<br>1B.2 | Coastal scrub, valley and foothill grassland, coastal prairie, cismontane woodland. Often on serpentine; various soils reported though usually on clay, in grassland. 3-400 m. perennial bulbiferous herb. Blooms Feb-Apr | Very Low | No suitable habitat on either site |
| *Hemizonia congesta* ssp. *congesta*<br>congested-headed hayfield tarplant | None/None<br>G5T2 / S2<br>1B.2 | Valley and foothill grassland. Grassy valleys and hills, often in fallow fields; sometimes along roadsides. 20-560 m. annual herb. Blooms Apr-Nov | Very Low | No suitable habitat on either site |
| *Hesperolinon congestum*<br>Marin western flax | Threatened/Threatened<br>G1 / S1<br>1B.1 | Chaparral, valley and foothill grassland. In serpentine barrens and in serpentine grassland and chaparral. 60-370 m. annual herb. Blooms Apr-Jul | Very Low | No suitable habitat on either site |
| *Iris longipetala*<br>coast iris | None/None<br>G3 / S3<br>4.2 | Coastal prairie, lower montane coniferous forest, meadows and seeps. Mesic sites, heavy soils. 0-600 m. perennial rhizomatous herb. Blooms Mar-May | Very Low | No suitable habitat on either site |
| *Leptosiphon acicularis*<br>bristly leptosiphon | None/None<br>G4? / S4?<br>4.2 | Chaparral, cismontane woodland, coastal prairie, valley and foothill grassland. Grassy areas, woodland, chaparral. 55-1500 m. annual herb. Blooms Apr-Jul | Very Low | No suitable habitat on either site |
| *Lessingia hololeuca*<br>woolly-headed lessingia | None/None<br>G2G3 / S2S3<br>3 | Coastal scrub, lower montane coniferous forest, valley and foothill grassland, broadleafed upland forest. Clay, serpentine; roadsides, fields. 15-305 m. annual herb. Blooms Jun-Oct | Very Low | No suitable habitat on either site |
| *Lessingia micradenia* var. *micradenia*<br>Tamalpais lessingia | None/None<br>G2T2 / S2<br>1B.2 | Chaparral, valley and foothill grassland. Usually on serpentine, in serpentine grassland or serpentine chaparral. Often on roadsides. 60-305 m. annual herb. Blooms (Jun)Jul-Oct | Very Low | No suitable habitat on either site |
| *Micropus amphibolus*<br>Mt. Diablo cottonweed | None/None<br>G3G4 / S3S4<br>3.2 | Valley and foothill grassland, cismontane woodland, chaparral, broadleafed upland forest. Bare, grassy or rocky slopes. 45-825 m. annual herb. Blooms Mar-May | Very Low | No suitable habitat on either site |
| *Ranunculus lobbii*<br>Lobb's aquatic buttercup | None/None<br>G4 / S3<br>4.2 | Cismontane woodland, valley and foothill grassland, vernal pools, north coast coniferous forest. Mesic sites. 15-470 m. annual herb (aquatic). Blooms Feb-May | Very Low | No suitable habitat on either site |

**20-09674: Novato Costco Fuel Center**

| Scientific Name<br>Common Name | Status | Habitat Requirements | Potential to Occur in Project Area | Habitat Suitability/<br>Observations |
|---|---|---|---|---|
| **Plants and Lichens** | | | | |
| *Ribes victoris*<br>Victor's gooseberry | None/None<br>G3G4 / S3S4<br>4.3 | Broadleafed upland forest, chaparral. Wooded slopes in shaded canyons. 100-750 m. perennial deciduous shrub. Blooms Mar-Apr | Very Low | No suitable habitat on either site |
| *Streptanthus glandulosus* ssp. *pulchellus*<br>Mt. Tamalpais bristly jewelflower | None/None<br>G4T2 / S2<br>1B.2 | Chaparral, valley and foothill grassland. Serpentine slopes. 125-670 m. annual herb. Blooms May-Jul(Aug) | Very Low | No suitable habitat on either site |
| **Invertebrates** | | | | |
| *Adela oplerella*<br>Opler's longhorn moth | None/None<br>G2 / S2 | From Marin County and the Oakland area on the inner coast ranges south to Santa Clara County. One record from Santa Cruz County. All but Santa Cruz site is on serpentine grassland. Larvae feed on Platystemon californicus. | Very Low | No suitable habitat on either site |
| *Bombus caliginosus*<br>obscure bumble bee | None/None<br>G4? / S1S2 | Coastal areas from Santa Barabara county to north to Washington state. Food plant genera include Baccharis, Cirsium, Lupinus, Lotus, Grindelia and Phacelia. | Very Low | No suitable habitat on either site |
| *Bombus occidentalis*<br>western bumble bee | None/Candidate Endangered<br>G2G3 / S1 | Once common & widespread, species has declined precipitously from central CA to southern B.C., perhaps from disease. | Very Low | No suitable habitat on either site |
| *Calicina diminua*<br>Marin blind harvestman | None/None<br>G1 / S1 | Known only from the type locality, Mount Burdell, Novato, Marin County. Known only from the type series. Serpentine endemic. | Very Low | No suitable habitat on either site |
| *Talanites ubicki*<br>Ubick's gnaphosid spider | None/None<br>G1 / S1 | Known only from the type locality, Mount Burdell, Novato, Marin County. Serpentine endemic. | Very Low | No suitable habitat on either site |
| *Tryonia imitator*<br>mimic tryonia (=California brackishwater snail) | None/None<br>G2 / S2 | Inhabits coastal lagoons, estuaries and salt marshes, from Sonoma County south to San Diego County. Found only in permanently submerged areas in a variety of sediment types; able to withstand a wide range of salinities. | Very Low | No suitable habitat on either site |
| *Vespericola marinensis*<br>Marin hesperian | None/None<br>G2 / S2 | Found in moist spots in coastal brushfield and chaparral vegetation in Marin County. Under leaves of cow-parsnip, around spring seeps, in leafmold along streams, in alder woods and mixed evergreen forest. | Very Low | No suitable habitat on either site |
| **Fish** | | | | |
| *Eucyclogobius newberryi*<br>tidewater goby | Endangered/None<br>G3 / S3<br>SSC | Brackish water habitats along the California coast from Agua Hedionda Lagoon, San Diego County to the mouth of the Smith River. Found in shallow lagoons and lower stream reaches, they need fairly still but not stagnant water and high oxygen levels. | Very Low | No suitable habitat on either site |
| *Oncorhynchus mykiss irideus pop. 8*<br>steelhead - central California coast DPS | Threatened/None<br>G5T2T3Q / S2S3 | From Russian River, south to Soquel Creek and to, but not including, Pajaro River. Also San Francisco and San Pablo Bay basins. | Very Low | No suitable habitat on either site |
| *Spirinchus thaleichthys*<br>longfin smelt | Candidate/Threatened<br>G5 / S1 | Euryhaline, nektonic & anadromous. Found in open waters of estuaries, mostly in middle or bottom of water column. Prefer salinities of 15-30 ppt, but can be found in completely freshwater to almost pure seawater. | Very Low | No suitable habitat on either site |
| **Amphibians** | | | | |
| *Dicamptodon ensatus*<br>California giant salamander | None/None<br>G3 / S2S3<br>SSC | Known from wet coastal forests near streams and seeps from Mendocino County south to Monterey County, and east to Napa County. Aquatic larvae found in cold, clear streams, occasionally in lakes and ponds. Adults known from wet forests under rocks and logs near streams and lakes. | Very Low | No suitable habitat on either site |
| *Rana boylii*<br>foothill yellow-legged frog | None/Candidate Threatened<br>G3 / S3<br>SSC | Partly-shaded, shallow streams and riffles with a rocky substrate in a variety of habitats. Needs at least some cobble-sized substrate for egg-laying. Needs at least 15 weeks to attain metamorphosis. | Very Low | No suitable habitat on either site |
| *Rana draytonii*<br>California red-legged frog | Threatened/None<br>G2G3 / S2S3<br>SSC | Lowlands and foothills in or near permanent sources of deep water with dense, shrubby or emergent riparian vegetation. Requires 11-20 weeks of permanent water for larval development. Must have access to estivation habitat. | Very Low | No suitable habitat on either site |
| **Reptiles** | | | | |

**20-09674: Novato Costco Fuel Center**

| Scientific Name<br>Common Name | Status | Habitat Requirements | Potential to Occur in Project Area | Habitat Suitability/ Observations |
|---|---|---|---|---|
| **Plants and Lichens** | | | | |
| *Emys marmorata*<br>western pond turtle | None/None<br>G3G4 / S3<br>SSC | A thoroughly aquatic turtle of ponds, marshes, rivers, streams and irrigation ditches, usually with aquatic vegetation, below 6000 ft elevation. Needs basking sites and suitable (sandy banks or grassy open fields) upland habitat up to 0.5 km from water for egg-laying. | Very Low | No suitable habitat on either site |
| **Birds** | | | | |
| *Ardea alba*<br>great egret | None/None<br>G5 / S4 | Colonial nester in large trees. Rookery sites located near marshes, tide-flats, irrigated pastures, and margins of rivers and lakes. | Very Low | No suitable habitat on either site |
| *Ardea herodias*<br>great blue heron | None/None<br>G5 / S4 | Colonial nester in tall trees, cliffsides, and sequestered spots on marshes. Rookery sites in close proximity to foraging areas: marshes, lake margins, tide-flats, rivers and streams, wet meadows. | Very Low | No suitable habitat on either site |
| *Asio flammeus*<br>short-eared owl | None/None<br>G5 / S3<br>SSC | Found in swamp lands, both fresh and salt; lowland meadows; irrigated alfalfa fields. Tule patches/tall grass needed for nesting/daytime seclusion. Nests on dry ground in depression concealed in vegetation. | Very Low | No suitable habitat on either site |
| *Athene cunicularia*<br>burrowing owl | None/None<br>G4 / S3<br>SSC | Open, dry annual or perennial grasslands, deserts, and scrublands characterized by low-growing vegetation. Subterranean nester, dependent upon burrowing mammals, most notably, the California ground squirrel. | Very Low | No suitable habitat on either site |
| *Charadrius alexandrinus nivosus*<br>western snowy plover | Threatened/None<br>G3T3 / S2S3<br>SSC | Sandy beaches, salt pond levees & shores of large alkali lakes. Needs sandy, gravelly or friable soils for nesting. | Very Low | No suitable habitat on either site |
| *Circus hudsonius*<br>northern harrier | None/None<br>G5 / S3<br>SSC | Breed in open habitats such as tundra, prairie grassland, fields, and marshes. Nests concealed in ground by grasses or wetland vegetation. | Very Low | No suitable habitat on either site |
| *Contopus cooperi*<br>olive-sided flycatcher | None/None<br>G4 / S4<br>SSC | Nesting habitats are mixed conifer, montane hardwood-conifer, Douglas-fir, redwood, red fir & lodgepole pine. Most numerous in montane conifer forests where tall trees overlook canyons, meadows, lakes or other open terrain. | Very Low | No suitable habitat on either site |
| *Egretta thula*<br>snowy egret | None/None<br>G5 / S4 | Colonial nester, with nest sites situated in protected beds of dense tules. Rookery sites situated close to foraging areas: marshes, tidal-flats, streams, wet meadows, and borders of lakes. | Very Low | No suitable habitat on either site |
| *Elanus leucurus*<br>white-tailed kite | None/None<br>G5 / S3S4<br>FP | Rolling foothills and valley margins with scattered oaks & river bottomlands or marshes next to deciduous woodland. Open grasslands, meadows, or marshes for foraging close to isolated, dense-topped trees for nesting and perching. | Very Low | No suitable habitat on either site |
| *Geothlypis trichas sinuosa*<br>saltmarsh common yellowthroat | None/None<br>G5T3 / S3<br>SSC | Resident of the San Francisco Bay region, in fresh and salt water marshes. Requires thick, continuous cover down to water surface for foraging; tall grasses, tule patches, willows for nesting. | Very Low | No suitable habitat on either site |
| *Laterallus jamaicensis coturniculus*<br>California black rail | None/Threatened<br>G3G4T1 / S1<br>FP | Inhabits freshwater marshes, wet meadows and shallow margins of saltwater marshes bordering larger bays. Needs water depths of about 1 inch that do not fluctuate during the year and dense vegetation for nesting habitat. | Very Low | No suitable habitat on either site |
| *Melospiza melodia samuelis*<br>San Pablo song sparrow | None/None<br>G5T2 / S2<br>SSC | Resident of salt marshes along the north side of San Francisco and San Pablo bays. Inhabits tidal sloughs in the Salicornia marshes; nests in Grindelia bordering slough channels. | Very Low | No suitable habitat on either site |
| *Nycticorax nycticorax*<br>black-crowned night heron | None/None<br>G5 / S4 | Colonial nester, usually in trees, occasionally in tule patches. Rookery sites located adjacent to foraging areas: lake margins, mud-bordered bays, marshy spots. | Very Low | On-site trees not suitable for nesting |
| *Rallus obsoletus obsoletus*<br>California Ridgway's rail | Endangered/Endangered<br>G5T1 / S1<br>FP | Salt water and brackish marshes traversed by tidal sloughs in the vicinity of San Francisco Bay. Associated with abundant growths of pickleweed, but feeds away from cover on invertebrates from mud-bottomed sloughs. | Very Low | No suitable habitat on either site |
| *Strix occidentalis caurina*<br>northern spotted owl | Threatened/Threatened<br>G3T3 / S2S3 | Old-growth forests or mixed stands of old-growth and mature trees. Occasionally in younger forests with patches of big trees. High, multistory canopy dominated by big trees, many trees with cavities or broken tops, woody debris, and space under canopy. | Very Low | No suitable habitat on either site |
| **Mammals** | | | | |

| 20-09674: Novato Costco Fuel Center | | | | |
|---|---|---|---|---|
| **Scientific Name<br>Common Name** | **Status** | **Habitat Requirements** | **Potential to Occur in Project Area** | **Habitat Suitability/ Observations** |
| **Plants and Lichens** | | | | |
| *Antrozous pallidus*<br>pallid bat | None/None<br>G5 / S3<br>SSC | Deserts, grasslands, shrublands, woodlands and forests. Most common in open, dry habitats with rocky areas for roosting. Roosts must protect bats from high temperatures. Very sensitive to disturbance of roosting sites. | Very Low | No suitable habitat on either site |
| *Corynorhinus townsendii*<br>Townsend's big-eared bat | None/None<br>G3G4 / S2<br>SSC | Throughout California in a wide variety of habitats. Most common in mesic sites. Roosts in the open, hanging from walls and ceilings. Roosting sites limiting. Extremely sensitive to human disturbance. | Very Low | No suitable habitat on either site |
| *Reithrodontomys raviventris*<br>salt-marsh harvest mouse | Endangered/Endangered<br>G1G2 / S1S2<br>FP | Only in the saline emergent wetlands of San Francisco Bay and its tributaries. Pickleweed is primary habitat, but may occur in other marsh vegetation types and in adjacent upland areas. Does not burrow; builds loosely organized nests. Requires higher areas for flood escape. | Very Low | No suitable habitat on either site |
| **Sensitive Natural Communities** | | | | |
| *Coastal Brackish Marsh*<br>Coastal Brackish Marsh | None/None<br>G2 / S2.1 | | Very Low | No habitat on either site |
| *Northern Coastal Salt Marsh*<br>Northern Coastal Salt Marsh | None/None<br>G3 / S3.2 | | Very Low | No habitat on either site |

# Appendix CRS

Cultural Resources Study (Confidential)

# CONFIDENTIAL APPENDIX

**To protect sensitive information about the location and nature of cultural resources, this appendix is not included in the public draft of this document.

# Appendix EN

## Fuel Consumption Calculations

# Costco Fuel Center Project

Last Updated: September 21, 2020

Compression-Ignition Engine Brake-Specific Fuel Consumption (BSFC) Factors **[1]**:

| | | | |
|---|---|---|---|
| HP: 0 to 100 | 0.0588 | HP: Greater than 100 | 0.0529 |

*Values above are expressed in gallons per horsepower-hour/BSFC.*

**CONSTRUCTION EQUIPMENT**

| Construction Equipment | # | Hours per Day | Horsepower | Load Factor | Construction Phase | Fuel Used (gallons) |
|---|---|---|---|---|---|---|
| Concrete/Industrial Saws | 1 | 8 | 81 | 0.73 | Site Prep | 277.98 |
| Excavators | 3 | 8 | 158 | 0.38 | Site Prep | 761.68 |
| Rubber Tired Dozer | 2 | 8 | 247 | 0.40 | Site Prep | 835.59 |
| Tractors/Loaders/Backhoes | 4 | 8 | 97 | 0.37 | Site Prep | 674.90 |
| Graders | 1 | 8 | 187 | 0.41 | Grading | 648.43 |
| Excavators | 1 | 8 | 158 | 0.38 | Grading | 507.78 |
| Rubber Tired Dozer | 3 | 8 | 247 | 0.40 | Grading | 2,506.78 |
| Tractors/Loaders/Backhoes | 4 | 8 | 97 | 0.37 | Grading | 1,349.79 |
| Cranes | 2 | 7 | 231 | 0.29 | Building | 3,866.80 |
| Forklifts | 6 | 8 | 89 | 0.20 | Building | 3,916.24 |
| Generator Sets | 2 | 8 | 84 | 0.74 | Building | 4,558.67 |
| Tractors/Loaders/Backhoes | 6 | 7 | 97 | 0.37 | Building | 6,909.24 |
| Welders | 2 | 8 | 46 | 0.45 | Building | 1,518.09 |
| Air Compressors | 1 | 6 | 78 | 0.48 | Arch Coating | 831.65 |
| Excavators | 1 | 8 | 158 | 0.38 | Paving | 710.90 |
| Graders | 1 | 8 | 187 | 0.41 | Paving | 907.80 |
| Pavers | 4 | 8 | 130 | 0.42 | Paving | 2,585.95 |
| Paving Equipment | 4 | 8 | 132 | 0.36 | Paving | 2,250.63 |
| Rollers | 4 | 8 | 80 | 0.38 | Paving | 1,600.64 |
| Rubber Tired Dozer | 1 | 8 | 247 | 0.40 | Paving | 1,169.83 |
| Tractors/Loaders/Backhoes | 3 | 8 | 97 | 0.37 | Paving | 1,417.28 |
| | | | | | **Total Fuel Used** | **39,806.66** |
| | | | | | | **(Gallons)** |

| Construction Phase | Days of Operation |
|---|---|
| Site Preparation Phase | 10 |
| Grading Phase | 20 |
| Building Construction Phase | 78 |
| Paving Phase | 28 |
| Architectural Coating Phase | 63 |
| Total Days | 199 |

## WORKER TRIPS

| Constuction Phase | MPG [2] | Trips | Trip Length (miles) | Fuel Used (gallons) |
|---|---|---|---|---|
| Site Prep Phase | 24.4 | 15 | 10.8 | 66.39 |
| Grading Phase | 24.4 | 18 | 10.8 | 159.34 |
| Building Phase | 24.4 | 138 | 10.8 | 4764.39 |
| Paving Phase | 24.4 | 30 | 10.8 | 371.80 |
| Architectural Coating Phase | 24.4 | 28 | 10.8 | 780.79 |
| | | | **Total** | **6,142.72** |

## HAULING AND VENDOR TRIPS

| Trip Class | MPG [2] | Trips | Trip Length (miles) | Fuel Used (gallons) |
|---|---|---|---|---|
| **HAULING TRIPS** | | | | |
| Site Prep Phase | 7.5 | 0 | 20.0 | 0.00 |
| Grading Phase | 7.5 | 0 | 20.0 | 0.00 |
| Building Phase | 7.5 | 0 | 20.0 | 0.00 |
| Paving Phase | 7.5 | 0 | 20.0 | 0.00 |
| Architectural Coating Phase | 7.5 | 0 | 20.0 | 0.00 |
| | | | **Total** | **-** |
| **VENDOR TRIPS** | | | | |
| Site Prep Phase | 7.5 | 0 | 7.3 | 0.00 |
| Grading Phase | 7.5 | 0 | 7.3 | 0.00 |
| Building Phase | 7.5 | 54 | 7.3 | 4099.68 |
| Paving Phase | 7.5 | 0 | 7.3 | 0.00 |
| Architectural Coating Phase | 7.5 | 0 | 7.3 | 0.00 |
| | | | **Total** | **4,099.68** |

| | |
|---|---|
| **Total Gasoline Consumption (gallons)** | **6,142.72** |
| **Total Diesel Consumption (gallons)** | **43,906.34** |

**Sources:**

**[1]** United States Environmental Protection Agency. 2018. *Exhaust and Crankcase Emission Factors for Nonroad Compression-Ignition Engines in MOVES2014b* . July 2018. Available at: https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100UXEN.pdf.

**[2]** United States Department of Transportation, Bureau of Transportation Statistics. 2020. *National Transportation Statistics* . Available at: https://www.bts.gov/topics/national-transportation-statistics.

# Appendix FP

## Costco Wholesale Fueling Facility Program

BARGHAUSEN

# GENERAL INFORMATION

## Costco Wholesale
## Fueling Facility Program

300 Vintage Way
Novato, California 94945

Costco Loc. No. 141
APN No. 153-340-36

Prepared for:
Costco Wholesale
999 Lake Drive
Issaquah, WA 98027

August 19, 2020
Our Job No. 7785

## Introduction

The Costco Gasoline fueling facility component to this Costco Wholesale development will include equipment of the latest technology, with many safety features to prevent potential environmental impacts, designed in accordance with local, state, and federal requirements, and will be installed by State Certified Installation Contractors according to specific construction guidelines and requirements. Below are some of the operational and design features that provide exceptional environmental safeguards.

## Operational Features

1. The Costco Gasoline fueling facility is designed to operate as an unattended self-serve facility. However, Costco Wholesale's policy is to provide a Costco Gasoline Program trained employee and supervisor at the site during all hours of operation. The Costco Gasoline training program includes an interactive test that all gasoline employees must pass before working at a Costco Gasoline facility.

2. The Costco Gasoline fueling facility is designed to operate as an unattended self-serve facility. However, Costco Wholesale's policy is to provide a Costco Gasoline Program trained employee and supervisor at the site during all hours of operation. The Costco Gasoline training program includes an interactive test that all gasoline employees must pass before working at a Costco Gasoline facility.

3. In addition to the above-mentioned employee, the facility is supported by senior management in the Warehouse during all gasoline station operation hours. The supervisor will be equipped with a roam telephone programmed to receive calls from the fueling facility and Warehouse. Every gasoline facility is equipped with a "911" telephone that automatically contacts emergency dispatch in addition to a regular telephone line and roam phones.

4. Employees are trained to identify maintenance requirements and physically inspect the fuel islands regularly during operating hours. Their training includes the proper spill clean up and emergency response procedures. Trained employees check for leaking hoses, malfunctioning nozzles, fuel spills, and physical damage to the dispensers and controller enclosure. During non-operating hours, the power to the dispensers is turned off and each nozzle pad is locked. Should the system require attention beyond what the trained site person could handle, the local authorized and certified service contractor would be contacted and dispatched to repair the equipment.

5. Emergency shutoff switches are installed next to the controller enclosure and in locations near the dispensers, as dictated by the fire code.

6. Closed circuit television monitor cameras aimed to show all fueling positions, the tank slab, and equipment enclosure are mounted on canopy columns adjacent to the fuel islands. A split screen monitor located in the Costco Warehouse allows for full-time monitoring of the fueling operation. All images are recorded by the camera system.

7. The tank and piping monitoring system is programmed to activate visual/audible alarms in the event of an alarm condition. A visual/audible alarm is located on the outside of the controller enclosure and a visual/audible alarm is located in the Costco Warehouse entry/exit area. Further, the monitoring system is designed so that if power is lost to the monitoring console the facility is shut down and will not operate.

8. An independent security company monitors the Costco Warehouse alarm system. The alarm system acknowledges an alarm condition at the fueling facility and notifies Costco Wholesale management staff of an alarm condition should it occur after operating hours.

## Design Features

1. Costco Wholesale's tank and piping system is certified to meet the Federal UST leak detection standards of 95 percent probability of detection and five percent probability of false alarm. California State Water Resources Control Board also certifies the system under LG-113.

2. Costco Wholesale utilizes one of the most durable joint sealers available today to seal the concrete control joints. PTi sealer is a petroleum-resistant sealant developed by Prevention Technologies, Inc (PTi). The sealer is used to prevent petroleum products from entering the underlying soil at the concrete joints. This product is used for its superior elasticity and user-friendly application. The elasticity allows the product to maintain a tight seal even with concrete expansion. The easy application ensures a proper seal whether it is applied by a contractor or maintenance personnel. Costco Wholesale is one of the few, if not only companies, to have a nationwide standard to seal control joints and other areas to prevent product spills from reaching the soil.

3. The storm drainage system for the fueling facility area will be designed in accordance with State of California Best Management Practices for water quality treatment standards. Stormwater from the fueling area will be isolated and will be directed to a catch basin and processed through an oil/water separator prior to discharge to the downstream system.

4. The underground tank and piping control units are housed inside the controller enclosure. The enclosure will contain the power console, the dispenser interface unit, the submersible pump variable speed controllers, and the monitoring system console. An air conditioner mounted on the side of the enclosure will have a preset thermostat to maintain a safe operating temperature.

5. The USTs and all containment sumps, including the dispenser sumps are all double-walled fiberglass. Fiberglass is used for its corrosion resistance and plasticity. The double-walled storage tank system includes a hydrostatic interstitial space sensor that monitors the primary and secondary tank walls. If a tank wall is compromised, the interstitial sensor will immediately shut down the product delivery system and activate a visual/audible alarm.

6. The tanks are secured in place with anchoring straps (tie-downs) connected to concrete hold down deadmen. The entire tank excavation hole is backfilled with pea gravel and capped with an 8-inch-thick reinforced concrete slab (overburden). The tie-downs, together with the overburden, overcome any possible buoyancy factors and resist buckling under hydrostatic pressures. Please see the attached exhibit illustrating the anchoring system.

7. All product, vapor and vent piping is non-corrosive and provides three levels of protection. First, all product piping is monitored with pressure line leak detection. Second, all piping is double wall to provide secondary containment. Third, all fiberglass piping is additionally monitored under vacuum per California 2481 regulations such that if a breach is detected in the vacuum, the product delivery system will shut down and system will sound audible alarm.

8. All piping connections to the tanks and dispensers are flexible. Flexible connectors are used to prevent rupture from any form of ground movement.

9. All piping slopes to the sumps at the USTs. If a piping leak occurs, the gasoline will flow through the secondary pipe to the sump, where a sensor is triggered to immediately shut down the system and activate an audible/visual alarm.

10. All tanks and dispensers are equipped with latest Phase I and Phase II Enhanced Vapor Recovery (EVR) vapor recovery air pollution control equipment technology per CARB regulations and associated Executive Orders. The Phase I EVR equipment controls the vapors

in the return path from the tanks back to the tanker truck during offloading filling operations. The Stage I EVR systems are 98 percent effective in controlling fugitive emissions from escaping into the environment. The Phase II EVR equipment controls the vapors in the return path from the vehicles back to the tanks and are 95 percent effective in controlling fugitive emissions from escaping into the environment.

11. The UST monitoring system incorporates automatic shutoffs. If gasoline is detected in the sump at the fuel dispenser, the dispenser shuts down automatically and an alarm is sounded. If a problem is detected with a tank, the tank is automatically shut down and an alarm is sounded. If the product piping system detects a failure of the 0.1 gallons per hour (GPH) test, the line is automatically shut down and the alarm is sounded. Pursuant to federal requirements, monitoring equipment must be able to detect a minimum leak of 3 GPH (equivalent to the accuracy of a mechanical leak detector). By providing monitoring to a higher standard (0.1 vs. 3), Costco maintains a higher degree of safety than required by current federal requirements.

12. Each fuel dispenser includes several safety devices. Specifically, each dispenser sump is equipped with an automatic shutoff valve to protect against vehicle impact. In addition, each fuel hose includes a poppeted breakaway device that will stop the flow of fuel at both ends of the hose in the event of an accidental drive-off. Also, each dispenser is equipped with internal fire extinguishers. Lastly, all dispensers include leak detection sensors connected to the alarm console inside the controller enclosure.

## Regulatory Agencies and Regulations

As described above, the Costco Wholesale retail fueling facility provides a significant number of features to reduce and control the potential for environmental health hazards. All systems to be installed are of the latest technology and meet or exceed all local, state, and federal regulations.

The following is a list of regulations and agencies that govern gasoline facilities and require specific permits or approvals. This list shows the magnitude of the regulatory environment that governs this industry.

1. California Fire Code, Chapters 22 and 34

2. California Code of Regulations Title 23, Division 3, Chapter 16 ("California Underground Storage Tank Regulations")

3. California Health and Safety Code, Chapter 6.7 ("Underground Storage of Hazardous Substances")

4. Environmental Protection Agency (EPA) Underground Storage Tank Regulations (Subpart D, 40 Code of Federal Regulations (CFR) Part 280)

5. Underwriters Laboratories, Inc. (UL)

6. National Fire Protection Agency (NFPA) Articles 30 and 30A, regarding Flammable and Combustible Liquids Code

7. American Petroleum Institute (API) Recommended Practices for Installation of Underground Storage Systems

8. California Air Resources Board (CARB) Executive Orders and Procedures and Local Air Quality Management District Regulations

9. Local County Environmental Health Hazardous Materials Division, CUPA, which provides enforcement of the State Water Resources Control Board (SWRCB) Regulations

# Appendix NOI

RCNM Calculations

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 9/21/2020
Case Descriptio Novato Costco - Grading

---- Receptor #1 ----

| | | Baselines (dBA) | | |
|---|---|---|---|---|
| Description | Land Use | Daytime | Evening | Night |
| Residences acr | Residential | 65 | 65 | 65 |

| | | | | Equipment | | | |
|---|---|---|---|---|---|---|---|
| | | | | Spec | Actual | Receptor | Estimated |
| | | Impact | | Lmax | Lmax | Distance | Shielding |
| Description | | Device | Usage(%) | (dBA) | (dBA) | (feet) | (dBA) |
| Backhoe | | No | 40 | | 77.6 | 580 | 0 |
| Excavator | | No | 40 | | 80.7 | 580 | 0 |
| Dozer | | No | 40 | | 81.7 | 580 | 0 |

| | | | | Results | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Calculated (dBA) | | | Noise Limits (dBA) | | | | | | Noise Limit Exceedance (dBA) | | | | |
| | | | | Day | | Evening | | Night | | Day | | Evening | | Night | |
| Equipment | | *Lmax | Leq | Lmax | Leq | Lmax | Leq | Lmax | Leq | Lmax | Leq | Lmax | Leq | Lmax | Leq |
| Backhoe | | 56.3 | 52.3 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Excavator | | 59.4 | 55.4 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Dozer | | 60.4 | 56.4 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | Total | 60.4 | 59.8 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

*Calculated Lmax is the Loudest value.

---- Receptor #2 ----

| | | Baselines (dBA) | | |
|---|---|---|---|---|
| Description | Land Use | Daytime | Evening | Night |
| Vintage Oaks S | Commercial | 65 | 65 | 65 |

| | | | | Equipment | | | |
|---|---|---|---|---|---|---|---|
| | | | | Spec | Actual | Receptor | Estimated |
| | | Impact | | Lmax | Lmax | Distance | Shielding |
| Description | | Device | Usage(%) | (dBA) | (dBA) | (feet) | (dBA) |
| Backhoe | | No | 40 | | 77.6 | 160 | 0 |
| Excavator | | No | 40 | | 80.7 | 160 | 0 |
| Dozer | | No | 40 | | 81.7 | 160 | 0 |

| | | | | Results | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Calculated (dBA) | | | Noise Limits (dBA) | | | | | | Noise Limit Exceedance (dBA) | | | | |
| | | | | Day | | Evening | | Night | | Day | | Evening | | Night | |
| Equipment | | *Lmax | Leq | Lmax | Leq | Lmax | Leq | Lmax | Leq | Lmax | Leq | Lmax | Leq | Lmax | Leq |
| Backhoe | | 67.5 | 63.5 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Excavator | | 70.6 | 66.6 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Dozer | | 71.6 | 67.6 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | Total | 71.6 | 71 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

*Calculated Lmax is the Loudest value.

# Appendix OPS

Focused Operations Analysis

December 4, 2020

Mr. Chris Blunk, PE
City of Novato Public Works
922 Machin Avenue
Novato, CA 94945

# Rowland Boulevard Focused Operational Analysis

Dear Mr. Blunk;

This letter summarizes the findings of a focused operational analysis completed for the Rowland Boulevard corridor in the City of Novato. The intent of the assessment was to determine potential improvements that can be made within the existing public right-of-way to maintain traffic flow and reduce queuing issues as traffic growth occurs, particularly on the roadway segment between US 101 and Vintage Way North which already encounters inefficient operation during peak periods. The analysis focuses on future conditions with buildout of potential projects in the vicinity including Hanna Ranch, conversion of a retail use to a fast-casual restaurant in the Vintage Oaks shopping center, and the proposed Costco Fuel Station. The future traffic volumes used in the analysis were obtained from the draft *Costco Gasoline Fuel Station Addition Transportation Impact Analysis*, Kittelson & Associates, November 2020 (referred to herein as the Costco Fuel Station TIS).

## Background

As indicated in the Costco Fuel Station TIS, queues on westbound Rowland Boulevard between Rowland Way and Vintage Way North currently exceed the available storage during the weekend midday peak periods. Observations also indicate poor lane utilization on both this segment and the adjacent segment between Rowland Way and the US 101 North Ramps, with the inside lane heavily utilized and the center and outside lanes underutilized. Blockages also occasionally occur in the center lane as drivers attempt to merge into the inside lane. This pattern is attributable to the large volumes of drivers destined to US 101 South; while the intersection at Rowland Boulevard/US 101 South has dual westbound left-turn lanes, drivers need to be positioned in the inside lane on the upstream Rowland Boulevard segment to reach them. The Costco Fuel Station TIS identified that this queueing constraint can be expected to worsen in the future.

## Approach

In order to best assess the corridor's constraints related to lane utilization and closely-spaced signals, the traffic simulation software Simtraffic was used. Simtraffic is a simulation-based extension of the Synchro software application, which is commonly used in traffic operational studies and incorporates signal timing and coordination parameters. Simtraffic also adds a driver behavior component to the operational analysis, recognizing that drivers often position their vehicles in certain lanes well upstream of an intersection, and that there is a diverse mix of driver types on the road. The results of ten randomly-seeded Simtraffic runs were used to determine 95th percentile queues for each lane at the study intersections. Simtraffic also produces an "upstream blockage time" metric that reflects the percent of time that vehicle queues fully utilize the available storage in a lane and preclude additional drivers from entering the lane even when the signal is green. This additional indicator was used in the analysis as it is reflective of observed queuing conditions on Rowland Boulevard, particularly on the westbound segment between Rowland Way and Vintage Way North.

The applied Synchro and Simtraffic models include the intersections on Rowland Boulevard at Redwood Boulevard, US 101 South Ramps, US 101 North Ramps, Rowland Way, and Vintage Way North. Time periods analyzed include the weekday p.m. peak hour and weekend midday peak hour. The results described below generally focus on constrained segments and movements, with full calculation sheets reflecting all locations enclosed for reference. It is noted that the queuing and Level of Service (LOS) calculations shown may differ from those contained in the Costco Fuel Station TIS; this is to be expected as the current analysis is based on traffic simulation while the Costco Fuel Station TIS was based on *Highway Capacity Manual* (HCM) methodologies and formulas.

## Findings

Following are the key findings of the assessment. Tabular summaries of the data are provided at the end of this section, and calculation sheets are enclosed.

- With no modifications, under future volumes the corridor can be expected to experience substantial queuing and delays during one or both peak hours. Specific areas of concern at individual intersections on Rowland Boulevard include:
    - US 101 South Ramps – deficient LOS E operation
    - US 101 North Ramps – adverse queuing on the westbound Rowland Boulevard approach
    - Rowland Way – adverse queuing on the eastbound and westbound Rowland Boulevard approaches
    - Vintage Way North – adverse queuing on the eastbound Rowland Boulevard and northbound Vintage Way approaches, as well as deficient LOS E operation

- Updating the signal coordination along the Rowland Boulevard corridor between Redwood Boulevard and Vintage Way North would improve both operation and queuing in the future as compared to maintaining the current signal timing. All intersections would operate at acceptable Levels of Service and the delays encountered by drivers on the corridor would be decreased by up to 27 percent. Still, adverse queuing is projected to occur at the following locations:
    - US 101 North Ramps – westbound upstream lane blockages up to 11 percent of the time
    - Rowland Way – westbound upstream lane blockages up to 33 percent of the time in both lanes
    - Vintage Way North - northbound queues on Vintage Way extending 722 feet, through the northern Vintage Oaks shopping center signalized intersection

- Additional modifications would be necessary to further reduce queuing impacts and improve lane utilization on westbound Rowland Boulevard. Recommended improvements include:
    - Re-stripe westbound Rowland Boulevard on the US 101 overpass so that drivers in the center (#2) lane can access either the through or left-turn lanes at the US 101 South intersection; this modification allows westbound drivers destined to US 101 south to use two lanes on Rowland Boulevard all the way to the Rowland Way intersection
    - On the westbound approach at the Rowland Way intersection, eliminate the existing median and replace with an approximately 150-foot long third westbound through lane
    - Shift the existing eastbound lanes on Rowland Boulevard slightly southward between the US 101 South and Rowland Way intersections by narrowing the existing through lanes (currently 13 feet wide) to 11 feet wide; this modification is needed to ensure that the new westbound through lane on Rowland Boulevard at the Rowland Way intersection aligns with the receiving lane on the east side of the intersection
    - Restripe the "cat track" markings for the dual southbound right-turn movements on Rowland Way at Rowland Boulevard to target the #1 and #2 lanes instead of the #2 and #3 lanes; this change would improve lane utilization and reduce the amount of green time needed to serve Rowland Way.

Annotated screenshots of the Synchro/Simtraffic network including these modifications are shown in Figures 1 and 2.

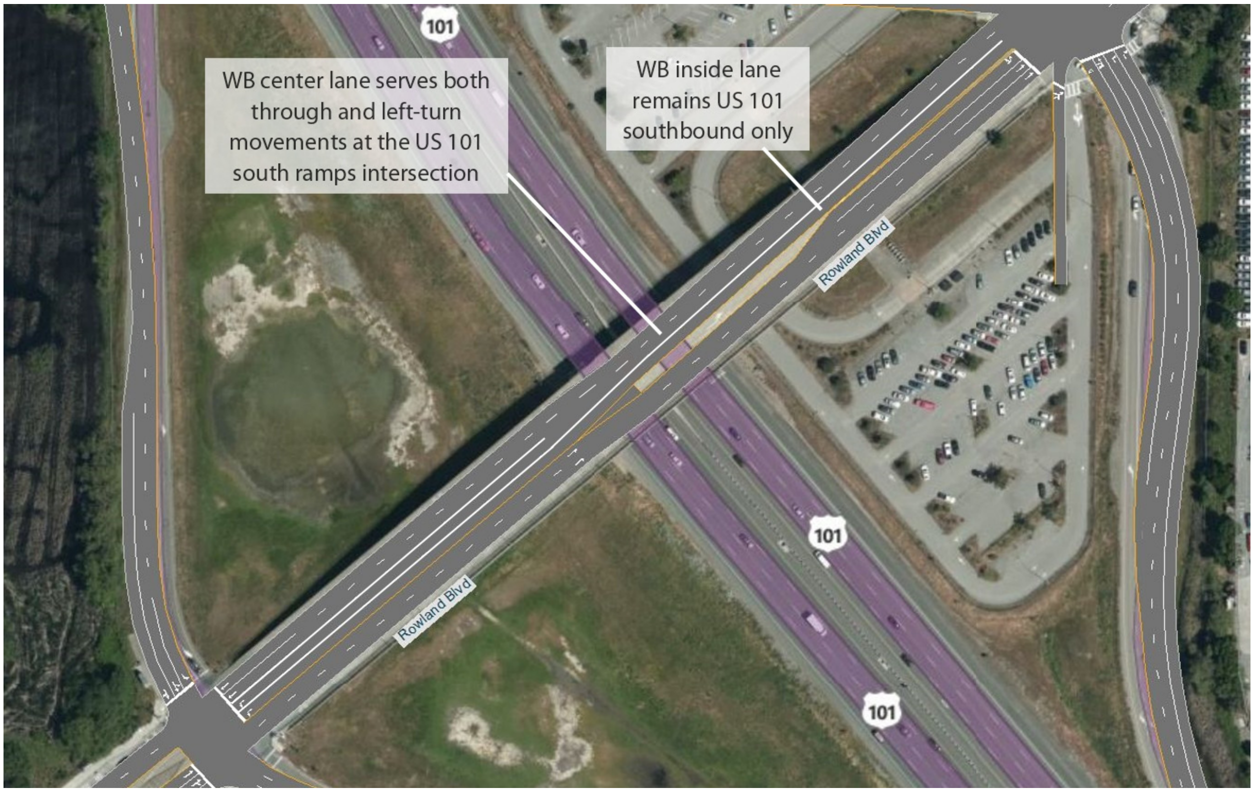

**Figure 1** - Modification on US 101 Overpass

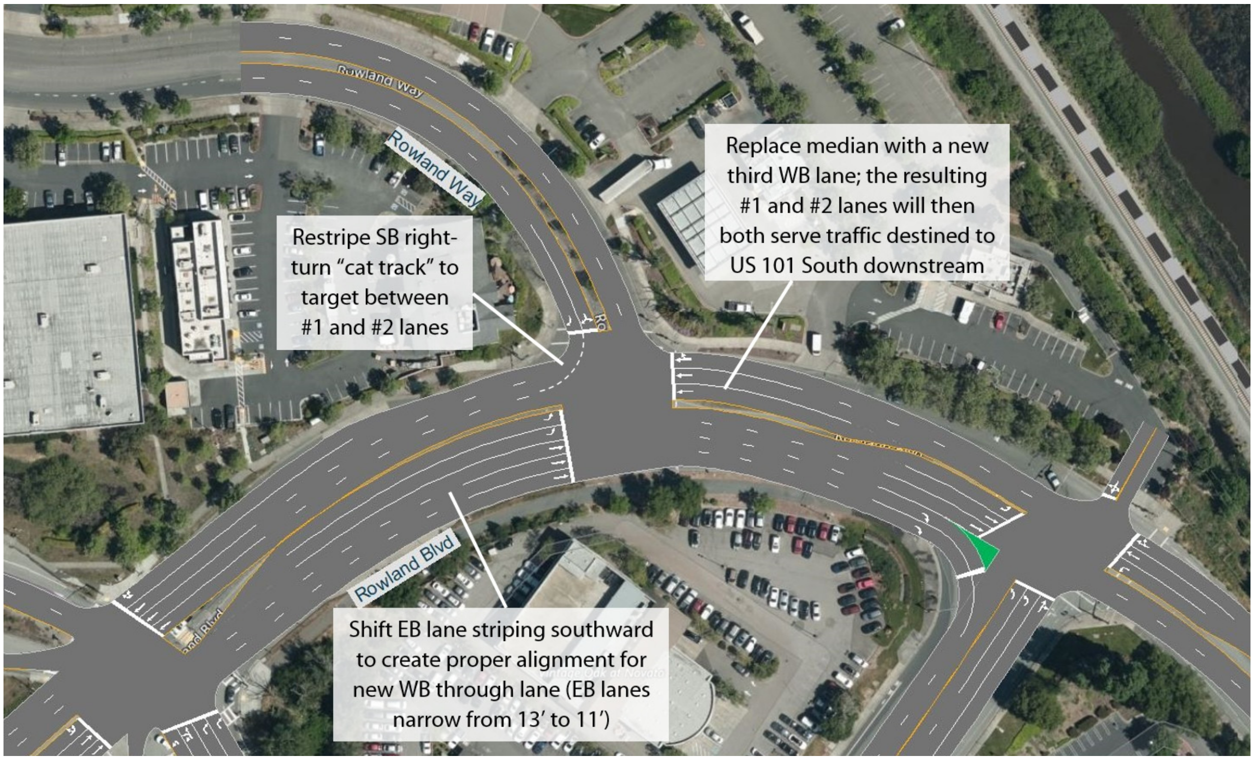

**Figure 2** - Modifications between US 101 and Vintage Way North

- With the recommended improvements, intersections on the corridor would operate at acceptable Levels of Service and with minimal queuing impacts. Total network delays would be decreased by 39 percent compared to the scenario where no modifications are made and decreased by 20 percent compared to the scenario with updated signal coordination only. Despite the improvements, there are two locations where 95th percentile queues could still result in upstream lane blockages on westbound Rowland Boulevard:
    - US 101 North Ramps – the westbound inside (#1) lane is projected to encounter upstream lane blockages approximately 2 percent of the time during the weekday p.m. peak hour
    - Rowland Way – the westbound center (#2) lane is projected to encounter upstream lane blockages approximately 1 to 4 percent of the time during peak hours, and the outer (#3) lane is projected to encounter upstream blockages approximately 8 to 10 percent of the time during peak hours, with 95th percentile queue lengths extending approximately 20 feet (one vehicle length) into the upstream intersection at Vintage Way North
    - Because the potential upstream lane blockages would not cause 95th percentile queues to extend into pedestrian crosswalks and are projected to occur infrequently (no more than 10 percent of the time during peak hours), they would not constitute a significant safety impact.

- Fully eliminating the queuing constraints on westbound Rowland Boulevard between Rowland Way and Vintage Way North may be infeasible, even with roadway widening, given the especially short distance between the intersections. Roadway widening to add another westbound lane (resulting in a total of four westbound lanes between Rowland Way and the US 101 North intersection) would entail right-of-way acquisition and substantial costs and could potentially result in adverse impacts to pedestrians by increasing crossing distances. It is therefore recommended that the City focus efforts on making improvements to the roadway system within the available right-of-way.

A summary of peak hour queuing and lane blockage results for key intersection movements during the weekday p.m. peak hour and weekend midday peak hour are shown in Tables 1 and 2, respectively.

**Table 1 – Future Weekday PM Peak Hour Queuing and Lane Blockages on Key Movements**

| **Intersection**<br>Movement | **95th Percentile Queues** | | |
|---|---|---|---|
| | **With Current Configuration and Signal Timing** | **With Current Configuration and Updated Coordination** | **With Recommended Modifications** |
| **Rowland Blvd/US 101 NB Ramps** | | | |
| NB off-ramp 95% queue (1,200 ft storage) | 446 | 355 | 349 |
| WB Rowland 95% queue (370 ft storage) | **437** | **476** | **400** |
| WB Upstream Blockage Inside Lane | ***20%*** | ***11%*** | 2% |
| **Rowland Blvd/Rowland Way** | | | |
| EB Rowland 95% queue (370 ft storage) | **509** | 162 | 188 |
| EB Upstream Blockage Through Lanes | ***13%*** | 0% | 0% |
| WB Rowland 95% queue (340 ft storage) | 336 | 317 | 324 |
| WB Upstream Blockage New Inside Lane | - | - | 0% |
| WB Upstream Blockage Current Inside Lane | ***17%*** | ***24%*** | 1% |
| WB Upstream Blockage Outside Lane | ***15%*** | ***27%*** | 8% |
| **Rowland Blvd/Vintage Way North** | | | |
| NB Vintage 95% queue (575 ft storage) | 175 | 494 | 313 |
| EB Rowland 95% queue (280 ft storage) | **328** | 162 | 104 |
| EB Upstream Blockage EB Through Lanes | ***21%*** | 0% | 0% |
| WB Rowland 95% queue (1,000 ft storage) | 519 | 397 | 300 |

Notes: 95th Percentile Queue based on the average of the ten Simtraffic runs; all distances are measured in feet; upstream blockage reflects percent of time that queues preclude traffic from entering lane at upstream intersection

**Bold** = queue exceeds available storage; ***Bold Italic*** = upstream lane blockage exceeds 10 percent

**Table 2 – Future Weekend Midday Peak Hour Queuing and Lane Blockages on Key Movements**

| **Intersection**<br>Movement | **95th Percentile Queues** | | |
|---|---|---|---|
| | **With Current Configuration and Signal Timing** | **With Current Configuration and Updated Coordination** | **With Recommended Modifications** |
| **Rowland Blvd/US 101 NB Ramps** | | | |
| NB off-ramp 95% queue (1,200 ft storage) | 960 | 682 | 772 |
| WB Rowland 95% queue (370 ft storage) | **447** | **457** | 279 |
| WB Upstream Blockage Inside Lane | ***29%*** | 7% | 0% |
| **Rowland Blvd/Rowland Way** | | | |
| EB Rowland 95% queue (370 ft storage) | **508** | 285 | 271 |
| EB Upstream Blockage Through Lanes | ***23%*** | 0% | 0% |
| WB Rowland 95% queue (340 ft storage) | **456** | **385** | **358** |
| WB Upstream Blockage New Inside Lane | - | - | 0% |
| WB Upstream Blockage Current Inside Lane | ***37%*** | ***33%*** | 4% |
| WB Upstream Blockage Outside Lane | ***32%*** | ***31%*** | 10% |
| **Rowland Blvd/Vintage Way North** | | | |
| NB Vintage 95% queue (575 ft storage) | **693** | **722** | 418 |
| EB Rowland 95% queue (280 ft storage) | **304** | 278 | 264 |
| EB Upstream Blockage EB Through Lanes | ***31%*** | 2% | 0% |
| WB Rowland 95% queue (1,000 ft storage) | **1,511** | 841 | 370 |

Notes: 95th Percentile Queue based on the average of the ten Simtraffic runs; all distances are measured in feet; upstream blockage reflects percent of time that queues preclude traffic from entering lane at upstream intersection
**Bold** = queue exceeds available storage; ***Bold Italic*** = upstream lane blockage exceeds 10 percent

Future peak hour levels of service for each scenario (as obtained through traffic simulation) are shown in Table 3, and network-level measures of effectiveness are shown in Table 4.

**Table 3 – Future Peak Hour Levels of Service**

| **Intersection**<br>Movement | **With Current Configuration and Signal Timing** | | **With Current Configuration and Updated Coordination** | | **With Recommended Modifications** | |
|---|---|---|---|---|---|---|
| | **PM** | **LOS** | **Delay** | **LOS** | **Delay** | **LOS** |
| **Rowland Blvd/Redwood Boulevard** | | | | | | |
| Weekday PM Peak Hour | 27.3 | C | 30.0 | C | 26.1 | C |
| Weekend Midday Peak Hour | 26.1 | C | 30.2 | C | 26.4 | C |
| **Rowland Blvd/US 101 NB Ramps** | | | | | | |
| Weekday PM Peak Hour | 29.5 | C | 17.7 | B | 18.5 | B |
| Weekend Midday Peak Hour | 26.1 | C | 21.5 | C | 21.9 | C |
| **Rowland Blvd/US 101 SB Ramps** | | | | | | |
| Weekday PM Peak Hour | 39.6 | D | 25.6 | C | 20.7 | C |
| Weekend Midday Peak Hour | 62.8 | **E** | 32.2 | C | 26.2 | C |
| **Rowland Blvd/Rowland Way** | | | | | | |
| Weekday PM Peak Hour | 29.2 | C | 21.6 | C | 14.7 | B |
| Weekend Midday Peak Hour | 35.1 | D | 21.6 | C | 16.3 | B |
| **Rowland Blvd/Vintage Way North** | | | | | | |
| Weekday PM Peak Hour | 34.9 | C | 26.0 | C | 13.4 | B |
| Weekend Midday Peak Hour | 62.7 | **E** | 50.2 | D | 26.3 | C |

Notes: Delay is measured in average seconds per vehicle and reflects the average of ten Simtraffic runs; LOS = Level of Service; **Bold** = deficient operation

**Table 4 – Future Network Measures of Effectiveness**

| **Intersection**<br>Movement | **With Current Configuration and Signal Timing** | | **With Current Configuration and Updated Coordination** | | **With Recommended Modifications** | |
|---|---|---|---|---|---|---|
| | **Ave Speed (mph)** | **Total Delay (sec)** | **Ave Speed (mph)** | **Total Delay (sec)** | **Ave Speed (mph)** | **Total Delay (sec)** |
| Weekday PM Peak Hour | 12 | 90.7 | 14 | 66.4 | 16 | 55.0 |
| *Change* | | - | *+2* | *-27%* | *+4* | *-39%* |
| Weekend Midday Peak Hour | 10 | 119.8 | 12 | 91.8 | 14 | 73.4 |
| *Change* | | - | *+2* | *-23%* | *+4* | *-39%* |

Note: Values reflect network-level performance including all five study intersections and connecting roadway segments; Change reflects comparison to the current configuration and timing

## Potential Additional Measures

Should the City proceed with concept-level or full designs of the recommended improvements, there are several additional components that may benefit from further investigation, as described below.

- Westbound bike lanes – The viability of providing on-street bike lanes on westbound Rowland Boulevard between Vintage Way North and the US 101 North Ramps intersection should be further assessed once topographic and right-of-way mapping are available. Currently, a Class I off-street pathway serves bicyclists on this segment, but its location on the south side of Rowland Boulevard makes it inconvenient to westbound bicyclists as it requires crossing the street twice. Based on review of aerial imagery, it appears that provision of a westbound bike lane *may* be possible through a combination of narrowing vehicle lanes and medians, though this would need to be confirmed through design and in the context of other recommended modifications.

- Extension of new westbound through lane – The recommended additional westbound lane approaching the Rowland Way intersection would be constructed in an area that is currently a raised median. It would be possible to extend this new lane all the way to Vintage Way North if the existing eastbound left-turn pocket serving Taco Bell at the Vintage Way North intersection were eliminated and those eastbound left-turn movements prohibited. This modification would affect Taco Bell's access, though ingress for eastbound Rowland Boulevard drivers would still be possible via Rowland Way and through the Chevron gas station or Century Theaters parking lot. While this modification would not fully eliminate queue blockages on westbound Rowland Boulevard, it would reduce them somewhat by providing additional vehicle storage.

Thank you for giving W-Trans the opportunity to provide these services. Please call if you have any questions.

Sincerely,

Briana Byrne

Briana Byrne, EIT
Associate Engineer

Zachary Matley

Zachary Matley, AICP
Principal

JZM/bkb/NOV925.L1

Enclosure: Simtraffic output

## Intersection: 1: Redwood Blvd & Rowland Blvd

| Movement | EB | EB | EB | EB | WB | WB | WB | NB | NB | NB | SB | SB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Directions Served | L | T | T | R | UL | T | TR | L | T | TR | L | L |
| Maximum Queue (ft) | 104 | 166 | 233 | 80 | 189 | 301 | 308 | 46 | 48 | 44 | 209 | 170 |
| Average Queue (ft) | 61 | 98 | 154 | 25 | 77 | 220 | 252 | 23 | 22 | 26 | 145 | 100 |
| 95th Queue (ft) | 113 | 188 | 259 | 80 | 191 | 344 | 357 | 56 | 53 | 50 | 231 | 184 |
| Link Distance (ft) |  | 612 | 612 |  |  | 294 | 294 |  | 705 | 705 |  | 1269 |
| Upstream Blk Time (%) |  |  |  |  |  | 4 | 9 |  |  |  |  |  |
| Queuing Penalty (veh) |  |  |  |  |  | 26 | 58 |  |  |  |  |  |
| Storage Bay Dist (ft) | 245 |  |  | 65 | 208 |  |  | 102 |  |  | 248 |  |
| Storage Blk Time (%) |  | 0 | 29 | 0 |  | 14 |  |  |  |  | 1 |  |
| Queuing Penalty (veh) |  | 0 | 13 | 0 |  | 14 |  |  |  |  | 1 |  |

## Intersection: 1: Redwood Blvd & Rowland Blvd

| Movement | SB | SB |
|---|---|---|
| Directions Served | T | R |
| Maximum Queue (ft) | 34 | 47 |
| Average Queue (ft) | 13 | 18 |
| 95th Queue (ft) | 37 | 51 |
| Link Distance (ft) | 1269 |  |
| Upstream Blk Time (%) |  |  |
| Queuing Penalty (veh) |  |  |
| Storage Bay Dist (ft) |  | 380 |
| Storage Blk Time (%) |  |  |
| Queuing Penalty (veh) |  |  |

## Intersection: 2: US 101 SB On-Ramp/US 101 SB Off-Ramp & Rowland Blvd

| Movement | EB | EB | EB | WB | WB | WB | WB | SB | SB | SB |
|---|---|---|---|---|---|---|---|---|---|---|
| Directions Served | T | TR | R | L | L | T | T | L | LT | TR |
| Maximum Queue (ft) | 224 | 226 | 172 | 298 | 322 | 228 | 270 | 204 | 198 | 96 |
| Average Queue (ft) | 162 | 158 | 108 | 245 | 263 | 127 | 164 | 146 | 140 | 56 |
| 95th Queue (ft) | 259 | 255 | 187 | 317 | 341 | 258 | 301 | 215 | 218 | 103 |
| Link Distance (ft) | 294 | 294 | 294 |  | 1059 | 1059 | 1059 | 1718 | 1718 |  |
| Upstream Blk Time (%) |  | 0 | 0 |  |  |  |  |  |  |  |
| Queuing Penalty (veh) |  | 0 | 0 |  |  |  |  |  |  |  |
| Storage Bay Dist (ft) |  |  |  | 442 |  |  |  |  |  | 290 |
| Storage Blk Time (%) |  |  |  |  |  |  |  |  |  |  |
| Queuing Penalty (veh) |  |  |  |  |  |  |  |  |  |  |

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## Intersection: 3: US 101 NB Off-Ramp/US 101 NB On-Ramp & Rowland Blvd

| Movement | EB | EB | EB | WB | WB | WB | WB | NB | NB | NB | NB | NE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Directions Served | <L | T | T | T | T | T | R> | < | <LT | R | R | <LR |
| Maximum Queue (ft) | 227 | 605 | 605 | 388 | 370 | 293 | 169 | 233 | 261 | 393 | 400 | 49 |
| Average Queue (ft) | 79 | 412 | 407 | 367 | 246 | 157 | 95 | 156 | 181 | 288 | 274 | 22 |
| 95th Queue (ft) | 293 | 718 | 720 | 437 | 434 | 327 | 205 | 243 | 273 | 446 | 430 | 56 |
| Link Distance (ft) |  | 1059 | 1059 | 373 | 373 | 373 |  |  | 1898 | 1898 |  | 205 |
| Upstream Blk Time (%) |  |  |  | 20 | 2 | 0 |  |  |  |  |  |  |
| Queuing Penalty (veh) |  |  |  | 144 | 15 | 2 |  |  |  |  |  |  |
| Storage Bay Dist (ft) | 440 |  |  |  |  |  | 186 | 450 |  |  | 1000 |  |
| Storage Blk Time (%) |  | 14 |  |  |  | 1 | 3 |  |  |  |  |  |
| Queuing Penalty (veh) |  | 8 |  |  |  | 8 | 12 |  |  |  |  |  |

## Intersection: 4: Rowland Blvd & Rowland Way

| Movement | EB | EB | EB | EB | EB | WB | WB | SB | SB |
|---|---|---|---|---|---|---|---|---|---|
| Directions Served | UL | L | T | T | T | T | TR | LR | R |
| Maximum Queue (ft) | 145 | 247 | 400 | 243 | 200 | 282 | 290 | 375 | 329 |
| Average Queue (ft) | 82 | 185 | 290 | 100 | 87 | 246 | 259 | 280 | 172 |
| 95th Queue (ft) | 154 | 319 | 509 | 284 | 228 | 332 | 336 | 437 | 355 |
| Link Distance (ft) |  |  | 373 | 373 | 373 | 255 | 255 | 375 | 375 |
| Upstream Blk Time (%) |  |  | 13 | 0 | 0 | 17 | 15 | 18 | 0 |
| Queuing Penalty (veh) |  |  | 84 | 1 | 0 | 152 | 132 | 0 | 0 |
| Storage Bay Dist (ft) | 235 | 235 |  |  |  |  |  |  |  |
| Storage Blk Time (%) |  | 0 | 30 |  |  |  |  |  |  |
| Queuing Penalty (veh) |  | 0 | 69 |  |  |  |  |  |  |

## Intersection: 5: Rowland Blvd & Vintage Way (North)

| Movement | EB | EB | EB | EB | EB | WB | WB | WB | B82 | NB | NB | NB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Directions Served | L | T | T | R | R | L | T | TR | T | L | L | TR |
| Maximum Queue (ft) | 102 | 273 | 255 | 28 | 29 | 85 | 446 | 456 | 13 | 144 | 157 | 28 |
| Average Queue (ft) | 35 | 252 | 223 | 5 | 6 | 27 | 337 | 361 | 2 | 88 | 107 | 7 |
| 95th Queue (ft) | 111 | 316 | 328 | 36 | 40 | 100 | 494 | 497 | 22 | 156 | 175 | 28 |
| Link Distance (ft) |  | 255 | 255 | 255 | 255 |  | 498 | 498 | 1619 | 565 | 565 |  |
| Upstream Blk Time (%) |  | 21 | 3 |  |  |  | 1 | 1 |  |  |  |  |
| Queuing Penalty (veh) |  | 95 | 12 |  |  |  | 3 | 5 |  |  |  |  |
| Storage Bay Dist (ft) | 92 |  |  |  |  | 80 |  |  |  |  |  | 180 |
| Storage Blk Time (%) |  | 63 |  |  |  | 0 | 64 |  |  |  | 1 |  |
| Queuing Penalty (veh) |  | 12 |  |  |  | 1 | 1 |  |  |  | 0 |  |

## Intersection: 5: Rowland Blvd & Vintage Way (North)

| Movement | SB |
|---|---|
| Directions Served | LTR |
| Maximum Queue (ft) | 25 |
| Average Queue (ft) | 8 |
| 95th Queue (ft) | 29 |
| Link Distance (ft) | 97 |
| Upstream Blk Time (%) |  |
| Queuing Penalty (veh) |  |
| Storage Bay Dist (ft) |  |
| Storage Blk Time (%) |  |
| Queuing Penalty (veh) |  |

## Intersection: 6: Vintage Way (South) & Rowland Blvd

| Movement | EB | NB | NB | SE |
|---|---|---|---|---|
| Directions Served | LR | <L | L | R> |
| Maximum Queue (ft) | 223 | 69 | 32 | 292 |
| Average Queue (ft) | 131 | 47 | 13 | 183 |
| 95th Queue (ft) | 240 | 77 | 38 | 316 |
| Link Distance (ft) | 520 | 101 | 101 | 1619 |
| Upstream Blk Time (%) |  | 0 |  |  |
| Queuing Penalty (veh) |  | 0 |  |  |
| Storage Bay Dist (ft) |  |  |  |  |
| Storage Blk Time (%) |  |  |  |  |
| Queuing Penalty (veh) |  |  |  |  |

## Network Summary

Network wide Queuing Penalty: 868

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## 1: Redwood Blvd & Rowland Blvd Performance by movement

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Denied Del/Veh (s) | 3.1 | 0.4 | 2.7 | 0.0 | 0.1 | 0.1 | 4.3 | 0.1 | 0.1 | 1.6 | 0.5 | 3.0 |
| Total Del/Veh (s) | 42.0 | 22.5 | 11.9 | 44.7 | 26.8 | 28.4 | 41.0 | 38.7 | 7.4 | 36.6 | 32.4 | 5.8 |
| Avg Speed (mph) | 7 | 12 | 16 | 4 | 7 | 6 | 8 | 8 | 19 | 14 | 17 | 28 |
| Fuel Eff. (mpg) | 16.4 | 22.4 | 25.5 | 12.2 | 15.9 | 17.4 | 19.0 | 20.4 | 34.9 | 26.5 | 29.3 | 31.5 |
| HC Emissions (g) | 1 | 5 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 5 | 0 | 2 |
| CO Emissions (g) | 45 | 260 | 16 | 14 | 88 | 25 | 13 | 11 | 10 | 314 | 22 | 129 |
| NOx Emissions (g) | 2 | 18 | 1 | 1 | 10 | 3 | 1 | 1 | 1 | 20 | 2 | 8 |

## 1: Redwood Blvd & Rowland Blvd Performance by movement

| Movement | All |
|---|---|
| Denied Del/Veh (s) | 0.8 |
| Total Del/Veh (s) | 27.3 |
| Avg Speed (mph) | 11 |
| Fuel Eff. (mpg) | 22.2 |
| HC Emissions (g) | 15 |
| CO Emissions (g) | 947 |
| NOx Emissions (g) | 68 |

## 2: US 101 SB On-Ramp/US 101 SB Off-Ramp & Rowland Blvd Performance by movement

| Movement | EBT | EBR | WBL | WBT | SBL | SBT | SBR | All |
|---|---|---|---|---|---|---|---|---|
| Denied Del/Veh (s) | 0.1 | 0.0 | 0.1 | 0.0 | 0.2 | 0.1 | 2.8 | 0.2 |
| Total Del/Veh (s) | 20.4 | 10.4 | 64.2 | 14.2 | 45.1 | 20.4 | 23.7 | 29.5 |
| Avg Speed (mph) | 9 | 11 | 8 | 19 | 15 | 19 | 21 | 13 |
| Fuel Eff. (mpg) | 15.6 | 21.5 | 18.0 | 24.2 | 28.1 | 28.0 | 27.7 | 22.2 |
| HC Emissions (g) | 4 | 1 | 5 | 33 | 5 | 1 | 2 | 50 |
| CO Emissions (g) | 179 | 88 | 260 | 1019 | 318 | 11 | 141 | 2015 |
| NOx Emissions (g) | 16 | 9 | 31 | 110 | 25 | 1 | 9 | 201 |

## 3: US 101 NB Off-Ramp/US 101 NB On-Ramp & Rowland Blvd Performance by movement

| Movement | EBL2 | EBL | EBT | WBT | WBR | WBR2 | NBL2 | NBL | NBT | NBR | NEL2 | NEL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Denied Del/Veh (s) | 0.0 | 0.0 | 0.1 | 0.1 |  | 0.4 | 0.8 | 0.4 | 0.6 | 0.9 | 0.2 | 0.1 |
| Total Del/Veh (s) | 106.1 | 52.8 | 66.2 | 39.2 |  | 10.7 | 28.7 | 38.4 | 33.5 | 36.1 | 52.6 | 51.3 |
| Avg Speed (mph) | 6 | 9 | 8 | 6 | 5 | 12 | 18 | 17 | 17 | 16 | 2 | 2 |
| Fuel Eff. (mpg) | 14.4 | 20.2 | 17.5 | 13.8 | 15.8 | 21.4 | 28.9 | 28.2 | 29.4 | 27.1 | 8.8 | 7.8 |
| HC Emissions (g) | 0 | 0 | 13 | 17 | 0 | 7 | 7 | 0 | 3 | 12 | 0 | 0 |
| CO Emissions (g) | 5 | 25 | 597 | 529 | 0 | 188 | 326 | 6 | 58 | 650 | 0 | 1 |
| NOx Emissions (g) | 0 | 2 | 55 | 53 | 0 | 22 | 30 | 0 | 9 | 56 | 0 | 0 |

## 3: US 101 NB Off-Ramp/US 101 NB On-Ramp & Rowland Blvd Performance by movement

| Movement | NER | All |
|---|---|---|
| Denied Del/Veh (s) |  | 0.4 |
| Total Del/Veh (s) | 25.9 | 39.6 |
| Avg Speed (mph) | 2 | 11 |
| Fuel Eff. (mpg) | 8.6 | 22.1 |
| HC Emissions (g) | 0 | 60 |
| CO Emissions (g) | 0 | 2386 |
| NOx Emissions (g) | 0 | 226 |

## 4: Rowland Blvd & Rowland Way Performance by movement

| Movement | EBL | EBT | WBT | WBR | SBL | SBR | All |
|---|---|---|---|---|---|---|---|
| Denied Del/Veh (s) | 0.0 | 0.0 | 0.0 | 1.9 | 8.0 | 6.4 | 0.8 |
| Total Del/Veh (s) | 79.0 | 17.5 | 21.9 | 12.5 | 126.0 | 64.5 | 29.2 |
| Avg Speed (mph) | 3 | 10 | 7 | 9 | 2 | 3 | 7 |
| Fuel Eff. (mpg) | 9.2 | 16.1 | 15.1 | 17.9 | 5.7 | 9.6 | 13.9 |
| HC Emissions (g) | 2 | 11 | 4 | 0 | 1 | 1 | 18 |
| CO Emissions (g) | 58 | 614 | 195 | 5 | 19 | 73 | 965 |
| NOx Emissions (g) | 6 | 49 | 24 | 1 | 1 | 6 | 87 |

## 5: Rowland Blvd & Vintage Way (North) Performance by movement

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | SBL | SBT | SBR | All |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Denied Del/Veh (s) | 0.0 | 0.0 | 0.0 |  | 38.9 | 70.9 | 0.0 | 0.0 | 0.1 | 0.1 |  | 12.7 |
| Total Del/Veh (s) | 59.0 | 46.0 | 2.3 |  | 71.4 | 73.9 | 14.3 | 8.8 | 35.0 | 24.3 |  | 34.9 |
| Avg Speed (mph) | 3 | 4 | 20 | 4 | 4 | 3 | 14 | 20 | 2 | 2 | 2 | 6 |
| Fuel Eff. (mpg) | 9.7 | 11.0 | 40.6 | 10.9 | 8.2 | 7.1 | 28.4 | 27.5 | 8.1 | 8.0 | 6.1 | 14.2 |
| HC Emissions (g) | 0 | 2 | 1 | 0 | 3 | 0 | 3 | 0 | 0 | 0 | 0 | 8 |
| CO Emissions (g) | 2 | 108 | 56 | 0 | 174 | 2 | 185 | 11 | 0 | 0 | 0 | 537 |
| NOx Emissions (g) | 0 | 12 | 5 | 0 | 12 | 0 | 10 | 1 | 0 | 0 | 0 | 40 |

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## 6: Vintage Way (South) & Rowland Blvd Performance by movement

| Movement | EBL | EBR | NBL2 | NBL | SET | SER | SER2 | All |
|---|---|---|---|---|---|---|---|---|
| Denied Del/Veh (s) | 0.4 | 0.2 |  | 0.1 | 0.0 | 0.1 | 0.0 | 0.2 |
| Total Del/Veh (s) | 18.8 | 13.6 |  | 6.4 | 1.7 | 21.1 | 20.1 | 16.2 |
| Avg Speed (mph) | 10 | 11 | 8 | 7 | 23 | 16 | 16 | 15 |
| Fuel Eff. (mpg) | 24.9 | 30.5 | 19.5 | 22.6 | 34.0 | 32.1 | 31.8 | 30.3 |
| HC Emissions (g) | 3 | 0 | 0 | 0 | 0 | 2 | 1 | 7 |
| CO Emissions (g) | 90 | 0 | 0 | 4 | 10 | 74 | 50 | 229 |
| NOx Emissions (g) | 10 | 0 | 0 | 1 | 1 | 10 | 7 | 28 |

## Total Network Performance

| | |
|---|---|
| Denied Del/Veh (s) | 8.3 |
| Total Del/Veh (s) | 90.7 |
| Avg Speed (mph) | 12 |
| Fuel Eff. (mpg) | 20.8 |
| HC Emissions (g) | 255 |
| CO Emissions (g) | 11314 |
| NOx Emissions (g) | 1015 |

## Intersection: 1: Redwood Blvd & Rowland Blvd

| Movement | EB | EB | EB | EB | WB | WB | WB | NB | NB | NB | SB | SB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Directions Served | L | T | T | R | UL | T | TR | L | T | TR | L | L |
| Maximum Queue (ft) | 128 | 271 | 306 | 72 | 156 | 256 | 279 | 53 | 65 | 45 | 244 | 315 |
| Average Queue (ft) | 79 | 159 | 212 | 28 | 69 | 121 | 149 | 23 | 29 | 27 | 195 | 181 |
| 95th Queue (ft) | 144 | 298 | 343 | 82 | 163 | 278 | 308 | 59 | 69 | 51 | 299 | 382 |
| Link Distance (ft) |  | 612 | 612 |  |  | 294 | 294 |  | 705 | 705 |  | 1269 |
| Upstream Blk Time (%) |  |  |  |  |  | 0 | 1 |  |  |  |  |  |
| Queuing Penalty (veh) |  |  |  |  |  | 3 | 7 |  |  |  |  |  |
| Storage Bay Dist (ft) | 245 |  |  | 65 | 208 |  |  | 102 |  |  | 248 |  |
| Storage Blk Time (%) | 0 | 1 | 39 | 0 |  | 3 |  | 0 | 0 |  | 10 | 2 |
| Queuing Penalty (veh) | 0 | 1 | 18 | 0 |  | 3 |  | 0 | 0 |  | 22 | 4 |

## Intersection: 1: Redwood Blvd & Rowland Blvd

| Movement | SB | SB |
|---|---|---|
| Directions Served | T | R |
| Maximum Queue (ft) | 30 | 36 |
| Average Queue (ft) | 10 | 14 |
| 95th Queue (ft) | 33 | 38 |
| Link Distance (ft) | 1269 |  |
| Upstream Blk Time (%) |  |  |
| Queuing Penalty (veh) |  |  |
| Storage Bay Dist (ft) |  | 380 |
| Storage Blk Time (%) |  |  |
| Queuing Penalty (veh) |  |  |

## Intersection: 2: US 101 SB On-Ramp/US 101 SB Off-Ramp & Rowland Blvd

| Movement | EB | EB | EB | WB | WB | WB | WB | SB | SB | SB |
|---|---|---|---|---|---|---|---|---|---|---|
| Directions Served | T | TR | R | L | L | T | T | L | LT | TR |
| Maximum Queue (ft) | 205 | 195 | 139 | 229 | 237 | 153 | 180 | 188 | 187 | 84 |
| Average Queue (ft) | 114 | 115 | 68 | 131 | 144 | 53 | 75 | 132 | 126 | 46 |
| 95th Queue (ft) | 230 | 217 | 147 | 240 | 250 | 161 | 203 | 210 | 212 | 100 |
| Link Distance (ft) | 294 | 294 | 294 |  | 1059 | 1059 | 1059 | 1718 | 1718 |  |
| Upstream Blk Time (%) | 0 |  |  |  |  |  |  |  |  |  |
| Queuing Penalty (veh) | 0 |  |  |  |  |  |  |  |  |  |
| Storage Bay Dist (ft) |  |  |  | 442 |  |  |  |  |  | 290 |
| Storage Blk Time (%) |  |  |  |  |  |  |  |  |  |  |
| Queuing Penalty (veh) |  |  |  |  |  |  |  |  |  |  |

## Intersection: 3: US 101 NB Off-Ramp/US 101 NB On-Ramp & Rowland Blvd

| Movement | EB | EB | EB | WB | WB | WB | WB | NB | NB | NB | NB | NE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Directions Served | <L | T | T | T | T | T | R> | < | <LT | R | R | <LR |
| Maximum Queue (ft) | 106 | 216 | 217 | 390 | 371 | 250 | 156 | 227 | 254 | 331 | 315 | 49 |
| Average Queue (ft) | 43 | 117 | 118 | 316 | 241 | 125 | 100 | 159 | 185 | 219 | 218 | 24 |
| 95th Queue (ft) | 103 | 237 | 238 | 476 | 461 | 290 | 198 | 246 | 280 | 355 | 343 | 55 |
| Link Distance (ft) |  | 1059 | 1059 | 373 | 373 | 373 |  |  | 1898 | 1898 |  | 205 |
| Upstream Blk Time (%) |  |  |  | 11 | 5 | 0 |  |  |  |  |  |  |
| Queuing Penalty (veh) |  |  |  | 78 | 33 | 1 |  |  |  |  |  |  |
| Storage Bay Dist (ft) | 440 |  |  |  |  |  | 186 | 450 |  |  | 1000 |  |
| Storage Blk Time (%) |  |  |  |  |  | 1 | 2 |  |  |  |  |  |
| Queuing Penalty (veh) |  |  |  |  |  | 7 | 9 |  |  |  |  |  |

## Intersection: 4: Rowland Blvd & Rowland Way

| Movement | EB | EB | EB | EB | EB | WB | WB | SB | SB |
|---|---|---|---|---|---|---|---|---|---|
| Directions Served | UL | L | T | T | T | T | TR | LR | R |
| Maximum Queue (ft) | 121 | 154 | 222 | 132 | 149 | 289 | 296 | 322 | 248 |
| Average Queue (ft) | 73 | 102 | 127 | 75 | 96 | 263 | 278 | 242 | 136 |
| 95th Queue (ft) | 134 | 168 | 244 | 149 | 158 | 315 | 317 | 370 | 287 |
| Link Distance (ft) |  |  | 373 | 373 | 373 | 256 | 256 | 375 | 375 |
| Upstream Blk Time (%) |  |  |  |  |  | 24 | 27 | 1 | 0 |
| Queuing Penalty (veh) |  |  |  |  |  | 210 | 235 | 0 | 0 |
| Storage Bay Dist (ft) | 235 | 235 |  |  |  |  |  |  |  |
| Storage Blk Time (%) |  |  | 1 |  |  |  |  |  |  |
| Queuing Penalty (veh) |  |  | 2 |  |  |  |  |  |  |

## Intersection: 5: Rowland Blvd & Vintage Way (North)

| Movement | EB | EB | EB | EB | WB | WB | WB | NB | NB | NB | SB |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Directions Served | L | T | T | R | L | T | TR | L | L | TR | LTR |
| Maximum Queue (ft) | 31 | 154 | 81 | 6 | 70 | 316 | 340 | 345 | 381 | 111 | 34 |
| Average Queue (ft) | 12 | 108 | 44 | 1 | 17 | 231 | 258 | 244 | 285 | 31 | 13 |
| 95th Queue (ft) | 39 | 162 | 90 | 13 | 77 | 368 | 397 | 453 | 494 | 144 | 38 |
| Link Distance (ft) |  | 256 | 256 | 256 |  | 593 | 593 | 590 | 590 |  | 107 |
| Upstream Blk Time (%) |  |  |  |  |  |  |  |  | 1 |  |  |
| Queuing Penalty (veh) |  |  |  |  |  |  |  |  | 0 |  |  |
| Storage Bay Dist (ft) | 92 |  |  |  | 80 |  |  |  |  | 180 |  |
| Storage Blk Time (%) |  | 13 |  |  | 0 | 42 |  |  | 41 | 0 |  |
| Queuing Penalty (veh) |  | 3 |  |  | 1 | 1 |  |  | 8 | 0 |  |

## Intersection: 6: Vintage Way (South) & Rowland Blvd

| Movement | EB | NB |
|---|---|---|
| Directions Served | LR | <L |
| Maximum Queue (ft) | 87 | 6 |
| Average Queue (ft) | 60 | 1 |
| 95th Queue (ft) | 92 | 10 |
| Link Distance (ft) | 518 | 99 |
| Upstream Blk Time (%) | | |
| Queuing Penalty (veh) | | |
| Storage Bay Dist (ft) | | |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

