APPENDICES FOR THE WEST OAKLAND LINK INITIAL STUDY/ MITIGATED NEGATIVE DECLARATION

June 2022

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Air Quality Analysis Technical Errata

Memorandum

To:	Mark Aikawa and Eva Pong
From:	Cory Matsui, ICF Senior Air Quality Specialist Diana Roberts, ICF Project Manager
Date:	November 30, 2020
Re:	**Air Quality Technical Errata**

Dear Mr. Aikawa and Ms. Pong,

The below documentation serves as an update to the existing regulatory and environmental conditions at the project site regarding air quality as of 2020. As needed, effect conclusions are updated as well. This errata memorandum was prepared by ICF staff member Cory Matsui, senior air quality specialist. It includes the following sections:

- Project Description
- Setting
- Effects Analysis
- References

Project Description

The footprint for the project has not changed since the San Francisco-Oakland Bay Bridge Regional Bicycle/Pedestrian Connection Initial Study/Mitigated Negative Declaration (IS/MND) was drafted in 2014. However, the project proponent has introduced three phasing options to guide construction.

The Link may be implemented in more than one phase to respond to timing considerations and the availability of funds as well as the schedule for related projects. The sections that follow discuss the possible phasing options. All Class II bicycle lanes and bicycle boxes would be installed as part of the initial period of construction, regardless of phasing options.

Phasing Option 1

Phasing Option 1 would construct approximately 2,900 feet of Class I path structure, beginning approximately 600 feet east of Maritime Street and continuing to the Bay Bridge Trail. Starting from the east, the structure would begin approximately 600 feet east of Maritime Street with an

interim connection to the multi-use path (MUP), which was installed as part of the high-occupancy vehicle/bus extension project. Under Phasing Option 1, the West Oakland Link profile would be lowered to tie in to West Grand Avenue. The structure would continue west, parallel to West Grand Avenue. The elevated Link structure would span Maritime Street and the existing at-grade railroad crossings near Burma Road. The structure would then continue under the Interstate 80 ramps and tie in at the connection to the Bay Bridge Trail. Construction under the initial build portion of Phasing Option 1 would correspond to a portion of Segment 4 and all of Segment 5.

When additional funding for construction is available, the Link would be extended to Mandela Parkway. The interim connection to West Grand Avenue could either be demolished or retained as an emergency access point. The remaining easterly portion of Segment 4 would be constructed with a slightly revised vertical profile. Segments 1 through 3 as well as the ramps to Maritime Street and Oakland Maritime Support Services (OMSS) (the remainder of Segment 4) would also be constructed.

Phasing Option 2

Phasing Option 2 would be similar to Phasing Option 1. However, a 600-foot segment on the east side of Maritime Street would be designed and constructed so that the bridge deck could be raised during a future phase of the project, providing a smooth profile and minimizing elevation changes for the Link under the full build condition. Construction under the initial build portion of Phasing Option 2 would correspond to a portion of Segment 4 and all of Segment 5.

When additional funding for construction becomes available, the Link would be extended to Mandela Parkway. The above-mentioned 600 feet of the bridge deck could be raised to its final elevation by extending the bridge columns. Segments 1 through 3, the remaining easterly portion of Segment 4, and the ramps to Maritime Street and OMSS would also be constructed.

Phasing Option 3

Phasing Option 3 would construct Segment 4, except for the ramps to Maritime Street, OMSS, and Segment 5 of the Link project.

When additional funding for construction is available, Segments 1 through 3 and the ramps to Maritime Street and OMSS could be constructed.

Setting

Changes in the Setting

In general, the environmental setting of the project area is largely similar to the setting discussed in the 2015 air quality technical memorandum. With respect to ambient air quality in the project area, the most recent monitoring data from the California Air Resources Board (CARB) for the 2017–2019 period is available. That data, shown in Table 1, below, indicate that there has been an increase in the number of violations regarding ozone and particulate matter 2.5 micrometers in diameter and smaller (PM2.5) relative to the 2011–2013 period. Although the 2015 Air Quality Analysis technical

memorandum showed that there were two violations of the PM2.5 standard in the 2011–2013 period, the current dataset shows that there were approximately 21 violations of the PM2.5 standard and, additionally, a violation of the state and federal 8-hour ozone standards and a violation of the state 1-hour ozone standard. There have not been any changes with respect to carbon monoxide or nitrogen dioxide violations.

Table 1. Ambient Air Quality Monitoring Data for the Oakland-West Station

Pollutant Standards	2017	2018	2019
Ozone (O_3)			
Maximum 1-hour concentration	0.087	0.063	0.101
Maximum 8-hour concentration	0.069	0.050	0.072
3-hour concentration	0.048	0.047	0.049
Days state 1-hour standard exceeded (0.09 ppm)	0	0	1
Days state 8-hour standard exceeded (0.070 ppm)	0	0	1
Days national 8-hour standard exceeded (0.070 ppm)	0	0	1
Carbon Monoxide (CO)			
Maximum 1-hour concentration	6	3.6	2.4
Maximum 8-hour concentration	2.1	3.1	1.7
Days state 1-hour standard exceeded (20 ppm)	—	—	—
Days national 1-hour standard exceeded (35 ppm)	0	0	0
Days state 8-hour standard exceeded (9.0 ppm)	—	—	—
Days national 8-hour standard exceeded (9 ppm)	0	0	0
Particulate Matter (PM10)			
No data available			
Particulate Matter (PM2.5)			
Maximum state 24-hour concentration	56.0	169.2	29.3
Maximum national 24-hour concentration	56.0	169.2	29.3
Annual average concentration	12.9	14.4	7.8
Days national 24-hour standard exceeded (expected) (35 µg/m^3)	7.1	14.6	0.0
Nitrogen Dioxide (NO_2)			
Maximum 1-hour concentration	52.3	75.6	50.0
Annual average concentration	13	12	11
Days state standard exceeded (0.18 ppm)	0	0	0
Days national standard exceeded (0.100 ppm)	0	0	0

Source: California Air Resources Board 2020a; U.S. Environmental Protection Agency 2020a.
Notes:
ppm = parts per million
µg/m^3 = micrograms per cubic meter
— = insufficient data available to determine the value

With respect to the National Ambient Air Quality Standards (NAAQS), Alameda County was previously listed as a nonattainment area for particulate matter 2.5 micrometers in diameter and smaller (PM2.5); however, the county is currently considered to be in attainment for PM2.5 under the NAAQS. The current attainment status of Alameda County for all pollutants is reported in Table 2.

Table 2. Federal and State Attainment Status of the Project Area (Alameda County)

Pollutant	NAAQS	CAAQS
Ozone (8-hour standard)	Marginal Nonattainment	Nonattainment
CO	Maintenance (P)	Attainment
PM10	Attainment	Nonattainment
PM2.5	Attainment	Nonattainment

Sources: California Air Resources Board 2020; U.S. Environmental Protection Agency 2020.
(P) = designation applies to a portion of the county; NAAQS = National Ambient Air Quality Standards; CAAQS = California Ambient Air Quality Standards

With respect to sensitive receptors, the discussion in the 2015 memorandum adequately describes the types of receptors found in the project vicinity. The sensitive receptors in the vicinity are still recreational facilities (Raimondi Park) and residences. In addition, the project site is still partially located in a largely commercial and industrial area.

Changes in Regulatory Setting

The regulatory setting applicable to the proposed project described in the 2015 memorandum is largely representative of the current regulatory environment. Overall, the fundamental regulations regarding criteria air pollutants have not changed substantially. However, there have been minor changes to the ambient air quality standards since the 2015 memorandum; namely, the NAAQS for ozone were changed from 0.075 part per million (ppm) to 0.070 ppm. The current NAAQS and California Ambient Air Quality Standards (CAAQS) are listed in Table 3.

Effects Analysis

Changes in Methods

A quantitative analysis of the project's impacts in order to evaluate specifically construction with the phasing options has not been conducted because the quantitative results in the 2015 memorandum represent a worst-case scenario. Consequently, there are no changes to the methodology of the air quality analysis.

Table 3. Federal and State Ambient Air Quality Standards

Criteria Pollutant	Average Time	California Standards	National Standards[a]	
			Primary	Secondary
Ozone	1 hour	0.09 ppm	None[b]	None[b]
	8 hours	0.070 ppm	0.070 ppm	0.070 ppm
CO	8 hours	9.0 ppm	9 ppm	None
	1 hour	20 ppm	35 ppm	None
PM10	24 hours	50 µg/m^3	150 µg/m^3	150 µg/m^3
	Annual mean	20 µg/m^3	None	None
PM2.5	24 hours	None	35 µg/m^3	35 µg/m^3
	Annual mean	12 µg/m^3	12.0 µg/m^3	15 µg/m^3
NO_2	Annual mean	0.030 ppm	0.053 ppm	0.053 ppm
	1 hour	0.18 ppm	0.100 ppm	None
SO_2[c]	Annual mean	None	0.030 ppm	None
	24 hours	0.04 ppm	0.14 ppm	None
	3 hours	None	None	0.5 ppm
	1 hour	0.25 ppm	0.075 ppm	None
Lead	30-day average	1.5 µg/m^3	None	None
	Calendar quarter	None	1.5 µg/m^3	1.5 µg/m^3
	3-month average	None	0.15 µg/m^3	0.15 µg/m^3
Sulfates	24 hours	25 µg/m^3	None	None
Visibility-reducing Particles	8 hours	—[d]	None	None
Hydrogen Sulfide	1 hour	0.03 ppm	None	None
Vinyl Chloride	24 hours	0.01 ppm	None	None

Source: California Air Resources Board. 2016. *Ambient Air Quality Standards.* May 4. Available: https://ww3.arb.ca.gov/research/aaqs/aaqs2.pdf. Accessed: October 20, 2020.

ppm = parts per million; µg/m^3 = micrograms per cubic meter

a. National standards are divided into primary and secondary standards. Primary standards are intended to protect public health, whereas secondary standards are intended to protect public welfare and the environment.

b. The federal 1-hour standard of 12 parts per hundred million was in effect from 1979 through June 15, 2005. The revoked standard is referenced because it was employed for such a long period and is a benchmark for State Implementation Plans.

c. The annual and 24-hour NAAQS for SO_2 apply only for 1 year after designation of the new 1-hour standard to those areas that were previously in nonattainment for the 24-hour and annual NAAQS.

d. The CAAQS for visibility-reducing particles is defined by an extinction coefficient of 0.23 per kilometer, which is visibility of 10 miles or more due to particles when relative humidity is less than 70 percent.

Changes in Effects

As noted in the 2015 memorandum, the project is exempt from conformity requirements because it is a bicycle and pedestrian facility. The use of phasing options during construction does not change the project's exemption from conformity requirements; therefore, regional and project-level conformity analyses are not required.

For operational emissions of ozone precursors, carbon monoxide (CO), particulate matter 10 micrometers in diameter and smaller (PM10), and PM2.5, the phasing options would not change the number of path users who travel to and from the 100-space parking lot appreciably. The 2015 memorandum assumed that the project would become operational in 2019; the actual operational year will be at least several years later. Consequently, the operational emissions shown in Table 4 of the 2015 memorandum represent a worst-case scenario because vehicle emissions in 2019 would be higher on a per-mile basis than in subsequent years. The vehicle fleet generally becomes less polluting over time because of advancements in vehicle technology and the retirement of older, more polluting vehicles. Because the project would become operational at a time subsequent to 2019, the operational emissions are anticipated to be less than what is shown in Table 4 of the 2015 memorandum.

With respect to mobile-source air toxic (MSAT) impacts, the phasing options would not change the project's designation as one that has no meaningful MSAT impacts. The rationale for this designation, as noted in the 2015 memorandum, is that the project would involve construction of a bicycle/pedestrian path and therefore would have minimal air quality impacts. This rationale is still valid.

Construction of the proposed project with the phasing options described above would not result in worsened impacts with respect to construction-related emissions of ozone precursors, CO, and PM10 relative to emissions described in the 2015 memorandum. Overall, the phasing options would result in construction activities and emissions with a lower intensity compared with the originally planned construction activities because project construction between Frontage Road and Mandela Parkway would occur later than the rest of the project. Emissions from the project with the phasing options are therefore anticipated to be less than the quantified emissions shown in Table 5 of the 2015 memorandum. As shown in that table, the construction years assumed in the original analysis were 2017 through 2019. Because project construction would start and end approximately four years later, the construction equipment would be cleaner because older, more polluting equipment would be replaced by newer, cleaner equipment. Therefore, the portion of the project from Frontage Road to Mandela Parkway would be constructed at a later date, whenever funding is available, and with newer, cleaner equipment. In summary, construction with the phasing options would result in fewer emissions compared with those shown in the 2015 memorandum because construction would occur later and with cleaner equipment.

Impacts related to naturally occurring asbestos (NOA) would remain unchanged from the impacts described in the 2015 memorandum. The project would still not be located in an area that is known to contain NOA.

A new multi-family residential building will be constructed at 2011–2195 Wood Street that was not previously considered in the 2015 memorandum. To reduce health effects from existing sources of pollution in the area (e.g., Interstate 80, Port of Oakland, trains), the Wood Street project was required to comply with the City of Oakland's (City's) conditions of approval. These conditions of approval required the project sponsor to choose one of two options. The first was to prepare a Health Risk Assessment (HRA). If health risks are below acceptable levels, then no further measures are needed. If risks are above acceptable levels, then the project sponsor would need to implement approved HRA recommendations. Alternatively, the project sponsor can choose to implement all of the measures listed in the City's conditions of approval.

Although the planned building is not currently built or occupied, it is possible that it will be constructed and occupied by the time construction of the project commences. As such, construction of the project could adversely affect future occupants (i.e., sensitive receptors) at the 2011–2195 Wood Street building through emissions of toxic air contaminants (TAC). The primary TAC of concern associated with project construction is diesel particulate matter (DPM), which is a carcinogen emitted by diesel internal combustion engines. Construction activities would generate DPM and could expose adjacent receptors at the Wood Street building to significant health risks. DPM concentrations would be dramatically reduced as the distance between construction activities and sensitive receptors increases, however. Given the linear nature of the project, it is not anticipated that construction activity would occur next to the Wood Street building for a prolonged period of time. Nevertheless, the proximity of project construction activity to sensitive receptors warrants an additional mitigation measure that was not proposed in the 2015 memorandum. With implementation of this additional mitigation measure, AQ-4, future construction activity in proximity to the Wood Street building or other reasonably foreseeable projects with sensitive receptors would require an evaluation for its health risk effect on those receptors. Health risks from project construction that are above the applicable Bay Area Air Quality Management District (BAAQMD) thresholds would necessitate implementation of additional measures to reduce impacts on sensitive receptors to a less-than-significant level.

Mitigation Measure AQ-4: Prepare a Health Risk Assessment prior to Construction near the Wood Street Residences and Implement Risk Reduction Measures (as necessary)

The project sponsor shall prepare a site-specific construction HRA for all construction activity within 1,000 feet of the 2011–2195 Wood Street project once the construction schedule for such activity is known. This HRA shall be prepared well in advance of construction so that if provision of filtration, as discussed below, can be installed prior to construction in the vicinity.

For the 2011–2195 Wood Street project, the project sponsor shall determine the specific measures or features that were approved for the Wood Street project, pursuant to the City's conditions of approval to reduce exposure to existing sources of TACs. Indoor air filtration at the Wood Street project is expected to be equal to MERV-13 or greater efficiency standards, based on the requirements of the West Oakland Community Action Plan. The project sponsor shall also confirm other measures at this building that will be implemented, such as strategic site layout planning, and indoor air quality monitoring units.

If the project's construction HRA demonstrates that health risk exposures or PM2.5 concentrations at adjacent receptors would be less than BAAQMD thresholds, then additional mitigation would be unnecessary. However, if the HRA demonstrates that health risks or PM2.5 concentrations would exceed BAAQMD thresholds, inclusive of the Wood Street project's conditions of approval, then additional mitigation shall be provided by the applicant to reduce risks so that the project's incremental risk is below BAAQMD project thresholds and the project does not contribute to an exceedance of the BAAQMD cumulative threshold . The additional mitigation may include source reductions, such as mandating Tier 4 engines in construction equipment, and/or receptor reductions, such as higher air filtration efficiency standards than those approved for the Wood Street project (e.g., MERV 14 or higher). The use of filtration with

higher MERV values, such as MERV-14, would result in additional filtering of particles beyond MERV-13, with up to 84% efficiency for MERV-14 for particles less than 1 micron in size.[1]

As summarized above, with the additional mitigation proposed above, there would be no notable worsened impacts under the phasing options and at the planned Wood Street building, compared to that identified in the 2015 technical memorandum. The original mitigation measures outlined in the 2015 memorandum would still be applicable as best management practices to reduce dust and exhaust emissions.

[1] Based on estimates from the U.S. Environmental Protection Agency (https://www.epa.gov/indoor-air-quality-iaq/what-merv-rating-1).

References

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California Air Resources Board. 2020a. *iADAM Air Quality Data Statistics*. Available: https://www.arb.ca.gov/adam/topfour/topfour1.php. Accessed: November 3, 2020.

California Air Resources Board. 2020b. *Summaries of Historical Area Designations for State Standards.* Available: https://ww2.arb.ca.gov/our-work/programs/state-and-federal-area-designations/state-area-designations/summary-tables. Accessed: October 28, 2020.

U.S. Environmental Protection Agency. 2020a. *Monitor Values Report*. Available: https://www.epa.gov/outdoor-air-quality-data/monitor-values-report. Accessed: November 3, 2020.

U.S. Environmental Protection Agency. 2020b. *Criteria Pollutant Nonattainment Summary Report*. Available: https://www3.epa.gov/airquality/greenbook/ancl3.html. Accessed: October 28, 2020.

Appendix A-2

Air Quality Analysis: San Francisco-Oakland Bay Bridge (SFOBB) Bicycle/Pedestrian Regional Connection Project— Air Quality Analysis (EA 4H970 EFIS 0413000324)

Memorandum

Date:	September 30, 2014
To:	Eva Lillie and Brian Krcelic TYLIN International 1111 Broadway, Suite 2150 Oakland, CA 94607
From:	Rich Walter and Kate Giberson
Subject:	**San Francisco-Oakland Bay Bridge (SFOBB) Bicycle/Pedestrian Regional Connection Project— Air Quality Analysis (EA 4H970 EFIS 0413000324)**

Introduction

The San Francisco-Oakland Bay Bridge (SFOBB) Bicycle/Pedestrian Connection Project (Project) is a new bicycle/pedestrian path connection (Path) between West Oakland and the new bike path leading to the new East Span of the San Francisco Oakland Bay Bridge (Bay Bridge) in Oakland, California (**Figure 1**). The Path would be approximately 6,030 linear feet. On the west end, the Path would connect to the existing bicycle/pedestrian path on the Bay Bridge (Bay Bridge Trail) on the south side of the Bay Bridge toll plaza. On the east end, the Path would connect to the existing bicycle/pedestrian path on Mandela Parkway. Refer to **Figure 2**.

The purpose of the Project is to provide a safe connection for bicyclists and pedestrians to travel between West Oakland and the Bay Bridge Trail. The area in between is occupied by industry, roadways, railways and I-880. Current access for bicyclists and pedestrians is on roadways extending through the industrial area which have heavy truck traffic.

The Project is proposed by the Gateway Park Working Group, which includes the following nine local, regional and state agencies: The Bay Area Toll Authority (BATA), the California Department of Transportation (Caltrans), San Francisco Bay Conservation and Development Commission (BCDC), California Transportation Commission (CTC), East Bay Regional Park District (EBRPD), City of Oakland, Port of Oakland, East Bay Municipal Utility District (EBMUD), and Association of Bay Area Governments (ABAG's). The agency responsible for operation and maintenance of the bike path is anticipated to be Caltrans but could also be City of Oakland.

Caltrans is the lead agency under the National Environmental Policy Act (NEPA). BATA is the lead agency under the California Environmental Quality Act (CEQA). The environmental documents are a CEQA initial study/mitigated negative declaration (IS/MND) and a NEPA categorical exclusion.

Because the project will involve the use of federal funds and Caltrans is the lead agency under NEPA, the technical memorandum addressed criteria pollutants and mobile source air toxics (MSATs) for construction and operational impacts consistent with Caltrans environmental procedures. As discussed in the memorandum, the Project will be exempt from transportation conformity requirements per Title 40 Part 93 of the Code of Federal Regulations (40CFR 93). The environmental document addresses criteria pollutants, health risks, odor, and climate change and greenhouse gas emissions for construction and operational impacts consistent with the Bay Area Air Quality Management District (BAAQMD) CEQA air quality guidelines.

This memorandum was prepared by ICF staff Shannon Hatcher, senior air quality specialist, and Kai-Ling Kuo, transportation engineer and air quality specialist. This memorandum includes the following sections.

- Project Description
- Project Construction
- Environmental Setting
- Environmental Consequences
- Avoidance, Minimization, and Mitigation Measures
- References Cited

Project Description

The proposed project is a new Class I bike path[1] located in the City of Oakland, Alameda County, near the I-880 and I-80 interchange and the new East Span of the Bay Bridge (**Figures 1, 2, and 3**).

The Class I Path would extend 6,030 feet (1.14 mile) between Mandela Parkway on the east and the Bay Bridge Trail on the west. The Path is an elevated structure for most of this distance to provide access across existing freeways, railways and industrial areas. It is an independent structure, except over the railroad tracks where it would be on the West Grand Avenue overcrossing structure. The elevated Path reaches a maximum height of 37 feet where it is on the overcrossing structure.

The Class I Path would be 17 feet wide (15 feet clear width and 2 feet for fencing), except on the overcrossing structure where it reduces to 14 feet wide (10 feet clear width and 4 feet for fencing). The bike path would have a maximum grade of 5 percent.

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[1] Bicycle Path Classifications:
Class I bikeways (bike paths) are separate paths with exclusive right of way for bicycles and pedestrians, with minimal vehicular crossings.
Class II bikeways (bike lanes) are striped lanes on streets, separating bicycles from vehicles, within the road right-of-way.
Class III bikeways (bike routes) are lanes shared with motor vehicles.
Source: California Department of Transportation. Highway Design Manual. Chapter 1000 Bicycle Transportation Design. Last updated March 7, 2014. http://www.dot.ca.gov/hq/oppd/hdm/hdmtoc.htm

Project Location

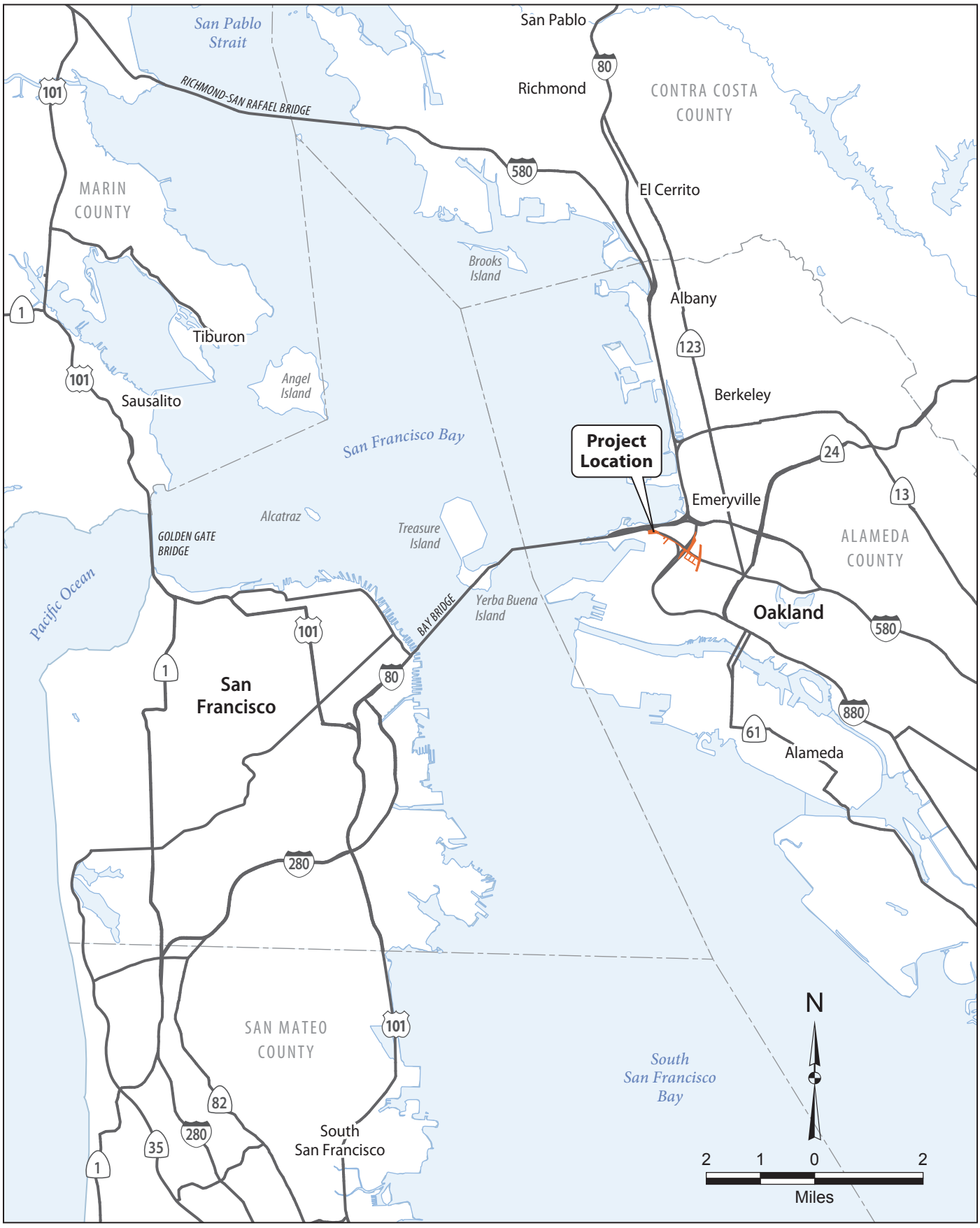


Figure 1

Path

TYLIN INTERNATIONAL | 1111 Broadway, Suite 2150 ▪ Oakland, CA 94607 ▪ 510.457.3030 ▪ www.tylin.com

Project Area

Figure 2

Path

The Project could also include Class II bike lanes and a 100-space parking lot at the east end of the Class I Path, if funding is available. The Class II bike lanes would extend along surface streets near the east touchdown of the Path, providing connections to Mandela Parkway and to the proposed Wood Street parking lot.

Class I Path Segments

The Path has been divided into the following five segments described below from east to west (**Figure 3**).

1. At-Grade Connection to Mandela Parkway
2. Separate Elevated Structure East
3. West Grand Avenue Overcrossing
4. Separate Elevated Structure West
5. At-Grade Connection to Bay Bridge Trail

Segment 1. At-Grade Connection to Mandela Parkway

The Class I Path would be at-grade along the south side of West Grand Avenue, between Mandela Parkway and Campbell Street (**Figure 4**). This segment would be approximately 450 feet long and 15-feet wide since no fencing is required. There would be a landscape median on the north side of the path to separate the path from vehicular traffic.

Where Campbell Street and Willow Street currently intersect with West Grand Avenue, a cul-de-sac or barrier would be created on the south side of West Grand Avenue to prevent regular vehicular traffic from crossing the new Class I Path.

Segment 2. Separate Elevated Structure East

From Campbell Street, the Class I Path would continue for approximately 1,050 feet as a separate structure along the south side of West Grand Avenue. The Path has an elevated ascent similar to West Grand Avenue, crossing over Willow Street and Wood Street (**Figure 5**). After the Wood Street crossing, the Path would continue on the West Grand Avenue overcrossing (refer to Segment 3 below).

Construction of this segment would require permanently closing or vacating the existing Grand Avenue Alley. Grand Avenue Alley is the narrow one-way street on the south side of Grand Avenue, between Mandela Parkway and Wood Street.

Segment 3. West Grand Avenue Overcrossing

After the Wood Street overcrossing, the Class I Path would continue on the West Grand Avenue overcrossing for approximately 780 feet. It would cross over the frontage road and railroad tracks (narrow gauge tracks or spur line), under the I-880 freeway structures, and over the Burlington Northern & Santa Fe Railroad and Union Pacific railroad tracks (**Figure 6**). The width of the travel

lanes and striped median would be reduced to provide enough width for the Path using the existing West Grand Avenue roadway structure. After the railroad crossings, the Path would continue as a separate structure on the south side of West Grand Avenue (refer to Segment 4).

Segment 4. Separate Elevated Structure West

After the railroad crossing, the Class I path would continue for approximately 3,400 feet as a separate structure on the south side of West Grand Avenue. It would cross over Maritime Street and continue to the touchdown near the Caltrans maintenance facility (**Figures 7 and 8**). East of the Caltrans maintenance facility, the path would descend with a switchback curve.

This segment could also include two ramps, from the elevated structure to Maritime Street, that could be constructed after the Class I path if funding is available. On the east side of Maritime Street, there could be a 700-foot-long ramp extending to Burma Road. On the west side of Maritime Street, there could be a 250-foot-long ramp extending to a roof-top landing and rest stop on the planned Oakland Maritime Support Services building. The maximum grade on the ramps would be 5 percent.

Segment 5. At-Grade Connection to Bay Bridge Trail

From the west touchdown, the Class I Path would continue another 350 feet at grade level below the I-880/80 connection lanes and connect to the existing Bay Bridge Trail (also known as Segment 2 bike path) (**Figure 8**).

Class II Bike Lanes

The Project could also include Class II bike lanes along surface streets near the east touchdown of the Class I Path, providing connections to Mandela Parkway and the proposed Wood Street parking lot (**Figure 3**). The width of the Class II bike lanes, extending along each side of the street, would be 5 feet. The Class II bike lanes, which cover approximately 4,650 linear feet, would be constructed after the Class I Path, if funding is available.

Class II bike lanes would extend along the following surface streets:

- 20th Street, from Mandela Parkway (one block south of West Grand Avenue) to Wood Street
- Wood Street, from 20th Street to 24th Street
- Willow Street, from 20th Street to West Grand Avenue
- Campbell Street, from 20th Street to West Grand Avenue

Where Campbell Street currently intersects with West Grand Avenue, bollards would be installed to allow emergency vehicles but prevent regular vehicular traffic from crossing the new Class I Path on the south side of West Grand Avenue. Where Willow Street currently intersects with West Grand Avenue, a cul-de-sac would be created to prevent vehicular traffic from crossing the new Class I Pike path on the south side of West Grand Avenue.