## Network Summary

Network wide Queuing Penalty: 645

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## 1: Redwood Blvd & Rowland Blvd Performance by movement

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Denied Del/Veh (s) | 3.0 | 0.4 | 3.1 | 0.0 | 0.0 | 0.3 | 3.8 | 0.1 | 0.1 | 1.7 | 0.3 | 3.1 |
| Total Del/Veh (s) | 54.0 | 32.1 | 13.9 | 36.7 | 13.4 | 11.9 | 48.7 | 44.4 | 9.6 | 66.7 | 40.5 | 5.9 |
| Avg Speed (mph) | 6 | 9 | 14 | 5 | 11 | 10 | 7 | 8 | 17 | 9 | 13 | 28 |
| Fuel Eff. (mpg) | 14.1 | 19.0 | 23.7 | 15.1 | 21.7 | 26.7 | 17.5 | 19.0 | 33.8 | 20.4 | 27.2 | 28.2 |
| HC Emissions (g) | 1 | 5 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 5 | 0 | 2 |
| CO Emissions (g) | 58 | 269 | 21 | 12 | 87 | 19 | 11 | 15 | 9 | 352 | 15 | 181 |
| NOx Emissions (g) | 3 | 18 | 1 | 1 | 9 | 2 | 1 | 1 | 1 | 20 | 1 | 10 |

## 1: Redwood Blvd & Rowland Blvd Performance by movement

| Movement | All |
|---|---|
| Denied Del/Veh (s) | 0.8 |
| Total Del/Veh (s) | 30.0 |
| Avg Speed (mph) | 10 |
| Fuel Eff. (mpg) | 21.1 |
| HC Emissions (g) | 16 |
| CO Emissions (g) | 1048 |
| NOx Emissions (g) | 68 |

## 2: US 101 SB On-Ramp/US 101 SB Off-Ramp & Rowland Blvd Performance by movement

| Movement | EBT | EBR | WBL | WBT | SBL | SBT | SBR | All |
|---|---|---|---|---|---|---|---|---|
| Denied Del/Veh (s) | 0.1 | 0.0 | 0.1 | 0.0 | 0.2 | 0.1 | 2.7 | 0.1 |
| Total Del/Veh (s) | 15.6 | 8.2 | 28.9 | 6.7 | 40.2 | 75.1 | 20.4 | 17.9 |
| Avg Speed (mph) | 10 | 12 | 14 | 24 | 16 | 13 | 22 | 17 |
| Fuel Eff. (mpg) | 16.7 | 23.2 | 23.8 | 25.4 | 28.6 | 24.4 | 28.0 | 24.6 |
| HC Emissions (g) | 3 | 1 | 5 | 32 | 5 | 1 | 2 | 49 |
| CO Emissions (g) | 145 | 71 | 269 | 959 | 296 | 20 | 130 | 1890 |
| NOx Emissions (g) | 15 | 8 | 33 | 106 | 24 | 2 | 8 | 196 |

## 3: US 101 NB Off-Ramp/US 101 NB On-Ramp & Rowland Blvd Performance by movement

| Movement | EBL2 | EBL | EBT | WBT | WBR | WBR2 | NBL2 | NBL | NBT | NBR | NEL2 | NEL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Denied Del/Veh (s) | 0.0 | 0.0 | 0.0 | 0.0 |  | 0.3 | 0.6 | 0.7 | 0.6 | 0.7 | 0.1 | 0.1 |
| Total Del/Veh (s) | 40.9 | 33.9 | 14.3 | 32.5 |  | 9.2 | 34.7 | 35.1 | 41.6 | 27.7 | 33.2 | 45.9 |
| Avg Speed (mph) | 10 | 13 | 20 | 7 | 18 | 13 | 17 | 17 | 15 | 18 | 3 | 3 |
| Fuel Eff. (mpg) | 16.8 | 21.4 | 23.5 | 14.3 | 19.2 | 21.3 | 27.9 | 29.2 | 27.1 | 28.9 | 10.6 | 9.8 |
| HC Emissions (g) | 0 | 0 | 12 | 18 | 0 | 6 | 7 | 0 | 1 | 12 | 0 | 0 |
| CO Emissions (g) | 3 | 28 | 612 | 595 | 0 | 178 | 334 | 7 | 28 | 634 | 1 | 1 |
| NOx Emissions (g) | 0 | 2 | 55 | 57 | 0 | 21 | 30 | 1 | 4 | 54 | 0 | 0 |

## 3: US 101 NB Off-Ramp/US 101 NB On-Ramp & Rowland Blvd Performance by movement

| Movement | NER | All |
|---|---|---|
| Denied Del/Veh (s) | 0.1 | 0.3 |
| Total Del/Veh (s) | 48.8 | 25.3 |
| Avg Speed (mph) | 2 | 15 |
| Fuel Eff. (mpg) | 8.0 | 24.0 |
| HC Emissions (g) | 0 | 57 |
| CO Emissions (g) | 1 | 2422 |
| NOx Emissions (g) | 0 | 223 |

## 4: Rowland Blvd & Rowland Way Performance by movement

| Movement | EBL | EBT | WBT | WBR | SBL | SBR | All |
|---|---|---|---|---|---|---|---|
| Denied Del/Veh (s) | 0.0 | 0.0 | 0.1 | 0.0 | 0.4 | 0.2 | 0.1 |
| Total Del/Veh (s) | 46.4 | 6.7 | 26.0 | 17.3 | 77.1 | 45.3 | 21.9 |
| Avg Speed (mph) | 5 | 17 | 6 | 8 | 3 | 4 | 8 |
| Fuel Eff. (mpg) | 13.0 | 18.6 | 15.7 | 18.9 | 8.9 | 12.9 | 16.2 |
| HC Emissions (g) | 2 | 11 | 3 | 1 | 0 | 2 | 18 |
| CO Emissions (g) | 74 | 659 | 130 | 11 | 18 | 76 | 968 |
| NOx Emissions (g) | 7 | 50 | 18 | 2 | 1 | 7 | 85 |

## 5: Rowland Blvd & Vintage Way (North) Performance by movement

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | SBL | SBT | SBR | All |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Denied Del/Veh (s) | 0.0 | 0.0 | 0.0 |  | 4.8 | 1.4 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 1.5 |
| Total Del/Veh (s) | 46.5 | 8.3 | 2.4 |  | 32.6 | 22.8 | 73.6 | 47.7 | 48.0 | 38.9 | 16.4 | 26.7 |
| Avg Speed (mph) | 4 | 15 | 21 | 1 | 7 | 9 | 5 | 7 | 1 | 1 | 3 | 8 |
| Fuel Eff. (mpg) | 12.6 | 20.5 | 38.2 | 4.3 | 17.3 | 20.6 | 14.4 | 16.7 | 4.8 | 4.6 | 12.5 | 18.8 |
| HC Emissions (g) | 0 | 4 | 1 | 0 | 5 | 0 | 2 | 0 | 0 | 0 | 0 | 13 |
| CO Emissions (g) | 2 | 159 | 70 | 0 | 231 | 1 | 163 | 8 | 0 | 0 | 0 | 635 |
| NOx Emissions (g) | 0 | 17 | 6 | 0 | 19 | 0 | 9 | 1 | 0 | 0 | 0 | 52 |

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## 6: Vintage Way (South) & Rowland Blvd Performance by movement

| Movement | EBL | EBR | NBL | SET | All |
|---|---|---|---|---|---|
| Denied Del/Veh (s) | 0.4 |  |  | 0.0 | 0.2 |
| Total Del/Veh (s) | 6.0 |  |  | 1.6 | 3.3 |
| Avg Speed (mph) | 17 | 18 | 10 | 23 | 21 |
| Fuel Eff. (mpg) | 32.4 | 24.6 | 35.1 | 32.6 | 32.5 |
| HC Emissions (g) | 2 | 0 | 0 | 6 | 8 |
| CO Emissions (g) | 67 | 0 | 0 | 159 | 227 |
| NOx Emissions (g) | 7 | 0 | 0 | 21 | 28 |

## Total Network Performance

| | |
|---|---|
| Denied Del/Veh (s) | 1.6 |
| Total Del/Veh (s) | 66.4 |
| Avg Speed (mph) | 14 |
| Fuel Eff. (mpg) | 22.4 |
| HC Emissions (g) | 247 |
| CO Emissions (g) | 11155 |
| NOx Emissions (g) | 975 |

## Intersection: 1: Redwood Blvd & Rowland Blvd

| Movement | EB | EB | EB | EB | WB | WB | WB | NB | NB | NB | SB | SB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Directions Served | L | T | T | R | UL | T | TR | L | T | TR | L | L |
| Maximum Queue (ft) | 114 | 139 | 224 | 76 | 109 | 214 | 264 | 63 | 52 | 40 | 239 | 252 |
| Average Queue (ft) | 76 | 82 | 139 | 19 | 66 | 109 | 151 | 27 | 24 | 25 | 191 | 165 |
| 95th Queue (ft) | 133 | 161 | 235 | 70 | 134 | 220 | 280 | 65 | 57 | 49 | 288 | 311 |
| Link Distance (ft) |  | 612 | 612 |  |  | 300 | 300 |  | 706 | 706 |  | 1267 |
| Upstream Blk Time (%) |  |  |  |  |  | 0 | 1 |  |  |  |  |  |
| Queuing Penalty (veh) |  |  |  |  |  | 0 | 4 |  |  |  |  |  |
| Storage Bay Dist (ft) | 245 |  |  | 65 | 208 |  |  | 102 |  |  | 248 |  |
| Storage Blk Time (%) |  |  | 21 | 0 |  | 1 |  | 0 |  |  | 9 | 1 |
| Queuing Penalty (veh) |  |  | 9 | 0 |  | 1 |  | 0 |  |  | 19 | 3 |

## Intersection: 1: Redwood Blvd & Rowland Blvd

| Movement | SB | SB |
|---|---|---|
| Directions Served | T | R |
| Maximum Queue (ft) | 35 | 40 |
| Average Queue (ft) | 12 | 13 |
| 95th Queue (ft) | 39 | 41 |
| Link Distance (ft) | 1267 |  |
| Upstream Blk Time (%) |  |  |
| Queuing Penalty (veh) |  |  |
| Storage Bay Dist (ft) |  | 380 |
| Storage Blk Time (%) |  |  |
| Queuing Penalty (veh) |  |  |

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## Intersection: 2: US 101 SB On-Ramp/US 101 SB Off-Ramp & Rowland Blvd

| Movement | EB | EB | EB | WB | WB | WB | WB | B7 | B7 | B7 | SB | SB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Directions Served | T | TR | R | L | L | T | T | T | T | T | L | LT |
| Maximum Queue (ft) | 209 | 211 | 159 | 292 | 305 | 117 | 116 | 17 | 24 | 4 | 212 | 212 |
| Average Queue (ft) | 136 | 142 | 96 | 179 | 190 | 45 | 53 | 3 | 5 | 1 | 152 | 145 |
| 95th Queue (ft) | 238 | 235 | 175 | 388 | 400 | 136 | 140 | 29 | 42 | 7 | 234 | 233 |
| Link Distance (ft) | 300 | 300 | 300 | 450 | 450 | 450 | 450 | 520 | 520 | 520 | 1718 | 1718 |
| Upstream Blk Time (%) |  | 0 |  | 2 | 2 |  |  |  |  |  |  |  |
| Queuing Penalty (veh) |  | 0 |  | 12 | 10 |  |  |  |  |  |  |  |
| Storage Bay Dist (ft) |  |  |  |  |  |  |  |  |  |  |  |  |
| Storage Blk Time (%) |  |  |  |  |  |  |  |  |  |  |  | 1 |
| Queuing Penalty (veh) |  |  |  |  |  |  |  |  |  |  |  | 1 |

## Intersection: 2: US 101 SB On-Ramp/US 101 SB Off-Ramp & Rowland Blvd

| Movement | SB |
|---|---|
| Directions Served | TR |
| Maximum Queue (ft) | 109 |
| Average Queue (ft) | 51 |
| 95th Queue (ft) | 129 |
| Link Distance (ft) |  |
| Upstream Blk Time (%) |  |
| Queuing Penalty (veh) |  |
| Storage Bay Dist (ft) | 290 |
| Storage Blk Time (%) |  |
| Queuing Penalty (veh) |  |

## Intersection: 3: US 101 NB Off-Ramp/US 101 NB On-Ramp & Rowland Blvd

| Movement | EB | EB | EB | WB | WB | WB | WB | NB | NB | NB | NB | NE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Directions Served | <L | T | T | T | T | T | R> | < | <LT | R | R | <LR |
| Maximum Queue (ft) | 72 | 268 | 249 | 237 | 262 | 254 | 208 | 256 | 314 | 321 | 306 | 36 |
| Average Queue (ft) | 39 | 140 | 145 | 139 | 142 | 128 | 106 | 157 | 234 | 219 | 222 | 18 |
| 95th Queue (ft) | 78 | 275 | 260 | 251 | 261 | 264 | 218 | 299 | 349 | 349 | 326 | 45 |
| Link Distance (ft) |  | 520 | 520 | 369 | 369 | 369 |  |  | 1916 | 1916 |  | 204 |
| Upstream Blk Time (%) |  |  |  |  |  | 0 |  |  |  |  |  |  |
| Queuing Penalty (veh) |  |  |  |  |  | 1 |  |  |  |  |  |  |
| Storage Bay Dist (ft) | 250 |  |  |  |  |  | 200 | 450 |  |  | 1000 |  |
| Storage Blk Time (%) |  | 1 |  |  |  | 1 | 1 | 0 | 0 |  |  |  |
| Queuing Penalty (veh) |  | 1 |  |  |  | 8 | 3 | 0 | 1 |  |  |  |

## Intersection: 4: Rowland Blvd & Rowland Way

| Movement | EB | EB | EB | EB | EB | WB | WB | WB | SB | SB |
|---|---|---|---|---|---|---|---|---|---|---|
| Directions Served | L | L | T | T | T | T | T | TR | LR | R |
| Maximum Queue (ft) | 123 | 149 | 167 | 118 | 138 | 203 | 284 | 321 | 199 | 198 |
| Average Queue (ft) | 69 | 97 | 94 | 61 | 78 | 125 | 203 | 250 | 146 | 136 |
| 95th Queue (ft) | 133 | 154 | 188 | 134 | 150 | 237 | 324 | 368 | 215 | 220 |
| Link Distance (ft) |  |  | 369 | 369 | 369 |  | 281 | 281 | 373 | 373 |
| Upstream Blk Time (%) |  |  |  |  |  |  | 1 | 8 |  |  |
| Queuing Penalty (veh) |  |  |  |  |  |  | 12 | 69 |  |  |
| Storage Bay Dist (ft) | 260 | 260 |  |  |  | 145 |  |  |  |  |
| Storage Blk Time (%) |  |  | 0 |  |  | 1 | 8 |  |  |  |
| Queuing Penalty (veh) |  |  | 0 |  |  | 6 | 45 |  |  |  |

## Intersection: 5: Vintage Way (North) & Rowland Blvd

| Movement | EB | EB | EB | WB | WB | WB | NB | NB | NB | SB |
|---|---|---|---|---|---|---|---|---|---|---|
| Directions Served | L | T | T | L | T | TR | L | L | TR | LTR |
| Maximum Queue (ft) | 27 | 98 | 81 | 5 | 224 | 278 | 250 | 278 | 25 | 18 |
| Average Queue (ft) | 9 | 54 | 42 | 1 | 146 | 178 | 189 | 210 | 5 | 5 |
| 95th Queue (ft) | 31 | 104 | 88 | 8 | 249 | 300 | 287 | 313 | 29 | 22 |
| Link Distance (ft) |  | 281 | 281 |  | 490 | 490 | 618 | 618 |  | 63 |
| Upstream Blk Time (%) |  |  |  |  |  |  |  |  |  |  |
| Queuing Penalty (veh) |  |  |  |  |  |  |  |  |  |  |
| Storage Bay Dist (ft) | 85 |  |  | 80 |  |  |  |  | 180 |  |
| Storage Blk Time (%) |  | 2 |  |  | 17 |  |  | 21 |  |  |
| Queuing Penalty (veh) |  | 0 |  |  | 0 |  |  | 4 |  |  |

## Intersection: 6: Vintage Way (South) & Rowland Blvd

| Movement | EB | NB |
|---|---|---|
| Directions Served | LR | <L |
| Maximum Queue (ft) | 89 | 15 |
| Average Queue (ft) | 61 | 3 |
| 95th Queue (ft) | 90 | 19 |
| Link Distance (ft) | 518 | 99 |
| Upstream Blk Time (%) |  |  |
| Queuing Penalty (veh) |  |  |
| Storage Bay Dist (ft) |  |  |
| Storage Blk Time (%) |  |  |
| Queuing Penalty (veh) |  |  |

## Network Summary

Network wide Queuing Penalty: 211

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## 1: Redwood Blvd & Rowland Blvd Performance by movement

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Denied Del/Veh (s) | 2.9 | 0.3 | 2.8 | 0.0 | 0.0 | 0.0 | 3.7 | 0.1 | 0.1 | 1.7 | 0.6 | 3.0 |
| Total Del/Veh (s) | 50.2 | 15.8 | 7.7 | 39.5 | 13.7 | 12.8 | 47.1 | 47.8 | 8.1 | 65.4 | 39.4 | 6.4 |
| Avg Speed (mph) | 6 | 16 | 19 | 5 | 12 | 10 | 7 | 8 | 19 | 9 | 14 | 28 |
| Fuel Eff. (mpg) | 15.3 | 24.8 | 27.7 | 15.0 | 21.3 | 28.0 | 17.5 | 18.5 | 36.3 | 20.6 | 26.0 | 28.9 |
| HC Emissions (g) | 1 | 5 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 5 | 0 | 2 |
| CO Emissions (g) | 49 | 259 | 15 | 13 | 132 | 21 | 15 | 14 | 9 | 355 | 24 | 168 |
| NOx Emissions (g) | 2 | 18 | 1 | 1 | 11 | 2 | 1 | 1 | 1 | 20 | 2 | 10 |

## 1: Redwood Blvd & Rowland Blvd Performance by movement

| Movement | All |
|---|---|
| Denied Del/Veh (s) | 0.8 |
| Total Del/Veh (s) | 26.1 |
| Avg Speed (mph) | 11 |
| Fuel Eff. (mpg) | 22.5 |
| HC Emissions (g) | 17 |
| CO Emissions (g) | 1074 |
| NOx Emissions (g) | 70 |

## 2: US 101 SB On-Ramp/US 101 SB Off-Ramp & Rowland Blvd Performance by movement

| Movement | EBT | EBR | WBL | WBT | SBL | SBT | SBR | All |
|---|---|---|---|---|---|---|---|---|
| Denied Del/Veh (s) | 0.0 | 0.0 | 0.3 | 0.0 | 0.2 | 0.1 | 2.6 | 0.2 |
| Total Del/Veh (s) | 17.7 | 10.9 | 29.8 | 3.9 | 39.0 | 35.2 | 19.0 | 18.5 |
| Avg Speed (mph) | 10 | 11 | 8 | 25 | 15 | 16 | 23 | 14 |
| Fuel Eff. (mpg) | 17.7 | 23.0 | 23.4 | 30.9 | 28.4 | 25.7 | 28.7 | 25.9 |
| HC Emissions (g) | 4 | 1 | 1 | 9 | 5 | 0 | 2 | 22 |
| CO Emissions (g) | 150 | 65 | 71 | 328 | 330 | 6 | 132 | 1082 |
| NOx Emissions (g) | 15 | 7 | 7 | 28 | 26 | 0 | 8 | 91 |

## 3: US 101 NB Off-Ramp/US 101 NB On-Ramp & Rowland Blvd Performance by movement

| Movement | EBL2 | EBL | EBT | WBT | WBR | WBR2 | NBL2 | NBL | NBT | NBR | NEL2 | NEL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Denied Del/Veh (s) | 0.0 | 0.0 | 0.0 | 0.0 |  | 0.1 | 0.6 | 0.5 | 0.7 | 0.7 | 0.1 | 0.1 |
| Total Del/Veh (s) | 52.6 | 32.6 | 15.2 | 16.2 |  | 9.7 | 36.1 | 45.1 | 46.6 | 27.0 | 46.0 | 53.3 |
| Avg Speed (mph) | 6 | 9 | 15 | 12 | 8 | 13 | 16 | 16 | 14 | 18 | 3 | 2 |
| Fuel Eff. (mpg) | 18.7 | 22.5 | 29.6 | 18.0 | 17.0 | 23.4 | 27.4 | 27.3 | 27.0 | 29.4 | 10.5 | 7.9 |
| HC Emissions (g) | 0 | 0 | 4 | 17 | 0 | 6 | 7 | 0 | 2 | 12 | 0 | 0 |
| CO Emissions (g) | 1 | 8 | 144 | 563 | 0 | 160 | 360 | 6 | 48 | 626 | 1 | 1 |
| NOx Emissions (g) | 0 | 1 | 17 | 59 | 0 | 20 | 31 | 0 | 6 | 54 | 0 | 0 |

## 3: US 101 NB Off-Ramp/US 101 NB On-Ramp & Rowland Blvd Performance by movement

| Movement | NER | All |
|---|---|---|
| Denied Del/Veh (s) |  | 0.2 |
| Total Del/Veh (s) |  | 20.7 |
| Avg Speed (mph) | 2 | 15 |
| Fuel Eff. (mpg) | 7.2 | 26.0 |
| HC Emissions (g) | 0 | 48 |
| CO Emissions (g) | 0 | 1917 |
| NOx Emissions (g) | 0 | 188 |

## 4: Rowland Blvd & Rowland Way Performance by movement

| Movement | EBL | EBT | WBT | WBR | SBL | SBR | All |
|---|---|---|---|---|---|---|---|
| Denied Del/Veh (s) | 0.0 | 0.0 | 0.0 | 0.1 | 0.3 | 0.2 | 0.0 |
| Total Del/Veh (s) | 39.6 | 5.1 | 14.6 | 14.8 | 50.8 | 35.8 | 14.7 |
| Avg Speed (mph) | 6 | 19 | 11 | 10 | 4 | 5 | 11 |
| Fuel Eff. (mpg) | 13.6 | 17.4 | 19.4 | 23.0 | 11.8 | 14.4 | 17.4 |
| HC Emissions (g) | 1 | 14 | 5 | 0 | 0 | 3 | 24 |
| CO Emissions (g) | 69 | 821 | 262 | 8 | 18 | 105 | 1283 |
| NOx Emissions (g) | 6 | 63 | 31 | 1 | 2 | 9 | 112 |

## 5: Vintage Way (North) & Rowland Blvd Performance by movement

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | SBL | SBT | SBR | All |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Denied Del/Veh (s) | 0.0 | 0.0 | 0.0 |  | 0.4 | 0.6 | 0.0 | 0.0 |  |  | 0.1 | 0.1 |
| Total Del/Veh (s) | 55.2 | 5.0 | 2.4 |  | 12.5 | 15.5 | 39.8 | 19.8 |  |  | 24.5 | 13.4 |
| Avg Speed (mph) | 4 | 20 | 21 | 4 | 13 | 10 | 7 | 13 | 0 | 1 | 1 | 12 |
| Fuel Eff. (mpg) | 12.6 | 23.3 | 41.0 | 11.6 | 22.6 | 24.0 | 19.6 | 21.4 | 1.5 | 2.3 | 5.7 | 24.1 |
| HC Emissions (g) | 0 | 4 | 1 | 0 | 6 | 0 | 3 | 0 | 0 | 0 | 0 | 14 |
| CO Emissions (g) | 3 | 205 | 78 | 0 | 265 | 1 | 197 | 8 | 0 | 0 | 0 | 758 |
| NOx Emissions (g) | 0 | 16 | 7 | 0 | 20 | 0 | 10 | 0 | 0 | 0 | 0 | 54 |

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## 6: Vintage Way (South) & Rowland Blvd Performance by movement

| Movement | EBL | EBR | NBL | SET | All |
|---|---|---|---|---|---|
| Denied Del/Veh (s) | 0.4 | 0.3 | 0.1 | 0.0 | 0.2 |
| Total Del/Veh (s) | 6.4 | 3.4 | 3.2 | 1.7 | 3.6 |
| Avg Speed (mph) | 16 | 16 | 9 | 23 | 21 |
| Fuel Eff. (mpg) | 32.3 | 32.6 | 35.1 | 31.6 | 31.8 |
| HC Emissions (g) | 2 | 0 | 0 | 5 | 7 |
| CO Emissions (g) | 78 | 0 | 0 | 150 | 228 |
| NOx Emissions (g) | 8 | 0 | 0 | 20 | 28 |

## Total Network Performance

| | |
|---|---|
| Denied Del/Veh (s) | 0.8 |
| Total Del/Veh (s) | 55.0 |
| Avg Speed (mph) | 16 |
| Fuel Eff. (mpg) | 22.6 |
| HC Emissions (g) | 280 |
| CO Emissions (g) | 13573 |
| NOx Emissions (g) | 1083 |

## Intersection: 1: Redwood Blvd & Rowland Blvd

| Movement | EB | EB | EB | EB | WB | WB | WB | NB | NB | NB | SB | SB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Directions Served | L | T | T | R | UL | T | TR | L | T | TR | L | L |
| Maximum Queue (ft) | 98 | 210 | 253 | 45 | 75 | 215 | 263 | 39 | 46 | 62 | 206 | 151 |
| Average Queue (ft) | 64 | 128 | 165 | 11 | 39 | 143 | 188 | 16 | 22 | 36 | 137 | 84 |
| 95th Queue (ft) | 124 | 254 | 285 | 53 | 82 | 246 | 297 | 44 | 54 | 70 | 225 | 162 |
| Link Distance (ft) |  | 612 | 612 |  |  | 294 | 294 |  | 705 | 705 |  | 1269 |
| Upstream Blk Time (%) |  |  |  |  |  | 0 | 2 |  |  |  |  |  |
| Queuing Penalty (veh) |  |  |  |  |  | 2 | 10 |  |  |  |  |  |
| Storage Bay Dist (ft) | 245 |  |  | 65 | 208 |  |  | 102 |  |  | 248 |  |
| Storage Blk Time (%) |  | 1 | 33 |  |  | 2 |  |  |  |  | 1 |  |
| Queuing Penalty (veh) |  | 1 | 10 |  |  | 1 |  |  |  |  | 1 |  |

## Intersection: 1: Redwood Blvd & Rowland Blvd

| Movement | SB | SB |
|---|---|---|
| Directions Served | T | R |
| Maximum Queue (ft) | 24 | 20 |
| Average Queue (ft) | 8 | 7 |
| 95th Queue (ft) | 24 | 23 |
| Link Distance (ft) | 1269 |  |
| Upstream Blk Time (%) |  |  |
| Queuing Penalty (veh) |  |  |
| Storage Bay Dist (ft) |  | 380 |
| Storage Blk Time (%) |  |  |
| Queuing Penalty (veh) |  |  |

## Intersection: 2: US 101 SB On-Ramp/US 101 SB Off-Ramp & Rowland Blvd

| Movement | EB | EB | EB | WB | WB | WB | WB | SB | SB | SB |
|---|---|---|---|---|---|---|---|---|---|---|
| Directions Served | T | TR | R | L | L | T | T | L | LT | TR |
| Maximum Queue (ft) | 277 | 284 | 168 | 329 | 336 | 141 | 192 | 267 | 271 | 54 |
| Average Queue (ft) | 189 | 187 | 106 | 230 | 247 | 79 | 114 | 210 | 209 | 28 |
| 95th Queue (ft) | 310 | 305 | 185 | 350 | 362 | 160 | 211 | 281 | 282 | 59 |
| Link Distance (ft) | 294 | 294 | 294 |  | 1059 | 1059 | 1059 | 1718 | 1718 |  |
| Upstream Blk Time (%) | 3 | 1 |  |  |  |  |  |  |  |  |
| Queuing Penalty (veh) | 14 | 6 |  |  |  |  |  |  |  |  |
| Storage Bay Dist (ft) |  |  |  | 442 |  |  |  |  |  | 290 |
| Storage Blk Time (%) |  |  |  |  | 0 |  |  |  | 1 |  |
| Queuing Penalty (veh) |  |  |  |  | 1 |  |  |  | 1 |  |

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## Intersection: 3: US 101 NB Off-Ramp/US 101 NB On-Ramp & Rowland Blvd

| Movement | EB | EB | EB | WB | WB | WB | WB | NB | NB | NB | NB | NE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Directions Served | <L | T | T | T | T | T | R> | < | <LT | R | R | <LR |
| Maximum Queue (ft) | 380 | 948 | 948 | 385 | 396 | 323 | 208 | 158 | 471 | 815 | 727 | 23 |
| Average Queue (ft) | 156 | 636 | 643 | 375 | 278 | 157 | 94 | 71 | 196 | 499 | 483 | 6 |
| 95th Queue (ft) | 477 | 1132 | 1130 | 409 | 447 | 337 | 219 | 179 | 649 | 960 | 841 | 26 |
| Link Distance (ft) |  | 1059 | 1059 | 373 | 373 | 373 |  |  | 1898 | 1898 |  | 205 |
| Upstream Blk Time (%) |  | 5 | 5 | 29 | 4 | 0 |  |  |  |  |  |  |
| Queuing Penalty (veh) |  | 31 | 31 | 232 | 36 | 1 |  |  |  |  |  |  |
| Storage Bay Dist (ft) | 440 |  |  |  |  |  | 186 | 450 |  |  | 1000 |  |
| Storage Blk Time (%) | 0 | 41 |  |  |  | 4 | 1 |  | 0 | 2 | 2 |  |
| Queuing Penalty (veh) | 0 | 26 |  |  |  | 23 | 7 |  | 0 | 12 | 16 |  |

## Intersection: 4: Rowland Blvd & Rowland Way

| Movement | EB | EB | EB | EB | EB | WB | WB | SB | SB |
|---|---|---|---|---|---|---|---|---|---|
| Directions Served | UL | L | T | T | T | T | TR | LR | R |
| Maximum Queue (ft) | 179 | 260 | 401 | 323 | 224 | 286 | 309 | 372 | 324 |
| Average Queue (ft) | 107 | 232 | 332 | 151 | 106 | 272 | 281 | 295 | 157 |
| 95th Queue (ft) | 195 | 319 | 508 | 368 | 239 | 290 | 313 | 456 | 369 |
| Link Distance (ft) |  |  | 373 | 373 | 373 | 256 | 256 | 375 | 375 |
| Upstream Blk Time (%) |  |  | 23 | 0 | 0 | 37 | 32 | 26 | 2 |
| Queuing Penalty (veh) |  |  | 200 | 2 | 0 | 416 | 359 | 0 | 0 |
| Storage Bay Dist (ft) | 235 | 235 |  |  |  |  |  |  |  |
| Storage Blk Time (%) | 0 | 0 | 40 |  |  |  |  |  |  |
| Queuing Penalty (veh) | 0 | 3 | 126 |  |  |  |  |  |  |

## Intersection: 5: Rowland Blvd & Vintage Way (North)

| Movement | EB | EB | EB | EB | EB | WB | WB | WB | B82 | NB | NB | NB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Directions Served | L | T | T | R | R | L | T | TR | T | L | L | TR |
| Maximum Queue (ft) | 93 | 282 | 256 | 75 | 43 | 33 | 639 | 635 | 618 | 555 | 568 | 165 |
| Average Queue (ft) | 31 | 265 | 241 | 13 | 12 | 10 | 475 | 484 | 198 | 415 | 428 | 57 |
| 95th Queue (ft) | 110 | 297 | 304 | 99 | 58 | 56 | 746 | 732 | 765 | 693 | 692 | 202 |
| Link Distance (ft) |  | 256 | 256 | 256 | 256 |  | 585 | 585 | 1534 | 572 | 572 |  |
| Upstream Blk Time (%) |  | 31 | 3 |  |  |  | 28 | 21 |  | 11 | 14 |  |
| Queuing Penalty (veh) |  | 187 | 20 |  |  |  | 99 | 77 |  | 0 | 0 |  |
| Storage Bay Dist (ft) | 92 |  |  |  |  | 80 |  |  |  |  |  | 180 |
| Storage Blk Time (%) |  | 78 |  |  |  | 0 | 84 |  |  |  | 53 | 0 |
| Queuing Penalty (veh) |  | 25 |  |  |  | 0 | 3 |  |  |  | 15 | 0 |

## Intersection: 5: Rowland Blvd & Vintage Way (North)

| Movement | B77 | B77 | SB |
|---|---|---|---|
| Directions Served | T | T | LTR |
| Maximum Queue (ft) | 119 | 144 | 47 |
| Average Queue (ft) | 42 | 46 | 20 |
| 95th Queue (ft) | 254 | 256 | 52 |
| Link Distance (ft) | 680 | 680 | 98 |
| Upstream Blk Time (%) | 0 | 0 |  |
| Queuing Penalty (veh) | 0 | 0 |  |
| Storage Bay Dist (ft) |  |  |  |
| Storage Blk Time (%) |  |  |  |
| Queuing Penalty (veh) |  |  |  |

## Intersection: 6: Vintage Way (South) & Rowland Blvd

| Movement | EB | NB | SE | B82 |
|---|---|---|---|---|
| Directions Served | LR | <L | R> | T |
| Maximum Queue (ft) | 149 | 112 | 246 | 60 |
| Average Queue (ft) | 92 | 89 | 158 | 10 |
| 95th Queue (ft) | 167 | 128 | 261 | 137 |
| Link Distance (ft) | 519 | 99 | 1534 | 585 |
| Upstream Blk Time (%) |  | 9 |  | 0 |
| Queuing Penalty (veh) |  | 0 |  | 0 |
| Storage Bay Dist (ft) |  |  |  |  |
| Storage Blk Time (%) |  |  |  |  |
| Queuing Penalty (veh) |  |  |  |  |

## Network Summary

Network wide Queuing Penalty: 1995

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## 1: Redwood Blvd & Rowland Blvd Performance by movement

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Denied Del/Veh (s) | 3.0 | 0.4 | 2.8 | 0.0 | 0.0 | 0.0 | 4.3 | 0.1 | 0.2 | 1.8 | 0.3 | 3.2 |
| Total Del/Veh (s) | 43.8 | 24.6 | 9.0 | 40.8 | 23.3 | 22.2 | 36.1 | 41.2 | 10.6 | 35.7 | 21.7 | 3.6 |
| Avg Speed (mph) | 7 | 11 | 18 | 4 | 7 | 7 | 8 | 9 | 17 | 14 | 21 | 31 |
| Fuel Eff. (mpg) | 16.0 | 21.7 | 24.8 | 13.6 | 17.4 | 20.1 | 19.5 | 21.4 | 30.9 | 26.0 | 31.9 | 32.9 |
| HC Emissions (g) | 1 | 5 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 5 | 0 | 1 |
| CO Emissions (g) | 50 | 299 | 13 | 7 | 69 | 20 | 6 | 11 | 22 | 315 | 18 | 92 |
| NOx Emissions (g) | 2 | 19 | 1 | 1 | 7 | 2 | 0 | 1 | 1 | 20 | 2 | 6 |

## 1: Redwood Blvd & Rowland Blvd Performance by movement

| Movement | All |
|---|---|
| Denied Del/Veh (s) | 0.8 |
| Total Del/Veh (s) | 26.1 |
| Avg Speed (mph) | 12 |
| Fuel Eff. (mpg) | 23.0 |
| HC Emissions (g) | 14 |
| CO Emissions (g) | 921 |
| NOx Emissions (g) | 62 |

## 2: US 101 SB On-Ramp/US 101 SB Off-Ramp & Rowland Blvd Performance by movement

| Movement | EBT | EBR | WBL | WBT | SBL | SBT | SBR | All |
|---|---|---|---|---|---|---|---|---|
| Denied Del/Veh (s) | 0.0 | 0.0 | 0.1 | 0.0 | 0.2 |  | 2.5 | 0.1 |
| Total Del/Veh (s) | 32.4 | 11.5 | 31.0 | 10.2 | 45.2 | 27.5 | 10.8 | 26.1 |
| Avg Speed (mph) | 6 | 11 | 13 | 22 | 14 | 13 | 27 | 14 |
| Fuel Eff. (mpg) | 14.4 | 21.6 | 22.1 | 24.8 | 27.9 | 26.4 | 30.4 | 23.4 |
| HC Emissions (g) | 3 | 1 | 5 | 28 | 6 | 0 | 1 | 45 |
| CO Emissions (g) | 161 | 78 | 263 | 787 | 395 | 1 | 89 | 1774 |
| NOx Emissions (g) | 15 | 8 | 34 | 87 | 32 | 0 | 5 | 182 |

## 3: US 101 NB Off-Ramp/US 101 NB On-Ramp & Rowland Blvd Performance by movement

| Movement | EBL2 | EBL | EBT | WBT | WBR | WBR2 | NBL2 | NBL | NBT | NBR | NEL2 | NEL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Denied Del/Veh (s) | 0.0 | 0.0 | 0.3 | 0.1 |  | 0.6 | 0.8 | 0.9 | 0.5 | 0.9 |  | 0.1 |
| Total Del/Veh (s) | 113.0 | 87.9 | 112.8 | 42.0 |  | 9.8 | 24.3 | 42.8 | 23.8 | 66.0 |  | 47.3 |
| Avg Speed (mph) | 5 | 6 | 5 | 6 | 18 | 13 | 19 | 17 | 21 | 11 | 2 | 2 |
| Fuel Eff. (mpg) | 13.1 | 15.1 | 13.5 | 13.4 | 20.5 | 21.6 | 28.5 | 26.9 | 27.8 | 23.0 | 10.1 | 9.9 |
| HC Emissions (g) | 0 | 0 | 11 | 16 | 0 | 6 | 4 | 0 | 1 | 14 | 0 | 0 |
| CO Emissions (g) | 2 | 28 | 550 | 528 | 0 | 162 | 213 | 5 | 22 | 876 | 0 | 0 |
| NOx Emissions (g) | 0 | 2 | 50 | 52 | 0 | 19 | 18 | 0 | 3 | 75 | 0 | 0 |

## 3: US 101 NB Off-Ramp/US 101 NB On-Ramp & Rowland Blvd Performance by movement

| Movement | All |
|---|---|
| Denied Del/Veh (s) | 0.5 |
| Total Del/Veh (s) | 62.8 |
| Avg Speed (mph) | 8 |
| Fuel Eff. (mpg) | 18.8 |
| HC Emissions (g) | 53 |
| CO Emissions (g) | 2386 |
| NOx Emissions (g) | 220 |

## 4: Rowland Blvd & Rowland Way Performance by movement

| Movement | EBL | EBT | WBT | WBR | SBL | SBR | All |
|---|---|---|---|---|---|---|---|
| Denied Del/Veh (s) | 0.0 | 0.0 | 0.0 | 0.0 | 28.9 | 26.9 | 2.5 |
| Total Del/Veh (s) | 79.5 | 19.7 | 29.4 | 19.6 | 167.2 | 88.4 | 35.1 |
| Avg Speed (mph) | 3 | 10 | 6 | 7 | 1 | 2 | 6 |
| Fuel Eff. (mpg) | 8.9 | 15.6 | 14.2 | 17.4 | 3.8 | 6.5 | 12.9 |
| HC Emissions (g) | 1 | 11 | 3 | 1 | 0 | 1 | 18 |
| CO Emissions (g) | 56 | 680 | 154 | 15 | 25 | 60 | 991 |
| NOx Emissions (g) | 6 | 53 | 21 | 2 | 1 | 5 | 88 |

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## 5: Rowland Blvd & Vintage Way (North) Performance by movement

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Denied Del/Veh (s) | 0.0 | 0.5 | 0.0 |  | 46.9 | 41.3 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 |
| Total Del/Veh (s) | 97.4 | 63.3 | 2.5 |  | 161.1 | 112.8 | 62.0 | 54.3 | 33.0 | 35.6 | 43.6 | 47.3 |
| Avg Speed (mph) | 2 | 3 | 20 | 2 | 2 | 2 | 5 | 6 | 8 | 2 | 1 | 1 |
| Fuel Eff. (mpg) | 7.4 | 8.9 | 39.8 | 6.1 | 5.5 | 5.3 | 16.1 | 15.8 | 19.7 | 5.9 | 5.5 | 4.6 |
| HC Emissions (g) | 0 | 5 | 1 | 0 | 6 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| CO Emissions (g) | 2 | 139 | 67 | 1 | 242 | 2 | 181 | 7 | 1 | 0 | 0 | 0 |
| NOx Emissions (g) | 0 | 15 | 6 | 0 | 15 | 0 | 14 | 1 | 0 | 0 | 0 | 0 |

## 5: Rowland Blvd & Vintage Way (North) Performance by movement

| Movement | All |
|---|---|
| Denied Del/Veh (s) | 10.1 |
| Total Del/Veh (s) | 62.7 |
| Avg Speed (mph) | 4 |
| Fuel Eff. (mpg) | 11.6 |
| HC Emissions (g) | 14 |
| CO Emissions (g) | 643 |
| NOx Emissions (g) | 51 |

## 6: Vintage Way (South) & Rowland Blvd Performance by movement

| Movement | EBL | EBR | NBL | SET | SER | SER2 | All |
|---|---|---|---|---|---|---|---|
| Denied Del/Veh (s) | 0.4 | 0.2 | 0.8 | 0.0 | 0.0 | 0.0 | 0.3 |
| Total Del/Veh (s) | 13.6 | 7.5 | 10.2 | 1.8 | 17.2 | 15.6 | 12.5 |
| Avg Speed (mph) | 12 | 15 | 5 | 23 | 17 | 18 | 15 |
| Fuel Eff. (mpg) | 26.9 | 28.1 | 15.0 | 33.9 | 32.4 | 33.0 | 30.5 |
| HC Emissions (g) | 2 | 0 | 0 | 2 | 4 | 3 | 11 |
| CO Emissions (g) | 69 | 1 | 12 | 31 | 81 | 77 | 271 |
| NOx Emissions (g) | 7 | 0 | 2 | 5 | 12 | 11 | 36 |

## Total Network Performance

| | |
|---|---|
| Denied Del/Veh (s) | 8.3 |
| Total Del/Veh (s) | 119.8 |
| Avg Speed (mph) | 10 |
| Fuel Eff. (mpg) | 19.4 |
| HC Emissions (g) | 256 |
| CO Emissions (g) | 11218 |
| NOx Emissions (g) | 1013 |

## Intersection: 1: Redwood Blvd & Rowland Blvd

| Movement | EB | EB | EB | EB | WB | WB | WB | NB | NB | NB | SB | SB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Directions Served | L | T | T | R | UL | T | TR | L | T | TR | L | L |
| Maximum Queue (ft) | 155 | 273 | 336 | 55 | 85 | 174 | 209 | 35 | 46 | 63 | 250 | 276 |
| Average Queue (ft) | 91 | 143 | 182 | 13 | 41 | 82 | 124 | 14 | 23 | 37 | 198 | 150 |
| 95th Queue (ft) | 178 | 293 | 360 | 56 | 112 | 201 | 252 | 40 | 57 | 70 | 290 | 316 |
| Link Distance (ft) |  | 612 | 612 |  |  | 294 | 294 |  | 705 | 705 |  | 1269 |
| Upstream Blk Time (%) |  |  |  |  |  |  | 0 |  |  |  |  |  |
| Queuing Penalty (veh) |  |  |  |  |  |  | 1 |  |  |  |  |  |
| Storage Bay Dist (ft) | 245 |  |  | 65 | 208 |  |  | 102 |  |  | 248 |  |
| Storage Blk Time (%) |  | 4 | 34 | 0 |  | 0 |  |  |  |  | 9 | 1 |
| Queuing Penalty (veh) |  | 4 | 10 | 0 |  | 0 |  |  |  |  | 20 | 3 |

## Intersection: 1: Redwood Blvd & Rowland Blvd

| Movement | SB | SB |
|---|---|---|
| Directions Served | T | R |
| Maximum Queue (ft) | 26 | 23 |
| Average Queue (ft) | 9 | 9 |
| 95th Queue (ft) | 33 | 31 |
| Link Distance (ft) | 1269 |  |
| Upstream Blk Time (%) |  |  |
| Queuing Penalty (veh) |  |  |
| Storage Bay Dist (ft) |  | 380 |
| Storage Blk Time (%) |  |  |
| Queuing Penalty (veh) |  |  |

## Intersection: 2: US 101 SB On-Ramp/US 101 SB Off-Ramp & Rowland Blvd

| Movement | EB | EB | EB | WB | WB | WB | WB | SB | SB | SB |
|---|---|---|---|---|---|---|---|---|---|---|
| Directions Served | T | TR | R | L | L | T | T | L | LT | TR |
| Maximum Queue (ft) | 303 | 297 | 202 | 212 | 229 | 132 | 158 | 235 | 235 | 51 |
| Average Queue (ft) | 183 | 181 | 101 | 141 | 166 | 54 | 75 | 174 | 171 | 27 |
| 95th Queue (ft) | 330 | 321 | 195 | 234 | 254 | 135 | 174 | 251 | 243 | 59 |
| Link Distance (ft) | 294 | 294 | 294 |  | 1059 | 1059 | 1059 | 1718 | 1718 |  |
| Upstream Blk Time (%) | 3 | 2 | 0 |  |  |  |  |  |  |  |
| Queuing Penalty (veh) | 11 | 9 | 0 |  |  |  |  |  |  |  |
| Storage Bay Dist (ft) |  |  |  | 442 |  |  |  |  |  | 290 |
| Storage Blk Time (%) |  |  |  |  |  |  |  |  |  |  |
| Queuing Penalty (veh) |  |  |  |  |  |  |  |  |  |  |

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## Intersection: 3: US 101 NB Off-Ramp/US 101 NB On-Ramp & Rowland Blvd

| Movement | EB | EB | EB | WB | WB | WB | WB | NB | NB | NB | NB | NE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Directions Served | <L | T | T | T | T | T | R> | < | <LT | R | R | <LR |
| Maximum Queue (ft) | 91 | 312 | 326 | 385 | 331 | 118 | 76 | 222 | 272 | 522 | 527 | 28 |
| Average Queue (ft) | 53 | 187 | 197 | 337 | 190 | 61 | 35 | 109 | 141 | 428 | 437 | 7 |
| 95th Queue (ft) | 106 | 370 | 384 | 457 | 384 | 130 | 80 | 255 | 295 | 672 | 682 | 27 |
| Link Distance (ft) |  | 1059 | 1059 | 373 | 373 | 373 |  |  | 1898 | 1898 |  | 205 |
| Upstream Blk Time (%) |  |  |  | 7 | 0 |  |  |  |  |  |  |  |
| Queuing Penalty (veh) |  |  |  | 54 | 3 |  |  |  |  |  |  |  |
| Storage Bay Dist (ft) | 440 |  |  |  |  |  | 186 | 450 |  |  | 1000 |  |
| Storage Blk Time (%) |  | 0 |  |  |  |  |  |  | 0 |  |  |  |
| Queuing Penalty (veh) |  | 0 |  |  |  |  |  |  | 0 |  |  |  |

## Intersection: 4: Rowland Blvd & Rowland Way

| Movement | EB | EB | EB | EB | EB | WB | WB | SB | SB |
|---|---|---|---|---|---|---|---|---|---|
| Directions Served | UL | L | T | T | T | T | TR | LR | R |
| Maximum Queue (ft) | 151 | 168 | 276 | 180 | 174 | 293 | 303 | 279 | 198 |
| Average Queue (ft) | 105 | 132 | 161 | 117 | 129 | 278 | 286 | 207 | 92 |
| 95th Queue (ft) | 161 | 186 | 285 | 201 | 198 | 294 | 305 | 330 | 216 |
| Link Distance (ft) |  |  | 373 | 373 | 373 | 256 | 256 | 375 | 375 |
| Upstream Blk Time (%) |  |  | 0 |  |  | 33 | 31 | 1 |  |
| Queuing Penalty (veh) |  |  | 1 |  |  | 364 | 348 | 0 |  |
| Storage Bay Dist (ft) | 235 | 235 |  |  |  |  |  |  |  |
| Storage Blk Time (%) |  | 0 | 2 |  |  |  |  |  |  |
| Queuing Penalty (veh) |  | 0 | 7 |  |  |  |  |  |  |

## Intersection: 5: Rowland Blvd & Vintage Way (North)

| Movement | EB | EB | EB | EB | WB | WB | WB | B82 | NB | NB | NB | B77 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Directions Served | L | T | T | R | L | T | TR | T | L | L | TR | T |
| Maximum Queue (ft) | 106 | 256 | 245 | 6 | 83 | 615 | 612 | 94 | 596 | 608 | 186 | 128 |
| Average Queue (ft) | 42 | 203 | 162 | 1 | 26 | 432 | 437 | 22 | 466 | 476 | 47 | 48 |
| 95th Queue (ft) | 118 | 278 | 270 | 13 | 98 | 686 | 684 | 155 | 715 | 722 | 183 | 256 |
| Link Distance (ft) |  | 256 | 256 | 256 |  | 593 | 593 | 1502 | 590 | 590 |  | 491 |
| Upstream Blk Time (%) |  | 2 | 0 |  |  | 7 | 6 |  | 14 | 17 |  | 2 |
| Queuing Penalty (veh) |  | 11 | 2 |  |  | 25 | 21 |  | 0 | 0 |  | 0 |
| Storage Bay Dist (ft) | 92 |  |  |  | 80 |  |  |  |  |  | 180 |  |
| Storage Blk Time (%) | 1 | 44 |  |  | 0 | 83 |  |  |  | 52 | 0 |  |
| Queuing Penalty (veh) | 4 | 14 |  |  | 1 | 3 |  |  |  | 15 | 0 |  |

## Intersection: 5: Rowland Blvd & Vintage Way (North)

| Movement | B77 | SB |
|---|---|---|
| Directions Served | T | LTR |
| Maximum Queue (ft) | 154 | 48 |
| Average Queue (ft) | 58 | 22 |
| 95th Queue (ft) | 278 | 54 |
| Link Distance (ft) | 491 | 107 |
| Upstream Blk Time (%) | 2 |  |
| Queuing Penalty (veh) | 0 |  |
| Storage Bay Dist (ft) |  |  |
| Storage Blk Time (%) |  |  |
| Queuing Penalty (veh) |  |  |

## Intersection: 6: Vintage Way (South) & Rowland Blvd

| Movement | EB | NB | SE | B82 |
|---|---|---|---|---|
| Directions Served | LR | <L | R> |  |
| Maximum Queue (ft) | 144 | 111 | 448 | 57 |
| Average Queue (ft) | 92 | 81 | 276 | 10 |
| 95th Queue (ft) | 161 | 122 | 537 | 131 |
| Link Distance (ft) | 518 | 99 | 1502 | 593 |
| Upstream Blk Time (%) |  | 4 |  |  |
| Queuing Penalty (veh) |  | 0 |  |  |
| Storage Bay Dist (ft) |  |  |  |  |
| Storage Blk Time (%) |  |  |  |  |
| Queuing Penalty (veh) |  |  |  |  |

## Network Summary

Network wide Queuing Penalty: 932

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## 1: Redwood Blvd & Rowland Blvd Performance by movement

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Denied Del/Veh (s) | 3.0 | 0.4 | 2.9 | 0.0 | 0.0 | 0.0 | 3.6 | 0.1 | 0.1 | 1.9 | 0.4 | 3.2 |
| Total Del/Veh (s) | 63.2 | 29.4 | 15.8 | 43.2 | 10.2 | 10.6 | 58.2 | 39.6 | 12.0 | 74.0 | 34.5 | 5.4 |
| Avg Speed (mph) | 5 | 10 | 13 | 4 | 13 | 11 | 6 | 8 | 16 | 8 | 16 | 29 |
| Fuel Eff. (mpg) | 13.7 | 20.9 | 23.4 | 14.0 | 21.8 | 28.5 | 15.8 | 21.0 | 29.3 | 19.3 | 27.1 | 28.4 |
| HC Emissions (g) | 1 | 6 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 5 | 0 | 2 |
| CO Emissions (g) | 55 | 288 | 11 | 7 | 86 | 20 | 5 | 9 | 21 | 349 | 22 | 125 |
| NOx Emissions (g) | 3 | 20 | 1 | 1 | 8 | 2 | 0 | 1 | 1 | 19 | 2 | 7 |

## 1: Redwood Blvd & Rowland Blvd Performance by movement

| Movement | All |
|---|---|
| Denied Del/Veh (s) | 0.8 |
| Total Del/Veh (s) | 30.2 |
| Avg Speed (mph) | 10 |
| Fuel Eff. (mpg) | 21.1 |
| HC Emissions (g) | 16 |
| CO Emissions (g) | 998 |
| NOx Emissions (g) | 66 |

## 2: US 101 SB On-Ramp/US 101 SB Off-Ramp & Rowland Blvd Performance by movement

| Movement | EBT | EBR | WBL | WBT | SBL | SBT | SBR | All |
|---|---|---|---|---|---|---|---|---|
| Denied Del/Veh (s) | 0.0 | 0.0 | 0.1 | 0.0 | 0.2 | 0.3 | 2.4 | 0.1 |
| Total Del/Veh (s) | 29.9 | 13.0 | 26.0 | 6.3 | 36.3 | 42.4 | 10.8 | 21.5 |
| Avg Speed (mph) | 7 | 11 | 15 | 25 | 17 | 13 | 27 | 16 |
| Fuel Eff. (mpg) | 15.3 | 22.2 | 23.7 | 26.7 | 30.4 | 25.7 | 30.7 | 25.1 |
| HC Emissions (g) | 3 | 1 | 6 | 33 | 6 | 1 | 1 | 51 |
| CO Emissions (g) | 139 | 64 | 320 | 874 | 391 | 10 | 82 | 1881 |
| NOx Emissions (g) | 15 | 7 | 38 | 102 | 32 | 1 | 5 | 201 |

## 3: US 101 NB Off-Ramp/US 101 NB On-Ramp & Rowland Blvd Performance by movement

| Movement | EBL2 | EBL | EBT | WBT | WBR | WBR2 | NBL2 | NBL | NBT | NBR | NEL2 | NEL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Denied Del/Veh (s) | 0.0 | 0.0 | 0.0 | 0.0 |  | 0.2 | 0.6 |  | 0.9 | 0.8 |  | 0.1 |
| Total Del/Veh (s) | 42.2 | 26.9 | 27.0 | 25.5 |  | 5.1 | 30.9 |  | 18.4 | 51.0 | 25.7 | 54.1 |
| Avg Speed (mph) | 9 | 14 | 15 | 9 | 17 | 16 | 17 | 31 | 19 | 13 | 2 | 2 |
| Fuel Eff. (mpg) | 18.8 | 22.3 | 21.8 | 15.6 | 19.5 | 21.8 | 27.5 | 42.1 | 29.2 | 24.5 | 7.8 | 7.1 |
| HC Emissions (g) | 0 | 1 | 14 | 20 | 0 | 5 | 5 | 0 | 1 | 15 | 0 | 0 |
| CO Emissions (g) | 2 | 32 | 671 | 700 | 0 | 162 | 243 | 0 | 10 | 907 | 0 | 0 |
| NOx Emissions (g) | 0 | 3 | 68 | 67 | 0 | 18 | 20 | 0 | 1 | 77 | 0 | 0 |

## 3: US 101 NB Off-Ramp/US 101 NB On-Ramp & Rowland Blvd Performance by movement

| Movement | All |
|---|---|
| Denied Del/Veh (s) | 0.3 |
| Total Del/Veh (s) | 32.2 |
| Avg Speed (mph) | 13 |
| Fuel Eff. (mpg) | 22.4 |
| HC Emissions (g) | 60 |
| CO Emissions (g) | 2728 |
| NOx Emissions (g) | 255 |

## 4: Rowland Blvd & Rowland Way Performance by movement

| Movement | EBL | EBT | WBT | WBR | SBL | SBR | All |
|---|---|---|---|---|---|---|---|
| Denied Del/Veh (s) | 0.0 | 0.0 | 0.1 | 0.0 | 0.5 | 0.3 | 0.1 |
| Total Del/Veh (s) | 53.9 | 7.8 | 27.7 | 22.1 | 58.6 | 38.2 | 21.6 |
| Avg Speed (mph) | 4 | 16 | 6 | 7 | 3 | 5 | 8 |
| Fuel Eff. (mpg) | 11.4 | 18.5 | 15.0 | 16.5 | 10.3 | 14.0 | 16.0 |
| HC Emissions (g) | 1 | 14 | 2 | 0 | 1 | 1 | 20 |
| CO Emissions (g) | 81 | 776 | 141 | 9 | 23 | 59 | 1088 |
| NOx Emissions (g) | 8 | 66 | 20 | 1 | 2 | 5 | 103 |

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## 5: Rowland Blvd & Vintage Way (North) Performance by movement

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Denied Del/Veh (s) | 0.0 | 0.1 | 0.0 |  | 34.5 | 28.2 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 |  |
| Total Del/Veh (s) | 67.6 | 24.0 | 2.8 |  | 133.9 | 109.6 | 65.1 | 42.3 | 27.6 | 44.7 | 49.8 |  |
| Avg Speed (mph) | 3 | 7 | 20 | 2 | 2 | 3 | 5 | 7 | 8 | 1 | 1 | 1 |
| Fuel Eff. (mpg) | 9.7 | 15.8 | 37.6 | 5.3 | 7.4 | 8.2 | 15.5 | 16.5 | 22.3 | 4.5 | 5.3 | 5.0 |
| HC Emissions (g) | 0 | 5 | 1 | 0 | 3 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| CO Emissions (g) | 4 | 190 | 82 | 0 | 210 | 2 | 192 | 7 | 1 | 1 | 0 | 0 |
| NOx Emissions (g) | 0 | 19 | 8 | 0 | 12 | 0 | 14 | 1 | 0 | 0 | 0 | 0 |

## 5: Rowland Blvd & Vintage Way (North) Performance by movement

| Movement | All |
|---|---|
| Denied Del/Veh (s) | 7.1 |
| Total Del/Veh (s) | 50.2 |
| Avg Speed (mph) | 5 |
| Fuel Eff. (mpg) | 13.9 |
| HC Emissions (g) | 12 |
| CO Emissions (g) | 689 |
| NOx Emissions (g) | 54 |

## 6: Vintage Way (South) & Rowland Blvd Performance by movement

| Movement | EBL | EBR | NBL2 | NBL | SET | SER | SER2 | All |
|---|---|---|---|---|---|---|---|---|
| Denied Del/Veh (s) | 0.4 | 0.3 |  | 0.4 | 0.0 | 0.0 | 0.0 | 0.2 |
| Total Del/Veh (s) | 14.0 | 16.0 |  | 8.6 | 2.1 | 33.0 | 30.0 | 19.2 |
| Avg Speed (mph) | 12 | 11 | 6 | 6 | 23 | 14 | 14 | 14 |
| Fuel Eff. (mpg) | 26.8 | 27.6 | 24.6 | 17.2 | 33.0 | 30.6 | 30.9 | 29.8 |
| HC Emissions (g) | 1 | 0 | 0 | 0 | 0 | 5 | 5 | 12 |
| CO Emissions (g) | 60 | 0 | 0 | 11 | 18 | 106 | 113 | 309 |
| NOx Emissions (g) | 6 | 0 | 0 | 2 | 3 | 14 | 15 | 39 |

## Total Network Performance

| | |
|---|---|
| Denied Del/Veh (s) | 5.6 |
| Total Del/Veh (s) | 91.8 |
| Avg Speed (mph) | 12 |
| Fuel Eff. (mpg) | 21.2 |
| HC Emissions (g) | 273 |
| CO Emissions (g) | 12181 |
| NOx Emissions (g) | 1097 |

## Intersection: 1: Redwood Blvd & Rowland Blvd

| Movement | EB | EB | EB | EB | WB | WB | WB | NB | NB | NB | SB | SB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Directions Served | L | T | T | R | UL | T | TR | L | T | TR | L | L |
| Maximum Queue (ft) | 132 | 167 | 269 | 59 | 98 | 167 | 226 | 42 | 55 | 76 | 245 | 222 |
| Average Queue (ft) | 78 | 103 | 167 | 19 | 49 | 105 | 153 | 17 | 20 | 40 | 185 | 133 |
| 95th Queue (ft) | 156 | 189 | 293 | 71 | 96 | 178 | 246 | 47 | 56 | 76 | 287 | 263 |
| Link Distance (ft) |  | 612 | 612 |  |  | 300 | 300 |  | 706 | 706 |  | 1267 |
| Upstream Blk Time (%) |  |  |  |  |  |  | 0 |  |  |  |  |  |
| Queuing Penalty (veh) |  |  |  |  |  |  | 2 |  |  |  |  |  |
| Storage Bay Dist (ft) | 245 |  |  | 65 | 208 |  |  | 102 |  |  | 248 |  |
| Storage Blk Time (%) | 0 | 0 | 29 | 0 |  | 0 |  |  | 0 |  | 4 | 0 |
| Queuing Penalty (veh) | 0 | 0 | 9 | 0 |  | 0 |  |  | 0 |  | 8 | 0 |

## Intersection: 1: Redwood Blvd & Rowland Blvd

| Movement | SB | SB |
|---|---|---|
| Directions Served | T | R |
| Maximum Queue (ft) | 28 | 23 |
| Average Queue (ft) | 8 | 8 |
| 95th Queue (ft) | 32 | 27 |
| Link Distance (ft) | 1267 |  |
| Upstream Blk Time (%) |  |  |
| Queuing Penalty (veh) |  |  |
| Storage Bay Dist (ft) |  | 380 |
| Storage Blk Time (%) |  |  |
| Queuing Penalty (veh) |  |  |

## Intersection: 2: US 101 SB On-Ramp/US 101 SB Off-Ramp & Rowland Blvd

| Movement | EB | EB | EB | WB | WB | WB | WB | B7 | B7 | SB | SB | SB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Directions Served | T | TR | R | L | L | T | T | T | T | L | LT | TR |
| Maximum Queue (ft) | 277 | 268 | 163 | 354 | 358 | 114 | 152 | 3 | 5 | 249 | 237 | 72 |
| Average Queue (ft) | 186 | 184 | 107 | 231 | 250 | 60 | 85 | 1 | 1 | 194 | 193 | 28 |
| 95th Queue (ft) | 290 | 283 | 178 | 460 | 479 | 119 | 173 | 7 | 12 | 269 | 260 | 89 |
| Link Distance (ft) | 300 | 300 | 300 | 450 | 450 | 450 | 450 | 520 | 520 | 1718 | 1718 |  |
| Upstream Blk Time (%) | 0 | 0 |  | 1 | 2 |  |  |  |  |  |  |  |
| Queuing Penalty (veh) | 1 | 1 |  | 7 | 12 |  |  |  |  |  |  |  |
| Storage Bay Dist (ft) |  |  |  |  |  |  |  |  |  |  |  | 290 |
| Storage Blk Time (%) |  |  |  |  |  |  |  |  |  |  | 0 |  |
| Queuing Penalty (veh) |  |  |  |  |  |  |  |  |  |  | 0 |  |

---

## Intersection: 3: US 101 NB Off-Ramp/US 101 NB On-Ramp & Rowland Blvd

| Movement | EB | EB | EB | WB | WB | WB | WB | NB | NB | NB | NB | NE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Directions Served | <L | T | T | T | T | T | R> | < | <LT | R | R | <LR |
| Maximum Queue (ft) | 90 | 286 | 290 | 282 | 270 | 245 | 175 | 212 | 301 | 618 | 635 | 14 |
| Average Queue (ft) | 46 | 184 | 191 | 160 | 151 | 136 | 81 | 80 | 160 | 473 | 487 | 4 |
| 95th Queue (ft) | 97 | 356 | 371 | 295 | 279 | 263 | 192 | 229 | 362 | 759 | 772 | 20 |
| Link Distance (ft) |  | 520 | 520 | 369 | 369 | 369 |  |  | 1916 | 1916 |  | 204 |
| Upstream Blk Time (%) |  |  |  |  | 0 | 0 |  |  |  |  |  |  |
| Queuing Penalty (veh) |  |  |  |  | 0 | 0 |  |  |  |  |  |  |
| Storage Bay Dist (ft) | 250 |  |  |  |  |  | 200 | 450 |  |  | 1000 |  |
| Storage Blk Time (%) |  | 2 |  |  |  | 2 |  |  | 0 |  |  |  |
| Queuing Penalty (veh) |  | 1 |  |  |  | 9 |  |  | 0 |  |  |  |

## Intersection: 4: Rowland Blvd & Rowland Way

| Movement | EB | EB | EB | EB | EB | WB | WB | WB | SB | SB |
|---|---|---|---|---|---|---|---|---|---|---|
| Directions Served | L | L | T | T | T | T | T | TR | LR | R |
| Maximum Queue (ft) | 178 | 193 | 236 | 158 | 180 | 204 | 310 | 324 | 223 | 179 |
| Average Queue (ft) | 126 | 150 | 162 | 111 | 130 | 165 | 264 | 290 | 138 | 103 |
| 95th Queue (ft) | 197 | 215 | 271 | 173 | 188 | 247 | 345 | 358 | 233 | 187 |
| Link Distance (ft) |  |  | 369 | 369 | 369 |  | 281 | 281 | 373 | 373 |
| Upstream Blk Time (%) |  |  | 0 |  |  |  | 4 | 10 |  |  |
| Queuing Penalty (veh) |  |  | 1 |  |  |  | 43 | 114 |  |  |
| Storage Bay Dist (ft) | 260 | 260 |  |  |  | 145 |  |  |  |  |
| Storage Blk Time (%) |  | 0 | 1 |  |  | 3 | 13 |  |  |  |
| Queuing Penalty (veh) |  | 0 | 2 |  |  | 19 | 91 |  |  |  |

## Intersection: 5: Vintage Way (North) & Rowland Blvd

| Movement | EB | EB | EB | EB | EB | WB | WB | WB | NB | NB | NB | SB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Directions Served | L | T | T | R | R | L | T | TR | L | L | TR | LTR |
| Maximum Queue (ft) | 93 | 242 | 252 | 36 | 37 | 19 | 314 | 338 | 388 | 399 | 199 | 47 |
| Average Queue (ft) | 38 | 196 | 194 | 6 | 9 | 4 | 229 | 251 | 303 | 319 | 68 | 16 |
| 95th Queue (ft) | 121 | 256 | 264 | 34 | 47 | 36 | 342 | 370 | 409 | 418 | 245 | 47 |
| Link Distance (ft) |  | 281 | 281 | 281 | 281 |  | 490 | 490 | 618 | 618 |  | 63 |
| Upstream Blk Time (%) |  | 0 | 1 |  |  |  |  |  |  |  |  | 0 |
| Queuing Penalty (veh) |  | 1 | 3 |  |  |  |  |  |  |  |  | 0 |
| Storage Bay Dist (ft) | 85 |  |  |  |  | 80 |  |  |  |  | 180 |  |
| Storage Blk Time (%) | 2 | 36 |  |  |  |  | 38 |  |  | 34 |  |  |
| Queuing Penalty (veh) | 7 | 12 |  |  |  |  | 1 |  |  | 9 |  |  |

## Intersection: 6: Vintage Way (South) & Rowland Blvd

| Movement | EB | NB | SE | B82 | B82 |
|---|---|---|---|---|---|
| Directions Served | LR | <L | R> | T | |
| Maximum Queue (ft) | 157 | 110 | 484 | 255 | 61 |
| Average Queue (ft) | 99 | 82 | 298 | 66 | 10 |
| 95th Queue (ft) | 181 | 122 | 515 | 270 | 91 |
| Link Distance (ft) | 518 | 99 | 1569 | 490 | 490 |
| Upstream Blk Time (%) | | 3 | | | |
| Queuing Penalty (veh) | | 0 | | | |
| Storage Bay Dist (ft) | | | | | |
| Storage Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |

## Network Summary

Network wide Queuing Penalty: 357

---

## 1: Redwood Blvd & Rowland Blvd Performance by movement

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Denied Del/Veh (s) | 2.8 | 0.4 | 2.9 | 0.0 | 0.0 | 0.0 | 4.2 | 0.1 | 0.1 | 1.9 | 0.3 | 3.1 |
| Total Del/Veh (s) | 54.3 | 18.2 | 8.9 | 50.0 | 15.3 | 13.6 | 50.4 | 50.2 | 11.4 | 56.5 | 39.1 | 4.6 |
| Avg Speed (mph) | 6 | 14 | 17 | 4 | 10 | 10 | 8 | 8 | 17 | 10 | 14 | 30 |
| Fuel Eff. (mpg) | 14.7 | 24.5 | 26.1 | 13.0 | 19.8 | 27.3 | 19.9 | 19.9 | 30.0 | 21.5 | 27.7 | 29.5 |

## 1: Redwood Blvd & Rowland Blvd Performance by movement

| Movement | All |
|---|---|
| Denied Del/Veh (s) | 0.8 |
| Total Del/Veh (s) | 26.4 |
| Avg Speed (mph) | 11 |
| Fuel Eff. (mpg) | 22.6 |

## 2: US 101 SB On-Ramp/US 101 SB Off-Ramp & Rowland Blvd Performance by movement

| Movement | EBT | EBR | WBL | WBT | SBL | SBT | SBR | All |
|---|---|---|---|---|---|---|---|---|
| Denied Del/Veh (s) | 0.0 | 0.0 | 0.2 | 0.0 | 0.2 | 0.1 | 2.7 | 0.1 |
| Total Del/Veh (s) | 27.9 | 12.1 | 30.1 | 5.1 | 34.1 | 36.8 | 11.2 | 21.9 |
| Avg Speed (mph) | 7 | 11 | 8 | 23 | 17 | 18 | 27 | 12 |
| Fuel Eff. (mpg) | 16.2 | 22.7 | 22.8 | 34.3 | 29.5 | 28.3 | 29.7 | 25.6 |

## 3: US 101 NB Off-Ramp/US 101 NB On-Ramp & Rowland Blvd Performance by movement

| Movement | EBL2 | EBL | EBT | WBT | WBR | WBR2 | NBL2 | NBL | NBT | NBR | NEL2 | NEL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Denied Del/Veh (s) | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.7 | 0.7 | 0.6 | 0.8 | 0.1 | |
| Total Del/Veh (s) | 58.5 | 29.3 | 23.2 | 15.7 | | 8.0 | 30.0 | 32.9 | 24.9 | 46.7 | 56.3 | |
| Avg Speed (mph) | 7 | 9 | 12 | 12 | 11 | 15 | 18 | 18 | 18 | 14 | 2 | 4 |
| Fuel Eff. (mpg) | 17.9 | 22.4 | 24.7 | 18.3 | 19.8 | 23.0 | 27.6 | 26.7 | 28.0 | 25.6 | 7.9 | 13.7 |

## 3: US 101 NB Off-Ramp/US 101 NB On-Ramp & Rowland Blvd Performance by movement

| Movement | All |
|---|---|
| Denied Del/Veh (s) | 0.3 |
| Total Del/Veh (s) | 26.2 |
| Avg Speed (mph) | 14 |
| Fuel Eff. (mpg) | 24.1 |

## 4: Rowland Blvd & Rowland Way Performance by movement

| Movement | EBL | EBT | WBT | WBR | SBL | SBR | All |
|---|---|---|---|---|---|---|---|
| Denied Del/Veh (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 0.2 | 0.0 |
| Total Del/Veh (s) | 50.9 | 7.4 | 17.0 | 17.0 | 52.2 | 31.8 | 16.3 |
| Avg Speed (mph) | 4 | 16 | 10 | 9 | 4 | 6 | 10 |
| Fuel Eff. (mpg) | 11.6 | 18.5 | 16.6 | 20.1 | 11.9 | 15.5 | 16.8 |

## 5: Vintage Way (North) & Rowland Blvd Performance by movement

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Denied Del/Veh (s) | 0.2 | 0.1 | 0.0 |  | 6.7 | 7.8 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 |
| Total Del/Veh (s) | 74.2 | 28.0 | 3.0 |  | 50.2 | 53.1 | 30.9 | 20.8 | 8.2 | 51.8 | 56.5 | 12.7 |
| Avg Speed (mph) | 3 | 7 | 20 | 2 | 5 | 5 | 9 | 13 | 18 | 1 | 1 | 2 |
| Fuel Eff. (mpg) | 9.6 | 15.0 | 37.3 | 9.0 | 14.4 | 15.3 | 24.1 | 20.3 | 33.6 | 3.2 | 3.4 | 7.6 |

## 5: Vintage Way (North) & Rowland Blvd Performance by movement

| Movement | All |
|---|---|
| Denied Del/Veh (s) | 1.4 |
| Total Del/Veh (s) | 26.3 |
| Avg Speed (mph) | 8 |
| Fuel Eff. (mpg) | 20.4 |

## 6: Vintage Way (South) & Rowland Blvd Performance by movement

| Movement | EBL | EBR | NBL2 | NBL | SET | SER | SER2 | All |
|---|---|---|---|---|---|---|---|---|
| Denied Del/Veh (s) | 0.4 | 0.1 |  | 1.6 | 0.0 | 0.0 | 0.0 | 0.4 |
| Total Del/Veh (s) | 17.1 | 6.7 |  | 10.9 | 2.5 | 31.3 | 28.2 | 19.2 |
| Avg Speed (mph) | 11 | 12 | 8 | 5 | 22 | 14 | 15 | 14 |
| Fuel Eff. (mpg) | 25.3 | 28.4 | 32.3 | 13.7 | 30.3 | 29.3 | 29.3 | 28.1 |

## Total Network Performance

|  |  |
|---|---|
| Denied Del/Veh (s) | 1.7 |
| Total Del/Veh (s) | 73.4 |
| Avg Speed (mph) | 14 |
| Fuel Eff. (mpg) | 21.9 |

# Appendix TIS

Transportation Impact Study

Transportation Impact Analysis

# Costco Gasoline Fuel Station Addition

Novato, California

December 2020

Transportation Impact Analysis

# Costco Gasoline Fuel Station Addition

## Novato, California

Prepared For:
**Costco Wholesale**
999 Lake Drive
Issaquah, Washington 98207
(425) 313-6052

Prepared By:
**Kittelson & Associates, Inc.**
155 Grand Avenue, Suite 505
Oakland, California 94612
(510) 839-1742

Project Manager: Amy Lopez, RSP
Project Principal: Chris Tiesler

Project No. 24900

December 2020

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# APPENDICES

# INTRODUCTION

This report summarizes the transportation impacts associated with the operation of a new Costco Gasoline fuel station in Novato, CA. The fuel station would be located in the vicinity the existing Costco warehouse (warehouse) located at the intersection of Rowland Blvd and Vintage Way in the Vintage Oaks Shopping Center.

## PROJECT DESCRIPTION

The Project is located within and adjacent to the Vintage Oaks Shopping Center in Novato, Marin County, California. Vintage Oaks is located southeast of the Highway 101 and Rowland Boulevard freeway interchange. The project proposes to construct a fuel facility (gas station) at an existing Costco Wholesale (Costco) at 300 Vintage Way, and encompasses a portion of an existing parking lot, located southwest of the existing Costco building and includes approximately 1.15 acres of Assessor's Parcel Number 153-340-36 (fuel facility site). In addition to the fuel facility, the proposed project includes improvements to an approximately 1.0-mile stretch of Rowland Boulevard between Redwood Boulevard and its south intersection with Vintage Way as well as roadway striping improvements along Vintage Way to provide a left-turn lane at the shopping center driveway nearest the entrance to the fuel facility. Figure 1 shows the regional location of the project area. Figure 2 and Figure 3 show the proposed site plan for the Costco fuel station development. Figure 4 shows the Vintage Way striping for the left-turn pocket.

## SCOPE OF THE REPORT

The analyses performed for this study determine the expected transportation-related effects of the Project. The scope of the report was developed in coordination with the City of Novato (City) and Costco Wholesale. The following six study intersections were selected based on land use and circulation conditions near the Project site and access to the existing Costco warehouse:

1. Rowland Blvd/Redwood Blvd
2. Rowland Blvd /101 SB Ramps
3. Rowland Blvd/101 NB Ramps
4. Rowland Blvd/Rowland Way
5. Rowland Blvd/Vintage Way (north)
6. Rowland Blvd/Vintage Way (south)

This report evaluates the following transportation issues:

- Existing (year 2019) conditions within the site vicinity during the weekday PM and Saturday midday peak hours
- Trip generation and distribution estimates for the Project

- Existing conditions during the weekday PM and Saturday midday peak hours with the addition of Project-related traffic
- Trip generation and distribution estimates for the Hanna Ranch and Vintage Oaks planned developments
- Future conditions during the weekday PM and Saturday midday peak hours
- Future conditions during the weekday PM and Saturday midday peak hours with the addition of Project-related traffic
- Change in regional daily vehicle-miles traveled (VMT) as a result of the Project
- Left-turn lane warrant analysis at Vintage Way/future relocated Costco site access
- Transit, pedestrian, and bicyclist access to and near the Project site

● - Study Intersection

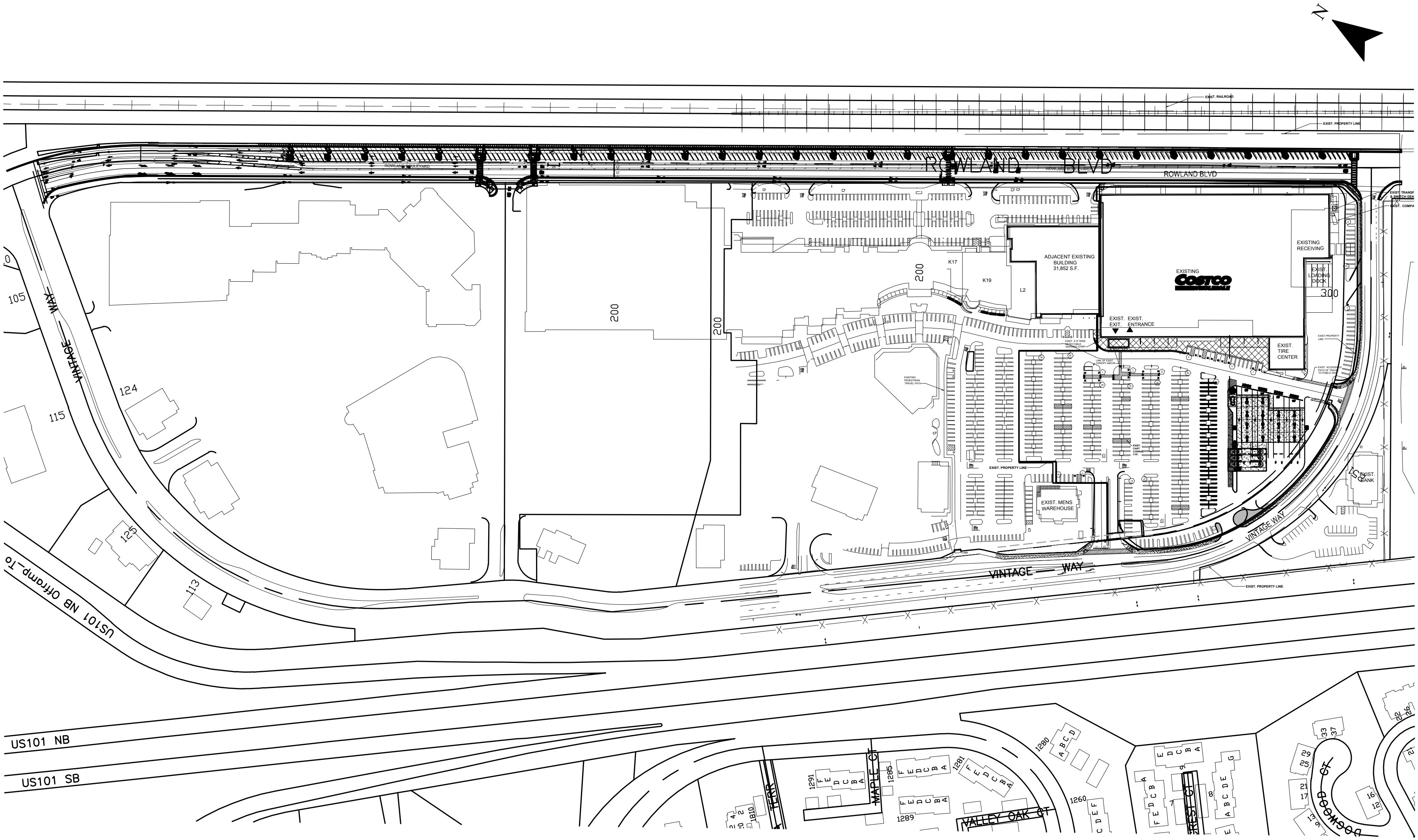
▨ - Proposed Development Site

Site Vicinity Map
Novato, CA

Figure
1

C:\KAI Applications\Autodesk\TEMP\AcPublish_26884\24900_bubblefigs.dwg Aug 06, 2020 - 5:44pm - lhunt Layout Tab: 01 Site Vicinity

KITTELSON & ASSOCIATES



Overall Site Plan
Novato, CA

Figure
2

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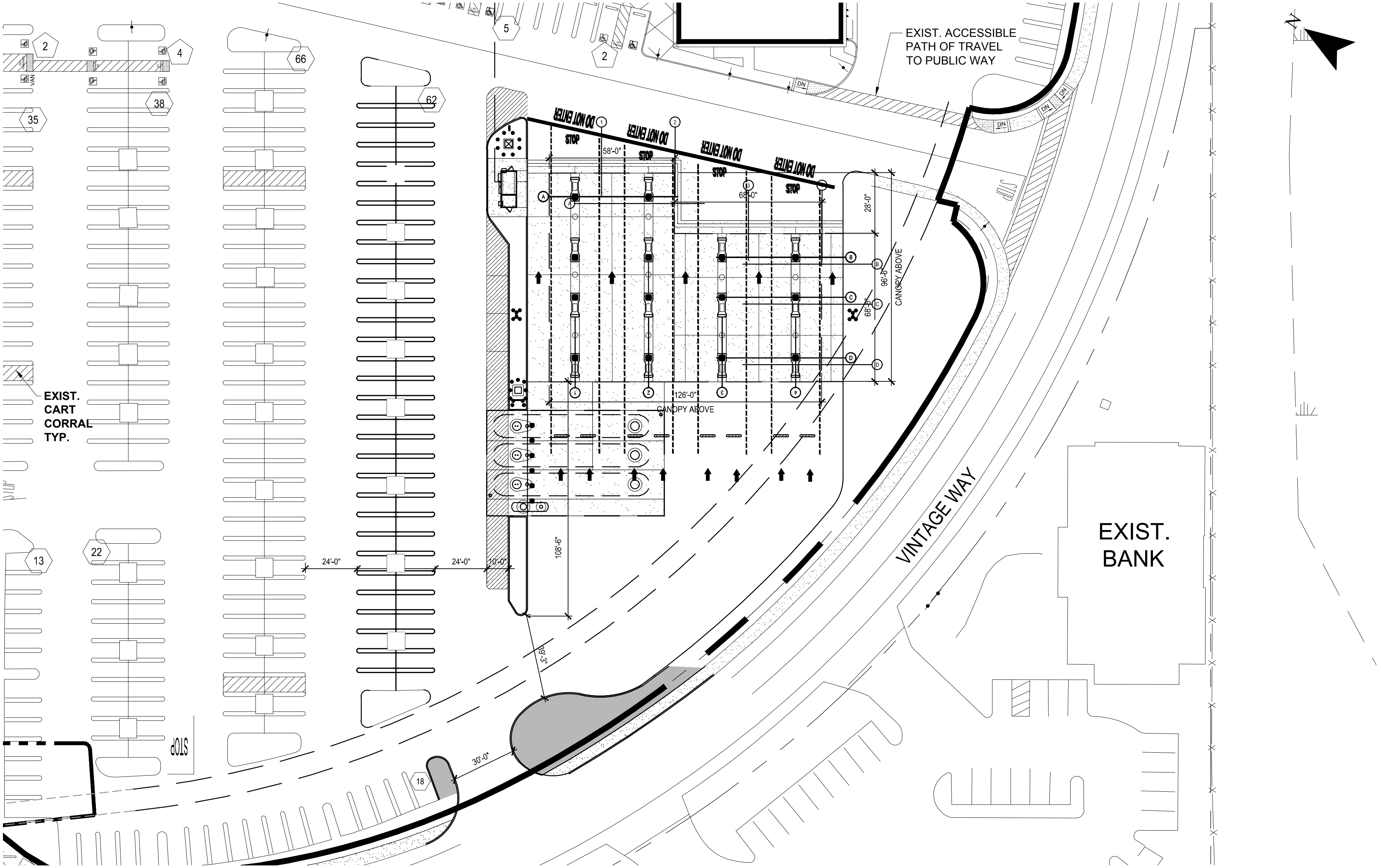

## Costco Fuel Station Expansion Detail
## Novato, CA

Figure
3

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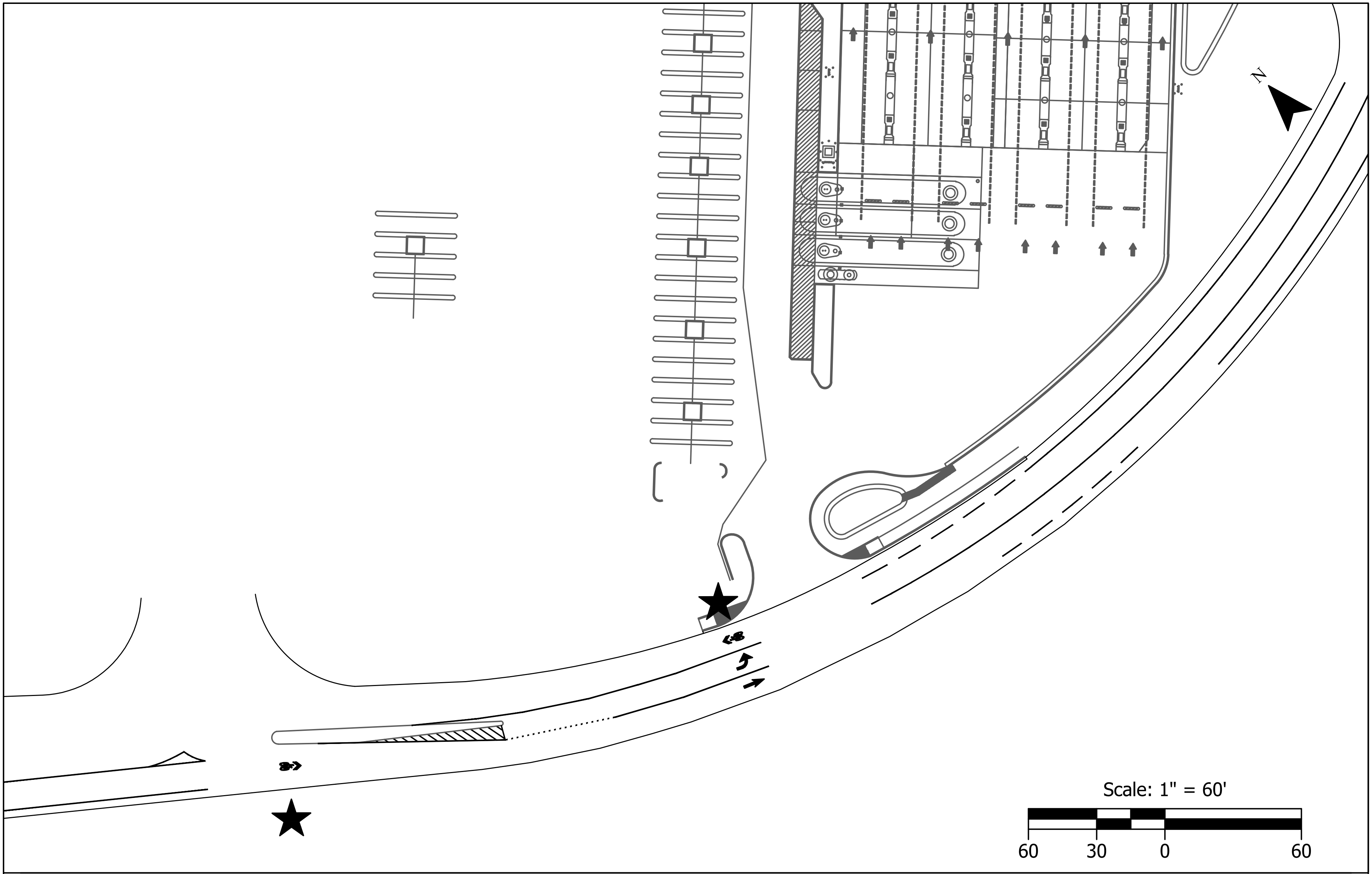


Legend:

★ -Share the Road Signing SHARE THE ROAD

Striping Concept
Novato, CA

Figure
4

# EXISTING CONDITIONS

The existing conditions analysis identifies the site conditions and current operational and geometric characteristics of the study intersections as well as transit services, bicyclist, and pedestrian facilities near the Project site.

## ROADWAY NETWORK

**Highway 101** is a north-south US highway providing statewide connections. In Marin County, it starts at the north end of the Golden Gate Bridge and traverses communities by the San Francisco Bay, near Mill Valley, Larkspur, San Rafael, and Novato. It extends southward into San Francisco, San Jose, and eventually reaches Los Angeles. To the north, it extends into Petaluma, Santa Rosa, and the coastal cities northward to Oregon. In the City of Novato, it is a 4- to 5- lane highway. Interchanges near the study area are located at Ignacio Blvd/Bel Marin Keys Blvd, Rowland Blvd, and De Long Ave.

**Rowland Blvd** is a four-lane arterial at the US 101 interchange that turns into a major collector east of the interchange and west of Novato Blvd. Rowland Blvd features bike lanes on both sides and a two-way left-turn lane in the middle. East of the interchange, Rowland Blvd provides access to the Vintage Oaks Shopping Center, a hospital, and the US 101 highway. West of the interchange, Rowland Blvd provides access residential land uses. The speed limit is 35 miles per hour (mph).

**Vintage Way** is a four-lane collector, becoming a two-lane collector, that circles around the Vintage Oaks Shopping Center and connects to Rowland Blvd on both sides. Vintage Way provides access to the shopping center via seven driveways. A landscaped median runs along the roadway north of the Project site, and bike lanes are on both sides of the street. The speed limit is 35 mph.

**Redwood Blvd** is a four-lane, north-south arterial with a speed limit of 35 mph. It begins at Olompali State Historic Park to the north and ends at a business center south of the US 101 and SR 37 interchange. North of Rowland Blvd, Redwood Blvd provides access to retail and light industrial uses. To the south, it provides access to residential uses.

**Novato Blvd** is a four-lane, north-south collector with a speed limit of 35 to 40 mph. Novato Blvd intersects Rowland Blvd west of Redwood Blvd. The land uses around Novato Blvd are mostly residential with some retail uses to the north. Novato Blvd runs between the US 101 and SR 37 interchange to the south and continues to the intersection of Pt. Reyes-Petaluma Rd in Petaluma.

### Pedestrian Facilities

Sidewalks are present on the inside of the loop around Vintage Oaks Shopping Center on Rowland Blvd and Vintage Way. Standard longitudinal marked crosswalks are present at the intersections of Rowland Blvd with Rowland Way and Vintage Way as well as at each driveway, except one driveway on Rowland Blvd providing access to the rear of the shopping center.

## Bicycle Facilities

Bicycle facilities are defined by the following three classes in Chapter 1000 of California Department of Transportation's (Caltrans) *Highway Design Manual* and *Design Information Bulletin 89*:

- **Class I bikeway (bike path)** – Provides a completely separated facility designed for the exclusive use of bicyclists and pedestrians with crossing points minimized.
- **Class II bikeway (bike lane)** – Provides a restricted right-of-way lane for the exclusive or semi-exclusive use of bicycles with through travel by motor vehicles or pedestrians prohibited, but with vehicle parking and cross-flows by pedestrians and motorists permitted.
- **Class III bikeway (bike route)** – Provides a right-of-way designated by signs or permanent markings and shared with pedestrians and motorists.
- **Class IV bikeway (cycle track)** – This is a dedicated, separated and protected on-street lane for bicyclists. Cycle tracks (or protected bike lanes) typically are used along streets with high traffic volumes and high speeds, providing additional protection for bicyclists using vertical separation, such as concrete curb or safe-hit posts.

Existing bicycle facilities in the region include:

- Class II bike lane on Rowland Blvd from Novato Blvd to Vintage Way
- Class II bike lanes on Redwood Blvd north of Rowland Blvd
- Class II bike lane on Novato Blvd north of Rowland Blvd
- Class I Shared Use Path on Novato Blvd south of Rowland Blvd
- Class III bike route on Redwood Blvd south of Rowland Blvd

The Novato Bicycle/Pedestrian Plan does not propose additional bike facilities or enhancements to existing facilities that would provide access to the Project site.

## Transit Service

Marin County Transit (MCT) and Golden Gate Transit (GGT) provide bus service in the study area. The shopping center has five bus stops that are served by MCT 251. Between US 101 northbound and the Rowland Blvd offramp, the Novato Park & Ride lot provides commuters with access to the GGT 56X bus. The US 101 Northbound onramp at Rowland Blvd also has a bus pad that is served by the GGT 70 and the MCT 35 and 71X. Table 1 summarizes bus service in the area.

**Table 1: Transit Routes Near the Project Site**

| Route | From/To | Operation Time | Frequency |
|---|---|---|---|
| **Golden Gate Transit** | | | |
| 56X | Novato GGT – San Francisco (Harrison & 3^rd^) | Weekday Commuter<br>Southbound, 5:30 AM to 8:30 AM<br>Northbound, 4:11 PM to 7:11 PM | Every 60 min |
| 70 | Novato GGT – Salesforce Transit Center | 5:00 AM to 1:30 AM | Every 30 min, peak<br>Every 60 min, off-peak and weekends |
| **Marin County Transit** | | | |
| 251 | Hamilton Theater – San Carlos Way & San Marin Dr | Weekdays, 6:30 AM to 8:00 PM<br>Weekends, 8:00 AM to 8:00 PM | Every 60 min |
| 35 | Kerner Blvd & Larkspur St – Redwood Blvd & Olive Ave | 5:00 AM to 2:30 AM | Every 7-30 min (San Rafael)<br>Every 30-60 min (N of San Rafael) |
| 71X | Bay St & Bridgeway – Redwood Blvd & Olive Ave | Weekdays, 6:00 AM to 7:00 PM | Every 30 min, peak<br>Every 60 min, off peak |

Source: https://www.goldengate.org/bus/schedules-maps/ Accessed August 2020

https://marintransit.org/ Accessed August 2020

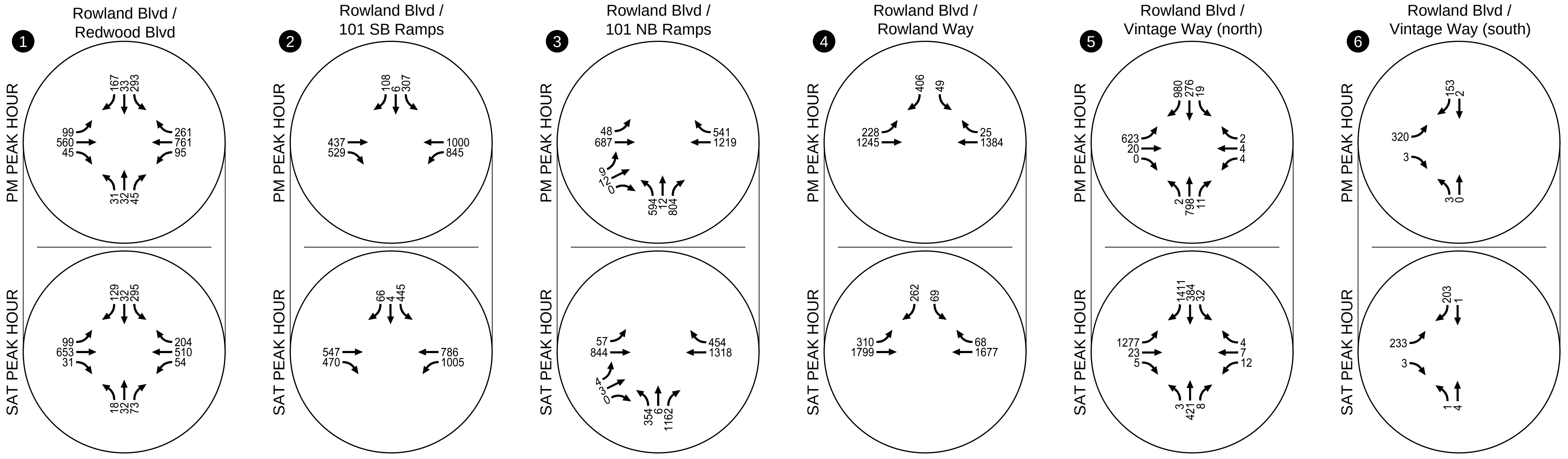
## EXISTING TRAFFIC CONDITIONS

At the time of this analysis (summer 2020), partial closures were in effect due to the COVID-19 pandemic. Therefore, traffic patterns were irregular and traffic volumes did not represent typical traffic conditions. Kittelson used a combination of historical data, Costco Warehouse transaction data, and the Institute of Transportation Engineers (ITE) trip generation rates to develop existing traffic volumes at the study intersections. Data used to develop existing volumes are:

- 2019 traffic counts for six study intersections, provided by the City of Novato (City)
- Costco fuel station transaction data at the Rohnert Park and Vallejo locations for the month of April 2019.
- January 2020 vehicle turning movement volumes at three Costco driveways on Vintage Way
    - Kittelson contracted with a data collection firm to collect traffic volumes on January 30 and February 1, 2020 in the PM peak period (4:00 PM to 7:00 PM) and Saturday midday peak period (11:00 AM to 2:00 PM).
    - *Appendix A* includes these traffic counts.

The system peak hours were selected based on the 2019 data counts:

- PM peak hour: 4:00 to 5:00 PM
- Saturday peak hour: 12:00 to 1:00 PM



Year 2019 Existing Volumes
Weekday PM and Saturday Midday Peak Hours
Novato, CA

Figure
5

## Intersection Operations Analysis Methodologies and Level of Service Standards

"Level of service" describes the operating conditions experienced by users of a facility. Level of service (LOS) is a qualitative measure of the effect of a number of factors, including speed, travel time, traffic interruptions, freedom to maneuver, driving comfort and convenience. Levels of service are designated A through F from best to worst, which cover the entire range of traffic operations that might occur. LOS A through E generally represent traffic volumes at less than roadway capacity while LOS F represents over capacity or forced flow conditions. In general, LOS D or better is considered acceptable while LOS E and LOS F are not.

All intersection level of service evaluations used the peak 15-minute flow rate during the weekday AM and PM peak hours. Using the peak 15-minute flow rate ensures that this analysis is based on a reasonable worst-case scenario. For this reason, the analysis reflects conditions that are only likely to occur for 15 minutes out of each average peak hour. During all other periods, the transportation system likely will operate under conditions better than the conditions described in this report.

## Intersection Operations

LOS is a quantitative stratification of a performance measure or measures representing quality of service. The measures used to determine LOS for transportation system elements are called service measures. The Highway Capacity Manual (HCM) defines six levels of service, ranging from A to F, for each service measure or combination of service measures. The service measures to define the LOS of intersections are control delay and volume over capacity (V/C) ratio. Control delay alone is used to characterize LOS for the entire intersection or an approach. Control delay and volume-to-capacity ratio are used to characterize LOS for a lane group.

Intersection analysis was conducted using the operational methodology outlined in the *Highway Capacity Manual* (HCM) 2000 Edition (Transportation Research Board, Washington, D.C., 2016) at all intersections, as operationalized by Synchro 10. The 2000 edition was utilized over the newer 6th Edition due to some intersections having more than 4 traditional legs that are required for results in the 6th Edition. Table 2 and Table 3 present the relationship of average delay to level of service for signalized intersections and all-way stop intersections, respectively.

### Table 2: Signalized Intersection Level of Service Definitions

| Average Delay Per Vehicle (Seconds) | LOS | Description of Traffic Conditions |
|---|---|---|
| ≤10.0 | A | This level is typically assigned when the volume-to-capacity ratio is low and either progression is exceptionally favorable, or the cycle length is very short. |
| >10.0 and ≤20.0 | B | This level is typically assigned when the volume-to-capacity ratio is low and either progression is highly favorable, or the cycle length is short. More vehicles stop than with LOS A. |
| >20.0 and ≤35.0 | C | This level is typically assigned when progression is favorable, or the cycle length is moderate. Individual cycle failures (i.e., one or more queued vehicles are not able to depart as a result of insufficient capacity during the cycle) may begin to appear at this level. The number of vehicles stopping is significant, although many vehicles still pass through the intersection without stopping. |
| >35.0 and ≤55.0 | D | This level is typically assigned when the volume-to-capacity ratio is high and either progression is ineffective, or the cycle length is long. Many vehicles stop and individual cycle failures are noticeable. |
| >55.0 and ≤80.0 | E | This level is typically assigned when the volume-to-capacity ratio is high, progression is unfavorable, and the cycle length is long. Individual cycle failures are frequent. |
| ≤80.0 | F | This level is typically assigned when the volume-to-capacity ratio is very high (greater than 1.0), progression is very poor, and the cycle length is long. Most cycles fail to clear the queue. |

Source: Transportation Research Board, Highway Capacity Manual 6th Edition, Washington, D.C., 2016.

### Table 3: All-Way Stop-Controlled Intersection Level of Service Definitions

| Average Delay Per Vehicle (Seconds) | LOS |
|---|---|
| ≤10.0 | A |
| >10.0 and ≤15.0 | B |
| >15.0 and ≤25.0 | C |
| >25.0 and ≤35.0 | D |
| >35.0 and ≤50.0 | E |
| >50.0 | F |

Source: Transportation Research Board, Highway Capacity Manual 6th Edition, Washington, D.C., 2016.

The existing operations at the study intersections are shown in Table 4. The results indicate that all study intersections are operating at LOS D or better for all peak hours, except Intersection 1, which operates at LOS E in the weekday PM and Saturday midday peak hours.

*Appendix B* includes the Synchro output reports for Existing Conditions.

## Table 4: Existing Conditions Intersection Operations

| No. | Location | Control | Peak Hour | LOS Standard | Delay | LOS |
|---|---|---|---|---|---|---|
| 1 | Rowland Boulevard/ Redwood Boulevard | Signal | PM | D | 26.5 | C |
| | | | Sat | | 27.0 | C |
| 2 | Rowland Boulevard/ US 101 SB Ramps | Signal | PM | D | 24.8 | C |
| | | | Sat | | 32.5 | C |
| 3 | Rowland Boulevard/ US 101 NB Ramps | Signal | PM | D | 34.3 | C |
| | | | Sat | | 29.3 | C |
| 4 | Rowland Boulevard / Rowland Way | Signal | PM | D | 16.9 | B |
| | | | Sat | | 19.3 | B |
| 5 | Rowland Boulevard/ Vintage Way (north) | Signal | PM | D | 13.5 | B |
| | | | Sat | | 14.5 | B |
| 6 | Rowland Boulevard/ Vintage Way (south) | AWSC | PM | D | 10.0 | A |
| | | | Sat | | 9.0 | A |

Source: Kittelson & Associates, 2020

Note:
- Synchro 10th Edition and HCM 2000 methodology were used.
- **Bold** indicates intersection operates beyond the standard.
- AWSC: All-Way Stop Control
- Average delay in seconds is presented for signalized and stop control intersections.

# TRANSPORTATION IMPACT ANALYSIS

The transportation impact analysis identifies how the study area's transportation system will operate when the Project is operational. The effects of traffic that would be generated by the Project during the typical weekday AM and PM peak hours were examined as follows:

- New site-generated trips and rerouted existing trips (those trips already going to the warehouse) were estimated for the Project.
- Distribution of new trips and rerouted existing trips were developed based on existing traffic patterns.
- Existing (year 2019) with Project conditions consist of existing traffic volumes plus the distribution of new trips associated with the Project during the weekday AM and PM peak hours.
- Change in vehicle-miles traveled (VMT) as a result of the Project
- Personal vehicle queuing at the Project site
- Transit, pedestrian, and bicyclist access to and near the Project site

This analysis includes both effects that would result in potentially significant impacts under the California Environmental Quality Act (CEQA) guidelines and non-CEQA effects associated with traffic operations on the transportation network.

## CEQA SIGNIFICANCE CRITERIA

The Project's impact is not considered to be significant unless it would:

a. Conflict with a program, plan, ordinance, or policy addressing the circulation system, including transit, roadway, bicycle, and pedestrian facilities.

b. Conflict or be inconsistent with CEQA Guideline section 15064.3, subdivision (b).

c. Substantially increase hazards due to a geometric design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment).

d. Result in inadequate emergency access.

Significance criterion "b" is related to the implementation of vehicle-miles traveled (VMT) as the primary performance metric. Since the City of Novato has not yet adopted VMT impact criteria, the City of San Jose's standard of significance is used for the VMT analysis in this transportation impact analysis. The standard is presented in Table 5.

**Table 5: City of San Jose VMT Standard of Significance**

| Project Types | Significance Criteria | Current Level | Threshold |
|---|---|---|---|
| Retail/ Hotel/ School Uses | Net increase in existing regional total VMT | Regional Total VMT | Net Increase |

Source: San Jose Transportation Analysis Handbook, April 2018

# NON-CEQA CRITERIA

While level of service (LOS) is no longer applicable to CEQA analyses, the City of Novato requires intersection operations analysis to assess the effects of a project on street network operations. The City of Novato has a level of service standard of LOS D for signalized and all-way stop-controlled intersections. The Marin County Congestion Management Plan has a LOS standard of E for US 101, as documented in TR Program 4.1 of the City's general plan.[1]

# PROJECT ANALYSIS

The Project is a new Costco Gasoline fuel station with 28 fueling positions and on-site queue storage. As shown previously in Figure 1, the Project is located on Vintage Way at the south end of the Vintage Oaks Shopping Center. The number of new trips and rerouted trips estimated to be generated by the Project, as well as how these trips would be distributed onto the transportation network, are discussed in this section.

## Trip Generation

This section discusses the data used to develop trip generation estimates for the Project.

### *Costco Trip Generation Database*

For the past 18 years, Kittelson has maintained a database of traffic data and travel characteristics for Costco Wholesale. The database is updated periodically when new Costco traffic counts or other travel information become available to Kittelson. The database contains a large quantity of data related to Costco Gasoline fuel stations. It includes trip generation rates and trip type information for more than 35 Costco Gasoline facilities located throughout the U.S. Costco has invested significant effort into developing this use-specific trip generation database for both their warehouses and their fuel stations because of the unique characteristics of Costco member travel patterns that exist due to membership requirements and the nature of Costco sales. These unique elements apply to the trip

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[1] City of Novato General Plan, revised May 2014.

generation for Costco warehouses, Costco Gasoline fuel stations, and the interaction of trips between the two. Costco does not build stand-alone fuel stations (i.e., no warehouse nearby).

To best evaluate the anticipated transportation characteristics of the proposed Novato Costco Gasoline fuel station, Kittelson selected data for sites with 24+ fueling positions. These sites are considered representative of the Novato site based on population size in the surrounding area and geographic location. Table 6 lists the seven gas station sites and the trip generation observed at each site. Kittelson developed an average trip rate for the total number of trips to estimate the number of total trips (inbound + outbound) the Project would generate.

The Costco-specific trip generation data presented herein follows nationally accepted practices for trip generation data collection as recommended by the Institute of Transportation Engineers (ITE) and presents a robust dataset upon which to confidently and accurately predict the trip generation of the fuel station.

**Table 6: Project Trip Generation**

| Location | Fueling Positions | Weekday P.M. Peak Hour | Saturday Midday Peak Hour |
|---|---|---|---|
| | | Total Trip Ends (in+out) | Total Trip Ends (in+out) |
| Concord, CA | 24 | 550 | 700 |
| Cypress, CA | 24 | 654 | 740 |
| NE San Jose, CA | 24 | 458 | 686 |
| Portland, OR | 24 | 404 | 616 |
| Rancho Del Ray, CA | 24 | 676 | 678 |
| Rohnert Park, CA | 24 | 498 | 606 |
| Temecula, CA | 30 | 793 | 849 |
| **Average** | | **576** | **696** |

Source: Kittelson & Associates, Inc., 2020

### *Novato Costco Gasoline Fuel Station Trip Type Estimate*

In developing a trip generation estimate for a new fuel station addition, it is important to recognize that the total number of trips generated will include:

- Net new “gas-only” trips, of which the destination is the new gas station alone. These trips do not exist on the roadway network today.
- Internal capture trips account for those members who patronize both the warehouse and the fuel station during a single visit to the Costco site. As such, although they account for a trip to both the warehouse and the fuel station, they only account for one overall set of

inbound/outbound trips to the vicinity of the warehouse and fuel station and therefore account for one round trip on the surrounding transportation system. These trips already existing on the roadway network today and are accounted for at the access between the warehouse and the fuel station.

- Pass-by trips represent members (and trips) that are currently traveling on the surrounding street network for some other primary purpose (such as a trip from work to home) and stop into the site en route during their normal travel. As such, pass-by trips do not result in a net increase in traffic on the surrounding transportation system and their only effect occurs at the immediate intersections and site access driveways where they become turning movements.
- Diverted trips are similar to pass-by trips in that they represent members (and trips) that are currently traveling on the surrounding street network for some other primary travel purpose and travel around the block to access the site while en route to their primary destination. These trips exist on the roadway network today and, as the name indicates, divert from the primary roadways members take to their primary destination and result in changes in through and turn movement volumes at intersections in the vicinity of the Costco site.

The unique nature of Costco operations and its membership requirements result in different trip characteristics than those observed at typical fuel stations summarized in the standard reference *Trip Generation*, published by the Institute of Transportation Engineers (ITE). The percentages of pass-by at Costco Gasoline fuel stations is considerably lower than those quoted in the ITE *Trip Generation* manual for typical fuel stations. Correspondingly, membership requirements also have a significant effect on trip internalization (or sharing of trips) between the warehouse and the fuel station. Fewer people exclusively visit a Costco Gasoline fuel station (in comparison to a typical standalone fuel station) because they have another primary purpose for visiting the site (that being a trip to the warehouse).

Table 7 presents the estimated trip generation for each trip type based on data in the Costco trip generation database. The additional fueling positions are estimated to generate approximately 117 net new gas-only weekday PM peak hour trips (or 59 total additional vehicles) and 172 net new gas-only Saturday midday peak hour trips (or 86 total additional vehicles). Again, the estimate accounts for the documented internalization (sharing) of trips between the existing Costco warehouse and the proposed fuel station, as well as gas-only pass-by and diverted trips to the fuel station from traffic already on nearby roadways.

### Table 7: Trip Generation Estimates by Trip Type

| Costco Gasoline Fuel Station | Daily Trips | Weekday PM Peak Hour Trips | Saturday Midday Peak Hour Trips |
|---|---|---|---|
| Total Trips | 6,870 | 576 | 696 |
| *Warehouse + Gas Trips (33% Weekday, 36% Saturday)* | *-2,250* | *-189* | *-250* |
| Total Gas-Only Trips | 4,620 | 387 | 446 |
| *Pass-by Trips (36% Weekday, 30% Saturday)* | *-1,655* | *-139* | *-133* |
| *Diverted Trips (34% Weekday, 32% Saturday)* | *-1,560* | *-131* | *-141* |
| **Net New Gas-Only Trips** | **1,405** | **117** | **172** |

Source: Kittelson & Associates, Inc. 2020

Note: Percentages of warehouse + gas "shared" trips, gas-only pass-by trips, and gas-only diverted trips are estimated based on historical data from the Costco trip generation database.

Rowland Blvd and Vintage Way provide access to the shopping center, a destination for primary trips on the transportation network, and do not provide through access to the surrounding street network. Therefore, Kittelson assumed the share of fuel station trips typically assigned as pass-by trips would be attributed to primary trips to the Vintage Oaks Shopping Center.

## Trip Distribution

Based traffic data at other Costco Gasoline fuel stations, the number of inbound/outbound trips for the Project are estimated as a 50%/50% split of the total trips shown in Table 7. Figure 6 presents the trip distribution percentages on the roadway near the Vintage Oaks Shopping Center. To the west of the Rowland Blvd/Rowland Way intersection, Project trips are distributed in proportion to vehicle movement volumes under Existing conditions at the intersections to the west.

● - Study Intersection
■ - Proposed Development Site

Net New and Diverted Trips %
Passby Trips %

## Project Trip Distribution
Novato, CA

Figure
6

KITTELSON & ASSOCIATES

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# EXISTING PLUS PROJECT CONDITIONS

The potential effects of the Project on existing operations at the study intersections are discussed in this section.

## Intersection Operations

Kittelson developed traffic volumes for Existing plus Project conditions using an additive approach. Kittelson estimated vehicle trips generated by the Project and added these trips to existing volumes on the roadway network to develop the volumes for the Existing plus Project conditions. Existing plus Project turning movement volumes are presented in Figure 7 and Figure 8.

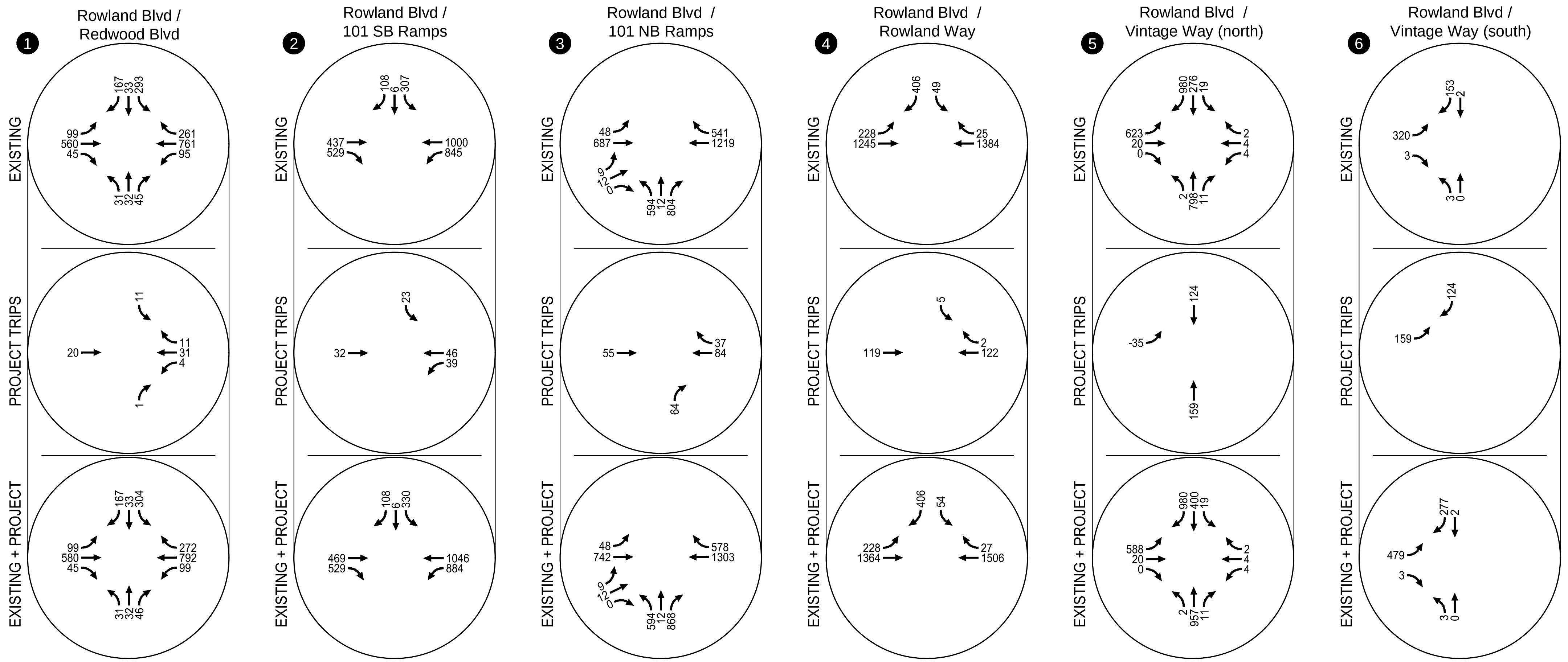
As shown in Table 8, all study intersections would operate within City standard of LOS D or better under Existing plus Project conditions. *Appendix C* includes Synchro output reports for Existing plus Project conditions.

**Table 8: Existing Plus Project Conditions Intersection Operations**

| No. | Location | Control | Peak Hour | LOS Standard | Delay | LOS |
|---|---|---|---|---|---|---|
| 1 | Rowland Boulevard/ Redwood Boulevard | Signal | PM | D | 26.8 | C |
| | | | Sat | | 27.3 | C |
| 2 | Rowland Boulevard/ US 101 SB Ramps | Signal | PM | D | 25.9 | C |
| | | | Sat | | 32.2 | C |
| 3 | Rowland Boulevard/ US 101 NB Ramps | Signal | PM | D | 39.0 | D |
| | | | Sat | | 21.8 | C |
| 4 | Rowland Boulevard / Rowland Way | Signal | PM | D | 18.6 | B |
| | | | Sat | | 21.1 | C |
| 5 | Rowland Boulevard/ Vintage Way (north) | Signal | PM | D | 15.3 | B |
| | | | Sat | | 18.1 | B |
| 6 | Rowland Boulevard/ Vintage Way (south) | AWSC | PM | D | 15.4 | C |
| | | | Sat | | 14.4 | B |

Source: Kittelson & Associates, 2020

Note:
- Synchro 10th Edition and HCM 2000 methodology were used.
- **Bold** indicates intersection operates beyond the standard.
- AWSC: All-Way Stop Control
- Average delay in seconds is presented for signalized and stop control intersections.



Year 2019 Existing + Project Volumes
Weekday PM Peak Hour
Novato, CA

Figure
7

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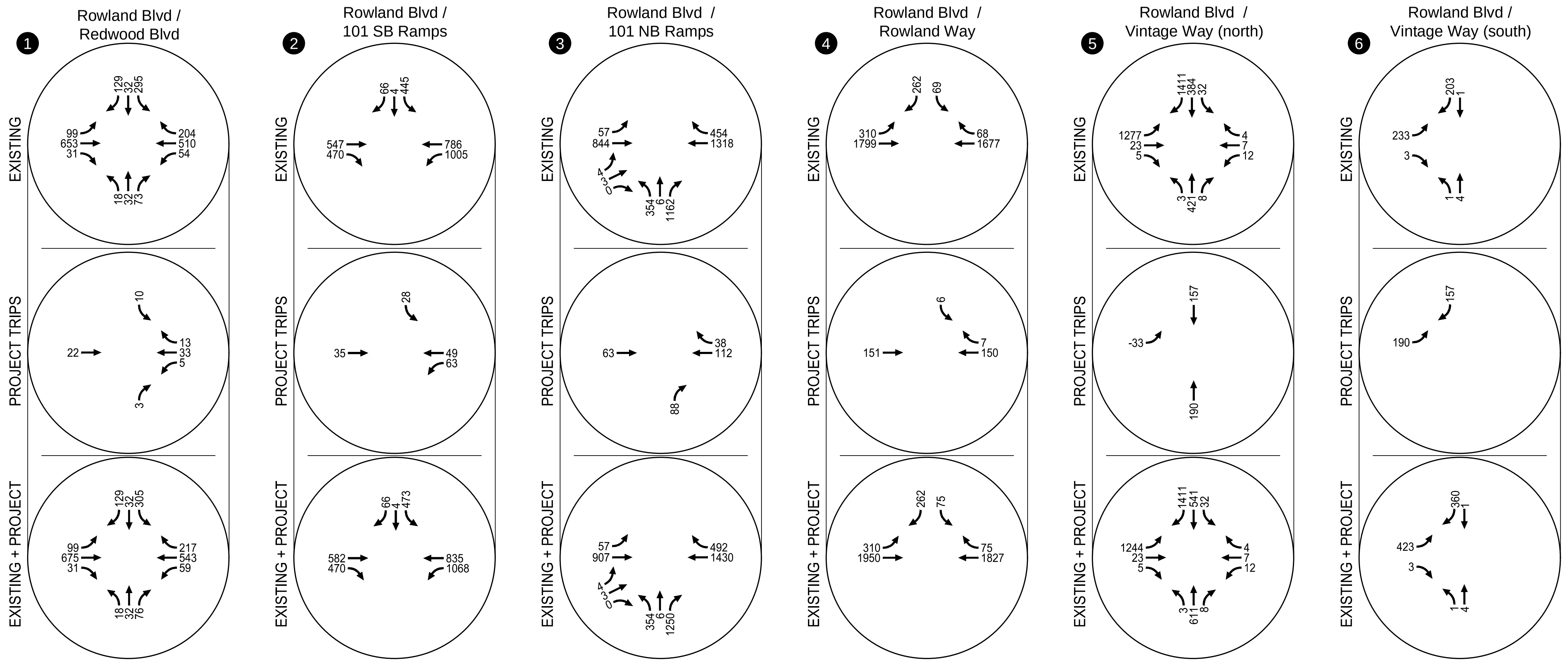


Year 2019 Existing + Project Volumes
Weekday Saturday Midday Peak Hour
Novato, CA

Figure
8

KITTELSON & ASSOCIATES

## Driveway Operations

Kittelson evaluated traffic operations at the Costco site driveway on Vintage Way adjacent to the planned entrance to the fuel station queue storage area. Kittelson collected turning movement volumes at the driveway on January 20 and February 1, 2020 for the weekday PM and Saturday midday peak hours. The evaluation involved a traffic operations analysis of the driveway with Project volumes using PTV Vistro software, applying HCM 6th edition methodologies. It also involved performing a left-turn lane warrant analysis without and with Project volumes utilizing guidance from the American Association of State Highway Transportation Officials' (AASHTO) *A Policy on Geometric Design of Highways and Streets*, 7th Edition (2018), also known as the AASHTO "Green Book." Kittelson performed both types of analyses for Existing without and with Project volumes for the weekday PM and Saturday midday peak hours. Traffic volumes at the driveway are included as *Appendix A*.

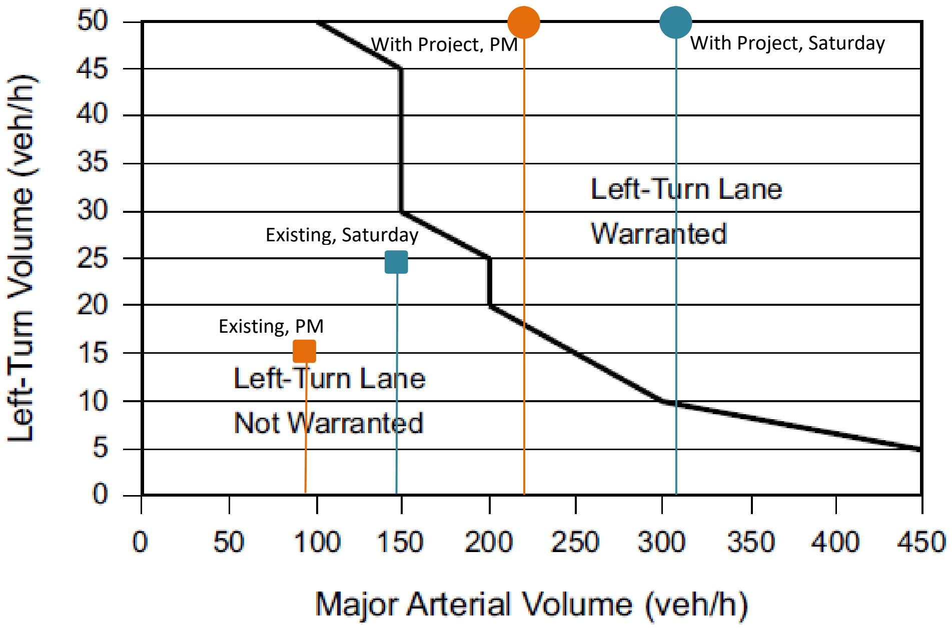
### *Level of Service*

Vintage Way in the vicinity of the driveway has one travel lane in each direction, no median, and class II bike lanes. The Costco driveway operates at LOS B with existing traffic volumes and would continue to operate at LOS B with Project volumes.

### *Left-Turn Warrant*

Vintage Way at the driveway does not meet the left-turn warrant with existing traffic volumes, shown in Figure 9 with square indicators. With the addition of Project traffic, Vintage Way would meet the warrant, shown in Figure 9 with circle indicators. The volume of southbound through traffic on Vintage Way is 39 and 60 vehicles during the weekday PM and Saturday peak hours, respectively. This means on average a southbound vehicle approaches the area about once per minute during the peak hours. The curb-to-curb width of Vintage Way at the southbound approach to the driveway is approximately 36 feet with 6-foot class II bike lanes and 12-foot travel lanes. The current curb-to-curb cross section of the roadway could not accommodate the addition of a left-turn lane while retaining the travel lanes and class II bike lanes. To provide a left-turn lane and provide continuous bike facility connectivity, the bike lanes would transition to a class III bicycle route (i.e., bicycles and vehicles share the lane) denoted with sharrows and signs for an approximately 200' distance between the existing driveway at near the existing Men's Warehouse and the driveway nearest the entry to the Costco fuel station. Figure 4 presents such shared lane and left-turn pocket roadway improvements.

**Figure 9: Left-Turn Lane Warrant Results, Weekday PM and Saturday Peak Hours**



Source: AASHTO Green Book Figure 9-35, 2018; Kittelson & Associates, Inc., 2020

Note: Saturday peak hour left-turn volume is 57 vehicles, which would be located beyond the chart's upper limit.

## FUTURE CONDITIONS

Future traffic conditions represent the change in traffic volumes resulting from approved developments in the Project area. The City has approved the Hanna Ranch development to the south of the Project site (see Figure 10) and a change in commercial uses in the northern part of the Vintage Oaks Shopping Center.

Kittelson sourced traffic volumes at the study intersections for the Hanna Ranch development from the Hanna Ranch Traffic Study dated June 9, 2017.[2] The City is currently reviewing the Hanna Ranch development to the south of the project site (see Figure 10) and recently approved a commercial project (Pad W site) in the northern part of the Vintage Oaks Shopping Center. Kittelson used trip rates from ITE's *Trip Generation*, 10th Edition, to estimate the trip generation of the commercial uses (presented in Figure 10). Kittelson then distributed these commercial use trips to the street network in proportion with Existing turning movement volumes at the study intersections. Since the change in commercial uses at the Pad W site are in the northern part of the shopping center, none of the trips are routed through the Rowland Blvd/Vintage Way (south) intersection.

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[2] Hanna Ranch Traffic Study is available online at https://www.novato.org/home/showdocument?id=26209

## Figure 10: Development Project Under Review

Source: Hanna Ranch Traffic Study, 2017

## Table 9: Trip Generation for Pad W Site

| Land Use | Rate | PM Peak Hour | | | Saturday Peak Hour | | |
|---|---|---|---|---|---|---|---|
| | | In | Out | Total | In | Out | Total |
| Shopping-Center<br>(ITE Code 820) | KSF | 48% | 52% | 3.81 | 48% | 52% | 4.50 |
| Fast Casual Restaurant<br>(ITE Code 930) | KSF | 62% | 38% | 14.13 | 62% | 38% | 34.02 |
| Retail | 1.2 KSF | 3 | 2 | 5 | 3 | 2 | 5 |
| Retail | 2.2 KSF | 4 | 4 | 8 | 5 | 5 | 10 |
| Restaurant | 2.2 KSF | 19 | 12 | 31 | 47 | 28 | 75 |
| Total | | **26** | **18** | **44** | **55** | **35** | **90** |

Source: ITE Trip Generation, 10th Edition

KSF = 1,000 square feet

## Intersection Operations

Kittelson developed traffic volumes for Future conditions using an additive approach. Kittelson added the background traffic volumes from approved projects to the Existing year 2019 counts. Future peak hour turning movement volumes are presented in Figure 11.

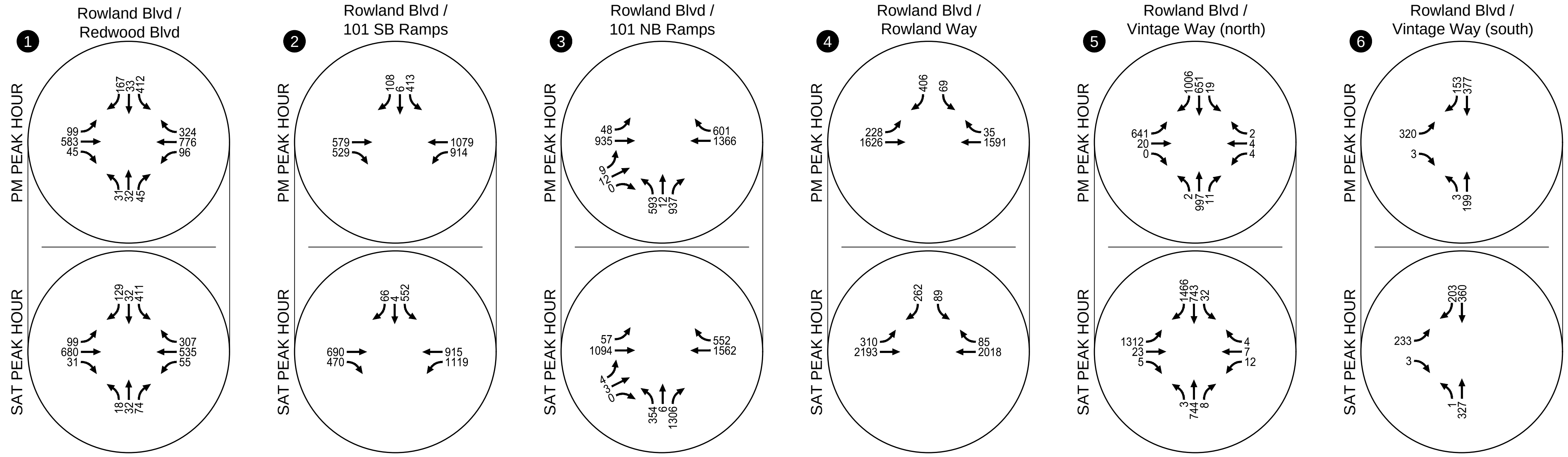
As shown in Table 10, all study intersections are expected to operate acceptably at LOS D or better under Future conditions. *Appendix D* includes Synchro output reports for Future conditions.

**Table 10: Future Conditions Intersection Operations**

| No. | Location | Control | Peak Hour | LOS Standard | Delay | LOS |
|---|---|---|---|---|---|---|
| 1 | Rowland Boulevard/ Redwood Boulevard | Signal | PM | D | 28.5 | C |
| | | | Sat | | 29.2 | C |
| 2 | Rowland Boulevard/ US 101 SB Ramps | Signal | PM | D | 27.6 | C |
| | | | Sat | | 34.5 | C |
| 3 | Rowland Boulevard/ US 101 NB Ramps | Signal | PM | D | 40.6 | D |
| | | | Sat | | 22.5 | C |
| 4 | Rowland Boulevard / Rowland Way | Signal | PM | D | 20.2 | C |
| | | | Sat | | 25.1 | C |
| 5 | Rowland Boulevard/ Vintage Way (north) | Signal | PM | D | 18.4 | B |
| | | | Sat | | 26.3 | C |
| 6 | Rowland Boulevard/ Vintage Way (south) | AWSC | PM | D | 22.2 | C |
| | | | Sat | | 23.2 | C |

Source: Kittelson & Associates, 2020

Note:
- Synchro 10th Edition and HCM 2000 methodology were used.
- **Bold** indicates intersection operates beyond the standard.
- AWSC: All-Way Stop Control
- Average delay in seconds is presented for signalized and stop control intersections.



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Future Background Volumes
Weekday PM and Saturday Midday Peak Hours
Novato, CA

Figure
11

# FUTURE PLUS PROJECT CONDITIONS

The potential effects of the Project on future traffic operations at the study intersections are discussed in this section.

## Intersection Operations

Kittelson developed traffic volumes for Future plus Project conditions using an additive approach. Kittelson added Project trips to Future conditions traffic on the roadway network to develop the volumes for the Future plus Project conditions. Future plus Project turning movement volumes for weekday PM and Saturday peak hours are presented in Figure 12 and Figure 13, respectively.

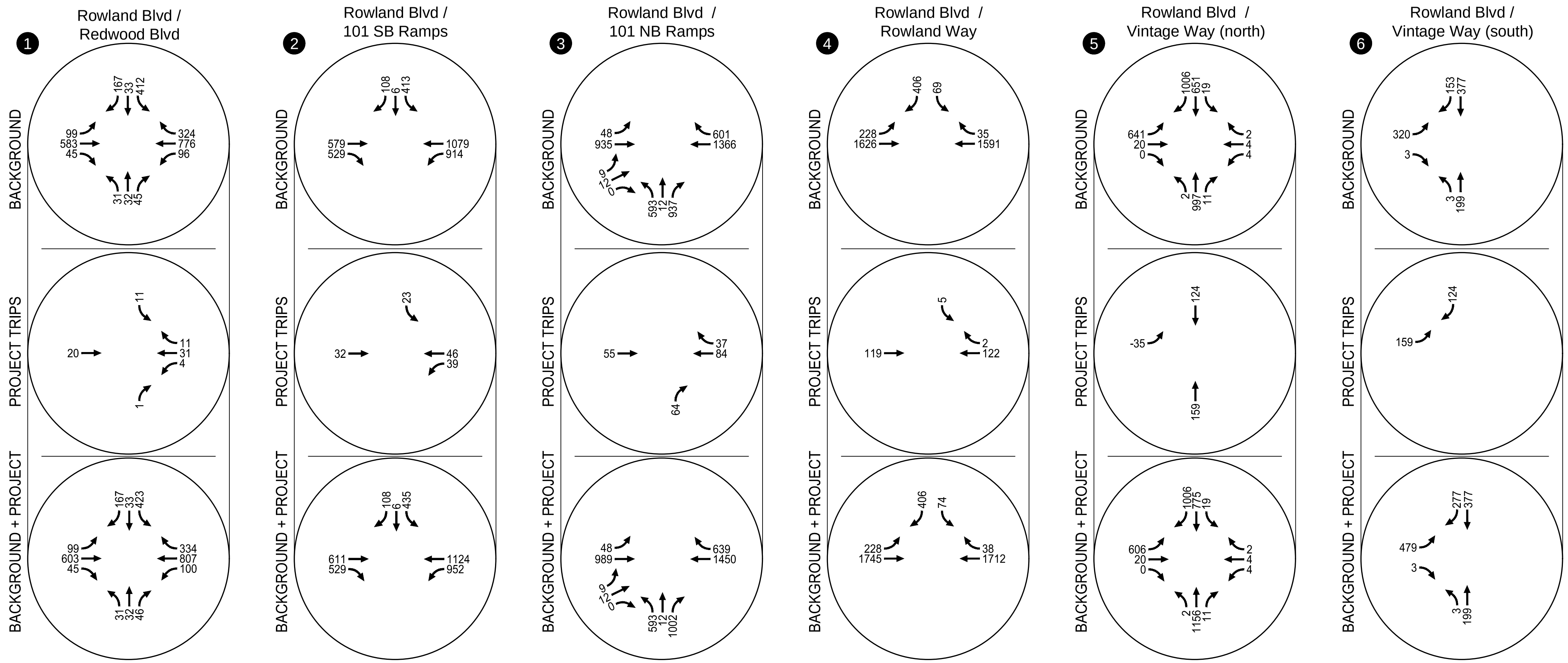
As shown in Table 11, all study intersections would operate acceptably at LOS D or better under Future plus Project conditions, except the Rowland Boulevard/ Vintage Way (north) intersection (#5) during the Saturday peak hour and the Rowland Boulevard/ Vintage Way (south) intersection (#6) during the weekday PM and Saturday peak hours. *Appendix E* includes Synchro output reports for Future plus Project conditions.

**Table 11: Future Plus Project Conditions Intersection Operations**

| No. | Location | Control | Peak Hour | LOS Standard | Delay | LOS |
|---|---|---|---|---|---|---|
| 1 | Rowland Boulevard/ Redwood Boulevard | Signal | PM | D | 29.0 | C |
| | | | Sat | | 29.6 | C |
| 2 | Rowland Boulevard/ US 101 SB Ramps | Signal | PM | D | 28.1 | C |
| | | | Sat | | 37.2 | D |
| 3 | Rowland Boulevard/ US 101 NB Ramps | Signal | PM | D | 42.9 | D |
| | | | Sat | | 25.2 | C |
| 4 | Rowland Boulevard / Rowland Way | Signal | PM | D | 21.9 | C |
| | | | Sat | | 32.0 | C |
| 5 | Rowland Boulevard/ Vintage Way (south) | Signal | PM | D | 30.4 | C |
| | | | Sat | | **55.9** | **E** |
| 6 | Rowland Boulevard/ Vintage Way (south) | AWSC | PM | D | **73.7** | **F** |
| | | | Sat | | **95.9** | **F** |

Source: Kittelson & Associates, 2020

Note:
- Synchro 10th Edition and HCM 2000 methodology were used.
- **Bold** indicates intersection operates beyond the standard.
- AWSC: All-Way Stop Control
- Average delay in seconds is presented for signalized and stop control intersections.



# Future Background + Project Volumes
Weekday PM Peak Hour
Novato, CA

Figure
12

## Recommended Improvements

To improve upon intersection operations at locations that would operation beyond the standard, Kittelson recommends the following improvements:

- Changes to traffic signal phasing (optimization) at the Rowland Blvd/Vintage Way (north) intersection (#5) on Saturday would improve traffic operations during the Saturday peak hour and bring operations to LOS B, within the City's standard.
- Incorporate a southbound right-turn lane pocket for approximately 150 feet on Rowland Blvd as part of future restriping improvements along that street to increase capacity at the Rowland Blvd/Vintage Way (south) intersection (#6).

Table 12 presents the operations at the intersections with the recommended improvements. *Appendix F* contains Synchro output reports.

**Table 12: Future Plus Project Intersection Operations with Recommended Improvements**

| No. | Location | Control | Peak Hour | LOS Standard | Delay | LOS |
|---|---|---|---|---|---|---|
| 5 | Rowland Boulevard/ Vintage Way (north) | Signal | Saturday | D | 19.2 | B |
| 6 | Rowland Boulevard/ Vintage Way (south) | AWSC | PM | D | 27.8 | D |
|  |  |  | Saturday |  | 26.8 | D |

Source: Kittelson & Associates, 2020

Note:
- Synchro 10th Edition and HCM 2000 methodology were used.
- AWSC: All-Way Stop Control
- Average delay in seconds is presented for signalized and stop control intersections.

## 95TH PERCENTILE QUEUE LENGTHS

Kittelson utilized Synchro software, version 10, to analyze 95th percentile queues for informational purposes. 95th percentile queues represent worst-case conditions, occurring for three (3) minutes during the busiest time of day (i.e., 5% of the peak hour). Table 13 and Table 14 present 95th percentile queue lengths for intersections #2 through #5 for the weekday PM and Saturday midday peak hours, respectively. *Appendix G* contains Synchro queue analysis reports.

As presented in the tables, most intersection queues are expected to fit within the available storage capacity under all analysis scenarios. Exceptions to this finding are:

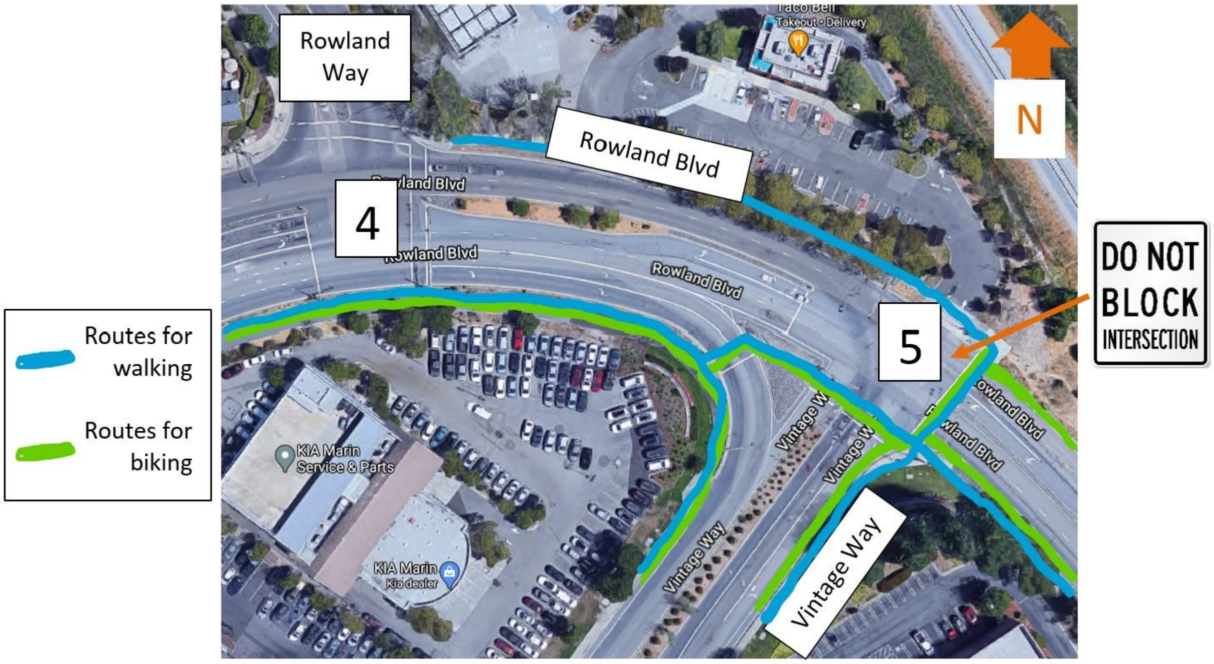
- Rowland Blvd/Rowland Way (#4) westbound through movement: expected to exceed available capacity during all scenarios other than Existing conditions, weekday PM peak hour

- Rowland Blvd/Vintage Way (north) (#5) southbound through movement: expected to extend into the upstream intersection under Future Plus Project conditions, Saturday peak hour

Additional analysis with optimization of traffic signal timing at both intersections demonstrated some improvement to traffic operations and some reduction in queue lengths. However, queuing for people driving westbound at Rowland Blvd/Rowland Way (#4) would continue to exceed the storage capacity between Rowland Way and Vintage Way. This means for a short period during the busiest time on weekday evenings, the queue at Rowland Way may extend back to Vintage Way, causing people at the Vintage Way intersection to wait briefly at that intersection even if they have a green light.

Figure 14 presents the segment of Rowland Blvd between Rowland Way and Vintage Way and illustrates the routes for people walking and biking in the area. As shown, the intersection at Vintage Way has crosswalks that provide connections for people walking and biking between the multi-use path coming from the freeway overpass along the south side of Rowland Blvd and the bike lanes and sidewalks along Vintage Way and the far side of Rowland Blvd. Today, the intersection has “DO NOT BLOCK INTERSECTION” signs.

**Figure 14: Rowland Blvd between Rowland Way and Vintage Way**



Source: Google Maps, Kittelson & Associates, Inc., 2020

Kittelson evaluated the queue spillback from the Rowland Blvd/Rowland Way (#4) intersection for potential adverse effects to people walking and biking at the Rowland Blvd/Vintage Way (north) (#5) intersection. As shown in Figure 14, the intersection at Vintage Way does not have a crosswalk on the west leg. Therefore, during the instances when a queue extends for the full length of the segment between the two intersections, people would not be walking across that side of the intersection where vehicles are at the tail of the queue. Additionally, the provision of "DO NOT BLOCK INTERSECTION" signs notifies drivers they should wait behind the crosswalks, and not block the intersection or roll forward across the crosswalk, if there is not room for them to continue fully through the intersection. The provision of crosswalks with dedicated pedestrian crossing phases plus the "DO NOT BLOCK INTERSECTION" signs provide appropriate indicators to people driving, walking, and biking about how and when to move through the intersection.

Kittelson also investigated the history of injury crashes at the Rowland Blvd/Vintage way intersection to see whether there is a history of crashes involving people walking and biking. In reviewing crash data for the five-year period of 2015-2019,[3] Kittelson found two vehicle-only injury crashes and zero bike- or pedestrian-involved crashes have occurred at the intersection. *Appendix H presents the 2015-2019 crash data at Rowland Blvd/Vintage Way.*

Traffic congestion, like the congestion that may already occur sometimes on Rowland Blvd and that is expected to occur in the future, results in low vehicle speeds. While drivers may perceive driving slowly as unpleasant, low vehicle speeds are correlated with safer roadway conditions for people walking and biking since all parties have time to see one another and stop before colliding. Likewise, higher vehicle speeds are correlated with uncomfortable condition for people walking and biking and are correlated with more severe injury and fatal crashes involving people walking and biking. Therefore, the queuing and congestion expected to occur on Rowland Blvd during the busiest periods do not substantially increase hazards due to a geometric design feature.

---

[3] Transportation Injury Mapping System online crash database, https://tims.berkeley.edu/

## Table 13: 95th Percentile Queues, Existing and Existing Plus Project Conditions, (Intersections 2-5)

| # | Intersection | Scenario | Northbound | | | Southbound | | | Eastbound | | | Westbound | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Left | Through | Right | Left | Through | Right | Left | Through | Right | Left | Through | Right |
| 2 | Rowland Boulevard/ US 101 SB Ramps | Storage | - | - | - | >1000 | >1000 | - | - | 630 | 315 | >1000 | >1000 | - |
| | | Existing, Weekday PM | - | - | - | 174 | 90 | - | - | 309 | 74 | 258 | 175 | - |
| | | Existing + Project, Weekday PM | - | - | - | 186 | 100 | - | - | 330 | 75 | 325 | 173 | - |
| | | Existing, Saturday | - | - | - | 251 | 132 | - | - | 351 | 75 | >564 | 254 | - |
| | | Existing + Project, Saturday | - | - | - | 268 | 140 | - | - | 368 | 76 | >620 | 258 | - |
| 3 | Rowland Boulevard/ US 101 NB Ramps | Storage | >1000 | >1000 | >1000 | - | - | - | 430 | >1000 | - | - | 1125 | 200 |
| | | Existing, Weekday PM | 318 | 318 | 395 | - | - | - | 78 | 342 | - | - | 271 | 55 |
| | | Existing + Project, Weekday PM | 334 | 335 | 463 | - | - | - | 77 | 385 | - | - | 313 | 69 |
| | | Existing, Saturday | 187 | 185 | 480 | - | - | - | 78 | 303 | - | - | 305 | 53 |
| | | Existing + Project, Saturday | 187 | 185 | 524 | - | - | - | 72 | 430 | - | - | 339 | 74 |
| 4 | Rowland Boulevard / Rowland Way | Storage | - | - | - | >500 | - | >500 | 600 | 975 | - | - | 600 | - |
| | | Existing, Weekday PM | - | - | - | 259 | - | 86 | 167 | 141 | - | - | 567 | - |
| | | Existing + Project, Weekday PM | - | - | - | >317 | - | 92 | 182 | 157 | - | - | **656** | - |
| | | Existing, Saturday | - | - | - | 251 | - | 80 | 242 | 233 | - | - | **939** | - |
| | | Existing + Project, Saturday | - | - | - | 261 | - | 80 | 242 | 266 | - | - | **1142** | - |
| 5 | Rowland Boulevard/ Vintage Way (north) | Storage | - | >1000 | - | 85 | 520 | 420 | 720 | 550 | - | - | 65 | - |
| | | Existing, Weekday PM | - | >431 | - | 38 | 131 | <25 | 174 | <25 | - | - | <25 | - |
| | | Existing + Project, Weekday PM | - | >541 | - | 37 | 179 | <25 | 164 | <25 | - | - | <25 | - |
| | | Existing, Saturday | - | 199 | - | 54 | 184 | <25 | 458 | <25 | - | - | 40 | - |
| | | Existing + Project, Saturday | - | 294 | - | 54 | 261 | <25 | 440 | <25 | - | - | 40 | - |

Source: Kittelson & Associates, Inc., 2020

Intersections analyzed using HCM 2000 methodologies

Queue lengths reported in feet

**Bold** indicates queue exceeds available storage.

## Table 14: 95th Percentile Queues, Future and Future Plus Project Conditions (Intersections 2-5)

| # | Intersection | Scenario | Northbound | | | Southbound | | | Eastbound | | | Westbound | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Left | Through | Right | Left | Through | Right | Left | Through | Right | Left | Through | Right |
| 2 | Rowland Boulevard/ US 101 SB Ramps | Storage | - | - | - | >1000 | >1000 | - | - | 630 | 315 | >1000 | >1000 | - |
| | | Future, Weekday PM | - | - | - | 232 | 132 | - | - | 388 | 79 | >395 | 174 | - |
| | | Future + Project, Weekday PM | - | - | - | 246 | 139 | - | - | 404 | 81 | >496 | 173 | - |
| | | Future, Saturday | - | - | - | 315 | 160 | - | - | 420 | 82 | >668 | 275 | - |
| | | Future + Project, Saturday | - | - | - | 336 | 168 | - | - | >462 | 82 | >724 | 273 | - |
| 3 | Rowland Boulevard/ US 101 NB Ramps | Storage | >1000 | >1000 | >1000 | - | - | - | 430 | >1000 | - | - | 1125 | 200 |
| | | Future, Weekday PM | 318 | 318 | 486 | - | - | - | 64 | 475 | - | - | 314 | 70 |
| | | Future + Project, Weekday PM | 318 | 318 | 513 | - | - | - | 62 | 512 | - | - | 340 | 105 |
| | | Future, Saturday | 187 | 185 | 569 | - | - | - | 64 | >582 | - | - | 383 | 116 |
| | | Future + Project, Saturday | 187 | 185 | 652 | - | - | - | 62 | >636 | - | - | 423 | 153 |
| 4 | Rowland Boulevard / Rowland Way | Storage | - | - | - | >500 | - | >500 | 600 | 975 | - | - | 600 | - |
| | | Future, Weekday PM | - | - | - | >375 | - | 92 | 182 | 201 | - | - | **735** | - |
| | | Future + Project, Weekday PM | - | - | - | >396 | - | 97 | 182 | 224 | - | - | **854** | - |
| | | Future, Saturday | - | - | - | 284 | - | 82 | 242 | 325 | - | - | **>1525** | - |
| | | Future + Project, Saturday | - | - | - | >294 | - | 81 | 242 | 367 | - | - | **>1731** | - |
| 5 | Rowland Boulevard/ Vintage Way (north) | Storage | - | >1000 | - | 85 | 520 | 420 | 720 | 550 | - | - | 65 | - |
| | | Future, Weekday PM | - | >605 | - | 38 | >347 | <25 | 180 | 20 | - | - | <25 | - |
| | | Future + Project, Weekday PM | - | >732 | - | 38 | >448 | <25 | 170 | 20 | - | - | <25 | - |
| | | Future, Saturday | - | >415 | - | 54 | >432 | <25 | 478 | 23 | - | - | 40 | - |
| | | Future + Project, Saturday | - | >577 | - | 54 | **>565** | <25 | 460 | 23 | - | - | 40 | - |

Source: Kittelson & Associates, Inc., 2020

Intersections analyzed using HCM 2000 methodologies

Queue lengths reported in feet

**Bold** indicates queue exceeds available storage.

# VEHICLE MILES TRAVELED (VMT)

Kittelson performed an analysis of vehicle-miles traveled (VMT) associated with the Project. This involves analysis of VMT for five types of trips associated with the fuel station: net new gas-only trips, gas-only diverted trips, gas-only pass-by trips from the shopping center, new warehouse + gas (shared) trips, and warehouse + gas trips shifting to Novato from existing Costco warehouses with fuel stations.

## Analysis Methodologies and Data

Kittelson obtained fuel transaction and member data from Costco for the month of April 2019. Costco provided data for fuel transactions made at the Rohnert Park and Vallejo fuel stations by members whose ZIP codes are in the Novato Market Area, shown in Figure 15, which includes the southern border of Marin County and Point Reyes National Seashore. The northern border of the market area is delineated by Point Reyes-Petaluma Rd from SR 1 to the border of Marin and Sonoma Counties, then follows the County border to the Petaluma River. To protect members' confidentiality, Costco consolidated members locations into one-square-mile zones (represented by the grid of dots on the figures).

Costco also provided fuel transaction data for the South San Francisco and Richmond locations. The data show members living in the Novato Market Area do purchase fuel at South San Francisco and Richmond. However, given the cost of tolls to cross the Golden Gate and Richmond–San Rafael Bridges, Kittelson assumed members do not make home-based trips to the South San Francisco and Richmond locations. Kittelson assumed those fuel purchases are made by members who already are in the area for other purposes. Therefore, the South San Francisco and Richmond locations are excluded from the analysis.

Kittelson used the software ArcGIS Online to analyze the data. Kittelson used the "Driving Distance" function to calculate miles traveled from these one-square-mile zones to the Rohnert Park and Vallejo Costco fuel stations, non-Costco fuel stations in Novato, and the proposed Novato Costco fuel station.

## Net New Gas-Only Trips

As discussed in the Trip Generation section, a portion of Project trips are "gas-only" trips, of which the destination is only the new gas station and not the warehouse. Due to the nature of fuel stations, members who would purchase fuel at the new Costco fuel station already are purchasing gas somewhere today. Therefore, this analysis calculates VMT on the street system attributed to the difference between VMT from Costco member's homes to the new fuel station and VMT from Costco member's homes to an existing fuel station nearest their home.

Figure 16 and Figure 17 show the spatial results of this analysis. Kittelson mapped existing fuel stations closest to members' homes within the City of Novato. The analysis assumes members would choose the existing fuel station with the shortest driving distance to make a gas-only trip today and would only make a primary gas trip of up to three miles (approximately ten minutes) one-way. Kittelson calculated VMT using the average distance that a person would make from their home to a nearby gas station multiplied by the number of estimated gas-only trips.

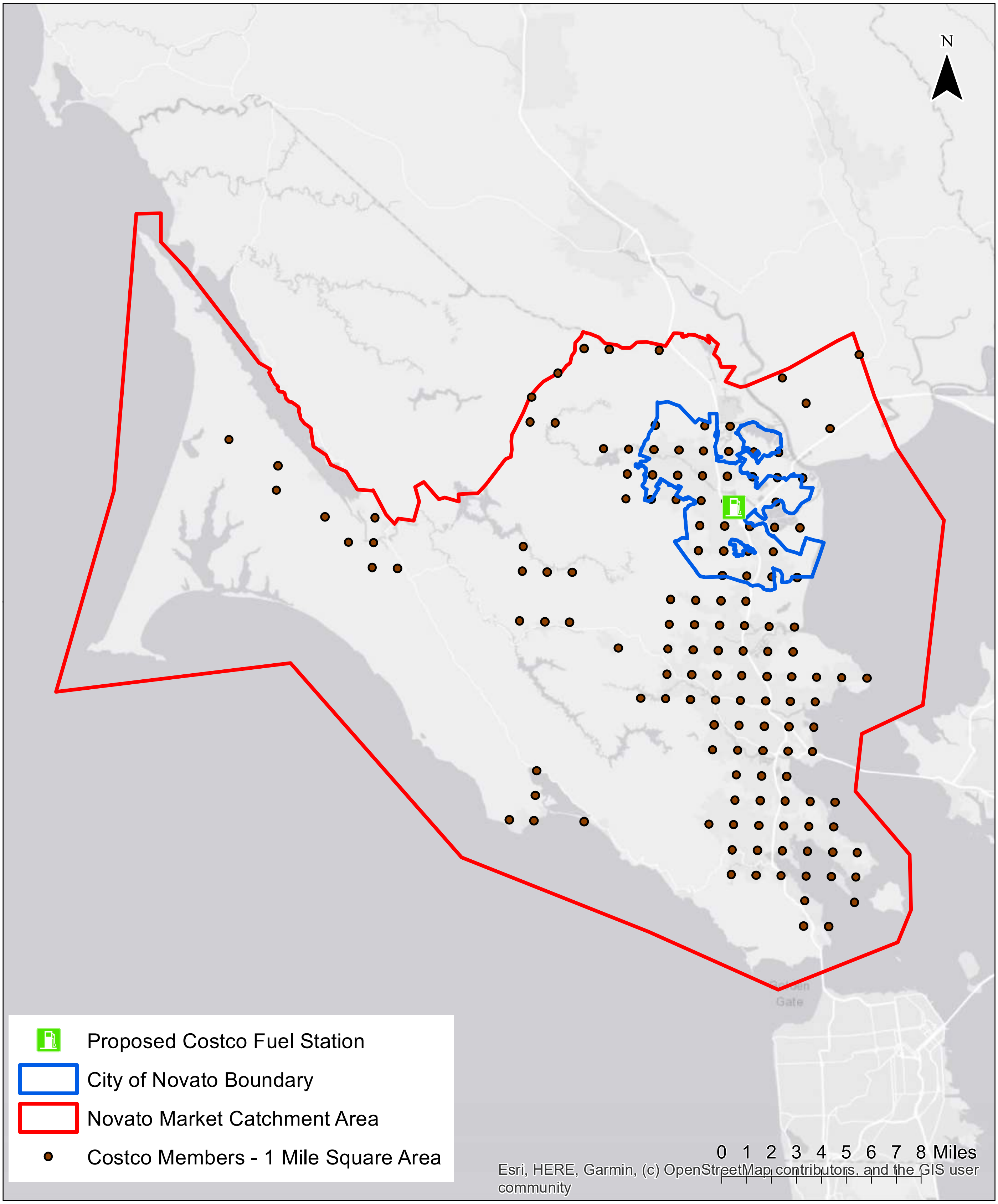
The analysis further assumes members who live within three miles of Costco will sometimes make gas-only trips, and members living more than three miles away would buy gas when they are already going to shop at the warehouse, somewhere else in the Vintage Oaks shopping center, or both the warehouse and other Vintage Oaks businesses. Table 15 presents a decrease in total VMT of 409 vehicle-miles resulting from 1,405 daily net new gas-only trips.