Bike Path Segments

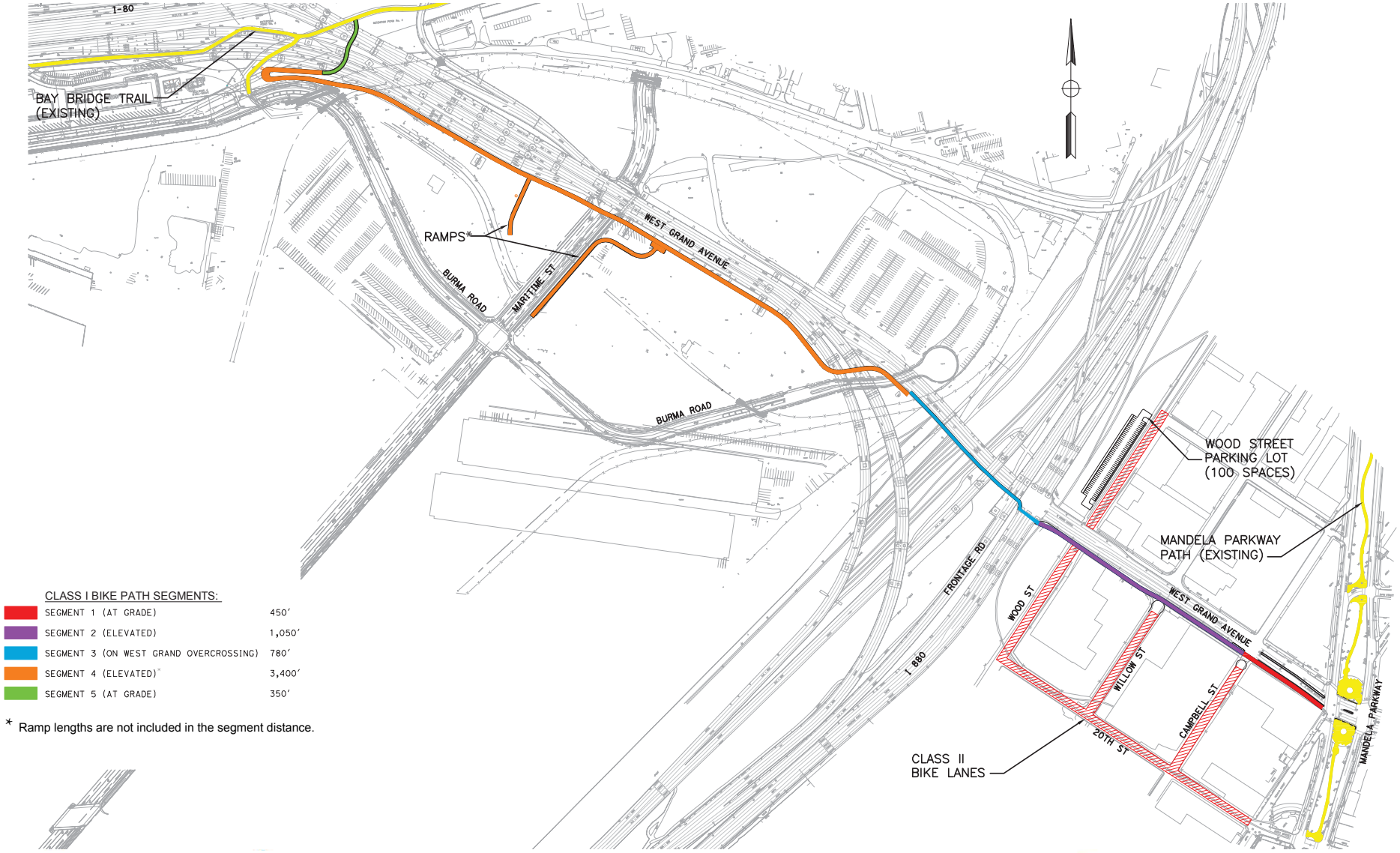
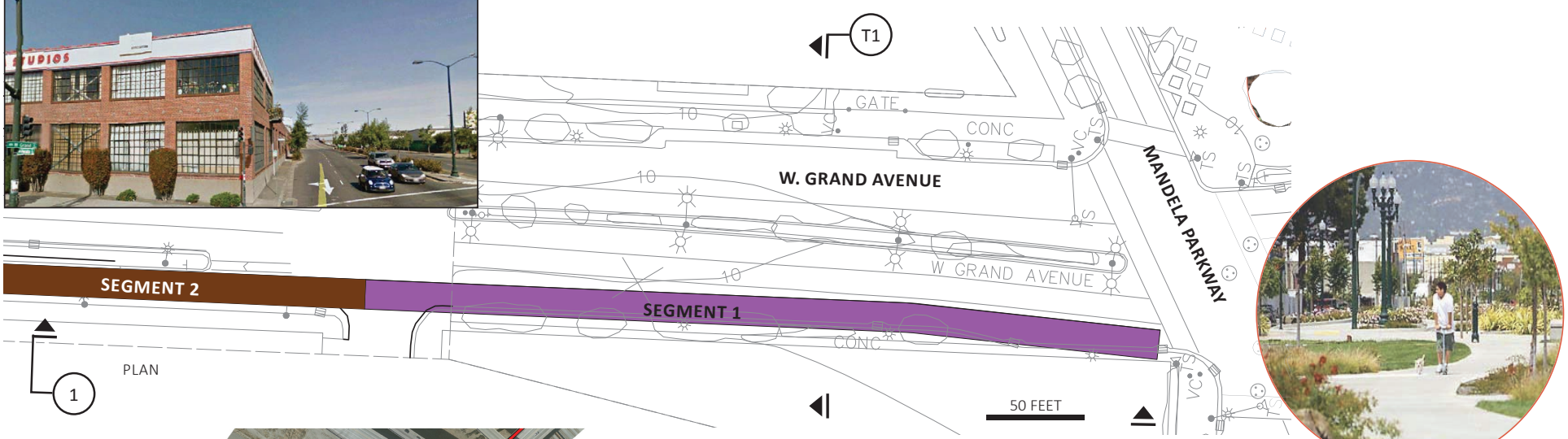
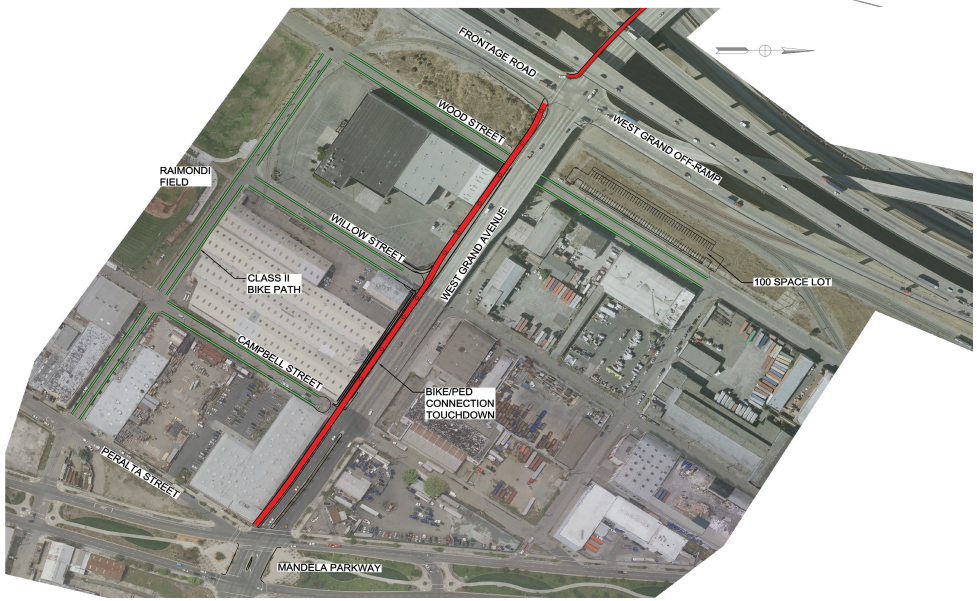


Figure 3

Path

Bike Path Segment 1





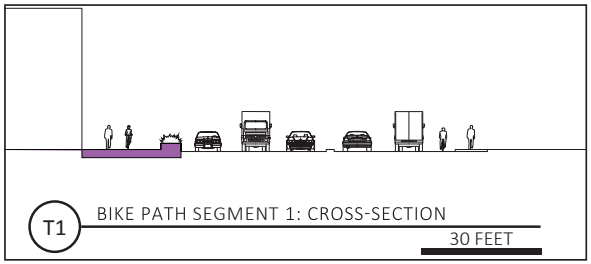


Figure 4

Path

Wood Street Parking Lot

The project could include construction of a new 100-space parking lot located on the west side of Wood Street, north of West Grand Avenue, and beneath the east side of the I-880 freeway (**Figure 3**). The parking lot would cover .48 acres (21,217 square feet).

The parking lot would include lighting to achieve a minimum of ½ foot candle and 1 foot candle at primary circulation areas. The parking lot would include landscaping, which could include drought-tolerant trees, shrubs and groundcover on an additional 6,000 sf. The Wood Street parking lot would be constructed after the Class I Path, if funding is available.

Mandela Parkway Median

The Project could include streetscape improvements, such as landscaping and art work, on the Mandela Parkway median within one block of West Grand Avenue. The landscaping would enhance the existing landscaping and would not involve any major changes.

Project Features

Access Points

As described above for Segments 1 and 5, the Path would be accessible from Mandela Parkway at West Grand Avenue on the east end and from the Bay Bridge Trail on the west end (**Figure 3**).

Additionally, there could be access points on either side of Maritime Street, whereby the elevated portion of the Path could have ramps extending down to the east and/or west side of Maritime Street (**Figure 3**). On the west side of Maritime Street, the ramp would be approximately 250 linear feet and could include a landing on the roof top of the planned Oakland Maritime Support Services building. On the east side of Maritime Street, the ramp would be approximately 700 feet. Both ramps would have a maximum grade of 5%.

Fencing

The elevated portion of the Path would include fencing that is 8 feet in height above the finished surface. The fencing will comply with all relevant building and safety codes. The type of fence has not been determined, but it is unlikely to be chain link fencing, except when the path is on West Grand Avenue over the railroad tracks (Segment 3). For Segment 3, there would likely be a 3- to 4-foot high concrete barrier between the path and vehicular traffic.

Lighting

The Path would be open at all times. Therefore, low-level lighting would be installed along the Path. It is anticipated that 1- to 2-foot candles[2] with LED lights would be side mounted in the barrier along the elevated segments, although there could also be some overhead lights installed at the top of the fencing if deemed necessary for safety. Lighting along the at-grade segments would be provided by new or existing street lights or pedestrian light standards.

Rest Areas

The elevated portion of the Path could have some wider areas that would serve as rest areas, but the number and location has not been determined. It is anticipated that there would be up to three such rest areas dispersed along the elevated segments.

Way-Finding Elements

The Path would include centerline striping and way-finding signage. There could also be safety signage, such as signs indicating the bicycle speed limit. Additionally, the Path could include *way-finding elements*, which may include old Bay Bridge artifacts, to help guide users to the existing paths and new East Span of the Bay Bridge.

Landscaping

The elevated portion of the Path could include planters in the wider rest areas or attached to the exterior sides of the structure. There could also be some landscaping under the structure at the west end touchdown (where path makes a switchback curve and descends) and at the east end (between Wood Street and Campbell Street).

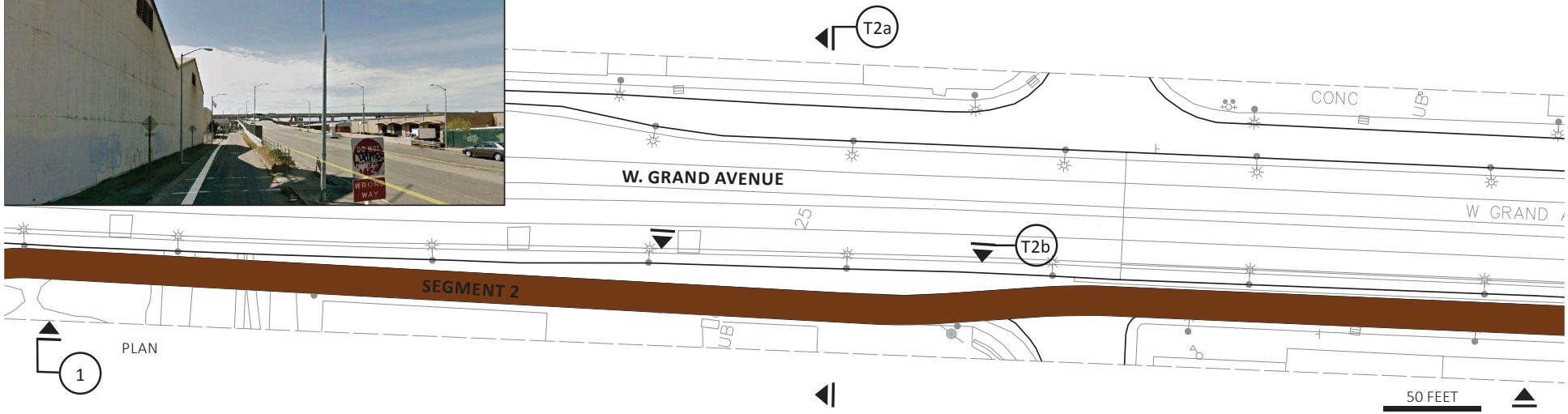
Stormwater Drainage

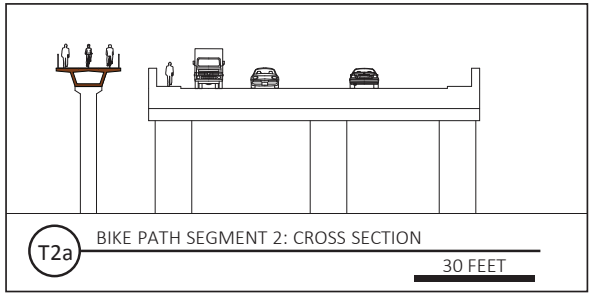
Stormwater on the elevated structure would likely drain off at downspouts at the columns, and continue as surface flows or be conveyed to an existing drainage system, depending on the existing drainage patterns and facilities at each location. There would be no stormwater flowing into existing wetlands or drainages.

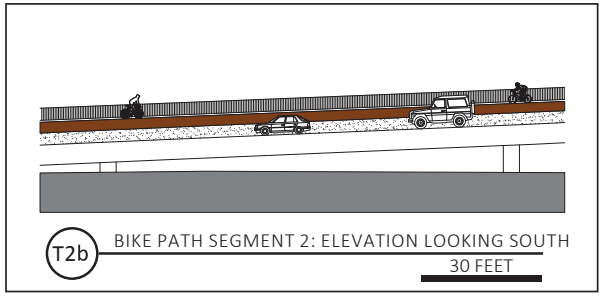
It is estimated that approximately 1.73 acres or 75,356 sf of stormwater treatment is needed. Stormwater treatment options include vegetated flow-through treatment areas or bio-treatment basins beneath the elevated path and/or in vacant areas by freeways and the proposed Wood Street parking lot. All areas under consideration for stormwater treatment options are within the project area (**Figure 9**).

[2] The term foot-candle refers to a measurement of illumination. It is a unit of illumination, equivalent to the illumination produced by a source of one candle at a distance of one foot and equal to one lumen incident per square foot. http://en.wikipedia.org/wiki/Foot-candle

Bike Path Segment 2







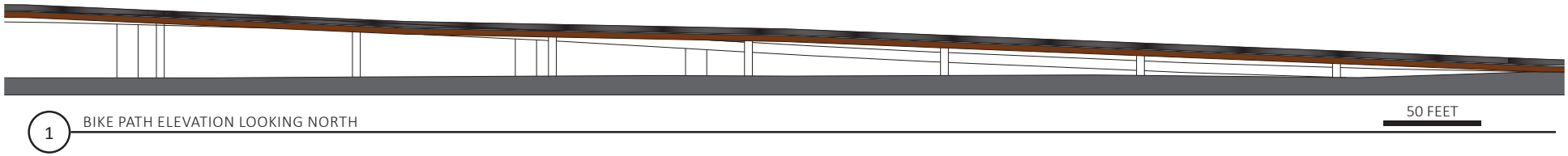


Figure 5

Path

Bike Path Segment 3

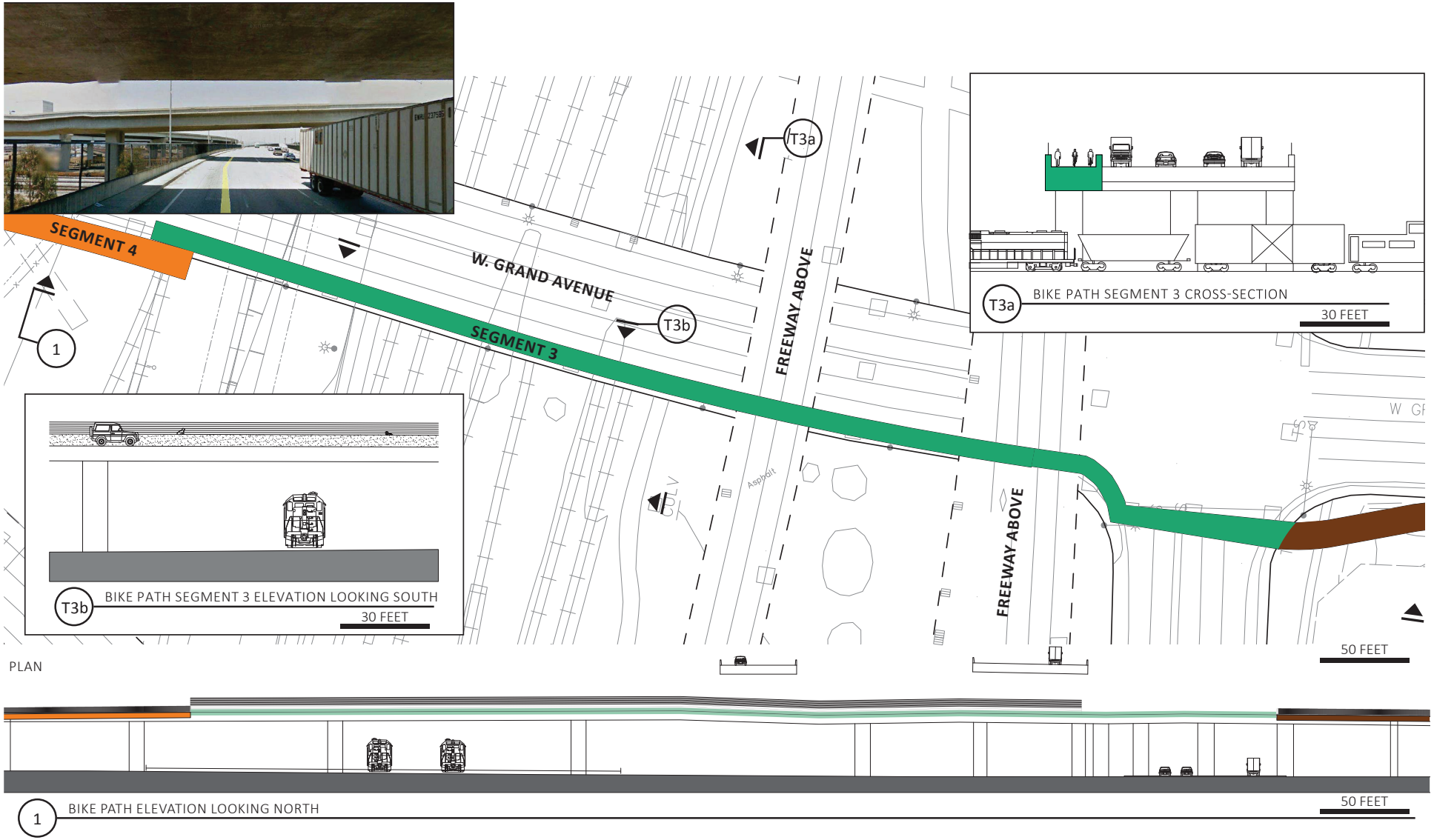


Figure 6

Path

Bike Path Segment 4

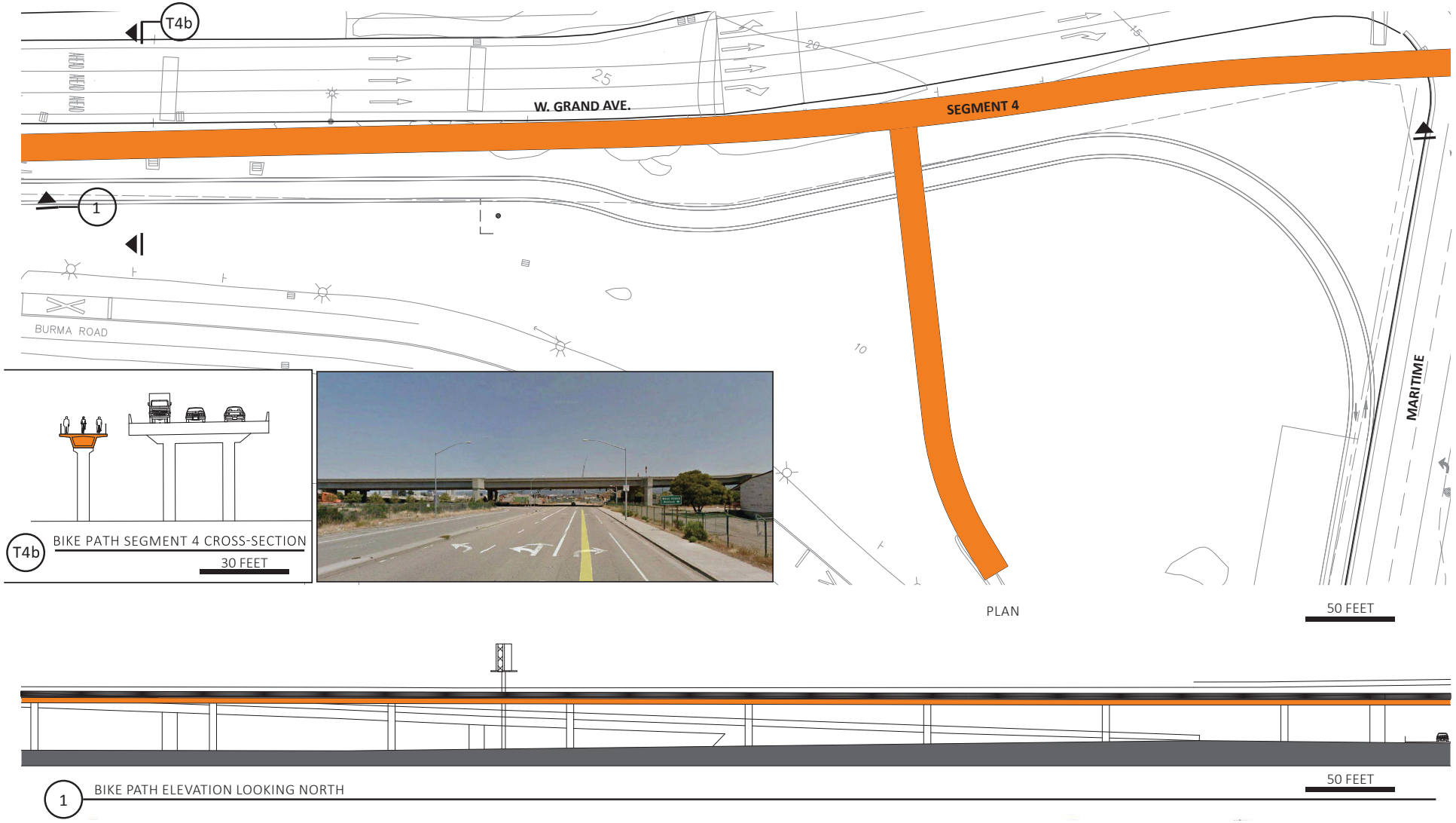


Figure 7

Path

Bike Path Segment 5

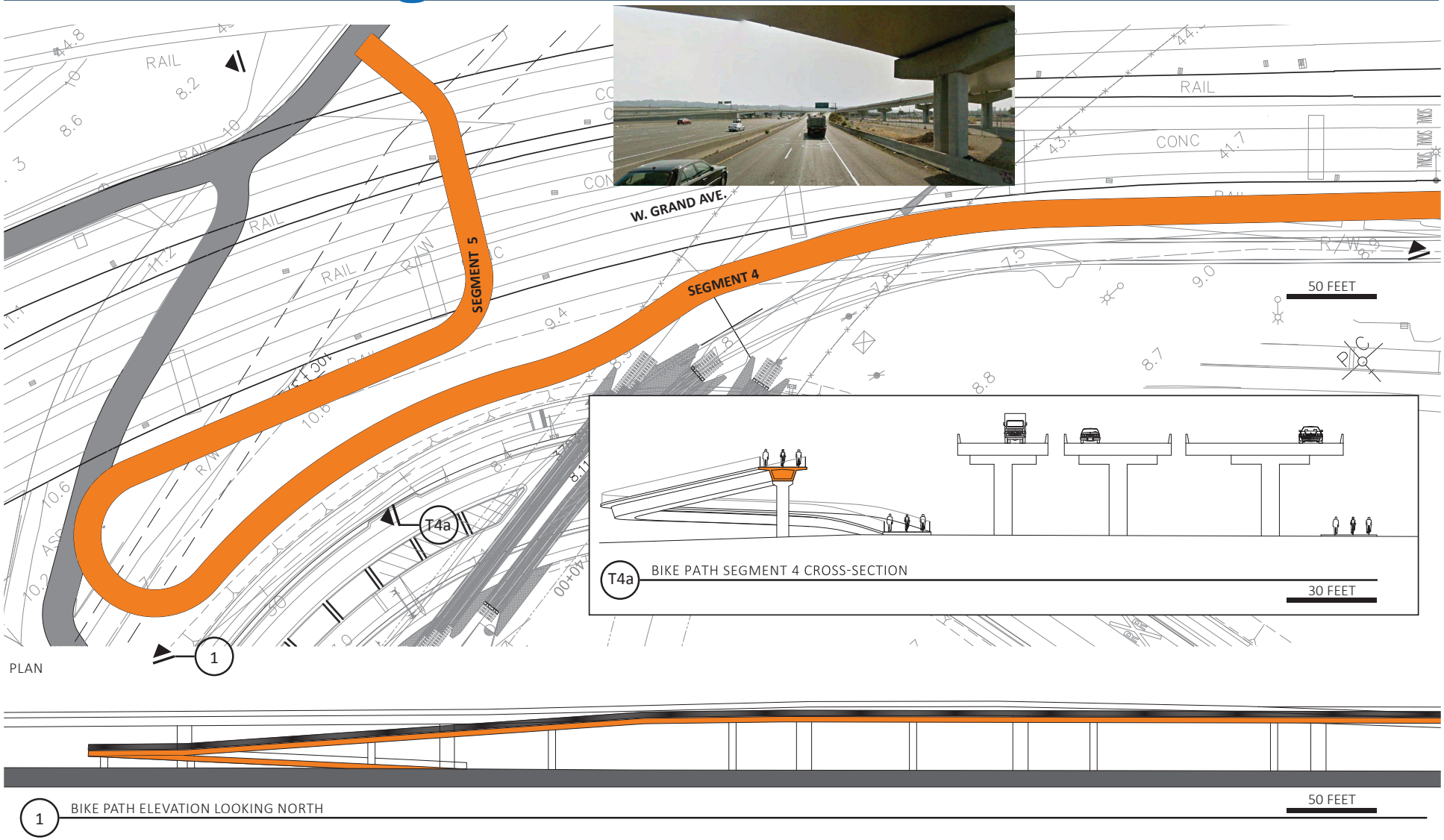


Figure 8

Path

Potential Stormwater Treatment Areas

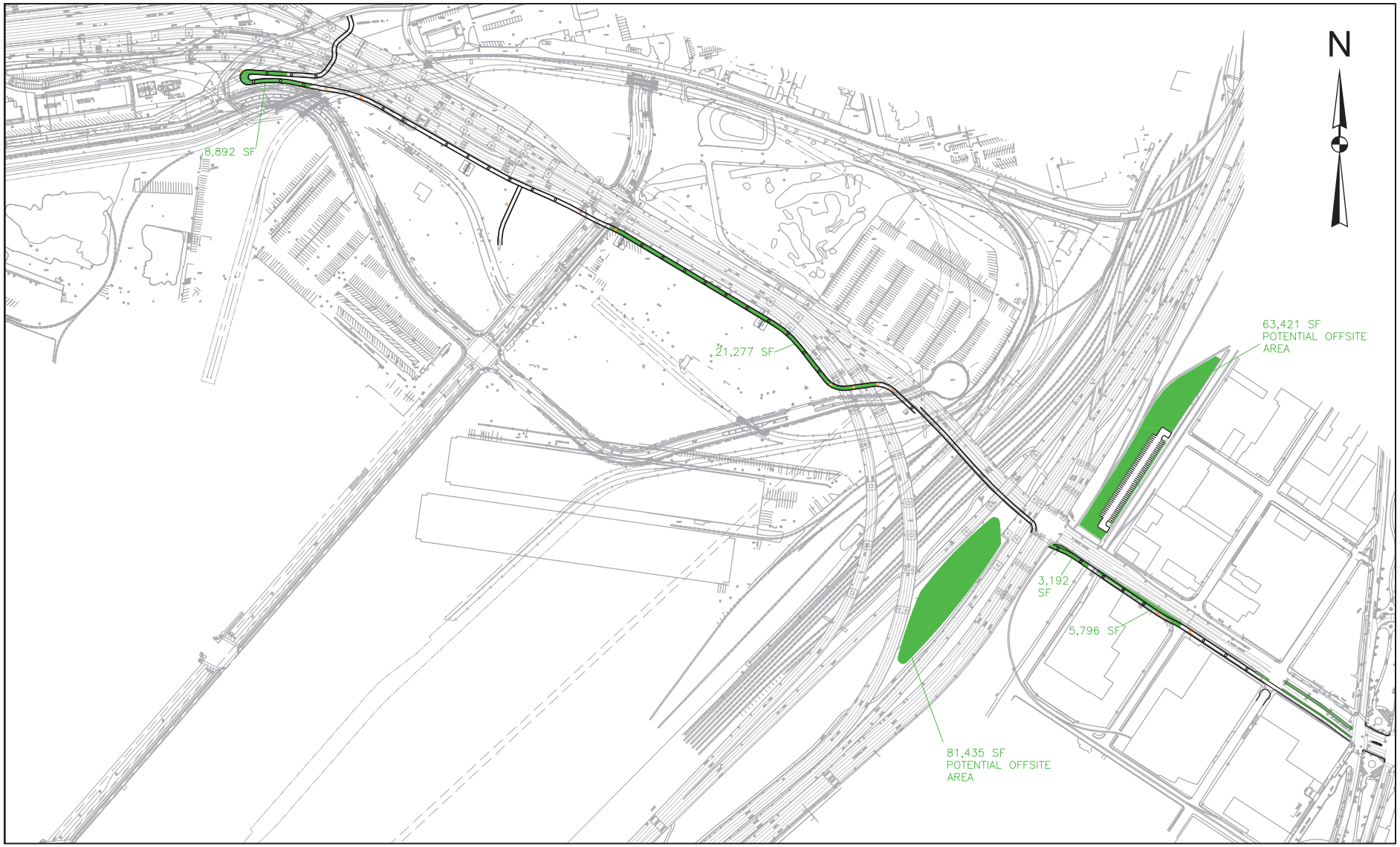


Figure 9

Path

Safety

In addition to the fencing and lighting described above, the elevated portion of the Path would include solar call boxes and security cameras. It is anticipated that the Path would be patrolled periodically by California Highway Patrol or City of Oakland officers on bicycles.

Operation & Maintenance

The Path would be open 24 hours per day, seven days per week. Maintenance would include weekly trash removal, monthly sweeping, and bi-annual inspections for restriping, resurfacing, and repairs.

Project Construction

Excavation and Grading

Project construction would require excavation, grading and new pavement as follows:

- Excavation up to 5 feet deep for 45 column footings for the elevated path (note that supporting piles would be driven 50-60 feet deep);
- Excavation up to 3 feet deep for at-grade modifications at the west end touch down near the Caltrans maintenance facility and the east touch down at Campbell Street and Willow Street, where there would be intersection modifications to create cul-de-sacs;
- Excavation up to 3 feet deep for at-grade modifications along City streets for new pavement sections, sidewalks and driveways; and
- Excavation up to 3 feet deep and grading for gravel and asphalt pavement at the Wood Street parking lot.

It is estimated that the project would result in up to approximately 2,600 cubic yards of cut material. During excavation, soils would be tested for contamination. Clean soils would be used or sold for reuse at nearby construction sites. Contaminated soils would be disposed at an appropriate facility.

It is possible that trees could be removed (e.g., northwest of the Maritime Street/Burma Road intersection or along West Grand Avenue), based on review of an aerial photo.

Construction Hours and Duration

Construction is anticipated to occur between the hours of 7:00 a.m. and 6:00 p.m., Monday through Saturday. It is possible that evening work will be required for construction over Maritime Street. There would be no construction on Sundays or national holidays without special permission.

Project construction is estimated to occur over 26 months from March 2017 to May 2019.

Vehicle Access

Construction truck activity and haul routes would be limited to key collector roads, including West Grand Avenue, Maritime Street, Frontage Parkway, and Wood Street. Construction vehicles may also use Burma Road, Mandela Parkway, Campbell Street, Willow Street, Peralta Street, and 20th Street.

Construction activities are not anticipated to result in any long-term road closures. Temporary road closures could include Campbell Street for intersection modifications at West Grand Avenue and Maritime Street to place falsework over Maritime Street for the new elevated structure.

Temporary lane closures could occur on West Grand Avenue, Maritime Street, Wood Street, Willow Street, Engineers Road, Peralta Street, Campbell Street, and 20th Street.

Construction Equipment

Construction equipment and vehicles could include: backhoes, loaders, tractors, cranes, lifts, pile drivers, concrete trucks and pump, paving machine, compactors/rollers, and trucks for demolition, grading, and materials delivery.

Construction equipment and power tools could include: jackhammers, air compressors, generators, concrete saws, power drills, welding equipment, sandblasting equipment, painting equipment, power and impact wrenches, and the like.

Piles for the 45 footings (estimated amount to support the elevated path) could be driven piles (precast concrete or steel) or cast-in-drilled-hole concrete piles, or a combination depending on the specific site conditions along the structure.

Staging

Construction staging would be on a disturbed or paved area, away from drainages. Options include using the Wood Street parking lot area before parking construction begins and renting a nearby parcel, possibly along Maritime Street or Burma Road.

Environmental Setting

The air quality management agencies of direct importance in the project area include the U.S Environmental Protection Agency (EPA), the California Air Resources Board (ARB), and the Bay Area Air Quality Management District (BAAQMD). The follow sections provide a brief description of these agencies, as well as existing air quality conditions in the project area. Sensitive receptors in the project area are also provided.

Federal Regulations

The federal Clean Air Act (CAA), enacted in 1963 and amended several times thereafter (including the 1990 amendments known as CAAA 1990, which are the current federal governing regulations

for air quality), establishes the framework for modern air pollution control. The EPA has established national ambient air quality standards (NAAQS) for six criteria pollutants (**Table 1**). Criteria pollutants include carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2) ozone, lead, and particulate matter (PM), which includes two subsets: PM less than 10 microns in diameter (PM10) and PM less than 2.5 microns in diameter (PM2.5). Most standards have been set to protect public health. For some pollutants, standards have been based on values such as protection of crops, protection of materials, or avoidance of nuisance conditions.

Under the 1990 CAAA, the U.S. Department of Transportation (DOT) cannot fund, authorize, or approve Federal actions to support programs or projects that are not first found to conform to State Implementation Plan (SIP) for achieving the goals of the CAA requirements. Conformity with the CAA typically takes place on two levels—first, at the regional level and second, at the project level. At the regional level, EPA transportation conformity regulations requires that the project be included in a currently conforming regional transportation plan (RTP) and transportation improvement program (TIP) at the time of project approval. Conformity at the project level requires hot spot analysis if a region is designated nonattainment or maintenance for CO and/or PM.

State Regulations

Responsibility for achieving the California ambient air quality standards (CAAQS) (Table 1), which for certain pollutants and averaging periods are more stringent than federal standards, is placed on the ARB and local air pollution control districts. State standards are achieved through district-level air quality management plans that are incorporated into the SIP, for which ARB is the lead agency.

The California Clean Air Act of 1988 (California CAA) substantially added to the authority and responsibilities of air districts. The California CAA designates air districts as lead air quality planning agencies, requires air districts to prepare air quality plans, and grants air districts authority to implement transportation control measures.

The California CAA focuses on attainment of the state ambient air quality standards and requires designation of attainment and nonattainment areas with respect to these standards. The act also requires that local and regional air districts expeditiously adopt and prepare an air quality attainment plan (Clean Air Plan) if the district violates state air quality standards for ozone, CO, SO_2, or NO_2. These plans are specifically designed to attain state standards and must be designed to achieve an annual 5% reduction in district-wide emissions of each nonattainment pollutant or its precursors. No locally prepared attainment plans are required for areas that violate the state PM10 standards; the ARB is responsible for developing plans and projects that achieve compliance with the state PM10 standards.

Table 1. Federal and State Ambient Air Quality Standards

			National Standards	
Criteria Pollutant	Average Time	California Standards	Primary	Secondary
Ozone	1-hour	0.09 ppm	None	None
	8–hour	0.070 ppm	0.075 ppm	0.075 ppm
Particulate Matter (PM10)	24-hour	50 μg/m^3	150 μg/m^3	150 μg/m^3
	Annual mean	20 μg/m^3	None	None
Fine Particulate Matter (PM2.5)	24-hour	None	35 μg/m^3	35 μg/m^3
	Annual mean	12 μg/m^3	12.0 μg/m^3	15.0 μg/m^3
Carbon Monoxide	8-hour	9.0 ppm	9 ppm	None
	1-hour	20 ppm	35 ppm	None
Nitrogen Dioxide	Annual mean	0.030 ppm	0.053 ppm	0.053 ppm
	1-hour	0.18 ppm	0.100 ppm	None
Sulfur Dioxide	Annual mean	None	0.030 ppm	None
	24-hour	0.04 ppm	0.014 ppm	None
	3-hour	None	None	0.5 ppm
	1-hour	0.25 ppm	0.075 ppm	None
Lead	30-day Average	1.5 μg/m^3	None	None
	Calendar quarter	None	1.5 μg/m^3	1.5 μg/m^3
	3-month average	None	0.15 μg/m^3	0.15 μg/m^3
Sulfates	24-hour	25 μg/m^3	None	None
Hydrogen Sulfide	1-hour	0.03 ppm	None	None
Vinyl Chloride	24-hour	0.01 ppm	None	None

Source: California Air Resources Board 2013

Notes:

ppm = parts per million

μg/m^3 = micrograms per cubic meter

Local Regulations

At the local level, air quality is managed through land use and development planning practices, which are implemented in the project area through the general planning process. The BAAQMD is responsible for establishing and enforcing local air quality rules and regulations that address the requirements of federal and state air quality laws. It is also responsible for ensuring the NAAQS and CAAQS are met. The proposed project is subject to BAAQMD rules and regulations at the time of construction, and may be subject to the following rules.

- Regulation 2, Rule 2 (New Source Review). This regulation contains requirements for Best Available Control Technology and emission offsets.
- Regulation 2, Rule 5 (New Source Review of Toxic Air Contaminates). This regulation outlines guidance for evaluating TAC emissions and their potential health risks.

- Regulation 6, Rule 1 (Particulate Matter). This regulation restricts emissions of PM darker than No. 1 on the Ringlemann Chart to less than three minutes in any one hour.
- Regulation 7 (Odorous Substances). This regulation establishes general odor limitations on odorous substances and specific emission limitations on certain odorous compounds.
- Regulation 8, Rule 3 (Architectural Coatings). This regulation limits the quantity of VOCs in architectural coatings.
- Regulation 9, Rule 6 (Nitrogen oxides emission from natural gas-fired boilers and water heaters). This regulation limits emissions of NO_X generated by natural gas-fired boilers.
- Regulation 9, Rule 8 (Stationary Internal Combustion Engines). This regulation limits emissions of NO_X and CO from stationary internal combustion engines of more than 50 horsepower.
- Regulation 11, Rule 2 (Asbestos Demolition, Renovation and Manufacturing). This regulation controls emissions of asbestos to the atmosphere during demolition, renovation, milling and manufacturing and establishes appropriate waste disposal procedures.

Existing Air Quality Conditions

The existing air quality conditions in the project area can be characterized by monitoring data collected in the region. The nearest monitoring station to the project is the Oakland-West station located at 1100 21st Street. The station is approximately 0.4 miles east of the project area and monitors for ozone, CO, PM2.5, and NO_2. There are currently no stations in the county that collect data on PM10. Table 2 summarizes ozone, CO, PM2.5, and NO_2 pollutant levels from the Oakland-West station for the last 3 years for which complete data are available (2011–2013). Air quality concentrations are expressed in terms of ppm or micrograms per cubic meter ($\mu g/m^3$). As shown in **Table 2**, the monitoring station has experienced two violations of the national PM2.5 standard during this time period.

Attainment Status

Local monitoring data (Table 2) are used to designate areas as nonattainment, maintenance, attainment, or unclassified for the NAAQS and CAAQS. The four designations are further defined as:

- **Nonattainment:** Assigned to areas where monitored pollutant concentrations consistently violate the standard in question.
- **Maintenance:** Assigned to areas where monitored pollutant concentrations exceeded the standard in question in the past but are no longer in violation of that standard.
- **Attainment:** Assigned to areas where pollutant concentrations meet the standard in question over a designated period of time.
- **Unclassified:** Assigned to areas were data are insufficient to determine whether a pollutant is violating the standard in question

Table 2. Ambient Air Quality Monitoring Data for the Oakland-West Station

Pollutant Standards	2011	2012	2013
Ozone (O_3)			
Maximum 1-hour concentration	0.057	0.061	0.071
Maximum 8-hour concentration	0.048	0.049	0.060
4th highest 8-hour concentration	0.045	0.046	0.045
Days state 1-hour standard exceeded (0.09 ppm)	0	0	0
Days state 8-hour standard exceeded (0.070 ppm)	0	0	0
Days national 8-hour standard exceeded (0.075 ppm)	0	0	0
Carbon Monoxide (CO)			
Maximum 1-hour concentration	2.7	2.4	3.2
Maximum 8-hour concentration	3.5	2.8	3.8
Days state 1-hour standard exceeded (20 ppm)	0	0	0
Days national 1-hour standard exceeded (35 ppm)	0	0	0
Days state 8-hour standard exceeded (9.0 ppm)	0	0	0
Days national 8-hour standard exceeded (9 ppm)	0	0	0
Particulate Matter (PM10)			
No data available			
Particulate Matter (PM2.5)			
Maximum state 24-hour concentration	43.1	29.2	42.7
Maximum national 24-hour concentration	-	12.3	42.7
Annual average concentration	-	-	12.7
Days national 24-hour standard exceeded (expected) (35 µg/m3)	0	0	2
Nitrogen Dioxide (NO_2)			
Maximum 1-hour Concentration	62.4	53.2	63.9
Annual Average Concentration	15	15	16
Days state standard exceeded (0.18 ppm)	0	0	0
Days national standard exceeded (0.100 ppm)	0	0	0

Source: California Air Resources Board 2014a; U.S. Environmental Protection Agency 2014a.

Notes:

ppm = parts per million

$\mu g/m^3$ = micrograms per cubic meter

\- = there was insufficient data available to determine the value

Table 3 summarizes the attainment status of the project area with regard to the NAAQS and CAAQS.

Table 3. Federal and State Attainment Status of the Project Area (Alameda County)

Pollutant	NAAQS	CAAQS
8-hour ozone	Marginal Nonattainment	Nonattainment
CO	Maintenance (P)	Attainment
PM10	Attainment	Nonattainment
PM2.5	Nonattainment	Nonattainment

Sources: California Air Resources Board 2014b; U.S. Environmental Protection Agency 2014b.
Notes:
(P) = designation applies to a portion of the County

Sensitive Receptors

Sensitive receptors are typically defined as facilities that attract children, the elderly, people with illnesses, or other sensitive to the effects of air pollution. Examples of sensitive receptors include residences, hospitals, schools, parks, and places of worship.

The Project would run through the industrial and commercial area in the west Oakland. Local air pollutants in the project area is emitted primarily by vehicular traffic traveling on the freeways (I-880, I-80), including truck traffic, as well as railroad and port-related operations. The Class I bike path would run immediately adjacent to W Grand Avenue and the Class II bike lanes would run on 20th Street, Wood Street, Willow Street, and Campbell Street.

Existing recreational uses include the bicycle/pedestrian pathway along Mandela Parkway and Raimondi Park on south side of 20th Street, between Wood Street and Campbell Street. The Mandela Parkway median includes informal seating areas within 100 feet of the intersection with West Grand Avenue. Raimondi Park is primarily used for active recreation, such as baseball and football activities. The closest residences are located on Peralta about 320 feet south of the Class II bike lane on 20th Street. There are no schools, churches, or hospitals within 1,000 feet of the project area.

Environmental Consequences

This section describes the proposed air quality effects[3] that could result from project implementation.

[3] Health risk effects related to exposure of proposed Path users to existing pollutant concentrations due to the proximity of major highways and railroad and port-related operations are addressed in the CEQA document.

Impact AQ-1: Conflict with transportation conformity requirements

As discussed above, federally funded projects must demonstrate compliance with the SIP through regional and project level conformity analyses. However, not all federally funded projects must complete a conformity analysis. The CAA lists certain types of highway and roadway transit projects that are exempt from the conformity requirements (40 CFR 93.126). Bicycle and pedestrian facilities, such as the Project, are among those listed in the CAA as exempt from conformity. Consequently, while the proposed project is federally funded, it may proceed toward implementation without a conformity analysis. Since the Project is exempt from transportation conformity per 40 CFR 93.126, neither an evaluation of inclusion of the Project in the currently conforming RTP and TIP (i.e. regional conformity analysis), nor a CO or PM hot-spot analysis (i.e. project level conformity analysis) is required.

Impact AQ-2: Generate operation-related emissions of ozone precursors (ROG and NO_X), CO, and PM10

Long-term project air quality impacts are limited to those associated with new vehicle trips to park in the project area and utilize the Path. The Project would not increase the capacity or traffic speed of the roadway system in the project area. Long-term project operation would require the use of electricity for proposed lighting along the Path and at the parking lot, which would primarily generate indirect emissions of greenhouse gases, with minimal criteria pollutant emissions.

The Project entails constructing a Class I bike path along the south side of West Grand Avenue; Class II bike lanes on parts of 20th Street, Wood Street, Willow Street, and Campbell Street; and a 100-space parking lot for the Path users. Path users and existing Bay Bridge Trail users utilizing the new parking lot could generate new vehicle trips to and from the parking lot.

Based on the trip generation estimated by the project's transportation consultant (Tellez pers. comm.), the parking lot is estimated to generate up to 550–600 local daily trips on weekdays and 2,500–2,800 local daily trips on weekends. Daily vehicle trips to and from the parking lot are estimated based on the existing Bay Bridge Trail bicycle/pedestrian counts. It is anticipated that some trail users would continue to use their existing parking locations, and some trail users who currently park elsewhere would switch to the new lot because it would be a more convenient location or result in a shorter travel distance. Therefore, the net new vehicle trips generated by the Project are expected to be fewer than the estimated daily vehicle trips.

The California Emission Estimator Model (CalEEMod), version 2013.2.2 was used to estimate direct criteria pollutant emissions from vehicle trips and indirect greenhouse gas emissions from electricity usage for proposed lighting. The operational assumptions and CalEEMod inputs and outputs are provided in **Attachment 1**. The default vehicle trip lengths and vehicle trip types from the CalEEMod for the "City Park" lane use were also used for the analysis.

Table 4 summarizes the maximum daily emissions and the annual emissions for the project using 550 weekday daily trips and 2,500 weekend daily vehicle trips. As described above, the emission estimates represent a worst-case scenario because the net new vehicle trips generated by the Project are expected to be fewer that estimated daily vehicle trips. While project implementation

would result in a minor net increase in vehicle trips, vehicle miles traveled, and associated operational emissions, these increases are anticipated to be fairly minimal. No mitigation is required.

Table 4. Summary of Operational Criteria Pollutant Emissions

Daily/Annual Emissions	ROG	NO_x	CO	PM10	PM2.5
Maximum Daily Emissions (lbs/day)	7.74	19.71	71.96	11.68	3.32
Annual Emissions (tons/year)	0.61	1.68	6.39	0.91	0.26
BAAQMD Thresholds (lbs/day)	54	54	*CAAQS*	82	54

Notes:
CAAQS = violation of a *CAAQS*
See Attachment 1 for operation assumptions and CalEEMod inputs and outputs.

Impact AQ-3: Generate significant levels of MSAT emissions

The Project falls under FHWA Category 1, no meaningful mobile source air toxic (MSAT) impacts, because it is exempt from CAA conformity under 40 CFR 93.126 (see Impact AQ-1). Moreover, because the purpose of the Project is to construct a bicycle/pedestrian path connection and promote safety access, it would cause minimal air quality impacts for CAA criteria pollutants and would not be linked with any special MSAT concerns. As such, this Project would not result in substantial changes in traffic volumes, vehicle mix, basic project location, or any other factor that would cause an increase in MSAT impacts of the project from that of the no-project alternative.

Moreover, EPA regulations for vehicle engines and fuels would cause overall MSAT emissions to decline significantly over the next several decades. Based on regulations now in effect, an analysis of national trends with EPA's MOVES model forecasts a combined reduction of over 80 percent in the total annual emission rate for the priority MSAT from 2010 to 2050 while vehicle-miles of travel are projected to increase by over 100 percent. This will both reduce the background level of MSAT as well as the possibility of even minor MSAT emissions from this project.

Impact AQ-4: Generate construction-related emissions of ozone precursors (ROG and NO_X), CO, and PM10

Construction activities associated with the Project would generate short-term emissions of ROG, NO_x, CO, PM10, and PM2.5. Emissions would originate from on-road hauling trips, construction worker commute trips, construction site fugitive dust, and off-road construction equipment. Construction-related emissions would vary substantially depending on the level of activity, specific construction operations, and wind and precipitation conditions.

CalEEMod were used to estimate construction emissions based on the project-specific inputs of construction phases and schedule, duration, equipment, demolition and earthmoving volume, and truck and worker trips associated with each phase. Construction data, including phases, schedule, construction equipment, and off-haul debris are provided by the project's engineering consultant TYLIN International. The construction assumptions and CalEEMod inputs and outputs are provided

in **Attachment 1**. Construction equipment defaults, such as emission factors, horsepower, and load factors, from the CalEEMod were used for the analysis. It is assumed that on-site construction equipment and construction activities would occur 5 days per week and 8 hours per day. The default vehicle trip lengths, for hauling trucks and workers, from the CalEEMod were also used for the analysis.

Table 5 summarizes the maximum daily emissions and the annual emissions for the project. Project construction is estimated to occur less than five years (over 2 years from March 2017 to May 2019).

Table 5. Summary of Construction Criteria Pollutant Emissions

Daily/Annual Emissions	ROG	NO_x	CO	PM10			PM2.5		
				Dust	Exhaust	Total	Dust	Exhaust	Total
Year 2017									
Maximum Daily Emissions (lbs/day)	2.53	19.49	18.85	2.06	1.07	2.71	0.41	1.04	1.36
Annual Emissions (tons/year)	0.14	1.04	1.15	0.10	0.06	0.16	0.02	0.06	0.08
Year 2018									
Maximum Daily Emissions (lbs/day)	1.62	13.59	13.69	1.73	0.65	2.08	0.32	0.61	0.93
Annual Emissions (tons/year)	0.10	0.88	0.89	0.08	0.04	0.13	0.02	0.04	0.06
Year 2019									
Maximum Daily Emissions (lbs/day)	0.59	5.03	6.17	0.40	0.26	0.67	0.11	0.24	0.35
Annual Emissions (tons/year)	0.01	0.09	0.13	0.01	0.00	0.02	0.00	0.00	0.01
BAAQMD Thresholds (lbs/day)	54	54	-	BMPs	82	-	BMPs	54	-

Notes:
BMPs = best management practices.
See Attachment 1 for construction assumptions and CalEEMod inputs and outputs.

Federal transportation conformity requires the evaluation of construction-related hot-spot emissions if construction activities will last longer than five years in one general location. While the proposed project is not subject to conformity requirements, as construction of the project is expected to last up to 26-months, a hot-spot analysis would not be required under transportation conformity requirements.

Construction activities are subject to Caltrans Standard Specifications, Section 14-9, Air Quality. This section requires the contractor to comply with the BAAQMD rules, ordinances, and regulations, as well as control dust from construction related activities. The BAAQMD (2011) Air Quality Guidelines establishes thresholds of significance for criteria pollutants, TACs, and odors. It also considers dust

impacts to be less than significant through the application of best management practices (BMPs). In addition, the BAAQMD recommends construction contractors to implement all basic construction mitigation measures as listed in the Air Quality Guidelines to reduce construction emissions from dust and diesel exhaust. Implementation of Mitigation Measures AQ-1 through AQ-3 is therefore required.

Impact AQ-5: Expose receptors to naturally occurring asbestos during construction

Depending on a project's size and geographic location, BAAQMD may require mitigation to address potential impacts from naturally occurring asbestos (NOA). BAAQMD enforces ARB's applicable air toxic control measures (ATCM) which requires operations engaged in road construction and maintenance, grading, and quarrying and surface mining activities in areas where NOA is likely to be found, to employ the best available dust mitigation measures to reduce and control dust emissions.

Projects that are located in an area known to contain NOA or have the potential to disturb asbestos (from soil or building material) are required to prepare and submit applicable notification forms and comply with all the requirements of ARB's ATCM. For projects that not involve earth-disturbing activity in an area known to contain NOA or are not located in these NOA areas, it can be assumed that the Project would not have the potential to expose people to airborne asbestos particles.

The Project is not located in an area known to contain NOA. Accordingly, the Project is not required to submit NOA notification forms, but must employ the best available dust mitigation measures to reduce and control dust emissions (as outlined in Mitigation Measure AQ-2).

Avoidance, Minimization, and Mitigation Measures

Most of the construction impacts on air quality are short-term in duration and, therefore, would not result in long-term adverse conditions. Implementation of the following mitigation measures would reduce any air quality impacts resulting from construction activities.

Mitigation Measure AQ-1: Implement California Department of Transportation Standard Specifications

The project applicant will comply with Caltrans' Standard Specifications in Section 14-9 Air Quality (2010).

- Section 14-9.02 specifically requires compliance by the contractor with all applicable laws and regulations related to air quality, including air pollution control district and air quality management district regulations and local ordinances.
- Section 14-9.03 is directed at controlling dust. If dust palliative materials other than water are to be used, material specifications are contained in Section 18.

Mitigation Measure AQ-2: Implement BAAQMD Basic Control Measures to Control Construction-Related Dust

In accordance with the BAAQMD's current Air Quality Guidelines (2011), when practical, the project applicant will implement the following BAAQMD-recommended control measures to reduce particulate matter emissions from construction activities.

- All exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) will be watered two times per day.
- All haul trucks transporting soil, sand, or other loose material off-site will be covered.
- All visible mud or dirt track-out onto adjacent public roads will be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweeping is prohibited.
- All vehicle speeds on unpaved roads will be limited to 15 miles per hour.
- All roadways, driveways, and sidewalks to be paved will be completed as soon as possible. Building pads will be laid as soon as possible after grading unless seeding or soil binders are used.
- A publicly visible sign will be posted with the telephone number and person to contact at the Lead Agency regarding dust complaints. This person will respond and take corrective action within 48 hours. The Air District's phone number will also be visible to ensure compliance with applicable regulations.

Mitigation Measure AQ-3: Implement BAAQMD Basic Control Measures to Reduce Exhaust Emissions during Construction

The project applicant will implement, to the extent feasible, the following measures to reduce exhaust emissions (NO_x and PM10) from construction equipment. These mitigation measures are based on measures proposed in the BAAQMD Air Quality Guidelines (2011).

- Idling times will be minimized either by shutting equipment off when not in use or reducing the maximum idling time to 5 minutes (as required by the California Airborne Toxics Control Measure—13 California Code of Regulations [CCR] 2485). Clear signage will be provided for construction workers at all access points.
- All construction equipment will be maintained and properly tuned in accordance with manufacturer's specifications. All equipment will be checked by a certified visible emissions evaluator.

References Cited

Printed References

Bay Area Air Quality Management District. 2011. California Environmental Quality Act Air Quality Guidelines. May. San Francisco, CA.

California Air Resources Board. 2013. *Ambient Air Quality Standards*. Last revised: June 4, 2013. Available: http://www.arb.ca.gov/research/aaqs/aaqs2.pdf. Accessed: July 15, 2014.

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U.S. Environmental Protection Agency. 2014a. Monitor Values Report. Last revised: July 11, 2014. Available: http://www.epa.gov/airdata/ad_rep_mon.html. Accessed: July 15, 2014.

U.S. Environmental Protection Agency. 2014b. *The Green Book Nonattainment Areas for Criteria Pollutants*. Last revised: July 2, 2014. Available: <http://www.epa.gov/oar/oaqps/greenbk/>. Accessed: July 15, 2014.

Personal Communications

Tellez, Kathrin. Transportation Engineer. Fehr and Peers. July 15, 2014—email to Kai-Ling Kuo, ICF International, San Jose, CA, regarding vehicle trips generated by the Wood Street parking lot.

Attachment 1

Calculations for Estimating Construction and Operation Emissions

San Francisco-Oakland Bay Bridge Bicycle/Pedestrian Connection Project

Construction Emissions - Criteria Pollutants

Maximum Daily Emissions from Tailpipe Exhaust and Fugitive Dust (CalEEMod Output)

Year	ROG	NOX	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total
	lb/day									
2017	2.53	19.49	18.85	0.04	2.06	1.07	2.71	0.41	1.04	1.36
2018	1.62	13.59	13.69	0.03	1.73	0.65	2.08	0.32	0.61	0.93
2019	0.59	5.03	6.17	0.01	0.40	0.26	0.67	0.11	0.24	0.35

Annual Emissions from Tailpipe Exhaust and Fugitive Dust (CalEEMod Output)

Year	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total
	tons/yr									
2017	0.14	1.04	1.15	0.00	0.10	0.06	0.16	0.02	0.06	0.08
2018	0.10	0.88	0.89	0.00	0.08	0.04	0.13	0.02	0.04	0.06
2019	0.01	0.09	0.13	0.00	0.01	0.00	0.02	0.00	0.00	0.01

Construction Emissions - GHGs

Total Annual Emissions from Tailpipe Exhaust and Electricity Usage

Year	CO2	CH4	N2O	CO2e
	MT/yr			
2017	180.93	0.02	0.00	181.32
2018	149.06	0.02	0.00	149.54
2019	22.45	0.00	0.00	22.50
Total	352.45	0.04	0.00	353.36

Annual Emissions from Tailpipe Exhaust (CalEEMod Output)

Year	CO2	CH4	N2O	CO2e
	MT/yr			
2017	179.27	0.02	0.00	179.65
2018	147.07	0.02	0.00	147.53
2019	21.62	0.00	0.00	21.66

Annual Emissions from Electricity Usage from Office Trailer

Year	CO2	CH4	N2O	CO2e
	MT/yr			
2017	1.67	0.000	0.000	1.68
2018	2.00	0.000	0.000	2.01
2019	0.83	0.000	0.000	0.84

Work Days
218
261
109

Construction Electricity Usage

Electricity intensity of other commercial use (kWh/sq f	22.5	(2014 Climate Registry Default Emission Factors, Table 14.7)
Number of field office trailer	1	
Sq ft per trailer	440	
Work days per year	261	
Electricity Usage (kWh/day/trailer)	38	

Operation Emissions - Criteria Pollutants

Maximum Daily Emissions from Vehicle Trips (CalEEMod Output)

Source	ROG	NOX	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total
	lb/day									
Vehicle Trips	7.74	19.71	71.96	0.18	11.39	0.29	11.68	3.05	0.27	3.32

Annual Emissions from Vehicle Trips (CalEEMod Output)

Source	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total
	tons/yr									
Vehicle Trips	0.61	1.68	6.39	0.01	0.88	0.02	0.91	0.24	0.02	0.26

Parking Lot Vehicle Trips Generation

550 weekday daily vehicle trips

2500 weekend daily vehicle trips

Note:

Estimation of daily vehicle trips to/from the parking lot are developed based on existing Bay Bridge Trail bicycle/pedestrian counts. It is anticipated that some trail users would continue to park where they currently do and some trail users that currently park elsewhere would switch to the new lot; therefore, the net new vehicle trips generated by the project are expected to be fewer than the estimated daily vehicle trips. Consequently, emission estimates using 550 weekday daily trips and 2,500 weekend daily vehicle trips represent a worst-case scenario.

Operation Emissions - GHGs

Annual Emissions from Vehicle Trips and Electricity Usage for Lighting (CalEEMod Output)

Source	CO2	CH4	N2O	CO2e
	MT/yr			
Area	0.002	0.000	0.000	0.002
Vehicle Trips	1,001	0.036	0.000	1,002
Electricity	14.72	0.001	0.000	14.81
Total	1,016	0.037	0.000	1,017

Electricity Usage for Lighting

200	kWh/evening
365	days
73000	kWh/year

Parameters

lb to MT	0.0004536
MWh to kWH	1000

	CO2	CH4	N2O	Source
Electricity Emission Rates (lbs/MWh)	444.62	0.029	0.006	PG&E 2012 CO2 Emission Rates (Climate Registry 2014), 2010 eGrid (EPA 2014)
GWP	1	25	298	IPCC AR4

References:

Climate Registry. 2014. General Reporting Protocol, 2014 Climate Registry Default Emission Factors. Available: http://www.theclimateregistry.org/resources/protocols/general-reporting-protocol/.

EPA. 2014. 2010 eGRID Version 1.0, 2010 summary Table. Last Updated: 2/24. Available: http://www.epa.gov/cleanenergy/energy-resources/egrid/.