**Table 15: VMT for Net New Gas-Only Trips**

| Gas-Only Trips by Fuel Station Destination | Daily Trips | Daily VMT |
|---|---|---|
| Gas-Only Trips Currently Made to Members’ Closest Fuel Station* | 1,405 | 1,781 |
| Gas-Only Trips to Novato Costco Gas Station | | 1,372 |
| **Total** | | **-409** |

Source: Kittelson & Associates, Inc., 2020

*Members who would make gas-only trips to the Costco fuel station in the future when it is in operation currently buy their gas somewhere. This line assumes members purchase gas today at the fuel station closest to their home.

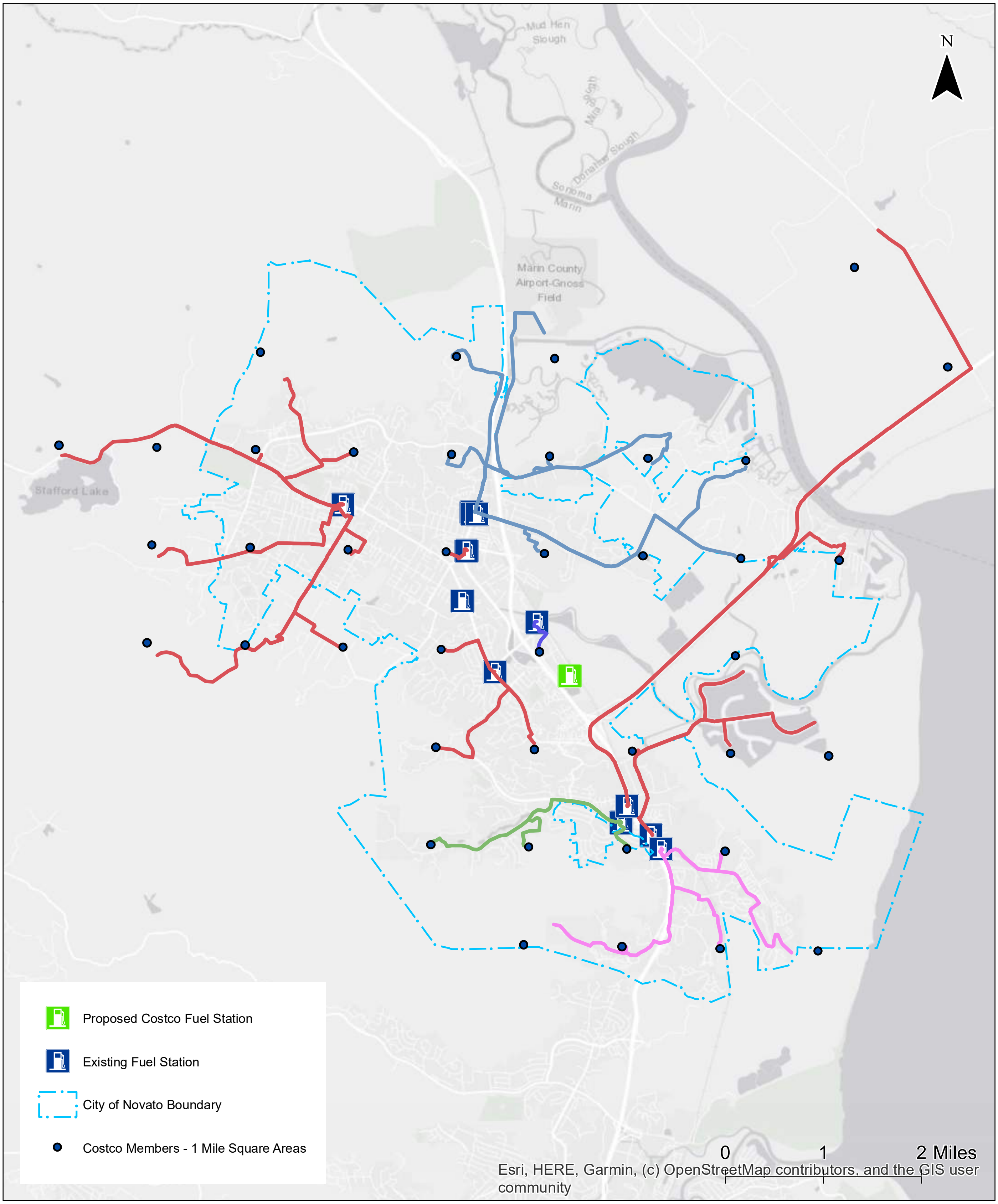


Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community

**Novato Market Catchment Area**

Figure
15

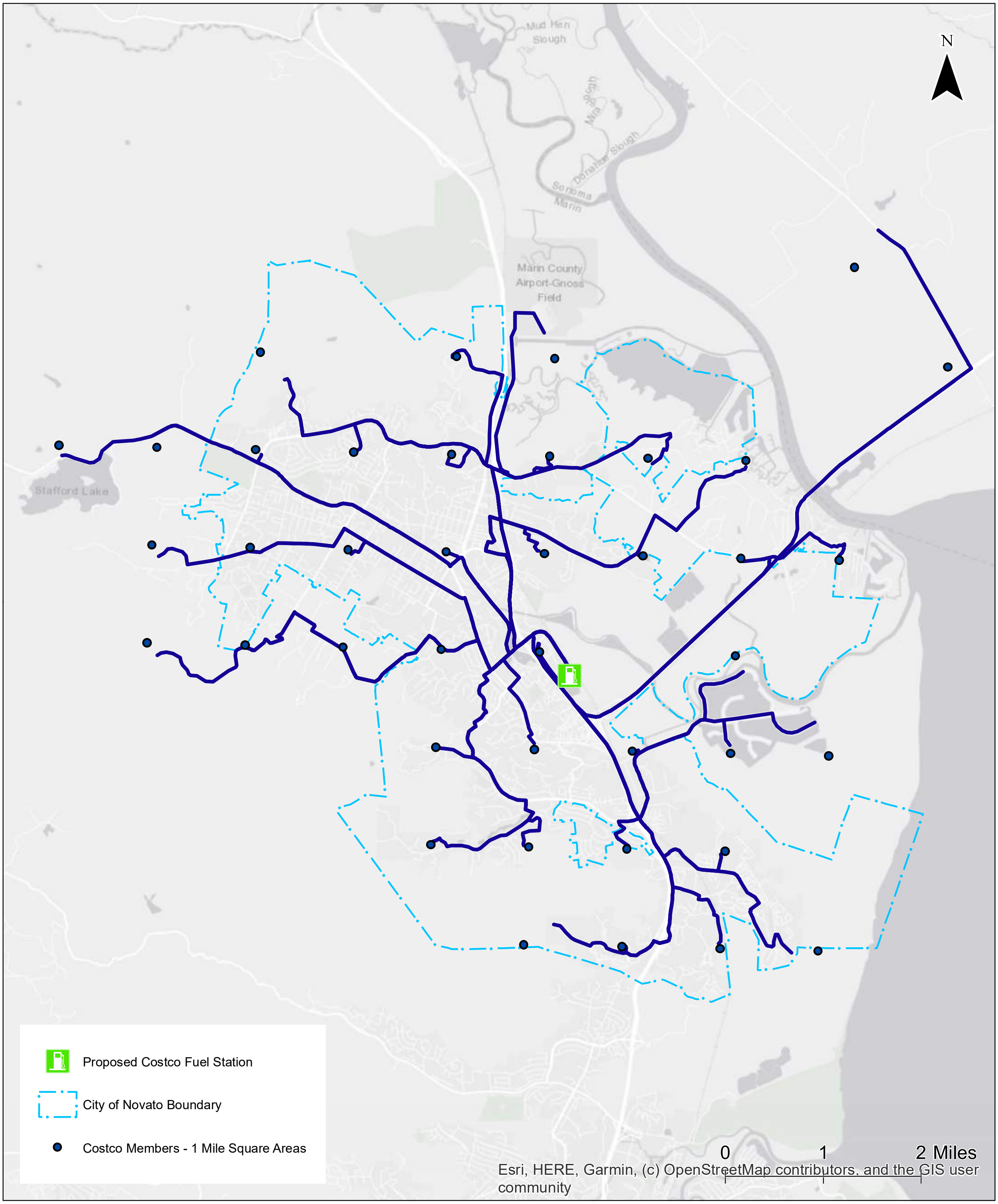
*Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet*



## Existing Net New External Trip VMT

Figure
16

*Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet*



## Future Net New External Trip VMT

Figure
17

**KITTELSON**
& ASSOCIATES

Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet

## Gas-Only Diverted Trips

A portion of Project trips are diverted trips associated with members who are currently traveling on the surrounding street network for some other primary purpose and stop by the Project site during that trip. To calculate VMT for gas-only diverted trips, diversion distances were calculated based on existing gas stations in the area. Kittelson worked with City staff to identify the four following typical routes from which Costco members would divert to buy gas today:

- US 101, exiting at De Long
- Redwood Blvd
- US 101, exiting at Rowland Blvd
- US 101, exiting at Ignacio Blvd

Figure 18 through Figure 21 show the paths and relative distances of gas-only diverted trips for the four diversion routes. Table 16 presents an increase in total VMT of 2,633 vehicle-miles resulting from 1,560 daily gas-only diverted trips.

**Table 16: VMT for Gas-Only Diverted Trips**

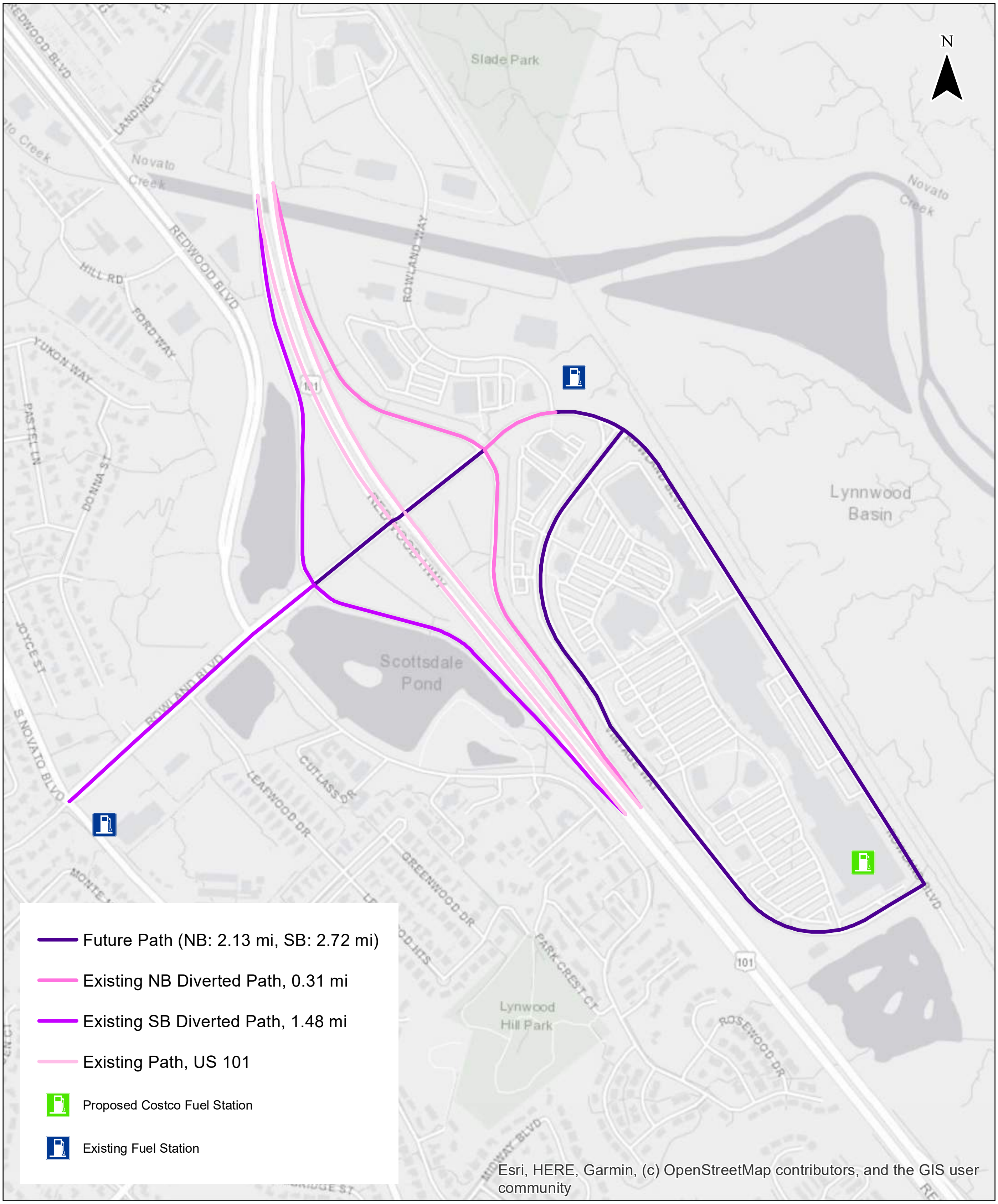
| Path | Diversion Distance to Fuel Station (mi.) | | % Traveling along Route[4] | Daily Trips along Diversion Route | Daily VMT |
|---|---|---|---|---|---|
| | Existing | Future[5] | | | |
| US 101/De Long Ave NB | 1.32 | 2.13 | 15% | 234 | 188 |
| US 101/De Long Ave SB | 1.08 | 2.72 | 15% | 234 | 382 |
| Redwood Blvd | 0.74 | 2.84 | 10% | 156 | 342 |
| US 101/Rowland Blvd NB | 0.31 | 2.13 | 15% | 234 | 423 |
| US 101/Rowland Blvd SB | 1.48 | 2.72 | 15% | 234 | 287 |
| US 101/Ignacio Blvd NB | 0.40 | 2.13 | 15% | 234 | 402 |
| US 101/Ignacio Blvd SB | 0.10 | 2.72 | 15% | 234 | 609 |
| Average | 0.78 | | | | |
| **Total** | | | | **1,560** | **2,633** |

Source: Kittelson & Associates, Inc. 2020

---

[4] Calculated using Caltrans 2017 Traffic Volumes and the City of Novato Existing Conditions Report
https://dot.ca.gov/programs/traffic-operations/census/traffic-volumes/2017/route-101
https://www.novato.org/home/showdocument?id=11293

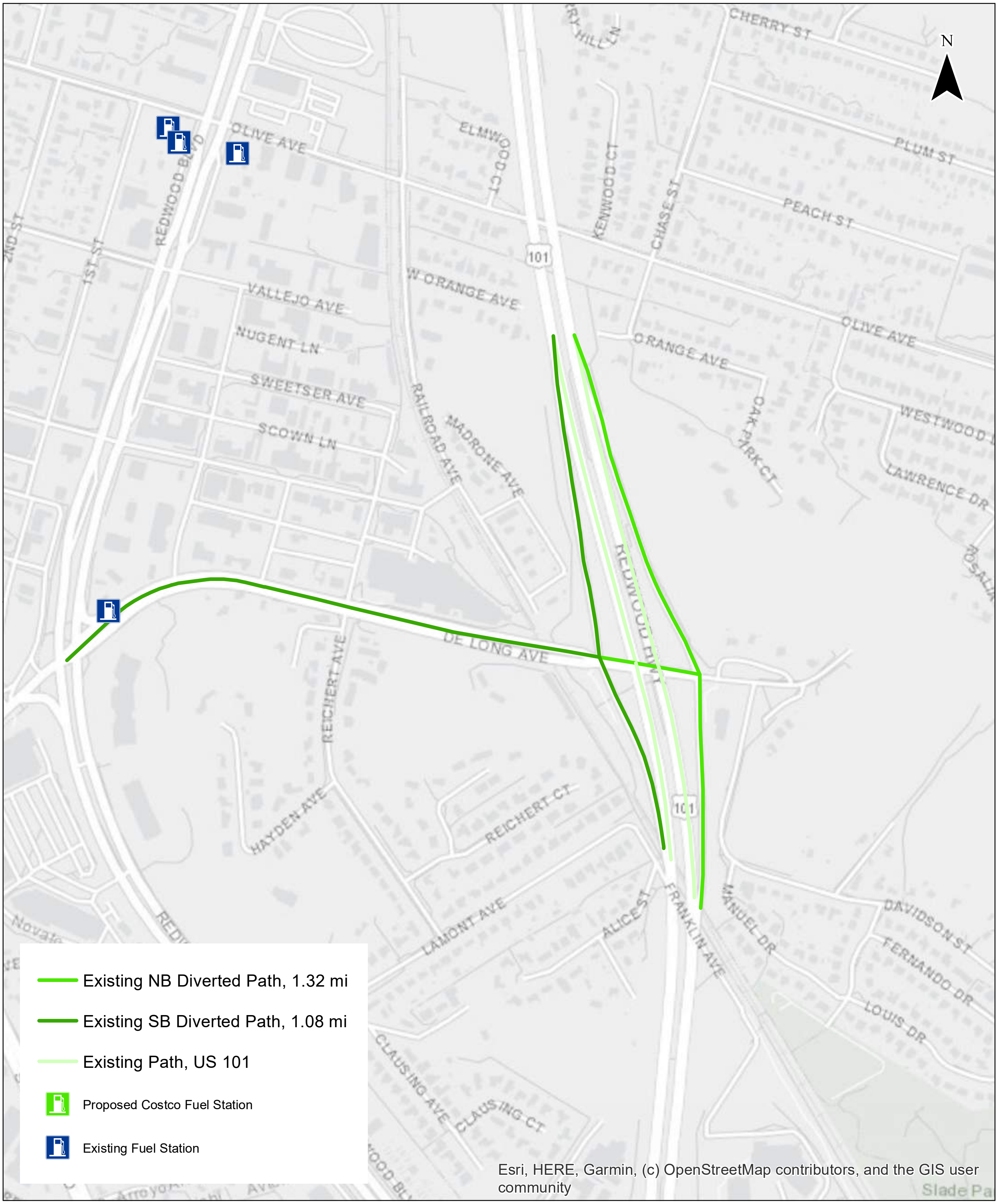
[5] All future diversion distances from US 101 are calculated from the US 101/Rowland Blvd interchange.



**Existing and Future Path to Fuel Stations**
**US 101 at Rowland Blvd**

Figure
18

*Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet*



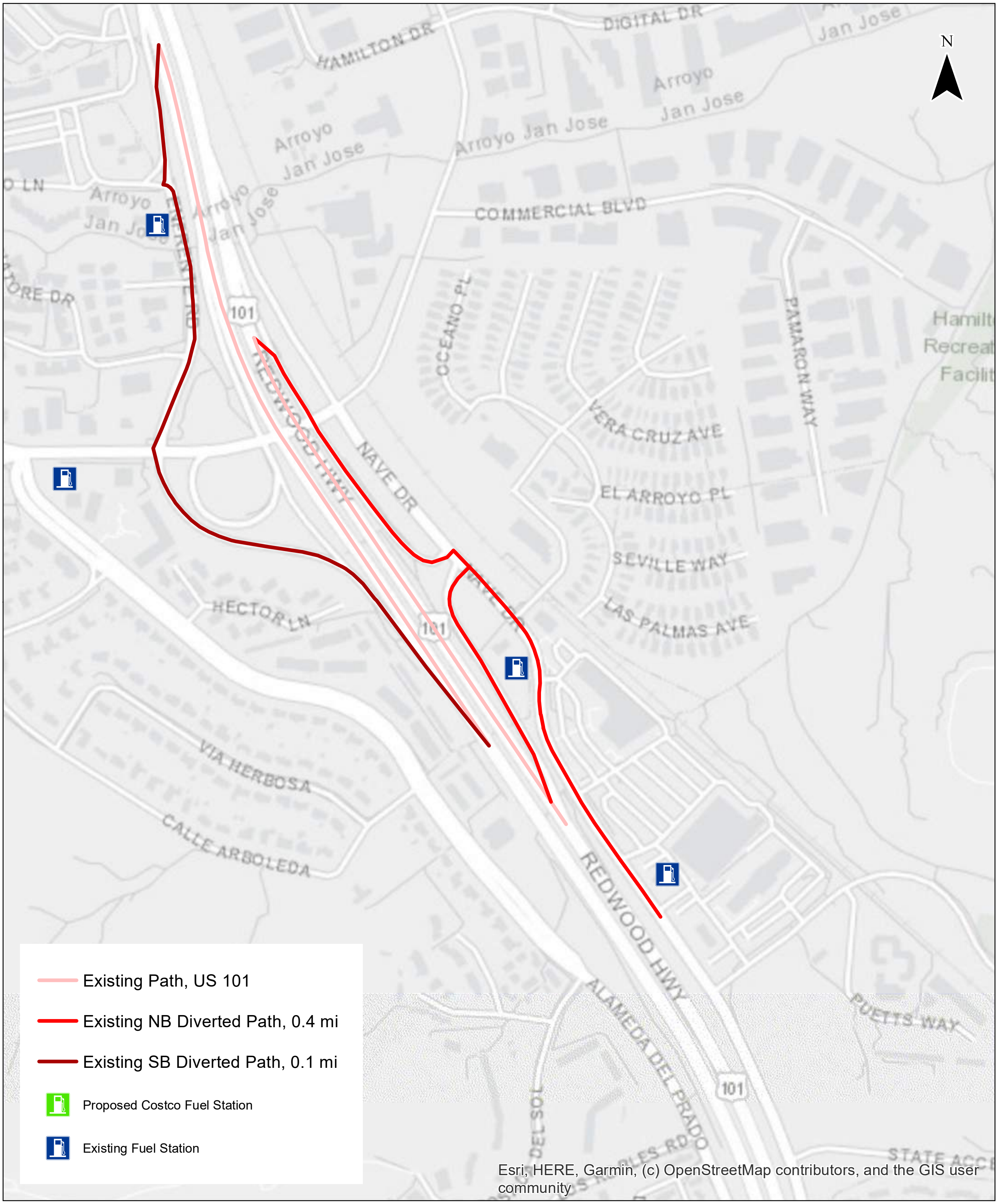
Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community

## Existing Paths to Fuel Station
## US 101 at De Long Ave

Figure
19

KITTELSON & ASSOCIATES

*Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet*



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**Existing Paths to Fuel Station**
**US 101 at Ignacio Blvd**

Figure
20

*Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet*

Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community

## Existing and Future Diverted Path to Fuel Stations Northbound/Southbound Vehicles on Redwood Blvd

Figure 21

KITTELSON & ASSOCIATES

Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet

## Gas-Only Pass-By Trips from Shopping Center

Pass-by trips represent members (i.e., trips) that are currently traveling on the surrounding street network for some other primary purpose and stop into the site as they pass by. In the case of the Costco fuel station, pass-by trips are considered trips made by members shopping elsewhere within the Vintage Oaks Shopping Center who would stop by the Costco fuel station but would not go to the warehouse. The analysis assumes Costco members shopping in the Vintage Oaks Shopping Center would travel on average an additional 0.25-mile roundtrip to make a fuel purchase. Table 17 presents an increase in total VMT of 414 vehicle-miles resulting from 1,655 daily gas-only pass-by trips from the shopping center.

**Table 17: VMT for Pass-by Trips from Shopping Center**

| Daily Gas-Only Pass-by Trips | Average Distance per Trip | Daily VMT |
|---|---|---|
| 1,655 | 0.25 | 414 |

Source: Kittelson & Associates, Inc. 2020

## Warehouse + Gas Trips

A portion of Project trips are shared between the warehouse and fuel station when members shop at the warehouse and buy gas during a single visit to the Costco site. As such, although they account for a trip to both the warehouse and the fuel station, these trips to the Project site are on the street network today since members already shop at the warehouse.

As previously stated, Costco members who would purchase fuel at the new Novato Costco fuel station already buy gas somewhere today. Therefore, the share of trips that would be future shared trips (i.e., warehouse + gas trips) would result in a decrease in total VMT on the system. Members would be able to combine two existing trips into one: a gas purchase trip currently routed elsewhere in the area would be combined with a member's existing trip to the warehouse. Therefore, combining trips would yield a VMT credit to the Project.

To calculate this reduction in VMT, Kittelson assumes Costco members making a new internal trip were previously making the same type of trip as the data show for the PM peak hour (i.e., the same ratio of gas-only diverted, pass-by, and primary trips relative to total gas-only trips). Reductions were calculated for trips diverting to existing fuel stations, pass-by trips made by people who are already in the shopping center, and home-based trips to existing fuel stations, which are on the street network today. Home-based trip distances were calculated using similar methodology to the net new external trips. Instead of driving to another gas station in Novato, some members will combine their gas trips with warehouse trips. The average distance from each point to the closest gas station (as shown in Figure 16) is credited to the Project. An average diverted distance was calculated using the existing diversion distances in Table 16. Table 18 presents a decrease in total VMT of 1,496 vehicle-miles resulting from 2,250 daily new warehouse + gas trips.

### Table 18: VMT for Warehouse + Gas Trips

| Present-Day Trip Type | Percentage of Warehouse + Gas Trips | Number of Daily Warehouse + Gas Trips | Average Miles to Existing Fuel Station | Daily VMT |
|---|---|---|---|---|
| Divert to Existing Fuel Stations | 36% | 810 | 0.78 | -629 |
| Pass-by to Existing Fuel Stations | 34% | 757 | 0 | 0 |
| Home-Based Trips to Existing Fuel Stations | 30% | 684 | * | -867 |
| **Total** | | **2,250** | | **-1,496** |

Source: Kittelson & Associates, Inc. 2020

* Average distance not applied to home-based trips. Calculation uses spatial analysis to assign home-based trips along the shortest route to the nearest fuel station.

### *VMT Credit for Shifting from Existing Costco Fuel Stations in Region*

Fuel transaction data from the Costco Gasoline fuel stations in Rohnert Park, Vallejo, South San Francisco, and Richmond demonstrate some members living in the south Marin County area purchase fuel at these existing Costco fuel stations, referred to as a “regional fuel trip” for this discussion. It is expected that many of the regional fuel trips to those existing Costco fuel stations are made as trips of convenience by members when they already are in those areas for another purpose. However, some of those regional fuel trips are expected to be home-based trips made to the distant Costco sites for the purpose of members shopping at those warehouses and buying gas. These regional fuel trips are expected to shift from the distant Costco sites to the Novato location. This shift in regional fuel trips would result in a reduction in vehicle-miles traveled for each relocated regional fuel trip. Therefore, this shift in regional fuel trips would yield a VMT credit to the Project.

The two most accessible Costco warehouses with fuel stations are in Rohnert Park and Vallejo. The data show members living in the Novato Market Area do purchase fuel at South San Francisco and Richmond. However, given the cost of tolls to cross the Golden Gate and Richmond–San Rafael Bridges, Kittelson assumed members do not make home-based trips to the South San Francisco and Richmond locations.

Kittelson calculated the distance from each square-mile zone to the Rohnert Park and Vallejo warehouses to develop total daily VMT for each location. Project trip generation (Table 7) shows 30% of gas-only trips are net new trips (i.e., home-based trips). This demonstrates the propensity of Costco members to make a primary trip to buy Costco gas. Therefore, the analysis assumes 30% of the total fuel purchases currently occurring at Rohnert Park and Vallejo instead would occur at the Novato location. The analysis assumes the share of these purchases (and therefore the share of trips) that would shift to Novato would be commensurate to the share of fuel purchases currently made at Rohnert Park and Vallejo. Table 19 presents a decrease in total VMT of 1,600 vehicle-miles resulting from 42 daily regional fuel trips.

**Table 19: VMT for Warehouse + Gas Trips: 30% Shifting from Existing Warehouses**

| Existing Warehouse | Average Daily Regional Fuel Trips* | 30% of Average Daily Regional Fuel Trips | Range of Roundtrip Distances Traveled (mi.) | Daily VMT |
|---|---|---|---|---|
| **Rohnert Park** | 119 | 36 | 6-43 | -1,356 |
| **Vallejo** | 21 | 6 | 24-46 | -244 |
| **Total** | **140** | **42** | | **-1,600** |

Source: Kittelson & Associates, Inc. 2020

* Based on Costco fuel station transaction data for Vallejo and Rohnert Park in April 2019.

### Overall Change in Regional Daily VMT

The overall change in regional daily VMT resulting from the Project is presented in Table 20. With construction and operation of the Novato Costco fuel station, regional daily VMT is estimated to decrease by 458 vehicle-miles. Therefore, Project impacts would be ***less than significant***.

**Table 20: Overall Project VMT**

| Trip Type | Total Daily VMT |
|---|---|
| Net New Gas-Only Trips | -409 |
| Gas-Only Diverted Trips | 2,633 |
| Gas-Only Pass-By Trips from Shopping Center | 414 |
| Warehouse + Gas Trips | -1,496 |
| *Warehouse + Gas Trips: 30% Shifting from Existing Warehouses* | -1,600 |
| **Total** | **-458** |

Source: Kittelson & Associates, Inc. 2020

## NON-AUTO MODE OF TRAVEL ASSESSMENT

The Project is a new fuel station providing for the sale of gasoline and no other goods or services. Due to the nature of this land use, the Project is expected to generate vehicle trips and not generate a substantive amount of pedestrian, bicycle, or transit trips. The fuel station itself likely will not generate pedestrian activity since the only service provided is the sale of gasoline; Costco fuel stations do not have a convenience store. Therefore, Project impacts to non-auto modes of travel would be ***less than significant***.

# CONCLUSIONS

The results of the traffic impact analysis indicate the proposed Costco Gasoline fuel station can be accommodated within Novato while not increasing regional daily VMT and while maintaining acceptable levels of service on the surrounding transportation system with recommended improvements in place. The findings of the transportation impact analysis are summarized and recommended Project-related improvements to the transportation network are discussed in this section.

## PROJECT IMPACTS

The VMT analysis indicates the addition of the Project-related VMT would result in a net decrease in regional daily VMT of 458 vehicle-miles. Therefore, Project impacts would be ***less than significant***.

Due to the nature of this land use, the Project is expected to generate vehicle trips and not generate a substantive amount of pedestrian, bicycle, or transit trips. The fuel station itself likely will not generate pedestrian activity since the only service provided is the sale of gasoline; Costco fuel stations do not have a convenience store. Therefore, Project impacts to non-auto modes of travel would be ***less than significant***.

## RECOMMENDED IMPROVEMENTS

The Project would result in traffic operations below the City's standard of LOS D at the Rowland Blvd/Vintage Way (north) signalized intersection and the Rowland Blvd/Vintage Way (south) all-way stop controlled intersection. Therefore, Kittelson recommends the following improvements to improve operations at intersection projected to operate beyond the standard:

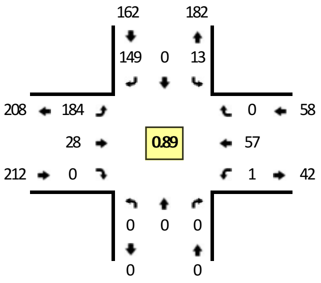
> **Intersection #5 Improvement:** Revise signal phasing to optimize green-time allocation relative to anticipated future volumes.
>
> **Intersection #6 Improvement:** Incorporate a southbound right-turn lane pocket for approximately 150 feet on Rowland Blvd as part of restriping improvements along that street.
>
> **Vintage Way Improvement:** Restripe approximately 200' of Vintage Way to provide a left-turn lane into the driveway nearest the planned Costco fuel station and provide a class III bike route with sharrow markings and signs.

# Appendix A Traffic Count Data

Type of peak hour being reported: Intersection Peak | Method for determining peak hour: Total Entering Volume

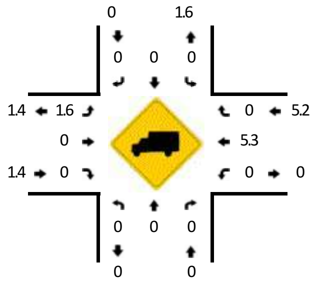
**LOCATION:** DWY 1 -- Vintage Way | **QC JOB #:** 15171609

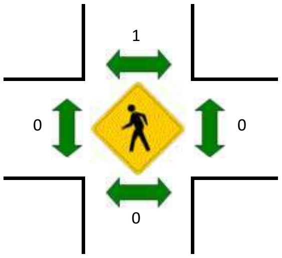
**CITY/STATE:** Novato, CA | **DATE:** Thu, Jan 30 2020

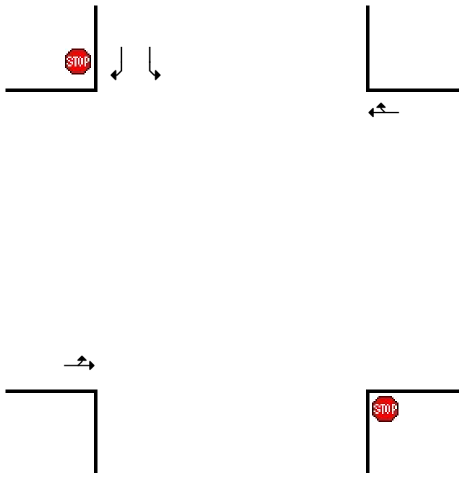


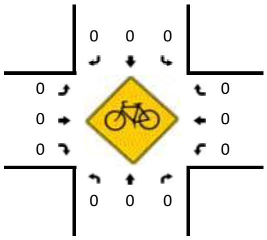
## Peak-Hour: 4:45 PM -- 5:45 PM
## Peak 15-Min: 5:15 PM -- 5:30 PM

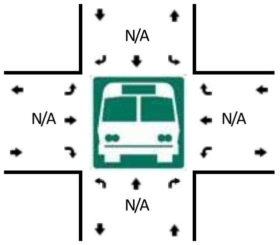
Quality Counts
DATA THAT DRIVES COMMUNITIES

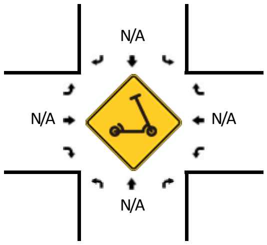












| 15-Min Count Period Beginning At | DWY 1 (Northbound) | | | | DWY 1 (Southbound) | | | | Vintage Way (Eastbound) | | | | Vintage Way (Westbound) | | | | Total | Hourly Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | Thru | Right | U | Left | Thru | Right | U | Left | Thru | Right | U | Left | Thru | Right | U | | |
| 4:00 PM | 0 | 0 | 0 | 0 | 4 | 0 | 42 | 0 | 42 | 12 | 0 | 0 | 0 | 14 | 1 | 0 | 115 | |
| 4:15 PM | 0 | 0 | 0 | 0 | 2 | 0 | 37 | 0 | 36 | 10 | 0 | 0 | 0 | 10 | 1 | 0 | 96 | |
| 4:30 PM | 0 | 0 | 0 | 0 | 4 | 0 | 33 | 0 | 40 | 7 | 0 | 1 | 0 | 9 | 0 | 0 | 94 | |
| 4:45 PM | 0 | 0 | 0 | 0 | 3 | 0 | 32 | 0 | 47 | 12 | 0 | 1 | 0 | 10 | 0 | 0 | 105 | 410 |
| 5:00 PM | 0 | 0 | 0 | 0 | 4 | 0 | 38 | 0 | 47 | 5 | 0 | 0 | 0 | 11 | 0 | 1 | 106 | 401 |
| 5:15 PM | 0 | 0 | 0 | 0 | 3 | 0 | 43 | 0 | 44 | 8 | 0 | 1 | 0 | 22 | 0 | 0 | 121 | 426 |
| 5:30 PM | 0 | 0 | 0 | 0 | 3 | 0 | 36 | 0 | 44 | 3 | 0 | 0 | 0 | 14 | 0 | 0 | 100 | 432 |
| 5:45 PM | 0 | 0 | 0 | 0 | 2 | 0 | 38 | 0 | 34 | 5 | 0 | 0 | 0 | 6 | 0 | 0 | 85 | 412 |
| 6:00 PM | 0 | 0 | 0 | 0 | 0 | 0 | 37 | 0 | 41 | 4 | 0 | 0 | 0 | 6 | 0 | 0 | 88 | 394 |
| 6:15 PM | 0 | 0 | 0 | 0 | 0 | 0 | 38 | 0 | 30 | 5 | 0 | 1 | 0 | 13 | 1 | 0 | 88 | 361 |
| 6:30 PM | 0 | 0 | 0 | 0 | 1 | 0 | 33 | 0 | 39 | 2 | 0 | 0 | 0 | 10 | 0 | 0 | 85 | 346 |
| 6:45 PM | 0 | 0 | 0 | 0 | 0 | 0 | 27 | 0 | 23 | 5 | 0 | 0 | 0 | 6 | 0 | 0 | 61 | 322 |

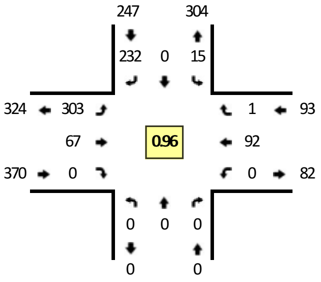
| Peak 15-Min Flowrates | Northbound | | | | Southbound | | | | Eastbound | | | | Westbound | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | Thru | Right | U | Left | Thru | Right | U | Left | Thru | Right | U | Left | Thru | Right | U | |
| All Vehicles | 0 | 0 | 0 | 0 | 12 | 0 | 172 | 0 | 176 | 32 | 0 | 4 | 0 | 88 | 0 | 0 | 484 |
| Heavy Trucks | 0 | 0 | 0 | | 0 | 0 | 0 | | 4 | 0 | 0 | | 0 | 8 | 0 | | 12 |
| Buses | | | | | | | | | | | | | | | | | |
| Pedestrians | | 0 | | | | 0 | | | | 0 | | | | 0 | | | 0 |
| Bicycles | 0 | 0 | 0 | | 0 | 0 | 0 | | 0 | 0 | 0 | | 0 | 0 | 0 | | 0 |
| Scooters | | | | | | | | | | | | | | | | | |

*Comments:*

Report generated on 2/7/2020 1:21 PM | SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

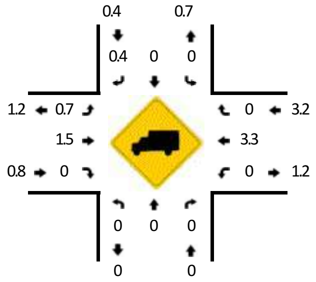
Type of peak hour being reported: Intersection Peak    Method for determining peak hour: Total Entering Volume

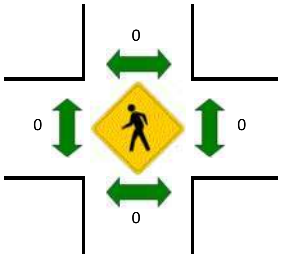
**LOCATION:** DWY 1 -- Vintage Way    **QC JOB #:** 15171610
**CITY/STATE:** Novato, CA    **DATE:** Sat, Feb 1 2020

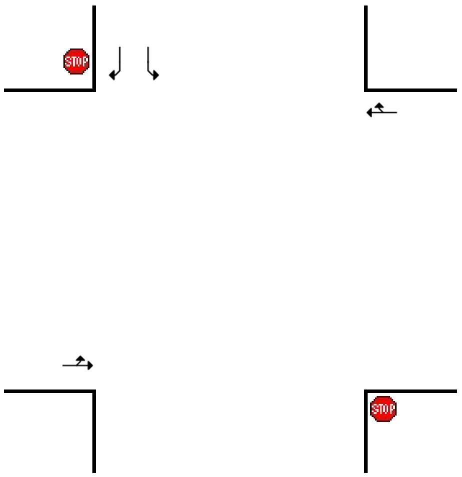


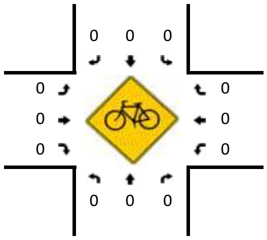
## Peak-Hour: 1:00 PM -- 2:00 PM
## Peak 15-Min: 1:00 PM -- 1:15 PM

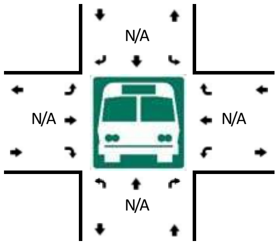
Quality Counts
DATA THAT DRIVES COMMUNITIES

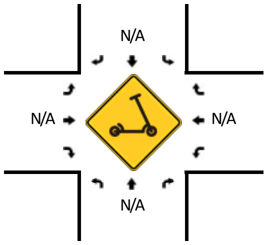












| 15-Min Count Period Beginning At | DWY 1 (Northbound) | | | | DWY 1 (Southbound) | | | | Vintage Way (Eastbound) | | | | Vintage Way (Westbound) | | | | Total | Hourly Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | Thru | Right | U | Left | Thru | Right | U | Left | Thru | Right | U | Left | Thru | Right | U | | |
| 11:00 AM | 0 | 0 | 0 | 0 | 2 | 0 | 43 | 0 | 67 | 15 | 0 | 1 | 0 | 23 | 2 | 0 | 153 | |
| 11:15 AM | 0 | 0 | 0 | 0 | 5 | 0 | 47 | 0 | 53 | 13 | 0 | 0 | 0 | 25 | 0 | 0 | 143 | |
| 11:30 AM | 0 | 0 | 0 | 0 | 5 | 0 | 47 | 0 | 78 | 21 | 0 | 0 | 0 | 19 | 2 | 0 | 172 | |
| 11:45 AM | 0 | 0 | 0 | 0 | 5 | 0 | 58 | 0 | 78 | 15 | 0 | 1 | 0 | 25 | 1 | 0 | 183 | 651 |
| 12:00 PM | 0 | 0 | 0 | 0 | 2 | 0 | 45 | 0 | 72 | 17 | 0 | 0 | 0 | 17 | 0 | 0 | 153 | 651 |
| 12:15 PM | 0 | 0 | 0 | 0 | 4 | 0 | 52 | 0 | 71 | 14 | 0 | 0 | 0 | 25 | 0 | 0 | 166 | 674 |
| 12:30 PM | 0 | 0 | 0 | 0 | 3 | 0 | 40 | 0 | 65 | 11 | 0 | 2 | 0 | 22 | 0 | 0 | 143 | 645 |
| 12:45 PM | 0 | 0 | 0 | 0 | 5 | 0 | 39 | 0 | 65 | 17 | 0 | 1 | 0 | 25 | 1 | 0 | 153 | 615 |
| 1:00 PM | 0 | 0 | 0 | 0 | 5 | 0 | 60 | 0 | 74 | 14 | 0 | 0 | 0 | 31 | 0 | 0 | 184 | 646 |
| 1:15 PM | 0 | 0 | 0 | 0 | 2 | 0 | 50 | 0 | 87 | 20 | 0 | 0 | 0 | 22 | 0 | 0 | 181 | 661 |
| 1:30 PM | 0 | 0 | 0 | 0 | 5 | 0 | 67 | 0 | 71 | 16 | 0 | 0 | 0 | 20 | 0 | 0 | 179 | 697 |
| 1:45 PM | 0 | 0 | 0 | 0 | 3 | 0 | 55 | 0 | 71 | 17 | 0 | 0 | 0 | 19 | 1 | 0 | 166 | 710 |

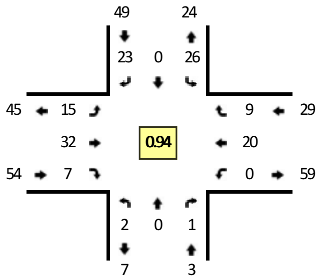
| Peak 15-Min Flowrates | Northbound | | | | Southbound | | | | Eastbound | | | | Westbound | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | Thru | Right | U | Left | Thru | Right | U | Left | Thru | Right | U | Left | Thru | Right | U | |
| All Vehicles | 0 | 0 | 0 | 0 | 20 | 0 | 240 | 0 | 296 | 56 | 0 | 0 | 0 | 124 | 0 | 0 | 736 |
| Heavy Trucks | 0 | 0 | 0 | | 0 | 0 | 0 | | 4 | 0 | 0 | | 0 | 0 | 0 | | 4 |
| Buses | | | | | | | | | | | | | | | | | |
| Pedestrians | | 0 | | | | 0 | | | | 0 | | | | 0 | | | 0 |
| Bicycles | 0 | 0 | 0 | | 0 | 0 | 0 | | 0 | 0 | 0 | | 0 | 0 | 0 | | 0 |
| Scooters | | | | | | | | | | | | | | | | | |

*Comments:*

Report generated on 2/7/2020 1:21 PM    SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

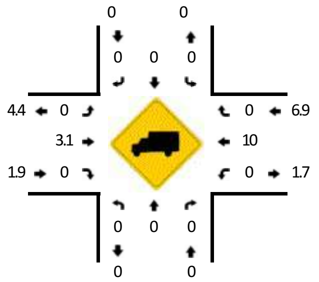
Type of peak hour being reported: Intersection Peak | Method for determining peak hour: Total Entering Volume

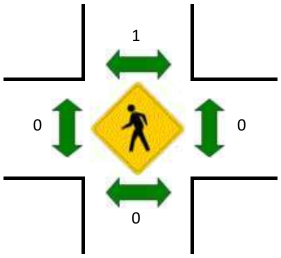
**LOCATION:** DWY 2 -- Vintage Way | **QC JOB #:** 15171613
**CITY/STATE:** Novato, CA | **DATE:** Thu, Jan 30 2020

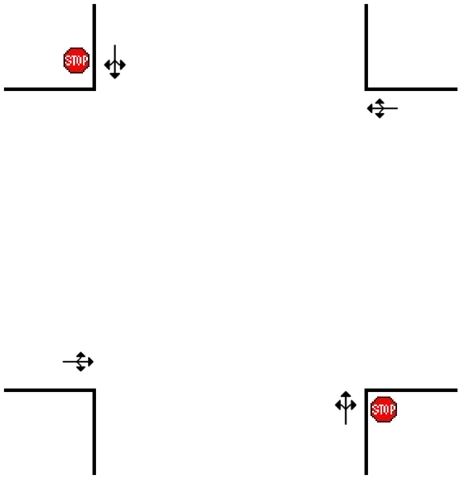


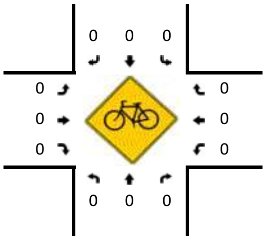
**Peak-Hour: 4:00 PM -- 5:00 PM**
**Peak 15-Min: 4:00 PM -- 4:15 PM**

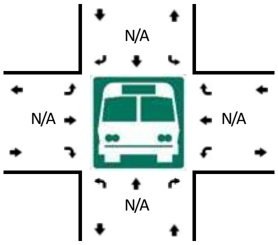
Quality Counts
DATA THAT DRIVES COMMUNITIES

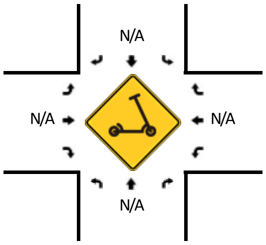












| 15-Min Count Period Beginning At | DWY 2 (Northbound) | | | | DWY 2 (Southbound) | | | | Vintage Way (Eastbound) | | | | Vintage Way (Westbound) | | | | Total | Hourly Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | Thru | Right | U | Left | Thru | Right | U | Left | Thru | Right | U | Left | Thru | Right | U | | |
| 4:00 PM | 0 | 0 | 0 | 0 | 2 | 0 | 9 | 0 | 2 | 11 | 3 | 0 | 0 | 6 | 3 | 0 | 36 | |
| 4:15 PM | 0 | 0 | 1 | 0 | 5 | 0 | 4 | 0 | 6 | 5 | 1 | 0 | 0 | 7 | 2 | 0 | 31 | |
| 4:30 PM | 0 | 0 | 0 | 0 | 14 | 0 | 5 | 0 | 3 | 7 | 1 | 0 | 0 | 4 | 0 | 0 | 34 | |
| 4:45 PM | 2 | 0 | 0 | 0 | 5 | 0 | 5 | 0 | 4 | 9 | 2 | 0 | 0 | 3 | 4 | 0 | 34 | 135 |
| 5:00 PM | 1 | 0 | 0 | 0 | 3 | 0 | 6 | 0 | 0 | 9 | 1 | 0 | 0 | 5 | 1 | 0 | 26 | 125 |
| 5:15 PM | 3 | 0 | 0 | 0 | 2 | 1 | 14 | 0 | 1 | 9 | 1 | 0 | 1 | 6 | 2 | 0 | 40 | 134 |
| 5:30 PM | 1 | 0 | 0 | 0 | 3 | 0 | 7 | 0 | 1 | 4 | 1 | 0 | 0 | 5 | 0 | 0 | 22 | 122 |
| 5:45 PM | 1 | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 2 | 5 | 0 | 0 | 0 | 3 | 0 | 0 | 14 | 102 |
| 6:00 PM | 1 | 0 | 0 | 0 | 3 | 0 | 3 | 0 | 0 | 4 | 0 | 0 | 0 | 4 | 1 | 0 | 16 | 92 |
| 6:15 PM | 0 | 0 | 0 | 0 | 2 | 0 | 8 | 0 | 1 | 2 | 2 | 0 | 0 | 4 | 0 | 0 | 19 | 71 |
| 6:30 PM | 2 | 0 | 0 | 0 | 1 | 0 | 4 | 0 | 0 | 3 | 0 | 0 | 0 | 5 | 1 | 0 | 16 | 65 |
| 6:45 PM | 0 | 0 | 0 | 0 | 2 | 0 | 4 | 0 | 1 | 4 | 0 | 0 | 0 | 1 | 0 | 0 | 12 | 63 |

| Peak 15-Min Flowrates | Northbound | | | | Southbound | | | | Eastbound | | | | Westbound | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | Thru | Right | U | Left | Thru | Right | U | Left | Thru | Right | U | Left | Thru | Right | U | |
| All Vehicles | 0 | 0 | 0 | 0 | 8 | 0 | 36 | 0 | 8 | 44 | 12 | 0 | 0 | 24 | 12 | 0 | 144 |
| Heavy Trucks | 0 | 0 | 0 | | 0 | 0 | 0 | | 0 | 4 | 0 | | 0 | 0 | 0 | | 4 |
| Buses | | | | | | | | | | | | | | | | | |
| Pedestrians | | 0 | | | | 0 | | | | 0 | | | | 0 | | | 0 |
| Bicycles | 0 | 0 | 0 | | 0 | 0 | 0 | | 0 | 0 | 0 | | 0 | 0 | 0 | | 0 |
| Scooters | | | | | | | | | | | | | | | | | |

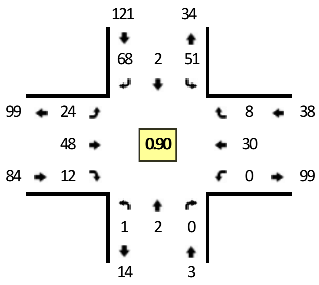
*Comments:*

Report generated on 2/7/2020 1:21 PM | SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak | Method for determining peak hour: Total Entering Volume

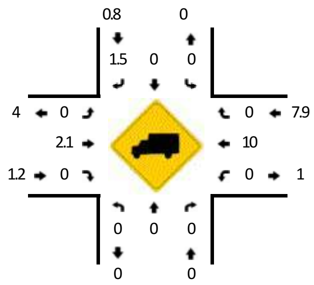
**LOCATION:** DWY 2 -- Vintage Way | **QC JOB #:** 15171614

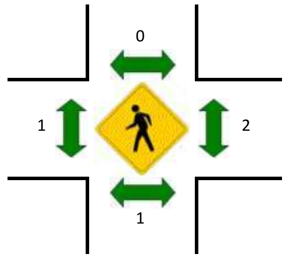
**CITY/STATE:** Novato, CA | **DATE:** Sat, Feb 1 2020

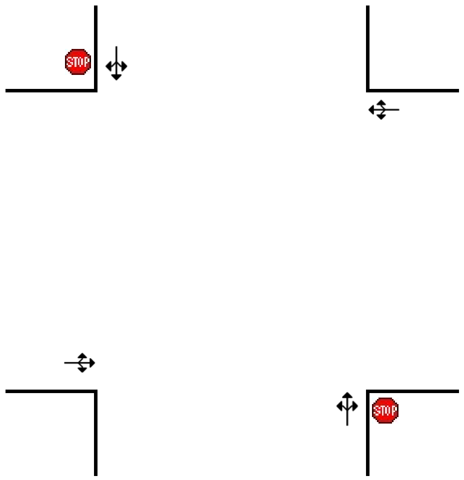


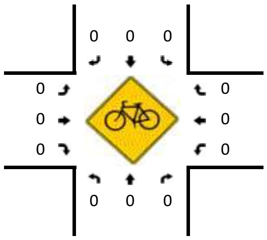
## Peak-Hour: 12:45 PM -- 1:45 PM
## Peak 15-Min: 12:45 PM -- 1:00 PM

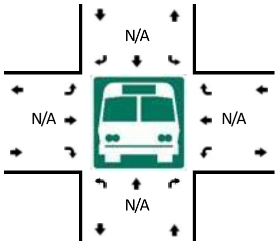
Quality Counts
DATA THAT DRIVES COMMUNITIES

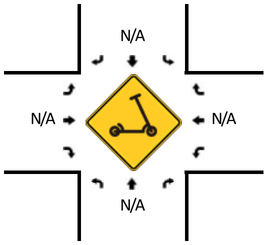












| 15-Min Count Period Beginning At | DWY 2 (Northbound) | | | | DWY 2 (Southbound) | | | | Vintage Way (Eastbound) | | | | Vintage Way (Westbound) | | | | Total | Hourly Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | Thru | Right | U | Left | Thru | Right | U | Left | Thru | Right | U | Left | Thru | Right | U | | |
| 11:00 AM | 1 | 0 | 0 | 0 | 10 | 0 | 20 | 0 | 4 | 9 | 4 | 0 | 2 | 4 | 3 | 0 | 57 | |
| 11:15 AM | 1 | 0 | 0 | 0 | 7 | 0 | 18 | 0 | 4 | 11 | 3 | 0 | 0 | 7 | 3 | 0 | 54 | |
| 11:30 AM | 0 | 1 | 0 | 0 | 14 | 0 | 12 | 0 | 5 | 16 | 4 | 0 | 0 | 10 | 0 | 0 | 62 | |
| 11:45 AM | 0 | 0 | 1 | 0 | 14 | 0 | 18 | 0 | 4 | 12 | 4 | 0 | 0 | 6 | 3 | 0 | 62 | 235 |
| 12:00 PM | 0 | 1 | 0 | 0 | 11 | 0 | 7 | 0 | 9 | 7 | 3 | 0 | 0 | 9 | 4 | 0 | 51 | 229 |
| 12:15 PM | 1 | 1 | 0 | 0 | 7 | 1 | 14 | 0 | 1 | 17 | 0 | 0 | 0 | 11 | 1 | 0 | 54 | 229 |
| 12:30 PM | 1 | 0 | 0 | 0 | 13 | 0 | 18 | 0 | 4 | 8 | 2 | 0 | 1 | 3 | 5 | 0 | 55 | 222 |
| 12:45 PM | 0 | 0 | 0 | 0 | 16 | 1 | 17 | 0 | 7 | 12 | 3 | 0 | 0 | 9 | 3 | 0 | 68 | 228 |
| 1:00 PM | 0 | 1 | 0 | 0 | 11 | 0 | 21 | 0 | 4 | 12 | 3 | 0 | 0 | 9 | 2 | 0 | 63 | 240 |
| 1:15 PM | 1 | 1 | 0 | 0 | 8 | 1 | 17 | 0 | 8 | 12 | 2 | 0 | 0 | 4 | 2 | 0 | 56 | 242 |
| 1:30 PM | 0 | 0 | 0 | 0 | 16 | 0 | 13 | 0 | 5 | 12 | 4 | 0 | 0 | 8 | 1 | 0 | 59 | 246 |
| 1:45 PM | 1 | 0 | 0 | 0 | 8 | 0 | 16 | 0 | 6 | 11 | 2 | 0 | 0 | 3 | 4 | 0 | 51 | 229 |

| Peak 15-Min Flowrates | Northbound | | | | Southbound | | | | Eastbound | | | | Westbound | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | Thru | Right | U | Left | Thru | Right | U | Left | Thru | Right | U | Left | Thru | Right | U | |
| All Vehicles | 0 | 0 | 0 | 0 | 64 | 4 | 68 | 0 | 28 | 48 | 12 | 0 | 0 | 36 | 12 | 0 | 272 |
| Heavy Trucks | 0 | 0 | 0 | | 0 | 0 | 0 | | 0 | 0 | 0 | | 0 | 4 | 0 | | 4 |
| Buses | | | | | | | | | | | | | | | | | |
| Pedestrians | | 0 | | | | 0 | | | | 0 | | | | 4 | | | 4 |
| Bicycles | 0 | 0 | 0 | | 0 | 0 | 0 | | 0 | 0 | 0 | | 0 | 0 | 0 | | 0 |
| Scooters | | | | | | | | | | | | | | | | | |

*Comments:*

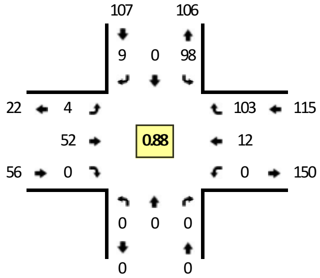
Report generated on 2/7/2020 1:21 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak | Method for determining peak hour: Total Entering Volume

**LOCATION:** DWY 3 -- Vintage Way | **QC JOB #:** 15171617

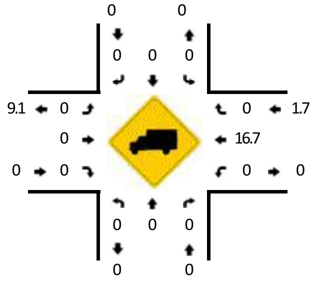
**CITY/STATE:** Novato, CA | **DATE:** Thu, Jan 30 2020

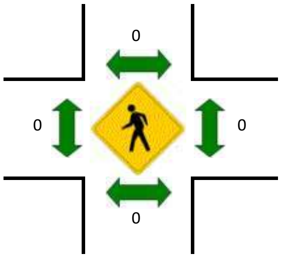


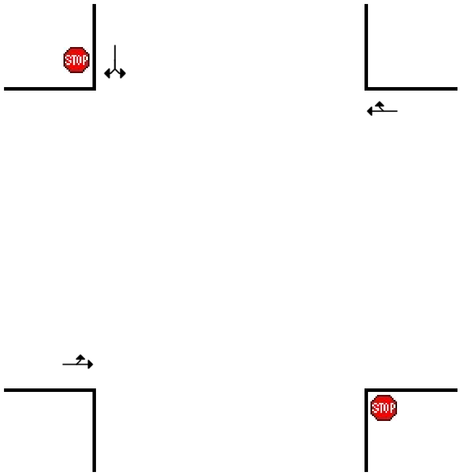
**Peak-Hour: 4:30 PM -- 5:30 PM**

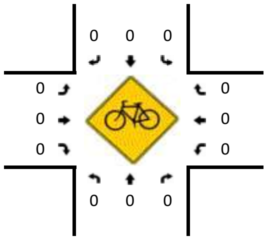
**Peak 15-Min: 4:30 PM -- 4:45 PM**

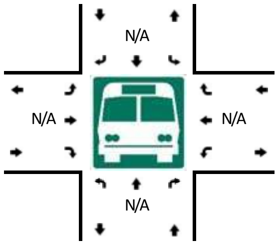
Quality Counts
DATA THAT DRIVES COMMUNITIES

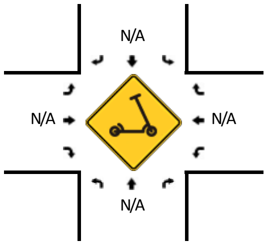












| 15-Min Count Period Beginning At | DWY 3 (Northbound) | | | | DWY 3 (Southbound) | | | | Vintage Way (Eastbound) | | | | Vintage Way (Westbound) | | | | Total | Hourly Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | Thru | Right | U | Left | Thru | Right | U | Left | Thru | Right | U | Left | Thru | Right | U | | |
| 4:00 PM | 0 | 0 | 0 | 0 | 20 | 0 | 3 | 0 | 2 | 10 | 0 | 0 | 0 | 6 | 21 | 0 | 62 | |
| 4:15 PM | 0 | 0 | 0 | 0 | 14 | 0 | 7 | 0 | 5 | 7 | 0 | 0 | 0 | 5 | 18 | 0 | 56 | |
| 4:30 PM | 0 | 0 | 0 | 0 | 18 | 0 | 2 | 0 | 1 | 22 | 0 | 1 | 0 | 3 | 32 | 0 | 79 | |
| 4:45 PM | 0 | 0 | 0 | 0 | 23 | 0 | 1 | 0 | 2 | 12 | 0 | 0 | 0 | 5 | 26 | 0 | 69 | 266 |
| 5:00 PM | 0 | 0 | 0 | 0 | 30 | 0 | 3 | 0 | 0 | 11 | 0 | 0 | 0 | 1 | 18 | 0 | 63 | 267 |
| 5:15 PM | 0 | 0 | 0 | 0 | 27 | 0 | 3 | 0 | 0 | 7 | 0 | 0 | 0 | 3 | 27 | 0 | 67 | 278 |
| 5:30 PM | 0 | 0 | 0 | 0 | 21 | 0 | 1 | 0 | 0 | 7 | 0 | 0 | 0 | 4 | 22 | 0 | 55 | 254 |
| 5:45 PM | 0 | 0 | 0 | 0 | 16 | 0 | 1 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 17 | 0 | 40 | 225 |
| 6:00 PM | 0 | 0 | 0 | 0 | 16 | 0 | 1 | 0 | 0 | 5 | 0 | 0 | 0 | 2 | 25 | 0 | 49 | 211 |
| 6:15 PM | 0 | 0 | 0 | 0 | 14 | 0 | 2 | 0 | 0 | 5 | 0 | 0 | 0 | 1 | 16 | 0 | 38 | 182 |
| 6:30 PM | 0 | 0 | 0 | 0 | 21 | 0 | 4 | 0 | 0 | 4 | 0 | 0 | 0 | 3 | 14 | 0 | 46 | 173 |
| 6:45 PM | 0 | 0 | 0 | 0 | 13 | 0 | 1 | 0 | 3 | 3 | 0 | 0 | 0 | 0 | 17 | 0 | 37 | 170 |

| Peak 15-Min Flowrates | Northbound | | | | Southbound | | | | Eastbound | | | | Westbound | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | Thru | Right | U | Left | Thru | Right | U | Left | Thru | Right | U | Left | Thru | Right | U | |
| All Vehicles | 0 | 0 | 0 | 0 | 72 | 0 | 8 | 0 | 4 | 88 | 0 | 4 | 0 | 12 | 128 | 0 | 316 |
| Heavy Trucks | 0 | 0 | 0 | | 0 | 0 | 0 | | 0 | 0 | 0 | | 0 | 4 | 0 | | 4 |
| Buses | | | | | | | | | | | | | | | | | |
| Pedestrians | | 0 | | | | 0 | | | | 0 | | | | 0 | | | 0 |
| Bicycles | 0 | 0 | 0 | | 0 | 0 | 0 | | 0 | 0 | 0 | | 0 | 0 | 0 | | 0 |
| Scooters | | | | | | | | | | | | | | | | | |

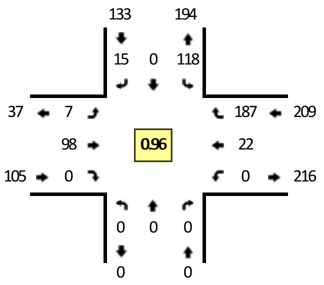
*Comments:*

Report generated on 2/7/2020 1:21 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

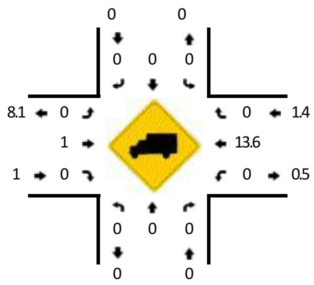
Type of peak hour being reported: Intersection Peak    Method for determining peak hour: Total Entering Volume

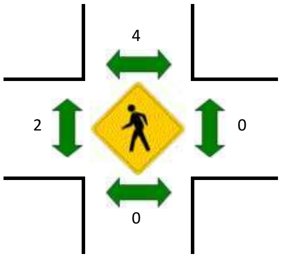
**LOCATION:** DWY 3 -- Vintage Way    **QC JOB #:** 15171618
**CITY/STATE:** Novato, CA    **DATE:** Sat, Feb 1 2020

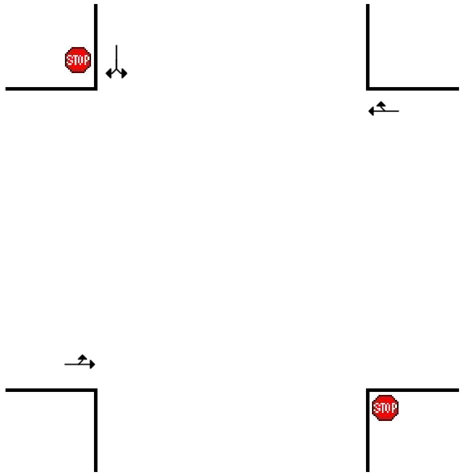


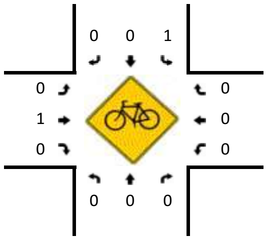
**Peak-Hour: 11:30 AM -- 12:30 PM**
**Peak 15-Min: 12:15 PM -- 12:30 PM**

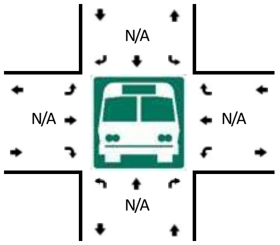
Quality Counts
DATA THAT DRIVES COMMUNITIES

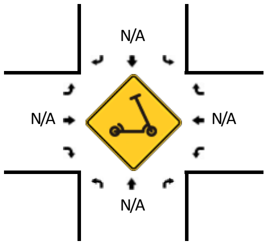












| 15-Min Count Period Beginning At | DWY 3 (Northbound) | | | | DWY 3 (Southbound) | | | | Vintage Way (Eastbound) | | | | Vintage Way (Westbound) | | | | Total | Hourly Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | Thru | Right | U | Left | Thru | Right | U | Left | Thru | Right | U | Left | Thru | Right | U | | |
| 11:00 AM | 0 | 0 | 0 | 0 | 29 | 0 | 2 | 0 | 2 | 16 | 0 | 0 | 0 | 6 | 35 | 0 | 90 | |
| 11:15 AM | 0 | 0 | 0 | 0 | 25 | 0 | 3 | 0 | 0 | 21 | 0 | 0 | 0 | 8 | 41 | 0 | 98 | |
| 11:30 AM | 0 | 0 | 0 | 0 | 24 | 0 | 2 | 0 | 4 | 30 | 0 | 0 | 0 | 4 | 49 | 0 | 113 | |
| 11:45 AM | 0 | 0 | 0 | 0 | 30 | 0 | 3 | 0 | 1 | 26 | 0 | 0 | 0 | 5 | 48 | 0 | 113 | 414 |
| 12:00 PM | 0 | 0 | 0 | 0 | 34 | 0 | 5 | 0 | 1 | 20 | 0 | 0 | 0 | 6 | 39 | 0 | 105 | 429 |
| 12:15 PM | 0 | 0 | 0 | 0 | 30 | 0 | 5 | 0 | 1 | 22 | 0 | 0 | 0 | 7 | 51 | 0 | 116 | 447 |
| 12:30 PM | 0 | 0 | 0 | 0 | 36 | 0 | 1 | 0 | 3 | 17 | 0 | 0 | 0 | 7 | 40 | 0 | 104 | 438 |
| 12:45 PM | 0 | 0 | 0 | 0 | 23 | 0 | 5 | 0 | 4 | 27 | 0 | 0 | 0 | 6 | 32 | 0 | 97 | 422 |
| 1:00 PM | 0 | 0 | 0 | 0 | 30 | 0 | 8 | 0 | 2 | 24 | 0 | 0 | 0 | 7 | 30 | 0 | 101 | 418 |
| 1:15 PM | 0 | 0 | 0 | 0 | 26 | 0 | 2 | 0 | 1 | 22 | 0 | 0 | 0 | 5 | 47 | 0 | 103 | 405 |
| 1:30 PM | 0 | 0 | 0 | 0 | 27 | 0 | 4 | 0 | 1 | 29 | 0 | 0 | 0 | 3 | 44 | 0 | 108 | 409 |
| 1:45 PM | 0 | 0 | 0 | 0 | 34 | 0 | 3 | 0 | 5 | 19 | 0 | 0 | 0 | 3 | 35 | 0 | 99 | 411 |

| Peak 15-Min Flowrates | Northbound | | | | Southbound | | | | Eastbound | | | | Westbound | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | Thru | Right | U | Left | Thru | Right | U | Left | Thru | Right | U | Left | Thru | Right | U | |
| All Vehicles | 0 | 0 | 0 | 0 | 120 | 0 | 20 | 0 | 4 | 88 | 0 | 0 | 0 | 28 | 204 | 0 | 464 |
| Heavy Trucks | 0 | 0 | 0 | | 0 | 0 | 0 | | 0 | 0 | 0 | | 0 | 8 | 0 | | 8 |
| Buses | | | | | | | | | | | | | | | | | |
| Pedestrians | | 0 | | | | 0 | | | | 0 | | | | 0 | | | 0 |
| Bicycles | 0 | 0 | 0 | | 0 | 0 | 0 | | 0 | 0 | 0 | | 0 | 0 | 0 | | 0 |
| Scooters | | | | | | | | | | | | | | | | | |

*Comments:*

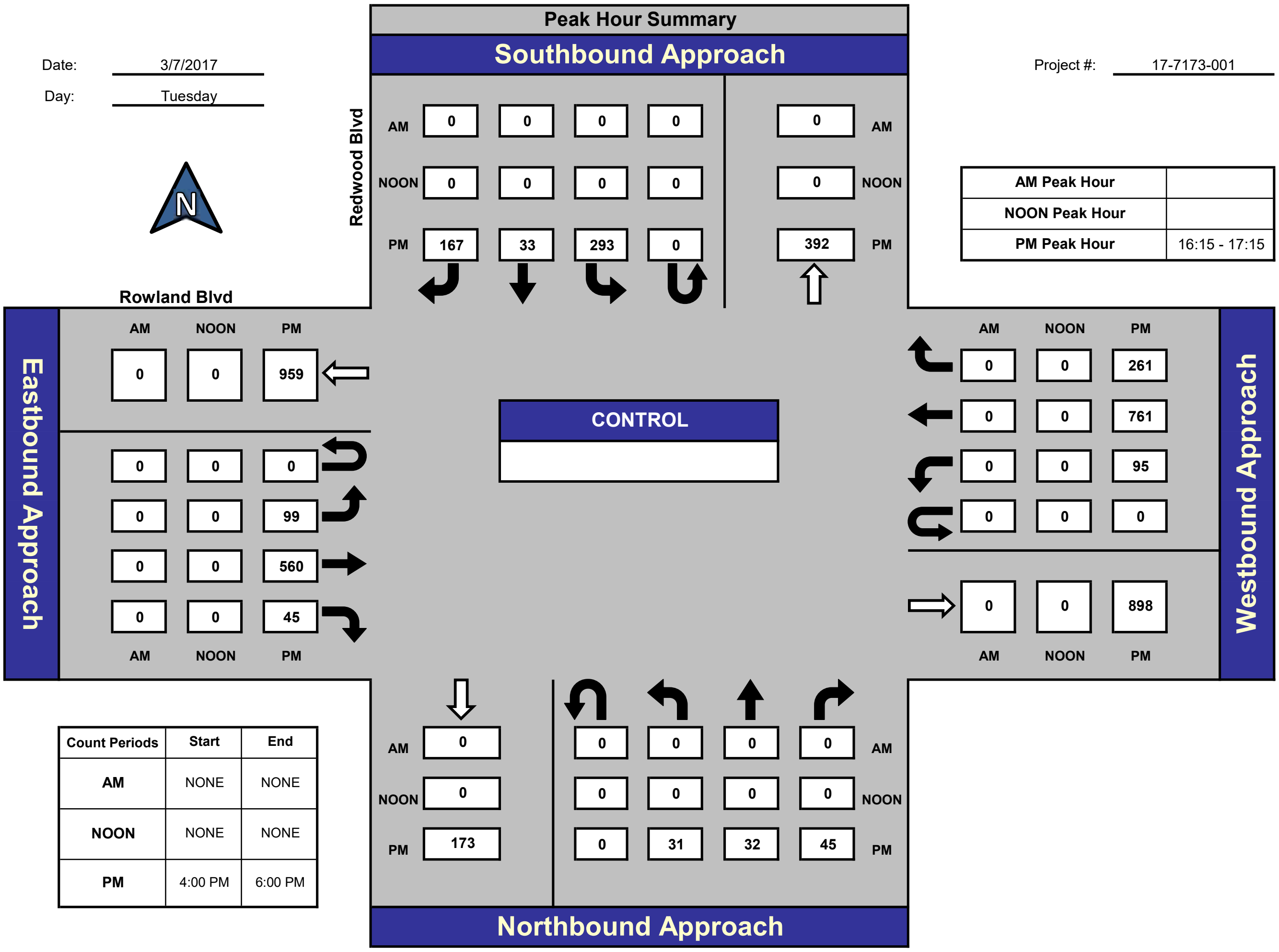
Report generated on 2/7/2020 1:21 PM    SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

## *Redwood Blvd & Rowland Blvd*

Date: 3/7/2017
Day: Tuesday

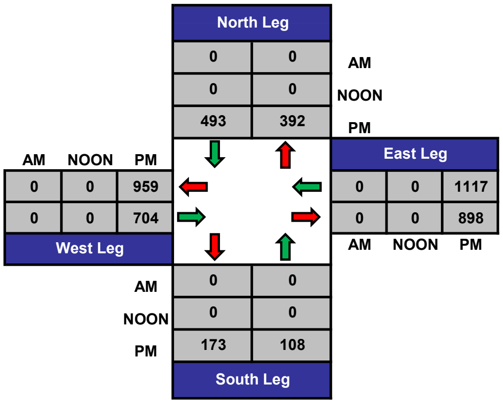
Project #: 17-7173-001

| AM Peak Hour | |
|---|---|
| NOON Peak Hour | |
| PM Peak Hour | 16:15 - 17:15 |

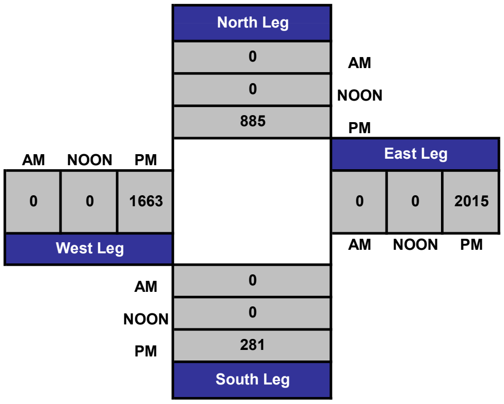


| Count Periods | Start | End |
|---|---|---|
| AM | NONE | NONE |
| NOON | NONE | NONE |
| PM | 4:00 PM | 6:00 PM |

## Total Ins & Outs



## Total Volume Per Leg



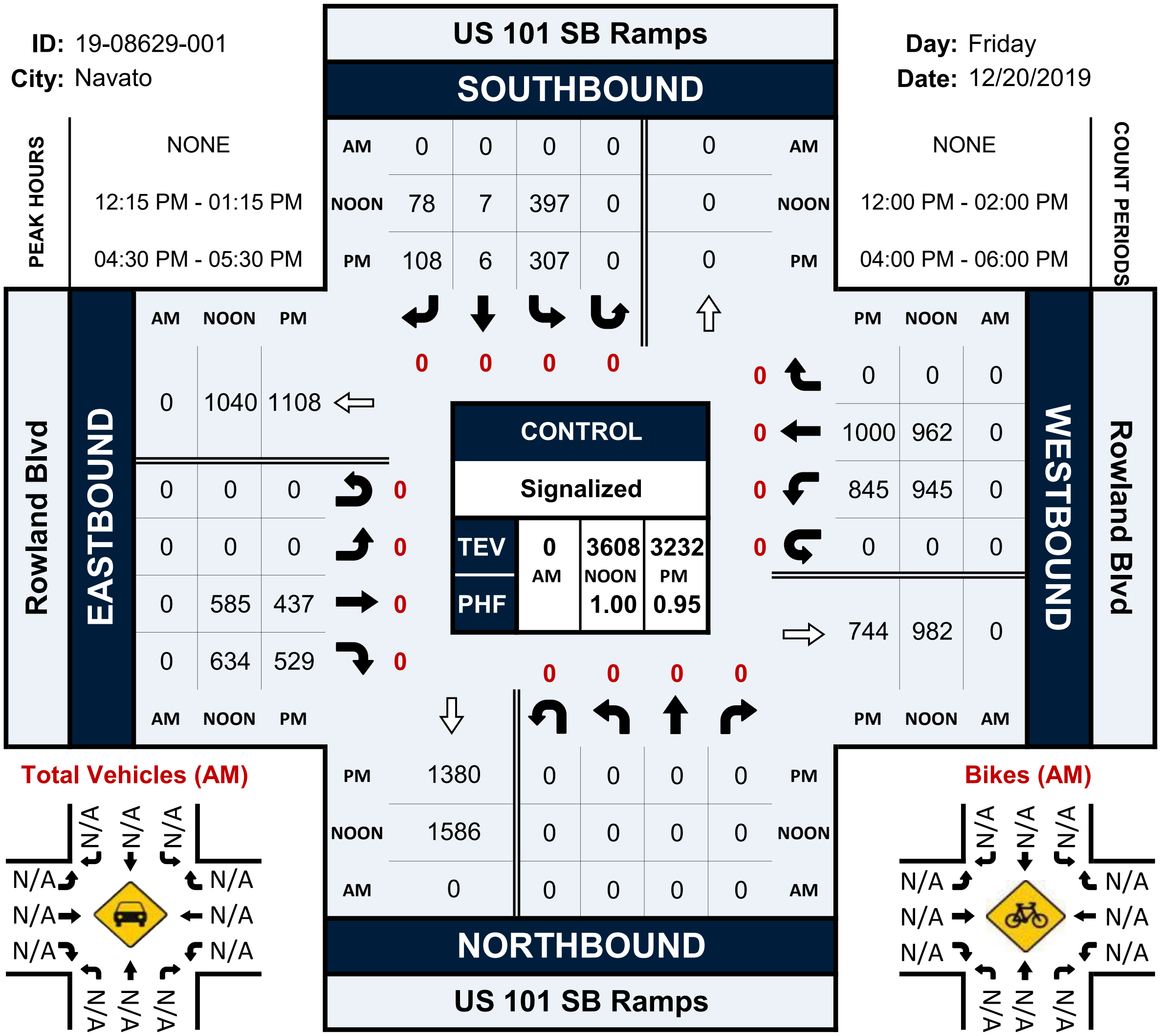
Prepared by National Data & Surveying Services