Gateway Bike Path - Construction and Operation Emissions

Alameda County, Summer

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Parking Lot	100.00	Space	0.64	27,750.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	63
Climate Zone	5			**Operational Year**	2019
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	444.62	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Update with PG&E 2012 CO2 Emission Rates (Climate Registry 2014).

Demolition - 1,700 cy of export from path and 900 of export from parking lot, assume 1.3 tons/cy.

Vehicle Trips - Assume 550 trips/day on weekday and 2,500 trips/day on weekend. Use trip lengths and types for City Park land use.

Consumer Products - No consumer products related to parking lot.

Area Coating - No building in praking lot.

Energy Use - Lighting for path and parking lot is assumed to use about 200 kWh/evening (73,000 kWh/year).

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					
2017	2.5337	19.4914	18.8534	0.0375	2.0567	1.0657	2.7145	0.4122	1.0363	1.3594	0.0000	3,408.0427	3,408.0427	0.3537	0.0000	3,415.4708
2018	1.6173	13.5921	13.6906	0.0294	1.7267	0.6470	2.0838	0.3230	0.6071	0.9302	0.0000	2,603.9299	2,603.9299	0.4366	0.0000	2,613.0985
2019	0.7623	5.0256	6.1721	0.0119	0.4039	0.2649	0.6689	0.1077	0.2438	0.3515	0.0000	1,060.7463	1,060.7463	0.2126	0.0000	1,065.2101
Total	**4.9133**	**38.1091**	**38.7160**	**0.0787**	**4.1873**	**1.9776**	**5.4671**	**0.8429**	**1.8872**	**2.6410**	**0.0000**	**7,072.7189**	**7,072.7189**	**1.0029**	**0.0000**	**7,093.7793**

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	6.9200e-003	1.0000e-004	0.0103	0.0000		4.0000e-005	4.0000e-005		4.0000e-005	4.0000e-005		0.0219	0.0219	6.0000e-005		0.0231
Energy	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
Mobile	7.7365	19.7072	71.9554	0.1779	11.3869	0.2882	11.6750	3.0505	0.2655	3.3160		14,412.7908	14,412.7908	0.4893		14,423.0661
Total	**7.7434**	**19.7073**	**71.9657**	**0.1779**	**11.3869**	**0.2882**	**11.6751**	**3.0505**	**0.2656**	**3.3160**		**14,412.8126**	**14,412.8126**	**0.4894**	**0.0000**	**14,423.0893**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition-Bike Path	Demolition	3/1/2017	4/25/2017	5	40	

2	Site Preparation-Bike Path	Site Preparation	4/1/2017	5/28/2017	5	40	
3	Grading-Bike Path	Grading	5/1/2017	6/25/2017	5	40	
4	Footings-Bike Path	Trenching	7/1/2017	12/15/2017	5	120	
5	Columns-Bike Path	Trenching	9/1/2017	2/15/2018	5	120	
6	Bridge-Bike Path	Trenching	11/1/2017	6/12/2018	5	160	
7	Drainage-Bike Path	Trenching	3/1/2018	5/23/2018	5	60	
8	Signals Lighting-Bike Path	Building Construction	5/1/2018	5/28/2018	5	20	
9	Paving-Bike Path	Paving	6/1/2018	6/28/2018	5	20	
10	Landscaping-Bike Path	Paving	8/1/2018	8/28/2018	5	20	
11	Demolition-Parking Lot	Demolition	9/1/2018	9/28/2018	5	20	
12	Grading-Parking Lot	Site Preparation	10/1/2018	11/23/2018	5	40	
13	Drainage-Parking Lot	Trenching	12/1/2018	1/12/2019	5	30	
14	Paving-Parking Lot	Paving	2/1/2019	2/14/2019	5	10	
15	Lighting-Parking Lot	Building Construction	3/1/2019	3/28/2019	5	20	
16	Landscaping-Parking Lot	Paving	4/1/2019	4/28/2019	5	20	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition-Bike Path	Concrete/Industrial Saws	0	8.00	81	0.73
Demolition-Bike Path	Generator Sets	1	8.00	84	0.42
Demolition-Bike Path	Rubber Tired Dozers	0	1.00	255	0.40
Demolition-Bike Path	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Site Preparation-Bike Path	Graders	0	8.00	174	0.41

Site Preparation-Bike Path	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Grading-Bike Path	Concrete/Industrial Saws	0	8.00	81	0.73
Grading-Bike Path	Rubber Tired Dozers	0	1.00	255	0.40
Grading-Bike Path	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Footings-Bike Path	Generator Sets	1	8.00	84	0.42
Footings-Bike Path	Pumps	1	8.00	84	0.42
Columns-Bike Path	Generator Sets	1	8.00	84	0.42
Columns-Bike Path	Pumps	1	8.00	84	0.42
Bridge-Bike Path	Cranes	1	8.00	226	0.29
Drainage-Bike Path	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Signals Lighting-Bike Path	Cranes	0	4.00	226	0.29
Signals Lighting-Bike Path	Forklifts	0	6.00	89	0.20
Signals Lighting-Bike Path	Generator Sets	1	8.00	84	0.42
Signals Lighting-Bike Path	Tractors/Loaders/Backhoes	0	8.00	97	0.37
Paving-Bike Path	Cement and Mortar Mixers	0	6.00	9	0.56
Paving-Bike Path	Pavers	1	8.00	125	0.42
Paving-Bike Path	Rollers	1	8.00	80	0.38
Paving-Bike Path	Tractors/Loaders/Backhoes	0	7.00	97	0.37
Landscaping-Bike Path	Cement and Mortar Mixers	0	6.00	9	0.56
Landscaping-Bike Path	Generator Sets	1	8.00	84	0.42
Landscaping-Bike Path	Pavers	0	7.00	125	0.42
Landscaping-Bike Path	Rollers	0	7.00	80	0.38
Landscaping-Bike Path	Tractors/Loaders/Backhoes	0	7.00	97	0.37
Demolition-Parking Lot	Concrete/Industrial Saws	0	8.00	81	0.73
Demolition-Parking Lot	Generator Sets	1	8.00	84	0.42
Demolition-Parking Lot	Rubber Tired Dozers	0	1.00	255	0.40
Demolition-Parking Lot	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Grading-Parking Lot	Graders	0	8.00	174	0.41

Grading-Parking Lot	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Drainage-Parking Lot	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Paving-Parking Lot	Cement and Mortar Mixers	0	6.00	9	0.56
Paving-Parking Lot	Pavers	1	7.00	125	0.42
Paving-Parking Lot	Rollers	1	7.00	80	0.38
Paving-Parking Lot	Tractors/Loaders/Backhoes	0	7.00	97	0.37
Lighting-Parking Lot	Cranes	0	4.00	226	0.29
Lighting-Parking Lot	Forklifts	0	6.00	89	0.20
Lighting-Parking Lot	Generator Sets	1	8.00	84	0.42
Lighting-Parking Lot	Tractors/Loaders/Backhoes	0	8.00	97	0.37
Landscaping-Parking Lot	Cement and Mortar Mixers	0	6.00	9	0.56
Landscaping-Parking Lot	Generator Sets	1	8.00	84	0.42
Landscaping-Parking Lot	Pavers	0	7.00	125	0.42
Landscaping-Parking Lot	Rollers	0	7.00	80	0.38
Landscaping-Parking Lot	Tractors/Loaders/Backhoes	0	7.00	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
Demolition-Bike Path	2	40.00	0.00	212.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation-Bike Path	1	40.00	4.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading-Bike Path	1	40.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Footings-Bike Path	2	40.00	4.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Columns-Bike Path	2	40.00	4.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Bridge-Bike Path	1	40.00	4.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Drainage-Bike Path	1	40.00	4.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Signals Lighting-Bike Path	1	40.00	4.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving-Bike Path	2	40.00	4.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT

Landscaping-Bike Path	1	40.00	4.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Demolition-Parking Lot	2	40.00	0.00	112.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading-Parking Lot	1	40.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Drainage-Parking Lot	1	40.00	4.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving-Parking Lot	2	40.00	4.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Lighting-Parking Lot	1	40.00	4.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Landscaping-Parking Lot	1	40.00	4.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

3.2 Demolition-Bike Path - 2017

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					1.1823	0.0000	1.1823	0.1790	0.0000	0.1790			0.0000			0.0000
Off-Road	0.6404	5.5776	4.5356	6.8400e-003		0.3994	0.3994		0.3811	0.3811		671.8792	671.8792	0.1261		674.5281
Total	**0.6404**	**5.5776**	**4.5356**	**6.8400e-003**	**1.1823**	**0.3994**	**1.5817**	**0.1790**	**0.3811**	**0.5601**		**671.8792**	**671.8792**	**0.1261**		**674.5281**

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	0.1034	1.3744	0.9699	4.0000e-003	0.0925	0.0183	0.1108	0.0253	0.0169	0.0422		396.6319	396.6319	2.8700e-003		396.6922
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	0.1465	0.1782	2.0822	4.6700e-003	0.3772	2.9500e-003	0.3802	0.1001	2.7200e-003	0.1028		377.3387	377.3387	0.0188		377.7338
Total	**0.2498**	**1.5526**	**3.0521**	**8.6700e-003**	**0.4697**	**0.0213**	**0.4910**	**0.1254**	**0.0196**	**0.1450**		**773.9706**	**773.9706**	**0.0217**		**774.4260**

3.3 Site Preparation-Bike Path - 2017

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					8.0000e-004	0.0000	8.0000e-004	9.0000e-005	0.0000	9.0000e-005			0.0000			0.0000
Off-Road	0.3168	3.0439	2.3938	3.1100e-003		0.2289	0.2289		0.2106	0.2106		318.2649	318.2649	0.0975		320.3128
Total	**0.3168**	**3.0439**	**2.3938**	**3.1100e-003**	**8.0000e-004**	**0.2289**	**0.2297**	**9.0000e-005**	**0.2106**	**0.2107**		**318.2649**	**318.2649**	**0.0975**		**320.3128**

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	0.0399	0.3505	0.4059	9.6000e-004	0.0267	5.2500e-003	0.0319	7.6300e-003	4.8200e-003	0.0125		94.7773	94.7773	7.3000e-004		94.7926
Worker	0.1465	0.1782	2.0822	4.6700e-003	0.3772	2.9500e-003	0.3802	0.1001	2.7200e-003	0.1028		377.3387	377.3387	0.0188		377.7338
Total	**0.1864**	**0.5288**	**2.4881**	**5.6300e-003**	**0.4039**	**8.2000e-003**	**0.4121**	**0.1077**	**7.5400e-003**	**0.1152**		**472.1160**	**472.1160**	**0.0195**		**472.5263**

3.4 Grading-Bike Path - 2017

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					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.0000			0.0000
Off-Road	0.3168	3.0439	2.3938	3.1100e-003		0.2289	0.2289		0.2106	0.2106		318.2649	318.2649	0.0975		320.3128
Total	**0.3168**	**3.0439**	**2.3938**	**3.1100e-003**	**0.0000**	**0.2289**	**0.2289**	**0.0000**	**0.2106**	**0.2106**		**318.2649**	**318.2649**	**0.0975**		**320.3128**

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	0.1465	0.1782	2.0822	4.6700e-003	0.3772	2.9500e-003	0.3802	0.1001	2.7200e-003	0.1028		377.3387	377.3387	0.0188		377.7338
Total	**0.1465**	**0.1782**	**2.0822**	**4.6700e-003**	**0.3772**	**2.9500e-003**	**0.3802**	**0.1001**	**2.7200e-003**	**0.1028**		**377.3387**	**377.3387**	**0.0188**		**377.7338**

3.5 Footings-Bike Path - 2017

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	0.6633	5.1060	4.3164	7.4700e-003		0.3491	0.3491		0.3491	0.3491		707.2284	707.2284	0.0591		708.4698
Total	**0.6633**	**5.1060**	**4.3164**	**7.4700e-003**		**0.3491**	**0.3491**		**0.3491**	**0.3491**		**707.2284**	**707.2284**	**0.0591**		**708.4698**

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	0.0399	0.3505	0.4059	9.6000e-004	0.0267	5.2500e-003	0.0319	7.6300e-003	4.8200e-003	0.0125		94.7773	94.7773	7.3000e-004		94.7926
Worker	0.1465	0.1782	2.0822	4.6700e-003	0.3772	2.9500e-003	0.3802	0.1001	2.7200e-003	0.1028		377.3387	377.3387	0.0188		377.7338
Total	**0.1864**	**0.5288**	**2.4881**	**5.6300e-003**	**0.4039**	**8.2000e-003**	**0.4121**	**0.1077**	**7.5400e-003**	**0.1152**		**472.1160**	**472.1160**	**0.0195**		**472.5263**

3.6 Columns-Bike Path - 2017

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	0.6633	5.1060	4.3164	7.4700e-003		0.3491	0.3491		0.3491	0.3491		707.2284	707.2284	0.0591		708.4698
Total	**0.6633**	**5.1060**	**4.3164**	**7.4700e-003**		**0.3491**	**0.3491**		**0.3491**	**0.3491**		**707.2284**	**707.2284**	**0.0591**		**708.4698**

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	0.0399	0.3505	0.4059	9.6000e-004	0.0267	5.2500e-003	0.0319	7.6300e-003	4.8200e-003	0.0125		94.7773	94.7773	7.3000e-004		94.7926
Worker	0.1465	0.1782	2.0822	4.6700e-003	0.3772	2.9500e-003	0.3802	0.1001	2.7200e-003	0.1028		377.3387	377.3387	0.0188		377.7338
Total	**0.1864**	**0.5288**	**2.4881**	**5.6300e-003**	**0.4039**	**8.2000e-003**	**0.4121**	**0.1077**	**7.5400e-003**	**0.1152**		**472.1160**	**472.1160**	**0.0195**		**472.5263**

3.6 Columns-Bike Path - 2018

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	0.5886	4.7041	4.2866	7.4700e-003		0.3055	0.3055		0.3055	0.3055		707.2284	707.2284	0.0523		708.3261
Total	**0.5886**	**4.7041**	**4.2866**	**7.4700e-003**		**0.3055**	**0.3055**		**0.3055**	**0.3055**		**707.2284**	**707.2284**	**0.0523**		**708.3261**

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	0.0377	0.3177	0.3859	9.6000e-004	0.0267	4.8600e-003	0.0316	7.6300e-003	4.4700e-003	0.0121		93.1452	93.1452	7.2000e-004		93.1602
Worker	0.1309	0.1602	1.8673	4.6700e-003	0.3772	2.8500e-003	0.3801	0.1001	2.6300e-003	0.1027		363.3578	363.3578	0.0173		363.7205
Total	**0.1687**	**0.4779**	**2.2533**	**5.6300e-003**	**0.4039**	**7.7100e-003**	**0.4116**	**0.1077**	**7.1000e-003**	**0.1148**		**456.5030**	**456.5030**	**0.0180**		**456.8807**

3.7 Bridge-Bike Path - 2017

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	0.6480	7.6930	2.7563	5.6400e-003		0.3430	0.3430		0.3155	0.3155		577.2380	577.2380	0.1769		580.9522
Total	**0.6480**	**7.6930**	**2.7563**	**5.6400e-003**		**0.3430**	**0.3430**		**0.3155**	**0.3155**		**577.2380**	**577.2380**	**0.1769**		**580.9522**

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	0.0399	0.3505	0.4059	9.6000e-004	0.0267	5.2500e-003	0.0319	7.6300e-003	4.8200e-003	0.0125		94.7773	94.7773	7.3000e-004		94.7926
Worker	0.1465	0.1782	2.0822	4.6700e-003	0.3772	2.9500e-003	0.3802	0.1001	2.7200e-003	0.1028		377.3387	377.3387	0.0188		377.7338
Total	**0.1864**	**0.5288**	**2.4881**	**5.6300e-003**	**0.4039**	**8.2000e-003**	**0.4121**	**0.1077**	**7.5400e-003**	**0.1152**		**472.1160**	**472.1160**	**0.0195**		**472.5263**

3.7 Bridge-Bike Path - 2018

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	0.5584	6.6732	2.4673	5.6400e-003		0.2888	0.2888		0.2657	0.2657		568.0309	568.0309	0.1768		571.7444
Total	**0.5584**	**6.6732**	**2.4673**	**5.6400e-003**		**0.2888**	**0.2888**		**0.2657**	**0.2657**		**568.0309**	**568.0309**	**0.1768**		**571.7444**

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	0.0377	0.3177	0.3859	9.6000e-004	0.0267	4.8600e-003	0.0316	7.6300e-003	4.4700e-003	0.0121		93.1452	93.1452	7.2000e-004		93.1602
Worker	0.1309	0.1602	1.8673	4.6700e-003	0.3772	2.8500e-003	0.3801	0.1001	2.6300e-003	0.1027		363.3578	363.3578	0.0173		363.7205
Total	**0.1687**	**0.4779**	**2.2533**	**5.6300e-003**	**0.4039**	**7.7100e-003**	**0.4116**	**0.1077**	**7.1000e-003**	**0.1148**		**456.5030**	**456.5030**	**0.0180**		**456.8807**

3.8 Drainage-Bike Path - 2018

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	0.2661	2.6297	2.3367	3.1100e-003		0.1863	0.1863		0.1714	0.1714		312.7760	312.7760	0.0974		314.8208
Total	**0.2661**	**2.6297**	**2.3367**	**3.1100e-003**		**0.1863**	**0.1863**		**0.1714**	**0.1714**		**312.7760**	**312.7760**	**0.0974**		**314.8208**

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	0.0377	0.3177	0.3859	9.6000e-004	0.0267	4.8600e-003	0.0316	7.6300e-003	4.4700e-003	0.0121		93.1452	93.1452	7.2000e-004		93.1602
Worker	0.1309	0.1602	1.8673	4.6700e-003	0.3772	2.8500e-003	0.3801	0.1001	2.6300e-003	0.1027		363.3578	363.3578	0.0173		363.7205
Total	**0.1687**	**0.4779**	**2.2533**	**5.6300e-003**	**0.4039**	**7.7100e-003**	**0.4116**	**0.1077**	**7.1000e-003**	**0.1148**		**456.5030**	**456.5030**	**0.0180**		**456.8807**

3.9 Signals Lighting-Bike Path - 2018

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	0.2869	2.3346	2.1268	3.7300e-003		0.1487	0.1487		0.1487	0.1487		353.6142	353.6142	0.0255		354.1500
Total	**0.2869**	**2.3346**	**2.1268**	**3.7300e-003**		**0.1487**	**0.1487**		**0.1487**	**0.1487**		**353.6142**	**353.6142**	**0.0255**		**354.1500**

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	0.0377	0.3177	0.3859	9.6000e-004	0.0267	4.8600e-003	0.0316	7.6300e-003	4.4700e-003	0.0121		93.1452	93.1452	7.2000e-004		93.1602
Worker	0.1309	0.1602	1.8673	4.6700e-003	0.3772	2.8500e-003	0.3801	0.1001	2.6300e-003	0.1027		363.3578	363.3578	0.0173		363.7205
Total	**0.1687**	**0.4779**	**2.2533**	**5.6300e-003**	**0.4039**	**7.7100e-003**	**0.4116**	**0.1077**	**7.1000e-003**	**0.1148**		**456.5030**	**456.5030**	**0.0180**		**456.8807**

3.10 Paving-Bike Path - 2018

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	0.5715	5.9631	4.7495	7.1400e-003		0.3411	0.3411		0.3138	0.3138		718.8418	718.8418	0.2238		723.5413
Paving	0.0838					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**0.6554**	**5.9631**	**4.7495**	**7.1400e-003**		**0.3411**	**0.3411**		**0.3138**	**0.3138**		**718.8418**	**718.8418**	**0.2238**		**723.5413**

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	0.0377	0.3177	0.3859	9.6000e-004	0.0267	4.8600e-003	0.0316	7.6300e-003	4.4700e-003	0.0121		93.1452	93.1452	7.2000e-004		93.1602
Worker	0.1309	0.1602	1.8673	4.6700e-003	0.3772	2.8500e-003	0.3801	0.1001	2.6300e-003	0.1027		363.3578	363.3578	0.0173		363.7205
Total	**0.1687**	**0.4779**	**2.2533**	**5.6300e-003**	**0.4039**	**7.7100e-003**	**0.4116**	**0.1077**	**7.1000e-003**	**0.1148**		**456.5030**	**456.5030**	**0.0180**		**456.8807**

3.11 Landscaping-Bike Path - 2018

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	0.2869	2.3346	2.1268	3.7300e-003		0.1487	0.1487		0.1487	0.1487		353.6142	353.6142	0.0255		354.1500

Paving	0.0838					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**0.3707**	**2.3346**	**2.1268**	**3.7300e-003**		**0.1487**	**0.1487**		**0.1487**	**0.1487**		**353.6142**	**353.6142**	**0.0255**		**354.1500**

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	0.0377	0.3177	0.3859	9.6000e-004	0.0267	4.8600e-003	0.0316	7.6300e-003	4.4700e-003	0.0121		93.1452	93.1452	7.2000e-004		93.1602
Worker	0.1309	0.1602	1.8673	4.6700e-003	0.3772	2.8500e-003	0.3801	0.1001	2.6300e-003	0.1027		363.3578	363.3578	0.0173		363.7205
Total	**0.1687**	**0.4779**	**2.2533**	**5.6300e-003**	**0.4039**	**7.7100e-003**	**0.4116**	**0.1077**	**7.1000e-003**	**0.1148**		**456.5030**	**456.5030**	**0.0180**		**456.8807**

3.12 Demolition-Parking Lot - 2018

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					1.2518	0.0000	1.2518	0.1895	0.0000	0.1895			0.0000			0.0000
Off-Road	0.5530	4.9643	4.4635	6.8400e-003		0.3350	0.3350		0.3201	0.3201		666.3902	666.3902	0.1229		668.9707
Total	**0.5530**	**4.9643**	**4.4635**	**6.8400e-003**	**1.2518**	**0.3350**	**1.5869**	**0.1895**	**0.3201**	**0.5097**		**666.3902**	**666.3902**	**0.1229**		**668.9707**

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	0.1065	1.3194	0.9937	4.2100e-003	0.0977	0.0192	0.1169	0.0268	0.0176	0.0444		411.8261	411.8261	3.0500e-003		411.8902
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	0.1309	0.1602	1.8673	4.6700e-003	0.3772	2.8500e-003	0.3801	0.1001	2.6300e-003	0.1027		363.3578	363.3578	0.0173		363.7205
Total	**0.2375**	**1.4796**	**2.8610**	**8.8800e-003**	**0.4749**	**0.0220**	**0.4969**	**0.1268**	**0.0203**	**0.1471**		**775.1839**	**775.1839**	**0.0203**		**775.6107**

3.13 Grading-Parking Lot - 2018

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					0.0159	0.0000	0.0159	1.7200e-003	0.0000	1.7200e-003			0.0000			0.0000
Off-Road	0.2661	2.6297	2.3367	3.1100e-003		0.1863	0.1863		0.1714	0.1714		312.7760	312.7760	0.0974		314.8208
Total	**0.2661**	**2.6297**	**2.3367**	**3.1100e-003**	**0.0159**	**0.1863**	**0.2022**	**1.7200e-003**	**0.1714**	**0.1731**		**312.7760**	**312.7760**	**0.0974**		**314.8208**

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	0.1309	0.1602	1.8673	4.6700e-003	0.3772	2.8500e-003	0.3801	0.1001	2.6300e-003	0.1027		363.3578	363.3578	0.0173		363.7205
Total	**0.1309**	**0.1602**	**1.8673**	**4.6700e-003**	**0.3772**	**2.8500e-003**	**0.3801**	**0.1001**	**2.6300e-003**	**0.1027**		**363.3578**	**363.3578**	**0.0173**		**363.7205**

3.14 Drainage-Parking Lot - 2018

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	0.2661	2.6297	2.3367	3.1100e-003		0.1863	0.1863		0.1714	0.1714		312.7760	312.7760	0.0974		314.8208
Total	**0.2661**	**2.6297**	**2.3367**	**3.1100e-003**		**0.1863**	**0.1863**		**0.1714**	**0.1714**		**312.7760**	**312.7760**	**0.0974**		**314.8208**

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	0.0377	0.3177	0.3859	9.6000e-004	0.0267	4.8600e-003	0.0316	7.6300e-003	4.4700e-003	0.0121		93.1452	93.1452	7.2000e-004		93.1602
Worker	0.1309	0.1602	1.8673	4.6700e-003	0.3772	2.8500e-003	0.3801	0.1001	2.6300e-003	0.1027		363.3578	363.3578	0.0173		363.7205
Total	**0.1687**	**0.4779**	**2.2533**	**5.6300e-003**	**0.4039**	**7.7100e-003**	**0.4116**	**0.1077**	**7.1000e-003**	**0.1148**		**456.5030**	**456.5030**	**0.0180**		**456.8807**

3.14 Drainage-Parking Lot - 2019

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	0.2328	2.3374	2.3027	3.1100e-003		0.1560	0.1560		0.1436	0.1436		307.5419	307.5419	0.0973		309.5852
Total	**0.2328**	**2.3374**	**2.3027**	**3.1100e-003**		**0.1560**	**0.1560**		**0.1436**	**0.1436**		**307.5419**	**307.5419**	**0.0973**		**309.5852**

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	0.0347	0.2900	0.3598	9.6000e-004	0.0267	4.5100e-003	0.0312	7.6300e-003	4.1500e-003	0.0118		91.5370	91.5370	7.0000e-004		91.5516
Worker	0.1196	0.1460	1.7021	4.6700e-003	0.3772	2.7800e-003	0.3800	0.1001	2.5800e-003	0.1026		350.3409	350.3409	0.0161		350.6782
Total	**0.1543**	**0.4359**	**2.0619**	**5.6300e-003**	**0.4039**	**7.2900e-003**	**0.4112**	**0.1077**	**6.7300e-003**	**0.1144**		**441.8779**	**441.8779**	**0.0168**		**442.2298**

3.15 Paving-Parking Lot - 2019

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	0.4403	4.5897	4.1102	6.2500e-003		0.2577	0.2577		0.2370	0.2370		618.8684	618.8684	0.1958		622.9803
Paving	0.1677					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**0.6080**	**4.5897**	**4.1102**	**6.2500e-003**		**0.2577**	**0.2577**		**0.2370**	**0.2370**		**618.8684**	**618.8684**	**0.1958**		**622.9803**

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	0.0347	0.2900	0.3598	9.6000e-004	0.0267	4.5100e-003	0.0312	7.6300e-003	4.1500e-003	0.0118		91.5370	91.5370	7.0000e-004		91.5516
Worker	0.1196	0.1460	1.7021	4.6700e-003	0.3772	2.7800e-003	0.3800	0.1001	2.5800e-003	0.1026		350.3409	350.3409	0.0161		350.6782
Total	**0.1543**	**0.4359**	**2.0619**	**5.6300e-003**	**0.4039**	**7.2900e-003**	**0.4112**	**0.1077**	**6.7300e-003**	**0.1144**		**441.8779**	**441.8779**	**0.0168**		**442.2298**

3.16 Lighting-Parking Lot - 2019

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	0.2520	2.1442	2.1131	3.7300e-003		0.1282	0.1282		0.1282	0.1282		353.6142	353.6142	0.0224		354.0846
Total	**0.2520**	**2.1442**	**2.1131**	**3.7300e-003**		**0.1282**	**0.1282**		**0.1282**	**0.1282**		**353.6142**	**353.6142**	**0.0224**		**354.0846**

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	0.0347	0.2900	0.3598	9.6000e-004	0.0267	4.5100e-003	0.0312	7.6300e-003	4.1500e-003	0.0118		91.5370	91.5370	7.0000e-004		91.5516

Worker	0.1196	0.1460	1.7021	4.6700e-003	0.3772	2.7800e-003	0.3800	0.1001	2.5800e-003	0.1026		350.3409	350.3409	0.0161		350.6782
Total	**0.1543**	**0.4359**	**2.0619**	**5.6300e-003**	**0.4039**	**7.2900e-003**	**0.4112**	**0.1077**	**6.7300e-003**	**0.1144**		**441.8779**	**441.8779**	**0.0168**		**442.2298**

3.17 Landscaping-Parking Lot - 2019

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	0.2520	2.1442	2.1131	3.7300e-003		0.1282	0.1282		0.1282	0.1282		353.6142	353.6142	0.0224		354.0846
Paving	0.0838					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**0.3358**	**2.1442**	**2.1131**	**3.7300e-003**		**0.1282**	**0.1282**		**0.1282**	**0.1282**		**353.6142**	**353.6142**	**0.0224**		**354.0846**

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	0.0347	0.2900	0.3598	9.6000e-004	0.0267	4.5100e-003	0.0312	7.6300e-003	4.1500e-003	0.0118		91.5370	91.5370	7.0000e-004		91.5516
Worker	0.1196	0.1460	1.7021	4.6700e-003	0.3772	2.7800e-003	0.3800	0.1001	2.5800e-003	0.1026		350.3409	350.3409	0.0161		350.6782
Total	**0.1543**	**0.4359**	**2.0619**	**5.6300e-003**	**0.4039**	**7.2900e-003**	**0.4112**	**0.1077**	**6.7300e-003**	**0.1144**		**441.8779**	**441.8779**	**0.0168**		**442.2298**

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	7.7365	19.7072	71.9554	0.1779	11.3869	0.2882	11.6750	3.0505	0.2655	3.3160		14,412.7908	14,412.7908	0.4893		14,423.0661
Unmitigated	7.7365	19.7072	71.9554	0.1779	11.3869	0.2882	11.6750	3.0505	0.2655	3.3160		14,412.7908	14,412.7908	0.4893		14,423.0661

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Parking Lot	550.00	2,500.00	2500.00	2,363,587	2,363,587
Total	550.00	2,500.00	2,500.00	2,363,587	2,363,587

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
Parking Lot	9.50	7.30	7.30	33.00	48.00	19.00	66	28	6

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.542590	0.062129	0.167184	0.110637	0.030730	0.004573	0.019109	0.050292	0.001784	0.003671	0.005678	0.000201	0.001421

5.0 Energy Detail

4.4 Fleet Mix

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	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
NaturalGas Unmitigated	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

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					
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		**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**

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	6.9200e-003	1.0000e-004	0.0103	0.0000		4.0000e-005	4.0000e-005		4.0000e-005	4.0000e-005		0.0219	0.0219	6.0000e-005		0.0231
Unmitigated	6.9200e-003	1.0000e-004	0.0103	0.0000		4.0000e-005	4.0000e-005		4.0000e-005	4.0000e-005		0.0219	0.0219	6.0000e-005		0.0231

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					
Consumer Products	5.9400e-003					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Landscaping	9.8000e-004	1.0000e-004	0.0103	0.0000		4.0000e-005	4.0000e-005		4.0000e-005	4.0000e-005		0.0219	0.0219	6.0000e-005		0.0231
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**6.9200e-003**	**1.0000e-004**	**0.0103**	**0.0000**		**4.0000e-005**	**4.0000e-005**		**4.0000e-005**	**4.0000e-005**		**0.0219**	**0.0219**	**6.0000e-005**		**0.0231**

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 Vegetation

Gateway Bike Path - Construction and Operation Emissions

Alameda County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Parking Lot	100.00	Space	0.64	27,750.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	63
Climate Zone	5			**Operational Year**	2019
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	444.62	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Update with PG&E 2012 CO2 Emission Rates (Climate Registry 2014).