# US 101 SB Ramps & Rowland Blvd

## Peak Hour Turning Movement Count

**ID:** 19-08629-001
**City:** Navato

**Day:** Friday
**Date:** 12/20/2019



| PEAK HOURS | | COUNT PERIODS |
|---|---|---|
| NONE | AM | NONE |
| 12:15 PM - 01:15 PM | NOON | 12:00 PM - 02:00 PM |
| 04:30 PM - 05:30 PM | PM | 04:00 PM - 06:00 PM |

**US 101 SB Ramps — SOUTHBOUND**

| | ↲ | ↓ | ↳ | U-turn | ⇧ |
|---|---|---|---|---|---|
| AM | 0 | 0 | 0 | 0 | 0 |
| NOON | 78 | 7 | 397 | 0 | 0 |
| PM | 108 | 6 | 307 | 0 | 0 |
| | 0 | 0 | 0 | 0 | |

**Rowland Blvd — WESTBOUND**

| | | PM | NOON | AM |
|---|---|---|---|---|
| 0 | ↰ | 0 | 0 | 0 |
| 0 | ← | 1000 | 962 | 0 |
| 0 | ↙ | 845 | 945 | 0 |
| 0 | U-turn | 0 | 0 | 0 |
| | ⇨ | 744 | 982 | 0 |

**Rowland Blvd — EASTBOUND**

| | AM | NOON | PM | |
|---|---|---|---|---|
| ⇦ | 0 | 1040 | 1108 | |
| U-turn | 0 | 0 | 0 | 0 |
| ↗ | 0 | 0 | 0 | 0 |
| → | 0 | 585 | 437 | 0 |
| ↘ | 0 | 634 | 529 | 0 |

**US 101 SB Ramps — NORTHBOUND**

| | ⇩ | U-turn | ↰ | ↑ | ↱ |
|---|---|---|---|---|---|
| | | 0 | 0 | 0 | 0 |
| PM | 1380 | 0 | 0 | 0 | 0 |
| NOON | 1586 | 0 | 0 | 0 | 0 |
| AM | 0 | 0 | 0 | 0 | 0 |

**CONTROL**

Signalized

| | AM | NOON | PM |
|---|---|---|---|
| TEV | 0 | 3608 | 3232 |
| PHF | | 1.00 | 0.95 |

**Total Vehicles (AM)**

| Approach | Left | Through | Right |
|---|---|---|---|
| Southbound | N/A | N/A | N/A |
| Eastbound | N/A | N/A | N/A |
| Westbound | N/A | N/A | N/A |
| Northbound | N/A | N/A | N/A |

**Bikes (AM)**

| Approach | Left | Through | Right |
|---|---|---|---|
| Southbound | N/A | N/A | N/A |
| Eastbound | N/A | N/A | N/A |
| Westbound | N/A | N/A | N/A |
| Northbound | N/A | N/A | N/A |

**Total Vehicles (Noon)**

| | | | |
|---|---|---|---|
| Southbound | 78 | 7 | 397 |
| Eastbound | 0 | 585 | 634 |
| Westbound | 0 | 962 | 945 |
| Northbound | 0 | 0 | 0 |

**Bikes (NOON)**

| | | | |
|---|---|---|---|
| Southbound | 0 | 0 | 0 |
| Eastbound | 0 | 3 | 0 |
| Westbound | 0 | 2 | 0 |
| Northbound | 0 | 0 | 0 |

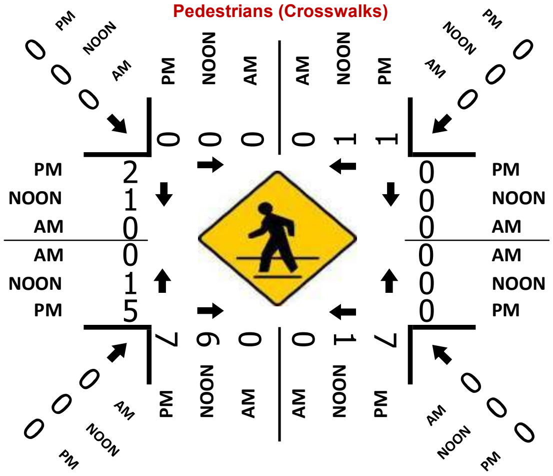
**Total Vehicles (PM)**

| | | | |
|---|---|---|---|
| Southbound | 108 | 6 | 307 |
| Eastbound | 0 | 437 | 529 |
| Westbound | 0 | 1000 | 845 |
| Northbound | 0 | 0 | 0 |

**Bikes (PM)**

| | | | |
|---|---|---|---|
| Southbound | 0 | 0 | 0 |
| Eastbound | 0 | 1 | 0 |
| Westbound | 0 | 1 | 0 |
| Northbound | 0 | 0 | 0 |

**Pedestrians (Crosswalks)**



| Crosswalk | Direction | AM | NOON | PM |
|---|---|---|---|---|
| North | → | 0 | 0 | 0 |
| North | ← | 0 | 1 | 1 |
| West | ↓ | 0 | 1 | 2 |
| West | ↑ | 0 | 1 | 5 |
| East | ↓ | 0 | 0 | 0 |
| East | ↑ | 0 | 0 | 0 |
| South | → | 0 | 6 | 7 |
| South | ← | 0 | 1 | 7 |
| Northwest diagonal | ↘ | 0 | 0 | 0 |
| Northeast diagonal | ↙ | 0 | 0 | 0 |
| Southwest diagonal | ↗ | 0 | 0 | 0 |
| Southeast diagonal | ↖ | 0 | 0 | 0 |

Prepared by National Data & Surveying Services

# US 101 NB Ramps & Rowland Blvd

## Peak Hour Turning Movement Count

**ID:** 19-08629-002
**City:** Navato

**Day:** Friday
**Date:** 12/20/2019

| PEAK HOURS | | | COUNT PERIODS |
|---|---|---|---|
| AM | NONE | AM | NONE |
| NOON | 12:00 PM - 01:00 PM | NOON | 12:00 PM - 02:00 PM |
| PM | 04:00 PM - 05:00 PM | PM | 04:00 PM - 06:00 PM |

### US 101 NB Ramps
### SOUTHBOUND

| | ↲ | ↓ | ↳ | ↶ | ⇧ |
|---|---|---|---|---|---|
| AM | 0 | 0 | 0 | 0 | 0 |
| NOON | 0 | 0 | 0 | 0 | 578 |
| PM | 0 | 0 | 0 | 0 | 601 |
| | 0 | 0 | 0 | 0 | |

### Rowland Blvd
### EASTBOUND

| | AM | NOON | PM | |
|---|---|---|---|---|
| ⇦ | 0 | 1887 | 1813 | |
| ↶ | 0 | 1 | 0 | 0 |
| ↱ | 0 | 58 | 48 | 0 |
| → | 0 | 902 | 687 | 0 |
| ↴ | 0 | 0 | 0 | 0 |

### Rowland Blvd
### WESTBOUND

| | | PM | NOON | AM |
|---|---|---|---|---|
| 0 | ↰ | 541 | 509 | 0 |
| 0 | ← | 1219 | 1385 | 0 |
| 0 | ↙ | 0 | 0 | 0 |
| 0 | ↷ | 0 | 0 | 0 |
| | ⇨ | 1491 | 2106 | 0 |

**CONTROL**

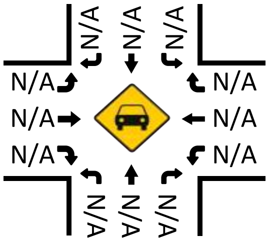
**Signalized**

| | AM | NOON | PM |
|---|---|---|---|
| TEV | 0 | 4571 | 3905 |
| PHF | | 0.99 | 0.96 |

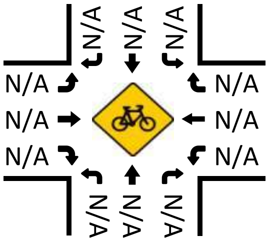
### NORTHBOUND
### US 101 NB Ramps

| | ⇩ | ↷ | ↰ | ↑ | ↱ |
|---|---|---|---|---|---|
| | | 0 | 0 | 0 | 0 |
| PM | 0 | 0 | 594 | 12 | 804 |
| NOON | 0 | 0 | 501 | 11 | 1204 |
| AM | 0 | 0 | 0 | 0 | 0 |

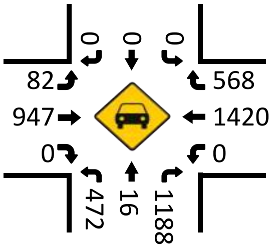
Total Vehicles (AM)



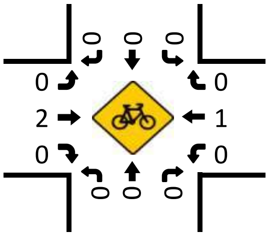
Bikes (AM)



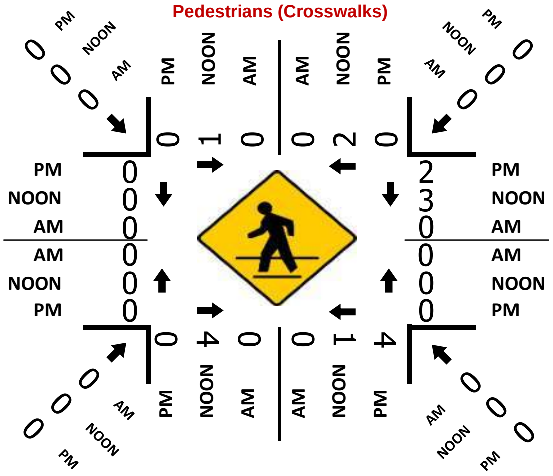
Total Vehicles (Noon)



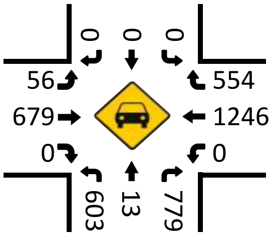
Bikes (NOON)



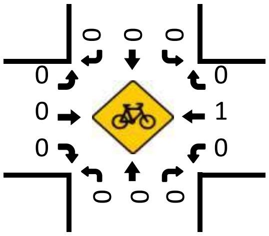
Pedestrians (Crosswalks)



Total Vehicles (PM)



Bikes (PM)



National Data & Surveying Services

# Intersection Turning Movement Count

| PM | NORTHBOUND | | | | | SOUTHBOUND | | | | EASTBOUND | | | | | WESTBOUND | | | | | NORTHBOUND2 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | NL | NT | NR | NU | NT2 | SL | ST | SR | SU | EL | ET | ER | EU | EL2 | WL | WT | WR | WU | WR2 | N2L2 | N2T2 | N2R2 | TOTAL |
| 4:00 PM | 145 | 2 | 204 | 0 | 1 | 0 | 0 | 0 | 0 | 12 | 169 | 0 | 0 | 0 | 0 | 281 | 114 | 0 | 0 | 0 | 1 | 0 | 929 |
| 4:15 PM | 134 | 2 | 201 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 172 | 0 | 0 | 2 | 0 | 320 | 138 | 0 | 1 | 2 | 1 | 0 | 987 |
| 4:30 PM | 167 | 4 | 228 | 0 | 1 | 0 | 0 | 0 | 0 | 10 | 163 | 0 | 0 | 0 | 0 | 297 | 149 | 0 | 0 | 2 | 6 | 0 | 1027 |
| 4:45 PM | 148 | 4 | 171 | 0 | 2 | 0 | 0 | 0 | 0 | 12 | 183 | 0 | 0 | 0 | 0 | 321 | 140 | 0 | 0 | 5 | 4 | 0 | 990 |
| 5:00 PM | 154 | 3 | 179 | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 161 | 0 | 0 | 0 | 0 | 308 | 127 | 0 | 1 | 1 | 0 | 0 | 954 |
| 5:15 PM | 147 | 3 | 185 | 0 | 1 | 0 | 0 | 0 | 0 | 16 | 169 | 0 | 0 | 1 | 0 | 301 | 142 | 0 | 0 | 3 | 3 | 1 | 972 |
| 5:30 PM | 144 | 8 | 187 | 0 | 2 | 0 | 0 | 0 | 0 | 9 | 115 | 0 | 0 | 1 | 0 | 301 | 126 | 0 | 0 | 1 | 3 | 0 | 897 |
| 5:45 PM | 147 | 0 | 210 | 0 | 1 | 0 | 0 | 0 | 0 | 17 | 141 | 0 | 0 | 1 | 0 | 308 | 135 | 0 | 0 | 3 | 0 | 1 | 964 |
| | NL | NT | NR | NU | NT2 | SL | ST | SR | SU | EL | ET | ER | EU | EL2 | WL | WT | WR | WU | WR2 | N2L | N2T2 | N2R2 | TOTAL |
| **TOTAL VOLUMES :** | 1039 | 26 | 1355 | 0 | 7 | 0 | 0 | 0 | 0 | 93 | 1132 | 0 | 0 | 4 | 0 | 2129 | 936 | 0 | 2 | 14 | 18 | 1 | 6756 |
| **APPROACH %'s :** | 42.81% | 1.07% | 55.83% | 0.00% | 0.29% | | | | | 7.57% | 92.11% | 0.00% | 0.00% | 0.33% | 0.00% | 69.42% | 30.52% | 0.00% | 0.07% | 42.42% | 54.55% | 3.03% | |
| **PEAK HR :** | **03:45 PM - 04:45 PM** | | | | | | | | | | | | | | | | | | | | | | TOTAL |
| **PEAK HR VOL :** | 446 | 8 | 633 | 0 | 2 | 0 | 0 | 0 | 0 | 36 | 504 | 0 | 0 | 2 | 0 | 898 | 401 | 0 | 1 | 4 | 8 | 0 | 2943 |
| **PEAK HR FACTOR :** | 0.668 | 0.500 | 0.694 | 0.000 | 0.500 | 0.000 | 0.000 | 0.000 | 0.000 | 0.643 | 0.733 | 0.000 | 0.000 | 0.250 | 0.000 | 0.702 | 0.673 | 0.000 | 0.250 | 0.500 | 0.333 | 0.000 | 0.716 |
| | | | 0.681 | | | | | | | | | 0.721 | | | | | 0.708 | | | | 0.375 | | |

Prepared by National Data & Surveying Services

# Rowland Way & Rowland Blvd

## Peak Hour Turning Movement Count

**ID:** 19-08629-003
**City:** Navato

**Day:** Friday
**Date:** 12/20/2019

| PEAK HOURS | | COUNT PERIODS |
|---|---|---|
| NONE | AM | NONE |
| 12:45 PM - 01:45 PM | NOON | 12:00 PM - 02:00 PM |
| 04:15 PM - 05:15 PM | PM | 04:00 PM - 06:00 PM |

**Rowland Way**

**SOUTHBOUND**

| | | | | | | |
|---|---|---|---|---|---|---|
| AM | 0 | 0 | 0 | 0 | 0 | AM |
| NOON | 363 | 0 | 90 | 0 | 500 | NOON |
| PM | 406 | 0 | 49 | 0 | 253 | PM |
| | ↲ | ↓ | ↳ | U | ⇧ | |
| | 0 | 0 | 0 | 0 | | |

**Rowland Blvd**

**EASTBOUND**

| AM | NOON | PM | | |
|---|---|---|---|---|
| 0 | 1989 | 1793 | ⇦ | |
| 0 | 4 | 3 | U | 0 |
| 0 | 436 | 228 | ↰ | 0 |
| 0 | 1695 | 1245 | → | 0 |
| 0 | 0 | 0 | ↴ | 0 |
| AM | NOON | PM | | |

**CONTROL**

**Signalized**

| | AM | NOON | PM |
|---|---|---|---|
| TEV | 0 | 4274 | 3340 |
| PHF | | 0.98 | 0.93 |

**Rowland Blvd**

**WESTBOUND**

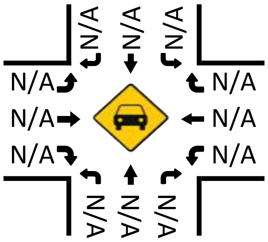
| | | PM | NOON | AM |
|---|---|---|---|---|
| 0 | ↰ | 25 | 64 | 0 |
| 0 | ← | 1384 | 1622 | 0 |
| 0 | ↱ | 0 | 0 | 0 |
| 0 | U | 0 | 0 | 0 |
| | ⇨ | 1294 | 1785 | 0 |
| | | PM | NOON | AM |

**NORTHBOUND**

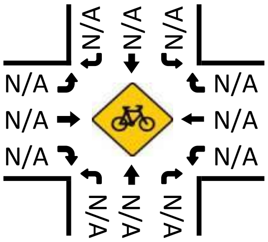
**Rowland Way**

| | | | | | | |
|---|---|---|---|---|---|---|
| | | 0 | 0 | 0 | 0 | |
| | ⇩ | U | ↰ | ↑ | ↱ | |
| PM | 0 | 0 | 0 | 0 | 0 | PM |
| NOON | 0 | 0 | 0 | 0 | 0 | NOON |
| AM | 0 | 0 | 0 | 0 | 0 | AM |

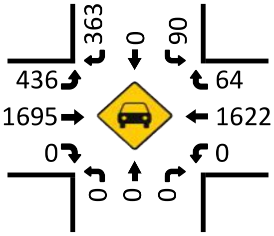
**Total Vehicles (AM)**



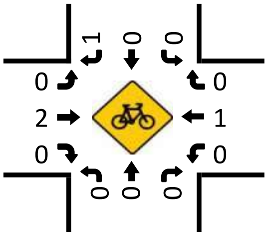
**Bikes (AM)**



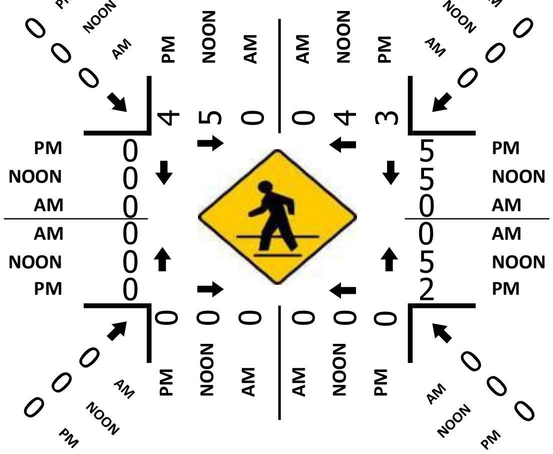
**Total Vehicles (Noon)**



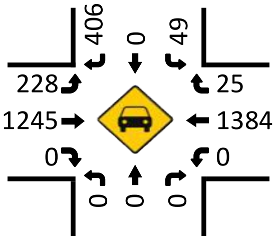
**Bikes (NOON)**



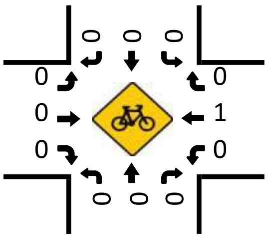
**Pedestrians (Crosswalks)**



**Total Vehicles (PM)**



**Bikes (PM)**



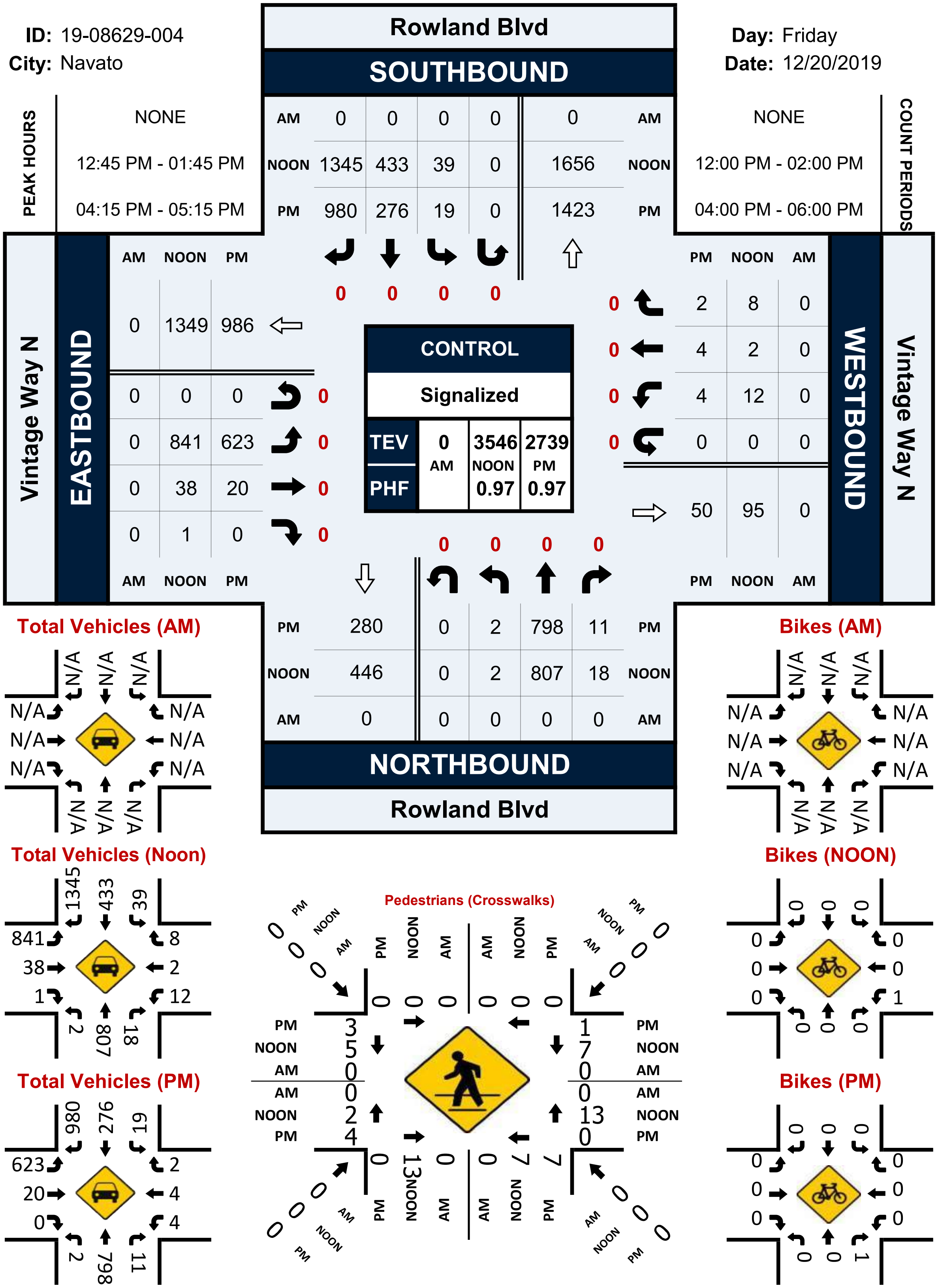
Prepared by National Data & Surveying Services

# Rowland Blvd & Vintage Way N

## Peak Hour Turning Movement Count

**ID:** 19-08629-004
**City:** Navato

**Day:** Friday
**Date:** 12/20/2019



| | PEAK HOURS | COUNT PERIODS |
|---|---|---|
| AM | NONE | NONE |
| NOON | 12:45 PM - 01:45 PM | 12:00 PM - 02:00 PM |
| PM | 04:15 PM - 05:15 PM | 04:00 PM - 06:00 PM |

**Rowland Blvd SOUTHBOUND**

| | ↲ | ↓ | ↳ | U | ⇧ |
|---|---|---|---|---|---|
| AM | 0 | 0 | 0 | 0 | 0 |
| NOON | 1345 | 433 | 39 | 0 | 1656 |
| PM | 980 | 276 | 19 | 0 | 1423 |
| | 0 | 0 | 0 | 0 | |

**Vintage Way N EASTBOUND**

| | AM | NOON | PM | |
|---|---|---|---|---|
| ⇦ | 0 | 1349 | 986 | |
| U | 0 | 0 | 0 | 0 |
| ⮥ | 0 | 841 | 623 | 0 |
| → | 0 | 38 | 20 | 0 |
| ↴ | 0 | 1 | 0 | 0 |

**Vintage Way N WESTBOUND**

| | | PM | NOON | AM |
|---|---|---|---|---|
| 0 | ↰ | 2 | 8 | 0 |
| 0 | ← | 4 | 2 | 0 |
| 0 | ↲ | 4 | 12 | 0 |
| 0 | U | 0 | 0 | 0 |
| | ⇨ | 50 | 95 | 0 |

**Rowland Blvd NORTHBOUND**

| | ⇩ | U | ↰ | ↑ | ↱ |
|---|---|---|---|---|---|
| | | 0 | 0 | 0 | 0 |
| PM | 280 | 0 | 2 | 798 | 11 |
| NOON | 446 | 0 | 2 | 807 | 18 |
| AM | 0 | 0 | 0 | 0 | 0 |

**CONTROL**

Signalized

| | AM | NOON | PM |
|---|---|---|---|
| TEV | 0 | 3546 | 2739 |
| PHF | | 0.97 | 0.97 |

**Total Vehicles (AM)**

| | Right | Through | Left |
|---|---|---|---|
| Southbound | N/A | N/A | N/A |
| Eastbound | N/A | N/A | N/A |
| Westbound | N/A | N/A | N/A |
| Northbound | N/A | N/A | N/A |

**Total Vehicles (Noon)**

| | | | |
|---|---|---|---|
| Southbound | 1345 | 433 | 39 |
| Eastbound | 841 | 38 | 1 |
| Westbound | 8 | 2 | 12 |
| Northbound | 2 | 807 | 18 |

**Total Vehicles (PM)**

| | | | |
|---|---|---|---|
| Southbound | 980 | 276 | 19 |
| Eastbound | 623 | 20 | 0 |
| Westbound | 2 | 4 | 4 |
| Northbound | 2 | 798 | 11 |

**Bikes (AM)**

| | | | |
|---|---|---|---|
| Southbound | N/A | N/A | N/A |
| Eastbound | N/A | N/A | N/A |
| Westbound | N/A | N/A | N/A |
| Northbound | N/A | N/A | N/A |

**Bikes (NOON)**

| | | | |
|---|---|---|---|
| Southbound | 0 | 0 | 0 |
| Eastbound | 0 | 0 | 0 |
| Westbound | 0 | 0 | 1 |
| Northbound | 0 | 0 | 0 |

**Bikes (PM)**

| | | | |
|---|---|---|---|
| Southbound | 0 | 0 | 0 |
| Eastbound | 0 | 0 | 0 |
| Westbound | 0 | 0 | 0 |
| Northbound | 0 | 0 | 1 |

**Pedestrians (Crosswalks)**

| | PM | NOON | AM | AM | NOON | PM |
|---|---|---|---|---|---|---|
| North | 0 | 0 | 0 | 0 | 0 | 0 |
| South | 0 | 13 | 0 | 0 | 7 | 7 |

| | PM | NOON | AM | AM | NOON | PM |
|---|---|---|---|---|---|---|
| West | 3 | 5 | 0 | 0 | 2 | 4 |
| East | 1 | 7 | 0 | 0 | 13 | 0 |

| | PM | NOON | AM |
|---|---|---|---|
| Northwest | 0 | 0 | 0 |
| Northeast | 0 | 0 | 0 |
| Southwest | 0 | 0 | 0 |
| Southeast | 0 | 0 | 0 |

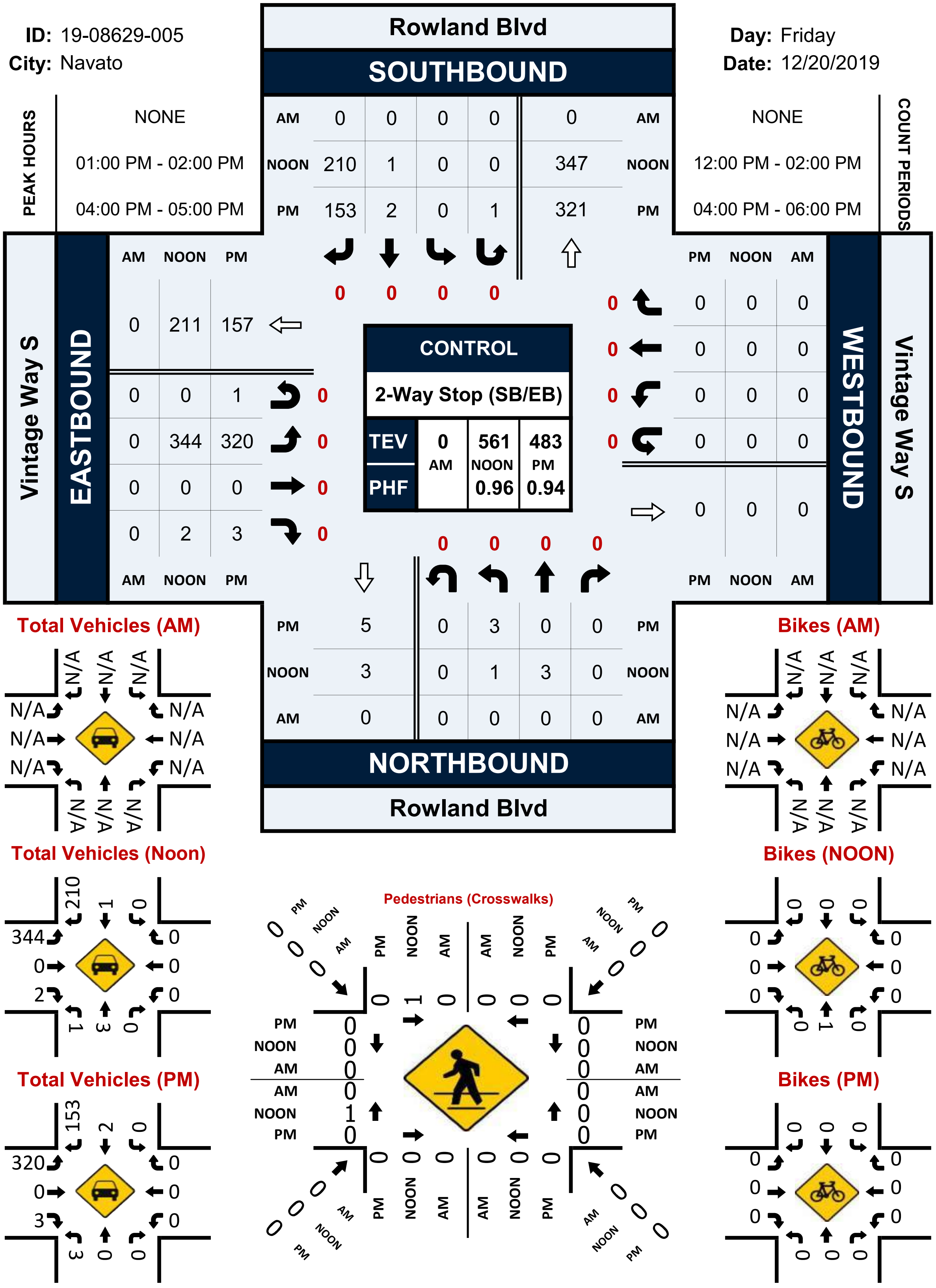
Prepared by National Data & Surveying Services

# Rowland Blvd & Vintage Way S

## Peak Hour Turning Movement Count

**ID:** 19-08629-005
**City:** Navato

**Day:** Friday
**Date:** 12/20/2019



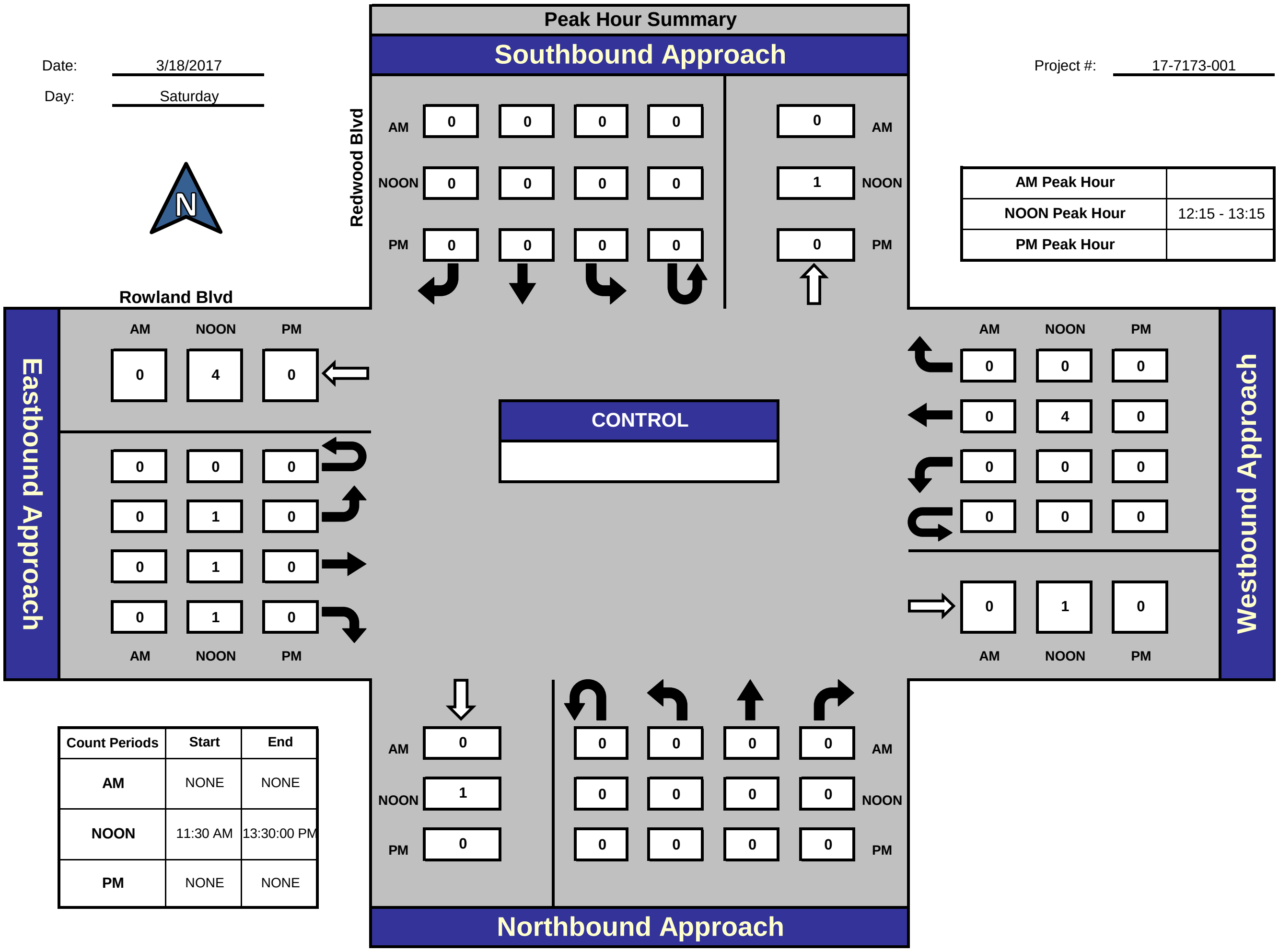
## *Redwood Blvd & Rowland Blvd*

Date: 3/18/2017

Day: Saturday

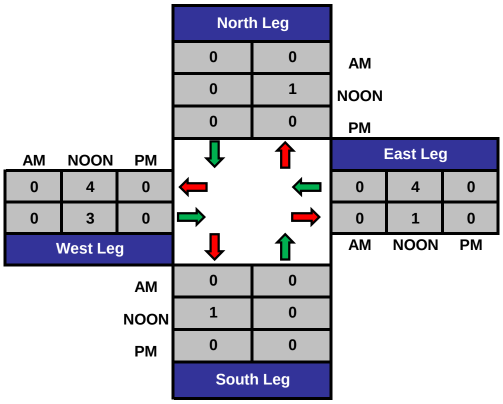
Project #: 17-7173-001

| AM Peak Hour | |
|---|---|
| NOON Peak Hour | 12:15 - 13:15 |
| PM Peak Hour | |

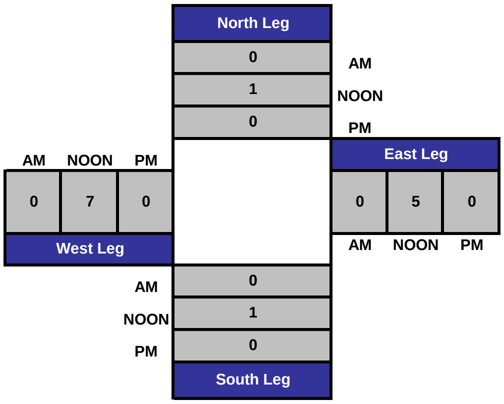


| Count Periods | Start | End |
|---|---|---|
| AM | NONE | NONE |
| NOON | 11:30 AM | 13:30:00 PM |
| PM | NONE | NONE |

## Total Ins & Outs



## Total Volume Per Leg



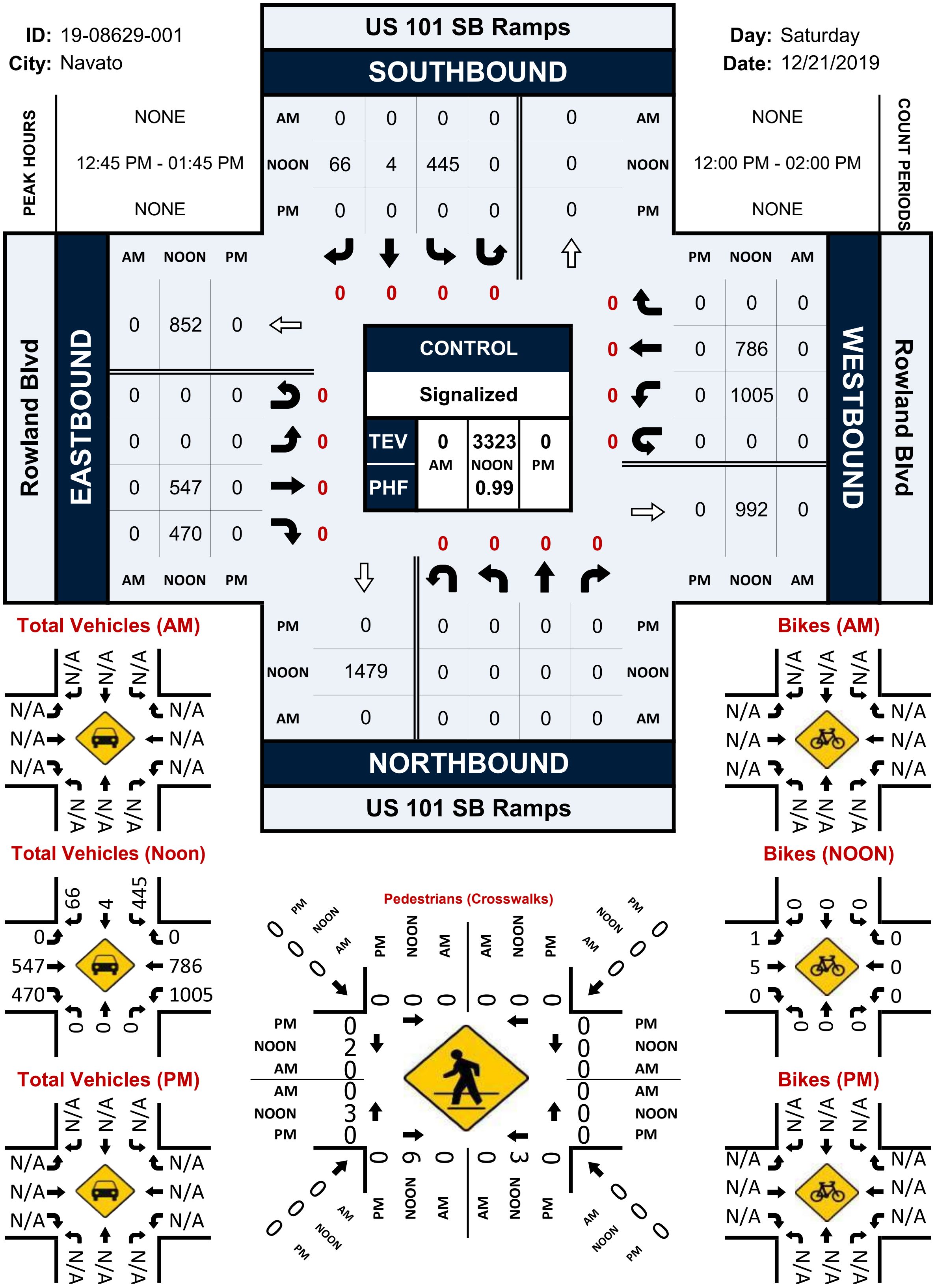
Prepared by National Data & Surveying Services

# US 101 SB Ramps & Rowland Blvd

## Peak Hour Turning Movement Count

**ID:** 19-08629-001
**City:** Navato

**Day:** Saturday
**Date:** 12/21/2019



Prepared by National Data & Surveying Services

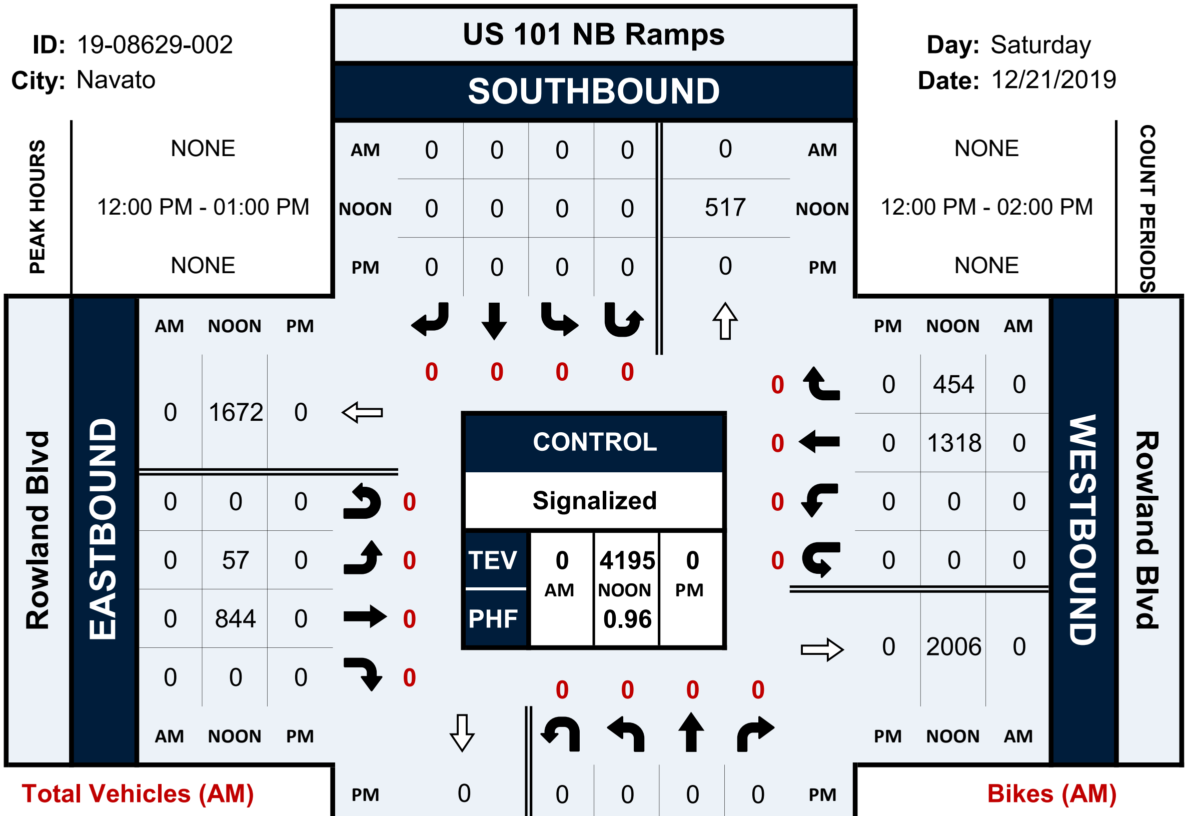
# US 101 NB Ramps & Rowland Blvd

## Peak Hour Turning Movement Count

**ID:** 19-08629-002
**City:** Navato

**Day:** Saturday
**Date:** 12/21/2019

| PEAK HOURS | | COUNT PERIODS |
|---|---|---|
| AM | NONE | NONE |
| NOON | 12:00 PM - 01:00 PM | 12:00 PM - 02:00 PM |
| PM | NONE | NONE |



**US 101 NB Ramps**
**SOUTHBOUND**

| | | | | | |
|---|---|---|---|---|---|
| AM | 0 | 0 | 0 | 0 | 0 |
| NOON | 0 | 0 | 0 | 0 | 517 |
| PM | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | |

**Rowland Blvd**
**EASTBOUND**

| | AM | NOON | PM | |
|---|---|---|---|---|
| ⇦ | 0 | 1672 | 0 | |
| U-turn | 0 | 0 | 0 | 0 |
| Left | 0 | 57 | 0 | 0 |
| Through | 0 | 844 | 0 | 0 |
| Right | 0 | 0 | 0 | 0 |

**Rowland Blvd**
**WESTBOUND**

| | | PM | NOON | AM |
|---|---|---|---|---|
| 0 | Left | 0 | 454 | 0 |
| 0 | Through | 0 | 1318 | 0 |
| 0 | Right | 0 | 0 | 0 |
| 0 | U-turn | 0 | 0 | 0 |
| | ⇨ | 0 | 2006 | 0 |

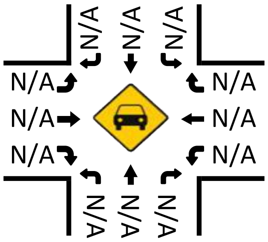
**CONTROL**
**Signalized**

| | AM | NOON | PM |
|---|---|---|---|
| TEV | 0 | 4195 | 0 |
| PHF | | 0.96 | |

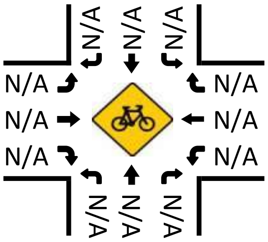
**NORTHBOUND**
**US 101 NB Ramps**

| | | | | | |
|---|---|---|---|---|---|
| | | 0 | 0 | 0 | 0 |
| PM | 0 | 0 | 0 | 0 | 0 |
| NOON | 0 | 0 | 354 | 6 | 1162 |
| AM | 0 | 0 | 0 | 0 | 0 |

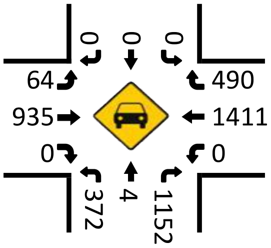
**Total Vehicles (AM)**



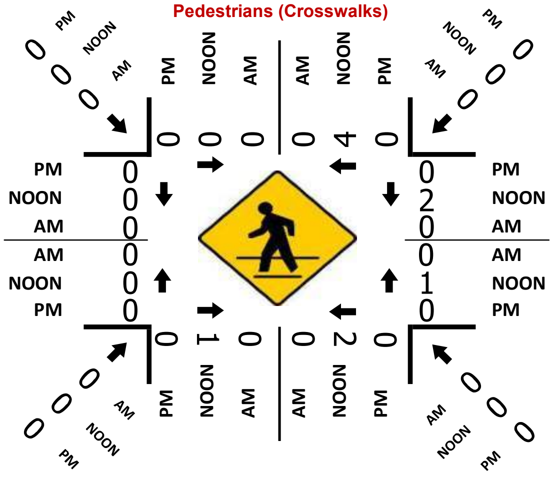
**Bikes (AM)**



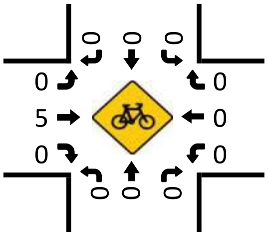
**Total Vehicles (Noon)**



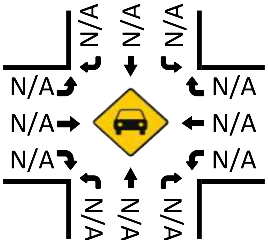
**Pedestrians (Crosswalks)**



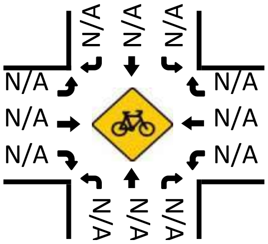
**Bikes (NOON)**



**Total Vehicles (PM)**



**Bikes (PM)**



# National Data & Surveying Services

# Intersection Turning Movement Count

**Location:** US 101 NB Ramps & Rowland Blvd
**City:** Navato
**Control:** Signalized

**Project ID:** 19-08629-002
**Date:** 2019-12-21

## Total

| **NS/EW Streets:** | US 101 NB Ramps | | | | | US 101 NB Ramps | | | | Rowland Blvd | | | | | Rowland Blvd | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **NOON** | NORTHBOUND | | | | | SOUTHBOUND | | | | EASTBOUND | | | | | WESTBOUND | | | | | NORTHBOUND2 | | | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | NL | NT | NR | NU | NT2 | SL | ST | SR | SU | EL | ET | ER | EU | EL2 | WL | WT | WR | WU | WR2 | N2L2 | N2T2 | N2R2 | TOTAL |
| 12:00 PM | 93 | 3 | 247 | 0 | 1 | 0 | 0 | 0 | 0 | 12 | 217 | 0 | 0 | 2 | 0 | 340 | 110 | 0 | 1 | 1 | 0 | 0 | 1027 |
| 12:15 PM | 109 | 1 | 315 | 0 | 2 | 0 | 0 | 0 | 0 | 12 | 188 | 0 | 0 | 2 | 0 | 297 | 111 | 0 | 0 | 3 | 2 | 0 | 1042 |
| 12:30 PM | 68 | 2 | 292 | 0 | 1 | 0 | 0 | 0 | 0 | 14 | 225 | 0 | 0 | 1 | 0 | 346 | 103 | 0 | 0 | 0 | 0 | 0 | 1052 |
| 12:45 PM | 84 | 0 | 308 | 0 | 0 | 0 | 0 | 0 | 0 | 19 | 214 | 0 | 0 | 0 | 0 | 335 | 130 | 0 | 1 | 0 | 1 | 0 | 1092 |
| 1:00 PM | 93 | 2 | 298 | 0 | 1 | 0 | 0 | 0 | 0 | 19 | 259 | 0 | 0 | 0 | 0 | 342 | 129 | 0 | 1 | 0 | 0 | 0 | 1144 |
| 1:15 PM | 99 | 1 | 299 | 0 | 0 | 0 | 0 | 0 | 0 | 16 | 200 | 0 | 0 | 4 | 0 | 363 | 123 | 0 | 0 | 0 | 0 | 1 | 1106 |
| 1:30 PM | 96 | 1 | 247 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 262 | 0 | 0 | 1 | 0 | 371 | 108 | 0 | 2 | 1 | 2 | 0 | 1101 |
| 1:45 PM | 89 | 0 | 288 | 0 | 2 | 0 | 0 | 0 | 0 | 13 | 189 | 0 | 0 | 0 | 0 | 369 | 126 | 0 | 0 | 2 | 0 | 0 | 1078 |
| | NL | NT | NR | NU | NT2 | SL | ST | SR | SU | EL | ET | ER | EU | EL2 | WL | WT | WR | WU | WR2 | N2L | N2T2 | N2R2 | TOTAL |
| **TOTAL VOLUMES :** | 731 | 10 | 2294 | 0 | 7 | 0 | 0 | 0 | 0 | 115 | 1754 | 0 | 0 | 10 | 0 | 2763 | 940 | 0 | 5 | 7 | 5 | 1 | 8642 |
| **APPROACH %'s :** | 24.03% | 0.33% | 75.41% | 0.00% | 0.23% | | | | | 6.12% | 93.35% | 0.00% | 0.00% | 0.53% | 0.00% | 74.51% | 25.35% | 0.00% | 0.13% | 53.85% | 38.46% | 7.69% | |
| **PEAK HR :** | **12:00 PM - 01:00 PM** | | | | | | | | | | | | | | | | | | | | | | TOTAL |
| **PEAK HR VOL :** | 354 | 6 | 1162 | 0 | 4 | 0 | 0 | 0 | 0 | 57 | 844 | 0 | 0 | 5 | 0 | 1318 | 454 | 0 | 2 | 4 | 3 | 0 | 4213 |
| **PEAK HR FACTOR :** | 0.812 | 0.500 | 0.922 | 0.000 | 0.500 | 0.000 | 0.000 | 0.000 | 0.000 | 0.750 | 0.938 | 0.000 | 0.000 | 0.625 | 0.000 | 0.952 | 0.873 | 0.000 | 0.500 | 0.333 | 0.375 | 0.000 | 0.965 |
| | | | 0.893 | | | | | | | | | 0.944 | | | | | 0.952 | | | | 0.350 | | |

Prepared by National Data & Surveying Services

# Rowland Way & Rowland Blvd

## Peak Hour Turning Movement Count

**ID:** 19-08629-003
**City:** Navato

**Day:** Saturday
**Date:** 12/21/2019

**PEAK HOURS**
NONE
12:45 PM - 01:45 PM
NONE

**COUNT PERIODS**
NONE
12:00 PM - 02:00 PM
NONE

**Rowland Way**
**SOUTHBOUND**

| | | | | | |
|---|---|---|---|---|---|
| AM | 0 | 0 | 0 | 0 | 0 |
| NOON | 262 | 0 | 69 | 0 | 378 |
| PM | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | |

**Rowland Blvd**
**EASTBOUND**

| | AM | NOON | PM | |
|---|---|---|---|---|
| | 0 | 1939 | 0 | |
| | 0 | 0 | 0 | 0 |
| | 0 | 310 | 0 | 0 |
| | 0 | 1799 | 0 | 0 |
| | 0 | 0 | 0 | 0 |
| | AM | NOON | PM | |

**Rowland Blvd**
**WESTBOUND**

| | PM | NOON | AM |
|---|---|---|---|
| 0 | 0 | 68 | 0 |
| 0 | 0 | 1677 | 0 |
| 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 |
| | 0 | 1868 | 0 |
| | PM | NOON | AM |

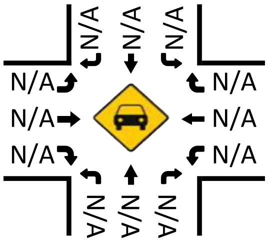
**CONTROL**
Signalized

| | AM | NOON | PM |
|---|---|---|---|
| TEV | 0 | 4185 | 0 |
| PHF | | 0.98 | |

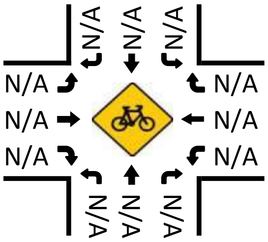
**NORTHBOUND**
**Rowland Way**

| | | | | | | |
|---|---|---|---|---|---|---|
| | | 0 | 0 | 0 | 0 | |
| PM | 0 | 0 | 0 | 0 | 0 | PM |
| NOON | 0 | 0 | 0 | 0 | 0 | NOON |
| AM | 0 | 0 | 0 | 0 | 0 | AM |

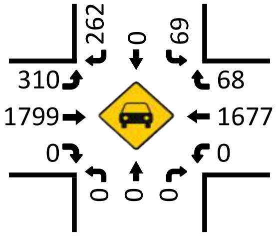
**Total Vehicles (AM)**



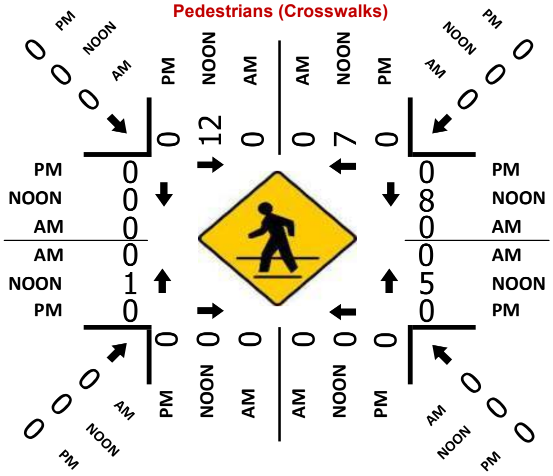
**Bikes (AM)**



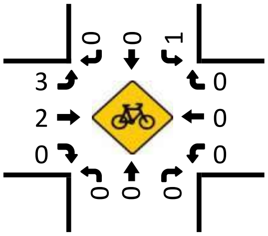
**Total Vehicles (Noon)**



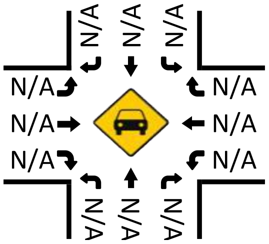
**Pedestrians (Crosswalks)**



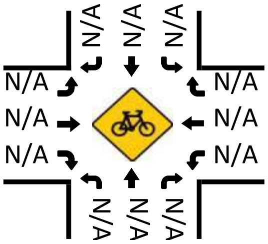
**Bikes (NOON)**



**Total Vehicles (PM)**



**Bikes (PM)**



Prepared by National Data & Surveying Services

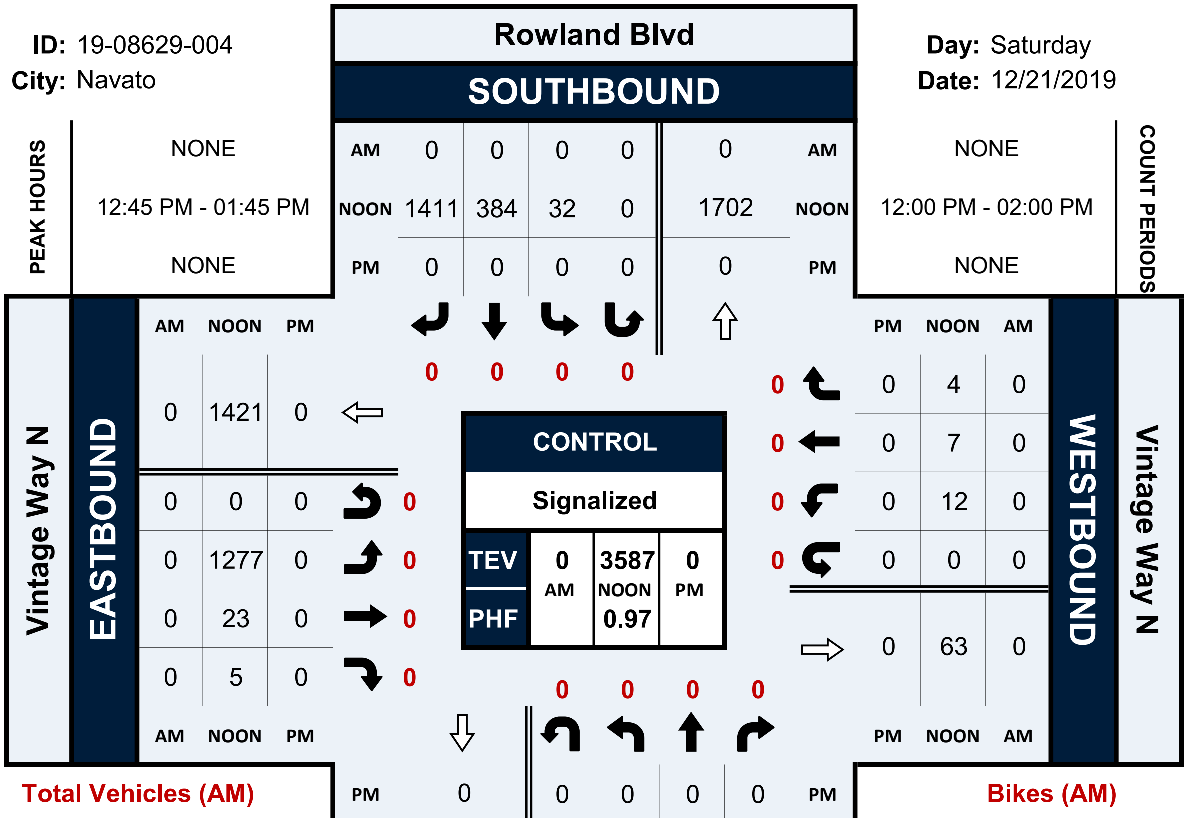
# Rowland Blvd & Vintage Way N

## Peak Hour Turning Movement Count

**ID:** 19-08629-004
**City:** Navato

**Day:** Saturday
**Date:** 12/21/2019

| | |
|---|---|
| **PEAK HOURS** | NONE<br>12:45 PM - 01:45 PM<br>NONE |
| **COUNT PERIODS** | NONE<br>12:00 PM - 02:00 PM<br>NONE |



**Rowland Blvd SOUTHBOUND**

| | | | | | | |
|---|---|---|---|---|---|---|
| AM | 0 | 0 | 0 | 0 | 0 | AM |
| NOON | 1411 | 384 | 32 | 0 | 1702 | NOON |
| PM | 0 | 0 | 0 | 0 | 0 | PM |

**Vintage Way N EASTBOUND**

| AM | NOON | PM |
|---|---|---|
| 0 | 1421 | 0 |
| 0 | 0 | 0 |
| 0 | 1277 | 0 |
| 0 | 23 | 0 |
| 0 | 5 | 0 |
| AM | NOON | PM |

**CONTROL**

Signalized

| | AM | NOON | PM |
|---|---|---|---|
| TEV | 0 | 3587 | 0 |
| PHF | | 0.97 | |

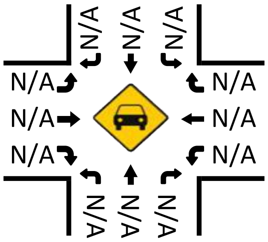
**Vintage Way N WESTBOUND**

| PM | NOON | AM |
|---|---|---|
| 0 | 4 | 0 |
| 0 | 7 | 0 |
| 0 | 12 | 0 |
| 0 | 0 | 0 |
| 0 | 63 | 0 |
| PM | NOON | AM |

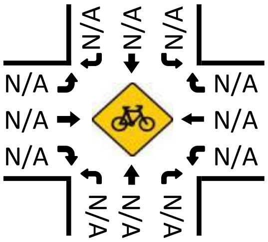
**Rowland Blvd NORTHBOUND**

| | | | | | | |
|---|---|---|---|---|---|---|
| PM | 0 | 0 | 0 | 0 | 0 | PM |
| NOON | 401 | 0 | 3 | 421 | 8 | NOON |
| AM | 0 | 0 | 0 | 0 | 0 | AM |

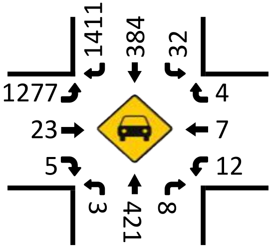
**Total Vehicles (AM)**



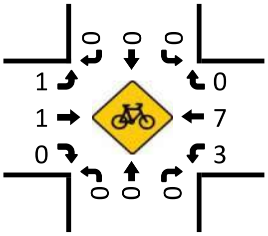
**Bikes (AM)**



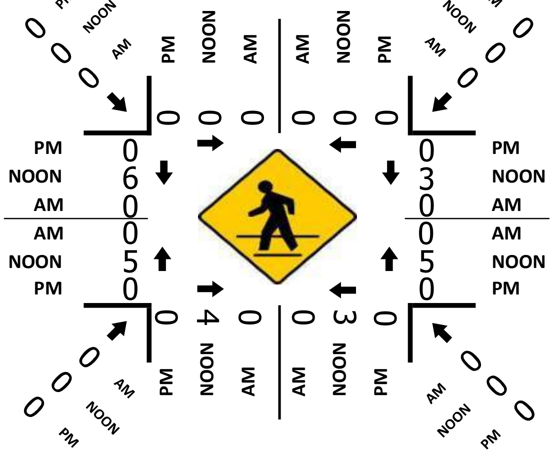
**Total Vehicles (Noon)**



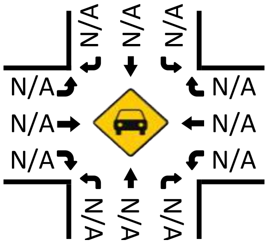
**Bikes (NOON)**



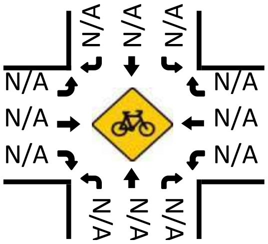
**Pedestrians (Crosswalks)**



**Total Vehicles (PM)**



**Bikes (PM)**



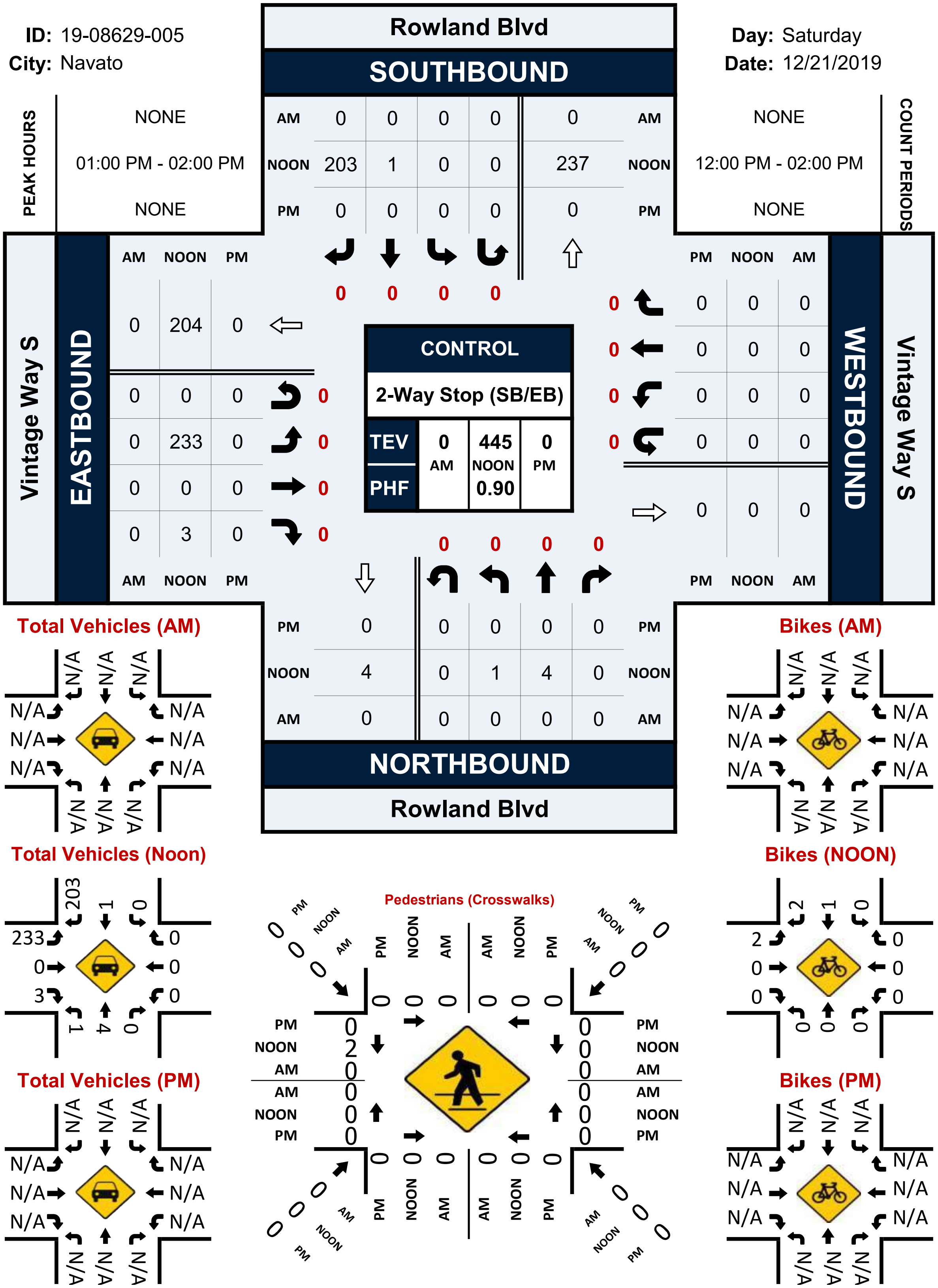
Prepared by National Data & Surveying Services

# Rowland Blvd & Vintage Way S

## Peak Hour Turning Movement Count

**ID:** 19-08629-005
**City:** Navato

**Day:** Saturday
**Date:** 12/21/2019



# Appendix B Year 2019 Existing Conditions Level-of-Service Worksheets

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | ↰↰ | ↑ | ↱ | ↰ | ↑↱ |  | ↰ | ↑↑ | ↱ | ↰ | ↑↑ | ↱ |
| Traffic Volume (vph) | 293 | 33 | 167 | 31 | 32 | 45 | 99 | 560 | 45 | 95 | 761 | 261 |
| Future Volume (vph) | 293 | 33 | 167 | 31 | 32 | 45 | 99 | 560 | 45 | 95 | 761 | 261 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 5.8 | 5.8 | 4.0 | 5.1 |  | 4.0 | 5.1 | 5.1 | 4.0 | 5.1 | 5.1 |
| Lane Util. Factor | 0.97 | 1.00 | 1.00 | 1.00 | 0.95 |  | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.91 |  | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |  | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3433 | 1863 | 1583 | 1770 | 3231 |  | 1770 | 3539 | 1583 | 1770 | 3539 | 1583 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |  | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3433 | 1863 | 1583 | 1770 | 3231 |  | 1770 | 3539 | 1583 | 1770 | 3539 | 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) | 308 | 35 | 176 | 33 | 34 | 47 | 104 | 589 | 47 | 100 | 801 | 275 |
| RTOR Reduction (vph) | 0 | 0 | 137 | 0 | 41 | 0 | 0 | 0 | 30 | 0 | 0 | 160 |
| Lane Group Flow (vph) | 308 | 35 | 39 | 33 | 40 | 0 | 104 | 589 | 17 | 100 | 801 | 115 |
| Turn Type | Prot | NA | Perm | Prot | NA |  | Prot | NA | Perm | Prot | NA | Perm |
| Protected Phases | 7 | 4 |  | 3 | 8 |  | 5 | 2 |  | 1 | 6 |  |
| Permitted Phases |  |  | 4 |  |  |  |  |  | 2 |  |  | 6 |
| Actuated Green, G (s) | 14.8 | 19.9 | 19.9 | 5.9 | 11.7 |  | 12.7 | 32.3 | 32.3 | 12.6 | 32.2 | 32.2 |
| Effective Green, g (s) | 14.8 | 19.9 | 19.9 | 5.9 | 11.7 |  | 12.7 | 32.3 | 32.3 | 12.6 | 32.2 | 32.2 |
| Actuated g/C Ratio | 0.17 | 0.22 | 0.22 | 0.07 | 0.13 |  | 0.14 | 0.36 | 0.36 | 0.14 | 0.36 | 0.36 |
| Clearance Time (s) | 4.0 | 5.8 | 5.8 | 4.0 | 5.1 |  | 4.0 | 5.1 | 5.1 | 4.0 | 5.1 | 5.1 |
| Vehicle Extension (s) | 2.5 | 2.5 | 2.5 | 2.0 | 2.5 |  | 2.0 | 4.0 | 4.0 | 2.0 | 4.0 | 4.0 |
| Lane Grp Cap (vph) | 567 | 413 | 351 | 116 | 421 |  | 250 | 1275 | 570 | 248 | 1271 | 568 |
| v/s Ratio Prot | c0.09 | 0.02 |  | 0.02 | 0.01 |  | c0.06 | 0.17 |  | 0.06 | c0.23 |  |
| v/s Ratio Perm |  |  | c0.02 |  |  |  |  |  | 0.01 |  |  | 0.07 |
| v/c Ratio | 0.54 | 0.08 | 0.11 | 0.28 | 0.10 |  | 0.42 | 0.46 | 0.03 | 0.40 | 0.63 | 0.20 |
| Uniform Delay, d1 | 34.3 | 27.6 | 27.8 | 39.8 | 34.3 |  | 35.1 | 22.0 | 18.5 | 35.1 | 23.8 | 19.8 |
| 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 | 0.8 | 0.1 | 0.1 | 0.5 | 0.1 |  | 0.4 | 0.4 | 0.0 | 0.4 | 1.2 | 0.2 |
| Delay (s) | 35.1 | 27.7 | 27.9 | 40.3 | 34.4 |  | 35.5 | 22.3 | 18.5 | 35.5 | 24.9 | 20.1 |
| Level of Service | D | C | C | D | C |  | D | C | B | D | C | C |
| Approach Delay (s) |  | 32.2 |  |  | 36.1 |  |  | 24.0 |  |  | 24.7 |  |
| Approach LOS |  | C |  |  | D |  |  | C |  |  | C |  |

| Intersection Summary |  |  |  |
|---|---|---|---|
| HCM 2000 Control Delay | 26.5 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.50 |  |  |
| Actuated Cycle Length (s) | 89.6 | Sum of lost time (s) | 18.9 |
| Intersection Capacity Utilization | 57.6% | ICU Level of Service | B |
| Analysis Period (min) | 15 |  |  |

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis
## 2: Rowland Blvd & Redwood Hwy (SB)

08/07/2020

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | ↰ | ↰↑↱ | | | | | | ↑↱ | ↱ | ↰↰ | ↑↑ | |
| Traffic Volume (vph) | 307 | 6 | 108 | 0 | 0 | 0 | 0 | 437 | 529 | 845 | 1000 | 0 |
| Future Volume (vph) | 307 | 6 | 108 | 0 | 0 | 0 | 0 | 437 | 529 | 845 | 1000 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | | | | | | 4.0 | 4.0 | 3.0 | 4.0 | |
| Lane Util. Factor | 0.91 | 0.91 | | | | | | 0.91 | 0.91 | 0.97 | 0.95 | |
| Frt | 1.00 | 0.94 | | | | | | 0.95 | 0.85 | 1.00 | 1.00 | |
| Flt Protected | 0.95 | 0.97 | | | | | | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1610 | 3096 | | | | | | 3216 | 1441 | 3433 | 3539 | |
| Flt Permitted | 0.95 | 0.97 | | | | | | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1610 | 3096 | | | | | | 3216 | 1441 | 3433 | 3539 | |
| 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) | 323 | 6 | 114 | 0 | 0 | 0 | 0 | 460 | 557 | 889 | 1053 | 0 |
| RTOR Reduction (vph) | 0 | 96 | 0 | 0 | 0 | 0 | 0 | 38 | 168 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 161 | 186 | 0 | 0 | 0 | 0 | 0 | 662 | 149 | 889 | 1053 | 0 |
| Turn Type | Split | NA | | | | | | NA | Perm | Prot | NA | |
| Protected Phases | 4 | 4 | | | | | | 2 | | 1 | 6 | |
| Permitted Phases | | | | | | | | | 2 | | | |
| Actuated Green, G (s) | 19.1 | 19.1 | | | | | | 56.3 | 56.3 | 34.6 | 93.9 | |
| Effective Green, g (s) | 19.1 | 19.1 | | | | | | 56.3 | 56.3 | 34.6 | 93.9 | |
| Actuated g/C Ratio | 0.16 | 0.16 | | | | | | 0.47 | 0.47 | 0.29 | 0.78 | |
| Clearance Time (s) | 3.0 | 3.0 | | | | | | 4.0 | 4.0 | 3.0 | 4.0 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | | | | | 4.0 | 4.0 | 2.0 | 2.5 | |
| Lane Grp Cap (vph) | 256 | 492 | | | | | | 1508 | 676 | 989 | 2769 | |
| v/s Ratio Prot | c0.10 | 0.06 | | | | | | c0.21 | | c0.26 | 0.30 | |
| v/s Ratio Perm | | | | | | | | | 0.10 | | | |
| v/c Ratio | 0.63 | 0.38 | | | | | | 0.44 | 0.22 | 0.90 | 0.38 | |
| Uniform Delay, d1 | 47.1 | 45.1 | | | | | | 21.3 | 18.9 | 41.0 | 4.0 | |
| Progression Factor | 1.00 | 1.00 | | | | | | 1.00 | 1.00 | 0.75 | 1.26 | |
| Incremental Delay, d2 | 3.5 | 0.2 | | | | | | 0.9 | 0.7 | 9.8 | 0.4 | |
| Delay (s) | 50.6 | 45.3 | | | | | | 22.2 | 19.6 | 40.5 | 5.5 | |
| Level of Service | D | D | | | | | | C | B | D | A | |
| Approach Delay (s) | | 47.2 | | | 0.0 | | | 21.4 | | | 21.5 | |
| Approach LOS | | D | | | A | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 24.8 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.62 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 10.0 |
| Intersection Capacity Utilization | 64.4% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis
## 3: Redwood Hwy (NB) & Rowland Blvd

08/07/2020

| | ↗ | → | ↘ | ↙ | ← | ↖ | ↖ | ↑ | ↗ | ↘ | ↓ | ↙ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations | ↰ | ↑↑ | | | ↑↑↑ | ↱ | ↰ | ⬑ | ↱↱ | | ✣ | |
| Traffic Volume (vph) | 48 | 687 | 0 | 0 | 1219 | 541 | 594 | 12 | 804 | 0 | 0 | 0 |
| Future Volume (vph) | 48 | 687 | 0 | 0 | 1219 | 541 | 594 | 12 | 804 | 0 | 0 | 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 | 4.0 | 3.5 | 3.5 | 3.0 | | | |
| Lane Util. Factor | 1.00 | 0.95 | | | 0.91 | 1.00 | 0.95 | 0.95 | 0.88 | | | |
| Frt | 1.00 | 1.00 | | | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | | | |
| Flt Protected | 0.95 | 1.00 | | | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | | | |
| Satd. Flow (prot) | 1770 | 3539 | | | 5085 | 1583 | 1681 | 1689 | 2787 | | | |
| Flt Permitted | 0.95 | 1.00 | | | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | | | |
| Satd. Flow (perm) | 1770 | 3539 | | | 5085 | 1583 | 1681 | 1689 | 2787 | | | |
| 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) | 50 | 716 | 0 | 0 | 1270 | 564 | 619 | 12 | 838 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 214 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 50 | 716 | 0 | 0 | 1270 | 350 | 316 | 316 | 838 | 0 | 0 | 0 |
| Turn Type | Prot | NA | | | NA | Perm | Split | NA | custom | | | |
| Protected Phases | 5 | 2 | | | 6 | | 8 | 8 | 1 | 7 | 7 | |
| Permitted Phases | | | | | | 6 | | | 8 | | | |
| Actuated Green, G (s) | 6.9 | 74.6 | | | 74.5 | 74.5 | 28.1 | 28.1 | 34.9 | | | |
| Effective Green, g (s) | 6.9 | 74.6 | | | 74.5 | 74.5 | 28.1 | 28.1 | 34.9 | | | |
| Actuated g/C Ratio | 0.06 | 0.62 | | | 0.62 | 0.62 | 0.23 | 0.23 | 0.29 | | | |
| Clearance Time (s) | 3.0 | 4.0 | | | 4.0 | 4.0 | 3.5 | 3.5 | 3.0 | | | |
| Vehicle Extension (s) | 2.0 | 2.0 | | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | | | |
| Lane Grp Cap (vph) | 101 | 2200 | | | 3156 | 982 | 393 | 395 | 810 | | | |
| v/s Ratio Prot | 0.03 | 0.20 | | | c0.25 | | 0.19 | 0.19 | c0.06 | | | |
| v/s Ratio Perm | | | | | | 0.22 | | | 0.24 | | | |
| v/c Ratio | 0.50 | 0.33 | | | 0.40 | 0.36 | 0.80 | 0.80 | 1.03 | | | |
| Uniform Delay, d1 | 54.9 | 10.8 | | | 11.5 | 11.1 | 43.4 | 43.3 | 42.5 | | | |
| Progression Factor | 0.98 | 1.40 | | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | |
| Incremental Delay, d2 | 1.3 | 0.4 | | | 0.4 | 1.0 | 10.7 | 10.5 | 40.9 | | | |
| Delay (s) | 55.3 | 15.4 | | | 11.9 | 12.1 | 54.1 | 53.8 | 83.4 | | | |
| Level of Service | E | B | | | B | B | D | D | F | | | |
| Approach Delay (s) | | 18.0 | | | 11.9 | | | 70.7 | | | 0.0 | |
| Approach LOS | | B | | | B | | | E | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 34.3 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.62 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 14.0 |
| Intersection Capacity Utilization | 63.6% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis
## 4: Rowland Blvd & Rowland Way