Demolition - 1,700 cy of export from path and 900 of export from parking lot, assume 1.3 tons/cy.

Vehicle Trips - Assume 550 trips/day on weekday and 2,500 trips/day on weekend. Use trip lengths and types for City Park land use.

Consumer Products - No consumer products related to parking lot.

Area Coating - No building in praking lot.

Energy Use - Lighting for path and parking lot is assumed to use about 200 kWh/evening (73,000 kWh/year).

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					
2017	0.1415	1.0429	1.1533	2.1700e-003	0.0962	0.0622	0.1583	0.0230	0.0603	0.0833	0.0000	179.2664	179.2664	0.0181	0.0000	179.6464
2018	0.1059	0.8791	0.8879	1.8000e-003	0.0815	0.0445	0.1260	0.0203	0.0417	0.0620	0.0000	147.0657	147.0657	0.0220	0.0000	147.5283
2019	0.0143	0.0901	0.1342	2.8000e-004	0.0115	4.7700e-003	0.0162	3.0700e-003	4.5900e-003	7.6600e-003	0.0000	21.6198	21.6198	2.1400e-003	0.0000	21.6647
Total	**0.2618**	**2.0120**	**2.1754**	**4.2500e-003**	**0.1891**	**0.1114**	**0.3005**	**0.0463**	**0.1066**	**0.1529**	**0.0000**	**347.9519**	**347.9519**	**0.0423**	**0.0000**	**348.8394**

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	1.1700e-003	1.0000e-005	9.3000e-004	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	1.7900e-003	1.7900e-003	0.0000	0.0000	1.8900e-003
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	14.7188	14.7188	9.6000e-004	2.0000e-004	14.8006
Mobile	0.6091	1.6791	6.3905	0.0136	0.8841	0.0233	0.9073	0.2376	0.0214	0.2590	0.0000	1,001.3813	1,001.3813	0.0358	0.0000	1,002.1325
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.6103**	**1.6792**	**6.3914**	**0.0136**	**0.8841**	**0.0233**	**0.9073**	**0.2376**	**0.0214**	**0.2590**	**0.0000**	**1,016.1020**	**1,016.1020**	**0.0367**	**2.0000e-004**	**1,016.9349**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition-Bike Path	Demolition	3/1/2017	4/25/2017	5	40	
2	Site Preparation-Bike Path	Site Preparation	4/1/2017	5/28/2017	5	40	
3	Grading-Bike Path	Grading	5/1/2017	6/25/2017	5	40	
4	Footings-Bike Path	Trenching	7/1/2017	12/15/2017	5	120	
5	Columns-Bike Path	Trenching	9/1/2017	2/15/2018	5	120	
6	Bridge-Bike Path	Trenching	11/1/2017	6/12/2018	5	160	
7	Drainage-Bike Path	Trenching	3/1/2018	5/23/2018	5	60	
8	Signals Lighting-Bike Path	Building Construction	5/1/2018	5/28/2018	5	20	
9	Paving-Bike Path	Paving	6/1/2018	6/28/2018	5	20	
10	Landscaping-Bike Path	Paving	8/1/2018	8/28/2018	5	20	
11	Demolition-Parking Lot	Demolition	9/1/2018	9/28/2018	5	20	
12	Grading-Parking Lot	Site Preparation	10/1/2018	11/23/2018	5	40	
13	Drainage-Parking Lot	Trenching	12/1/2018	1/12/2019	5	30	
14	Paving-Parking Lot	Paving	2/1/2019	2/14/2019	5	10	
15	Lighting-Parking Lot	Building Construction	3/1/2019	3/28/2019	5	20	
16	Landscaping-Parking Lot	Paving	4/1/2019	4/28/2019	5	20	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition-Bike Path	Concrete/Industrial Saws	0	8.00	81	0.73

Demolition-Bike Path	Generator Sets	1	8.00	84	0.42
Demolition-Bike Path	Rubber Tired Dozers	0	1.00	255	0.40
Demolition-Bike Path	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Site Preparation-Bike Path	Graders	0	8.00	174	0.41
Site Preparation-Bike Path	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Grading-Bike Path	Concrete/Industrial Saws	0	8.00	81	0.73
Grading-Bike Path	Rubber Tired Dozers	0	1.00	255	0.40
Grading-Bike Path	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Footings-Bike Path	Generator Sets	1	8.00	84	0.42
Footings-Bike Path	Pumps	1	8.00	84	0.42
Columns-Bike Path	Generator Sets	1	8.00	84	0.42
Columns-Bike Path	Pumps	1	8.00	84	0.42
Bridge-Bike Path	Cranes	1	8.00	226	0.29
Drainage-Bike Path	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Signals Lighting-Bike Path	Cranes	0	4.00	226	0.29
Signals Lighting-Bike Path	Forklifts	0	6.00	89	0.20
Signals Lighting-Bike Path	Generator Sets	1	8.00	84	0.42
Signals Lighting-Bike Path	Tractors/Loaders/Backhoes	0	8.00	97	0.37
Paving-Bike Path	Cement and Mortar Mixers	0	6.00	9	0.56
Paving-Bike Path	Pavers	1	8.00	125	0.42
Paving-Bike Path	Rollers	1	8.00	80	0.38
Paving-Bike Path	Tractors/Loaders/Backhoes	0	7.00	97	0.37
Landscaping-Bike Path	Cement and Mortar Mixers	0	6.00	9	0.56
Landscaping-Bike Path	Generator Sets	1	8.00	84	0.42
Landscaping-Bike Path	Pavers	0	7.00	125	0.42
Landscaping-Bike Path	Rollers	0	7.00	80	0.38
Landscaping-Bike Path	Tractors/Loaders/Backhoes	0	7.00	97	0.37
Demolition-Parking Lot	Concrete/Industrial Saws	0	8.00	81	0.73

Demolition-Parking Lot	Generator Sets	1	8.00	84	0.42
Demolition-Parking Lot	Rubber Tired Dozers	0	1.00	255	0.40
Demolition-Parking Lot	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Grading-Parking Lot	Graders	0	8.00	174	0.41
Grading-Parking Lot	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Drainage-Parking Lot	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Paving-Parking Lot	Cement and Mortar Mixers	0	6.00	9	0.56
Paving-Parking Lot	Pavers	1	7.00	125	0.42
Paving-Parking Lot	Rollers	1	7.00	80	0.38
Paving-Parking Lot	Tractors/Loaders/Backhoes	0	7.00	97	0.37
Lighting-Parking Lot	Cranes	0	4.00	226	0.29
Lighting-Parking Lot	Forklifts	0	6.00	89	0.20
Lighting-Parking Lot	Generator Sets	1	8.00	84	0.42
Lighting-Parking Lot	Tractors/Loaders/Backhoes	0	8.00	97	0.37
Landscaping-Parking Lot	Cement and Mortar Mixers	0	6.00	9	0.56
Landscaping-Parking Lot	Generator Sets	1	8.00	84	0.42
Landscaping-Parking Lot	Pavers	0	7.00	125	0.42
Landscaping-Parking Lot	Rollers	0	7.00	80	0.38
Landscaping-Parking Lot	Tractors/Loaders/Backhoes	0	7.00	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
Demolition-Bike Path	2	40.00	0.00	212.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation-Bike Path	1	40.00	4.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading-Bike Path	1	40.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Footings-Bike Path	2	40.00	4.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Columns-Bike Path	2	40.00	4.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT

Bridge-Bike Path	1	40.00	4.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Drainage-Bike Path	1	40.00	4.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Signals Lighting-Bike Path	1	40.00	4.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving-Bike Path	2	40.00	4.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Landscaping-Bike Path	1	40.00	4.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Demolition-Parking Lot	2	40.00	0.00	112.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading-Parking Lot	1	40.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Drainage-Parking Lot	1	40.00	4.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving-Parking Lot	2	40.00	4.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Lighting-Parking Lot	1	40.00	4.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Landscaping-Parking Lot	1	40.00	4.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

3.2 Demolition-Bike Path - 2017

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					0.0237	0.0000	0.0237	3.5800e-003	0.0000	3.5800e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0128	0.1116	0.0907	1.4000e-004		7.9900e-003	7.9900e-003		7.6200e-003	7.6200e-003	0.0000	12.1904	12.1904	2.2900e-003	0.0000	12.2384
Total	**0.0128**	**0.1116**	**0.0907**	**1.4000e-004**	**0.0237**	**7.9900e-003**	**0.0316**	**3.5800e-003**	**7.6200e-003**	**0.0112**	**0.0000**	**12.1904**	**12.1904**	**2.2900e-003**	**0.0000**	**12.2384**

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	2.2700e-003	0.0285	0.0253	8.0000e-005	1.7900e-003	3.7000e-004	2.1600e-003	4.9000e-004	3.4000e-004	8.3000e-004	0.0000	7.1893	7.1893	5.0000e-005	0.0000	7.1904
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	4.0500e-003	0.0388	9.0000e-005	7.2600e-003	6.0000e-005	7.3200e-003	1.9300e-003	5.0000e-005	1.9900e-003	0.0000	6.3535	6.3535	3.4000e-004	0.0000	6.3607
Total	**4.9800e-003**	**0.0326**	**0.0641**	**1.7000e-004**	**9.0500e-003**	**4.3000e-004**	**9.4800e-003**	**2.4200e-003**	**3.9000e-004**	**2.8200e-003**	**0.0000**	**13.5428**	**13.5428**	**3.9000e-004**	**0.0000**	**13.5511**

3.3 Site Preparation-Bike Path - 2017

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					2.0000e-005	0.0000	2.0000e-005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	6.3400e-003	0.0609	0.0479	6.0000e-005		4.5800e-003	4.5800e-003		4.2100e-003	4.2100e-003	0.0000	5.7745	5.7745	1.7700e-003	0.0000	5.8117
Total	**6.3400e-003**	**0.0609**	**0.0479**	**6.0000e-005**	**2.0000e-005**	**4.5800e-003**	**4.6000e-003**	**0.0000**	**4.2100e-003**	**4.2100e-003**	**0.0000**	**5.7745**	**5.7745**	**1.7700e-003**	**0.0000**	**5.8117**

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	9.0000e-004	7.2500e-003	0.0110	2.0000e-005	5.2000e-004	1.1000e-004	6.2000e-004	1.5000e-004	1.0000e-004	2.5000e-004	0.0000	1.7141	1.7141	1.0000e-005	0.0000	1.7144
Worker	2.7100e-003	4.0500e-003	0.0388	9.0000e-005	7.2600e-003	6.0000e-005	7.3200e-003	1.9300e-003	5.0000e-005	1.9900e-003	0.0000	6.3535	6.3535	3.4000e-004	0.0000	6.3607
Total	**3.6100e-003**	**0.0113**	**0.0498**	**1.1000e-004**	**7.7800e-003**	**1.7000e-004**	**7.9400e-003**	**2.0800e-003**	**1.5000e-004**	**2.2400e-003**	**0.0000**	**8.0676**	**8.0676**	**3.5000e-004**	**0.0000**	**8.0751**

3.4 Grading-Bike Path - 2017

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					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	6.3400e-003	0.0609	0.0479	6.0000e-005		4.5800e-003	4.5800e-003		4.2100e-003	4.2100e-003	0.0000	5.7745	5.7745	1.7700e-003	0.0000	5.8117
Total	**6.3400e-003**	**0.0609**	**0.0479**	**6.0000e-005**	**0.0000**	**4.5800e-003**	**4.5800e-003**	**0.0000**	**4.2100e-003**	**4.2100e-003**	**0.0000**	**5.7745**	**5.7745**	**1.7700e-003**	**0.0000**	**5.8117**

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	4.0500e-003	0.0388	9.0000e-005	7.2600e-003	6.0000e-005	7.3200e-003	1.9300e-003	5.0000e-005	1.9900e-003	0.0000	6.3535	6.3535	3.4000e-004	0.0000	6.3607
Total	**2.7100e-003**	**4.0500e-003**	**0.0388**	**9.0000e-005**	**7.2600e-003**	**6.0000e-005**	**7.3200e-003**	**1.9300e-003**	**5.0000e-005**	**1.9900e-003**	**0.0000**	**6.3535**	**6.3535**	**3.4000e-004**	**0.0000**	**6.3607**

3.5 Footings-Bike Path - 2017

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	0.0398	0.3064	0.2590	4.5000e-004		0.0209	0.0209		0.0209	0.0209	0.0000	38.4952	38.4952	3.2200e-003	0.0000	38.5628
Total	**0.0398**	**0.3064**	**0.2590**	**4.5000e-004**		**0.0209**	**0.0209**		**0.0209**	**0.0209**	**0.0000**	**38.4952**	**38.4952**	**3.2200e-003**	**0.0000**	**38.5628**

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	2.7000e-003	0.0217	0.0330	6.0000e-005	1.5500e-003	3.2000e-004	1.8700e-003	4.5000e-004	2.9000e-004	7.4000e-004	0.0000	5.1423	5.1423	4.0000e-005	0.0000	5.1432
Worker	8.1300e-003	0.0122	0.1165	2.6000e-004	0.0218	1.8000e-004	0.0220	5.7900e-003	1.6000e-004	5.9600e-003	0.0000	19.0605	19.0605	1.0200e-003	0.0000	19.0820
Total	**0.0108**	**0.0339**	**0.1495**	**3.2000e-004**	**0.0233**	**5.0000e-004**	**0.0238**	**6.2400e-003**	**4.5000e-004**	**6.7000e-003**	**0.0000**	**24.2028**	**24.2028**	**1.0600e-003**	**0.0000**	**24.2252**

3.6 Columns-Bike Path - 2017

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	0.0285	0.2196	0.1856	3.2000e-004		0.0150	0.0150		0.0150	0.0150	0.0000	27.5882	27.5882	2.3100e-003	0.0000	27.6367
Total	**0.0285**	**0.2196**	**0.1856**	**3.2000e-004**		**0.0150**	**0.0150**		**0.0150**	**0.0150**	**0.0000**	**27.5882**	**27.5882**	**2.3100e-003**	**0.0000**	**27.6367**

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	1.9300e-003	0.0156	0.0236	4.0000e-005	1.1100e-003	2.3000e-004	1.3400e-003	3.2000e-004	2.1000e-004	5.3000e-004	0.0000	3.6853	3.6853	3.0000e-005	0.0000	3.6860
Worker	5.8300e-003	8.7100e-003	0.0835	1.9000e-004	0.0156	1.3000e-004	0.0157	4.1500e-003	1.2000e-004	4.2700e-003	0.0000	13.6600	13.6600	7.3000e-004	0.0000	13.6754
Total	**7.7600e-003**	**0.0243**	**0.1071**	**2.3000e-004**	**0.0167**	**3.6000e-004**	**0.0171**	**4.4700e-003**	**3.3000e-004**	**4.8000e-003**	**0.0000**	**17.3454**	**17.3454**	**7.6000e-004**	**0.0000**	**17.3614**

3.6 Columns-Bike Path - 2018

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	0.0100	0.0800	0.0729	1.3000e-004		5.1900e-003	5.1900e-003		5.1900e-003	5.1900e-003	0.0000	10.9070	10.9070	8.1000e-004	0.0000	10.9239
Total	**0.0100**	**0.0800**	**0.0729**	**1.3000e-004**		**5.1900e-003**	**5.1900e-003**		**5.1900e-003**	**5.1900e-003**	**0.0000**	**10.9070**	**10.9070**	**8.1000e-004**	**0.0000**	**10.9239**

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	7.2000e-004	5.5800e-003	8.9500e-003	2.0000e-005	4.4000e-004	8.0000e-005	5.2000e-004	1.3000e-004	8.0000e-005	2.0000e-004	0.0000	1.4319	1.4319	1.0000e-005	0.0000	1.4321
Worker	2.0400e-003	3.1000e-003	0.0294	7.0000e-005	6.1700e-003	5.0000e-005	6.2200e-003	1.6400e-003	4.0000e-005	1.6900e-003	0.0000	5.1999	5.1999	2.7000e-004	0.0000	5.2055
Total	**2.7600e-003**	**8.6800e-003**	**0.0384**	**9.0000e-005**	**6.6100e-003**	**1.3000e-004**	**6.7400e-003**	**1.7700e-003**	**1.2000e-004**	**1.8900e-003**	**0.0000**	**6.6318**	**6.6318**	**2.8000e-004**	**0.0000**	**6.6376**

3.7 Bridge-Bike Path - 2017

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	0.0139	0.1654	0.0593	1.2000e-004		7.3700e-003	7.3700e-003		6.7800e-003	6.7800e-003	0.0000	11.2587	11.2587	3.4500e-003	0.0000	11.3312
Total	**0.0139**	**0.1654**	**0.0593**	**1.2000e-004**		**7.3700e-003**	**7.3700e-003**		**6.7800e-003**	**6.7800e-003**	**0.0000**	**11.2587**	**11.2587**	**3.4500e-003**	**0.0000**	**11.3312**

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	9.7000e-004	7.7900e-003	0.0118	2.0000e-005	5.6000e-004	1.1000e-004	6.7000e-004	1.6000e-004	1.0000e-004	2.6000e-004	0.0000	1.8427	1.8427	1.0000e-005	0.0000	1.8430
Worker	2.9100e-003	4.3500e-003	0.0418	9.0000e-005	7.8100e-003	6.0000e-005	7.8700e-003	2.0800e-003	6.0000e-005	2.1300e-003	0.0000	6.8300	6.8300	3.7000e-004	0.0000	6.8377
Total	**3.8800e-003**	**0.0121**	**0.0536**	**1.1000e-004**	**8.3700e-003**	**1.7000e-004**	**8.5400e-003**	**2.2400e-003**	**1.6000e-004**	**2.3900e-003**	**0.0000**	**8.6727**	**8.6727**	**3.8000e-004**	**0.0000**	**8.6807**

3.7 Bridge-Bike Path - 2018

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	0.0327	0.3904	0.1443	3.3000e-004		0.0169	0.0169		0.0155	0.0155	0.0000	30.1456	30.1456	9.3800e-003	0.0000	30.3427
Total	**0.0327**	**0.3904**	**0.1443**	**3.3000e-004**		**0.0169**	**0.0169**		**0.0155**	**0.0155**	**0.0000**	**30.1456**	**30.1456**	**9.3800e-003**	**0.0000**	**30.3427**

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	2.4800e-003	0.0192	0.0308	6.0000e-005	1.5100e-003	2.9000e-004	1.8000e-003	4.3000e-004	2.6000e-004	7.0000e-004	0.0000	4.9274	4.9274	4.0000e-005	0.0000	4.9282
Worker	7.0300e-003	0.0107	0.1013	2.5000e-004	0.0212	1.7000e-004	0.0214	5.6500e-003	1.5000e-004	5.8000e-003	0.0000	17.8938	17.8938	9.2000e-004	0.0000	17.9130
Total	**9.5100e-003**	**0.0299**	**0.1321**	**3.1000e-004**	**0.0228**	**4.6000e-004**	**0.0232**	**6.0800e-003**	**4.1000e-004**	**6.5000e-003**	**0.0000**	**22.8212**	**22.8212**	**9.6000e-004**	**0.0000**	**22.8412**

3.8 Drainage-Bike Path - 2018

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	7.9800e-003	0.0789	0.0701	9.0000e-005		5.5900e-003	5.5900e-003		5.1400e-003	5.1400e-003	0.0000	8.5124	8.5124	2.6500e-003	0.0000	8.5680
Total	**7.9800e-003**	**0.0789**	**0.0701**	**9.0000e-005**		**5.5900e-003**	**5.5900e-003**		**5.1400e-003**	**5.1400e-003**	**0.0000**	**8.5124**	**8.5124**	**2.6500e-003**	**0.0000**	**8.5680**

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	1.2700e-003	9.8500e-003	0.0158	3.0000e-005	7.8000e-004	1.5000e-004	9.2000e-004	2.2000e-004	1.3000e-004	3.6000e-004	0.0000	2.5269	2.5269	2.0000e-005	0.0000	2.5273
Worker	3.6100e-003	5.4600e-003	0.0520	1.3000e-004	0.0109	9.0000e-005	0.0110	2.9000e-003	8.0000e-005	2.9800e-003	0.0000	9.1763	9.1763	4.7000e-004	0.0000	9.1862
Total	**4.8800e-003**	**0.0153**	**0.0678**	**1.6000e-004**	**0.0117**	**2.4000e-004**	**0.0119**	**3.1200e-003**	**2.1000e-004**	**3.3400e-003**	**0.0000**	**11.7032**	**11.7032**	**4.9000e-004**	**0.0000**	**11.7135**

3.9 Signals Lighting-Bike Path - 2018

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	2.8700e-003	0.0234	0.0213	4.0000e-005		1.4900e-003	1.4900e-003		1.4900e-003	1.4900e-003	0.0000	3.2079	3.2079	2.3000e-004	0.0000	3.2128
Total	**2.8700e-003**	**0.0234**	**0.0213**	**4.0000e-005**		**1.4900e-003**	**1.4900e-003**		**1.4900e-003**	**1.4900e-003**	**0.0000**	**3.2079**	**3.2079**	**2.3000e-004**	**0.0000**	**3.2128**

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	4.2000e-004	3.2800e-003	5.2600e-003	1.0000e-005	2.6000e-004	5.0000e-005	3.1000e-004	7.0000e-005	4.0000e-005	1.2000e-004	0.0000	0.8423	0.8423	1.0000e-005	0.0000	0.8424
Worker	1.2000e-003	1.8200e-003	0.0173	4.0000e-005	3.6300e-003	3.0000e-005	3.6600e-003	9.7000e-004	3.0000e-005	9.9000e-004	0.0000	3.0588	3.0588	1.6000e-004	0.0000	3.0621
Total	**1.6200e-003**	**5.1000e-003**	**0.0226**	**5.0000e-005**	**3.8900e-003**	**8.0000e-005**	**3.9700e-003**	**1.0400e-003**	**7.0000e-005**	**1.1100e-003**	**0.0000**	**3.9011**	**3.9011**	**1.7000e-004**	**0.0000**	**3.9045**

3.10 Paving-Bike Path - 2018

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	5.7200e-003	0.0596	0.0475	7.0000e-005		3.4100e-003	3.4100e-003		3.1400e-003	3.1400e-003	0.0000	6.5212	6.5212	2.0300e-003	0.0000	6.5639
Paving	8.4000e-004					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**6.5600e-003**	**0.0596**	**0.0475**	**7.0000e-005**		**3.4100e-003**	**3.4100e-003**		**3.1400e-003**	**3.1400e-003**	**0.0000**	**6.5212**	**6.5212**	**2.0300e-003**	**0.0000**	**6.5639**

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	4.2000e-004	3.2800e-003	5.2600e-003	1.0000e-005	2.6000e-004	5.0000e-005	3.1000e-004	7.0000e-005	4.0000e-005	1.2000e-004	0.0000	0.8423	0.8423	1.0000e-005	0.0000	0.8424
Worker	1.2000e-003	1.8200e-003	0.0173	4.0000e-005	3.6300e-003	3.0000e-005	3.6600e-003	9.7000e-004	3.0000e-005	9.9000e-004	0.0000	3.0588	3.0588	1.6000e-004	0.0000	3.0621
Total	**1.6200e-003**	**5.1000e-003**	**0.0226**	**5.0000e-005**	**3.8900e-003**	**8.0000e-005**	**3.9700e-003**	**1.0400e-003**	**7.0000e-005**	**1.1100e-003**	**0.0000**	**3.9011**	**3.9011**	**1.7000e-004**	**0.0000**	**3.9045**

3.11 Landscaping-Bike Path - 2018

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	2.8700e-003	0.0234	0.0213	4.0000e-005		1.4900e-003	1.4900e-003		1.4900e-003	1.4900e-003	0.0000	3.2079	3.2079	2.3000e-004	0.0000	3.2128
Paving	8.4000e-004					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**3.7100e-003**	**0.0234**	**0.0213**	**4.0000e-005**		**1.4900e-003**	**1.4900e-003**		**1.4900e-003**	**1.4900e-003**	**0.0000**	**3.2079**	**3.2079**	**2.3000e-004**	**0.0000**	**3.2128**

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	4.2000e-004	3.2800e-003	5.2600e-003	1.0000e-005	2.6000e-004	5.0000e-005	3.1000e-004	7.0000e-005	4.0000e-005	1.2000e-004	0.0000	0.8423	0.8423	1.0000e-005	0.0000	0.8424
Worker	1.2000e-003	1.8200e-003	0.0173	4.0000e-005	3.6300e-003	3.0000e-005	3.6600e-003	9.7000e-004	3.0000e-005	9.9000e-004	0.0000	3.0588	3.0588	1.6000e-004	0.0000	3.0621
Total	**1.6200e-003**	**5.1000e-003**	**0.0226**	**5.0000e-005**	**3.8900e-003**	**8.0000e-005**	**3.9700e-003**	**1.0400e-003**	**7.0000e-005**	**1.1100e-003**	**0.0000**	**3.9011**	**3.9011**	**1.7000e-004**	**0.0000**	**3.9045**

3.12 Demolition-Parking Lot - 2018

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					0.0125	0.0000	0.0125	1.9000e-003	0.0000	1.9000e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	5.5300e-003	0.0496	0.0446	7.0000e-005		3.3500e-003	3.3500e-003		3.2000e-003	3.2000e-003	0.0000	6.0454	6.0454	1.1100e-003	0.0000	6.0688
Total	**5.5300e-003**	**0.0496**	**0.0446**	**7.0000e-005**	**0.0125**	**3.3500e-003**	**0.0159**	**1.9000e-003**	**3.2000e-003**	**5.1000e-003**	**0.0000**	**6.0454**	**6.0454**	**1.1100e-003**	**0.0000**	**6.0688**

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	1.1600e-003	0.0137	0.0130	4.0000e-005	9.4000e-004	1.9000e-004	1.1400e-003	2.6000e-004	1.8000e-004	4.4000e-004	0.0000	3.7324	3.7324	3.0000e-005	0.0000	3.7330
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	1.2000e-003	1.8200e-003	0.0173	4.0000e-005	3.6300e-003	3.0000e-005	3.6600e-003	9.7000e-004	3.0000e-005	9.9000e-004	0.0000	3.0588	3.0588	1.6000e-004	0.0000	3.0621
Total	**2.3600e-003**	**0.0155**	**0.0303**	**8.0000e-005**	**4.5700e-003**	**2.2000e-004**	**4.8000e-003**	**1.2300e-003**	**2.1000e-004**	**1.4300e-003**	**0.0000**	**6.7911**	**6.7911**	**1.9000e-004**	**0.0000**	**6.7950**

3.13 Grading-Parking Lot - 2018

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					3.2000e-004	0.0000	3.2000e-004	3.0000e-005	0.0000	3.0000e-005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	5.3200e-003	0.0526	0.0467	6.0000e-005		3.7300e-003	3.7300e-003		3.4300e-003	3.4300e-003	0.0000	5.6749	5.6749	1.7700e-003	0.0000	5.7120
Total	**5.3200e-003**	**0.0526**	**0.0467**	**6.0000e-005**	**3.2000e-004**	**3.7300e-003**	**4.0500e-003**	**3.0000e-005**	**3.4300e-003**	**3.4600e-003**	**0.0000**	**5.6749**	**5.6749**	**1.7700e-003**	**0.0000**	**5.7120**

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	2.4000e-003	3.6400e-003	0.0346	9.0000e-005	7.2600e-003	6.0000e-005	7.3200e-003	1.9300e-003	5.0000e-005	1.9800e-003	0.0000	6.1175	6.1175	3.1000e-004	0.0000	6.1241
Total	**2.4000e-003**	**3.6400e-003**	**0.0346**	**9.0000e-005**	**7.2600e-003**	**6.0000e-005**	**7.3200e-003**	**1.9300e-003**	**5.0000e-005**	**1.9800e-003**	**0.0000**	**6.1175**	**6.1175**	**3.1000e-004**	**0.0000**	**6.1241**

3.14 Drainage-Parking Lot - 2018

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	2.7900e-003	0.0276	0.0245	3.0000e-005		1.9600e-003	1.9600e-003		1.8000e-003	1.8000e-003	0.0000	2.9793	2.9793	9.3000e-004	0.0000	2.9988
Total	**2.7900e-003**	**0.0276**	**0.0245**	**3.0000e-005**		**1.9600e-003**	**1.9600e-003**		**1.8000e-003**	**1.8000e-003**	**0.0000**	**2.9793**	**2.9793**	**9.3000e-004**	**0.0000**	**2.9988**

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	4.4000e-004	3.4500e-003	5.5300e-003	1.0000e-005	2.7000e-004	5.0000e-005	3.2000e-004	8.0000e-005	5.0000e-005	1.3000e-004	0.0000	0.8844	0.8844	1.0000e-005	0.0000	0.8846
Worker	1.2600e-003	1.9100e-003	0.0182	5.0000e-005	3.8100e-003	3.0000e-005	3.8400e-003	1.0100e-003	3.0000e-005	1.0400e-003	0.0000	3.2117	3.2117	1.6000e-004	0.0000	3.2152
Total	**1.7000e-003**	**5.3600e-003**	**0.0237**	**6.0000e-005**	**4.0800e-003**	**8.0000e-005**	**4.1600e-003**	**1.0900e-003**	**8.0000e-005**	**1.1700e-003**	**0.0000**	**4.0961**	**4.0961**	**1.7000e-004**	**0.0000**	**4.0997**

3.14 Drainage-Parking Lot - 2019

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	1.0500e-003	0.0105	0.0104	1.0000e-005		7.0000e-004	7.0000e-004		6.5000e-004	6.5000e-004	0.0000	1.2555	1.2555	4.0000e-004	0.0000	1.2638
Total	**1.0500e-003**	**0.0105**	**0.0104**	**1.0000e-005**		**7.0000e-004**	**7.0000e-004**		**6.5000e-004**	**6.5000e-004**	**0.0000**	**1.2555**	**1.2555**	**4.0000e-004**	**0.0000**	**1.2638**

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	1.7000e-004	1.3500e-003	2.2400e-003	0.0000	1.2000e-004	2.0000e-005	1.4000e-004	3.0000e-005	2.0000e-005	5.0000e-005	0.0000	0.3725	0.3725	0.0000	0.0000	0.3725
Worker	4.9000e-004	7.5000e-004	7.0700e-003	2.0000e-005	1.6300e-003	1.0000e-005	1.6500e-003	4.3000e-004	1.0000e-005	4.5000e-004	0.0000	1.3270	1.3270	7.0000e-005	0.0000	1.3284
Total	**6.6000e-004**	**2.1000e-003**	**9.3100e-003**	**2.0000e-005**	**1.7500e-003**	**3.0000e-005**	**1.7900e-003**	**4.6000e-004**	**3.0000e-005**	**5.0000e-004**	**0.0000**	**1.6995**	**1.6995**	**7.0000e-005**	**0.0000**	**1.7010**