08/07/2020

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | ↰↰ | ↑↑↑ | ↑↱ |  | Y | ↱ |
| Traffic Volume (vph) | 228 | 1245 | 1384 | 25 | 49 | 406 |
| Future Volume (vph) | 228 | 1245 | 1384 | 25 | 49 | 406 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.0 | 4.0 |  | 3.0 | 3.0 |
| Lane Util. Factor | 0.97 | 0.91 | 0.95 |  | 1.00 | 0.95 |
| 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) | 3433 | 5085 | 3530 |  | 1625 | 1504 |
| Flt Permitted | 0.95 | 1.00 | 1.00 |  | 0.99 | 1.00 |
| Satd. Flow (perm) | 3433 | 5085 | 3530 |  | 1625 | 1504 |
| Peak-hour factor, PHF | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| Adj. Flow (vph) | 245 | 1339 | 1488 | 27 | 53 | 437 |
| RTOR Reduction (vph) | 0 | 0 | 1 | 0 | 75 | 201 |
| Lane Group Flow (vph) | 245 | 1339 | 1514 | 0 | 175 | 39 |
| Turn Type | Prot | NA | NA |  | Prot | Prot |
| Protected Phases | 5 | 2 | 6 |  | 4 | 4 |
| Permitted Phases |  |  |  |  |  |  |
| Actuated Green, G (s) | 13.7 | 84.5 | 67.3 |  | 17.6 | 17.6 |
| Effective Green, g (s) | 13.7 | 84.5 | 67.3 |  | 17.6 | 17.6 |
| Actuated g/C Ratio | 0.13 | 0.77 | 0.62 |  | 0.16 | 0.16 |
| Clearance Time (s) | 3.5 | 4.0 | 4.0 |  | 3.0 | 3.0 |
| Vehicle Extension (s) | 2.0 | 4.0 | 4.0 |  | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 431 | 3938 | 2177 |  | 262 | 242 |
| v/s Ratio Prot | c0.07 | 0.26 | c0.43 |  | c0.11 | 0.03 |
| v/s Ratio Perm |  |  |  |  |  |  |
| v/c Ratio | 0.57 | 0.34 | 0.70 |  | 0.67 | 0.16 |
| Uniform Delay, d1 | 44.9 | 3.8 | 14.0 |  | 43.0 | 39.4 |
| Progression Factor | 1.00 | 1.00 | 1.00 |  | 1.00 | 1.00 |
| Incremental Delay, d2 | 1.0 | 0.1 | 1.1 |  | 5.0 | 0.1 |
| Delay (s) | 45.9 | 3.8 | 15.1 |  | 48.0 | 39.5 |
| Level of Service | D | A | B |  | D | D |
| Approach Delay (s) |  | 10.3 | 15.1 |  | 43.8 |  |
| Approach LOS |  | B | B |  | D |  |

| Intersection Summary |  |  |  |
|---|---|---|---|
| HCM 2000 Control Delay | 16.9 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.67 |  |  |
| Actuated Cycle Length (s) | 109.1 | Sum of lost time (s) | 10.5 |
| Intersection Capacity Utilization | 66.6% | ICU Level of Service | C |
| Analysis Period (min) | 15 |  |  |

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis
## 5: Vintage Way/Driveway Access & Rowland Blvd

08/07/2020

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | ↰ | ↑↑ | ↱↱ | ↰ | ↑↱ |  | ↰↰ | ↱ |  |  | ✥ |  |
| Traffic Volume (vph) | 19 | 276 | 980 | 2 | 798 | 11 | 623 | 20 | 0 | 4 | 4 | 2 |
| Future Volume (vph) | 19 | 276 | 980 | 2 | 798 | 11 | 623 | 20 | 0 | 4 | 4 | 2 |
| 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 | 3.0 | 4.0 |  | 3.0 | 3.0 |  |  | 3.0 |  |
| Lane Util. Factor | 1.00 | 0.95 | 0.88 | 1.00 | 0.95 |  | 0.97 | 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 |  |  | 0.98 |  |
| Satd. Flow (prot) | 1770 | 3539 | 2787 | 1770 | 3532 |  | 3433 | 1863 |  |  | 1777 |  |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |  | 0.95 | 1.00 |  |  | 0.98 |  |
| Satd. Flow (perm) | 1770 | 3539 | 2787 | 1770 | 3532 |  | 3433 | 1863 |  |  | 1777 |  |
| 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) | 20 | 285 | 1010 | 2 | 823 | 11 | 642 | 21 | 0 | 4 | 4 | 2 |
| RTOR Reduction (vph) | 0 | 0 | 222 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| Lane Group Flow (vph) | 20 | 285 | 788 | 2 | 833 | 0 | 642 | 21 | 0 | 0 | 8 | 0 |
| Turn Type | Prot | NA | pm+ov | Prot | NA |  | Split | NA |  | Split | NA |  |
| Protected Phases | 5 | 2 | 3 | 1 | 6 |  | 3 | 3 |  | 4 | 4 |  |
| Permitted Phases |  |  | 2 |  |  |  |  |  |  |  |  |  |
| Actuated Green, G (s) | 0.9 | 21.5 | 53.3 | 1.3 | 21.9 |  | 31.8 | 31.8 |  |  | 0.7 |  |
| Effective Green, g (s) | 0.9 | 21.5 | 53.3 | 1.3 | 21.9 |  | 31.8 | 31.8 |  |  | 0.7 |  |
| Actuated g/C Ratio | 0.01 | 0.31 | 0.78 | 0.02 | 0.32 |  | 0.47 | 0.47 |  |  | 0.01 |  |
| Clearance Time (s) | 3.0 | 4.0 | 3.0 | 3.0 | 4.0 |  | 3.0 | 3.0 |  |  | 3.0 |  |
| Vehicle Extension (s) | 2.0 | 2.0 | 3.0 | 2.0 | 2.0 |  | 3.0 | 3.0 |  |  | 2.0 |  |
| Lane Grp Cap (vph) | 23 | 1114 | 2174 | 33 | 1132 |  | 1598 | 867 |  |  | 18 |  |
| v/s Ratio Prot | c0.01 | 0.08 | 0.17 | 0.00 | c0.24 |  | c0.19 | 0.01 |  |  | c0.00 |  |
| v/s Ratio Perm |  |  | 0.11 |  |  |  |  |  |  |  |  |  |
| v/c Ratio | 0.87 | 0.26 | 0.36 | 0.06 | 0.74 |  | 0.40 | 0.02 |  |  | 0.45 |  |
| Uniform Delay, d1 | 33.6 | 17.4 | 2.3 | 32.9 | 20.6 |  | 12.0 | 9.9 |  |  | 33.6 |  |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |  | 1.00 | 1.00 |  |  | 1.00 |  |
| Incremental Delay, d2 | 124.8 | 0.0 | 0.1 | 0.3 | 2.2 |  | 0.2 | 0.0 |  |  | 6.3 |  |
| Delay (s) | 158.5 | 17.5 | 2.4 | 33.2 | 22.8 |  | 12.2 | 9.9 |  |  | 39.9 |  |
| Level of Service | F | B | A | C | C |  | B | A |  |  | D |  |
| Approach Delay (s) |  | 8.0 |  |  | 22.8 |  |  | 12.1 |  |  | 39.9 |  |
| Approach LOS |  | A |  |  | C |  |  | B |  |  | D |  |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 13.5 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.54 | | |
| Actuated Cycle Length (s) | 68.3 | Sum of lost time (s) | 13.0 |
| Intersection Capacity Utilization | 53.5% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Sign Control | Stop | | | Stop | Stop | |
| Traffic Volume (vph) | 320 | 3 | 3 | 0 | 2 | 153 |
| Future Volume (vph) | 320 | 3 | 3 | 0 | 2 | 153 |
| Peak Hour Factor | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Hourly flow rate (vph) | 340 | 3 | 3 | 0 | 2 | 163 |

| Direction, Lane # | EB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total (vph) | 343 | 3 | 165 |
| Volume Left (vph) | 340 | 3 | 0 |
| Volume Right (vph) | 3 | 0 | 163 |
| Hadj (s) | 0.23 | 0.23 | -0.56 |
| Departure Headway (s) | 4.5 | 5.2 | 4.2 |
| Degree Utilization, x | 0.43 | 0.00 | 0.19 |
| Capacity (veh/h) | 771 | 639 | 797 |
| Control Delay (s) | 10.8 | 8.2 | 8.2 |
| Approach Delay (s) | 10.8 | 8.2 | 8.2 |
| Approach LOS | B | A | A |

| Intersection Summary | | | |
|---|---|---|---|
| Delay | 10.0 | | |
| Level of Service | A | | |
| Intersection Capacity Utilization | 34.2% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

## HCM Signalized Intersection Capacity Analysis
## 1: Rowland Blvd & Redwood Blvd

08/07/2020

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | ↰↰ | ↑ | ↱ | ↰ | ↑↱ |  | ↰ | ↑↑ | ↱ | ↰ | ↑↑ | ↱ |
| Traffic Volume (vph) | 295 | 32 | 129 | 18 | 32 | 73 | 99 | 653 | 31 | 54 | 510 | 204 |
| Future Volume (vph) | 295 | 32 | 129 | 18 | 32 | 73 | 99 | 653 | 31 | 54 | 510 | 204 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 5.8 | 5.8 | 4.0 | 5.1 |  | 4.0 | 5.1 | 5.1 | 4.0 | 5.1 | 5.1 |
| Lane Util. Factor | 0.97 | 1.00 | 1.00 | 1.00 | 0.95 |  | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.90 |  | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |  | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3433 | 1863 | 1583 | 1770 | 3171 |  | 1770 | 3539 | 1583 | 1770 | 3539 | 1583 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |  | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3433 | 1863 | 1583 | 1770 | 3171 |  | 1770 | 3539 | 1583 | 1770 | 3539 | 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) | 311 | 34 | 136 | 19 | 34 | 77 | 104 | 687 | 33 | 57 | 537 | 215 |
| RTOR Reduction (vph) | 0 | 0 | 91 | 0 | 61 | 0 | 0 | 0 | 23 | 0 | 0 | 153 |
| Lane Group Flow (vph) | 311 | 34 | 45 | 19 | 50 | 0 | 104 | 687 | 10 | 57 | 537 | 62 |
| Turn Type | Prot | NA | Perm | Prot | NA |  | Prot | NA | Perm | Prot | NA | Perm |
| Protected Phases | 7 | 4 |  | 3 | 8 |  | 5 | 2 |  | 1 | 6 |  |
| Permitted Phases |  |  | 4 |  |  |  |  |  | 2 |  |  | 6 |
| Actuated Green, G (s) | 14.8 | 27.7 | 27.7 | 3.6 | 17.2 |  | 9.3 | 24.8 | 24.8 | 8.6 | 24.1 | 24.1 |
| Effective Green, g (s) | 14.8 | 27.7 | 27.7 | 3.6 | 17.2 |  | 9.3 | 24.8 | 24.8 | 8.6 | 24.1 | 24.1 |
| Actuated g/C Ratio | 0.18 | 0.33 | 0.33 | 0.04 | 0.21 |  | 0.11 | 0.30 | 0.30 | 0.10 | 0.29 | 0.29 |
| Clearance Time (s) | 4.0 | 5.8 | 5.8 | 4.0 | 5.1 |  | 4.0 | 5.1 | 5.1 | 4.0 | 5.1 | 5.1 |
| Vehicle Extension (s) | 2.5 | 2.5 | 2.5 | 2.0 | 2.5 |  | 2.0 | 4.0 | 4.0 | 2.0 | 4.0 | 4.0 |
| Lane Grp Cap (vph) | 607 | 617 | 524 | 76 | 652 |  | 196 | 1049 | 469 | 182 | 1020 | 456 |
| v/s Ratio Prot | c0.09 | 0.02 |  | 0.01 | 0.02 |  | c0.06 | c0.19 |  | 0.03 | 0.15 |  |
| v/s Ratio Perm |  |  | c0.03 |  |  |  |  |  | 0.01 |  |  | 0.04 |
| v/c Ratio | 0.51 | 0.06 | 0.09 | 0.25 | 0.08 |  | 0.53 | 0.65 | 0.02 | 0.31 | 0.53 | 0.14 |
| Uniform Delay, d1 | 31.1 | 19.0 | 19.2 | 38.7 | 26.8 |  | 35.1 | 25.7 | 20.8 | 34.8 | 25.0 | 22.0 |
| 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 | 0.0 | 0.1 | 0.6 | 0.0 |  | 1.4 | 1.6 | 0.0 | 0.4 | 0.6 | 0.2 |
| Delay (s) | 31.7 | 19.1 | 19.3 | 39.3 | 26.8 |  | 36.5 | 27.3 | 20.8 | 35.1 | 25.6 | 22.2 |
| Level of Service | C | B | B | D | C |  | D | C | C | D | C | C |
| Approach Delay (s) |  | 27.3 |  |  | 28.7 |  |  | 28.2 |  |  | 25.4 |  |
| Approach LOS |  | C |  |  | C |  |  | C |  |  | C |  |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 27.0 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.47 |  |  |
| Actuated Cycle Length (s) | 83.6 | Sum of lost time (s) | 18.9 |
| Intersection Capacity Utilization | 54.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 |  |  |

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis
## 2: Rowland Blvd & Redwood Hwy (SB)

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | ↰ | ↰↑↱ | | | | | | ↑↱ | ↱ | ↰↰ | ↑↑ | |
| Traffic Volume (vph) | 445 | 4 | 66 | 0 | 0 | 0 | 0 | 547 | 470 | 1005 | 786 | 0 |
| Future Volume (vph) | 445 | 4 | 66 | 0 | 0 | 0 | 0 | 547 | 470 | 1005 | 786 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | | | | | | 4.0 | 4.0 | 3.0 | 4.0 | |
| Lane Util. Factor | 0.91 | 0.91 | | | | | | 0.91 | 0.91 | 0.97 | 0.95 | |
| Frt | 1.00 | 0.97 | | | | | | 0.97 | 0.85 | 1.00 | 1.00 | |
| Flt Protected | 0.95 | 0.96 | | | | | | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1610 | 3156 | | | | | | 3275 | 1441 | 3433 | 3539 | |
| Flt Permitted | 0.95 | 0.96 | | | | | | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1610 | 3156 | | | | | | 3275 | 1441 | 3433 | 3539 | |
| 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) | 468 | 4 | 69 | 0 | 0 | 0 | 0 | 576 | 495 | 1058 | 827 | 0 |
| RTOR Reduction (vph) | 0 | 24 | 0 | 0 | 0 | 0 | 0 | 19 | 202 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 234 | 283 | 0 | 0 | 0 | 0 | 0 | 725 | 125 | 1058 | 827 | 0 |
| Turn Type | Split | NA | | | | | | NA | Perm | Prot | NA | |
| Protected Phases | 4 | 4 | | | | | | 2 | | 1 | 6 | |
| Permitted Phases | | | | | | | | | 2 | | | |
| Actuated Green, G (s) | 23.3 | 23.3 | | | | | | 45.9 | 45.9 | 40.8 | 89.7 | |
| Effective Green, g (s) | 23.3 | 23.3 | | | | | | 45.9 | 45.9 | 40.8 | 89.7 | |
| Actuated g/C Ratio | 0.19 | 0.19 | | | | | | 0.38 | 0.38 | 0.34 | 0.75 | |
| Clearance Time (s) | 3.0 | 3.0 | | | | | | 4.0 | 4.0 | 3.0 | 4.0 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | | | | | 4.0 | 4.0 | 2.0 | 2.5 | |
| Lane Grp Cap (vph) | 312 | 612 | | | | | | 1252 | 551 | 1167 | 2645 | |
| v/s Ratio Prot | c0.15 | 0.09 | | | | | | c0.22 | | c0.31 | 0.23 | |
| v/s Ratio Perm | | | | | | | | | 0.09 | | | |
| v/c Ratio | 0.75 | 0.46 | | | | | | 0.58 | 0.23 | 0.91 | 0.31 | |
| Uniform Delay, d1 | 45.6 | 42.8 | | | | | | 29.4 | 25.1 | 37.8 | 5.0 | |
| Progression Factor | 1.00 | 1.00 | | | | | | 1.00 | 1.00 | 1.01 | 1.28 | |
| Incremental Delay, d2 | 8.7 | 0.2 | | | | | | 2.0 | 1.0 | 9.5 | 0.3 | |
| Delay (s) | 54.3 | 43.0 | | | | | | 31.4 | 26.0 | 47.5 | 6.7 | |
| Level of Service | D | D | | | | | | C | C | D | A | |
| Approach Delay (s) | | 47.9 | | | 0.0 | | | 29.7 | | | 29.6 | |
| Approach LOS | | D | | | A | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 32.5 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.74 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 10.0 |
| Intersection Capacity Utilization | 71.1% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## 3: Redwood Hwy (NB) & Rowland Blvd

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | ↰ | ↑↑ | | | ↑↑↑ | ↱ | ↰ | ↰ | ↱↱ | | ✥ | |
| Traffic Volume (vph) | 57 | 844 | 0 | 0 | 1318 | 454 | 354 | 6 | 1162 | 0 | 0 | 0 |
| Future Volume (vph) | 57 | 844 | 0 | 0 | 1318 | 454 | 354 | 6 | 1162 | 0 | 0 | 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 | 4.0 | 3.5 | 3.5 | 3.0 | | | |
| Lane Util. Factor | 1.00 | 0.95 | | | 0.91 | 1.00 | 0.95 | 0.95 | 0.88 | | | |
| Frt | 1.00 | 1.00 | | | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | | | |
| Flt Protected | 0.95 | 1.00 | | | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | | | |
| Satd. Flow (prot) | 1770 | 3539 | | | 5085 | 1583 | 1681 | 1688 | 2787 | | | |
| Flt Permitted | 0.95 | 1.00 | | | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | | | |
| Satd. Flow (perm) | 1770 | 3539 | | | 5085 | 1583 | 1681 | 1688 | 2787 | | | |
| 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) | 59 | 879 | 0 | 0 | 1373 | 473 | 369 | 6 | 1210 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 152 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 59 | 879 | 0 | 0 | 1373 | 321 | 188 | 187 | 1210 | 0 | 0 | 0 |
| Turn Type | Prot | NA | | | NA | Perm | Split | NA | custom | | | |
| Protected Phases | 5 | 2 | | | 6 | | 8 | 8 | 1 | 7 | 7 | |
| Permitted Phases | | | | | | 6 | | | 8 | | | |
| Actuated Green, G (s) | 7.4 | 58.7 | | | 81.5 | 81.5 | 20.6 | 20.6 | 50.8 | | | |
| Effective Green, g (s) | 7.4 | 58.7 | | | 81.5 | 81.5 | 20.6 | 20.6 | 50.8 | | | |
| Actuated g/C Ratio | 0.06 | 0.49 | | | 0.68 | 0.68 | 0.17 | 0.17 | 0.42 | | | |
| Clearance Time (s) | 3.0 | 4.0 | | | 4.0 | 4.0 | 3.5 | 3.5 | 3.0 | | | |
| Vehicle Extension (s) | 2.0 | 2.0 | | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | | | |
| Lane Grp Cap (vph) | 109 | 1731 | | | 3453 | 1075 | 288 | 289 | 1179 | | | |
| v/s Ratio Prot | 0.03 | c0.25 | | | 0.27 | | 0.11 | 0.11 | c0.26 | | | |
| v/s Ratio Perm | | | | | | 0.20 | | | 0.18 | | | |
| v/c Ratio | 0.54 | 0.51 | | | 0.40 | 0.30 | 0.65 | 0.65 | 1.03 | | | |
| Uniform Delay, d1 | 54.7 | 20.8 | | | 8.5 | 7.7 | 46.4 | 46.3 | 34.6 | | | |
| Progression Factor | 1.30 | 0.34 | | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | |
| Incremental Delay, d2 | 2.6 | 0.9 | | | 0.3 | 0.7 | 4.0 | 3.7 | 33.1 | | | |
| Delay (s) | 73.6 | 8.0 | | | 8.8 | 8.5 | 50.4 | 50.0 | 67.7 | | | |
| Level of Service | E | A | | | A | A | D | D | E | | | |
| Approach Delay (s) | | 12.1 | | | 8.7 | | | 63.6 | | | 0.0 | |
| Approach LOS | | B | | | A | | | E | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 29.3 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.77 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 14.0 |
| Intersection Capacity Utilization | 70.6% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis
## 4: Rowland Blvd & Rowland Way

08/07/2020

|  | ↗ | → | ← | ↖ | ↘ | ↙ |
|---|---|---|---|---|---|---|
| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
| Lane Configurations | ↰↰ | ↑↑↑ | ↑↱ |  | ↰↱ | ↱ |
| Traffic Volume (vph) | 310 | 1799 | 1677 | 68 | 69 | 262 |
| Future Volume (vph) | 310 | 1799 | 1677 | 68 | 69 | 262 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.0 | 4.0 |  | 3.0 | 3.0 |
| Lane Util. Factor | 0.97 | 0.91 | 0.95 |  | 1.00 | 0.95 |
| Frt | 1.00 | 1.00 | 0.99 |  | 0.91 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 |  | 0.98 | 1.00 |
| Satd. Flow (prot) | 3433 | 5085 | 3519 |  | 1664 | 1504 |
| Flt Permitted | 0.95 | 1.00 | 1.00 |  | 0.98 | 1.00 |
| Satd. Flow (perm) | 3433 | 5085 | 3519 |  | 1664 | 1504 |
| Peak-hour factor, PHF | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| Adj. Flow (vph) | 333 | 1934 | 1803 | 73 | 74 | 282 |
| RTOR Reduction (vph) | 0 | 0 | 1 | 0 | 31 | 153 |
| Lane Group Flow (vph) | 333 | 1934 | 1875 | 0 | 150 | 22 |
| Turn Type | Prot | NA | NA |  | Prot | Prot |
| Protected Phases | 5 | 2 | 6 |  | 4 | 4 |
| Permitted Phases |  |  |  |  |  |  |
| Actuated Green, G (s) | 19.5 | 119.5 | 96.5 |  | 17.9 | 17.9 |
| Effective Green, g (s) | 19.5 | 119.5 | 96.5 |  | 17.9 | 17.9 |
| Actuated g/C Ratio | 0.14 | 0.83 | 0.67 |  | 0.12 | 0.12 |
| Clearance Time (s) | 3.5 | 4.0 | 4.0 |  | 3.0 | 3.0 |
| Vehicle Extension (s) | 2.0 | 4.0 | 4.0 |  | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 463 | 4208 | 2351 |  | 206 | 186 |
| v/s Ratio Prot | c0.10 | 0.38 | c0.53 |  | c0.09 | 0.01 |
| v/s Ratio Perm |  |  |  |  |  |  |
| v/c Ratio | 0.72 | 0.46 | 0.80 |  | 0.73 | 0.12 |
| Uniform Delay, d1 | 59.8 | 3.5 | 17.0 |  | 60.9 | 56.2 |
| Progression Factor | 1.00 | 1.00 | 1.00 |  | 1.00 | 1.00 |
| Incremental Delay, d2 | 4.4 | 0.1 | 2.1 |  | 10.4 | 0.1 |
| Delay (s) | 64.3 | 3.6 | 19.1 |  | 71.4 | 56.3 |
| Level of Service | E | A | B |  | E | E |
| Approach Delay (s) |  | 12.5 | 19.1 |  | 64.0 |  |
| Approach LOS |  | B | B |  | E |  |

| Intersection Summary |  |  |  |
|---|---|---|---|
| HCM 2000 Control Delay | 19.3 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.78 |  |  |
| Actuated Cycle Length (s) | 144.4 | Sum of lost time (s) | 10.5 |
| Intersection Capacity Utilization | 76.5% | ICU Level of Service | D |
| Analysis Period (min) | 15 |  |  |

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis
## 5: Vintage Way/Driveway Access & Rowland Blvd

08/07/2020

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | ↰ | ↑↑ | ↱↱ | ↰ | ↑↱ |  | ↰↰ | ↱ |  |  | ✥ |  |
| Traffic Volume (vph) | 32 | 384 | 1411 | 3 | 421 | 8 | 1277 | 23 | 5 | 12 | 7 | 4 |
| Future Volume (vph) | 32 | 384 | 1411 | 3 | 421 | 8 | 1277 | 23 | 5 | 12 | 7 | 4 |
| 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 | 3.0 | 4.0 |  | 3.0 | 3.0 |  |  | 3.0 |  |
| Lane Util. Factor | 1.00 | 0.95 | 0.88 | 1.00 | 0.95 |  | 0.97 | 1.00 |  |  | 1.00 |  |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 |  | 1.00 | 0.97 |  |  | 0.98 |  |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |  | 0.95 | 1.00 |  |  | 0.97 |  |
| Satd. Flow (prot) | 1770 | 3539 | 2787 | 1770 | 3530 |  | 3433 | 1815 |  |  | 1773 |  |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |  | 0.95 | 1.00 |  |  | 0.97 |  |
| Satd. Flow (perm) | 1770 | 3539 | 2787 | 1770 | 3530 |  | 3433 | 1815 |  |  | 1773 |  |
| 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) | 33 | 396 | 1455 | 3 | 434 | 8 | 1316 | 24 | 5 | 12 | 7 | 4 |
| RTOR Reduction (vph) | 0 | 0 | 265 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 4 | 0 |
| Lane Group Flow (vph) | 33 | 396 | 1190 | 3 | 441 | 0 | 1316 | 27 | 0 | 0 | 19 | 0 |
| Turn Type | Prot | NA | pm+ov | Prot | NA |  | Split | NA |  | Split | NA |  |
| Protected Phases | 5 | 2 | 3 | 1 | 6 |  | 3 | 3 |  | 4 | 4 |  |
| Permitted Phases |  |  | 2 |  |  |  |  |  |  |  |  |  |
| Actuated Green, G (s) | 4.0 | 19.9 | 77.3 | 1.8 | 17.7 |  | 57.4 | 57.4 |  |  | 2.4 |  |
| Effective Green, g (s) | 4.0 | 19.9 | 77.3 | 1.8 | 17.7 |  | 57.4 | 57.4 |  |  | 2.4 |  |
| Actuated g/C Ratio | 0.04 | 0.21 | 0.82 | 0.02 | 0.19 |  | 0.61 | 0.61 |  |  | 0.03 |  |
| Clearance Time (s) | 3.0 | 4.0 | 3.0 | 3.0 | 4.0 |  | 3.0 | 3.0 |  |  | 3.0 |  |
| Vehicle Extension (s) | 2.0 | 2.0 | 3.0 | 2.0 | 2.0 |  | 3.0 | 3.0 |  |  | 2.0 |  |
| Lane Grp Cap (vph) | 74 | 745 | 2279 | 33 | 661 |  | 2085 | 1102 |  |  | 45 |  |
| v/s Ratio Prot | c0.02 | 0.11 | 0.32 | 0.00 | c0.12 |  | c0.38 | 0.01 |  |  | c0.01 |  |
| v/s Ratio Perm |  |  | 0.11 |  |  |  |  |  |  |  |  |  |
| v/c Ratio | 0.45 | 0.53 | 0.52 | 0.09 | 0.67 |  | 0.63 | 0.02 |  |  | 0.42 |  |
| Uniform Delay, d1 | 44.2 | 33.2 | 2.7 | 45.5 | 35.7 |  | 11.8 | 7.4 |  |  | 45.4 |  |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |  | 1.00 | 1.00 |  |  | 1.00 |  |
| Incremental Delay, d2 | 1.6 | 0.4 | 0.2 | 0.4 | 2.0 |  | 0.6 | 0.0 |  |  | 2.3 |  |
| Delay (s) | 45.7 | 33.5 | 2.9 | 46.0 | 37.7 |  | 12.4 | 7.4 |  |  | 47.7 |  |
| Level of Service | D | C | A | D | D |  | B | A |  |  | D |  |
| Approach Delay (s) |  | 10.1 |  |  | 37.7 |  |  | 12.3 |  |  | 47.7 |  |
| Approach LOS |  | B |  |  | D |  |  | B |  |  | D |  |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 14.5 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.61 | | |
| Actuated Cycle Length (s) | 94.5 | Sum of lost time (s) | 13.0 |
| Intersection Capacity Utilization | 68.3% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

# HCM Unsignalized Intersection Capacity Analysis
## 6: Rowland Blvd & Vintage Way

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | Y | | | ↰ | ↳ | |
| Sign Control | Stop | | | Stop | Stop | |
| Traffic Volume (vph) | 233 | 3 | 1 | 4 | 1 | 203 |
| Future Volume (vph) | 233 | 3 | 1 | 4 | 1 | 203 |
| Peak Hour Factor | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Hourly flow rate (vph) | 248 | 3 | 1 | 4 | 1 | 216 |

| Direction, Lane # | EB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total (vph) | 251 | 5 | 217 |
| Volume Left (vph) | 248 | 1 | 0 |
| Volume Right (vph) | 3 | 0 | 216 |
| Hadj (s) | 0.22 | 0.07 | -0.56 |
| Departure Headway (s) | 4.6 | 4.8 | 4.0 |
| Degree Utilization, x | 0.32 | 0.01 | 0.24 |
| Capacity (veh/h) | 747 | 691 | 853 |
| Control Delay (s) | 9.7 | 7.9 | 8.2 |
| Approach Delay (s) | 9.7 | 7.9 | 8.2 |
| Approach LOS | A | A | A |

| Intersection Summary | | | |
|---|---|---|---|
| Delay | 9.0 | | |
| Level of Service | A | | |
| Intersection Capacity Utilization | 32.4% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

# Appendix C Year 2019 Existing plus Project Conditions Level-of-Service Worksheets

HCM Signalized Intersection Capacity Analysis
1: Rowland Blvd & Redwood Blvd 08/07/2020

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | ↰↰ | ↑ | ↱ | ↰ | ↑↱ |  | ↰ | ↑↑ | ↱ | ↰ | ↑↑ | ↱ |
| Traffic Volume (vph) | 304 | 33 | 167 | 31 | 32 | 46 | 99 | 580 | 45 | 99 | 792 | 272 |
| Future Volume (vph) | 304 | 33 | 167 | 31 | 32 | 46 | 99 | 580 | 45 | 99 | 792 | 272 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 5.8 | 5.8 | 4.0 | 5.1 |  | 4.0 | 5.1 | 5.1 | 4.0 | 5.1 | 5.1 |
| Lane Util. Factor | 0.97 | 1.00 | 1.00 | 1.00 | 0.95 |  | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.91 |  | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |  | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3433 | 1863 | 1583 | 1770 | 3228 |  | 1770 | 3539 | 1583 | 1770 | 3539 | 1583 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |  | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3433 | 1863 | 1583 | 1770 | 3228 |  | 1770 | 3539 | 1583 | 1770 | 3539 | 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) | 320 | 35 | 176 | 33 | 34 | 48 | 104 | 611 | 47 | 104 | 834 | 286 |
| RTOR Reduction (vph) | 0 | 0 | 137 | 0 | 42 | 0 | 0 | 0 | 30 | 0 | 0 | 157 |
| Lane Group Flow (vph) | 320 | 35 | 39 | 33 | 40 | 0 | 104 | 611 | 17 | 104 | 834 | 129 |
| Turn Type | Prot | NA | Perm | Prot | NA |  | Prot | NA | Perm | Prot | NA | Perm |
| Protected Phases | 7 | 4 |  | 3 | 8 |  | 5 | 2 |  | 1 | 6 |  |
| Permitted Phases |  |  | 4 |  |  |  |  |  | 2 |  |  | 6 |
| Actuated Green, G (s) | 15.1 | 20.1 | 20.1 | 5.9 | 11.6 |  | 12.7 | 33.9 | 33.9 | 12.7 | 33.9 | 33.9 |
| Effective Green, g (s) | 15.1 | 20.1 | 20.1 | 5.9 | 11.6 |  | 12.7 | 33.9 | 33.9 | 12.7 | 33.9 | 33.9 |
| Actuated g/C Ratio | 0.17 | 0.22 | 0.22 | 0.06 | 0.13 |  | 0.14 | 0.37 | 0.37 | 0.14 | 0.37 | 0.37 |
| Clearance Time (s) | 4.0 | 5.8 | 5.8 | 4.0 | 5.1 |  | 4.0 | 5.1 | 5.1 | 4.0 | 5.1 | 5.1 |
| Vehicle Extension (s) | 2.5 | 2.5 | 2.5 | 2.0 | 2.5 |  | 2.0 | 4.0 | 4.0 | 2.0 | 4.0 | 4.0 |
| Lane Grp Cap (vph) | 566 | 409 | 347 | 114 | 409 |  | 245 | 1311 | 586 | 245 | 1311 | 586 |
| v/s Ratio Prot | c0.09 | 0.02 |  | 0.02 | 0.01 |  | c0.06 | 0.17 |  | 0.06 | c0.24 |  |
| v/s Ratio Perm |  |  | c0.02 |  |  |  |  |  | 0.01 |  |  | 0.08 |
| v/c Ratio | 0.57 | 0.09 | 0.11 | 0.29 | 0.10 |  | 0.42 | 0.47 | 0.03 | 0.42 | 0.64 | 0.22 |
| Uniform Delay, d1 | 35.2 | 28.4 | 28.6 | 40.8 | 35.3 |  | 36.1 | 21.9 | 18.3 | 36.1 | 23.7 | 19.7 |
| 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 | 1.1 | 0.1 | 0.1 | 0.5 | 0.1 |  | 0.4 | 0.4 | 0.0 | 0.4 | 1.1 | 0.3 |
| Delay (s) | 36.2 | 28.5 | 28.7 | 41.3 | 35.4 |  | 36.5 | 22.3 | 18.4 | 36.5 | 24.9 | 20.0 |
| Level of Service | D | C | C | D | D |  | D | C | B | D | C | B |
| Approach Delay (s) |  | 33.2 |  |  | 37.1 |  |  | 24.0 |  |  | 24.7 |  |
| Approach LOS |  | C |  |  | D |  |  | C |  |  | C |  |

| Intersection Summary |  |  |  |
|---|---|---|---|
| HCM 2000 Control Delay | 26.8 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.51 |  |  |
| Actuated Cycle Length (s) | 91.5 | Sum of lost time (s) | 18.9 |
| Intersection Capacity Utilization | 58.8% | ICU Level of Service | B |
| Analysis Period (min) | 15 |  |  |

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis
## 2: Rowland Blvd & Redwood Hwy (SB)

08/07/2020

| | ↗ | → | ↘ | ↙ | ← | ↖ | ↖ | ↑ | ↗ | ↘ | ↓ | ↙ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations | ↰ | ↰↑↱ | | | | | | ↑↱ | ↱ | ↰↰ | ↑↑ | |
| Traffic Volume (vph) | 330 | 6 | 108 | 0 | 0 | 0 | 0 | 469 | 529 | 884 | 1046 | 0 |
| Future Volume (vph) | 330 | 6 | 108 | 0 | 0 | 0 | 0 | 469 | 529 | 884 | 1046 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | | | | | | 4.0 | 4.0 | 3.0 | 4.0 | |
| Lane Util. Factor | 0.91 | 0.91 | | | | | | 0.91 | 0.91 | 0.97 | 0.95 | |
| Frt | 1.00 | 0.94 | | | | | | 0.95 | 0.85 | 1.00 | 1.00 | |
| Flt Protected | 0.95 | 0.97 | | | | | | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1610 | 3101 | | | | | | 3227 | 1441 | 3433 | 3539 | |
| Flt Permitted | 0.95 | 0.97 | | | | | | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1610 | 3101 | | | | | | 3227 | 1441 | 3433 | 3539 | |
| 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) | 347 | 6 | 114 | 0 | 0 | 0 | 0 | 494 | 557 | 931 | 1101 | 0 |
| RTOR Reduction (vph) | 0 | 85 | 0 | 0 | 0 | 0 | 0 | 33 | 177 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 173 | 209 | 0 | 0 | 0 | 0 | 0 | 695 | 146 | 931 | 1101 | 0 |
| Turn Type | Split | NA | | | | | | NA | Perm | Prot | NA | |
| Protected Phases | 4 | 4 | | | | | | 2 | | 1 | 6 | |
| Permitted Phases | | | | | | | | | 2 | | | |
| Actuated Green, G (s) | 19.7 | 19.7 | | | | | | 54.3 | 54.3 | 36.0 | 93.3 | |
| Effective Green, g (s) | 19.7 | 19.7 | | | | | | 54.3 | 54.3 | 36.0 | 93.3 | |
| Actuated g/C Ratio | 0.16 | 0.16 | | | | | | 0.45 | 0.45 | 0.30 | 0.78 | |
| Clearance Time (s) | 3.0 | 3.0 | | | | | | 4.0 | 4.0 | 3.0 | 4.0 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | | | | | 4.0 | 4.0 | 2.0 | 2.5 | |
| Lane Grp Cap (vph) | 264 | 509 | | | | | | 1460 | 652 | 1029 | 2751 | |
| v/s Ratio Prot | c0.11 | 0.07 | | | | | | c0.22 | | c0.27 | 0.31 | |
| v/s Ratio Perm | | | | | | | | | 0.10 | | | |
| v/c Ratio | 0.66 | 0.41 | | | | | | 0.48 | 0.22 | 0.90 | 0.40 | |
| Uniform Delay, d1 | 47.0 | 44.9 | | | | | | 22.9 | 20.0 | 40.4 | 4.3 | |
| Progression Factor | 1.00 | 1.00 | | | | | | 1.00 | 1.00 | 0.81 | 1.18 | |
| Incremental Delay, d2 | 4.4 | 0.2 | | | | | | 1.1 | 0.8 | 9.9 | 0.4 | |
| Delay (s) | 51.4 | 45.1 | | | | | | 24.0 | 20.8 | 42.6 | 5.5 | |
| Level of Service | D | D | | | | | | C | C | D | A | |
| Approach Delay (s) | | 47.5 | | | 0.0 | | | 23.0 | | | 22.5 | |
| Approach LOS | | D | | | A | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 25.9 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.65 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 10.0 |
| Intersection Capacity Utilization | 66.2% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis
## 3: Redwood Hwy (NB) & Rowland Blvd

08/07/2020

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | ↰ | ↑↑ | | | ↑↑↑ | ↱ | ↰ | ↰ | ↱↱ | | ✥ | |
| Traffic Volume (vph) | 48 | 742 | 0 | 0 | 1303 | 578 | 594 | 12 | 868 | 0 | 0 | 0 |
| Future Volume (vph) | 48 | 742 | 0 | 0 | 1303 | 578 | 594 | 12 | 868 | 0 | 0 | 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 | 4.0 | 3.5 | 3.5 | 3.0 | | | |
| Lane Util. Factor | 1.00 | 0.95 | | | 0.91 | 1.00 | 0.95 | 0.95 | 0.88 | | | |
| Frt | 1.00 | 1.00 | | | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | | | |
| Flt Protected | 0.95 | 1.00 | | | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | | | |
| Satd. Flow (prot) | 1770 | 3539 | | | 5085 | 1583 | 1681 | 1689 | 2787 | | | |
| Flt Permitted | 0.95 | 1.00 | | | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | | | |
| Satd. Flow (perm) | 1770 | 3539 | | | 5085 | 1583 | 1681 | 1689 | 2787 | | | |
| 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) | 52 | 807 | 0 | 0 | 1416 | 628 | 646 | 13 | 943 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 234 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 52 | 807 | 0 | 0 | 1416 | 394 | 329 | 330 | 943 | 0 | 0 | 0 |
| Turn Type | Prot | NA | | | NA | Perm | Split | NA | custom | | | |
| Protected Phases | 5 | 2 | | | 6 | | 8 | 8 | 1 | 7 | 7 | |
| Permitted Phases | | | | | | 6 | | | 8 | | | |
| Actuated Green, G (s) | 7.0 | 72.4 | | | 73.7 | 73.7 | 28.8 | 28.8 | 37.1 | | | |
| Effective Green, g (s) | 7.0 | 72.4 | | | 73.7 | 73.7 | 28.8 | 28.8 | 37.1 | | | |
| Actuated g/C Ratio | 0.06 | 0.60 | | | 0.61 | 0.61 | 0.24 | 0.24 | 0.31 | | | |
| Clearance Time (s) | 3.0 | 4.0 | | | 4.0 | 4.0 | 3.5 | 3.5 | 3.0 | | | |
| Vehicle Extension (s) | 2.0 | 2.0 | | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | | | |
| Lane Grp Cap (vph) | 103 | 2135 | | | 3123 | 972 | 403 | 405 | 861 | | | |
| v/s Ratio Prot | 0.03 | 0.23 | | | c0.28 | | 0.20 | 0.20 | c0.08 | | | |
| v/s Ratio Perm | | | | | | 0.25 | | | 0.26 | | | |
| v/c Ratio | 0.50 | 0.38 | | | 0.45 | 0.41 | 0.82 | 0.81 | 1.10 | | | |
| Uniform Delay, d1 | 54.8 | 12.2 | | | 12.4 | 11.9 | 43.1 | 43.1 | 41.5 | | | |
| Progression Factor | 0.99 | 1.45 | | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | |
| Incremental Delay, d2 | 1.3 | 0.5 | | | 0.5 | 1.3 | 11.5 | 11.3 | 60.0 | | | |
| Delay (s) | 55.5 | 18.2 | | | 12.9 | 13.1 | 54.6 | 54.4 | 101.5 | | | |
| Level of Service | E | B | | | B | B | D | D | F | | | |
| Approach Delay (s) | | 20.5 | | | 12.9 | | | 82.1 | | | 0.0 | |
| Approach LOS | | C | | | B | | | F | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 39.0 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.69 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 14.0 |
| Intersection Capacity Utilization | 65.9% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis
## 4: Rowland Blvd & Rowland Way

08/07/2020

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | ↰↰ | ↑↑↑ | ↑↱ |  | ↰↱ | ↱ |
| Traffic Volume (vph) | 228 | 1364 | 1506 | 27 | 54 | 406 |
| Future Volume (vph) | 228 | 1364 | 1506 | 27 | 54 | 406 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.0 | 4.0 |  | 3.0 | 3.0 |
| Lane Util. Factor | 0.97 | 0.91 | 0.95 |  | 1.00 | 0.95 |
| 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) | 3433 | 5085 | 3530 |  | 1629 | 1504 |
| Flt Permitted | 0.95 | 1.00 | 1.00 |  | 0.99 | 1.00 |
| Satd. Flow (perm) | 3433 | 5085 | 3530 |  | 1629 | 1504 |
| Peak-hour factor, PHF | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| Adj. Flow (vph) | 245 | 1467 | 1619 | 29 | 58 | 437 |
| RTOR Reduction (vph) | 0 | 0 | 1 | 0 | 67 | 207 |
| Lane Group Flow (vph) | 245 | 1467 | 1647 | 0 | 183 | 38 |
| Turn Type | Prot | NA | NA |  | Prot | Prot |
| Protected Phases | 5 | 2 | 6 |  | 4 | 4 |
| Permitted Phases |  |  |  |  |  |  |
| Actuated Green, G (s) | 14.6 | 97.7 | 79.6 |  | 19.5 | 19.5 |
| Effective Green, g (s) | 14.6 | 97.7 | 79.6 |  | 19.5 | 19.5 |
| Actuated g/C Ratio | 0.12 | 0.79 | 0.64 |  | 0.16 | 0.16 |
| Clearance Time (s) | 3.5 | 4.0 | 4.0 |  | 3.0 | 3.0 |
| Vehicle Extension (s) | 2.0 | 4.0 | 4.0 |  | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 403 | 4000 | 2262 |  | 255 | 236 |
| v/s Ratio Prot | c0.07 | 0.29 | c0.47 |  | c0.11 | 0.03 |
| v/s Ratio Perm |  |  |  |  |  |  |
| v/c Ratio | 0.61 | 0.37 | 0.73 |  | 0.72 | 0.16 |
| Uniform Delay, d1 | 52.1 | 4.0 | 15.0 |  | 49.7 | 45.3 |
| Progression Factor | 1.00 | 1.00 | 1.00 |  | 1.00 | 1.00 |
| Incremental Delay, d2 | 1.8 | 0.1 | 1.3 |  | 7.8 | 0.1 |
| Delay (s) | 53.9 | 4.1 | 16.3 |  | 57.6 | 45.4 |
| Level of Service | D | A | B |  | E | D |
| Approach Delay (s) |  | 11.2 | 16.3 |  | 51.6 |  |
| Approach LOS |  | B | B |  | D |  |

| Intersection Summary |  |  |  |
|---|---|---|---|
| HCM 2000 Control Delay | 18.6 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.71 |  |  |
| Actuated Cycle Length (s) | 124.2 | Sum of lost time (s) | 10.5 |
| Intersection Capacity Utilization | 70.3% | ICU Level of Service | C |
| Analysis Period (min) | 15 |  |  |

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis
## 5: Vintage Way/Driveway Access & Rowland Blvd

08/07/2020

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | ↰ | ↑↑ | ↱↱ | ↰ | ↑↱ |  | ↰↰ | ↱ |  |  | ✥ |  |
| Traffic Volume (vph) | 19 | 400 | 980 | 2 | 957 | 11 | 588 | 20 | 0 | 4 | 4 | 2 |
| Future Volume (vph) | 19 | 400 | 980 | 2 | 957 | 11 | 588 | 20 | 0 | 4 | 4 | 2 |
| 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 | 3.0 | 4.0 |  | 3.0 | 3.0 |  |  | 3.0 |  |
| Lane Util. Factor | 1.00 | 0.95 | 0.88 | 1.00 | 0.95 |  | 0.97 | 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 |  |  | 0.98 |  |
| Satd. Flow (prot) | 1770 | 3539 | 2787 | 1770 | 3533 |  | 3433 | 1863 |  |  | 1777 |  |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |  | 0.95 | 1.00 |  |  | 0.98 |  |
| Satd. Flow (perm) | 1770 | 3539 | 2787 | 1770 | 3533 |  | 3433 | 1863 |  |  | 1777 |  |
| 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) | 20 | 412 | 1010 | 2 | 987 | 11 | 606 | 21 | 0 | 4 | 4 | 2 |
| RTOR Reduction (vph) | 0 | 0 | 229 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| Lane Group Flow (vph) | 20 | 412 | 781 | 2 | 997 | 0 | 606 | 21 | 0 | 0 | 8 | 0 |
| Turn Type | Prot | NA | pm+ov | Prot | NA |  | Split | NA |  | Split | NA |  |
| Protected Phases | 5 | 2 | 3 | 1 | 6 |  | 3 | 3 |  | 4 | 4 |  |
| Permitted Phases |  |  | 2 |  |  |  |  |  |  |  |  |  |
| Actuated Green, G (s) | 0.9 | 21.5 | 51.3 | 1.3 | 21.9 |  | 29.8 | 29.8 |  |  | 0.7 |  |
| Effective Green, g (s) | 0.9 | 21.5 | 51.3 | 1.3 | 21.9 |  | 29.8 | 29.8 |  |  | 0.7 |  |
| Actuated g/C Ratio | 0.01 | 0.32 | 0.77 | 0.02 | 0.33 |  | 0.45 | 0.45 |  |  | 0.01 |  |
| Clearance Time (s) | 3.0 | 4.0 | 3.0 | 3.0 | 4.0 |  | 3.0 | 3.0 |  |  | 3.0 |  |
| Vehicle Extension (s) | 2.0 | 2.0 | 3.0 | 2.0 | 2.0 |  | 3.0 | 3.0 |  |  | 2.0 |  |
| Lane Grp Cap (vph) | 24 | 1147 | 2156 | 34 | 1167 |  | 1543 | 837 |  |  | 18 |  |
| v/s Ratio Prot | c0.01 | 0.12 | 0.16 | 0.00 | c0.28 |  | c0.18 | 0.01 |  |  | c0.00 |  |
| v/s Ratio Perm |  |  | 0.12 |  |  |  |  |  |  |  |  |  |
| v/c Ratio | 0.83 | 0.36 | 0.36 | 0.06 | 0.85 |  | 0.39 | 0.03 |  |  | 0.45 |  |
| Uniform Delay, d1 | 32.6 | 17.1 | 2.4 | 31.9 | 20.7 |  | 12.2 | 10.2 |  |  | 32.6 |  |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |  | 1.00 | 1.00 |  |  | 1.00 |  |
| Incremental Delay, d2 | 107.2 | 0.1 | 0.1 | 0.3 | 6.1 |  | 0.2 | 0.0 |  |  | 6.3 |  |
| Delay (s) | 139.8 | 17.2 | 2.5 | 32.2 | 26.8 |  | 12.4 | 10.2 |  |  | 38.9 |  |
| Level of Service | F | B | A | C | C |  | B | B |  |  | D |  |
| Approach Delay (s) |  | 8.6 |  |  | 26.8 |  |  | 12.3 |  |  | 38.9 |  |
| Approach LOS |  | A |  |  | C |  |  | B |  |  | D |  |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 15.3 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.59 | | |
| Actuated Cycle Length (s) | 66.3 | Sum of lost time (s) | 13.0 |
| Intersection Capacity Utilization | 56.9% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

# 6: Rowland Blvd & Vintage Way

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | Y | | | ↰ | ↱ | |
| Sign Control | Stop | | | Stop | Stop | |
| Traffic Volume (vph) | 479 | 3 | 3 | 0 | 2 | 277 |
| Future Volume (vph) | 479 | 3 | 3 | 0 | 2 | 277 |
| Peak Hour Factor | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Hourly flow rate (vph) | 510 | 3 | 3 | 0 | 2 | 295 |

| Direction, Lane # | EB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total (vph) | 513 | 3 | 297 |
| Volume Left (vph) | 510 | 3 | 0 |
| Volume Right (vph) | 3 | 0 | 295 |
| Hadj (s) | 0.23 | 0.23 | -0.56 |
| Departure Headway (s) | 4.9 | 5.9 | 4.7 |
| Degree Utilization, x | 0.69 | 0.00 | 0.39 |
| Capacity (veh/h) | 718 | 538 | 712 |
| Control Delay (s) | 18.2 | 8.9 | 10.6 |
| Approach Delay (s) | 18.2 | 8.9 | 10.6 |
| Approach LOS | C | A | B |

| Intersection Summary | | | |
|---|---|---|---|
| Delay | 15.4 | | |
| Level of Service | C | | |
| Intersection Capacity Utilization | 50.6% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

# HCM Signalized Intersection Capacity Analysis

## 1: Rowland Blvd & Redwood Blvd

08/07/2020

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | ↰↰ | ↑ | ↱ | ↰ | ↑↱ |  | ↰ | ↑↑ | ↱ | ↰ | ↑↑ | ↱ |
| Traffic Volume (vph) | 305 | 32 | 129 | 18 | 32 | 76 | 99 | 675 | 31 | 59 | 543 | 217 |
| Future Volume (vph) | 305 | 32 | 129 | 18 | 32 | 76 | 99 | 675 | 31 | 59 | 543 | 217 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 5.8 | 5.8 | 4.0 | 5.1 |  | 4.0 | 5.1 | 5.1 | 4.0 | 5.1 | 5.1 |
| Lane Util. Factor | 0.97 | 1.00 | 1.00 | 1.00 | 0.95 |  | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.89 |  | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |  | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3433 | 1863 | 1583 | 1770 | 3167 |  | 1770 | 3539 | 1583 | 1770 | 3539 | 1583 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |  | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3433 | 1863 | 1583 | 1770 | 3167 |  | 1770 | 3539 | 1583 | 1770 | 3539 | 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) | 321 | 34 | 136 | 19 | 34 | 80 | 104 | 711 | 33 | 62 | 572 | 228 |
| RTOR Reduction (vph) | 0 | 0 | 92 | 0 | 64 | 0 | 0 | 0 | 23 | 0 | 0 | 159 |
| Lane Group Flow (vph) | 321 | 34 | 44 | 19 | 50 | 0 | 104 | 711 | 10 | 62 | 572 | 69 |
| Turn Type | Prot | NA | Perm | Prot | NA |  | Prot | NA | Perm | Prot | NA | Perm |
| Protected Phases | 7 | 4 |  | 3 | 8 |  | 5 | 2 |  | 1 | 6 |  |
| Permitted Phases |  |  | 4 |  |  |  |  |  | 2 |  |  | 6 |
| Actuated Green, G (s) | 15.1 | 28.0 | 28.0 | 3.6 | 17.2 |  | 9.3 | 26.5 | 26.5 | 8.7 | 25.9 | 25.9 |
| Effective Green, g (s) | 15.1 | 28.0 | 28.0 | 3.6 | 17.2 |  | 9.3 | 26.5 | 26.5 | 8.7 | 25.9 | 25.9 |
| Actuated g/C Ratio | 0.18 | 0.33 | 0.33 | 0.04 | 0.20 |  | 0.11 | 0.31 | 0.31 | 0.10 | 0.30 | 0.30 |
| Clearance Time (s) | 4.0 | 5.8 | 5.8 | 4.0 | 5.1 |  | 4.0 | 5.1 | 5.1 | 4.0 | 5.1 | 5.1 |
| Vehicle Extension (s) | 2.5 | 2.5 | 2.5 | 2.0 | 2.5 |  | 2.0 | 4.0 | 4.0 | 2.0 | 4.0 | 4.0 |
| Lane Grp Cap (vph) | 604 | 608 | 517 | 74 | 635 |  | 192 | 1094 | 489 | 179 | 1069 | 478 |
| v/s Ratio Prot | c0.09 | 0.02 |  | 0.01 | 0.02 |  | c0.06 | c0.20 |  | 0.04 | 0.16 |  |
| v/s Ratio Perm |  |  | c0.03 |  |  |  |  |  | 0.01 |  |  | 0.04 |
| v/c Ratio | 0.53 | 0.06 | 0.09 | 0.26 | 0.08 |  | 0.54 | 0.65 | 0.02 | 0.35 | 0.54 | 0.14 |
| Uniform Delay, d1 | 32.1 | 19.8 | 20.0 | 39.8 | 27.8 |  | 36.2 | 25.6 | 20.6 | 35.9 | 24.9 | 21.8 |
| 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 | 0.0 | 0.1 | 0.7 | 0.0 |  | 1.7 | 1.5 | 0.0 | 0.4 | 0.7 | 0.2 |
| Delay (s) | 32.8 | 19.8 | 20.0 | 40.4 | 27.9 |  | 37.9 | 27.1 | 20.6 | 36.3 | 25.5 | 22.0 |
| Level of Service | C | B | C | D | C |  | D | C | C | D | C | C |
| Approach Delay (s) |  | 28.4 |  |  | 29.7 |  |  | 28.2 |  |  | 25.4 |  |
| Approach LOS |  | C |  |  | C |  |  | C |  |  | C |  |

| Intersection Summary |  |  |  |
|---|---|---|---|
| HCM 2000 Control Delay | 27.3 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.48 |  |  |
| Actuated Cycle Length (s) | 85.7 | Sum of lost time (s) | 18.9 |
| Intersection Capacity Utilization | 55.6% | 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) | 473 | 4 | 66 | 0 | 0 | 0 | 0 | 582 | 470 | 1068 | 835 | 0 |
| Future Volume (vph) | 473 | 4 | 66 | 0 | 0 | 0 | 0 | 582 | 470 | 1068 | 835 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 |  |  |  |  |  | 4.0 | 4.0 | 3.0 | 4.0 |  |
| Lane Util. Factor | 0.91 | 0.91 |  |  |  |  |  | 0.91 | 0.91 | 0.97 | 0.95 |  |
| Frt | 1.00 | 0.97 |  |  |  |  |  | 0.97 | 0.85 | 1.00 | 1.00 |  |
| Flt Protected | 0.95 | 0.96 |  |  |  |  |  | 1.00 | 1.00 | 0.95 | 1.00 |  |
| Satd. Flow (prot) | 1610 | 3159 |  |  |  |  |  | 3286 | 1441 | 3433 | 3539 |  |
| Flt Permitted | 0.95 | 0.96 |  |  |  |  |  | 1.00 | 1.00 | 0.95 | 1.00 |  |
| Satd. Flow (perm) | 1610 | 3159 |  |  |  |  |  | 3286 | 1441 | 3433 | 3539 |  |
| 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) | 498 | 4 | 69 | 0 | 0 | 0 | 0 | 613 | 495 | 1124 | 879 | 0 |
| RTOR Reduction (vph) | 0 | 22 | 0 | 0 | 0 | 0 | 0 | 16 | 222 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 249 | 300 | 0 | 0 | 0 | 0 | 0 | 755 | 115 | 1124 | 879 | 0 |
| Turn Type | Split | NA |  |  |  |  |  | NA | Perm | Prot | NA |  |
| Protected Phases | 4 | 4 |  |  |  |  |  | 2 |  | 1 | 6 |  |
| Permitted Phases |  |  |  |  |  |  |  |  | 2 |  |  |  |
| Actuated Green, G (s) | 24.2 | 24.2 |  |  |  |  |  | 40.9 | 40.9 | 44.9 | 88.8 |  |
| Effective Green, g (s) | 24.2 | 24.2 |  |  |  |  |  | 40.9 | 40.9 | 44.9 | 88.8 |  |
| Actuated g/C Ratio | 0.20 | 0.20 |  |  |  |  |  | 0.34 | 0.34 | 0.37 | 0.74 |  |
| Clearance Time (s) | 3.0 | 3.0 |  |  |  |  |  | 4.0 | 4.0 | 3.0 | 4.0 |  |
| Vehicle Extension (s) | 2.0 | 2.0 |  |  |  |  |  | 4.0 | 4.0 | 2.0 | 2.5 |  |
| Lane Grp Cap (vph) | 324 | 637 |  |  |  |  |  | 1119 | 491 | 1284 | 2618 |  |
| v/s Ratio Prot | c0.15 | 0.10 |  |  |  |  |  | c0.23 |  | c0.33 | 0.25 |  |
| v/s Ratio Perm |  |  |  |  |  |  |  |  | 0.08 |  |  |  |
| v/c Ratio | 0.77 | 0.47 |  |  |  |  |  | 0.67 | 0.23 | 0.88 | 0.34 |  |
| Uniform Delay, d1 | 45.3 | 42.3 |  |  |  |  |  | 33.8 | 28.3 | 34.9 | 5.4 |  |
| Progression Factor | 1.00 | 1.00 |  |  |  |  |  | 1.00 | 1.00 | 1.00 | 1.23 |  |
| Incremental Delay, d2 | 9.5 | 0.2 |  |  |  |  |  | 3.3 | 1.1 | 6.4 | 0.3 |  |
| Delay (s) | 54.7 | 42.5 |  |  |  |  |  | 37.1 | 29.4 | 41.3 | 6.9 |  |
| Level of Service | D | D |  |  |  |  |  | D | C | D | A |  |
| Approach Delay (s) |  | 47.8 |  |  | 0.0 |  |  | 34.8 |  |  | 26.2 |  |
| Approach LOS |  | D |  |  | A |  |  | C |  |  | C |  |

| Intersection Summary |  |  |  |
|---|---|---|---|
| HCM 2000 Control Delay | 32.2 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.78 |  |  |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 10.0 |
| Intersection Capacity Utilization | 74.7% | ICU Level of Service | D |
| Analysis Period (min) | 15 |  |  |

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis
## 3: Redwood Hwy (NB) & Rowland Blvd

08/07/2020

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | ↰ | ↑↑ | | | ↑↑↑ | ↱ | ↰ | ↰↑ | ↱↱ | | ✥ | |
| Traffic Volume (vph) | 57 | 907 | 0 | 0 | 1430 | 492 | 354 | 6 | 1250 | 0 | 0 | 0 |
| Future Volume (vph) | 57 | 907 | 0 | 0 | 1430 | 492 | 354 | 6 | 1250 | 0 | 0 | 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 | 4.0 | 3.5 | 3.5 | 3.0 | | | |
| Lane Util. Factor | 1.00 | 0.95 | | | 0.91 | 1.00 | 0.95 | 0.95 | 0.88 | | | |
| Frt | 1.00 | 1.00 | | | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | | | |
| Flt Protected | 0.95 | 1.00 | | | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | | | |
| Satd. Flow (prot) | 1770 | 3539 | | | 5085 | 1583 | 1681 | 1688 | 2787 | | | |
| Flt Permitted | 0.95 | 1.00 | | | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | | | |
| Satd. Flow (perm) | 1770 | 3539 | | | 5085 | 1583 | 1681 | 1688 | 2787 | | | |
| 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) | 59 | 945 | 0 | 0 | 1490 | 512 | 369 | 6 | 1302 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 153 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 59 | 945 | 0 | 0 | 1490 | 360 | 188 | 187 | 1302 | 0 | 0 | 0 |
| Turn Type | Prot | NA | | | NA | Perm | Split | NA | custom | | | |
| Protected Phases | 5 | 2 | | | 6 | | 8 | 8 | 1 | 7 | 7 | |
| Permitted Phases | | | | | | 6 | | | 8 | | | |
| Actuated Green, G (s) | 7.4 | 48.5 | | | 81.5 | 81.5 | 20.6 | 20.6 | 61.0 | | | |
| Effective Green, g (s) | 7.4 | 48.5 | | | 81.5 | 81.5 | 20.6 | 20.6 | 61.0 | | | |
| Actuated g/C Ratio | 0.06 | 0.40 | | | 0.68 | 0.68 | 0.17 | 0.17 | 0.51 | | | |
| Clearance Time (s) | 3.0 | 4.0 | | | 4.0 | 4.0 | 3.5 | 3.5 | 3.0 | | | |
| Vehicle Extension (s) | 2.0 | 2.0 | | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | | | |
| Lane Grp Cap (vph) | 109 | 1430 | | | 3453 | 1075 | 288 | 289 | 1416 | | | |
| v/s Ratio Prot | 0.03 | c0.27 | | | 0.29 | | 0.11 | 0.11 | c0.31 | | | |
| v/s Ratio Perm | | | | | | 0.23 | | | 0.16 | | | |
| v/c Ratio | 0.54 | 0.66 | | | 0.43 | 0.33 | 0.65 | 0.65 | 0.92 | | | |
| Uniform Delay, d1 | 54.7 | 29.1 | | | 8.7 | 8.0 | 46.4 | 46.3 | 27.2 | | | |
| Progression Factor | 1.30 | 0.39 | | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | |
| Incremental Delay, d2 | 2.4 | 2.0 | | | 0.4 | 0.8 | 4.0 | 3.7 | 9.6 | | | |
| Delay (s) | 73.5 | 13.4 | | | 9.1 | 8.8 | 50.4 | 50.0 | 36.8 | | | |
| Level of Service | E | B | | | A | A | D | D | D | | | |
| Approach Delay (s) | | 17.0 | | | 9.1 | | | 39.8 | | | 0.0 | |
| Approach LOS | | B | | | A | | | D | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 21.8 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.83 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 14.0 |
| Intersection Capacity Utilization | 75.5% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis
## 4: Rowland Blvd & Rowland Way

08/07/2020

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | ↰↰ | ↑↑↑ | ↑↱ | | ↰↱ | ↱ |
| Traffic Volume (vph) | 310 | 1950 | 1827 | 75 | 75 | 262 |
| Future Volume (vph) | 310 | 1950 | 1827 | 75 | 75 | 262 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.0 | 4.0 | | 3.0 | 3.0 |
| Lane Util. Factor | 0.97 | 0.91 | 0.95 | | 1.00 | 0.95 |
| Frt | 1.00 | 1.00 | 0.99 | | 0.92 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | | 0.98 | 1.00 |
| Satd. Flow (prot) | 3433 | 5085 | 3518 | | 1669 | 1504 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | | 0.98 | 1.00 |
| Satd. Flow (perm) | 3433 | 5085 | 3518 | | 1669 | 1504 |
| Peak-hour factor, PHF | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| Adj. Flow (vph) | 333 | 2097 | 1965 | 81 | 81 | 282 |
| RTOR Reduction (vph) | 0 | 0 | 1 | 0 | 27 | 156 |
| Lane Group Flow (vph) | 333 | 2097 | 2045 | 0 | 158 | 22 |
| Turn Type | Prot | NA | NA | | Prot | Prot |
| Protected Phases | 5 | 2 | 6 | | 4 | 4 |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | 19.8 | 128.6 | 105.3 | | 18.7 | 18.7 |
| Effective Green, g (s) | 19.8 | 128.6 | 105.3 | | 18.7 | 18.7 |
| Actuated g/C Ratio | 0.13 | 0.83 | 0.68 | | 0.12 | 0.12 |
| Clearance Time (s) | 3.5 | 4.0 | 4.0 | | 3.0 | 3.0 |
| Vehicle Extension (s) | 2.0 | 4.0 | 4.0 | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 440 | 4238 | 2400 | | 202 | 182 |
| v/s Ratio Prot | c0.10 | 0.41 | c0.58 | | c0.09 | 0.01 |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | 0.76 | 0.49 | 0.85 | | 0.78 | 0.12 |
| Uniform Delay, d1 | 64.9 | 3.6 | 18.6 | | 65.8 | 60.5 |
| Progression Factor | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 6.5 | 0.1 | 3.3 | | 16.4 | 0.1 |
| Delay (s) | 71.4 | 3.8 | 21.8 | | 82.2 | 60.6 |
| Level of Service | E | A | C | | F | E |
| Approach Delay (s) | | 13.0 | 21.8 | | 71.6 | |
| Approach LOS | | B | C | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 21.1 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.83 | | |
| Actuated Cycle Length (s) | 154.3 | Sum of lost time (s) | 10.5 |
| Intersection Capacity Utilization | 81.2% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis
# 5: Vintage Way/Driveway Access & Rowland Blvd

08/07/2020

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | ↰ | ↑↑ | ↱↱ | ↰ | ↑↱ | | ↰↰ | ↱ | | | ✥ | |
| Traffic Volume (vph) | 32 | 541 | 1411 | 3 | 611 | 8 | 1244 | 23 | 5 | 12 | 7 | 4 |
| Future Volume (vph) | 32 | 541 | 1411 | 3 | 611 | 8 | 1244 | 23 | 5 | 12 | 7 | 4 |
| 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 | 3.0 | 4.0 | | 3.0 | 3.0 | | | 3.0 | |
| Lane Util. Factor | 1.00 | 0.95 | 0.88 | 1.00 | 0.95 | | 0.97 | 1.00 | | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | | 1.00 | 0.97 | | | 0.98 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | | 0.97 | |
| Satd. Flow (prot) | 1770 | 3539 | 2787 | 1770 | 3533 | | 3433 | 1815 | | | 1773 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | | 0.97 | |
| Satd. Flow (perm) | 1770 | 3539 | 2787 | 1770 | 3533 | | 3433 | 1815 | | | 1773 | |
| 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) | 33 | 558 | 1455 | 3 | 630 | 8 | 1282 | 24 | 5 | 12 | 7 | 4 |
| RTOR Reduction (vph) | 0 | 0 | 257 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 4 | 0 |
| Lane Group Flow (vph) | 33 | 558 | 1198 | 3 | 637 | 0 | 1282 | 27 | 0 | 0 | 19 | 0 |
| Turn Type | Prot | NA | pm+ov | Prot | NA | | Split | NA | | Split | NA | |
| Protected Phases | 5 | 2 | 3 | 1 | 6 | | 3 | 3 | | 4 | 4 | |
| Permitted Phases | | | 2 | | | | | | | | | |
| Actuated Green, G (s) | 4.1 | 23.7 | 80.5 | 1.9 | 21.5 | | 56.8 | 56.8 | | | 2.4 | |
| Effective Green, g (s) | 4.1 | 23.7 | 80.5 | 1.9 | 21.5 | | 56.8 | 56.8 | | | 2.4 | |
| Actuated g/C Ratio | 0.04 | 0.24 | 0.82 | 0.02 | 0.22 | | 0.58 | 0.58 | | | 0.02 | |
| Clearance Time (s) | 3.0 | 4.0 | 3.0 | 3.0 | 4.0 | | 3.0 | 3.0 | | | 3.0 | |
| Vehicle Extension (s) | 2.0 | 2.0 | 3.0 | 2.0 | 2.0 | | 3.0 | 3.0 | | | 2.0 | |
| Lane Grp Cap (vph) | 74 | 857 | 2294 | 34 | 776 | | 1993 | 1054 | | | 43 | |
| v/s Ratio Prot | c0.02 | 0.16 | 0.30 | 0.00 | c0.18 | | c0.37 | 0.01 | | | c0.01 | |
| v/s Ratio Perm | | | 0.13 | | | | | | | | | |
| v/c Ratio | 0.45 | 0.65 | 0.52 | 0.09 | 0.82 | | 0.64 | 0.03 | | | 0.44 | |
| Uniform Delay, d1 | 45.7 | 33.3 | 2.7 | 47.1 | 36.3 | | 13.7 | 8.7 | | | 47.0 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | | 1.00 | |
| Incremental Delay, d2 | 1.6 | 1.4 | 0.2 | 0.4 | 6.7 | | 0.7 | 0.0 | | | 2.6 | |
| Delay (s) | 47.3 | 34.7 | 2.9 | 47.5 | 43.0 | | 14.4 | 8.7 | | | 49.7 | |
| Level of Service | D | C | A | D | D | | B | A | | | D | |
| Approach Delay (s) | | 12.3 | | | 43.0 | | | 14.3 | | | 49.7 | |
| Approach LOS | | B | | | D | | | B | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 18.1 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.66 | | |
| Actuated Cycle Length (s) | 97.8 | Sum of lost time (s) | 13.0 |
| Intersection Capacity Utilization | 72.6% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

# 6: Rowland Blvd & Vintage Way

| | ↗ | ↘ | ↖ | ↑ | ↓ | ↙ |
|---|---|---|---|---|---|---|
| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
| Lane Configurations | Y | | | ↰ | ↱ | |
| Sign Control | Stop | | | Stop | Stop | |
| Traffic Volume (vph) | 423 | 3 | 1 | 4 | 1 | 360 |
| Future Volume (vph) | 423 | 3 | 1 | 4 | 1 | 360 |
| Peak Hour Factor | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Hourly flow rate (vph) | 450 | 3 | 1 | 4 | 1 | 383 |

| Direction, Lane # | EB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total (vph) | 453 | 5 | 384 |
| Volume Left (vph) | 450 | 1 | 0 |
| Volume Right (vph) | 3 | 0 | 383 |
| Hadj (s) | 0.23 | 0.07 | -0.56 |
| Departure Headway (s) | 5.1 | 5.7 | 4.6 |
| Degree Utilization, x | 0.64 | 0.01 | 0.49 |
| Capacity (veh/h) | 685 | 555 | 740 |
| Control Delay (s) | 16.6 | 8.8 | 11.8 |
| Approach Delay (s) | 16.6 | 8.8 | 11.8 |
| Approach LOS | C | A | B |

| Intersection Summary | | | |
|---|---|---|---|
| Delay | 14.4 | | |
| Level of Service | B | | |
| Intersection Capacity Utilization | 52.6% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

# Appendix D Future Conditions Level-of-Service Worksheets

# HCM Signalized Intersection Capacity Analysis
## 1: Rowland Blvd & Redwood Blvd

08/07/2020

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | ↰↰ | ↑ | ↱ | ↰ | ↑↱ |  | ↰ | ↑↑ | ↱ | ↰ | ↑↑ | ↱ |
| Traffic Volume (vph) | 412 | 33 | 167 | 31 | 32 | 45 | 99 | 583 | 45 | 96 | 776 | 324 |
| Future Volume (vph) | 412 | 33 | 167 | 31 | 32 | 45 | 99 | 583 | 45 | 96 | 776 | 324 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 5.8 | 5.8 | 4.0 | 5.1 |  | 4.0 | 5.1 | 5.1 | 4.0 | 5.1 | 5.1 |
| Lane Util. Factor | 0.97 | 1.00 | 1.00 | 1.00 | 0.95 |  | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.91 |  | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |  | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3433 | 1863 | 1583 | 1770 | 3231 |  | 1770 | 3539 | 1583 | 1770 | 3539 | 1583 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |  | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3433 | 1863 | 1583 | 1770 | 3231 |  | 1770 | 3539 | 1583 | 1770 | 3539 | 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) | 434 | 35 | 176 | 33 | 34 | 47 | 104 | 614 | 47 | 101 | 817 | 341 |
| RTOR Reduction (vph) | 0 | 0 | 133 | 0 | 41 | 0 | 0 | 0 | 30 | 0 | 0 | 193 |
| Lane Group Flow (vph) | 434 | 35 | 43 | 33 | 40 | 0 | 104 | 614 | 17 | 101 | 817 | 148 |
| Turn Type | Prot | NA | Perm | Prot | NA |  | Prot | NA | Perm | Prot | NA | Perm |
| Protected Phases | 7 | 4 |  | 3 | 8 |  | 5 | 2 |  | 1 | 6 |  |
| Permitted Phases |  |  | 4 |  |  |  |  |  | 2 |  |  | 6 |
| Actuated Green, G (s) | 18.2 | 23.2 | 23.2 | 5.9 | 11.6 |  | 12.9 | 35.1 | 35.1 | 12.8 | 35.0 | 35.0 |
| Effective Green, g (s) | 18.2 | 23.2 | 23.2 | 5.9 | 11.6 |  | 12.9 | 35.1 | 35.1 | 12.8 | 35.0 | 35.0 |
| Actuated g/C Ratio | 0.19 | 0.24 | 0.24 | 0.06 | 0.12 |  | 0.13 | 0.37 | 0.37 | 0.13 | 0.36 | 0.36 |
| Clearance Time (s) | 4.0 | 5.8 | 5.8 | 4.0 | 5.1 |  | 4.0 | 5.1 | 5.1 | 4.0 | 5.1 | 5.1 |
| Vehicle Extension (s) | 2.5 | 2.5 | 2.5 | 2.0 | 2.5 |  | 2.0 | 4.0 | 4.0 | 2.0 | 4.0 | 4.0 |
| Lane Grp Cap (vph) | 651 | 450 | 382 | 108 | 390 |  | 238 | 1295 | 579 | 236 | 1291 | 577 |
| v/s Ratio Prot | c0.13 | 0.02 |  | 0.02 | 0.01 |  | c0.06 | 0.17 |  | 0.06 | c0.23 |  |
| v/s Ratio Perm |  |  | c0.03 |  |  |  |  |  | 0.01 |  |  | 0.09 |
| v/c Ratio | 0.67 | 0.08 | 0.11 | 0.31 | 0.10 |  | 0.44 | 0.47 | 0.03 | 0.43 | 0.63 | 0.26 |
| Uniform Delay, d1 | 36.0 | 28.1 | 28.3 | 43.0 | 37.5 |  | 38.2 | 23.3 | 19.5 | 38.2 | 25.1 | 21.3 |
| 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 | 2.3 | 0.1 | 0.1 | 0.6 | 0.1 |  | 0.5 | 0.4 | 0.0 | 0.5 | 1.2 | 0.3 |
| Delay (s) | 38.4 | 28.1 | 28.4 | 43.6 | 37.6 |  | 38.6 | 23.7 | 19.5 | 38.6 | 26.3 | 21.7 |
| Level of Service | D | C | C | D | D |  | D | C | B | D | C | C |
| Approach Delay (s) |  | 35.1 |  |  | 39.3 |  |  | 25.5 |  |  | 26.0 |  |
| Approach LOS |  | D |  |  | D |  |  | C |  |  | C |  |

| Intersection Summary |  |  |  |
|---|---|---|---|
| HCM 2000 Control Delay | 28.5 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.54 |  |  |
| Actuated Cycle Length (s) | 95.9 | Sum of lost time (s) | 18.9 |
| Intersection Capacity Utilization | 61.5% | ICU Level of Service | B |
| Analysis Period (min) | 15 |  |  |

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis
## 2: Rowland Blvd & Redwood Hwy (SB)

08/07/2020

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | ↰ | ↰↱ | | | | | | ↑↱ | ↱ | ↰↰ | ↑↑ | |
| Traffic Volume (vph) | 413 | 6 | 108 | 0 | 0 | 0 | 0 | 579 | 529 | 914 | 1079 | 0 |
| Future Volume (vph) | 413 | 6 | 108 | 0 | 0 | 0 | 0 | 579 | 529 | 914 | 1079 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | | | | | | 4.0 | 4.0 | 3.0 | 4.0 | |
| Lane Util. Factor | 0.91 | 0.91 | | | | | | 0.91 | 0.91 | 0.97 | 0.95 | |
| Frt | 1.00 | 0.95 | | | | | | 0.96 | 0.85 | 1.00 | 1.00 | |
| Flt Protected | 0.95 | 0.97 | | | | | | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1610 | 3118 | | | | | | 3264 | 1441 | 3433 | 3539 | |
| Flt Permitted | 0.95 | 0.97 | | | | | | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1610 | 3118 | | | | | | 3264 | 1441 | 3433 | 3539 | |
| 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) | 435 | 6 | 114 | 0 | 0 | 0 | 0 | 609 | 557 | 962 | 1136 | 0 |
| RTOR Reduction (vph) | 0 | 55 | 0 | 0 | 0 | 0 | 0 | 20 | 206 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 217 | 283 | 0 | 0 | 0 | 0 | 0 | 790 | 150 | 962 | 1136 | 0 |
| Turn Type | Split | NA | | | | | | NA | Perm | Prot | NA | |
| Protected Phases | 4 | 4 | | | | | | 2 | | 1 | 6 | |
| Permitted Phases | | | | | | | | | 2 | | | |
| Actuated Green, G (s) | 22.4 | 22.4 | | | | | | 50.7 | 50.7 | 36.9 | 90.6 | |
| Effective Green, g (s) | 22.4 | 22.4 | | | | | | 50.7 | 50.7 | 36.9 | 90.6 | |
| Actuated g/C Ratio | 0.19 | 0.19 | | | | | | 0.42 | 0.42 | 0.31 | 0.75 | |
| Clearance Time (s) | 3.0 | 3.0 | | | | | | 4.0 | 4.0 | 3.0 | 4.0 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | | | | | 4.0 | 4.0 | 2.0 | 2.5 | |
| Lane Grp Cap (vph) | 300 | 582 | | | | | | 1379 | 608 | 1055 | 2671 | |
| v/s Ratio Prot | c0.13 | 0.09 | | | | | | c0.24 | | c0.28 | 0.32 | |
| v/s Ratio Perm | | | | | | | | | 0.10 | | | |
| v/c Ratio | 0.72 | 0.49 | | | | | | 0.57 | 0.25 | 0.91 | 0.43 | |
| Uniform Delay, d1 | 45.9 | 43.6 | | | | | | 26.4 | 22.3 | 40.0 | 5.3 | |
| Progression Factor | 1.00 | 1.00 | | | | | | 1.00 | 1.00 | 0.79 | 1.09 | |
| Incremental Delay, d2 | 7.1 | 0.2 | | | | | | 1.7 | 1.0 | 10.6 | 0.5 | |
| Delay (s) | 53.0 | 43.9 | | | | | | 28.1 | 23.3 | 42.4 | 6.2 | |
| Level of Service | D | D | | | | | | C | C | D | A | |
| Approach Delay (s) | | 47.5 | | | 0.0 | | | 26.7 | | | 22.8 | |
| Approach LOS | | D | | | A | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 27.6 | 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) | 10.0 |
| Intersection Capacity Utilization | 69.4% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis
## 3: Redwood Hwy (NB) & Rowland Blvd