3.15 Paving-Parking Lot - 2019

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	2.2000e-003	0.0230	0.0206	3.0000e-005		1.2900e-003	1.2900e-003		1.1900e-003	1.1900e-003	0.0000	2.8071	2.8071	8.9000e-004	0.0000	2.8258

Paving	8.4000e-004					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**3.0400e-003**	**0.0230**	**0.0206**	**3.0000e-005**		**1.2900e-003**	**1.2900e-003**		**1.1900e-003**	**1.1900e-003**	**0.0000**	**2.8071**	**2.8071**	**8.9000e-004**	**0.0000**	**2.8258**

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	1.9000e-004	1.5000e-003	2.4900e-003	0.0000	1.3000e-004	2.0000e-005	1.5000e-004	4.0000e-005	2.0000e-005	6.0000e-005	0.0000	0.4139	0.4139	0.0000	0.0000	0.4139
Worker	5.5000e-004	8.3000e-004	7.8600e-003	2.0000e-005	1.8200e-003	1.0000e-005	1.8300e-003	4.8000e-004	1.0000e-005	5.0000e-004	0.0000	1.4745	1.4745	7.0000e-005	0.0000	1.4760
Total	**7.4000e-004**	**2.3300e-003**	**0.0104**	**2.0000e-005**	**1.9500e-003**	**3.0000e-005**	**1.9800e-003**	**5.2000e-004**	**3.0000e-005**	**5.6000e-004**	**0.0000**	**1.8884**	**1.8884**	**7.0000e-005**	**0.0000**	**1.8900**

3.16 Lighting-Parking Lot - 2019

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	2.5200e-003	0.0214	0.0211	4.0000e-005		1.2800e-003	1.2800e-003		1.2800e-003	1.2800e-003	0.0000	3.2079	3.2079	2.0000e-004	0.0000	3.2122
Total	**2.5200e-003**	**0.0214**	**0.0211**	**4.0000e-005**		**1.2800e-003**	**1.2800e-003**		**1.2800e-003**	**1.2800e-003**	**0.0000**	**3.2079**	**3.2079**	**2.0000e-004**	**0.0000**	**3.2122**

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	3.9000e-004	3.0000e-003	4.9800e-003	1.0000e-005	2.6000e-004	5.0000e-005	3.0000e-004	7.0000e-005	4.0000e-005	1.2000e-004	0.0000	0.8277	0.8277	1.0000e-005	0.0000	0.8279
Worker	1.0900e-003	1.6600e-003	0.0157	4.0000e-005	3.6300e-003	3.0000e-005	3.6600e-003	9.7000e-004	3.0000e-005	9.9000e-004	0.0000	2.9490	2.9490	1.5000e-004	0.0000	2.9520
Total	**1.4800e-003**	**4.6600e-003**	**0.0207**	**5.0000e-005**	**3.8900e-003**	**8.0000e-005**	**3.9600e-003**	**1.0400e-003**	**7.0000e-005**	**1.1100e-003**	**0.0000**	**3.7767**	**3.7767**	**1.6000e-004**	**0.0000**	**3.7799**

3.17 Landscaping-Parking Lot - 2019

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	2.5200e-003	0.0214	0.0211	4.0000e-005		1.2800e-003	1.2800e-003		1.2800e-003	1.2800e-003	0.0000	3.2079	3.2079	2.0000e-004	0.0000	3.2122
Paving	8.4000e-004					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**3.3600e-003**	**0.0214**	**0.0211**	**4.0000e-005**		**1.2800e-003**	**1.2800e-003**		**1.2800e-003**	**1.2800e-003**	**0.0000**	**3.2079**	**3.2079**	**2.0000e-004**	**0.0000**	**3.2122**

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	3.9000e-004	3.0000e-003	4.9800e-003	1.0000e-005	2.6000e-004	5.0000e-005	3.0000e-004	7.0000e-005	4.0000e-005	1.2000e-004	0.0000	0.8277	0.8277	1.0000e-005	0.0000	0.8279
Worker	1.0900e-003	1.6600e-003	0.0157	4.0000e-005	3.6300e-003	3.0000e-005	3.6600e-003	9.7000e-004	3.0000e-005	9.9000e-004	0.0000	2.9490	2.9490	1.5000e-004	0.0000	2.9520

Total	**1.4800e-003**	**4.6600e-003**	**0.0207**	**5.0000e-005**	**3.8900e-003**	**8.0000e-005**	**3.9600e-003**	**1.0400e-003**	**7.0000e-005**	**1.1100e-003**	**0.0000**	**3.7767**	**3.7767**	**1.6000e-004**	**0.0000**	**3.7799**

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	0.6091	1.6791	6.3905	0.0136	0.8841	0.0233	0.9073	0.2376	0.0214	0.2590	0.0000	1,001.3813	1,001.3813	0.0358	0.0000	1,002.1325
Unmitigated	0.6091	1.6791	6.3905	0.0136	0.8841	0.0233	0.9073	0.2376	0.0214	0.2590	0.0000	1,001.3813	1,001.3813	0.0358	0.0000	1,002.1325

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Parking Lot	550.00	2,500.00	2500.00	2,363,587	2,363,587
Total	550.00	2,500.00	2,500.00	2,363,587	2,363,587

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
Parking Lot	9.50	7.30	7.30	33.00	48.00	19.00	66	28	6

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.542590	0.062129	0.167184	0.110637	0.030730	0.004573	0.019109	0.050292	0.001784	0.003671	0.005678	0.000201	0.001421

5.0 Energy Detail

4.4 Fleet Mix

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 Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	14.7188	14.7188	9.6000e-004	2.0000e-004	14.8006
NaturalGas Mitigated	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
NaturalGas Unmitigated	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
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	14.7188	14.7188	9.6000e-004	2.0000e-004	14.8006

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					
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		**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**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e

Land Use	kWh/yr	MT/yr			
Parking Lot	72982.5	14.7188	9.6000e-004	2.0000e-004	14.8006
Total		**14.7188**	**9.6000e-004**	**2.0000e-004**	**14.8006**

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	1.1700e-003	1.0000e-005	9.3000e-004	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	1.7900e-003	1.7900e-003	0.0000	0.0000	1.8900e-003
Unmitigated	1.1700e-003	1.0000e-005	9.3000e-004	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	1.7900e-003	1.7900e-003	0.0000	0.0000	1.8900e-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	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	1.0800e-003					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	9.0000e-005	1.0000e-005	9.3000e-004	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	1.7900e-003	1.7900e-003	0.0000	0.0000	1.8900e-003
Total	**1.1700e-003**	**1.0000e-005**	**9.3000e-004**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**1.7900e-003**	**1.7900e-003**	**0.0000**	**0.0000**	**1.8900e-003**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
Parking Lot	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000

Unmitigated	0.0000	0.0000	0.0000	0.0000

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

9.0 Operational Offroad

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

10.0 Vegetation

Appendix B

Review of West Oakland Health Impact Studies

Memorandum

Date:	June 6, 2013
To:	Francis Lo/Eva Lillie TYLIN International 1111 Broadway, Suite 2150Oakland, California
Cc:	Rich Walter/Kate Giberson, ICF International
From:	Shannon Hatcher/Brenda Chang, ICF International
Subject:	**Review of West Oakland Health Impact Studies Relevant to the Proposed Gateway Park**

Introduction

This memorandum reviews current available studies that provide relevant information for evaluating the potential health impacts from major air pollutant sources on future persons who may recreate within the proposed Gateway Park project. The project area spans from the main park area at the westernmost portion of West Oakland at the I-80 Bay Bridge toll plaza eastward and south underneath the I-880 freeway. While the Environmental Impact Report (EIR) for the project will examine all relevant air quality issues, the focus of this memo is on the potential long-term carcinogenic impacts of diesel particulate matter (DPM). Thus, the purpose of this review is to review and summarize study findings relevant to DPM.

Major diesel emissions sources addressed in this review include:

- The Port of Oakland, including emissions from
  - Ocean Going Vessels (OGV)
  - Diesel trucks, and
  - Short line rail locomotives;
- Union Pacific Railyard, including emissions from
  - Freight locomotives;
- Adjacent highways, such as I-80, including emissions from
  - Diesel trucks
- Neighboring industries, including emissions from
  - Diesel-powered generators.

The Port of Oakland and neighboring freeways have been the subject of several studies, evaluating the long term health effects of these emission sources on neighboring communities, such as West Oakland. ICF reviewed these studies and data prepared by the California Air Resources Board (ARB), University of California-Berkeley, University of California-Davis, Caltrans, and the Bay Area Air Quality Management District (BAAQMD).

The impact of local air pollution in the Gateway Park project area is affected by several factors including, meteorology, distance between receptors and emission sources, pollutant levels and concentration, and current and future regulations that may reduce DPM from diesel vehicles and marine craft. The studies that were reviewed suggest that on-road truck traffic, both port and non-port related, is the most significant contributor of DPM in the area. DPM from ocean going vessels (OGV) and other marine-craft are also significant sources of DMP, but generally emit at greater distances from the proposed park area than local truck traffic, thereby reducing exposure and associated health effects when compared to local truck traffic sources. Also, the air quality in the project area has been shown to be improving over recent years and is anticipated to improve further in the future due to a variety of Federal and State regulations that control diesel vehicles, vessels, and the fuels themselves.

This literature review focuses on the findings related to cancer health risks associated with DPM and addresses the relative impact to visitors in the proposed Gateway Park. With respect to the long term effects on residents, the state's Office of Environmental Health Hazard Assessment (OEHHA) measures the cancer health risks as the chances in a population of a million that some number of persons may develop cancer over a 70-year lifetime exposure period. While most of the studies examine the long-term cancer risks of DPM on local residents, the proposed Gateway Park project does not include any residential facilities that would experience long-term exposure to DPM emissions. Instead, it would involve recreational visitors that would experience short-term transitory exposure to ambient DPM emissions. Therefore, conclusions made from the reviewed studies on the cumulative impact of DPM on local resident cancer risks were extrapolated in this memorandum to reflect shorter exposure periods experienced by Gateway Park patrons.

Review of Data Sources

Studies and Key Findings

ARB's West Oakland Study

ARB published a study, *Diesel Particulate Matter Health Risk Assessment for the West Oakland Community*, in 2008 addressing and quantifying the health impacts of air emissions of diesel particulate matter on West Oakland and overall Bay Area communities, which include impacts to the Gateway Park project area in the west end of West Oakland. These impacts were calculated using emissions inventories[1] from the year 2005 and dispersion models and were forecasted using available growth and control factors, such as future regulations, to project the same health risks in

[1] Developed by ARB, BAAQMD, and Union Pacific Railroad.

2010, 2015, and 2020. This study examined the DPM emissions from major sources in the area: the Maritime Port of Oakland (the Port), the Union Pacific Railyard, neighboring marine vessels, and local diesel truck traffic. Health impacts were measured by estimating a lifetime cancer risk the surrounding populating using OEHHA's Tier 1 analysis with an average risk factor to reflect upon the general population, including visitors, not just residents.[2]

This study presents the health risks findings by source and overall impacted area in both data tables and isopleth maps. The isopleth in Figure 1, below, shows an overall cancer risk in the range of 1,000 to over 1,500 in one million within the Gateway Project area (California Air Resources Board 2008: Figure 10). This cancer risk is similar to that of the main West Oakland community located between the I-880, I-580, and I-980 freeways. Emissions from diesel truck activity outside of the Port have the greatest impact on cancer risk, contributing to a cancer risk in the range of 500 to over 1,000 in a million from the overall predicted cancer risk of 1,000 to over 1,500 in one million. Emissions from the Port were estimated to contribute to a cancer risk in the range of 200 to over 500 in a million. The contributions to the overall cancer risk shown in Figure 1 from the various local sources are also summarized in Table 1. The average, population weighted, cancer risk in the West Oakland area in 2005 was estimated to be 1,187. The study found that even though the DPM emissions at the point of exhaust were far greater for ocean going marine vessels at the port, the actual effect it had on the cancer risk of local residents was less due to the distances between the marine vessels and the general population, as opposed to the proximity between trucks and general population.

The ARB West Oakland Study also noted that regulatory actions to reduce DPM emissions from trucks and marine vessels will dramatically reduce DPM emissions and their associated cancer risks. The study's forecasts include the implementation of ARB's 2000 Diesel Risk Reduction Plan and other regulations, which, when combined with population growth estimates, may reduce overall population weighted DPM cancer risk by 80% by 2015 and 75%[3] by 2020 from 2005 levels. These regulations are summarized in a later section on the applicable regulations affecting diesel emissions in the port and state. (California Air Resources Board 2008)

As shown in a 2008 BAAQMD study and addressed below, federal, state, and local regulations have made and continue to make a significant impact on local DPM emissions. This means that the DPM cancer risks at both the Gateway Park and West Oakland communities by the opening year of the Gateway Park project in 2015 will be significantly lower than those estimated in 2005. However, an 80% reduction in 2015 would result in a lowered cancer risk of between 200 and 300 in a million in the West Oakland area, which is still a significant cancer risk when compared to the BAAQMD cumulative health risk assessment (HRA) CEQA threshold of 100 in a million from all sources (Bay Area Air Quality Management District 2010a)[4]. Additionally, as the values presented in Figure 1 and

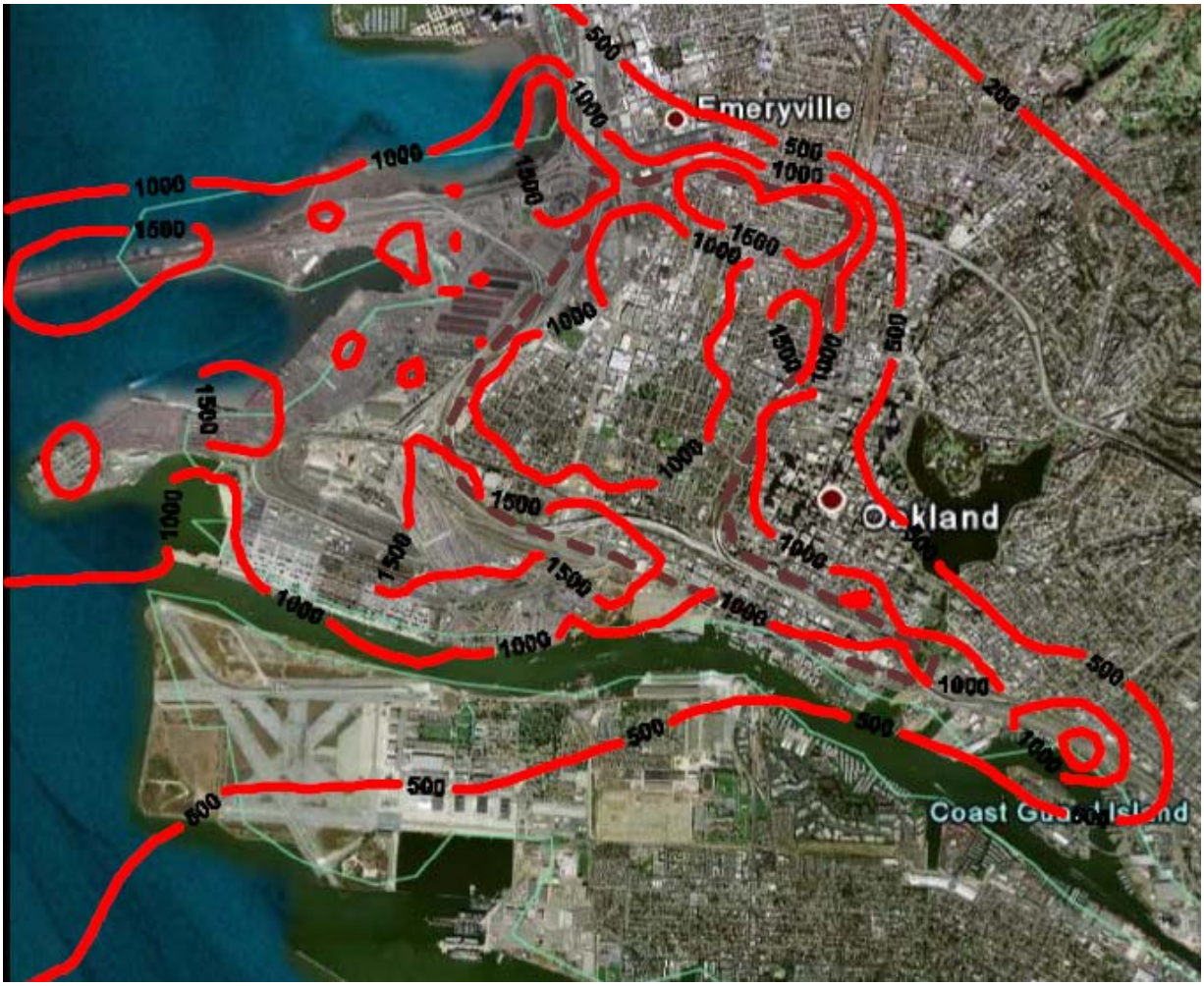
[2] In this memorandum, however, we assume that the cancer risk values presented by the ARB West Oakland Study represent just the residential population.

[3] The ARB study assumes that the increased population and activity growth in 2020 combined will exceed the diesel emissions reductions required by the regulatory program, thus resulting in an increase in emissions from 2015.

[4] The BAAQMD 2010 CEQA Guidelines have been formally suspended due to a court order which found that BAAQMD had to complete a CEQA evaluation of the CEQA guidelines before their adoption. BAAQMD's CEQA guidelines are not mandatory but CEQA lead agencies may choose to use them or not, as appropriate.

Table 1 are based on long-term exposure (i.e., 24-hours per day, 350 days per year, 70 years of exposure), an adjustment factor, discussed later, would need to be applied to the values presented in Figure 1 and Table 1 to characterize lower potential cancer risks for recreational visitors to the Gateway Park project, based on a lower exposure duration associated with the transitory use of Gateway Park.

Figure 1 - Estimated West Oakland Community Potential Cancer Risk from All Diesel PM Emissions Sources in 2005 (CALIFORNIA AIR RESOURCES BOARD 2008: Figure 10)[5]



[5] The ARB West Oakland Report assumes "[t]he risk levels are based on the 80th Percentile Breathing Rate. Total Modeled Emissions = 845 T/Y in 2005. Modeling Domain = 10 km x 10 km. Resolution = 250 m x 250 m. The dashed line represents the boundary for the West Oakland community."

Table 1 - Cancer Risks and Annual DPM emissions in 2005 by Emissions Source and Gateway Park location

Source	Diesel PM Emissions (TPY)	Residential[a] Cancer Risk to Gateway Park core area (by the Bay Bridge toll plaza)		Residential[a] Cancer Risk to Gateway Park east area (by the I-880 section between the Port and West Oakland)	
		min	max	min	max
All Sources	**845**	**1,000**	**>1,500**	**1,000**	**>1,500**
PART I - Port Operations	265	200	500	200	500
Port OGV	*209*	*100*	*225*	*100*	*200*
Port Trucks	*20*	*10*	*100*	*10*	*100*
Cargo Handling Equipment Activity	*21*	*10*	*100*	*10*	*100*
Commercial Harbor Craft	*13*	*10*	*100*	*10*	*100*
Port Locomotive	*2*	*1*	*10*	*1*	*>10*
PART II - UP Oakland Railyard	11	10	100	100	200
Cargo Handling Equipment Activity	2.2	-	-	-	-
Heavy Diesel Trucks	1.9	-	-	-	-
Locomotives	3.9	-	-	-	-
Transportation Refrigeration Units	3.2	-	-	-	-
PART III - Non-Port/Non-UP Activity	568	500	>1,000	500	>1,000
Off-Port On-Road Trucks	*90*	*200*	*>1,000*	*200*	*>1,000*
Off-Port OGV	*218*	*25*	*75*	*25*	*50*
Off-Port Commercial Harbor Craft	*238*	*100*	*500*	*100*	*200*
Amtrak	*3.4*	*<10*	*n/a*	*10*	*100*
Cargo Handling Equipment Activity	*4.3*	*1*	*10*	*1*	*10*
Off-Port Locomotive	*1.3*	*1*	*10*	*10*	*>10*
Stationary Sources	*0.2*	*<1*	*n/a*	*0*	*1*
Bay Bridge Construction	*13*	*1*	*25*	*1*	*10*
Distribution Center Truck Activity	-	*1*	*100*	*10*	*100*

Note:
TPY = Tons per Year.
- denotes value unavailable in report.

[a] These cancer risk values are based off of the isopleth maps available in the ARB West Oakland Study which looks at the overall cancer risk for the general population over a 70 year lifetime period. Patrons of the Gateway Park will be active at the park for short periods of time and will not reside there, thus the actual cancer risk at the park is anticipated to be lower. The values included here present an understanding of the contribution emissions sources to the overall health risks.

Source: Table 2 and Figures in Appendix D from the ARB West Oakland Study (California Air Resources Board 2008)

BAAQMD West Oakland Monitoring Study

Subsequent to the 2008 ARB West Oakland Study, in 2010, the BAAQMD published the *West Oakland Monitoring Study*[6] with the purpose of providing supplemental air quality monitoring data of Toxic Air Contaminant and diesel emissions concentrations in areas within and around the Port of the Oakland. Measurements of elemental carbon were used as surrogates to estimate the ambient levels of diesel emissions, as 70 to 90% of elemental carbon emissions were from diesel exhaust[7]. Sixteen air quality monitors were placed throughout West Oakland and measured over a four week period in two seasons: Summer 2009 and Winter 2009/2010. No monitors were located within 1,000 feet of the Gateway Park area by the Bay Bridge toll plaza; however, six monitors were located along I-880 east of the Port of Oakland. The study found that:

- Emissions concentrations were greater at locations closer to roadways with higher traffic levels and decreased at distances further from those roadways.
- DPM emissions by roadways were over five times higher than the West Oakland community average.
- Emissions from trucks were generally limited to well-established truck routes, whereas autos travel more ubiquitously through the area.
- The decrease in emissions measured between 2005[8] and 2009/2010[9] fell within the 20 to 50% reduction in DPM emissions sources projected by the 2008 ARB West Oakland study. According to the BAAQMD study, this was likely due to the impact of private fleet diesel truck and marine main engine clean fuel regulations which were adopted in 2008.
- West Oakland DPM concentrations in West Oakland were an average of 1.4 $\mu g/m^3$, which translates to a cancer risk of just under 450 in a million[10], in comparison to the average cancer risk estimated for 2005 of 1,187 in a million as estimated by the ARB West Oakland Study, a 62% reduction. (Bay Area Air Quality Management District 2010a).

The BAAQMD *West Oakland Monitoring Study* provides a confirmation of the effect of regulations and policies on air quality in reducing DPM emission in the real world. The findings also reaffirm that those living in close proximity to freeways and other major truck routes are exposed to a greater health risk than those living further from such sources. The study does not, however, make projections as to the future cancer risks or pollutant concentrations based on the monitoring data

[6] This draft report was prepared by the Desert Research Institute. As of May 30, 2013, no final report was available on the BAAQMD website.

[7] Based on a Chemical Mass Balance analysis in the same report.

[8] Values from ARB's 2008 West Oakland Study

[9] Values from the BAAQMD West Oakland Monitoring study

[10] The BAAQMD report estimated 2005 concentrations of DPM in $\mu g/m^3$ by dividing the modeled potential cancer risk isopleths values by 318 (BAAQMD 2010b: 4-3). Accordingly, the average 2009-2010 concentration of 1.4$\mu g/m^3$ was multiplied by 318 to calculate the associated cancer risk for West Oakland in 2009-2010. This adopted calculation is supported by the fact that both the ARB study and the BAAQMD study used the same cancer risk methodology, the OEHAA Tier 1 Analysis.

performed. Based on these findings, the portions of Gateway Park that are closer to the I-80, I-880, and I-580 freeways will have greater exposure to DPM than areas further from these sources, as close proximity to freeways and other major truck routes was found in this study to have a strong effect on local DPM concentrations and associated health risks.

Effects of Diesel Particle Filter Retrofits and Accelerated Fleet Turnover on Drayage Truck Emissions at the Port of Oakland

Researchers from the UC Berkeley published an article in the Journal of Environmental Science and Technology in 2011 (Dallmann, et. al. 2011) which documented a more recent effect of government regulations on real world diesel exhaust emissions. The purpose of this work was to measure the effect of ARB's drayage truck emissions control regulations, which became in effect in 2010, by measuring diesel emissions concentrations along major truck routes by the Port of Oakland before and after the regulation's adoption. Trucks affected by ARB's regulation consist of those that transport goods to or from California Ports and intermodal rail yards (California Air Resources Board 2012a). The ARB drayage regulation mainly required:

- A ban on all affected trucks with vehicle engine model years of 1993 or older by 2010,
- Diesel Particulate Filters (DPF) to be installed on all engines of model years between 1994 and 2003 by 2010, and
- Trucks of model years 2004 through 2006 are required to be retrofitted with DPFs by between 2010 and 2013, depending on the model year. [11]

The authors, Dallmann, et. al, measured the black carbon, a surrogate for diesel exhaust emissions at an overpass crossing over a major non-freeway surface street during a weekday day time period of 4-5 hours in November 2009 and June 2010[12]. Dallmann, et. al. 2011 findings included:

- Black carbon (from DPM) decreased by about 50% between 2009 and 2010 from Drayage trucks entering the Port.
- The fraction of very low-emitting trucks with lower black carbon emission rates was 3 times higher in 2010 than in 2009 within a span of 7 months.

The authors reasoned that the reduction in emissions from trucks was related to the accelerated turnover of older, more polluting vehicles and DPM filters requirement on the newer vehicle models. This conclusion was further supported by verifying the truck age distributions before and after the 2010 ARB regulations went into effect.

As discussed earlier, on road diesel trucks accounted for the majority of sources of cancer risk in the West Oakland and Gateway Park area. This study emphasized the importance and real-world impact

[11] Additionally, the regulation also provides incentives for the replacement of older trucks with 2007 or newer model year trucks that meet the strictest current emissions standards.
[12] The study assumed that retrofits were 95% complete by June 2010, based on a personal communication with Cleaire Advance Emission Controls in San Leandro.

of such regulations as the ARB Drayage Truck rules. Thus these and similar regulations should be taken into account when projecting future truck emissions.

Practical Mitigation Measures for Diesel Particulate Matter: Near-Road Vegetation Barriers (Fuller et. al. 2009)

A joint report between UC Davis and Caltrans was published in 2009 addressing the efficacy of using vegetative road-side barriers as mitigation for DPM from vehicular sources. The motivation for this report was based on the concern over siting sensitive receptor land uses (e.g., parks, schools, residences) near freeways and heavily trafficked roadways. The concern was further prompted by ARB policy recommendations to "avoid siting new sensitive land uses within 500 feet of a freeway, urban roads with 100,000 vehicles/day, or rural roads with 50,000 vehicles/day"(California Air Resources Board 2005) and the fact that many existing schools and other sensitive land uses were already within the 500 foot suggested buffer. The proposed Gateway Park area may be located as close as 15 feet from the nearest roadway, and the entire Gateway Park area is entirely within 1,600 feet of major freeways[13].

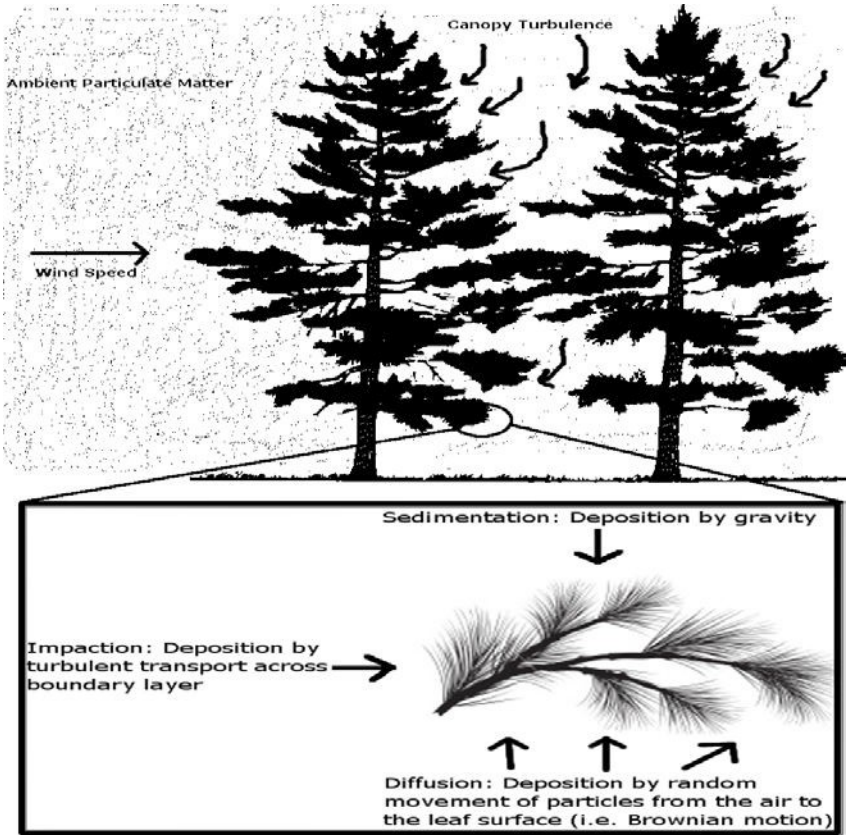
This study hypothesized that configurations of specific types of vegetation planted by the roadway source, between the roadway and receptors, would lessen the DPM concentration at the receptor through the absorption of DPM by the vegetation. The researchers modeled the gradient of DPM concentration perpendicular to a roadway for a variety of tree species and planting configurations and had the following findings:

- Vegetation captures airborne particulate matter that contacts coarse and sticky surfaces on the vegetation.
- Tall evergreen trees with greater surface area on foliage, branches, and trunk provide the most effective absorption of DPM. Evergreen trees also tend to be longer living and have coarse bark that maximizes surface area on the tree.
- Trees sited close to the emissions source (i.e., at the roadway) are more effective at reducing pollutant concentrations at the receptor than trees sited further from the roadway (i.e., at the receptor) due to the dispersion of the pollutants by the time they reach the vegetative barriers.
- Through a literature review, the study found that redwood trees could reduce between 83 and 99% of PM sized between 0.10 and 0.015µm, respectively at a wind speed of 1.0 m/s (Fuller et. al. 2009:7, Cahill 2008).
- Tree planting configuration significantly affects the wind flow through the vegetative barrier[14]. The study recommends specific spacing patterns for the best PM capture rate through a semipermeable barrier configuration to allow enough flow to the trees as to

[13] The furthest point perpendicular to the I-80 is located at the southern end of Gateway Park core area, where a small pier is currently located. This point is just under 1,500 feet from the edge of the I-80 to the north. All other areas of the park are located within 1,500 feet of either I-80, I-560, or I-880.
[14] The reasoning is based on of a wind tunnel study performed by Cahill (Cahill 2008).

facilitate greater contact between particles and tree surfaces. Trees that are planted too close together create an impermeable barrier that could cause higher concentrations of pollutants at 80 feet away from the barrier and beyond.

Figure 2 - Dry Deposition Illustration (UC Davis, Caltrans 2010:Figure 2.3)



The study explains the capture of pollutants via the dry deposition method, shown in Figure 2, which characterizes the transport of the particles through tree canopies via sedimentation, impaction, and diffusion. Table 2 shows published estimated PM removal rates of wind flow through redwood trees for various PM sizes.

Table 2 - Estimated PM Removal By Redwood Vegetation

Particle Diameter (μm)	Percent Removal by Redwood Vegetation
0.1	83%
0.075	86%
0.05	90%
0.035	95%
0.015	99%
Source: Cahill 2008, Fuller et. al. 2009:7	

Data Sets

The following selected data sets present relevant data that can be used to determine the transport and risk of pollutants from the major sources in the West Oakland and project area.

BAAQMD Windrose Data

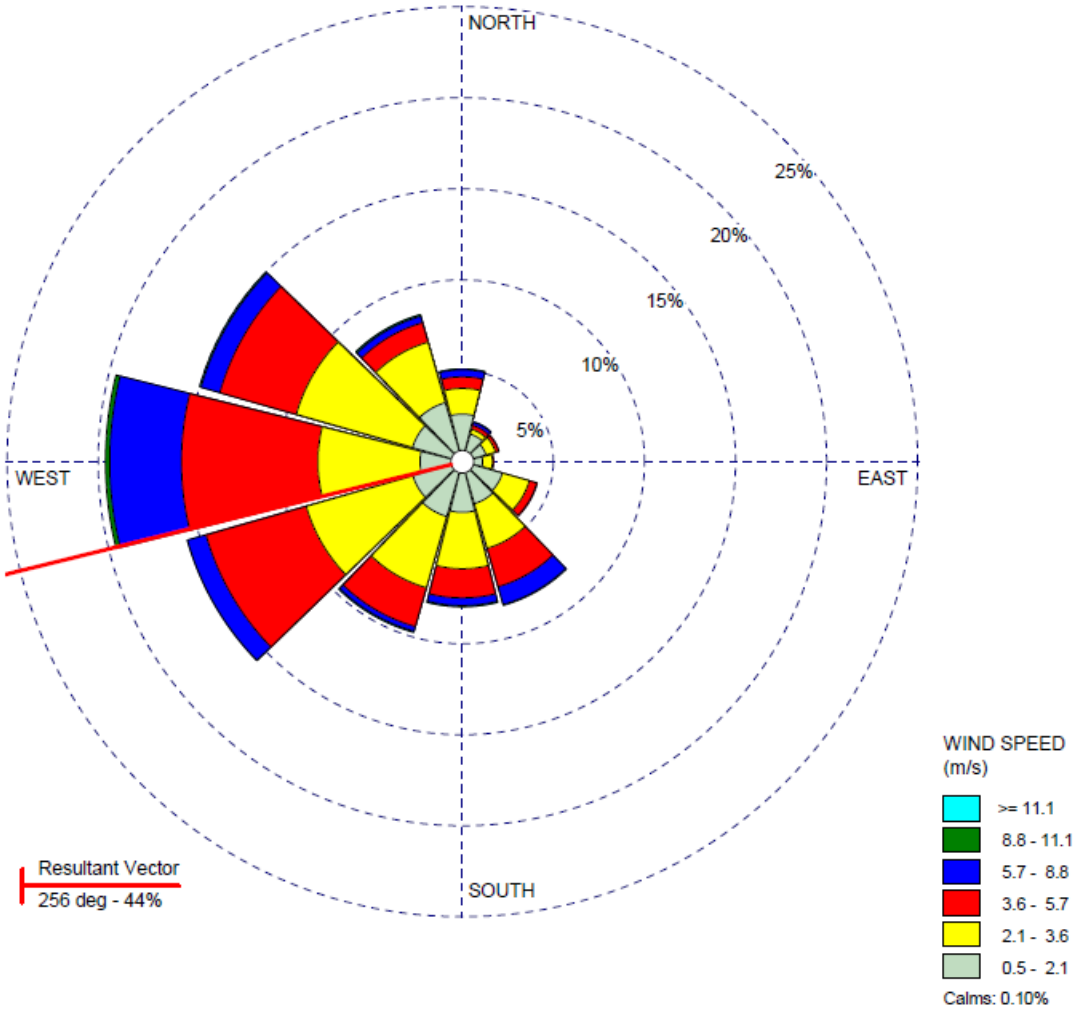
The BAAQMD gathers meteorological data, including wind speed and directional data, from monitoring sites throughout the Bay Area (Bay Area Air Quality Management District n.d.). Two monitoring sites are located within 1 mile of project area: at the Port of Oakland (0.8 mi) and the Oakland Sewage Treatment Plant (STP) located on East Bay Municipal Utility District property directly adjacent to the east of the Gateway Park project area (150 feet). Data from these sites were input into the WRPLOT View™ wind rose plot program to view individual and combined wind rose data (Lakes Environmental 2011). At both sites, wind speed and direction in the West Oakland area blow from the west around 20% of time and from the southwest and northwest at around 15% of the time from each direction. The majority of wind speeds range between 2.1 and 8.8 meters/s (m/s), with an average speed of 3.25 m/s heading in the east northeasterly direction 44% of the time[15], as shown in the wind rose in Figure 3. Additional wind rose figures are attached at the end of this memorandum.

Given this information, the Gateway Park core area would be most affected by latitudinal travel of marine and ocean going vessels west of the park area in the San Francisco Bay. The Gateway Park east area, as it is located underneath and around the I-880 and I-880/580/80 Maze (east of the Port of Oakland), would be most impacted by pollutants traveling eastward from activities at the Port of Oakland[16]. The impact of these meteorological factors is taken into account in the synthesis of the cancer risks from the ARB West Oakland Study.

[15] The most recent data available from the BAAQMD meteorological site was obtained in 2000 (Bay Area Air Quality Management District n.d.). However, a recent air monitoring network report published in 2012 with 2011 meteorology data for the Oakland STP site shows wind patterns that are consistent with those reported for 2002 (Bay Area Air Quality Management District 2012b).

[16] Additionally, the technical documents supporting the air dispersion model, CALINE 4, suggest that a greater concentration of pollutants would be present at receptors located close to and below freeways than in a typical at-grade situation at the same perpendicular distance from the freeway (Benson 1989:95).

Figure 30 - Combined Wind Rose Plot for the Wind Patterns Monitored at the Port of Oakland and the Oakland Sewage Treatment Plant. (Direction blowing from)



BAAQMD Cancer Risk Data

The BAAQMD 2010 CEQA guidelines recommends that a Lead Agency identify all $PM_{2.5}$ sources located within a 1,000 foot radius of a proposed project site, and recommends enlarging that radius if there are major sources beyond the 1,000 foot radius. Additionally, the Air District also provides a Google Earth™ based screening tool, used for addressing district PM thresholds, that characterizes cancer risks from various transportation and stationary sources (Bay Area Air Quality Management District 2012c). This screening tool shows the location of major sources and the associated health risks. The top three stationary and highway sources and their health risks are summarized in Table 3 below.

Table 3 - Nearby Stationary Sources and Their Associated Cancer Risks

Source	Source Location	Receptor Location	Cancer Risk per Million at Receptor
Top three Stationary Sources[a]			
EBMUD[b]– Wastewater Treatment Plant and Disposal Facility	2020 Wake Avenue, Oakland, CA	Not Available[c]	853
Caltrans – SF Bay Bridge	Toll Plaza	Not Available[c]	87
Alameda County Public Works Agency	3455 Ettie Street, Oakland, CA	Not Available[c]	36
Top Three Highway Sources[c]			
Link 815	I-80 near the Bay Bridge Toll Plaza	Bike/Pedestrian path located 25 feet south of link	123
		Transportation Museum outdoor facilities located at 175 south of link	56[c]
		Touchdown Pavilion located 200 feet south of link	50
		Baywalk at The Point located 400 feet south of link	31
Link 819	I-80 link 1 mile east of the Toll Plaza	Bike Path at 50 feet south of link	93
Link 822	I-80, between Link 819 and the I-580 and I-880 interchange	Bike Path at 50 feet south of link	92

[a] The BAAQMD database does not indicate what pollutants cause the cancer risks from these stationary sources. Therefore, it cannot be determined that these cancer risks are specifically due to DPM emissions or not.
[b] East Bay Municipal Utility District
[c] The screening-level risk and hazard impacts in the stationary source screening tool do not represent actual impacts. The values are based on worst case assumption scenarios to determine whether or not a refined modeling analysis may be needed. The calculations used in the screening analysis do not include source specific exhaust information such as stack height, exhaust gas exit velocity, exhaust gas temperature, nor do they account for actual distances from receptors.
[d] For the purposes of data accessibility, the BAAQMD divides major highways into links of approximately 0.5 to 2km in length, depending on continuity, and publishes the estimated health risks associated with each link and the receptor distance and orientation from each link on their website (Bay Area Air Quality Management District 2012c). The District also provides different health risk data depending on whether the receptor would be located at-grade (6-foot height above the ground) or elevated in a building 2 stories or higher (20-foot height above the ground). The top three links with the greatest health risks assume a receptor height of 6 feet. Note that these cancer risks represent residential cancer risks. Actual risks due to recreational activity and exposure rates may reduce these cancer risks.
[e] Extrapolated between cancer risks at 100 feet and 200 feet.
Sources: Bay Area Air Quality Management District 2012c

As shown by the cancer risks posed by major nearby sources to the project area, the cumulative cancer risks are well beyond the BAAQMD's recommended cumulative threshold of 100 per million. Stationary

source emissions from the EBMUD Wastewater Treatment Plant and disposal facility alone would result in health risks well in excess of the air district's threshold, at 853 per million. Because the pollutants that cause the stationary source health risks are unknown, cancer risks from stationary sources are excluded from following cancer risk analysis at Gateway Park below. [17] The cancer risks from highway sources, on the other hand, are included along with other local diesel emissions sources addressed in the scope of the ARB West Oakland Study in the cancer risk analysis below.

Applicable Regulations and Policies

The following summarizes applicable federal, state, and local regulations that impact diesel emissions in the present and future. Adopted or amended dates are in parenthesis.

Federal Regulations

- Stricter federal vehicle emissions standards for vehicle model years 2007 and newer (U.S. Environmental Protection Agency 2000).
- Low Sulfur and Ultra-Low Sulfur Fuel (2000)
    - These low sulfur fuels are phased-in for applicable nonroad, locomotive, and marine diesel engines from 2007 to 2014.
    - Ultra Low Sulfur Diesel was phased in for highway diesel fuel from 2006 to 2010. (U.S. Environmental Protection Agency 2000).
- Ocean Going Vessel regulations
    - North American Emission Control Area (ECA) (U.S. EPA 2010)
        - Fuel sulfur must be 35,000 ppm or lower by 2012
        - 5,000 ppm by 2020 depending on fuel availability[18]

State Regulations

- Diesel Risk Reduction Plan (DRRP) (2000)
    - Goal of reducing diesel PM emissions by 75% by 2010 and 85% in 2020 from 2000 values by requiring filters and greater vehicle turnover of older more polluting highway diesel vehicles. (California Air Resources Board 2000)
    - The DRRP supports a variety of other regulations, including:

[17] Despite the high cancer risk from EBMUD, this memorandum excludes stationary source cancer risks from the quantification of potential future cancer risks at Gateway Park because it is unknown whether or not the stationary source pollutants are diesel exhaust. Also, the ARB West Oakland study does not for these stationary sources in the calculation of the overall cancer risks.

[18] "The 2015 fuel sulfur standard of 0.1 percent fuel sulfur (1,000 ppm) is expected to reduce PM and SO_X emissions by more than 85 percent from today's levels. " (U.S. Environmental Protection Agency 2010).

- Truck and Bus Regulation (2008)[19]
  - 100% of heavier trucks will need to comply with the PM Filter regulation by 2016.
  - Starting January 1, 2012, heavier trucks must be retrofitted with PM filters.
  - Starting January 1, 2015, older trucks would need to be replaced with newer trucks.
  - By January 1. 2023, all otherwise non-exempt trucks and buses, including drayage trucks, will need to have a 2010 model year engine or the equivalent. (California Air Resources Board 2013).
- Port Drayage Truck Regulation (2010)
  - Ban on vehicle engine models older than 1994 which are not suitable for retrofitting
  - DPFs on all engines between the 1994 and 2003 model years by 2010. DPFs on 2004-2006 models by between 2010 and 2013, depending on the vehicle.
  - Incentives to encourage older engines (from 1994 and newer) to be replaced by 2007 or newer model year trucks that meet the strictest exhaust PM emissions standards.
  - All drayage trucks are to follow the truck and bus regulation as applicable. (California Air Resources Board 2011b)

- Goods Movement Emissions Reduction Plan (2006) (Proposition 1B)
  - Allots money for grants to air districts to assist ports in improving energy efficiency, electrification, or other emissions reduction efforts through new technologies.
  - As of December 2012, the BAAQMD's early grant project has completed the installation of install grid-based electrical power for three ship berths at the Port of Oakland. The installations of such power at nine additional berths have commenced. (California Air Resources Board 2012b).
- Ocean Going Vessel regulations
  - As of August 1, 2012, ships must comply with both the California OGV fuel regulation and North American Emission Control Area (ECA).
    - California OGV Fuel Regulation
      - Phase II Fuel requirements effective in 2014 Marine Gas oil <= 0.1% sulfur, marine diesel oil <= 0.1% sulfur. (California Air Resources Board 2012c)
- Harbor Craft

[19] "The regulation applies to nearly all diesel-fueled trucks and buses with a gross vehicle weight rating (GVWR) greater than 14,000 pounds that are privately or federally owned and for privately and publicly owned school buses." Municipal service vehicles do not count. (California Air Resources Board 2011a)

- All non-exempt harbor craft are to meet the engine emissions standard compliance schedule outlined in ARB's Final Regulation Order: Title 17, Section 93118.5 effective June 20, 2011. Compliance standards will vary depending on craft type, engine model year, and engine fuel.
- Any in-use diesel fueled harbor craft must comply with the low sulfur fuel use requirement in section 93118.5(e)(1) effective June 20, 2011. (California Air Resources Board 2012d).

Additional state policies, as summarized by the 2008 ARB West Oakland study, are summarized in Table 4, below.

Table 4 – Additional ARB Regulations that Reduce Emissions from Diesel PM On- and Off-Road Vehicles and Equipment (adoption date provided in parenthesis) (California Air Resources Board 2008:30)

Additional Adopted State Regulations	
Regulation	Adopted Date
New on-road heavy-duty diesel engine standards	October 2001
Tier 4 standards for new off-road diesel equipment	December 2004
California diesel fuel for harbor craft and intrastate locomotives	November 2004
Low-sulfur diesel fuel for vehicles and off-road equipment	July 2003
Heavy-duty engine manufacturers diagnostics	May2004
Heavy-duty on-board diagnostics	July 2005
Cleaner fuel for ship auxiliary engines	December2005
2005 California Rail MOU	
Transport refrigeration units	February 2004
Diesel truck operational idling limits	July 2004
Clean up existing diesel cargo handling equipment at ports and intermodal railyards	December 2005
Clean up existing fleet of off-road diesel equipment	July 2007
Clean up existing fleet of harbor craft	November2007
Cold ironing regulations	December 2007
Clean up port truck fleets	December 2007
Cleaner fuel for ship main engines, auxiliary engines and auxiliary boilers	July 2008
Clean up existing private fleets of diesel trucks	December 2008

Relevant State Policies (not requirements)

- Air Quality and Land Use Handbook: A Community Health Perspective recommends
  - "avoid[ing] siting new sensitive land uses within 500 feet of a freeway, urban roads with 100,000 vehicles/day, or rural roads with 50,000 vehicles/day." (California Air Resources Board 2005)

Local Regulations

In addition to supporting ARB's Diesel Risk Reduction Plan, the BAAQMD has local regulations to limit PM emissions from a variety of sources via permits as well CEQA thresholds for planned projects. The threshold applicable to this Project is as follows.

- BAAQMD Health Risk Thresholds: Cumulative Thresholds[20] A project is considered significant if a new receptor is placed within 1000 feet of a source and results in:
    - An increased cancer risk of greater than 100 in one million,
    - An increased non-cancer risk of greater than 10.0 hazard index, and
    - An increase in ambient PM2.5 concentration by 0.8 $\mu m/m^3$ from all local sources. (Bay Area Air Quality Management District 2010b:2-2)
- Port of Oakland's Maritime Air Quality Improvement Plan (April 2009)
    - The plan supports the implementation of the Port Maritime Air Quality Policy Statement which sets a goal of reducing the excess community cancer health risk related to exposure to DPM emissions associated with the Port's maritime operations by 85% from 2005 to 2020.
    - The plan set interim goals of reducing emissions in 2012 and 2020.
        - On and near shore PM emissions were to be reduced by 65% by 2012 and 85% by 2020 from 2005 values.
        - Off-shore emissions were to only to increase by 2% by 2012 and were to be reduced by 85% by 2020 from 2005 values. (Port of Oakland 2009)

Analysis and Discussion

Background Health Risks

Health risks from existing diesel emissions sources were conveniently summarized into the overall cancer risks by location as shown by the isopleths from the ARB West Oakland Study. The air dispersion modeling of the 2005 cancer risks took into account local wind speed and direction and other meteorological conditions. Total cancer risk from the port operations, rail yard, and other freight activity was between 1,000 and 1,500 in a million in 2005 for all areas of the Gateway Park project. Under 2005 scenarios, the majority of DPM is from On-Road Trucks which contributes from 20% to over 60% of the project area's cancer risk. The ARB projects that diesel emissions will be reduced by 80% from all sources by 2015 due to state regulations (California Air Resources Board 2008).

[20] In March 2012, an Alameda County Superior Court ruled that BAAQMD needed to comply with CEQA prior to adopting their 2010 Air Quality CEQA Guidelines, which included significance thresholds for criteria air pollutants and greenhouse gases. The Superior Court did not determine whether the thresholds were valid on the merits, but found that the adoption of the thresholds was a project under CEQA. While the BAAQMD is no longer recommending its significance thresholds for use by local agencies at this time, the BAAQMD thresholds are well-grounded on air quality regulations, scientific evidence, and scientific reasoning concerning air quality and greenhouse gas emissions

Park Health Risks

Anticipated health risks at the Gateway Park will likely be lower than those estimated in the ARB's West Oakland Study due to differences in the operational year analyzed (2005 in the ARB study compared to anticipated 2015 opening for the year), which affects the impact of applicable diesel emissions regulations, the exposure rate of the park patrons to pollutants, as well as the level of activities occurring in the Port in 2005 compared to 2015. The Park is scheduled to be open to the public in 2015, by which time the ARB estimates that diesel emissions and associated cancer risks will be 80% less than 2005 values (and 85% less by 2020). An 80% reduction in 2015 would result in a 70-year lifetime cancer risk of between 200 and 300 in a million (between 150 and 225 in 2020). Because this project's land use is transitory in nature, the use of such lifetime cancer risks substantially overestimates the health risks in the park area.

A more realistic cancer health risk can be scaled based on the estimated exposure rates between typical park patrons and the permanent resident characterized in the 70-year lifetime exposure scenario. The 70-year lifetime scenario assumes the standard OEHHA approach, which characterizes an extreme case of a resident who spends 350 days a year[21], or 8,400 hours per year[22], in the area. On the other hand, most Park visitors will likely be at the Park for far less time. As an example, park visitation of 2 hours per week or 104 hours per year would result in an exposure level of 1.2% of the lifetime occupancy rate. Using this exposure scenario, the scaled cancer risk for visitors to Gateway Park area in 2015 is estimated to be between 2.38 to 7.66 in one million, as shown in Table 5, depending on the type of patron (e.g., whether the patron is a child or adult visitor, or a passing bicycle commuter).

The cancer risks estimated for the Park visitors (using the exposure assumption of 2 hours per week) are well below the BAAQMD cumulative threshold of 100 in a million for increased cancer risk to a new receptor. In order to exceed the 100 in a million threshold at Gateway Park (using the profile of DPM exposure used in this memo), visitation would have to be more on the order of 30 times the example case (or approximately 60 hours per week).

However, it is important to note that these calculations are based on diesel emissions sources identified by the ARB West Oakland Study and do not include the effect of local stationary sources emitting other toxic air contaminants, such as those from the nearby EBMUD wastewater treatment plant located on the eastern side of the Park (See Table 3). In addition, this memorandum has not looked at potential exposure from port and freight operations associated with the adjacent Oakland Army Base redevelopment project.

A further consideration is the relative risk level of park visitors. As described above, West Oakland residents, depending on location, experience substantially elevated exposures to DPM. Since the Gateway site has similar levels of potential DPM exposure, West Oakland residents would likely not increase their DPM exposure level by visiting Gateway Park, compared to exposure from recreating within West Oakland itself. Thus, risks shown in Table 5 also need to be considered in the context of DPM exposures at existing or alternative recreational locations.

[21] OEHHA accounts for times not present due to holidays and vacation.

[22] Assumes 24 hours per each of the 350 days per year.

Table 5 - Scaled Cancer Health Risks in 2015 for Selected Gateway Park Patrons

Receptor Type	Hours per week	Hours per year	Percent of Lifetime Exposure[a]	% of normal adult breathing rate[b]	Cancer Risk (Low)	Cancer Risk (High)
2005 Background - 70 year Lifetime[c]	168	8,400	100%	100%	1,000	>1,500
2015 Projected - 70 year Lifetime[d]	168	8,400	100%	100%	200	>300
Visitor - Adult in 2015	2	104	1.2%	100%	2.48	>3.71
Visitor - Child in 2015	2	104	1.2%	150%	3.71	>5.56
Bicycle Commuter in 2015[e]	1.67	86.67	1.0%	130%	2.69	>4.03

[a] The percent of lifetime exposure is calculated on an hours of exposure per year basis.

[b] According to the OEHHA's *Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments*, the average adult breathing rate is 302 liters/kg per day for an 85th percentile, while the average child breathing rate is 452 liters/kg per day. Bicycle commuter breathing rates assume a high end adult breathing rate of 393 liters/kg per day. (California Environmental Protection Agency 2003:5-15,5-16)

[c] Only the cancer risks are based on values from the ARB West Oakland Study (California Air Resources Board 2008: 23). Hours per year assume 350 days per year, accounting for holidays and vacations, per OEHHA guidance.

[d] Adjusted cancer risks assume a proportional change with the 80% reduction in PM emissions anticipated for 2015. Hours per year assume 350 days per year, accounting for holidays and vacations, per OEHHA guidance.

[e] Assumes a bicyclist travels an average of 12 mph and the bicycle path way from the Gateway Point to the I-80/I-560 junction is 2 miles, which will take the bicyclist 10 minutes. This assumes a daily weekday round trip through the same bike path.

Recommendations

As previously mentioned, government regulations aimed to curb DPM emissions from diesel vehicles and vessels have shown to be successful in mitigating DPM in recent years and are expected to continue to do so in the future. A projected 80% reduction in DPM emissions in the West Oakland area by 2015 in addition to low exposure rates at the Park would reduce estimated cancer risks to visitors to well under maximum levels established by the BAAQMD. Despite the likely low incremental health risk (due primarily to the limited exposure duration) and planned emissions regulations, the potential DPM levels would likely remain elevated due to the number and proximity of pollutant sources surrounding the area, especially emissions sources from the adjacent freeways.

The EIR/EA analysis will determine whether or not the health risks are or are not considered significant through consideration of all existing and future sources and site exposures. If the EIR/EA determines that impacts are significant, then feasible mitigation will be evaluated. The analysis in this memorandum is preliminary at this time.

The application of additional control measures at Gateway Park could help to further reduce emissions from these sources, whether the EIR analysis finds significant impacts or not:

1. Plant vegetative barriers between the park and I-80 per configurations suggested by the UC Davis/Caltrans study on DPM vegetative barriers (Fuller et. al. 2009, 2013). Proper vegetative barriers may reduce DPM emissions by between 83% and 99%.[23]

2. Avoid locating areas where persons are expected to be spend relatively more time (such as assembly areas or picnic areas) directly adjacent to freeways.

References

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Appendix C-1

Transportation Impact Analysis: San Francisco-Oakland Bay Bridge Regional Bicycle & Pedestrian Connection: Path Report

EA 4H970 EFIS 0413000324
4-ALA-80-PM 0.5/3.8

Transportation Impact Analysis

San Francisco-Oakland Bay Bridge Regional Bicycle & Pedestrian Connection:

Path Report

Prepared for:

T.Y. Lin International

October 2014

FEHR & PEERS

WC12-2992

Transportation Impact Analysis

San Francisco-Oakland Bay Bridge Regional Bicycle & Pedestrian Connection

EA Number - EA 4H970

EFIS 0413000324

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October 2014

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EXECUTIVE SUMMARY

This report presents the results of the Transportation Impact Analysis (TIA) conducted for the proposed bicycle/pedestrian path connection (Path) between West Oakland and the Bay Bridge Trail that connects to the East Span of the San Francisco Oakland Bay Bridge (Bay Bridge) in Oakland, California.

1.1 PROJECT DESCRIPTION AND ANALYSIS PARAMETERS

The proposed project is a new Class 1 path located in the City of Oakland, Alameda County, connecting Mandela Parkway in the east to the Bay Bridge Trail in the west, near the I-880 and I-80 interchange. The path is an elevated structure for most of the 1.14 miles length to provide access across existing freeways, railways and industrial areas.

The project could also include Class 2 bike lanes and a 100-space parking lot at the east end (Wood Street lot) of the Class 1 bike path. The Class 2 bike lanes would extend along surface streets near the east touchdown of the Path, providing connections to Mandela Parkway and to the proposed Wood Street lot.

Project impacts on the study area roadway facilities were determined by measuring the effect project traffic would have on 10 intersections in the vicinity of the site during the weekday evening (4:00 to 6:00 PM) and Saturday afternoon (2:00 to 6:00 PM) peak periods. Conditions were evaluated under Existing, Near-term and Cumulative conditions without and with the project.

1.2 FINDINGS AND RECOMMENDATIONS

Results of the analysis show that in the existing and near-term conditions, the Path project would have a less-than-significant impact to intersection levels of service based on the City of Oakland standards of significance. In the cumulative condition, Path project impacts were identified at the West Grand Avenue/ Mandela Parkway intersection. Mitigation measures that would reduce the project's impact to a less-than-significant level were identified. Impacts to transit, bicycle, pedestrian and transit were also reviewed. Project impacts to transit were found to be less-than-significant. Potential bicycle and pedestrian safety impacts were identified; mitigation measures that would reduce the project's impact to a less-than-significant level were identified.

1.0 INTRODUCTION

This report presents the results of the Transportation Impact Analysis (TIA) conducted for the proposed bicycle/pedestrian path connection (Path) between West Oakland and the Bay Bridge Trail, near the I-880 and I-80 interchange, in Oakland, California. The Path would provide access to the existing bicycle/pedestrian path on the eastern span of the Bay Bridge, as well as access to existing and planned segments of the regional San Francisco Bay Trail. This chapter discusses the TIA purpose, study area, analysis methods, criteria used to identify significant impacts, and report organization.

1.1 STUDY PURPOSE

The purpose of this analysis is to evaluate the potential transportation impacts of the Path project, including impacts to intersection operations, bicycle, pedestrian and transit facilities. The proposed project is a new Class 1 path located in the City of Oakland, Alameda County, connecting Mandela Parkway in the east to the Bay Bridge Trail in the west, near the I-880 and I-80 interchange, as shown on **Figure 1**. The path is an elevated structure for most of the 1.14 miles length to provide access across existing freeways, railways and industrial areas.

The project could also include Class 2 bike lanes and a 100-space parking lot at the east end (Wood Street lot) of the Class 1 path. The Class 2 bike lanes would extend along surface streets near the east touchdown of the bike path, providing connections to Mandela Parkway and to the proposed Wood Street lot, as shown conceptually on **Figure 2.**

The Path is proposed by the Gateway Park Working Group. The Gateway Park Working Group includes the following nine local, regional and state agencies: The Bay Area Toll Authority (BATA), the California Department of Transportation (Caltrans), San Francisco Bay Conservation and Development Commission (BCDC), California Transportation Commission (CTC), East Bay Regional Park District (EBRPD), City of Oakland, Port of Oakland, East Bay Municipal Utility District (EBMUD), and Association of Bay Area Governments (ABAG's). The agency responsible for operation and maintenance of the bike path is anticipated to be Caltrans but could also be City of Oakland.

Figure 1.

Project Site Vicinity

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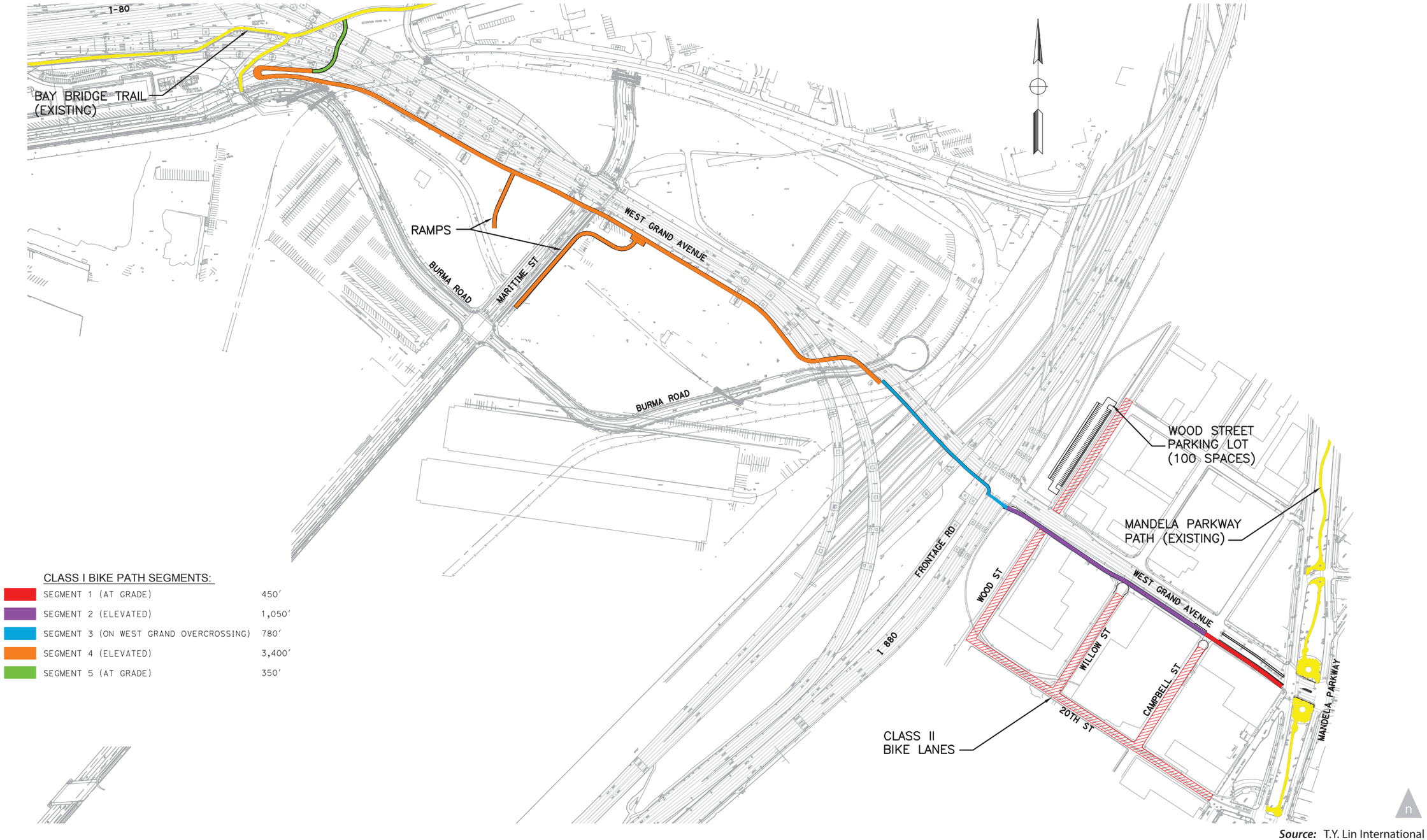

Source: T.Y. Lin International

Figure 2.