08/07/2020

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | ↰ | ↑↑ |  |  | ↑↑↑ | ↱ | ↰ | ↰ | ↱↱ |  | ✣ |  |
| Traffic Volume (vph) | 48 | 935 | 0 | 0 | 1366 | 601 | 593 | 12 | 937 | 0 | 0 | 0 |
| Future Volume (vph) | 48 | 935 | 0 | 0 | 1366 | 601 | 593 | 12 | 937 | 0 | 0 | 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 | 4.0 | 3.5 | 3.5 | 3.0 |  |  |  |
| Lane Util. Factor | 1.00 | 0.95 |  |  | 0.91 | 1.00 | 0.95 | 0.95 | 0.88 |  |  |  |
| Frt | 1.00 | 1.00 |  |  | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |  |  |  |
| Flt Protected | 0.95 | 1.00 |  |  | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 |  |  |  |
| Satd. Flow (prot) | 1770 | 3539 |  |  | 5085 | 1583 | 1681 | 1689 | 2787 |  |  |  |
| Flt Permitted | 0.95 | 1.00 |  |  | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 |  |  |  |
| Satd. Flow (perm) | 1770 | 3539 |  |  | 5085 | 1583 | 1681 | 1689 | 2787 |  |  |  |
| 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) | 50 | 974 | 0 | 0 | 1423 | 626 | 618 | 12 | 976 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 228 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 50 | 974 | 0 | 0 | 1423 | 398 | 315 | 316 | 976 | 0 | 0 | 0 |
| Turn Type | Prot | NA |  |  | NA | Perm | Split | NA | custom |  |  |  |
| Protected Phases | 5 | 2 |  |  | 6 |  | 8 | 8 | 1 | 7 | 7 |  |
| Permitted Phases |  |  |  |  |  | 6 |  |  | 8 |  |  |  |
| Actuated Green, G (s) | 6.9 | 72.0 |  |  | 74.6 | 74.6 | 28.0 | 28.0 | 37.5 |  |  |  |
| Effective Green, g (s) | 6.9 | 72.0 |  |  | 74.6 | 74.6 | 28.0 | 28.0 | 37.5 |  |  |  |
| Actuated g/C Ratio | 0.06 | 0.60 |  |  | 0.62 | 0.62 | 0.23 | 0.23 | 0.31 |  |  |  |
| Clearance Time (s) | 3.0 | 4.0 |  |  | 4.0 | 4.0 | 3.5 | 3.5 | 3.0 |  |  |  |
| Vehicle Extension (s) | 2.0 | 2.0 |  |  | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |  |  |  |
| Lane Grp Cap (vph) | 101 | 2123 |  |  | 3161 | 984 | 392 | 394 | 870 |  |  |  |
| v/s Ratio Prot | 0.03 | 0.28 |  |  | c0.28 |  | 0.19 | 0.19 | c0.09 |  |  |  |
| v/s Ratio Perm |  |  |  |  |  | 0.25 |  |  | 0.26 |  |  |  |
| v/c Ratio | 0.50 | 0.46 |  |  | 0.45 | 0.40 | 0.80 | 0.80 | 1.12 |  |  |  |
| Uniform Delay, d1 | 54.9 | 13.2 |  |  | 11.9 | 11.5 | 43.4 | 43.4 | 41.2 |  |  |  |
| Progression Factor | 0.94 | 1.45 |  |  | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |  |  |  |
| Incremental Delay, d2 | 1.2 | 0.6 |  |  | 0.5 | 1.2 | 10.7 | 10.6 | 69.8 |  |  |  |
| Delay (s) | 52.9 | 19.8 |  |  | 12.4 | 12.7 | 54.1 | 54.0 | 111.0 |  |  |  |
| Level of Service | D | B |  |  | B | B | D | D | F |  |  |  |
| Approach Delay (s) |  | 21.4 |  |  | 12.5 |  |  | 88.7 |  |  | 0.0 |  |
| Approach LOS |  | C |  |  | B |  |  | F |  |  | A |  |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 40.6 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.69 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 14.0 |
| Intersection Capacity Utilization | 67.3% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

# 4: Rowland Blvd & Rowland Way

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | ↰↰ | ↑↑↑ | ↑↱ |  | ⑂ | ↱ |
| Traffic Volume (vph) | 228 | 1626 | 1591 | 35 | 69 | 406 |
| Future Volume (vph) | 228 | 1626 | 1591 | 35 | 69 | 406 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.0 | 4.0 |  | 3.0 | 3.0 |
| Lane Util. Factor | 0.97 | 0.91 | 0.95 |  | 1.00 | 0.95 |
| Frt | 1.00 | 1.00 | 1.00 |  | 0.89 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 |  | 0.99 | 1.00 |
| Satd. Flow (prot) | 3433 | 5085 | 3528 |  | 1640 | 1504 |
| Flt Permitted | 0.95 | 1.00 | 1.00 |  | 0.99 | 1.00 |
| Satd. Flow (perm) | 3433 | 5085 | 3528 |  | 1640 | 1504 |
| Peak-hour factor, PHF | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| Adj. Flow (vph) | 245 | 1748 | 1711 | 38 | 74 | 437 |
| RTOR Reduction (vph) | 0 | 0 | 1 | 0 | 49 | 211 |
| Lane Group Flow (vph) | 245 | 1748 | 1748 | 0 | 209 | 42 |
| Turn Type | Prot | NA | NA |  | Prot | Prot |
| Protected Phases | 5 | 2 | 6 |  | 4 | 4 |
| Permitted Phases |  |  |  |  |  |  |
| Actuated Green, G (s) | 15.2 | 107.8 | 89.1 |  | 22.6 | 22.6 |
| Effective Green, g (s) | 15.2 | 107.8 | 89.1 |  | 22.6 | 22.6 |
| Actuated g/C Ratio | 0.11 | 0.78 | 0.65 |  | 0.16 | 0.16 |
| Clearance Time (s) | 3.5 | 4.0 | 4.0 |  | 3.0 | 3.0 |
| Vehicle Extension (s) | 2.0 | 4.0 | 4.0 |  | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 379 | 3989 | 2287 |  | 269 | 247 |
| v/s Ratio Prot | c0.07 | 0.34 | c0.50 |  | c0.13 | 0.03 |
| v/s Ratio Perm |  |  |  |  |  |  |
| v/c Ratio | 0.65 | 0.44 | 0.76 |  | 0.78 | 0.17 |
| Uniform Delay, d1 | 58.5 | 4.9 | 16.8 |  | 55.0 | 49.3 |
| Progression Factor | 1.00 | 1.00 | 1.00 |  | 1.00 | 1.00 |
| Incremental Delay, d2 | 2.8 | 0.1 | 1.7 |  | 12.0 | 0.1 |
| Delay (s) | 61.4 | 5.0 | 18.5 |  | 67.0 | 49.4 |
| Level of Service | E | A | B |  | E | D |
| Approach Delay (s) |  | 11.9 | 18.5 |  | 58.3 |  |
| Approach LOS |  | B | B |  | E |  |

| Intersection Summary |  |  |  |
|---|---|---|---|
| HCM 2000 Control Delay | 20.2 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.75 |  |  |
| Actuated Cycle Length (s) | 137.4 | Sum of lost time (s) | 10.5 |
| Intersection Capacity Utilization | 73.7% | ICU Level of Service | D |
| Analysis Period (min) | 15 |  |  |

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis
## 5: Vintage Way/Driveway Access & Rowland Blvd

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | ↰ | ↑↑ | ↱↱ | ↰ | ↑↱ |  | ↰↰ | ↱ |  |  | ✥ |  |
| Traffic Volume (vph) | 19 | 651 | 1006 | 2 | 997 | 11 | 641 | 20 | 0 | 4 | 4 | 2 |
| Future Volume (vph) | 19 | 651 | 1006 | 2 | 997 | 11 | 641 | 20 | 0 | 4 | 4 | 2 |
| 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 | 3.0 | 4.0 |  | 3.0 | 3.0 |  |  | 3.0 |  |
| Lane Util. Factor | 1.00 | 0.95 | 0.88 | 1.00 | 0.95 |  | 0.97 | 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 |  |  | 0.98 |  |
| Satd. Flow (prot) | 1770 | 3539 | 2787 | 1770 | 3534 |  | 3433 | 1863 |  |  | 1777 |  |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |  | 0.95 | 1.00 |  |  | 0.98 |  |
| Satd. Flow (perm) | 1770 | 3539 | 2787 | 1770 | 3534 |  | 3433 | 1863 |  |  | 1777 |  |
| 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) | 20 | 671 | 1037 | 2 | 1028 | 11 | 661 | 21 | 0 | 4 | 4 | 2 |
| RTOR Reduction (vph) | 0 | 0 | 221 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| Lane Group Flow (vph) | 20 | 671 | 816 | 2 | 1038 | 0 | 661 | 21 | 0 | 0 | 8 | 0 |
| Turn Type | Prot | NA | pm+ov | Prot | NA |  | Split | NA |  | Split | NA |  |
| Protected Phases | 5 | 2 | 3 | 1 | 6 |  | 3 | 3 |  | 4 | 4 |  |
| Permitted Phases |  |  | 2 |  |  |  |  |  |  |  |  |  |
| Actuated Green, G (s) | 2.0 | 23.2 | 55.9 | 1.3 | 22.5 |  | 32.7 | 32.7 |  |  | 0.8 |  |
| Effective Green, g (s) | 2.0 | 23.2 | 55.9 | 1.3 | 22.5 |  | 32.7 | 32.7 |  |  | 0.8 |  |
| Actuated g/C Ratio | 0.03 | 0.33 | 0.79 | 0.02 | 0.32 |  | 0.46 | 0.46 |  |  | 0.01 |  |
| Clearance Time (s) | 3.0 | 4.0 | 3.0 | 3.0 | 4.0 |  | 3.0 | 3.0 |  |  | 3.0 |  |
| Vehicle Extension (s) | 2.0 | 2.0 | 3.0 | 2.0 | 2.0 |  | 3.0 | 3.0 |  |  | 2.0 |  |
| Lane Grp Cap (vph) | 49 | 1156 | 2194 | 32 | 1119 |  | 1581 | 858 |  |  | 20 |  |
| v/s Ratio Prot | c0.01 | 0.19 | 0.17 | 0.00 | c0.29 |  | c0.19 | 0.01 |  |  | c0.00 |  |
| v/s Ratio Perm |  |  | 0.12 |  |  |  |  |  |  |  |  |  |
| v/c Ratio | 0.41 | 0.58 | 0.37 | 0.06 | 0.93 |  | 0.42 | 0.02 |  |  | 0.40 |  |
| Uniform Delay, d1 | 33.9 | 19.9 | 2.3 | 34.3 | 23.5 |  | 12.8 | 10.4 |  |  | 34.9 |  |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |  | 1.00 | 1.00 |  |  | 1.00 |  |
| Incremental Delay, d2 | 2.0 | 0.5 | 0.1 | 0.3 | 12.7 |  | 0.2 | 0.0 |  |  | 4.7 |  |
| Delay (s) | 35.9 | 20.3 | 2.4 | 34.6 | 36.2 |  | 13.0 | 10.5 |  |  | 39.6 |  |
| Level of Service | D | C | A | C | D |  | B | B |  |  | D |  |
| Approach Delay (s) |  | 9.7 |  |  | 36.2 |  |  | 12.9 |  |  | 39.6 |  |
| Approach LOS |  | A |  |  | D |  |  | B |  |  | D |  |

| Intersection Summary |  |  |  |
|---|---|---|---|
| HCM 2000 Control Delay | 18.4 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.61 |  |  |
| Actuated Cycle Length (s) | 71.0 | Sum of lost time (s) | 13.0 |
| Intersection Capacity Utilization | 59.5% | ICU Level of Service | B |
| Analysis Period (min) | 15 |  |  |

c Critical Lane Group

# HCM Unsignalized Intersection Capacity Analysis
## 6: Rowland Blvd & Vintage Way

08/07/2020

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations |  |  |  |  |  |  |
| Sign Control | Stop |  |  | Stop | Stop |  |
| Traffic Volume (vph) | 320 | 3 | 3 | 199 | 377 | 153 |
| Future Volume (vph) | 320 | 3 | 3 | 199 | 377 | 153 |
| Peak Hour Factor | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Hourly flow rate (vph) | 340 | 3 | 3 | 212 | 401 | 163 |

| Direction, Lane # | EB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total (vph) | 343 | 215 | 564 |
| Volume Left (vph) | 340 | 3 | 0 |
| Volume Right (vph) | 3 | 0 | 163 |
| Hadj (s) | 0.23 | 0.04 | -0.14 |
| Departure Headway (s) | 6.2 | 6.0 | 5.3 |
| Degree Utilization, x | 0.59 | 0.36 | 0.83 |
| Capacity (veh/h) | 542 | 553 | 668 |
| Control Delay (s) | 17.8 | 12.3 | 28.6 |
| Approach Delay (s) | 17.8 | 12.3 | 28.6 |
| Approach LOS | C | B | D |

| Intersection Summary |  |  |  |
|---|---|---|---|
| Delay | 22.2 |  |  |
| Level of Service | C |  |  |
| Intersection Capacity Utilization | 53.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 |  |  |

# HCM Signalized Intersection Capacity Analysis
## 1: Rowland Blvd & Redwood Blvd

08/07/2020

| | ↗ | → | ↘ | ↙ | ← | ↖ | ↖ | ↑ | ↗ | ↘ | ↓ | ↙ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations | ↰↰ | ↑ | ↱ | ↰ | ↑↱ | | ↰ | ↑↑ | ↱ | ↰ | ↑↑ | ↱ |
| Traffic Volume (vph) | 411 | 32 | 129 | 18 | 32 | 74 | 99 | 680 | 31 | 55 | 535 | 307 |
| Future Volume (vph) | 411 | 32 | 129 | 18 | 32 | 74 | 99 | 680 | 31 | 55 | 535 | 307 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 5.8 | 5.8 | 4.0 | 5.1 | | 4.0 | 5.1 | 5.1 | 4.0 | 5.1 | 5.1 |
| Lane Util. Factor | 0.97 | 1.00 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.90 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3433 | 1863 | 1583 | 1770 | 3169 | | 1770 | 3539 | 1583 | 1770 | 3539 | 1583 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3433 | 1863 | 1583 | 1770 | 3169 | | 1770 | 3539 | 1583 | 1770 | 3539 | 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) | 433 | 34 | 136 | 19 | 34 | 78 | 104 | 716 | 33 | 58 | 563 | 323 |
| RTOR Reduction (vph) | 0 | 0 | 92 | 0 | 64 | 0 | 0 | 0 | 22 | 0 | 0 | 226 |
| Lane Group Flow (vph) | 433 | 34 | 44 | 19 | 48 | 0 | 104 | 716 | 11 | 58 | 563 | 97 |
| Turn Type | Prot | NA | Perm | Prot | NA | | Prot | NA | Perm | Prot | NA | Perm |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | 4 | | | | | | 2 | | | 6 |
| Actuated Green, G (s) | 17.6 | 30.1 | 30.1 | 3.7 | 16.9 | | 12.7 | 31.7 | 31.7 | 9.0 | 28.0 | 28.0 |
| Effective Green, g (s) | 17.6 | 30.1 | 30.1 | 3.7 | 16.9 | | 12.7 | 31.7 | 31.7 | 9.0 | 28.0 | 28.0 |
| Actuated g/C Ratio | 0.19 | 0.32 | 0.32 | 0.04 | 0.18 | | 0.14 | 0.34 | 0.34 | 0.10 | 0.30 | 0.30 |
| Clearance Time (s) | 4.0 | 5.8 | 5.8 | 4.0 | 5.1 | | 4.0 | 5.1 | 5.1 | 4.0 | 5.1 | 5.1 |
| Vehicle Extension (s) | 2.5 | 2.5 | 2.5 | 2.0 | 2.5 | | 2.0 | 4.0 | 4.0 | 2.0 | 4.0 | 4.0 |
| Lane Grp Cap (vph) | 646 | 600 | 510 | 70 | 573 | | 240 | 1201 | 537 | 170 | 1060 | 474 |
| v/s Ratio Prot | c0.13 | 0.02 | | 0.01 | 0.02 | | c0.06 | c0.20 | | 0.03 | 0.16 | |
| v/s Ratio Perm | | | c0.03 | | | | | | 0.01 | | | 0.06 |
| v/c Ratio | 0.67 | 0.06 | 0.09 | 0.27 | 0.08 | | 0.43 | 0.60 | 0.02 | 0.34 | 0.53 | 0.20 |
| Uniform Delay, d1 | 35.2 | 21.8 | 22.1 | 43.5 | 31.8 | | 37.0 | 25.5 | 20.5 | 39.4 | 27.2 | 24.4 |
| 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 | 2.5 | 0.0 | 0.1 | 0.8 | 0.0 | | 0.5 | 0.9 | 0.0 | 0.4 | 0.7 | 0.3 |
| Delay (s) | 37.7 | 21.9 | 22.1 | 44.3 | 31.9 | | 37.5 | 26.5 | 20.5 | 39.9 | 27.9 | 24.7 |
| Level of Service | D | C | C | D | C | | D | C | C | D | C | C |
| Approach Delay (s) | | 33.3 | | | 33.7 | | | 27.6 | | | 27.5 | |
| Approach LOS | | C | | | C | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 29.2 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.49 | | |
| Actuated Cycle Length (s) | 93.4 | Sum of lost time (s) | 18.9 |
| Intersection Capacity Utilization | 58.8% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis
## 2: Rowland Blvd & Redwood Hwy (SB)

08/07/2020

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | ↰ | ↰↑↱ | | | | | | ↑↱ | ↱ | ↰↰ | ↑↑ | |
| Traffic Volume (vph) | 552 | 4 | 66 | 0 | 0 | 0 | 0 | 690 | 470 | 1119 | 915 | 0 |
| Future Volume (vph) | 552 | 4 | 66 | 0 | 0 | 0 | 0 | 690 | 470 | 1119 | 915 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | | | | | | 4.0 | 4.0 | 3.0 | 4.0 | |
| Lane Util. Factor | 0.91 | 0.91 | | | | | | 0.91 | 0.91 | 0.97 | 0.95 | |
| Frt | 1.00 | 0.97 | | | | | | 0.98 | 0.85 | 1.00 | 1.00 | |
| Flt Protected | 0.95 | 0.96 | | | | | | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1610 | 3167 | | | | | | 3316 | 1441 | 3433 | 3539 | |
| Flt Permitted | 0.95 | 0.96 | | | | | | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1610 | 3167 | | | | | | 3316 | 1441 | 3433 | 3539 | |
| 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) | 581 | 4 | 69 | 0 | 0 | 0 | 0 | 726 | 495 | 1178 | 963 | 0 |
| RTOR Reduction (vph) | 0 | 18 | 0 | 0 | 0 | 0 | 0 | 10 | 259 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 290 | 346 | 0 | 0 | 0 | 0 | 0 | 840 | 112 | 1178 | 963 | 0 |
| Turn Type | Split | NA | | | | | | NA | Perm | Prot | NA | |
| Protected Phases | 4 | 4 | | | | | | 2 | | 1 | 6 | |
| Permitted Phases | | | | | | | | | 2 | | | |
| Actuated Green, G (s) | 26.6 | 26.6 | | | | | | 36.2 | 36.2 | 47.2 | 86.4 | |
| Effective Green, g (s) | 26.6 | 26.6 | | | | | | 36.2 | 36.2 | 47.2 | 86.4 | |
| Actuated g/C Ratio | 0.22 | 0.22 | | | | | | 0.30 | 0.30 | 0.39 | 0.72 | |
| Clearance Time (s) | 3.0 | 3.0 | | | | | | 4.0 | 4.0 | 3.0 | 4.0 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | | | | | 4.0 | 4.0 | 2.0 | 2.5 | |
| Lane Grp Cap (vph) | 356 | 702 | | | | | | 1000 | 434 | 1350 | 2548 | |
| v/s Ratio Prot | c0.18 | 0.11 | | | | | | c0.25 | | c0.34 | 0.27 | |
| v/s Ratio Perm | | | | | | | | | 0.08 | | | |
| v/c Ratio | 0.81 | 0.49 | | | | | | 0.84 | 0.26 | 0.87 | 0.38 | |
| Uniform Delay, d1 | 44.4 | 40.8 | | | | | | 39.2 | 31.7 | 33.6 | 6.5 | |
| Progression Factor | 1.00 | 1.00 | | | | | | 1.00 | 1.00 | 0.98 | 1.30 | |
| Incremental Delay, d2 | 12.7 | 0.2 | | | | | | 8.4 | 1.4 | 5.9 | 0.4 | |
| Delay (s) | 57.0 | 41.0 | | | | | | 47.6 | 33.2 | 38.8 | 8.8 | |
| Level of Service | E | D | | | | | | D | C | D | A | |
| Approach Delay (s) | | 48.1 | | | 0.0 | | | 43.2 | | | 25.3 | |
| Approach LOS | | D | | | A | | | D | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 34.5 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.85 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 10.0 |
| Intersection Capacity Utilization | 81.3% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis
## 3: Redwood Hwy (NB) & Rowland Blvd

08/07/2020

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ↗ | → | ↘ | ↙ | ← | ↖ | ↖ | ↑ | ↗ | ↘ | ↓ | ↙ |
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations | ↰ | ↑↑ | | | ↑↑↑ | ↱ | ↰ | ↰ | ↱↱ | | ✥ | |
| Traffic Volume (vph) | 57 | 1094 | 0 | 0 | 1562 | 552 | 354 | 6 | 1306 | 0 | 0 | 0 |
| Future Volume (vph) | 57 | 1094 | 0 | 0 | 1562 | 552 | 354 | 6 | 1306 | 0 | 0 | 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 | 4.0 | 3.5 | 3.5 | 3.0 | | | |
| Lane Util. Factor | 1.00 | 0.95 | | | 0.91 | 1.00 | 0.95 | 0.95 | 0.88 | | | |
| Frt | 1.00 | 1.00 | | | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | | | |
| Flt Protected | 0.95 | 1.00 | | | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | | | |
| Satd. Flow (prot) | 1770 | 3539 | | | 5085 | 1583 | 1681 | 1688 | 2787 | | | |
| Flt Permitted | 0.95 | 1.00 | | | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | | | |
| Satd. Flow (perm) | 1770 | 3539 | | | 5085 | 1583 | 1681 | 1688 | 2787 | | | |
| 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) | 59 | 1140 | 0 | 0 | 1627 | 575 | 369 | 6 | 1360 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 157 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 59 | 1140 | 0 | 0 | 1627 | 418 | 188 | 187 | 1360 | 0 | 0 | 0 |
| Turn Type | Prot | NA | | | NA | Perm | Split | NA | custom | | | |
| Protected Phases | 5 | 2 | | | 6 | | 8 | 8 | 1 | 7 | 7 | |
| Permitted Phases | | | | | | 6 | | | 8 | | | |
| Actuated Green, G (s) | 7.4 | 40.8 | | | 81.5 | 81.5 | 20.6 | 20.6 | 68.7 | | | |
| Effective Green, g (s) | 7.4 | 40.8 | | | 81.5 | 81.5 | 20.6 | 20.6 | 68.7 | | | |
| Actuated g/C Ratio | 0.06 | 0.34 | | | 0.68 | 0.68 | 0.17 | 0.17 | 0.57 | | | |
| Clearance Time (s) | 3.0 | 4.0 | | | 4.0 | 4.0 | 3.5 | 3.5 | 3.0 | | | |
| Vehicle Extension (s) | 2.0 | 2.0 | | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | | | |
| Lane Grp Cap (vph) | 109 | 1203 | | | 3453 | 1075 | 288 | 289 | 1595 | | | |
| v/s Ratio Prot | 0.03 | c0.32 | | | 0.32 | | 0.11 | 0.11 | c0.34 | | | |
| v/s Ratio Perm | | | | | | 0.26 | | | 0.15 | | | |
| v/c Ratio | 0.54 | 0.95 | | | 0.47 | 0.39 | 0.65 | 0.65 | 0.85 | | | |
| Uniform Delay, d1 | 54.7 | 38.6 | | | 9.1 | 8.4 | 46.4 | 46.3 | 21.4 | | | |
| Progression Factor | 1.32 | 0.49 | | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | |
| Incremental Delay, d2 | 2.1 | 12.7 | | | 0.5 | 1.1 | 4.0 | 3.7 | 4.5 | | | |
| Delay (s) | 74.1 | 31.7 | | | 9.5 | 9.5 | 50.4 | 50.0 | 25.9 | | | |
| Level of Service | E | C | | | A | A | D | D | C | | | |
| Approach Delay (s) | | 33.8 | | | 9.5 | | | 31.1 | | | 0.0 | |
| Approach LOS | | C | | | A | | | C | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 22.5 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.92 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 14.0 |
| Intersection Capacity Utilization | 82.6% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

# 4: Rowland Blvd & Rowland Way

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | ↰↰ | ↑↑↑ | ↑↱ |  | Y | ↱ |
| Traffic Volume (vph) | 310 | 2193 | 2018 | 85 | 89 | 262 |
| Future Volume (vph) | 310 | 2193 | 2018 | 85 | 89 | 262 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.0 | 4.0 |  | 3.0 | 3.0 |
| Lane Util. Factor | 0.97 | 0.91 | 0.95 |  | 1.00 | 0.95 |
| Frt | 1.00 | 1.00 | 0.99 |  | 0.92 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 |  | 0.98 | 1.00 |
| Satd. Flow (prot) | 3433 | 5085 | 3518 |  | 1680 | 1504 |
| Flt Permitted | 0.95 | 1.00 | 1.00 |  | 0.98 | 1.00 |
| Satd. Flow (perm) | 3433 | 5085 | 3518 |  | 1680 | 1504 |
| Peak-hour factor, PHF | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| Adj. Flow (vph) | 333 | 2358 | 2170 | 91 | 96 | 282 |
| RTOR Reduction (vph) | 0 | 0 | 1 | 0 | 22 | 160 |
| Lane Group Flow (vph) | 333 | 2358 | 2260 | 0 | 173 | 23 |
| Turn Type | Prot | NA | NA |  | Prot | Prot |
| Protected Phases | 5 | 2 | 6 |  | 4 | 4 |
| Permitted Phases |  |  |  |  |  |  |
| Actuated Green, G (s) | 20.0 | 133.9 | 110.4 |  | 20.2 | 20.2 |
| Effective Green, g (s) | 20.0 | 133.9 | 110.4 |  | 20.2 | 20.2 |
| Actuated g/C Ratio | 0.12 | 0.83 | 0.69 |  | 0.13 | 0.13 |
| Clearance Time (s) | 3.5 | 4.0 | 4.0 |  | 3.0 | 3.0 |
| Vehicle Extension (s) | 2.0 | 4.0 | 4.0 |  | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 426 | 4226 | 2410 |  | 210 | 188 |
| v/s Ratio Prot | c0.10 | 0.46 | c0.64 |  | c0.10 | 0.02 |
| v/s Ratio Perm |  |  |  |  |  |  |
| v/c Ratio | 0.78 | 0.56 | 0.94 |  | 0.82 | 0.12 |
| Uniform Delay, d1 | 68.4 | 4.3 | 22.3 |  | 68.7 | 62.6 |
| Progression Factor | 1.00 | 1.00 | 1.00 |  | 1.00 | 1.00 |
| Incremental Delay, d2 | 8.4 | 0.2 | 7.9 |  | 21.4 | 0.1 |
| Delay (s) | 76.8 | 4.5 | 30.2 |  | 90.1 | 62.7 |
| Level of Service | E | A | C |  | F | E |
| Approach Delay (s) |  | 13.4 | 30.2 |  | 76.8 |  |
| Approach LOS |  | B | C |  | E |  |

| Intersection Summary |  |  |  |
|---|---|---|---|
| HCM 2000 Control Delay | 25.1 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.90 |  |  |
| Actuated Cycle Length (s) | 161.1 | Sum of lost time (s) | 10.5 |
| Intersection Capacity Utilization | 87.6% | ICU Level of Service | E |
| Analysis Period (min) | 15 |  |  |

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis
## 5: Vintage Way/Driveway Access & Rowland Blvd

08/07/2020

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | ↰ | ↑↑ | ↱↱ | ↰ | ↑↱ |  | ↰↰ | ↱ |  |  | ✥ |  |
| Traffic Volume (vph) | 32 | 743 | 1466 | 3 | 744 | 8 | 1312 | 23 | 5 | 12 | 7 | 4 |
| Future Volume (vph) | 32 | 743 | 1466 | 3 | 744 | 8 | 1312 | 23 | 5 | 12 | 7 | 4 |
| 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 | 3.0 | 4.0 |  | 3.0 | 3.0 |  |  | 3.0 |  |
| Lane Util. Factor | 1.00 | 0.95 | 0.88 | 1.00 | 0.95 |  | 0.97 | 1.00 |  |  | 1.00 |  |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 |  | 1.00 | 0.97 |  |  | 0.98 |  |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |  | 0.95 | 1.00 |  |  | 0.97 |  |
| Satd. Flow (prot) | 1770 | 3539 | 2787 | 1770 | 3534 |  | 3433 | 1815 |  |  | 1773 |  |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |  | 0.95 | 1.00 |  |  | 0.97 |  |
| Satd. Flow (perm) | 1770 | 3539 | 2787 | 1770 | 3534 |  | 3433 | 1815 |  |  | 1773 |  |
| 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) | 33 | 766 | 1511 | 3 | 767 | 8 | 1353 | 24 | 5 | 12 | 7 | 4 |
| RTOR Reduction (vph) | 0 | 0 | 267 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 4 | 0 |
| Lane Group Flow (vph) | 33 | 766 | 1244 | 3 | 774 | 0 | 1353 | 27 | 0 | 0 | 19 | 0 |
| Turn Type | Prot | NA | pm+ov | Prot | NA |  | Split | NA |  | Split | NA |  |
| Protected Phases | 5 | 2 | 3 | 1 | 6 |  | 3 | 3 |  | 4 | 4 |  |
| Permitted Phases |  |  | 2 |  |  |  |  |  |  |  |  |  |
| Actuated Green, G (s) | 4.1 | 23.7 | 80.5 | 1.9 | 21.5 |  | 56.8 | 56.8 |  |  | 2.4 |  |
| Effective Green, g (s) | 4.1 | 23.7 | 80.5 | 1.9 | 21.5 |  | 56.8 | 56.8 |  |  | 2.4 |  |
| Actuated g/C Ratio | 0.04 | 0.24 | 0.82 | 0.02 | 0.22 |  | 0.58 | 0.58 |  |  | 0.02 |  |
| Clearance Time (s) | 3.0 | 4.0 | 3.0 | 3.0 | 4.0 |  | 3.0 | 3.0 |  |  | 3.0 |  |
| Vehicle Extension (s) | 2.0 | 2.0 | 3.0 | 2.0 | 2.0 |  | 3.0 | 3.0 |  |  | 2.0 |  |
| Lane Grp Cap (vph) | 74 | 857 | 2294 | 34 | 776 |  | 1993 | 1054 |  |  | 43 |  |
| v/s Ratio Prot | c0.02 | 0.22 | 0.31 | 0.00 | c0.22 |  | c0.39 | 0.01 |  |  | c0.01 |  |
| v/s Ratio Perm |  |  | 0.13 |  |  |  |  |  |  |  |  |  |
| v/c Ratio | 0.45 | 0.89 | 0.54 | 0.09 | 1.00 |  | 0.68 | 0.03 |  |  | 0.44 |  |
| Uniform Delay, d1 | 45.7 | 35.8 | 2.8 | 47.1 | 38.1 |  | 14.2 | 8.7 |  |  | 47.0 |  |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |  | 1.00 | 1.00 |  |  | 1.00 |  |
| Incremental Delay, d2 | 1.6 | 11.4 | 0.3 | 0.4 | 31.5 |  | 0.9 | 0.0 |  |  | 2.6 |  |
| Delay (s) | 47.3 | 47.3 | 3.0 | 47.5 | 69.6 |  | 15.1 | 8.7 |  |  | 49.7 |  |
| Level of Service | D | D | A | D | E |  | B | A |  |  | D |  |
| Approach Delay (s) |  | 18.3 |  |  | 69.5 |  |  | 15.0 |  |  | 49.7 |  |
| Approach LOS |  | B |  |  | E |  |  | B |  |  | D |  |

| Intersection Summary |  |  |  |
|---|---|---|---|
| HCM 2000 Control Delay | 26.3 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.73 |  |  |
| Actuated Cycle Length (s) | 97.8 | Sum of lost time (s) | 13.0 |
| Intersection Capacity Utilization | 77.4% | ICU Level of Service | D |
| Analysis Period (min) | 15 |  |  |

c Critical Lane Group

# HCM Unsignalized Intersection Capacity Analysis
## 6: Rowland Blvd & Vintage Way

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | Y | | | ↰ | ↳ | |
| Sign Control | Stop | | | Stop | Stop | |
| Traffic Volume (vph) | 233 | 3 | 1 | 327 | 360 | 203 |
| Future Volume (vph) | 233 | 3 | 1 | 327 | 360 | 203 |
| Peak Hour Factor | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Hourly flow rate (vph) | 248 | 3 | 1 | 348 | 383 | 216 |

| Direction, Lane # | EB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total (vph) | 251 | 349 | 599 |
| Volume Left (vph) | 248 | 1 | 0 |
| Volume Right (vph) | 3 | 0 | 216 |
| Hadj (s) | 0.22 | 0.03 | -0.18 |
| Departure Headway (s) | 6.5 | 5.7 | 5.2 |
| Degree Utilization, x | 0.45 | 0.55 | 0.86 |
| Capacity (veh/h) | 524 | 599 | 688 |
| Control Delay (s) | 14.8 | 15.5 | 31.2 |
| Approach Delay (s) | 14.8 | 15.5 | 31.2 |
| Approach LOS | B | C | D |

| Intersection Summary | | | |
|---|---|---|---|
| Delay | 23.2 | | |
| Level of Service | C | | |
| Intersection Capacity Utilization | 51.1% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

# Appendix E Future plus Project Conditions Level-of-Service Worksheets

# HCM Signalized Intersection Capacity Analysis
## 1: Rowland Blvd & Redwood Blvd

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | ↰↰ | ↑ | ↱ | ↰ | ↑↱ | | ↰ | ↑↑ | ↱ | ↰ | ↑↑ | ↱ |
| Traffic Volume (vph) | 423 | 33 | 167 | 31 | 32 | 46 | 99 | 603 | 45 | 100 | 807 | 334 |
| Future Volume (vph) | 423 | 33 | 167 | 31 | 32 | 46 | 99 | 603 | 45 | 100 | 807 | 334 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 5.8 | 5.8 | 4.0 | 5.1 | | 4.0 | 5.1 | 5.1 | 4.0 | 5.1 | 5.1 |
| Lane Util. Factor | 0.97 | 1.00 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.91 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3433 | 1863 | 1583 | 1770 | 3228 | | 1770 | 3539 | 1583 | 1770 | 3539 | 1583 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3433 | 1863 | 1583 | 1770 | 3228 | | 1770 | 3539 | 1583 | 1770 | 3539 | 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) | 445 | 35 | 176 | 33 | 34 | 48 | 104 | 635 | 47 | 105 | 849 | 352 |
| RTOR Reduction (vph) | 0 | 0 | 133 | 0 | 42 | 0 | 0 | 0 | 30 | 0 | 0 | 190 |
| Lane Group Flow (vph) | 445 | 35 | 43 | 33 | 40 | 0 | 104 | 635 | 17 | 105 | 849 | 162 |
| Turn Type | Prot | NA | Perm | Prot | NA | | Prot | NA | Perm | Prot | NA | Perm |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | 4 | | | | | | 2 | | | 6 |
| Actuated Green, G (s) | 18.6 | 23.7 | 23.7 | 5.9 | 11.7 | | 12.9 | 36.2 | 36.2 | 12.9 | 36.2 | 36.2 |
| Effective Green, g (s) | 18.6 | 23.7 | 23.7 | 5.9 | 11.7 | | 12.9 | 36.2 | 36.2 | 12.9 | 36.2 | 36.2 |
| Actuated g/C Ratio | 0.19 | 0.24 | 0.24 | 0.06 | 0.12 | | 0.13 | 0.37 | 0.37 | 0.13 | 0.37 | 0.37 |
| Clearance Time (s) | 4.0 | 5.8 | 5.8 | 4.0 | 5.1 | | 4.0 | 5.1 | 5.1 | 4.0 | 5.1 | 5.1 |
| Vehicle Extension (s) | 2.5 | 2.5 | 2.5 | 2.0 | 2.5 | | 2.0 | 4.0 | 4.0 | 2.0 | 4.0 | 4.0 |
| Lane Grp Cap (vph) | 654 | 452 | 384 | 106 | 386 | | 233 | 1312 | 587 | 233 | 1312 | 587 |
| v/s Ratio Prot | c0.13 | 0.02 | | 0.02 | 0.01 | | 0.06 | 0.18 | | c0.06 | c0.24 | |
| v/s Ratio Perm | | | c0.03 | | | | | | 0.01 | | | 0.10 |
| v/c Ratio | 0.68 | 0.08 | 0.11 | 0.31 | 0.10 | | 0.45 | 0.48 | 0.03 | 0.45 | 0.65 | 0.28 |
| Uniform Delay, d1 | 36.7 | 28.5 | 28.8 | 43.9 | 38.3 | | 39.1 | 23.5 | 19.5 | 39.1 | 25.4 | 21.5 |
| 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 | 2.7 | 0.1 | 0.1 | 0.6 | 0.1 | | 0.5 | 0.4 | 0.0 | 0.5 | 1.2 | 0.4 |
| Delay (s) | 39.4 | 28.6 | 28.8 | 44.5 | 38.4 | | 39.6 | 23.9 | 19.6 | 39.6 | 26.7 | 21.9 |
| Level of Service | D | C | C | D | D | | D | C | B | D | C | C |
| Approach Delay (s) | | 36.0 | | | 40.1 | | | 25.7 | | | 26.4 | |
| Approach LOS | | D | | | D | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 29.0 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.55 | | |
| Actuated Cycle Length (s) | 97.6 | Sum of lost time (s) | 18.9 |
| Intersection Capacity Utilization | 62.6% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

# 2: Rowland Blvd & Redwood Hwy (SB)

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | ↰ | ↰↑↱ | | | | | | ↑↱ | ↱ | ↰↰ | ↑↑ | |
| Traffic Volume (vph) | 435 | 6 | 108 | 0 | 0 | 0 | 0 | 611 | 529 | 952 | 1124 | 0 |
| Future Volume (vph) | 435 | 6 | 108 | 0 | 0 | 0 | 0 | 611 | 529 | 952 | 1124 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | | | | | | 4.0 | 4.0 | 3.0 | 4.0 | |
| Lane Util. Factor | 0.91 | 0.91 | | | | | | 0.91 | 0.91 | 0.97 | 0.95 | |
| Frt | 1.00 | 0.95 | | | | | | 0.97 | 0.85 | 1.00 | 1.00 | |
| Flt Protected | 0.95 | 0.97 | | | | | | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1610 | 3122 | | | | | | 3275 | 1441 | 3433 | 3539 | |
| Flt Permitted | 0.95 | 0.97 | | | | | | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1610 | 3122 | | | | | | 3275 | 1441 | 3433 | 3539 | |
| 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) | 458 | 6 | 114 | 0 | 0 | 0 | 0 | 643 | 557 | 1002 | 1183 | 0 |
| RTOR Reduction (vph) | 0 | 51 | 0 | 0 | 0 | 0 | 0 | 18 | 220 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 229 | 298 | 0 | 0 | 0 | 0 | 0 | 814 | 148 | 1002 | 1183 | 0 |
| Turn Type | Split | NA | | | | | | NA | Perm | Prot | NA | |
| Protected Phases | 4 | 4 | | | | | | 2 | | 1 | 6 | |
| Permitted Phases | | | | | | | | | 2 | | | |
| Actuated Green, G (s) | 23.2 | 23.2 | | | | | | 48.4 | 48.4 | 38.4 | 89.8 | |
| Effective Green, g (s) | 23.2 | 23.2 | | | | | | 48.4 | 48.4 | 38.4 | 89.8 | |
| Actuated g/C Ratio | 0.19 | 0.19 | | | | | | 0.40 | 0.40 | 0.32 | 0.75 | |
| Clearance Time (s) | 3.0 | 3.0 | | | | | | 4.0 | 4.0 | 3.0 | 4.0 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | | | | | 4.0 | 4.0 | 2.0 | 2.5 | |
| Lane Grp Cap (vph) | 311 | 603 | | | | | | 1320 | 581 | 1098 | 2648 | |
| v/s Ratio Prot | c0.14 | 0.10 | | | | | | c0.25 | | c0.29 | 0.33 | |
| v/s Ratio Perm | | | | | | | | | 0.10 | | | |
| v/c Ratio | 0.74 | 0.49 | | | | | | 0.62 | 0.26 | 0.91 | 0.45 | |
| Uniform Delay, d1 | 45.5 | 43.2 | | | | | | 28.4 | 23.8 | 39.2 | 5.7 | |
| Progression Factor | 1.00 | 1.00 | | | | | | 1.00 | 1.00 | 0.80 | 1.04 | |
| Incremental Delay, d2 | 7.6 | 0.2 | | | | | | 2.2 | 1.1 | 10.2 | 0.5 | |
| Delay (s) | 53.1 | 43.4 | | | | | | 30.6 | 24.9 | 41.6 | 6.4 | |
| Level of Service | D | D | | | | | | C | C | D | A | |
| Approach Delay (s) | | 47.3 | | | 0.0 | | | 28.8 | | | 22.6 | |
| Approach LOS | | D | | | A | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 28.1 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.74 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 10.0 |
| Intersection Capacity Utilization | 71.7% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis
## 3: Redwood Hwy (NB) & Rowland Blvd

08/07/2020

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | ↰ | ↑↑ | | | ↑↑↑ | ↱ | ↰ | ↰ | ↱↱ | | ✥ | |
| Traffic Volume (vph) | 48 | 989 | 0 | 0 | 1451 | 639 | 593 | 12 | 1002 | 0 | 0 | 0 |
| Future Volume (vph) | 48 | 989 | 0 | 0 | 1451 | 639 | 593 | 12 | 1002 | 0 | 0 | 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 | 4.0 | 3.5 | 3.5 | 3.0 | | | |
| Lane Util. Factor | 1.00 | 0.95 | | | 0.91 | 1.00 | 0.95 | 0.95 | 0.88 | | | |
| Frt | 1.00 | 1.00 | | | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | | | |
| Flt Protected | 0.95 | 1.00 | | | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | | | |
| Satd. Flow (prot) | 1770 | 3539 | | | 5085 | 1583 | 1681 | 1689 | 2787 | | | |
| Flt Permitted | 0.95 | 1.00 | | | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | | | |
| Satd. Flow (perm) | 1770 | 3539 | | | 5085 | 1583 | 1681 | 1689 | 2787 | | | |
| 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) | 50 | 1030 | 0 | 0 | 1511 | 666 | 618 | 12 | 1044 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 229 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 50 | 1030 | 0 | 0 | 1511 | 437 | 315 | 316 | 1044 | 0 | 0 | 0 |
| Turn Type | Prot | NA | | | NA | Perm | Split | NA | custom | | | |
| Protected Phases | 5 | 2 | | | 6 | | 8 | 8 | 1 | 7 | 7 | |
| Permitted Phases | | | | | | 6 | | | 8 | | | |
| Actuated Green, G (s) | 6.9 | 70.2 | | | 74.6 | 74.6 | 28.0 | 28.0 | 39.3 | | | |
| Effective Green, g (s) | 6.9 | 70.2 | | | 74.6 | 74.6 | 28.0 | 28.0 | 39.3 | | | |
| Actuated g/C Ratio | 0.06 | 0.59 | | | 0.62 | 0.62 | 0.23 | 0.23 | 0.33 | | | |
| Clearance Time (s) | 3.0 | 4.0 | | | 4.0 | 4.0 | 3.5 | 3.5 | 3.0 | | | |
| Vehicle Extension (s) | 2.0 | 2.0 | | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | | | |
| Lane Grp Cap (vph) | 101 | 2070 | | | 3161 | 984 | 392 | 394 | 912 | | | |
| v/s Ratio Prot | 0.03 | c0.29 | | | 0.30 | | 0.19 | 0.19 | c0.11 | | | |
| v/s Ratio Perm | | | | | | 0.28 | | | 0.27 | | | |
| v/c Ratio | 0.50 | 0.50 | | | 0.48 | 0.44 | 0.80 | 0.80 | 1.14 | | | |
| Uniform Delay, d1 | 54.9 | 14.6 | | | 12.2 | 11.9 | 43.4 | 43.4 | 40.4 | | | |
| Progression Factor | 0.93 | 1.47 | | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | |
| Incremental Delay, d2 | 1.2 | 0.7 | | | 0.5 | 1.5 | 10.7 | 10.6 | 78.1 | | | |
| Delay (s) | 52.1 | 22.2 | | | 12.7 | 13.3 | 54.1 | 54.0 | 118.5 | | | |
| Level of Service | D | C | | | B | B | D | D | F | | | |
| Approach Delay (s) | | 23.6 | | | 12.9 | | | 94.2 | | | 0.0 | |
| Approach LOS | | C | | | B | | | F | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 42.9 | 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 | 69.6% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis
## 4: Rowland Blvd & Rowland Way

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | ↰↰ | ↑↑↑ | ↑↱ |  | ↰↱ | ↱ |
| Traffic Volume (vph) | 228 | 1745 | 1712 | 38 | 74 | 406 |
| Future Volume (vph) | 228 | 1745 | 1712 | 38 | 74 | 406 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.0 | 4.0 |  | 3.0 | 3.0 |
| Lane Util. Factor | 0.97 | 0.91 | 0.95 |  | 1.00 | 0.95 |
| Frt | 1.00 | 1.00 | 1.00 |  | 0.90 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 |  | 0.99 | 1.00 |
| Satd. Flow (prot) | 3433 | 5085 | 3528 |  | 1643 | 1504 |
| Flt Permitted | 0.95 | 1.00 | 1.00 |  | 0.99 | 1.00 |
| Satd. Flow (perm) | 3433 | 5085 | 3528 |  | 1643 | 1504 |
| Peak-hour factor, PHF | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| Adj. Flow (vph) | 245 | 1876 | 1841 | 41 | 80 | 437 |
| RTOR Reduction (vph) | 0 | 0 | 1 | 0 | 46 | 209 |
| Lane Group Flow (vph) | 245 | 1876 | 1881 | 0 | 218 | 44 |
| Turn Type | Prot | NA | NA |  | Prot | Prot |
| Protected Phases | 5 | 2 | 6 |  | 4 | 4 |
| Permitted Phases |  |  |  |  |  |  |
| Actuated Green, G (s) | 15.6 | 118.0 | 98.9 |  | 24.0 | 24.0 |
| Effective Green, g (s) | 15.6 | 118.0 | 98.9 |  | 24.0 | 24.0 |
| Actuated g/C Ratio | 0.10 | 0.79 | 0.66 |  | 0.16 | 0.16 |
| Clearance Time (s) | 3.5 | 4.0 | 4.0 |  | 3.0 | 3.0 |
| Vehicle Extension (s) | 2.0 | 4.0 | 4.0 |  | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 359 | 4027 | 2341 |  | 264 | 242 |
| v/s Ratio Prot | c0.07 | 0.37 | c0.53 |  | c0.13 | 0.03 |
| v/s Ratio Perm |  |  |  |  |  |  |
| v/c Ratio | 0.68 | 0.47 | 0.80 |  | 0.83 | 0.18 |
| Uniform Delay, d1 | 64.3 | 5.1 | 18.1 |  | 60.5 | 54.0 |
| Progression Factor | 1.00 | 1.00 | 1.00 |  | 1.00 | 1.00 |
| Incremental Delay, d2 | 4.2 | 0.1 | 2.2 |  | 17.8 | 0.1 |
| Delay (s) | 68.5 | 5.2 | 20.3 |  | 78.2 | 54.2 |
| Level of Service | E | A | C |  | E | D |
| Approach Delay (s) |  | 12.5 | 20.3 |  | 66.4 |  |
| Approach LOS |  | B | C |  | E |  |

| Intersection Summary |  |  |  |
|---|---|---|---|
| HCM 2000 Control Delay | 21.9 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.79 |  |  |
| Actuated Cycle Length (s) | 149.0 | Sum of lost time (s) | 10.5 |
| Intersection Capacity Utilization | 77.5% | ICU Level of Service | D |
| Analysis Period (min) | 15 |  |  |

c Critical Lane Group

## 5: Vintage Way/Driveway Access & Rowland Blvd

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | ↰ | ↑↑ | ↱↱ | ↰ | ↑↱ | | ↰↰ | ↱ | | | ✣ | |
| Traffic Volume (vph) | 19 | 775 | 1006 | 2 | 1156 | 11 | 606 | 20 | 0 | 4 | 4 | 2 |
| Future Volume (vph) | 19 | 775 | 1006 | 2 | 1156 | 11 | 606 | 20 | 0 | 4 | 4 | 2 |
| 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 | 3.0 | 4.0 | | 3.0 | 3.0 | | | 3.0 | |
| Lane Util. Factor | 1.00 | 0.95 | 0.88 | 1.00 | 0.95 | | 0.97 | 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 | | | 0.98 | |
| Satd. Flow (prot) | 1770 | 3539 | 2787 | 1770 | 3534 | | 3433 | 1863 | | | 1777 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | | 0.98 | |
| Satd. Flow (perm) | 1770 | 3539 | 2787 | 1770 | 3534 | | 3433 | 1863 | | | 1777 | |
| 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) | 20 | 799 | 1037 | 2 | 1192 | 11 | 625 | 21 | 0 | 4 | 4 | 2 |
| RTOR Reduction (vph) | 0 | 0 | 228 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| Lane Group Flow (vph) | 20 | 799 | 809 | 2 | 1202 | 0 | 625 | 21 | 0 | 0 | 8 | 0 |
| Turn Type | Prot | NA | pm+ov | Prot | NA | | Split | NA | | Split | NA | |
| Protected Phases | 5 | 2 | 3 | 1 | 6 | | 3 | 3 | | 4 | 4 | |
| Permitted Phases | | | 2 | | | | | | | | | |
| Actuated Green, G (s) | 0.9 | 21.5 | 53.2 | 1.3 | 21.9 | | 31.7 | 31.7 | | | 0.7 | |
| Effective Green, g (s) | 0.9 | 21.5 | 53.2 | 1.3 | 21.9 | | 31.7 | 31.7 | | | 0.7 | |
| Actuated g/C Ratio | 0.01 | 0.32 | 0.78 | 0.02 | 0.32 | | 0.46 | 0.46 | | | 0.01 | |
| Clearance Time (s) | 3.0 | 4.0 | 3.0 | 3.0 | 4.0 | | 3.0 | 3.0 | | | 3.0 | |
| Vehicle Extension (s) | 2.0 | 2.0 | 3.0 | 2.0 | 2.0 | | 3.0 | 3.0 | | | 2.0 | |
| Lane Grp Cap (vph) | 23 | 1115 | 2174 | 33 | 1134 | | 1595 | 865 | | | 18 | |
| v/s Ratio Prot | c0.01 | 0.23 | 0.17 | 0.00 | c0.34 | | c0.18 | 0.01 | | | c0.00 | |
| v/s Ratio Perm | | | 0.12 | | | | | | | | | |
| v/c Ratio | 0.87 | 0.72 | 0.37 | 0.06 | 1.06 | | 0.39 | 0.02 | | | 0.45 | |
| Uniform Delay, d1 | 33.6 | 20.7 | 2.3 | 32.9 | 23.2 | | 11.9 | 9.9 | | | 33.6 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | | 1.00 | |
| Incremental Delay, d2 | 124.8 | 1.9 | 0.1 | 0.3 | 44.2 | | 0.2 | 0.0 | | | 6.3 | |
| Delay (s) | 158.4 | 22.5 | 2.4 | 33.1 | 67.4 | | 12.1 | 9.9 | | | 39.8 | |
| Level of Service | F | C | A | C | E | | B | A | | | D | |
| Approach Delay (s) | | 12.8 | | | 67.3 | | | 12.0 | | | 39.8 | |
| Approach LOS | | B | | | E | | | B | | | 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) | 68.2 | Sum of lost time (s) | 13.0 |
| Intersection Capacity Utilization | 62.9% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

# HCM Unsignalized Intersection Capacity Analysis
## 6: Rowland Blvd & Vintage Way

08/07/2020

| | ↗ | ↘ | ↖ | ↑ | ↓ | ↙ |
|---|---|---|---|---|---|---|
| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
| Lane Configurations | Y | | | ↰ | ↱ | |
| Sign Control | Stop | | | Stop | Stop | |
| Traffic Volume (vph) | 479 | 3 | 3 | 199 | 377 | 277 |
| Future Volume (vph) | 479 | 3 | 3 | 199 | 377 | 277 |
| Peak Hour Factor | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Hourly flow rate (vph) | 510 | 3 | 3 | 212 | 401 | 295 |

| Direction, Lane # | EB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total (vph) | 513 | 215 | 696 |
| Volume Left (vph) | 510 | 3 | 0 |
| Volume Right (vph) | 3 | 0 | 295 |
| Hadj (s) | 0.23 | 0.04 | -0.22 |
| Departure Headway (s) | 6.5 | 6.9 | 6.0 |
| Degree Utilization, x | 0.93 | 0.41 | 1.16 |
| Capacity (veh/h) | 550 | 509 | 594 |
| Control Delay (s) | 47.5 | 14.6 | 111.3 |
| Approach Delay (s) | 47.5 | 14.6 | 111.3 |
| Approach LOS | E | B | F |

| Intersection Summary | | | |
|---|---|---|---|
| Delay | 73.7 | | |
| Level of Service | F | | |
| Intersection Capacity Utilization | 70.1% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

# HCM Signalized Intersection Capacity Analysis
## 1: Rowland Blvd & Redwood Blvd

08/07/2020

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | ↰↰ | ↑ | ↱ | ↰ | ↑↱ | | ↰ | ↑↑ | ↱ | ↰ | ↑↑ | ↱ |
| Traffic Volume (vph) | 421 | 32 | 129 | 18 | 32 | 76 | 99 | 702 | 31 | 61 | 567 | 320 |
| Future Volume (vph) | 421 | 32 | 129 | 18 | 32 | 76 | 99 | 702 | 31 | 61 | 567 | 320 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 5.8 | 5.8 | 4.0 | 5.1 | | 4.0 | 5.1 | 5.1 | 4.0 | 5.1 | 5.1 |
| Lane Util. Factor | 0.97 | 1.00 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.89 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3433 | 1863 | 1583 | 1770 | 3167 | | 1770 | 3539 | 1583 | 1770 | 3539 | 1583 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3433 | 1863 | 1583 | 1770 | 3167 | | 1770 | 3539 | 1583 | 1770 | 3539 | 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) | 443 | 34 | 136 | 19 | 34 | 80 | 104 | 739 | 33 | 64 | 597 | 337 |
| RTOR Reduction (vph) | 0 | 0 | 92 | 0 | 66 | 0 | 0 | 0 | 22 | 0 | 0 | 234 |
| Lane Group Flow (vph) | 443 | 34 | 44 | 19 | 48 | 0 | 104 | 739 | 11 | 64 | 597 | 103 |
| Turn Type | Prot | NA | Perm | Prot | NA | | Prot | NA | Perm | Prot | NA | Perm |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | 4 | | | | | | 2 | | | 6 |
| Actuated Green, G (s) | 18.0 | 30.5 | 30.5 | 3.7 | 16.9 | | 12.7 | 32.5 | 32.5 | 9.1 | 28.9 | 28.9 |
| Effective Green, g (s) | 18.0 | 30.5 | 30.5 | 3.7 | 16.9 | | 12.7 | 32.5 | 32.5 | 9.1 | 28.9 | 28.9 |
| Actuated g/C Ratio | 0.19 | 0.32 | 0.32 | 0.04 | 0.18 | | 0.13 | 0.34 | 0.34 | 0.10 | 0.31 | 0.31 |
| Clearance Time (s) | 4.0 | 5.8 | 5.8 | 4.0 | 5.1 | | 4.0 | 5.1 | 5.1 | 4.0 | 5.1 | 5.1 |
| Vehicle Extension (s) | 2.5 | 2.5 | 2.5 | 2.0 | 2.5 | | 2.0 | 4.0 | 4.0 | 2.0 | 4.0 | 4.0 |
| Lane Grp Cap (vph) | 652 | 600 | 509 | 69 | 565 | | 237 | 1214 | 543 | 170 | 1080 | 483 |
| v/s Ratio Prot | c0.13 | 0.02 | | 0.01 | 0.02 | | c0.06 | c0.21 | | 0.04 | 0.17 | |
| v/s Ratio Perm | | | c0.03 | | | | | | 0.01 | | | 0.06 |
| v/c Ratio | 0.68 | 0.06 | 0.09 | 0.28 | 0.09 | | 0.44 | 0.61 | 0.02 | 0.38 | 0.55 | 0.21 |
| Uniform Delay, d1 | 35.7 | 22.2 | 22.4 | 44.2 | 32.5 | | 37.7 | 25.8 | 20.6 | 40.1 | 27.5 | 24.4 |
| 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 | 2.6 | 0.0 | 0.1 | 0.8 | 0.0 | | 0.5 | 1.0 | 0.0 | 0.5 | 0.8 | 0.3 |
| Delay (s) | 38.2 | 22.2 | 22.4 | 45.0 | 32.5 | | 38.2 | 26.8 | 20.6 | 40.6 | 28.3 | 24.8 |
| Level of Service | D | C | C | D | C | | D | C | C | D | C | C |
| Approach Delay (s) | | 33.8 | | | 34.3 | | | 27.9 | | | 27.9 | |
| 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 | 0.50 | | |
| Actuated Cycle Length (s) | 94.7 | Sum of lost time (s) | 18.9 |
| Intersection Capacity Utilization | 59.7% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis
## 2: Rowland Blvd & Redwood Hwy (SB)

08/07/2020

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | ↰ | ↰↑↱ | | | | | | ↑↱ | ↱ | ↰↰ | ↑↑ | |
| Traffic Volume (vph) | 581 | 4 | 66 | 0 | 0 | 0 | 0 | 725 | 470 | 1182 | 964 | 0 |
| Future Volume (vph) | 581 | 4 | 66 | 0 | 0 | 0 | 0 | 725 | 470 | 1182 | 964 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | | | | | | 4.0 | 4.0 | 3.0 | 4.0 | |
| Lane Util. Factor | 0.91 | 0.91 | | | | | | 0.91 | 0.91 | 0.97 | 0.95 | |
| Frt | 1.00 | 0.97 | | | | | | 0.98 | 0.85 | 1.00 | 1.00 | |
| Flt Protected | 0.95 | 0.96 | | | | | | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1610 | 3170 | | | | | | 3324 | 1441 | 3433 | 3539 | |
| Flt Permitted | 0.95 | 0.96 | | | | | | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1610 | 3170 | | | | | | 3324 | 1441 | 3433 | 3539 | |
| 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) | 612 | 4 | 69 | 0 | 0 | 0 | 0 | 763 | 495 | 1244 | 1015 | 0 |
| RTOR Reduction (vph) | 0 | 16 | 0 | 0 | 0 | 0 | 0 | 9 | 267 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 306 | 363 | 0 | 0 | 0 | 0 | 0 | 868 | 114 | 1244 | 1015 | 0 |
| Turn Type | Split | NA | | | | | | NA | Perm | Prot | NA | |
| Protected Phases | 4 | 4 | | | | | | 2 | | 1 | 6 | |
| Permitted Phases | | | | | | | | | 2 | | | |
| Actuated Green, G (s) | 27.9 | 27.9 | | | | | | 35.8 | 35.8 | 46.3 | 85.1 | |
| Effective Green, g (s) | 27.9 | 27.9 | | | | | | 35.8 | 35.8 | 46.3 | 85.1 | |
| Actuated g/C Ratio | 0.23 | 0.23 | | | | | | 0.30 | 0.30 | 0.39 | 0.71 | |
| Clearance Time (s) | 3.0 | 3.0 | | | | | | 4.0 | 4.0 | 3.0 | 4.0 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | | | | | 4.0 | 4.0 | 2.0 | 2.5 | |
| Lane Grp Cap (vph) | 374 | 737 | | | | | | 991 | 429 | 1324 | 2509 | |
| v/s Ratio Prot | c0.19 | 0.11 | | | | | | c0.26 | | c0.36 | 0.29 | |
| v/s Ratio Perm | | | | | | | | | 0.08 | | | |
| v/c Ratio | 0.82 | 0.49 | | | | | | 0.88 | 0.26 | 0.94 | 0.40 | |
| Uniform Delay, d1 | 43.6 | 39.9 | | | | | | 40.0 | 32.1 | 35.5 | 7.1 | |
| Progression Factor | 1.00 | 1.00 | | | | | | 1.00 | 1.00 | 0.96 | 1.30 | |
| Incremental Delay, d2 | 12.4 | 0.2 | | | | | | 10.7 | 1.5 | 11.8 | 0.4 | |
| Delay (s) | 56.0 | 40.1 | | | | | | 50.7 | 33.6 | 45.7 | 9.7 | |
| Level of Service | E | D | | | | | | D | C | D | A | |
| Approach Delay (s) | | 47.2 | | | 0.0 | | | 45.5 | | | 29.6 | |
| Approach LOS | | D | | | A | | | D | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 37.2 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.89 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 10.0 |
| Intersection Capacity Utilization | 84.9% | 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) | 57 | 1158 | 0 | 0 | 1674 | 589 | 354 | 6 | 1394 | 0 | 0 | 0 |
| Future Volume (vph) | 57 | 1158 | 0 | 0 | 1674 | 589 | 354 | 6 | 1394 | 0 | 0 | 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 | 4.0 | 3.5 | 3.5 | 3.0 | | | |
| Lane Util. Factor | 1.00 | 0.95 | | | 0.91 | 1.00 | 0.95 | 0.95 | 0.88 | | | |
| Frt | 1.00 | 1.00 | | | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | | | |
| Flt Protected | 0.95 | 1.00 | | | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | | | |
| Satd. Flow (prot) | 1770 | 3539 | | | 5085 | 1583 | 1681 | 1688 | 2787 | | | |
| Flt Permitted | 0.95 | 1.00 | | | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | | | |
| Satd. Flow (perm) | 1770 | 3539 | | | 5085 | 1583 | 1681 | 1688 | 2787 | | | |
| 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) | 59 | 1206 | 0 | 0 | 1744 | 614 | 369 | 6 | 1452 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 157 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 59 | 1206 | 0 | 0 | 1744 | 457 | 188 | 187 | 1452 | 0 | 0 | 0 |
| Turn Type | Prot | NA | | | NA | Perm | Split | NA | custom | | | |
| Protected Phases | 5 | 2 | | | 6 | | 8 | 8 | 1 | 7 | 7 | |
| Permitted Phases | | | | | | 6 | | | 8 | | | |
| Actuated Green, G (s) | 7.4 | 42.0 | | | 81.5 | 81.5 | 20.6 | 20.6 | 67.5 | | | |
| Effective Green, g (s) | 7.4 | 42.0 | | | 81.5 | 81.5 | 20.6 | 20.6 | 67.5 | | | |
| Actuated g/C Ratio | 0.06 | 0.35 | | | 0.68 | 0.68 | 0.17 | 0.17 | 0.56 | | | |
| Clearance Time (s) | 3.0 | 4.0 | | | 4.0 | 4.0 | 3.5 | 3.5 | 3.0 | | | |
| Vehicle Extension (s) | 2.0 | 2.0 | | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | | | |
| Lane Grp Cap (vph) | 109 | 1238 | | | 3453 | 1075 | 288 | 289 | 1567 | | | |
| v/s Ratio Prot | 0.03 | c0.34 | | | 0.34 | | 0.11 | 0.11 | c0.36 | | | |
| v/s Ratio Perm | | | | | | 0.29 | | | 0.16 | | | |
| v/c Ratio | 0.54 | 0.97 | | | 0.51 | 0.43 | 0.65 | 0.65 | 0.93 | | | |
| Uniform Delay, d1 | 54.7 | 38.5 | | | 9.4 | 8.7 | 46.4 | 46.3 | 24.0 | | | |
| Progression Factor | 1.31 | 0.49 | | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | |
| Incremental Delay, d2 | 2.0 | 15.9 | | | 0.5 | 1.2 | 4.0 | 3.7 | 9.6 | | | |
| Delay (s) | 73.7 | 34.9 | | | 9.9 | 9.9 | 50.4 | 50.0 | 33.6 | | | |
| Level of Service | E | C | | | A | A | D | D | C | | | |
| Approach Delay (s) | | 36.8 | | | 9.9 | | | 37.0 | | | 0.0 | |
| Approach LOS | | D | | | A | | | D | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 25.2 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.98 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 14.0 |
| Intersection Capacity Utilization | 87.4% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
## 4: Rowland Blvd & Rowland Way

08/07/2020

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | ↰↰ | ↑↑↑ | ↑↱ | | Y | ↱ |
| Traffic Volume (vph) | 310 | 2344 | 2169 | 92 | 95 | 262 |
| Future Volume (vph) | 310 | 2344 | 2169 | 92 | 95 | 262 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.5 | 4.0 | 4.0 | | 3.0 | 3.0 |
| Lane Util. Factor | 0.97 | 0.91 | 0.95 | | 1.00 | 0.95 |
| Frt | 1.00 | 1.00 | 0.99 | | 0.93 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | | 0.97 | 1.00 |
| Satd. Flow (prot) | 3433 | 5085 | 3518 | | 1684 | 1504 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | | 0.97 | 1.00 |
| Satd. Flow (perm) | 3433 | 5085 | 3518 | | 1684 | 1504 |
| Peak-hour factor, PHF | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| Adj. Flow (vph) | 333 | 2520 | 2332 | 99 | 102 | 282 |
| RTOR Reduction (vph) | 0 | 0 | 2 | 0 | 20 | 162 |
| Lane Group Flow (vph) | 333 | 2520 | 2429 | 0 | 178 | 24 |
| Turn Type | Prot | NA | NA | | Prot | Prot |
| Protected Phases | 5 | 2 | 6 | | 4 | 4 |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | 20.0 | 133.9 | 110.4 | | 20.7 | 20.7 |
| Effective Green, g (s) | 20.0 | 133.9 | 110.4 | | 20.7 | 20.7 |
| Actuated g/C Ratio | 0.12 | 0.83 | 0.68 | | 0.13 | 0.13 |
| Clearance Time (s) | 3.5 | 4.0 | 4.0 | | 3.0 | 3.0 |
| Vehicle Extension (s) | 2.0 | 4.0 | 4.0 | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | 424 | 4213 | 2403 | | 215 | 192 |
| v/s Ratio Prot | c0.10 | 0.50 | c0.69 | | c0.11 | 0.02 |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | 0.79 | 0.60 | 1.01 | | 0.83 | 0.12 |
| Uniform Delay, d1 | 68.7 | 4.7 | 25.6 | | 68.7 | 62.4 |
| Progression Factor | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 8.6 | 0.3 | 21.1 | | 21.3 | 0.1 |
| Delay (s) | 77.3 | 5.0 | 46.7 | | 90.0 | 62.5 |
| Level of Service | E | A | D | | F | E |
| Approach Delay (s) | | 13.4 | 46.7 | | 76.7 | |
| Approach LOS | | B | D | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 32.0 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.96 | | |
| Actuated Cycle Length (s) | 161.6 | Sum of lost time (s) | 10.5 |
| Intersection Capacity Utilization | 92.3% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |

c  Critical Lane Group

# HCM Signalized Intersection Capacity Analysis
## 5: Vintage Way/Driveway Access & Rowland Blvd

08/07/2020

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | ↰ | ↑↑ | ↱↱ | ↰ | ↑↱ |  | ↰↰ | ↱ |  |  | ✥ |  |
| Traffic Volume (vph) | 32 | 900 | 1466 | 3 | 934 | 8 | 1279 | 23 | 5 | 12 | 7 | 4 |
| Future Volume (vph) | 32 | 900 | 1466 | 3 | 934 | 8 | 1279 | 23 | 5 | 12 | 7 | 4 |
| 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 | 3.0 | 4.0 |  | 3.0 | 3.0 |  |  | 3.0 |  |
| Lane Util. Factor | 1.00 | 0.95 | 0.88 | 1.00 | 0.95 |  | 0.97 | 1.00 |  |  | 1.00 |  |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 |  | 1.00 | 0.97 |  |  | 0.98 |  |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |  | 0.95 | 1.00 |  |  | 0.97 |  |
| Satd. Flow (prot) | 1770 | 3539 | 2787 | 1770 | 3535 |  | 3433 | 1815 |  |  | 1773 |  |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |  | 0.95 | 1.00 |  |  | 0.97 |  |
| Satd. Flow (perm) | 1770 | 3539 | 2787 | 1770 | 3535 |  | 3433 | 1815 |  |  | 1773 |  |
| 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) | 33 | 928 | 1511 | 3 | 963 | 8 | 1319 | 24 | 5 | 12 | 7 | 4 |
| RTOR Reduction (vph) | 0 | 0 | 267 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 4 | 0 |
| Lane Group Flow (vph) | 33 | 928 | 1244 | 3 | 970 | 0 | 1319 | 27 | 0 | 0 | 19 | 0 |
| Turn Type | Prot | NA | pm+ov | Prot | NA |  | Split | NA |  | Split | NA |  |
| Protected Phases | 5 | 2 | 3 | 1 | 6 |  | 3 | 3 |  | 4 | 4 |  |
| Permitted Phases |  |  | 2 |  |  |  |  |  |  |  |  |  |
| Actuated Green, G (s) | 4.1 | 23.7 | 80.5 | 1.9 | 21.5 |  | 56.8 | 56.8 |  |  | 2.4 |  |
| Effective Green, g (s) | 4.1 | 23.7 | 80.5 | 1.9 | 21.5 |  | 56.8 | 56.8 |  |  | 2.4 |  |
| Actuated g/C Ratio | 0.04 | 0.24 | 0.82 | 0.02 | 0.22 |  | 0.58 | 0.58 |  |  | 0.02 |  |
| Clearance Time (s) | 3.0 | 4.0 | 3.0 | 3.0 | 4.0 |  | 3.0 | 3.0 |  |  | 3.0 |  |
| Vehicle Extension (s) | 2.0 | 2.0 | 3.0 | 2.0 | 2.0 |  | 3.0 | 3.0 |  |  | 2.0 |  |
| Lane Grp Cap (vph) | 74 | 857 | 2294 | 34 | 777 |  | 1993 | 1054 |  |  | 43 |  |
| v/s Ratio Prot | c0.02 | 0.26 | 0.31 | 0.00 | c0.27 |  | c0.38 | 0.01 |  |  | c0.01 |  |
| v/s Ratio Perm |  |  | 0.13 |  |  |  |  |  |  |  |  |  |
| v/c Ratio | 0.45 | 1.08 | 0.54 | 0.09 | 1.25 |  | 0.66 | 0.03 |  |  | 0.44 |  |
| Uniform Delay, d1 | 45.7 | 37.0 | 2.8 | 47.1 | 38.1 |  | 14.0 | 8.7 |  |  | 47.0 |  |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |  | 1.00 | 1.00 |  |  | 1.00 |  |
| Incremental Delay, d2 | 1.6 | 55.7 | 0.3 | 0.4 | 122.5 |  | 0.8 | 0.0 |  |  | 2.6 |  |
| Delay (s) | 47.3 | 92.7 | 3.0 | 47.5 | 160.7 |  | 14.8 | 8.7 |  |  | 49.7 |  |
| Level of Service | D | F | A | D | F |  | B | A |  |  | D |  |
| Approach Delay (s) |  | 37.3 |  |  | 160.3 |  |  | 14.7 |  |  | 49.7 |  |
| Approach LOS |  | D |  |  | F |  |  | B |  |  | D |  |

| Intersection Summary |  |  |  |
|---|---|---|---|
| HCM 2000 Control Delay | 55.9 | HCM 2000 Level of Service | E |
| HCM 2000 Volume to Capacity ratio | 0.78 |  |  |
| Actuated Cycle Length (s) | 97.8 | Sum of lost time (s) | 13.0 |
| Intersection Capacity Utilization | 76.4% | ICU Level of Service | D |
| Analysis Period (min) | 15 |  |  |

c Critical Lane Group

# HCM Unsignalized Intersection Capacity Analysis
## 6: Rowland Blvd & Vintage Way

08/07/2020

| | ↗ | ↘ | ↖ | ↑ | ↓ | ↙ |
|---|---|---|---|---|---|---|
| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
| Lane Configurations | Y | | | ↰ | ↱ | |
| Sign Control | Stop | | | Stop | Stop | |
| Traffic Volume (vph) | 423 | 3 | 1 | 327 | 360 | 360 |
| Future Volume (vph) | 423 | 3 | 1 | 327 | 360 | 360 |
| Peak Hour Factor | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Hourly flow rate (vph) | 450 | 3 | 1 | 348 | 383 | 383 |

| Direction, Lane # | EB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total (vph) | 453 | 349 | 766 |
| Volume Left (vph) | 450 | 1 | 0 |
| Volume Right (vph) | 3 | 0 | 383 |
| Hadj (s) | 0.23 | 0.03 | -0.27 |
| Departure Headway (s) | 6.8 | 6.7 | 6.1 |
| Degree Utilization, x | 0.85 | 0.65 | 1.29 |
| Capacity (veh/h) | 523 | 520 | 599 |
| Control Delay (s) | 37.7 | 21.3 | 164.2 |
| Approach Delay (s) | 37.7 | 21.3 | 164.2 |
| Approach LOS | E | C | F |

| Intersection Summary | | | |
|---|---|---|---|
| Delay | 95.9 | | |
| Level of Service | F | | |
| Intersection Capacity Utilization | 71.3% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

# Appendix F Future plus Project Conditions with Proposed Improvements Level-of-Service Worksheets

# HCM Unsignalized Intersection Capacity Analysis
## 6: Rowland Blvd & Vintage Way

08/07/2020

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | ↰↱ | | | ↰↑ | ↑ | ↱ |
| Sign Control | Stop | | | Stop | Stop | |
| Traffic Volume (vph) | 479 | 3 | 3 | 199 | 377 | 277 |
| Future Volume (vph) | 479 | 3 | 3 | 199 | 377 | 277 |
| Peak Hour Factor | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Hourly flow rate (vph) | 510 | 3 | 3 | 212 | 401 | 295 |

| Direction, Lane # | EB 1 | NB 1 | SB 1 | SB 2 |
|---|---|---|---|---|
| Volume Total (vph) | 513 | 215 | 401 | 295 |
| Volume Left (vph) | 510 | 3 | 0 | 0 |
| Volume Right (vph) | 3 | 0 | 0 | 295 |
| Hadj (s) | 0.23 | 0.04 | 0.03 | -0.67 |
| Departure Headway (s) | 6.3 | 6.9 | 6.8 | 6.1 |
| Degree Utilization, x | 0.90 | 0.41 | 0.76 | 0.50 |
| Capacity (veh/h) | 559 | 509 | 519 | 580 |
| Control Delay (s) | 42.4 | 14.6 | 26.6 | 13.7 |
| Approach Delay (s) | 42.4 | 14.6 | 21.2 | |
| Approach LOS | E | B | C | |

| Intersection Summary | | | |
|---|---|---|---|
| Delay | 27.8 | | |
| Level of Service | D | | |
| Intersection Capacity Utilization | 53.2% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ↗ | → | ↘ | ↙ | ← | ↖ | ↖ | ↑ | ↗ | ↘ | ↓ | ↙ |
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations | ↰ | ↑↑ | ↱↱ | ↰ | ↑↱ | | ↰↰ | ↱ | | | ✥ | |
| Traffic Volume (vph) | 32 | 900 | 1466 | 3 | 934 | 8 | 1279 | 23 | 5 | 12 | 7 | 4 |
| Future Volume (vph) | 32 | 900 | 1466 | 3 | 934 | 8 | 1279 | 23 | 5 | 12 | 7 | 4 |
| 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 | 3.0 | 4.0 | | 3.0 | 3.0 | | | 3.0 | |
| Lane Util. Factor | 1.00 | 0.95 | 0.88 | 1.00 | 0.95 | | 0.97 | 1.00 | | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | | 1.00 | 0.97 | | | 0.98 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | | 0.97 | |
| Satd. Flow (prot) | 1770 | 3539 | 2787 | 1770 | 3535 | | 3433 | 1815 | | | 1773 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | | 0.97 | |
| Satd. Flow (perm) | 1770 | 3539 | 2787 | 1770 | 3535 | | 3433 | 1815 | | | 1773 | |
| 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) | 33 | 928 | 1511 | 3 | 963 | 8 | 1319 | 24 | 5 | 12 | 7 | 4 |
| RTOR Reduction (vph) | 0 | 0 | 304 | 0 | 1 | 0 | 0 | 3 | 0 | 0 | 4 | 0 |
| Lane Group Flow (vph) | 33 | 928 | 1207 | 3 | 970 | 0 | 1319 | 26 | 0 | 0 | 19 | 0 |
| Turn Type | Prot | NA | pm+ov | Prot | NA | | Split | NA | | Split | NA | |
| Protected Phases | 5 | 2 | 3 | 1 | 6 | | 3 | 3 | | 4 | 4 | |
| Permitted Phases | | | 2 | | | | | | | | | |
| Actuated Green, G (s) | 2.2 | 27.8 | 64.7 | 1.9 | 27.5 | | 36.9 | 36.9 | | | 1.4 | |
| Effective Green, g (s) | 2.2 | 27.8 | 64.7 | 1.9 | 27.5 | | 36.9 | 36.9 | | | 1.4 | |
| Actuated g/C Ratio | 0.03 | 0.34 | 0.80 | 0.02 | 0.34 | | 0.46 | 0.46 | | | 0.02 | |
| Clearance Time (s) | 3.0 | 4.0 | 3.0 | 3.0 | 4.0 | | 3.0 | 3.0 | | | 3.0 | |
| Vehicle Extension (s) | 2.0 | 2.0 | 3.0 | 2.0 | 2.0 | | 3.0 | 3.0 | | | 2.0 | |
| Lane Grp Cap (vph) | 48 | 1214 | 2226 | 41 | 1200 | | 1563 | 826 | | | 30 | |
| v/s Ratio Prot | c0.02 | 0.26 | 0.25 | 0.00 | c0.27 | | c0.38 | 0.01 | | | c0.01 | |
| v/s Ratio Perm | | | 0.19 | | | | | | | | | |
| v/c Ratio | 0.69 | 0.76 | 0.54 | 0.07 | 0.81 | | 0.84 | 0.03 | | | 0.64 | |
| Uniform Delay, d1 | 39.1 | 23.7 | 2.9 | 38.7 | 24.4 | | 19.5 | 12.2 | | | 39.5 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | | 1.00 | |
| Incremental Delay, d2 | 27.8 | 2.6 | 0.3 | 0.3 | 3.9 | | 4.4 | 0.0 | | | 28.1 | |
| Delay (s) | 66.9 | 26.3 | 3.2 | 39.0 | 28.2 | | 23.9 | 12.2 | | | 67.6 | |
| Level of Service | E | C | A | D | C | | C | B | | | E | |
| Approach Delay (s) | | 12.7 | | | 28.3 | | | 23.6 | | | 67.6 | |
| Approach LOS | | B | | | C | | | C | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 19.2 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.82 | | |
| Actuated Cycle Length (s) | 81.0 | Sum of lost time (s) | 13.0 |
| Intersection Capacity Utilization | 76.4% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

# HCM Unsignalized Intersection Capacity Analysis
## 6: Rowland Blvd & Vintage Way

08/07/2020

| | ↗ | ↘ | ↖ | ↑ | ↓ | ↙ |
|---|---|---|---|---|---|---|
| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
| Lane Configurations | ↰↱ | | | ↰ | ↑ | ↱ |
| Sign Control | Stop | | | Stop | Stop | |
| Traffic Volume (vph) | 423 | 3 | 1 | 327 | 360 | 360 |
| Future Volume (vph) | 423 | 3 | 1 | 327 | 360 | 360 |
| Peak Hour Factor | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Hourly flow rate (vph) | 450 | 3 | 1 | 348 | 383 | 383 |

| Direction, Lane # | EB 1 | NB 1 | SB 1 | SB 2 |
|---|---|---|---|---|
| Volume Total (vph) | 453 | 349 | 383 | 383 |
| Volume Left (vph) | 450 | 1 | 0 | 0 |
| Volume Right (vph) | 3 | 0 | 0 | 383 |
| Hadj (s) | 0.23 | 0.03 | 0.03 | -0.67 |
| Departure Headway (s) | 6.7 | 6.8 | 7.0 | 6.3 |
| Degree Utilization, x | 0.85 | 0.66 | 0.74 | 0.67 |
| Capacity (veh/h) | 523 | 508 | 499 | 559 |
| Control Delay (s) | 36.9 | 22.2 | 26.2 | 19.6 |
| Approach Delay (s) | 36.9 | 22.2 | 22.9 | |
| Approach LOS | E | C | C | |

| Intersection Summary | | | |
|---|---|---|---|
| Delay | 26.8 | | |
| Level of Service | D | | |
| Intersection Capacity Utilization | 49.2% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

# Appendix G 95th Percentile Queue Worksheets

# Queues
## 1: Rowland Blvd & Redwood Blvd

08/07/2020

| Lane Group | EBL | EBT | EBR | WBL | WBT | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 308 | 35 | 176 | 33 | 81 | 104 | 589 | 47 | 100 | 801 | 275 |
| v/c Ratio | 0.54 | 0.08 | 0.36 | 0.14 | 0.15 | 0.41 | 0.46 | 0.07 | 0.40 | 0.62 | 0.38 |
| Control Delay | 41.6 | 31.3 | 7.1 | 45.4 | 18.7 | 47.2 | 25.3 | 0.2 | 47.2 | 28.3 | 6.5 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.1 |
| Total Delay | 41.6 | 31.3 | 7.1 | 45.4 | 18.7 | 47.2 | 25.3 | 0.2 | 47.2 | 28.5 | 6.6 |
| Queue Length 50th (ft) | 78 | 16 | 0 | 16 | 8 | 51 | 119 | 0 | 49 | 175 | 8 |
| Queue Length 95th (ft) | 176 | 45 | 50 | 62 | 32 | 145 | 281 | 0 | 140 | 402 | 84 |
| Internal Link Dist (ft) |  | 150 |  |  | 206 |  | 130 |  |  | 323 |  |
| Turn Bay Length (ft) |  |  |  | 120 |  |  |  |  |  |  |  |
| Base Capacity (vph) | 1367 | 920 | 871 | 470 | 1229 | 470 | 1711 | 823 | 470 | 1709 | 893 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 259 | 83 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.23 | 0.04 | 0.20 | 0.07 | 0.07 | 0.22 | 0.34 | 0.06 | 0.21 | 0.55 | 0.34 |

Intersection Summary

# Queues

## 2: Rowland Blvd & Redwood Hwy (SB)

| | ↗ | → | ↑ | ↗ | ↘ | ↓ |
|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | NBT | NBR | SBL | SBT |
| Lane Group Flow (vph) | 161 | 282 | 700 | 317 | 889 | 1053 |
| v/c Ratio | 0.63 | 0.48 | 0.45 | 0.38 | 0.90 | 0.38 |
| Control Delay | 56.4 | 28.0 | 22.7 | 4.5 | 42.4 | 6.9 |
| Queue Delay | 0.0 | 0.0 | 0.7 | 0.4 | 0.0 | 0.0 |
| Total Delay | 56.4 | 28.0 | 23.4 | 4.9 | 42.4 | 6.9 |
| Queue Length 50th (ft) | 132 | 65 | 169 | 0 | 244 | 136 |
| Queue Length 95th (ft) | 174 | 90 | 309 | 74 | 258 | 175 |
| Internal Link Dist (ft) | | 180 | 323 | | | 1078 |
| Turn Bay Length (ft) | | | | | | |
| Base Capacity (vph) | 483 | 1008 | 1548 | 844 | 1087 | 2770 |
| Starvation Cap Reductn | 0 | 0 | 493 | 191 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.33 | 0.28 | 0.66 | 0.49 | 0.82 | 0.38 |

Intersection Summary

# Queues
## 3: Redwood Hwy (NB) & Rowland Blvd

08/07/2020

| | ↗ | → | ← | ↖ | ↖ | ↑ | ↗ |
|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | WBT | WBR | NBL | NBT | NBR |
| Lane Group Flow (vph) | 50 | 716 | 1270 | 564 | 316 | 316 | 838 |
| v/c Ratio | 0.43 | 0.33 | 0.40 | 0.47 | 0.80 | 0.80 | 0.94 |
| Control Delay | 63.3 | 16.8 | 13.3 | 2.7 | 58.3 | 57.9 | 57.8 |
| Queue Delay | 0.0 | 0.0 | 0.5 | 0.7 | 0.0 | 0.0 | 0.0 |
| Total Delay | 63.3 | 16.8 | 13.8 | 3.3 | 58.3 | 57.9 | 57.8 |
| Queue Length 50th (ft) | 39 | 176 | 175 | 0 | 244 | 243 | 361 |
| Queue Length 95th (ft) | 78 | 342 | 271 | 55 | 318 | 318 | 395 |
| Internal Link Dist (ft) | | 1078 | 342 | | | 113 | |
| Turn Bay Length (ft) | | | | 250 | | | |
| Base Capacity (vph) | 150 | 2200 | 3183 | 1201 | 616 | 618 | 988 |
| Starvation Cap Reductn | 0 | 0 | 1295 | 321 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.33 | 0.33 | 0.67 | 0.64 | 0.51 | 0.51 | 0.85 |

Intersection Summary

| Lane Group | EBL | EBT | WBT | SBL | SBR |
|---|---|---|---|---|---|
| Lane Group Flow (vph) | 245 | 1339 | 1515 | 250 | 240 |
| v/c Ratio | 0.57 | 0.34 | 0.70 | 0.74 | 0.54 |
| Control Delay | 55.3 | 4.3 | 17.0 | 45.4 | 11.2 |
| Queue Delay | 0.0 | 0.1 | 0.2 | 0.0 | 0.0 |
| Total Delay | 55.3 | 4.4 | 17.2 | 45.4 | 11.2 |
| Queue Length 50th (ft) | 84 | 87 | 347 | 107 | 0 |
| Queue Length 95th (ft) | 167 | 141 | 567 | 259 | 86 |
| Internal Link Dist (ft) |  | 342 | 319 | 100 |  |
| Turn Bay Length (ft) | 250 |  |  |  |  |
| Base Capacity (vph) | 1014 | 5022 | 3229 | 482 | 563 |
| Starvation Cap Reductn | 0 | 1993 | 799 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.24 | 0.44 | 0.62 | 0.52 | 0.43 |

Intersection Summary

# Queues
## 5: Vintage Way/Driveway Access & Rowland Blvd

08/07/2020

| Lane Group | EBL | EBT | EBR | WBL | WBT | NBL | NBT | SBT |
|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 20 | 285 | 1010 | 2 | 834 | 642 | 21 | 10 |
| v/c Ratio | 0.12 | 0.24 | 0.37 | 0.01 | 0.69 | 0.38 | 0.02 | 0.07 |
| Control Delay | 37.8 | 21.2 | 0.6 | 36.0 | 25.7 | 10.8 | 9.5 | 35.1 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 37.8 | 21.2 | 0.6 | 36.0 | 25.7 | 10.8 | 9.5 | 35.1 |
| Queue Length 50th (ft) | 6 | 32 | 0 | 1 | 115 | 56 | 3 | 2 |
| Queue Length 95th (ft) | 38 | 131 | 14 | 9 | #431 | 174 | 20 | 23 |
| Internal Link Dist (ft) |  | 319 |  |  | 981 |  | 486 | 155 |
| Turn Bay Length (ft) | 100 |  |  | 125 |  | 250 |  |  |
| Base Capacity (vph) | 613 | 1472 | 2704 | 460 | 1213 | 3021 | 1640 | 463 |
| Starvation Cap Reductn | 0 | 0 | 241 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.03 | 0.19 | 0.41 | 0.00 | 0.69 | 0.21 | 0.01 | 0.02 |

Intersection Summary

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

# Queues

## 1: Rowland Blvd & Redwood Blvd

08/07/2020

| | ↗ | → | ↘ | ↙ | ← | ↖ | ↑ | ↗ | ↘ | ↓ | ↙ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Group Flow (vph) | 311 | 34 | 136 | 19 | 111 | 104 | 687 | 33 | 57 | 537 | 215 |
| v/c Ratio | 0.50 | 0.05 | 0.22 | 0.07 | 0.18 | 0.37 | 0.64 | 0.06 | 0.22 | 0.51 | 0.35 |
| Control Delay | 37.0 | 25.4 | 6.2 | 41.8 | 13.9 | 42.2 | 28.7 | 0.2 | 41.5 | 27.5 | 6.0 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 37.0 | 25.4 | 6.2 | 41.8 | 13.9 | 42.2 | 28.7 | 0.2 | 41.5 | 27.6 | 6.0 |
| Queue Length 50th (ft) | 69 | 10 | 0 | 8 | 7 | 45 | 142 | 0 | 24 | 105 | 0 |
| Queue Length 95th (ft) | 173 | 43 | 44 | 41 | 34 | 141 | 318 | 0 | 90 | 256 | 60 |
| Internal Link Dist (ft) | | 150 | | | 206 | | 130 | | | 323 | |
| Turn Bay Length (ft) | | | | 120 | | | | | | | |
| Base Capacity (vph) | 1527 | 1026 | 933 | 525 | 1357 | 525 | 1914 | 907 | 525 | 1909 | 952 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 88 | 29 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.20 | 0.03 | 0.15 | 0.04 | 0.08 | 0.20 | 0.36 | 0.04 | 0.11 | 0.29 | 0.23 |

Intersection Summary

# Queues

## 2: Rowland Blvd & Redwood Hwy (SB)

| Lane Group | EBL | EBT | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 234 | 307 | 744 | 327 | 1058 | 827 |
| v/c Ratio | 0.75 | 0.48 | 0.59 | 0.43 | 0.91 | 0.31 |
| Control Delay | 59.2 | 39.8 | 32.2 | 5.3 | 49.5 | 7.9 |
| Queue Delay | 0.0 | 0.0 | 1.4 | 0.3 | 0.0 | 0.0 |
| Total Delay | 59.2 | 39.8 | 33.7 | 5.6 | 49.5 | 7.9 |
| Queue Length 50th (ft) | 192 | 107 | 243 | 0 | 405 | 134 |
| Queue Length 95th (ft) | 251 | 132 | 351 | 75 | #564 | 254 |
| Internal Link Dist (ft) |  | 180 | 323 |  |  | 1078 |
| Turn Bay Length (ft) |  |  |  |  |  |  |
| Base Capacity (vph) | 483 | 967 | 1270 | 752 | 1171 | 2644 |
| Starvation Cap Reductn | 0 | 0 | 320 | 107 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.48 | 0.32 | 0.78 | 0.51 | 0.90 | 0.31 |

Intersection Summary

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

# Queues
## 3: Redwood Hwy (NB) & Rowland Blvd

| Lane Group | EBL | EBT | WBT | WBR | NBL | NBT | NBR |
|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 59 | 879 | 1373 | 473 | 188 | 187 | 1210 |
| v/c Ratio | 0.48 | 0.51 | 0.39 | 0.38 | 0.65 | 0.65 | 0.96 |
| Control Delay | 79.9 | 8.6 | 10.8 | 2.3 | 55.4 | 55.1 | 48.7 |
| Queue Delay | 0.0 | 0.0 | 0.5 | 0.6 | 0.0 | 0.0 | 0.0 |
| Total Delay | 79.9 | 8.6 | 11.2 | 2.9 | 55.4 | 55.1 | 48.7 |
| Queue Length 50th (ft) | 49 | 101 | 147 | 0 | 148 | 147 | 518 |
| Queue Length 95th (ft) | m78 | 303 | 305 | 53 | 187 | 185 | 480 |
| Internal Link Dist (ft) |  | 1078 | 342 |  |  | 113 |  |
| Turn Bay Length (ft) |  |  |  | 250 |  |  |  |
| Base Capacity (vph) | 177 | 1731 | 3477 | 1231 | 560 | 562 | 1260 |
| Starvation Cap Reductn | 0 | 0 | 1449 | 409 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.33 | 0.51 | 0.68 | 0.58 | 0.34 | 0.33 | 0.96 |

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

## 4: Rowland Blvd & Rowland Way

| Lane Group | EBL | EBT | WBT | SBL | SBR |
|---|---|---|---|---|---|
| Lane Group Flow (vph) | 333 | 1934 | 1876 | 181 | 175 |
| v/c Ratio | 0.72 | 0.46 | 0.80 | 0.77 | 0.52 |
| Control Delay | 72.3 | 4.1 | 21.6 | 73.8 | 14.0 |
| Queue Delay | 0.0 | 0.4 | 9.0 | 0.0 | 0.0 |
| Total Delay | 72.3 | 4.6 | 30.6 | 73.8 | 14.0 |
| Queue Length 50th (ft) | 173 | 155 | 628 | 149 | 0 |
| Queue Length 95th (ft) | 242 | 233 | 939 | 251 | 80 |
| Internal Link Dist (ft) |  | 342 | 319 | 100 |  |
| Turn Bay Length (ft) | 250 |  |  |  |  |
| Base Capacity (vph) | 743 | 4692 | 2704 | 340 | 424 |
| Starvation Cap Reductn | 0 | 2014 | 811 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.45 | 0.72 | 0.99 | 0.53 | 0.41 |

| Intersection Summary |
|---|

# Queues
## 5: Vintage Way/Driveway Access & Rowland Blvd

| Lane Group | EBL | EBT | EBR | WBL | WBT | NBL | NBT | SBT |
|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 33 | 396 | 1455 | 3 | 442 | 1316 | 29 | 23 |
| v/c Ratio | 0.27 | 0.51 | 0.54 | 0.03 | 0.68 | 0.60 | 0.03 | 0.20 |
| Control Delay | 49.9 | 33.9 | 1.0 | 45.3 | 40.9 | 14.3 | 9.6 | 44.2 |
| Queue Delay | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 49.9 | 33.9 | 1.0 | 45.3 | 40.9 | 14.3 | 9.6 | 44.2 |
| Queue Length 50th (ft) | 18 | 93 | 0 | 2 | 122 | 207 | 5 | 10 |
| Queue Length 95th (ft) | 54 | 184 | 15 | 11 | 199 | 458 | 23 | 40 |
| Internal Link Dist (ft) |  | 319 |  |  | 981 |  | 486 | 155 |
| Turn Bay Length (ft) | 100 |  |  | 125 |  | 250 |  |  |
| Base Capacity (vph) | 402 | 1018 | 2688 | 301 | 802 | 2186 | 1156 | 305 |
| Starvation Cap Reductn | 0 | 0 | 165 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.08 | 0.39 | 0.58 | 0.01 | 0.55 | 0.60 | 0.03 | 0.08 |

| Intersection Summary |
|---|

# Queues

## 1: Rowland Blvd & Redwood Blvd

08/07/2020

| Lane Group | EBL | EBT | EBR | WBL | WBT | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 320 | 35 | 176 | 33 | 82 | 104 | 611 | 47 | 104 | 834 | 286 |
| v/c Ratio | 0.56 | 0.08 | 0.36 | 0.14 | 0.15 | 0.42 | 0.46 | 0.07 | 0.42 | 0.63 | 0.38 |
| Control Delay | 42.7 | 31.8 | 7.2 | 46.4 | 19.0 | 48.3 | 25.5 | 0.2 | 48.3 | 28.4 | 7.0 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 0.1 |
| Total Delay | 42.7 | 31.8 | 7.2 | 46.4 | 19.0 | 48.3 | 25.5 | 0.2 | 48.3 | 28.7 | 7.1 |
| Queue Length 50th (ft) | 85 | 17 | 0 | 16 | 8 | 54 | 126 | 0 | 54 | 186 | 12 |
| Queue Length 95th (ft) | 182 | 45 | 50 | 62 | 32 | 145 | 296 | 0 | 145 | 425 | 97 |
| Internal Link Dist (ft) |  | 150 |  |  | 206 |  | 130 |  |  | 323 |  |
| Turn Bay Length (ft) |  |  |  | 120 |  |  |  |  |  |  |  |
| Base Capacity (vph) | 1336 | 900 | 856 | 459 | 1201 | 459 | 1669 | 806 | 459 | 1669 | 878 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 302 | 106 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.24 | 0.04 | 0.21 | 0.07 | 0.07 | 0.23 | 0.37 | 0.06 | 0.23 | 0.61 | 0.37 |

Intersection Summary

| | ↗ | → | ↑ | ↗ | ↘ | ↓ |
|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | NBT | NBR | SBL | SBT |
| Lane Group Flow (vph) | 173 | 294 | 728 | 323 | 931 | 1101 |
| v/c Ratio | 0.66 | 0.49 | 0.49 | 0.39 | 0.90 | 0.40 |
| Control Delay | 57.0 | 30.6 | 24.7 | 4.7 | 44.5 | 6.9 |
| Queue Delay | 0.0 | 0.0 | 0.9 | 0.4 | 0.0 | 0.0 |
| Total Delay | 57.0 | 30.6 | 25.6 | 5.1 | 44.5 | 6.9 |
| Queue Length 50th (ft) | 142 | 75 | 191 | 0 | 268 | 150 |
| Queue Length 95th (ft) | 186 | 100 | 330 | 75 | 325 | 173 |
| Internal Link Dist (ft) | | 180 | 323 | | | 1078 |
| Turn Bay Length (ft) | | | | | | |
| Base Capacity (vph) | 483 | 1001 | 1492 | 828 | 1100 | 2750 |
| Starvation Cap Reductn | 0 | 0 | 457 | 174 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.36 | 0.29 | 0.70 | 0.49 | 0.85 | 0.40 |

Intersection Summary

# Queues
## 3: Redwood Hwy (NB) & Rowland Blvd

| Lane Group | EBL | EBT | WBT | WBR | NBL | NBT | NBR |
|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 52 | 807 | 1416 | 628 | 329 | 330 | 943 |
| v/c Ratio | 0.45 | 0.38 | 0.45 | 0.52 | 0.82 | 0.81 | 1.00 |
| Control Delay | 63.7 | 19.6 | 14.4 | 3.2 | 58.6 | 58.5 | 68.5 |
| Queue Delay | 0.0 | 0.0 | 0.6 | 0.8 | 0.0 | 0.0 | 0.0 |
| Total Delay | 63.7 | 19.6 | 15.0 | 4.0 | 58.6 | 58.5 | 68.5 |
| Queue Length 50th (ft) | 41 | 205 | 208 | 6 | 252 | 253 | ~440 |
| Queue Length 95th (ft) | 77 | 385 | 313 | 69 | 334 | 335 | 463 |
| Internal Link Dist (ft) |  | 1078 | 342 |  |  | 113 |  |
| Turn Bay Length (ft) |  |  |  | 250 |  |  |  |
| Base Capacity (vph) | 151 | 2133 | 3147 | 1211 | 616 | 618 | 1006 |
| Starvation Cap Reductn | 0 | 0 | 1219 | 293 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.34 | 0.38 | 0.73 | 0.68 | 0.53 | 0.53 | 0.94 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# Queues
## 4: Rowland Blvd & Rowland Way

| Lane Group | EBL | EBT | WBT | SBL | SBR |
|---|---|---|---|---|---|
| Lane Group Flow (vph) | 245 | 1467 | 1648 | 250 | 245 |
| v/c Ratio | 0.61 | 0.37 | 0.73 | 0.78 | 0.55 |
| Control Delay | 63.8 | 4.5 | 18.2 | 54.4 | 11.9 |
| Queue Delay | 0.0 | 0.2 | 0.5 | 0.0 | 0.0 |
| Total Delay | 63.8 | 4.6 | 18.7 | 54.4 | 11.9 |
| Queue Length 50th (ft) | 99 | 114 | 449 | 135 | 0 |
| Queue Length 95th (ft) | 182 | 157 | 656 | #317 | 92 |
| Internal Link Dist (ft) |  | 342 | 319 | 100 |  |
| Turn Bay Length (ft) | 250 |  |  |  |  |
| Base Capacity (vph) | 885 | 4912 | 3018 | 425 | 526 |
| Starvation Cap Reductn | 0 | 2072 | 833 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.28 | 0.52 | 0.75 | 0.59 | 0.47 |

Intersection Summary

\#  95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

# Queues
## 5: Vintage Way/Driveway Access & Rowland Blvd

08/07/2020

| | ↗ | → | ↘ | ↙ | ← | ↖ | ↑ | ↓ |
|---|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | NBL | NBT | SBT |
| Lane Group Flow (vph) | 20 | 412 | 1010 | 2 | 998 | 606 | 21 | 10 |
| v/c Ratio | 0.12 | 0.34 | 0.37 | 0.01 | 0.80 | 0.37 | 0.02 | 0.06 |
| Control Delay | 36.5 | 20.6 | 0.6 | 35.0 | 28.0 | 11.1 | 9.8 | 34.0 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 36.5 | 20.6 | 0.6 | 35.0 | 28.0 | 11.1 | 9.8 | 34.0 |
| Queue Length 50th (ft) | 6 | 46 | 0 | 1 | 140 | 52 | 3 | 2 |
| Queue Length 95th (ft) | 37 | 179 | 14 | 9 | #541 | 164 | 20 | 22 |
| Internal Link Dist (ft) | | 319 | | | 981 | | 486 | 155 |
| Turn Bay Length (ft) | 100 | | | 125 | | 250 | | |
| Base Capacity (vph) | 633 | 1518 | 2712 | 474 | 1251 | 3058 | 1659 | 477 |
| Starvation Cap Reductn | 0 | 0 | 233 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.03 | 0.27 | 0.41 | 0.00 | 0.80 | 0.20 | 0.01 | 0.02 |

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

# Queues

## 1: Rowland Blvd & Redwood Blvd

08/07/2020

| Lane Group | EBL | EBT | EBR | WBL | WBT | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 321 | 34 | 136 | 19 | 114 | 104 | 711 | 33 | 62 | 572 | 228 |
| v/c Ratio | 0.51 | 0.05 | 0.22 | 0.07 | 0.19 | 0.38 | 0.63 | 0.06 | 0.24 | 0.52 | 0.35 |
| Control Delay | 38.1 | 26.1 | 6.4 | 43.0 | 14.2 | 43.6 | 28.6 | 0.2 | 42.9 | 27.5 | 5.7 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 38.1 | 26.1 | 6.4 | 43.0 | 14.2 | 43.6 | 28.6 | 0.2 | 42.9 | 27.6 | 5.7 |
| Queue Length 50th (ft) | 73 | 11 | 0 | 8 | 7 | 46 | 150 | 0 | 27 | 115 | 0 |
| Queue Length 95th (ft) | 182 | 44 | 44 | 41 | 35 | 145 | 335 | 0 | 98 | 276 | 60 |
| Internal Link Dist (ft) |  | 150 |  |  | 206 |  | 130 |  |  | 323 |  |
| Turn Bay Length (ft) |  |  |  | 120 |  |  |  |  |  |  |  |
| Base Capacity (vph) | 1488 | 1002 | 914 | 511 | 1325 | 511 | 1878 | 893 | 511 | 1860 | 940 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 122 | 37 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.22 | 0.03 | 0.15 | 0.04 | 0.09 | 0.20 | 0.38 | 0.04 | 0.12 | 0.33 | 0.25 |

Intersection Summary

# Queues

## 2: Rowland Blvd & Redwood Hwy (SB)

08/07/2020

| | ↗ | → | ↑ | ↗ | ↘ | ↓ |
|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | NBT | NBR | SBL | SBT |
| Lane Group Flow (vph) | 249 | 322 | 771 | 337 | 1124 | 879 |
| v/c Ratio | 0.77 | 0.49 | 0.68 | 0.47 | 0.88 | 0.34 |
| Control Delay | 59.9 | 40.0 | 37.3 | 5.8 | 43.9 | 8.0 |
| Queue Delay | 0.0 | 0.0 | 3.4 | 0.3 | 0.0 | 0.0 |
| Total Delay | 59.9 | 40.0 | 40.7 | 6.1 | 43.9 | 8.0 |
| Queue Length 50th (ft) | 204 | 113 | 271 | 0 | 426 | 175 |
| Queue Length 95th (ft) | 268 | 140 | 368 | 76 | #620 | 258 |
| Internal Link Dist (ft) | | 180 | 323 | | | 1078 |
| Turn Bay Length (ft) | | | | | | |
| Base Capacity (vph) | 483 | 966 | 1137 | 713 | 1283 | 2618 |
| Starvation Cap Reductn | 0 | 0 | 266 | 83 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.52 | 0.33 | 0.89 | 0.53 | 0.88 | 0.34 |

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

# Queues
## 3: Redwood Hwy (NB) & Rowland Blvd

| Lane Group | EBL | EBT | WBT | WBR | NBL | NBT | NBR |
|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 59 | 945 | 1490 | 513 | 188 | 187 | 1302 |
| v/c Ratio | 0.48 | 0.66 | 0.43 | 0.42 | 0.65 | 0.65 | 0.87 |
| Control Delay | 79.5 | 13.9 | 11.1 | 2.8 | 55.4 | 55.1 | 31.2 |
| Queue Delay | 0.0 | 0.0 | 0.5 | 0.7 | 0.0 | 0.0 | 0.0 |
| Total Delay | 79.5 | 13.9 | 11.7 | 3.5 | 55.4 | 55.1 | 31.2 |
| Queue Length 50th (ft) | 49 | 213 | 165 | 8 | 148 | 147 | 484 |
| Queue Length 95th (ft) | m72 | 430 | 339 | 74 | 187 | 185 | 524 |
| Internal Link Dist (ft) |  | 1078 | 342 |  |  | 113 |  |
| Turn Bay Length (ft) |  |  |  | 250 |  |  |  |
| Base Capacity (vph) | 177 | 1429 | 3477 | 1233 | 560 | 562 | 1498 |
| Starvation Cap Reductn | 0 | 0 | 1402 | 393 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.33 | 0.66 | 0.72 | 0.61 | 0.34 | 0.33 | 0.87 |

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

# Queues

## 4: Rowland Blvd & Rowland Way

08/07/2020

|  | ↗ | → | ← | ↘ | ↙ |
|---|---|---|---|---|---|
| Lane Group | EBL | EBT | WBT | SBL | SBR |
| Lane Group Flow (vph) | 333 | 2097 | 2046 | 185 | 178 |
| v/c Ratio | 0.76 | 0.50 | 0.85 | 0.81 | 0.53 |
| Control Delay | 78.1 | 4.4 | 24.6 | 82.2 | 14.1 |
| Queue Delay | 0.0 | 0.6 | 47.2 | 0.0 | 0.0 |
| Total Delay | 78.1 | 5.0 | 71.8 | 82.2 | 14.1 |
| Queue Length 50th (ft) | 176 | 184 | 778 | 160 | 0 |
| Queue Length 95th (ft) | 242 | 266 | 1142 | 261 | 80 |
| Internal Link Dist (ft) |  | 342 | 319 | 100 |  |
| Turn Bay Length (ft) | 250 |  |  |  |  |
| Base Capacity (vph) | 678 | 4604 | 2549 | 311 | 405 |
| Starvation Cap Reductn | 0 | 1908 | 723 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.49 | 0.78 | 1.12 | 0.59 | 0.44 |

Intersection Summary

# Queues
## 5: Vintage Way/Driveway Access & Rowland Blvd

| Lane Group | EBL | EBT | EBR | WBL | WBT | NBL | NBT | SBT |
|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 33 | 558 | 1455 | 3 | 638 | 1282 | 29 | 23 |
| v/c Ratio | 0.28 | 0.62 | 0.54 | 0.03 | 0.83 | 0.61 | 0.03 | 0.21 |
| Control Delay | 50.8 | 35.6 | 1.0 | 45.7 | 46.9 | 15.3 | 9.8 | 44.7 |
| Queue Delay | 0.0 | 0.3 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 50.8 | 35.8 | 1.0 | 45.7 | 46.9 | 15.3 | 9.8 | 44.7 |
| Queue Length 50th (ft) | 19 | 137 | 0 | 2 | 188 | 214 | 5 | 11 |
| Queue Length 95th (ft) | 54 | 261 | 15 | 11 | 294 | 440 | 23 | 40 |
| Internal Link Dist (ft) |  | 319 |  |  | 981 |  | 486 | 155 |
| Turn Bay Length (ft) | 100 |  |  | 125 |  | 250 |  |  |
| Base Capacity (vph) | 383 | 990 | 2688 | 287 | 767 | 2085 | 1103 | 291 |
| Starvation Cap Reductn | 0 | 85 | 165 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.09 | 0.62 | 0.58 | 0.01 | 0.83 | 0.61 | 0.03 | 0.08 |

| Intersection Summary |
|---|

# Queues

## 1: Rowland Blvd & Redwood Blvd

08/07/2020

| Lane Group | EBL | EBT | EBR | WBL | WBT | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 434 | 35 | 176 | 33 | 81 | 104 | 614 | 47 | 101 | 817 | 341 |
| v/c Ratio | 0.66 | 0.08 | 0.34 | 0.15 | 0.15 | 0.44 | 0.47 | 0.07 | 0.42 | 0.63 | 0.44 |
| Control Delay | 43.9 | 30.8 | 6.5 | 49.3 | 20.5 | 51.2 | 27.4 | 0.2 | 51.2 | 30.4 | 7.2 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 0.2 |
| Total Delay | 43.9 | 30.8 | 6.5 | 49.3 | 20.5 | 51.2 | 27.4 | 0.2 | 51.2 | 30.8 | 7.4 |
| Queue Length 50th (ft) | 122 | 18 | 0 | 18 | 9 | 58 | 136 | 0 | 56 | 194 | 13 |
| Queue Length 95th (ft) | 246 | 45 | 49 | 65 | 34 | 151 | 317 | 0 | 149 | 443 | 111 |
| Internal Link Dist (ft) |  | 150 |  |  | 206 |  | 130 |  |  | 323 |  |
| Turn Bay Length (ft) |  |  |  | 120 |  |  |  |  |  |  |  |
| Base Capacity (vph) | 1277 | 878 | 839 | 439 | 1151 | 439 | 1599 | 777 | 439 | 1596 | 881 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 321 | 111 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.34 | 0.04 | 0.21 | 0.08 | 0.07 | 0.24 | 0.38 | 0.06 | 0.23 | 0.64 | 0.44 |

Intersection Summary

# Queues
## 2: Rowland Blvd & Redwood Hwy (SB)

| Lane Group | EBL | EBT | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 217 | 338 | 810 | 356 | 962 | 1136 |
| v/c Ratio | 0.72 | 0.53 | 0.58 | 0.44 | 0.91 | 0.43 |
| Control Delay | 58.5 | 36.6 | 29.6 | 5.0 | 44.1 | 7.4 |
| Queue Delay | 0.0 | 0.0 | 1.6 | 0.4 | 0.0 | 0.0 |
| Total Delay | 58.5 | 36.6 | 31.2 | 5.3 | 44.1 | 7.4 |
| Queue Length 50th (ft) | 179 | 106 | 246 | 0 | 287 | 131 |
| Queue Length 95th (ft) | 232 | 132 | 388 | 79 | #395 | 174 |
| Internal Link Dist (ft) |  | 180 | 323 |  |  | 1078 |
| Turn Bay Length (ft) |  |  |  |  |  |  |
| Base Capacity (vph) | 483 | 983 | 1399 | 814 | 1107 | 2672 |
| Starvation Cap Reductn | 0 | 0 | 393 | 142 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.45 | 0.34 | 0.81 | 0.53 | 0.87 | 0.43 |

Intersection Summary

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

# Queues

## 3: Redwood Hwy (NB) & Rowland Blvd

08/07/2020

| Lane Group | EBL | EBT | WBT | WBR | NBL | NBT | NBR |
|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 50 | 974 | 1423 | 626 | 315 | 316 | 976 |
| v/c Ratio | 0.43 | 0.46 | 0.45 | 0.51 | 0.80 | 0.80 | 1.03 |
| Control Delay | 60.4 | 21.1 | 13.9 | 3.2 | 58.3 | 58.1 | 74.4 |
| Queue Delay | 0.0 | 0.0 | 0.6 | 0.8 | 0.0 | 0.0 | 0.0 |
| Total Delay | 60.4 | 21.1 | 14.5 | 4.0 | 58.3 | 58.1 | 74.4 |
| Queue Length 50th (ft) | 39 | 253 | 204 | 7 | 243 | 243 | ~464 |
| Queue Length 95th (ft) | m64 | 475 | 314 | 70 | 318 | 318 | 486 |
| Internal Link Dist (ft) |  | 1078 | 342 |  |  | 113 |  |
| Turn Bay Length (ft) |  |  |  | 250 |  |  |  |
| Base Capacity (vph) | 150 | 2122 | 3185 | 1216 | 616 | 618 | 996 |
| Starvation Cap Reductn | 0 | 0 | 1240 | 299 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.33 | 0.46 | 0.73 | 0.68 | 0.51 | 0.51 | 0.98 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

# Queues
## 4: Rowland Blvd & Rowland Way

| | ↗ | → | ← | ↘ | ↙ |
|---|---|---|---|---|---|
| Lane Group | EBL | EBT | WBT | SBL | SBR |
| Lane Group Flow (vph) | 245 | 1748 | 1749 | 258 | 253 |
| v/c Ratio | 0.65 | 0.44 | 0.77 | 0.81 | 0.55 |
| Control Delay | 70.9 | 5.3 | 20.1 | 65.2 | 11.6 |
| Queue Delay | 0.0 | 0.2 | 1.5 | 0.0 | 0.0 |
| Total Delay | 70.9 | 5.5 | 21.6 | 65.2 | 11.6 |
| Queue Length 50th (ft) | 115 | 183 | 584 | 182 | 0 |
| Queue Length 95th (ft) | 182 | 201 | 735 | #375 | 92 |
| Internal Link Dist (ft) | | 342 | 319 | 100 | |
| Turn Bay Length (ft) | 250 | | | | |
| Base Capacity (vph) | 783 | 4818 | 2818 | 371 | 500 |
| Starvation Cap Reductn | 0 | 1946 | 818 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.31 | 0.61 | 0.87 | 0.70 | 0.51 |

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

## Queues
## 5: Vintage Way/Driveway Access & Rowland Blvd

| | ↗ | → | ↘ | ↙ | ← | ↖ | ↑ | ↓ |
|---|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | NBL | NBT | SBT |
| Lane Group Flow (vph) | 20 | 671 | 1037 | 2 | 1039 | 661 | 21 | 10 |
| v/c Ratio | 0.13 | 0.54 | 0.38 | 0.01 | 0.89 | 0.39 | 0.02 | 0.07 |
| Control Delay | 40.2 | 24.1 | 0.6 | 38.5 | 37.1 | 11.7 | 10.4 | 37.2 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 40.2 | 24.1 | 0.6 | 38.5 | 37.1 | 11.7 | 10.4 | 37.2 |
| Queue Length 50th (ft) | 6 | 91 | 0 | 1 | 162 | 58 | 3 | 3 |
| Queue Length 95th (ft) | 38 | #347 | 14 | 9 | #605 | 180 | 20 | 23 |
| Internal Link Dist (ft) | | 319 | | | 981 | | 486 | 155 |
| Turn Bay Length (ft) | 100 | | | 125 | | 250 | | |
| Base Capacity (vph) | 590 | 1453 | 2703 | 442 | 1168 | 2933 | 1592 | 446 |
| Starvation Cap Reductn | 0 | 0 | 240 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.03 | 0.46 | 0.42 | 0.00 | 0.89 | 0.23 | 0.01 | 0.02 |

Intersection Summary

#   95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

# Queues
## 1: Rowland Blvd & Redwood Blvd

08/07/2020

| | ↗ | → | ↘ | ↙ | ← | ↖ | ↑ | ↗ | ↘ | ↓ | ↙ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Group Flow (vph) | 433 | 34 | 136 | 19 | 112 | 104 | 716 | 33 | 58 | 563 | 323 |
| v/c Ratio | 0.65 | 0.05 | 0.22 | 0.08 | 0.20 | 0.42 | 0.58 | 0.05 | 0.25 | 0.54 | 0.46 |
| Control Delay | 40.8 | 25.8 | 6.0 | 46.3 | 15.3 | 47.2 | 28.9 | 0.2 | 46.3 | 30.2 | 5.9 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 40.8 | 25.8 | 6.0 | 46.3 | 15.3 | 47.2 | 28.9 | 0.2 | 46.3 | 30.2 | 6.0 |
| Queue Length 50th (ft) | 105 | 11 | 0 | 9 | 8 | 50 | 163 | 0 | 27 | 121 | 0 |
| Queue Length 95th (ft) | 245 | 44 | 44 | 44 | 37 | 151 | 360 | 0 | 98 | 290 | 73 |
| Internal Link Dist (ft) | | 150 | | | 206 | | 130 | | | 323 | |
| Turn Bay Length (ft) | | | | 120 | | | | | | | |
| Base Capacity (vph) | 1330 | 912 | 845 | 457 | 1194 | 457 | 1687 | 813 | 457 | 1662 | 915 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 154 | 34 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.33 | 0.04 | 0.16 | 0.04 | 0.09 | 0.23 | 0.42 | 0.04 | 0.13 | 0.37 | 0.37 |

Intersection Summary

# Queues

## 2: Rowland Blvd & Redwood Hwy (SB)

08/07/2020

| Lane Group | EBL | EBT | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 290 | 364 | 850 | 371 | 1178 | 963 |
| v/c Ratio | 0.81 | 0.50 | 0.84 | 0.53 | 0.87 | 0.38 |
| Control Delay | 61.3 | 39.6 | 47.5 | 6.3 | 41.9 | 9.9 |
| Queue Delay | 0.0 | 0.0 | 28.4 | 0.2 | 0.0 | 0.0 |
| Total Delay | 61.3 | 39.6 | 75.9 | 6.6 | 41.9 | 9.9 |
| Queue Length 50th (ft) | 235 | 127 | 334 | 0 | 448 | 218 |
| Queue Length 95th (ft) | 315 | 160 | 420 | 82 | #668 | 275 |
| Internal Link Dist (ft) |  | 180 | 323 |  |  | 1078 |
| Turn Bay Length (ft) |  |  |  |  |  |  |
| Base Capacity (vph) | 483 | 967 | 1010 | 694 | 1349 | 2546 |
| Starvation Cap Reductn | 0 | 0 | 198 | 50 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.60 | 0.38 | 1.05 | 0.58 | 0.87 | 0.38 |

Intersection Summary

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

| | ↗ | → | ← | ↖ | ↖ | ↑ | ↗ |
|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | WBT | WBR | NBL | NBT | NBR |
| Lane Group Flow (vph) | 59 | 1140 | 1627 | 575 | 188 | 187 | 1360 |
| v/c Ratio | 0.48 | 0.95 | 0.47 | 0.46 | 0.65 | 0.65 | 0.81 |
| Control Delay | 78.9 | 32.5 | 11.6 | 3.7 | 55.4 | 55.1 | 24.0 |
| Queue Delay | 0.0 | 0.0 | 0.7 | 0.8 | 0.0 | 0.0 | 0.0 |
| Total Delay | 78.9 | 32.5 | 12.3 | 4.5 | 55.4 | 55.1 | 24.0 |
| Queue Length 50th (ft) | 49 | 487 | 188 | 19 | 148 | 147 | 450 |
| Queue Length 95th (ft) | m64 | #582 | 383 | 116 | 187 | 185 | 569 |
| Internal Link Dist (ft) | | 1078 | 342 | | | 113 | |
| Turn Bay Length (ft) | | | | 250 | | | |
| Base Capacity (vph) | 177 | 1238 | 3477 | 1237 | 560 | 562 | 1676 |
| Starvation Cap Reductn | 0 | 0 | 1347 | 369 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.33 | 0.92 | 0.76 | 0.66 | 0.34 | 0.33 | 0.81 |

Intersection Summary

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

# Queues
## 4: Rowland Blvd & Rowland Way

| | ↗ | → | ← | ↘ | ↙ |
|---|---|---|---|---|---|
| Lane Group | EBL | EBT | WBT | SBL | SBR |
| Lane Group Flow (vph) | 333 | 2358 | 2261 | 195 | 183 |
| v/c Ratio | 0.78 | 0.56 | 0.94 | 0.84 | 0.53 |
| Control Delay | 82.3 | 5.2 | 32.4 | 89.4 | 13.6 |
| Queue Delay | 0.0 | 0.8 | 45.0 | 0.0 | 0.0 |
| Total Delay | 82.3 | 6.0 | 77.4 | 89.4 | 13.6 |
| Queue Length 50th (ft) | 178 | 247 | 1053 | 178 | 0 |
| Queue Length 95th (ft) | 242 | 325 | #1525 | 284 | 82 |
| Internal Link Dist (ft) | | 342 | 319 | 100 | |
| Turn Bay Length (ft) | 250 | | | | |
| Base Capacity (vph) | 641 | 4545 | 2411 | 293 | 396 |
| Starvation Cap Reductn | 0 | 1720 | 604 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.52 | 0.83 | 1.25 | 0.67 | 0.46 |

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

# Queues
## 5: Vintage Way/Driveway Access & Rowland Blvd

| | ↗ | → | ↘ | ↙ | ← | ↖ | ↑ | ↓ |
|---|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | NBL | NBT | SBT |
| Lane Group Flow (vph) | 33 | 766 | 1511 | 3 | 775 | 1353 | 29 | 23 |
| v/c Ratio | 0.28 | 0.85 | 0.56 | 0.03 | 1.01 | 0.65 | 0.03 | 0.21 |
| Control Delay | 50.8 | 44.8 | 1.0 | 45.7 | 73.4 | 16.0 | 9.8 | 44.7 |
| Queue Delay | 0.0 | 1.2 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 50.8 | 46.0 | 1.1 | 45.7 | 73.4 | 16.0 | 9.8 | 44.7 |
| Queue Length 50th (ft) | 19 | 204 | 0 | 2 | ~260 | 234 | 5 | 11 |
| Queue Length 95th (ft) | 54 | #432 | 15 | 11 | #415 | 478 | 23 | 40 |
| Internal Link Dist (ft) | | 319 | | | 981 | | 486 | 155 |
| Turn Bay Length (ft) | 100 | | | 125 | | 250 | | |
| Base Capacity (vph) | 383 | 990 | 2692 | 287 | 767 | 2085 | 1103 | 291 |
| Starvation Cap Reductn | 0 | 79 | 155 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.09 | 0.84 | 0.60 | 0.01 | 1.01 | 0.65 | 0.03 | 0.08 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

# Queues

## 1: Rowland Blvd & Redwood Blvd

08/07/2020

| Lane Group | EBL | EBT | EBR | WBL | WBT | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 445 | 35 | 176 | 33 | 82 | 104 | 635 | 47 | 105 | 849 | 352 |
| v/c Ratio | 0.67 | 0.08 | 0.34 | 0.15 | 0.16 | 0.44 | 0.48 | 0.07 | 0.44 | 0.64 | 0.45 |
| Control Delay | 44.6 | 31.0 | 6.5 | 49.9 | 20.7 | 52.1 | 27.8 | 0.2 | 52.1 | 30.8 | 7.8 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.6 | 0.2 |
| Total Delay | 44.6 | 31.0 | 6.5 | 49.9 | 20.7 | 52.1 | 27.8 | 0.2 | 52.1 | 31.4 | 8.1 |
| Queue Length 50th (ft) | 131 | 18 | 0 | 18 | 10 | 60 | 142 | 0 | 60 | 206 | 18 |
| Queue Length 95th (ft) | 253 | 45 | 49 | 65 | 34 | 152 | 334 | 0 | 153 | 468 | 125 |
| Internal Link Dist (ft) |  | 150 |  |  | 206 |  | 130 |  |  | 323 |  |
| Turn Bay Length (ft) |  |  |  | 120 |  |  |  |  |  |  |  |
| Base Capacity (vph) | 1253 | 863 | 828 | 430 | 1130 | 430 | 1566 | 763 | 430 | 1566 | 869 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 359 | 130 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.36 | 0.04 | 0.21 | 0.08 | 0.07 | 0.24 | 0.41 | 0.06 | 0.24 | 0.70 | 0.48 |

Intersection Summary

# Queues
## 2: Rowland Blvd & Redwood Hwy (SB)

| | ↗ | → | ↑ | ↗ | ↘ | ↓ |
|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | NBT | NBR | SBL | SBT |
| Lane Group Flow (vph) | 229 | 349 | 832 | 368 | 1002 | 1183 |
| v/c Ratio | 0.74 | 0.53 | 0.62 | 0.46 | 0.91 | 0.45 |
| Control Delay | 58.5 | 37.1 | 32.0 | 5.2 | 43.5 | 7.6 |
| Queue Delay | 0.0 | 0.0 | 1.9 | 0.3 | 0.0 | 0.0 |
| Total Delay | 58.5 | 37.1 | 34.0 | 5.5 | 43.5 | 7.6 |
| Queue Length 50th (ft) | 186 | 110 | 274 | 0 | 247 | 151 |
| Queue Length 95th (ft) | 246 | 139 | 404 | 81 | #496 | 173 |
| Internal Link Dist (ft) | | 180 | 323 | | | 1078 |
| Turn Bay Length (ft) | | | | | | |
| Base Capacity (vph) | 483 | 980 | 1337 | 800 | 1129 | 2647 |
| Starvation Cap Reductn | 0 | 0 | 337 | 115 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.47 | 0.36 | 0.83 | 0.54 | 0.89 | 0.45 |

Intersection Summary

\#    95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

# Queues

## 3: Redwood Hwy (NB) & Rowland Blvd

08/07/2020

| | ↗ | → | ← | ↖ | ↖ | ↑ | ↗ |
|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | WBT | WBR | NBL | NBT | NBR |
| Lane Group Flow (vph) | 50 | 1030 | 1511 | 666 | 315 | 316 | 1044 |
| v/c Ratio | 0.43 | 0.50 | 0.47 | 0.55 | 0.80 | 0.80 | 1.05 |
| Control Delay | 59.4 | 23.7 | 14.3 | 3.9 | 58.3 | 58.1 | 79.8 |
| Queue Delay | 0.0 | 0.0 | 0.7 | 0.9 | 0.0 | 0.0 | 0.0 |
| Total Delay | 59.4 | 23.7 | 15.0 | 4.8 | 58.3 | 58.1 | 79.8 |
| Queue Length 50th (ft) | 39 | 434 | 222 | 18 | 243 | 243 | ~511 |
| Queue Length 95th (ft) | m62 | 512 | 340 | 105 | 318 | 318 | 513 |
| Internal Link Dist (ft) | | 1078 | 342 | | | 113 | |
| Turn Bay Length (ft) | | | | 250 | | | |
| Base Capacity (vph) | 150 | 2068 | 3185 | 1217 | 616 | 618 | 1016 |
| Starvation Cap Reductn | 0 | 0 | 1210 | 286 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.33 | 0.50 | 0.77 | 0.72 | 0.51 | 0.51 | 1.03 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

# Queues
## 4: Rowland Blvd & Rowland Way

| Lane Group | EBL | EBT | WBT | SBL | SBR |
|---|---|---|---|---|---|
| Lane Group Flow (vph) | 245 | 1876 | 1882 | 264 | 253 |
| v/c Ratio | 0.68 | 0.47 | 0.80 | 0.85 | 0.56 |
| Control Delay | 77.1 | 5.6 | 21.9 | 74.5 | 12.4 |
| Queue Delay | 0.0 | 0.4 | 16.3 | 0.0 | 0.0 |
| Total Delay | 77.1 | 5.9 | 38.2 | 74.5 | 12.4 |
| Queue Length 50th (ft) | 132 | 204 | 683 | 223 | 4 |
| Queue Length 95th (ft) | 182 | 224 | 854 | #396 | 97 |
| Internal Link Dist (ft) |  | 342 | 319 | 100 |  |
| Turn Bay Length (ft) | 250 |  |  |  |  |
| Base Capacity (vph) | 708 | 4692 | 2661 | 338 | 473 |
| Starvation Cap Reductn | 0 | 1968 | 815 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.35 | 0.69 | 1.02 | 0.78 | 0.53 |

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

# Queues
## 5: Vintage Way/Driveway Access & Rowland Blvd

| | ↗ | → | ↘ | ↙ | ← | ↖ | ↑ | ↓ |
|---|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | NBL | NBT | SBT |
| Lane Group Flow (vph) | 20 | 799 | 1037 | 2 | 1203 | 625 | 21 | 10 |
| v/c Ratio | 0.12 | 0.67 | 0.38 | 0.01 | 0.99 | 0.37 | 0.02 | 0.07 |
| Control Delay | 37.8 | 26.2 | 0.6 | 36.0 | 49.3 | 10.8 | 9.5 | 35.2 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 37.8 | 26.2 | 0.6 | 36.0 | 49.3 | 10.8 | 9.5 | 35.2 |
| Queue Length 50th (ft) | 6 | 108 | 0 | 1 | 191 | 54 | 3 | 2 |
| Queue Length 95th (ft) | 38 | #448 | 14 | 9 | #732 | 170 | 20 | 23 |
| Internal Link Dist (ft) | | 319 | | | 981 | | 486 | 155 |
| Turn Bay Length (ft) | 100 | | | 125 | | 250 | | |
| Base Capacity (vph) | 615 | 1476 | 2704 | 461 | 1217 | 3023 | 1640 | 464 |
| Starvation Cap Reductn | 0 | 0 | 238 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.03 | 0.54 | 0.42 | 0.00 | 0.99 | 0.21 | 0.01 | 0.02 |

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

# Queues

## 1: Rowland Blvd & Redwood Blvd

08/07/2020

| | ↗ | → | ↘ | ↙ | ← | ↖ | ↑ | ↗ | ↘ | ↓ | ↙ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Group Flow (vph) | 443 | 34 | 136 | 19 | 114 | 104 | 739 | 33 | 64 | 597 | 337 |
| v/c Ratio | 0.66 | 0.06 | 0.22 | 0.08 | 0.21 | 0.42 | 0.59 | 0.05 | 0.28 | 0.56 | 0.47 |
| Control Delay | 41.3 | 25.9 | 6.0 | 46.9 | 15.3 | 47.8 | 29.3 | 0.2 | 47.1 | 30.7 | 5.9 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 |
| Total Delay | 41.3 | 25.9 | 6.0 | 46.9 | 15.3 | 47.8 | 29.3 | 0.2 | 47.1 | 30.8 | 5.9 |
| Queue Length 50th (ft) | 109 | 11 | 0 | 9 | 8 | 51 | 170 | 0 | 31 | 131 | 0 |
| Queue Length 95th (ft) | 252 | 44 | 44 | 44 | 37 | 152 | 377 | 0 | 106 | 311 | 75 |
| Internal Link Dist (ft) | | 150 | | | 206 | | 130 | | | 323 | |
| Turn Bay Length (ft) | | | | 120 | | | | | | | |
| Base Capacity (vph) | 1308 | 899 | 834 | 450 | 1176 | 450 | 1656 | 801 | 450 | 1635 | 912 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 169 | 34 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.34 | 0.04 | 0.16 | 0.04 | 0.10 | 0.23 | 0.45 | 0.04 | 0.14 | 0.41 | 0.38 |

Intersection Summary

# Queues

## 2: Rowland Blvd & Redwood Hwy (SB)

| Lane Group | EBL | EBT | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 306 | 379 | 877 | 381 | 1244 | 1015 |
| v/c Ratio | 0.82 | 0.50 | 0.88 | 0.55 | 0.94 | 0.40 |
| Control Delay | 60.8 | 39.1 | 50.5 | 6.4 | 48.3 | 10.8 |
| Queue Delay | 0.0 | 0.0 | 42.1 | 0.3 | 0.0 | 0.0 |
| Total Delay | 60.8 | 39.1 | 92.6 | 6.7 | 48.3 | 10.8 |
| Queue Length 50th (ft) | 247 | 132 | 348 | 0 | 489 | 242 |
| Queue Length 95th (ft) | 336 | 168 | #462 | 82 | #724 | 273 |
| Internal Link Dist (ft) |  | 180 | 323 |  |  | 1078 |
| Turn Bay Length (ft) |  |  |  |  |  |  |
| Base Capacity (vph) | 483 | 965 | 1006 | 699 | 1325 | 2510 |
| Starvation Cap Reductn | 0 | 0 | 198 | 50 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.63 | 0.39 | 1.09 | 0.59 | 0.94 | 0.40 |

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

# Queues

## 3: Redwood Hwy (NB) & Rowland Blvd

| | ↗ | → | ← | ↖ | ↖ | ↑ | ↗ |
|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | WBT | WBR | NBL | NBT | NBR |
| Lane Group Flow (vph) | 59 | 1206 | 1744 | 614 | 188 | 187 | 1452 |
| v/c Ratio | 0.48 | 0.97 | 0.50 | 0.50 | 0.65 | 0.65 | 0.88 |
| Control Delay | 78.3 | 36.5 | 12.1 | 4.4 | 55.4 | 55.1 | 28.8 |
| Queue Delay | 0.0 | 0.0 | 0.8 | 1.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 78.3 | 36.5 | 13.0 | 5.3 | 55.4 | 55.1 | 28.8 |
| Queue Length 50th (ft) | 49 | 518 | 208 | 29 | 148 | 147 | 514 |
| Queue Length 95th (ft) | m62 | #636 | 423 | 153 | 187 | 185 | 652 |
| Internal Link Dist (ft) | | 1078 | 342 | | | 113 | |
| Turn Bay Length (ft) | | | | 250 | | | |
| Base Capacity (vph) | 177 | 1238 | 3477 | 1236 | 560 | 562 | 1648 |
| Starvation Cap Reductn | 0 | 0 | 1300 | 354 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.33 | 0.97 | 0.80 | 0.70 | 0.34 | 0.33 | 0.88 |

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

## 4: Rowland Blvd & Rowland Way

| Lane Group | EBL | EBT | WBT | SBL | SBR |
|---|---|---|---|---|---|
| Lane Group Flow (vph) | 333 | 2520 | 2431 | 198 | 186 |
| v/c Ratio | 0.78 | 0.60 | 1.01 | 0.84 | 0.53 |
| Control Delay | 82.5 | 5.7 | 47.2 | 90.1 | 13.5 |
| Queue Delay | 0.0 | 1.0 | 34.9 | 0.0 | 0.0 |
| Total Delay | 82.5 | 6.7 | 82.0 | 90.1 | 13.5 |
| Queue Length 50th (ft) | 179 | 288 | ~1432 | 184 | 0 |
| Queue Length 95th (ft) | 242 | 367 | #1731 | #294 | 81 |
| Internal Link Dist (ft) |  | 342 | 319 | 100 |  |
| Turn Bay Length (ft) | 250 |  |  |  |  |
| Base Capacity (vph) | 639 | 4529 | 2403 | 291 | 398 |
| Starvation Cap Reductn | 0 | 1608 | 512 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.52 | 0.86 | 1.29 | 0.68 | 0.47 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

# Queues
## 5: Vintage Way/Driveway Access & Rowland Blvd

08/07/2020

| Lane Group | EBL | EBT | EBR | WBL | WBT | NBL | NBT | SBT |
|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 33 | 928 | 1511 | 3 | 971 | 1319 | 29 | 23 |
| v/c Ratio | 0.28 | 1.03 | 0.56 | 0.03 | 1.26 | 0.63 | 0.03 | 0.21 |
| Control Delay | 50.8 | 74.3 | 1.0 | 45.7 | 162.0 | 15.7 | 9.8 | 44.7 |
| Queue Delay | 0.0 | 13.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 50.8 | 87.3 | 1.1 | 45.7 | 162.0 | 15.7 | 9.8 | 44.7 |
| Queue Length 50th (ft) | 19 | 262 | 0 | 2 | ~387 | 225 | 5 | 11 |
| Queue Length 95th (ft) | 54 | #565 | 15 | 11 | #577 | 460 | 23 | 40 |
| Internal Link Dist (ft) |  | 319 |  |  | 981 |  | 486 | 155 |
| Turn Bay Length (ft) | 100 |  |  | 125 |  | 250 |  |  |
| Base Capacity (vph) | 383 | 990 | 2692 | 287 | 768 | 2085 | 1103 | 291 |
| Starvation Cap Reductn | 0 | 74 | 155 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.09 | 1.01 | 0.60 | 0.01 | 1.26 | 0.63 | 0.03 | 0.08 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

# Queues

## 1: Rowland Blvd & Redwood Blvd

08/07/2020

| Lane Group | EBL | EBT | EBR | WBL | WBT | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 445 | 35 | 176 | 33 | 82 | 104 | 635 | 47 | 105 | 849 | 352 |
| v/c Ratio | 0.66 | 0.07 | 0.33 | 0.13 | 0.14 | 0.41 | 0.48 | 0.07 | 0.40 | 0.63 | 0.43 |
| Control Delay | 42.4 | 29.2 | 6.5 | 41.9 | 16.7 | 46.7 | 24.9 | 0.2 | 45.7 | 27.1 | 4.8 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 0.1 |
| Total Delay | 42.4 | 29.2 | 6.5 | 41.9 | 16.7 | 46.7 | 24.9 | 0.2 | 45.7 | 27.5 | 4.9 |
| Queue Length 50th (ft) | 124 | 17 | 0 | 17 | 8 | 55 | 136 | 0 | 56 | 196 | 0 |
| Queue Length 95th (ft) | #279 | 40 | 47 | 55 | 27 | #144 | 278 | 0 | 133 | 381 | 68 |
| Internal Link Dist (ft) |  | 150 |  |  | 206 |  | 130 |  |  | 323 |  |
| Turn Bay Length (ft) |  |  |  | 120 |  |  |  |  |  |  |  |
| Base Capacity (vph) | 673 | 957 | 899 | 254 | 1545 | 254 | 1550 | 750 | 301 | 1611 | 912 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 284 | 92 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.66 | 0.04 | 0.20 | 0.13 | 0.05 | 0.41 | 0.41 | 0.06 | 0.35 | 0.64 | 0.43 |

Intersection Summary

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

# Queues
## 2: Rowland Blvd & Redwood Hwy (SB)

| Lane Group | EBL | EBT | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 229 | 349 | 832 | 368 | 1002 | 1183 |
| v/c Ratio | 0.69 | 0.50 | 0.68 | 0.48 | 0.88 | 0.46 |
| Control Delay | 48.1 | 29.5 | 32.4 | 5.6 | 41.9 | 8.9 |
| Queue Delay | 0.0 | 0.0 | 1.1 | 0.2 | 0.0 | 0.0 |
| Total Delay | 48.1 | 29.5 | 33.6 | 5.7 | 41.9 | 8.9 |
| Queue Length 50th (ft) | 160 | 90 | 251 | 0 | 308 | 87 |
| Queue Length 95th (ft) | 205 | 111 | #415 | 82 | #497 | 400 |
| Internal Link Dist (ft) |  | 180 | 323 |  |  | 1078 |
| Turn Bay Length (ft) |  |  |  |  |  |  |
| Base Capacity (vph) | 552 | 1120 | 1217 | 760 | 1143 | 2573 |
| Starvation Cap Reductn | 0 | 0 | 182 | 50 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.41 | 0.31 | 0.80 | 0.52 | 0.88 | 0.46 |

Intersection Summary

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

## 3: Redwood Hwy (NB) & Rowland Blvd

| Lane Group | EBL | EBT | WBT | WBR | NBL | NBT | NBR |
|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 50 | 1030 | 1511 | 666 | 315 | 316 | 1044 |
| v/c Ratio | 0.39 | 0.53 | 0.50 | 0.55 | 0.76 | 0.76 | 0.98 |
| Control Delay | 39.1 | 23.0 | 15.0 | 3.3 | 48.1 | 48.0 | 56.1 |
| Queue Delay | 0.0 | 0.0 | 0.5 | 0.6 | 0.0 | 0.0 | 0.0 |
| Total Delay | 39.1 | 23.0 | 15.6 | 3.9 | 48.1 | 48.0 | 56.1 |
| Queue Length 50th (ft) | 32 | 210 | 204 | 0 | 208 | 209 | ~434 |
| Queue Length 95th (ft) | m61 | 357 | 342 | 65 | 263 | 264 | 404 |
| Internal Link Dist (ft) |  | 1078 | 342 |  |  | 113 |  |
| Turn Bay Length (ft) |  |  |  | 250 |  |  |  |
| Base Capacity (vph) | 129 | 1956 | 3033 | 1212 | 608 | 610 | 1060 |
| Starvation Cap Reductn | 0 | 0 | 964 | 224 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.39 | 0.53 | 0.73 | 0.67 | 0.52 | 0.52 | 0.98 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

# Queues
## 4: Rowland Blvd & Rowland Way

| Lane Group | EBL | EBT | WBT | SBL | SBR |
|---|---|---|---|---|---|
| Lane Group Flow (vph) | 245 | 1876 | 1882 | 264 | 253 |
| v/c Ratio | 0.68 | 0.47 | 0.80 | 0.85 | 0.56 |
| Control Delay | 77.1 | 5.6 | 21.9 | 74.5 | 12.4 |
| Queue Delay | 0.0 | 0.4 | 16.3 | 0.0 | 0.0 |
| Total Delay | 77.1 | 5.9 | 38.2 | 74.5 | 12.4 |
| Queue Length 50th (ft) | 132 | 204 | 683 | 223 | 4 |
| Queue Length 95th (ft) | 182 | 224 | 854 | #396 | 97 |
| Internal Link Dist (ft) |  | 342 | 319 | 100 |  |
| Turn Bay Length (ft) | 250 |  |  |  |  |
| Base Capacity (vph) | 708 | 4692 | 2661 | 338 | 473 |
| Starvation Cap Reductn | 0 | 1968 | 815 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.35 | 0.69 | 1.02 | 0.78 | 0.53 |

### Intersection Summary

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

# Queues
## 5: Vintage Way/Driveway Access & Rowland Blvd

| Lane Group | EBL | EBT | EBR | WBL | WBT | NBL | NBT | SBT |
|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 20 | 799 | 1037 | 2 | 1203 | 625 | 21 | 10 |
| v/c Ratio | 0.16 | 0.54 | 0.39 | 0.01 | 0.77 | 0.46 | 0.03 | 0.08 |
| Control Delay | 33.2 | 15.7 | 0.7 | 27.0 | 19.0 | 15.9 | 14.5 | 29.3 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 33.2 | 15.7 | 0.7 | 27.0 | 19.0 | 15.9 | 14.5 | 29.3 |
| Queue Length 50th (ft) | 7 | 94 | 0 | 1 | 166 | 75 | 4 | 3 |
| Queue Length 95th (ft) | 30 | 237 | 17 | 7 | #356 | 173 | 21 | 18 |
| Internal Link Dist (ft) |  | 319 |  |  | 981 |  | 486 | 155 |
| Turn Bay Length (ft) | 100 |  |  | 125 |  | 250 |  |  |
| Base Capacity (vph) | 129 | 1610 | 2658 | 355 | 1936 | 1503 | 815 | 131 |
| Starvation Cap Reductn | 0 | 0 | 130 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.16 | 0.50 | 0.41 | 0.01 | 0.62 | 0.42 | 0.03 | 0.08 |

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

| Intersection | |
|---|---|
| Intersection Delay, s/veh | 28 |
| Intersection LOS | D |

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | Y | | | ↰ | ↑ | ↱ |
| Traffic Vol, veh/h | 479 | 3 | 3 | 199 | 377 | 277 |
| Future Vol, veh/h | 479 | 3 | 3 | 199 | 377 | 277 |
| Peak Hour Factor | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 510 | 3 | 3 | 212 | 401 | 295 |
| Number of Lanes | 1 | 0 | 0 | 1 | 1 | 1 |

| Approach | EB | NB | SB |
|---|---|---|---|
| Opposing Approach | | SB | NB |
| Opposing Lanes | 0 | 2 | 1 |
| Conflicting Approach Left | SB | EB | |
| Conflicting Lanes Left | 2 | 1 | 0 |
| Conflicting Approach Right | NB | | EB |
| Conflicting Lanes Right | 1 | 0 | 1 |
| HCM Control Delay | 42.3 | 14.6 | 21.7 |
| HCM LOS | E | B | C |

| Lane | NBLn1 | EBLn1 | SBLn1 | SBLn2 |
|---|---|---|---|---|
| Vol Left, % | 1% | 99% | 0% | 0% |
| Vol Thru, % | 99% | 0% | 100% | 0% |
| Vol Right, % | 0% | 1% | 0% | 100% |
| Sign Control | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 202 | 482 | 377 | 277 |
| LT Vol | 3 | 479 | 0 | 0 |
| Through Vol | 199 | 0 | 377 | 0 |
| RT Vol | 0 | 3 | 0 | 277 |
| Lane Flow Rate | 215 | 513 | 401 | 295 |
| Geometry Grp | 5 | 2 | 7 | 7 |
| Degree of Util (X) | 0.411 | 0.899 | 0.748 | 0.491 |
| Departure Headway (Hd) | 6.892 | 6.31 | 6.71 | 5.994 |
| Convergence, Y/N | Yes | Yes | Yes | Yes |
| Cap | 526 | 574 | 533 | 595 |
| Service Time | 4.892 | 4.38 | 4.508 | 3.792 |
| HCM Lane V/C Ratio | 0.409 | 0.894 | 0.752 | 0.496 |
| HCM Control Delay | 14.6 | 42.3 | 27 | 14.5 |
| HCM Lane LOS | B | E | D | B |
| HCM 95th-tile Q | 2 | 10.7 | 6.4 | 2.7 |

# Queues

## 1: Rowland Blvd & Redwood Blvd

08/07/2020

| Lane Group | EBL | EBT | EBR | WBL | WBT | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 443 | 34 | 136 | 19 | 114 | 104 | 739 | 33 | 64 | 597 | 337 |
| v/c Ratio | 0.60 | 0.06 | 0.23 | 0.07 | 0.17 | 0.38 | 0.63 | 0.06 | 0.23 | 0.51 | 0.45 |
| Control Delay | 38.3 | 24.8 | 6.4 | 39.6 | 12.8 | 43.2 | 28.0 | 0.2 | 40.7 | 25.9 | 5.3 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 38.3 | 24.8 | 6.4 | 39.6 | 12.8 | 43.2 | 28.0 | 0.2 | 40.7 | 25.9 | 5.3 |
| Queue Length 50th (ft) | 106 | 11 | 0 | 8 | 7 | 48 | 164 | 0 | 29 | 126 | 0 |
| Queue Length 95th (ft) | #277 | 40 | 42 | 37 | 30 | #144 | 322 | 0 | 91 | 253 | 66 |
| Internal Link Dist (ft) |  | 150 |  |  | 206 |  | 130 |  |  | 323 |  |
| Turn Bay Length (ft) |  |  |  | 120 |  |  |  |  |  |  |  |
| Base Capacity (vph) | 733 | 1043 | 946 | 277 | 1664 | 277 | 1755 | 836 | 277 | 1755 | 955 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 108 | 24 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.60 | 0.03 | 0.14 | 0.07 | 0.07 | 0.38 | 0.42 | 0.04 | 0.23 | 0.36 | 0.36 |

Intersection Summary

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

# Queues

## 2: Rowland Blvd & Redwood Hwy (SB)

| | ↗ | → | ↑ | ↗ | ↘ | ↓ |
|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | NBT | NBR | SBL | SBT |
| Lane Group Flow (vph) | 306 | 379 | 877 | 381 | 1244 | 1015 |
| v/c Ratio | 0.79 | 0.49 | 1.03 | 0.59 | 0.87 | 0.41 |
| Control Delay | 53.8 | 34.7 | 79.5 | 7.6 | 43.2 | 10.3 |
| Queue Delay | 0.0 | 0.0 | 9.6 | 0.0 | 0.0 | 0.0 |
| Total Delay | 53.8 | 34.7 | 89.1 | 7.6 | 43.2 | 10.3 |
| Queue Length 50th (ft) | 224 | 118 | ~371 | 0 | 414 | 112 |
| Queue Length 95th (ft) | 298 | 148 | #506 | 89 | #659 | 345 |
| Internal Link Dist (ft) | | 180 | 323 | | | 1078 |
| Turn Bay Length (ft) | | | | | | |
| Base Capacity (vph) | 526 | 1053 | 851 | 649 | 1431 | 2467 |
| Starvation Cap Reductn | 0 | 0 | 22 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.58 | 0.36 | 1.06 | 0.59 | 0.87 | 0.41 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

## 3: Redwood Hwy (NB) & Rowland Blvd

| Lane Group | EBL | EBT | WBT | WBR | NBL | NBT | NBR |
|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 59 | 1206 | 1744 | 614 | 188 | 187 | 1452 |
| v/c Ratio | 0.45 | 0.99 | 0.52 | 0.50 | 0.62 | 0.62 | 0.88 |
| Control Delay | 35.8 | 65.0 | 12.7 | 3.6 | 49.1 | 48.8 | 27.2 |
| Queue Delay | 0.0 | 0.0 | 0.7 | 0.7 | 0.0 | 0.0 | 0.0 |
| Total Delay | 35.8 | 65.0 | 13.4 | 4.3 | 49.1 | 48.8 | 27.2 |
| Queue Length 50th (ft) | 33 | 368 | 200 | 14 | 134 | 133 | 466 |
| Queue Length 95th (ft) | m59 | m#403 | 424 | 109 | 165 | 164 | 605 |
| Internal Link Dist (ft) |  | 1078 | 342 |  |  | 113 |  |
| Turn Bay Length (ft) |  |  |  | 250 |  |  |  |
| Base Capacity (vph) | 136 | 1222 | 3379 | 1236 | 580 | 583 | 1646 |
| Starvation Cap Reductn | 0 | 0 | 1152 | 311 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.43 | 0.99 | 0.78 | 0.66 | 0.32 | 0.32 | 0.88 |

Intersection Summary

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

# Queues

## 4: Rowland Blvd & Rowland Way

08/07/2020

| Lane Group | EBL | EBT | WBT | SBL | SBR |
|---|---|---|---|---|---|
| Lane Group Flow (vph) | 333 | 2520 | 2431 | 198 | 186 |
| v/c Ratio | 0.90 | 0.60 | 1.00 | 0.81 | 0.56 |
| Control Delay | 90.2 | 5.8 | 42.1 | 76.7 | 19.4 |
| Queue Delay | 0.0 | 3.1 | 36.8 | 0.0 | 0.0 |
| Total Delay | 90.2 | 8.9 | 78.9 | 76.7 | 19.4 |
| Queue Length 50th (ft) | 160 | 254 | ~1150 | 158 | 26 |
| Queue Length 95th (ft) | #266 | 375 | #1491 | 247 | 107 |
| Internal Link Dist (ft) |  | 342 | 319 | 100 |  |
| Turn Bay Length (ft) | 250 |  |  |  |  |
| Base Capacity (vph) | 372 | 4170 | 2420 | 329 | 401 |
| Starvation Cap Reductn | 0 | 1516 | 498 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.90 | 0.95 | 1.26 | 0.60 | 0.46 |

### Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

# Queues
## 5: Vintage Way/Driveway Access & Rowland Blvd

|  | ↗ | → | ↘ | ↙ | ← | ↖ | ↑ | ↓ |
|---|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | NBL | NBT | SBT |
| Lane Group Flow (vph) | 33 | 928 | 1511 | 3 | 971 | 1319 | 29 | 23 |
| v/c Ratio | 0.35 | 0.72 | 0.56 | 0.02 | 0.80 | 0.80 | 0.03 | 0.23 |
| Control Delay | 50.6 | 26.2 | 1.0 | 37.0 | 28.8 | 24.8 | 13.6 | 41.5 |
| Queue Delay | 0.0 | 0.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 50.6 | 27.2 | 1.1 | 37.0 | 28.8 | 24.8 | 13.6 | 41.5 |
| Queue Length 50th (ft) | 16 | 170 | 0 | 1 | 215 | 270 | 6 | 9 |
| Queue Length 95th (ft) | #53 | #383 | 16 | 10 | 324 | #517 | 25 | 36 |
| Internal Link Dist (ft) |  | 319 |  |  | 981 |  | 486 | 155 |
| Turn Bay Length (ft) | 100 |  |  | 125 |  | 250 |  |  |
| Base Capacity (vph) | 94 | 1417 | 2690 | 260 | 1562 | 1654 | 876 | 98 |
| Starvation Cap Reductn | 0 | 237 | 124 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.35 | 0.79 | 0.59 | 0.01 | 0.62 | 0.80 | 0.03 | 0.23 |

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

# HCM 6th AWSC
## 6: Rowland Blvd & Vintage Way

08/07/2020

| Intersection | |
|---|---|
| Intersection Delay, s/veh | 26.9 |
| Intersection LOS | D |

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | ↰↱ | | | ↰↑ | ↑ | ↱ |
| Traffic Vol, veh/h | 423 | 3 | 1 | 327 | 360 | 360 |
| Future Vol, veh/h | 423 | 3 | 1 | 327 | 360 | 360 |
| Peak Hour Factor | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 450 | 3 | 1 | 348 | 383 | 383 |
| Number of Lanes | 1 | 0 | 0 | 1 | 1 | 1 |

| Approach | EB | NB | SB |
|---|---|---|---|
| Opposing Approach | | SB | NB |
| Opposing Lanes | 0 | 2 | 1 |
| Conflicting Approach Left | SB | EB | |
| Conflicting Lanes Left | 2 | 1 | 0 |
| Conflicting Approach Right | NB | | EB |
| Conflicting Lanes Right | 1 | 0 | 1 |
| HCM Control Delay | 36 | 21.9 | 23.7 |
| HCM LOS | E | C | C |

| Lane | NBLn1 | EBLn1 | SBLn1 | SBLn2 |
|---|---|---|---|---|
| Vol Left, % | 0% | 99% | 0% | 0% |
| Vol Thru, % | 100% | 0% | 100% | 0% |
| Vol Right, % | 0% | 1% | 0% | 100% |
| Sign Control | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 328 | 426 | 360 | 360 |
| LT Vol | 1 | 423 | 0 | 0 |
| Through Vol | 327 | 0 | 360 | 0 |
| RT Vol | 0 | 3 | 0 | 360 |
| Lane Flow Rate | 349 | 453 | 383 | 383 |
| Geometry Grp | 5 | 2 | 7 | 7 |
| Degree of Util (X) | 0.658 | 0.841 | 0.739 | 0.663 |
| Departure Headway (Hd) | 6.791 | 6.684 | 6.949 | 6.232 |
| Convergence, Y/N | Yes | Yes | Yes | Yes |
| Cap | 534 | 539 | 525 | 582 |
| Service Time | 4.8 | 4.782 | 4.66 | 3.943 |
| HCM Lane V/C Ratio | 0.654 | 0.84 | 0.73 | 0.658 |
| HCM Control Delay | 21.9 | 36 | 26.9 | 20.4 |
| HCM Lane LOS | C | E | D | C |
| HCM 95th-tile Q | 4.8 | 8.7 | 6.2 | 4.9 |

# Appendix H 2015-2019 Crash Data, Rowland Blvd/Vintage Way

Crashes at Rowland Blvd/Vintage Way
2015-2019

Source: Transportation Injury Mapping System
https://tims.berkeley.edu/tools/gismap/

| CASE_ID | COLLISION_DATE | PRIMARY_RD | SECONDARY_RD | DISTANCE | DIRECTION | COLLISION_SEVERITY | NUMBER_KILLED | NUMBER_INJURED | PARTY_COUNT | PCF_VIOL_CATEGORY | TYPE_OF_COLLISION | MVIW | LIGHTING | CONTROL_DEVICE | COUNTY | CITY | POINT_X | POINT_Y |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8522406 | 12/19/2017 | ROWLAND BL | VINTAGE WY | 0 |  | 4 | 0 | 2 | 2 | 12 | D | C | A | A | MARIN | NOVATO | -122.555 | 38.09359 |
| 8670869 | 7/29/2018 | ROWLAND BL | VINTAGE WY | 0 |  | 3 | 0 | 1 | 1 | 3 | E | I | A | A | MARIN | NOVATO | -122.555 | 38.09359 |