Conceptual Project Components

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1.2 PROJECT STUDY AREA

Project impacts on the study area roadway facilities were determined by measuring the effect project traffic would have on intersections during the weekday evening (4:00 to 6:00 PM) and weekend afternoon (Saturday 2:00 to 6:00 PM) peak periods. Based on the review of the project location, travel routes to and from the project site, and operations of intersections as presented in results of the 2012 Oakland Army Base Project Initial Study/Addendum, the following intersections and roadway segments were identified for inclusion in the analysis, as shown on **Figure 3**:

Intersections

1. Burma Road/Maritime Street (signalized)
2. I-80 Ramps/West Grand Avenue/Maritime Street/Wake Avenue (signalized)
3. West Grand Avenue/Frontage Road/I-80 Ramps (signalized)
4. West Grand Avenue/Campbell Street (side-street stop)
5. 24th Street/Mandela Parkway (side-street stop)
6. West Grand Avenue/Mandela Parkway (signalized)
7. 20th Street/Mandela Parkway (side-street stop)
8. 7th Street/I-880 NB Off-Ramp/Frontage Road (signalized)
9. 7th Street/Maritime Street (signalized)
10. West Grand Avenue/Adeline Street (signalized)

Roadway Segments

1. Maritime Road, south of Grand Avenue
2. Maritime Road, north of 7th Street
3. Grand Avenue, west of Frontage Road
4. Grand Avenue, east of Mandela Parkway
5. 7th Street, east of Maritime Street

The proposed Path project is estimated to generate less than 100 weekday PM peak hour vehicle trips (see Chapter 3) and would add less than 10 weekday PM peak hour trips to any freeway segment within the study area. Therefore, no analysis freeway analysis was conducted for the Path project.

Figure 3.

Study Intersection Locations

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1.3 INTERSECTION ANALYSIS SCENARIOS

For this study, analysis was conducted for several scenarios, both without and with the project, including:

Scenario 1: Existing – Existing volumes obtained from recent traffic counts (Fall 2013) and the roadway system configuration as of October 2013.

Scenario 2: Existing with Project – Existing volumes obtained from traffic counts plus traffic estimated for the project. The roadway system is the same as Scenario 1, except for improvements that are proposed with the project.

Scenario 3: Near-term without Project – Existing volumes plus traffic estimates for approved and pending developments, and traffic increases due to regional growth. Volumes were developed through a combination of the forecasts included in the 2012 Oakland Army Base Project environmental assessment and the West Oakland Specific Plan EIR. This scenario reflects condition in the next 5 to 10 years when the project is expected to be completed.

Scenario 4: Near-term with Project – Traffic volumes from Scenario 3 plus traffic estimated for the project. The roadway system is the same as Scenario 1, except for improvements that are proposed with the project.

Scenario 5: Near-Term with Gateway Park without Project – Traffic volumes from Scenario 3 plus traffic estimated for the proposed Gateway Park project.

Scenario 6: Near-Term with Gateway Park with Project – Traffic volumes from Scenario 5 plus traffic estimated for the project, including roadway improvements proposed with the project.

Scenario 7: Far-Term (Cumulative) without Project – Projected traffic volumes and the projected roadway system for 2035. Volumes were developed through a combination of the forecasts included in the 2012 Oakland Army Base Project environmental assessment and the West Oakland Specific Plan EIR. This scenario assumes potential traffic increases from the proposed Gateway Park project.

Scenario 8: Far-Term (Cumulative) with Project – Traffic volumes from Scenario 7 plus changes from development of the project, including roadway improvements proposed with the project.

1.4 ANALYSIS METHODS

The operations of roadway facilities are described with the term "level of service" (LOS). LOS is a qualitative description of traffic flow based on factors such as speed, travel time, delay, and freedom to maneuver. Six levels of service are defined ranging from LOS A (i.e., best operating conditions) to LOS F (worst operating conditions). LOS E corresponds to operations "at capacity." When volumes exceed capacity, stop-and-go conditions result and operations are designated as LOS F. The City of Oakland generally strives to maintain LOS D or better for peak hour intersection operations, although LOS E is allowed at some locations.

Signalized Intersections

Traffic conditions at signalized intersections were evaluated using the method from Chapter 16 of the Transportation Research Board's 2000 *Highway Capacity Manual*. This operations analysis method uses various intersection characteristics (such as traffic volumes, lane geometry, and signal phasing) to estimate the average control delay experienced by motorists traveling through an intersection. Control delay incorporates delay associated with deceleration, acceleration, stopping, and moving up in the queue. **Table 1** summarizes the relationship between average delay per vehicle and LOS for signalized intersections.

Unsignalized Intersections

Traffic conditions at unsignalized intersections were evaluated using the method from Chapter 17 of the 2000 *Highway Capacity Manual*. With this method, operations are defined by the average control delay per vehicle (measured in seconds) for each movement that must yield the right-of-way. At two-way or side street-controlled intersections, the control delay (and LOS) is calculated for each controlled movement, as well as the left-turn movement from the major street, and the entire intersection. For controlled approaches composed of a single lane, the control delay is computed as the average of all movements in that lane. The delays for the entire intersection and for the movement or approach with the highest delay are reported. **Table 2** summarizes the relationship between delay and LOS for unsignalized intersections.

Roadway Segment

Roadway segment service levels were calculated by comparing the daily roadway volumes to the LOS thresholds presented in the HCM, as provided in **Table 3**.

TABLE 1
SIGNALIZED INTERSECTION LOS CRITERIA

Level of Service	Description	Average Control Delay Per Vehicle (Seconds)
A	Operations with very low delay occurring with favorable progression and/or short cycle lengths.	≤ 10.0
B	Operations with low delay occurring with good progression and/or short cycle lengths.	> 10.0 to 20.0
C	Operations with average delays resulting from fair progression and/or longer cycle lengths. Individual cycle failures begin to appear.	> 20.0 to 35.0
D	Operations with longer delays due to a combination of unfavorable progression, long cycle lengths, and/or high volume-to-capacity (V/C) ratios. Many vehicles stop and individual cycle failures are noticeable.	> 35.0 to 55.0
E	Operations with long delays indicating poor progression, long cycle lengths, and high V/C ratios. Individual cycle failures are frequent occurrences.	> 55.0 to 80.0
F	Operations with delays unacceptable to most drivers occurring due to over saturation, poor progression, or very long cycle lengths.	> 80.0

Source: *Highway Capacity Manual (*Transportation Research Board, 2000).

TABLE 2
UNSIGNALIZED INTERSECTION LOS CRITERIA

Level of Service	Description	Average Control Delay Per Vehicle (Seconds)
A	Little or no delays	≤ 10.0
B	Short traffic delays	> 10.0 to 15.0
C	Average traffic delays	> 15.0 to 25.0
D	Long traffic delays	> 25.0 to 35.0
E	Very long traffic delays	> 35.0 to 50.0
F	Extreme traffic delays with intersection capacity exceeded	> 50.0

Source: *Highway Capacity Manual (*Transportation Research Board, 2000).

TABLE 3
DAILY ROADWAY SEGMENT LOS THRESHOLDS

Number of Lanes	Facility Type	LOS A	LOS B	LOS C	LOS D	LOS E
2	Arterial	10,000	11,100	14,000	17,500	20,600
4	Arterial	23,300	25,800	32,600	40,700	47,900
6	Arterial	33,000	37,000	46,600	58,300	68,600
8	Arterial	41,100	45,700	57,600	72,000	84,700

Source: *Highway Capacity Manual (*Transportation Research Board, 2000).

1.5 SIGNIFICANCE CRITERIA

The determination of significance for project impacts is based on applicable policies, regulations, goals, and guidelines defined by the City of Oakland. The impacts of the project were evaluated by comparing the results of the level of service calculations under Existing with Project, Near-term with Project, and Cumulative with Project conditions to the results under Existing, Near-term without Project, and Cumulative without Project conditions, respectively. The detailed impact criteria for this study are presented below.

1.5.1 TRAFFIC LOAD AND CAPACITY THRESHOLDS

1. At a signalized study intersection which is located **outside the Downtown**[1] **area and that does not provide direct access to Downtown**, the project would cause the motor vehicle level of service (LOS) to degrade to worse than LOS D (i.e., LOS E or LOS F) and cause the total intersection average vehicle delay to increase by four (4) or more seconds (criteria applies to intersections 1, 2, 8 and 9);
2. At a signalized study intersection which is located **within the Downtown area or that provides direct access to Downtown**, the project would cause the motor vehicle LOS to degrade to worse than LOS E (i.e., LOS F) and cause the total intersection average vehicle delay to increase by four (4) or more seconds (criteria applies to intersections 3, 6 and 10);

[1] The Downtown area is defined in the Land Use and Transportation Element of the General Plan (page 67) as the area generally bounded by the West Grand Avenue to the north, Lake Merritt and Channel Park to the east, the Oakland Estuary to the south, and I-980/Brush Street to the west. Intersections that provide direct access to downtown are generally defined as principal arterials within two (2) miles of Downtown and minor arterials within one (1) mile of Downtown, provided that the street connects directly to Downtown.

3. At a signalized study intersection **outside the Downtown area and that does not provide direct access to Downtown** where the motor vehicle level of service is LOS E, the project would cause the total intersection average vehicle delay to increase by four (4) or more seconds;
4. At a signalized study intersection **outside the Downtown area and that does not provide direct access to Downtown** where the motor vehicle level of service is LOS E, the project would cause an increase in the average delay for any of the critical movements of six (6) seconds or more;
5. At a signalized study intersection for all areas where the motor vehicle level of service is LOS F, the project would cause (a) the overall volume-to-capacity ("V/C") ratio to increase 0.03 or more or (b) the critical movement V/C ratio to increase 0.05 or more;
6. At an unsignalized study intersection the project would add ten (10) or more vehicles to the critical movement, and after project completion, satisfy the California Manual on Uniform Traffic Control Devices (MUTCD) peak-hour volume traffic signal warrant (intersections 4, 5 and 7);
7. For a roadway segment of the Congestion Management Program (CMP) Network, the project would cause (a) the LOS to degrade from LOS E or better to LOS F or (b) the V/C ratio to increase 0.03 or more for a roadway segment that would operate at LOS F without the project;[2]
8. Cause congestion of regional significance on a roadway segment on the Metropolitan Transportation System (MTS) evaluated per the requirements of the Land Use Analysis Program of the CMP;[3]
9. Result in substantially increased travel times for AC Transit buses;

1.5.2 TRAFFIC SAFETY THRESHOLDS

10. Directly or indirectly cause or expose roadway users (e.g., motorists, pedestrians, bus riders, bicyclists) to a permanent and substantial transportation hazard due to a new or existing physical design feature or incompatible uses;
11. Directly or indirectly result in a permanent substantial decrease in pedestrian safety;
12. Directly or indirectly result in a permanent substantial decrease in bicyclist safety;
13. Directly or indirectly result in a permanent substantial decrease in bus rider safety
14. Generate substantial multi-modal traffic traveling across at-grade railroad crossings that cause or expose roadway users (e.g., motorists, pedestrians, bus riders, bicyclists) to a permanent and substantial transportation hazard.

---

[2] Refer to the ACTC Congestion Management Program for a description of the CMP Network. In Oakland, the CMP Network includes all state highways plus the portion of Grand Avenue between I-80 and I-580.

[3] Refer to ACTC's Congestion Management Program for a description of the MTS and the Land Use Analysis Program. The ACTC identified the roadway segments of the MTS that require evaluation in its letter commenting on the Notice of Preparation (NOP) issued by the City for the project (See page 4.13-119 for list of these roadway segments). Note that the City is required to send NOPs and notices of proposed general plan amendments to ACTC under the Land Use Analysis Program regardless of how many project-related trips are expected to be generated.

1.5.3 OTHER THRESHOLDS

15. Fundamentally conflict with adopted City policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities adopted for the purpose of avoiding or mitigating an environmental effect and actually result in a physical change in the environment;
16. Result in a substantial, though temporary, adverse effect on the circulation system during construction of the project; or
17. Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks.

1.5.4 CUMULATIVE IMPACTS

18. A project's contribution to cumulative impacts is considered "considerable" (i.e., significant) when the project exceeds at least one of the thresholds listed above in a future year scenario.

1.6 REPORT ORGANIZATION

This report is organized into the following chapters:

- ***Chapter 1 – Introduction*** describes the analysis methods used for the transportation impact assessment. This chapter also includes the study locations and significance criteria.
- ***Chapter 2 – Existing Conditions*** describes the transportation system near the project site, including the surrounding roadway network, weekday evening and Saturday afternoon peak period intersection turning movement volumes, existing bicycle, pedestrian, and transit facilities, and intersection levels of service. Daily roadway volumes in the study area are also presented.
- ***Chapter 3 – Project Traffic*** presents project information, including descriptions of the project components and project trip generation, distribution, and assignment.
- ***Chapter 4 – Existing With Project Conditions*** addresses the Existing with Project scenario.
- ***Chapter 5 – Near-term Conditions*** addresses the near-term condition (next 5 to 10 years), both without and with the project, and discusses project impacts.
- ***Chapter 6 – Cumulative Conditions*** addresses the cumulative conditions (next 20-years), both without and with the project, and discusses project impacts.
- ***Chapter 7 – Alameda County Transportation Commission*** Metropolitan Transportation System (MTS) Roadway Analysis presents the impacts of the project on the MTS roadway system.
- ***Chapter 8 – Other Transportation Thresholds*** evaluates the potential project effects on bicycle, pedestrian and transit networks in the project vicinity, and compares the project to traffic safety thresholds and other thresholds as discussed in the significance criteria section.

2.0 EXISTING CONDITIONS

A data collection effort was undertaken to evaluate existing transportation conditions in the study area. The assessment of existing conditions includes a description of the street and highway system, pedestrian and bicycle facilities, and public transit services near the project site. It also presents existing traffic volumes and operations for the study intersections with the results of level of service calculations.

2.1 EXISTING TRANSPORTATION FACILITIES

2.1.1 ROADWAY NETWORK

Regional access to the Path area is provided by several regional freeways, including Interstates 80 (I-80), 580 (I-580), 880 (I-880), 980 (I-980), and California State Route 24 (SR-24). Many of the roadways in the study area are also designated truck routes, as shown on **Figure 4.**

I-80 is an eight to ten-lane freeway extending west to San Francisco, and east through Berkeley, Sacramento, into Nevada and further east. Based on information from the Caltrans traffic data website reflective of 2013 data, I-80 has an annual daily traffic volume (AADT) of approximately 250,000 vehicles per day at the east of the toll plaza.

I-580 is an eight-lane east-west freeway between US 101, in Marin County, and I-5 south of Tracy. I-580 has an AADT of approximately 230,000 vehicles per day near SR 24/I-980.

I-880 is a north-south freeway that starts in the project area in Oakland with interchanges from I-80 and I-580 and runs south towards San Jose. I-880 has an AADT of approximately 74,000 vehicles per day south of I-80.

I-980 is an eight-lane north-south freeway east of the project site that connects SR 24 and I-580 to I-880. I-980 has an AADT of 113,000 vehicles in the study area.

SR 24 is an eight-lane east-west freeway between **I-580** in Oakland and Walnut Creek in the east. East of I-580, SR 24 continues as **I-980.** SR 24 has an average annual daily traffic volume (AADT) of approximately 146,000 vehicles east of I-980.

Other major roadways in the vicinity of the project include Mandela Parkway, Adeline Street, Grand Avenue, 7th Street, Frontage Road, Maritime Street, and Burma Road. The extents of these roadways in relation to the project are shown on Figure 1, and are described in more detail below.

Figure 4.

Designated Truck Routes

Graphics for Connection Report\WC12-2992_4_TruckRts

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Mandela Parkway is a north-south four-lane arterial through the study area. It connects the West Oakland BART Station in the south to Emeryville in the north. A 70 to 100 foot wide median provides a separated pedestrian/bicycle path, many plazas, and grass areas. Mandela Parkway provides on-street parking on both side of the street, and Class 2 bike lanes in both directions. The wide median results in two separate, intersections with the northbound and southbound travel lanes at intersecting streets. Where the intersections are signalized, the traffic signals are interconnected and coordinated.

Adeline Street is a north-south four-lane arterial through the study area. It connects the Oakland Inner Harbor in the south to Berkeley in the north. Adeline Street provides on-street parking on both side of the street. It does not currently provide any bicycle facilities but is a proposed bikeway. AC Transit operates local bus line 26 along Adeline Street.

Grand Avenue is an east-west four-to-six-lane arterial through the study area. It connects the Lake Merritt neighborhoods in Oakland in the east towards the eastern end of the Bay Bridge to the west. Grand Avenue provides on-street parking on both side of the street. It currently provides bike lanes east of Market Street, while it is a proposed bikeway west of Market Street. AC Transit operates the Transbay bus line NL along Grand Avenue. Grand Avenue is a designated truck route.

7th Street is an east-west four-lane roadway through the study area. It connects the Lake Merritt BART Station in the east to the Oakland Middle Harbor in the west. 7th Street is one-way (eastbound) east of Castro Street near the I-880-I-980 Interchange. Parking is generally provided on one or both sides of the street east of Mandela Parkway. Limited bicycle facilities are provided along 7th Street, however a portion of the Bay Trail runs along it west of Wood Street towards the Middle Harbor Shoreline Park. AC Transit operates several local bus lines along 7th Street and BART runs directly above 7th Street, which provides access to both the Lake Merritt Station and the West Oakland Station. It is a designated truck route for much of its length.

Frontage Road is a four-lane road that fronts I-880 for approximately one mile from 7th Street in the south to Grand Avenue in the north. Parking is not provided along Frontage Road and it has limited access points. No formal bicycle facilities are provided along Frontage Road. Although wide shoulders could provide ample space for a bicyclist, due to its freeway-centric location, high truck volume, and limited connectivity, it is not considered a bicycle friendly street.

Maritime Street is a north-south four-lane industrial road through the study area. It extends from the Oakland Middle Harbor in the south to Grand Avenue in the north. Parking is not provided along Maritime Street. No bicycle facilities are provided along the roadway, however wide shoulders provide ample space for a bicyclist and a bikeway is proposed along the facility. It is a heavily used truck route.

Burma Road is currently a low volume two-lane local street used primarily to access the Caltrans maintenance facility and port uses in that area. Bicycle facilities are prosed for Burma Road.

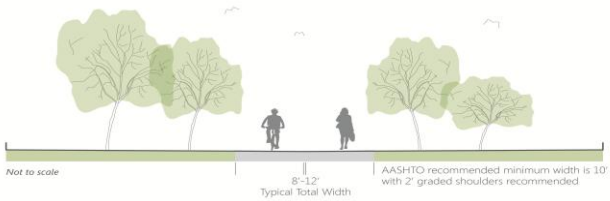
2.1.2 EXISTING PEDESTRIAN FACILITIES

Pedestrian facilities include sidewalks, pathways, crosswalks, and pedestrian signals. The City of Oakland's Pedestrian Master Plan (PMP, November 2002) designates Mandela Parkway as a City Route, and Grand Avenue as a Neighborhood Commercial Revitalization area. For each type of route, the PMP presents minimum design guidelines, which consists of the through passage zone, utility zone, and total sidewalk width. The through passage zone is the paved part of the sidewalk usable by pedestrians. The utility zone includes features such as street furnishings, vegetation, and signage. City Routes require an eight-foot through passage zone, and a four-foot utility zone, for a 12-foot total sidewalk width.

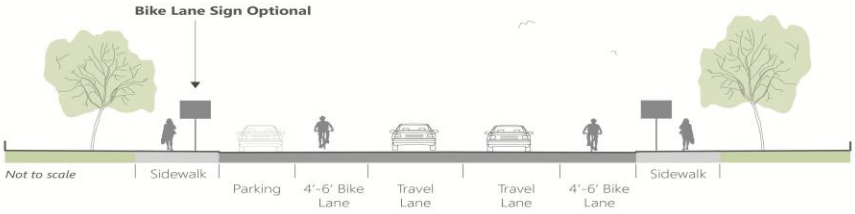
2.1.3 EXISTING BICYCLE FACILITIES

Bicycle facilities in Oakland include a number of general types, as described below, and as identified in the City of Oakland's 2007 Bicycle Master Plan Update (BMP). The graphics following the description of each type of bicycle facility are the minimum American Association of State Highway and Transportation Officials (AASHTO) standards for each type of bike facility to provide a general depiction of each type of bicycle facility. Within the City of Oakland, these standards provide a good framework for future implementation but depending on the circumstances and where feasible, the City of Oakland has chosen to go above and beyond AASHTO standards.

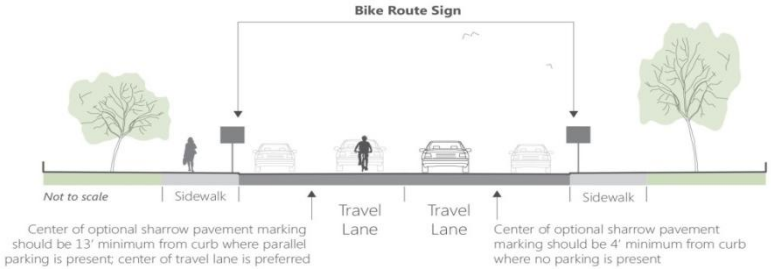
- Bike paths (Class 1) – Paved trails that are separated from roadways. These facilities are typically shared with pedestrians, although bicycles must yield to pedestrians. Vehicle cross-flow is minimized. Class 1 paths are typically 8 to 10 feet wide.



- Bike lanes (Class 2) provide restricted right-of-way and are designated for the use of bicycles with a striped lane on a street. Bicycle lanes are typically five to six feet wide. Adjacent vehicle parking and vehicle/pedestrian cross-flow are permitted.



- Bike routes (Class 3) provide for a right-of-way designated by signs or pavement markings (sharrows) for shared use with motor vehicles. Sharrows are a type of pavement marking (bike and arrow stencil) placed to guide bicyclists to the best place to ride on the road, avoid car doors, and remind drivers to share the road with cyclists.



- Class 3A Arterial Bicycle Routes are found along some arterial streets where bicycle lanes are not feasible and parallel streets do not provide adequate connectivity. Speed limits as low as 25 miles per hour (mph), and shared-lane bicycle stencils, wide curb lanes, and signage are used to encourage shared use.
- Class 3B Bicycle Boulevards are found along residential streets with low traffic volumes. Assignment of right-of-way to the route, traffic calming measures and bicycle traffic signal actuation are used to prioritize through-trips for bicycles.

A portion of the Bay Trail, a regional trail that will ultimately encircle the Bay Area, is located adjacent to the study area as an off-street trail connecting Emeryville and Berkeley to Oakland. This trail will ultimately connect the shorelines of all nine Bay Area counties, link 47 cities and cross major toll bridges with 500 miles of continuous bicycling and hiking trails. The East Span Bay Bridge Trail is partially completed and will ultimately connect Oakland to Treasure Island. A path on the west span of the Bay Bridge is also planned to be constructed, ultimately providing a connection between Oakland and San Francisco.

Figure 5 shows the extent of existing bicycle facilities in the study area, as well as proposed facilities.

2.1.4 EXISTING TRANSIT SERVICE

Transit service in the area is provided by AC Transit, Emery-Go-Round, Bay Area Rapid Transit (BART), Amtrak, and the Oakland Ferry. The extent of transit service in the study area is described below and shown on **Figure 6**.

AC Transit provides both local service and Transbay service throughout the City of Oakland and the greater East Bay and San Francisco area, while providing connections to other transit service providers. AC Transit buses connect major destinations within Alameda and Contra Costa Counties, including Downtown areas, employment centers and destinations, and transit hubs, including BART, Amtrak, and Ferry stations. Transbay route NL and Line 31 provide the closest service to the project site and operates along Grand Avenue (Route NL) and Peralta Street (Line 31). Stops are located on Grand Avenue at West Mandela Parkway (Route NL), and on Mandela Parkway (Line 31).

Emery-Go-Round is a free private shuttle providing service to all Emeryville residents, shoppers, visitors and employees. Shuttles operate five to seven days per week between 6:00 AM and 10:30 PM with 10 to 20 minute frequency. Emery-Go-Round connects with AC Transit local routes, Amtrak, and the MacArthur BART Station.

Bay Area Rapid Transit (BART) provides regional transportation connections to much of the Bay Area with several lines serving Oakland. The nearest stations are the West Oakland (1.1 miles) and MacArthur (1.6 miles) stations. The West Oakland station provides direct connections to the entire BART system, while the MacArthur Station serves the Fremont-Richmond, Pittsburg-Baypoint/SFO and Richmond/Daly City lines. BART train frequency ranges between 2-20 minutes from approximately 5:00 AM to 12:00 AM. Connections to BART are provided by AC Transit and Emery-Go-Round.

Figure 5.

Existing and Proposed Bicycle Facilities

Graphics for Connection Report\WC12-2992_5_BikeFac

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Figure 6.

Existing Transit Service

Graphics for Connection Report\WC12-2992_6_ExTransit

Amtrak is a national train operator that connects northern California to the rest of the country via passenger rail. There are two stations in the study area, one in Emeryville and one in Oakland's Jack London Square. Both Stations serve the San Joaquin, Capitol Corridor, California Zephyr, and Coast Starlight routes. Connections to Amtrak are provided by AC Transit, Emery-Go-Round, and the Oakland Ferry.

The ***Oakland Ferry*** operates as part of the San Francisco Bay Ferry and provides weekday, weekend, holiday, and season services to nine terminals around the bay. The Oakland Jack London Square Terminal provides direct ferry service to the San Francisco Ferry Building, San Francisco Pier 41, AT&T Park, and South San Francisco Oyster Point. Connections to the Ferry are provided by AC Transit and Amtrak.

2.2 EXISTING INTERSECTION VOLUMES AND LANE GEOMETRIES

Weekday evening (4:00 to 6:00 PM) and Saturday afternoon (2:00 to 6:00 PM) peak period intersection turning movement counts were conducted at the study intersections in October 2013 on clear days with area schools in session. Separate counts of bicycle, pedestrian and truck activity were conducted. For the study intersections, the single hour with the highest traffic volumes during each count period was identified. Daily traffic volumes were also collected for the roadway segments in the study area. Existing lane configurations and signal controls were obtained through field observations. The vehicle volumes are presented on **Figure 7** along with the existing intersection lane configurations and traffic controls. The pedestrian and bicycle volumes are shown on **Figure 8**. Traffic count worksheets are provided in **Appendix A**.

2.3 EXISTING INTERSECTION LEVELS OF SERVICE

Existing intersection lane configurations, signal timings, and peak hour turning movement volumes were used to calculate the levels of service for the key intersections during each peak hour. The existing truck percentages were used in the analysis of intersection operations as trucks behave differently than passenger vehicles because they take longer to accelerate, decelerate, and negotiate turns and therefore affect intersection operations. Existing pedestrian and bicycle activity was also factored into the analysis.

The results of the LOS analysis using the Synchro 8.0 software program for Existing conditions are presented in **Table 4**. **Appendix B** contains the corresponding LOS calculation sheets. The results of the LOS calculations indicate most study intersections operate at overall acceptable levels of service according to their designated LOS standard during both the weekday and Saturday peak hours.

The 7th Street/Maritime Street intersection operates at LOS E during the weekday PM peak hour, which is considered deficient based on the standards set by the City of Oakland. Deficient operations are primarily caused by heavy truck movements through the intersection.

Peak hour volume traffic signal warrants[4] were reviewed for the five unsignalized study intersections. At the West Grand Avenue/Campbell Street intersection, traffic signal warrants are satisfied during the weekday PM peak hour when considering the southbound right-turn movement; excluding the southbound right-turn movement, peak hour volume traffic signal warrants are not met. As the southbound right-turn movement operates with minimal delay and a signalized intersection (West Grand Avenue at Mandela Parkway) is located approximately 400 feet east of the intersection, signalization is not recommended. Peak hour volume warrants were not satisfied at any of the remaining unsignalized intersections during either the weekday PM or Saturday afternoon peak hour. Traffic signal warrant worksheets are provided in **Appendix C**.

2.4 DAILY TRAFFIC VOLUMES

Daily traffic counts were collect at 5-roadway segments for a seven day period, in addition to classification counts, which included bicycles and heavy vehicles, to determine the average daily traffic volumes for roadways in the vicinity of the project site. The average weekday and Saturday daily volumes are presented on Figure 7, and are summarized in **Table 5** along with the truck percentage. Pedestrian volumes were estimated based on the peak period count from the closest intersection. The corresponding daily level of service was calculated by comparing the passenger car equivalent (PCE) adjusted volume to the level of service thresholds. As trucks behave differently than passenger vehicles, each truck was considered to be 2 passenger vehicles for the purposes of calculating LOS. The results show that the roadways in the study area operate at LOS A on a daily basis on both a typical weekday and Saturday. Sunday volumes were also reviewed and are 20 to 30 percent less than Saturday volumes.

[4] Unsignalized intersection warrant analysis is intended to examine the general correlation between existing conditions and the need to install new traffic signals. Existing peak-hour volumes are compared against a subset of the standard traffic signal warrants recommended in the MUTCD and associated State guidelines. This analysis should not serve as the only basis for deciding whether and when to install a signal. To reach such a decision, the full set of warrants should be investigated based on field-measured traffic data and a thorough study of traffic and roadway conditions by an experienced engineer. Furthermore, the decision to install a signal should not be based solely on the warrants because the installation of signals can lead to certain types of collisions. The responsible State or local agency should undertake regular monitoring of actual traffic conditions and accident data and conduct a timely re-evaluation of the full set of warrants in order to prioritize and program intersections for signalization.

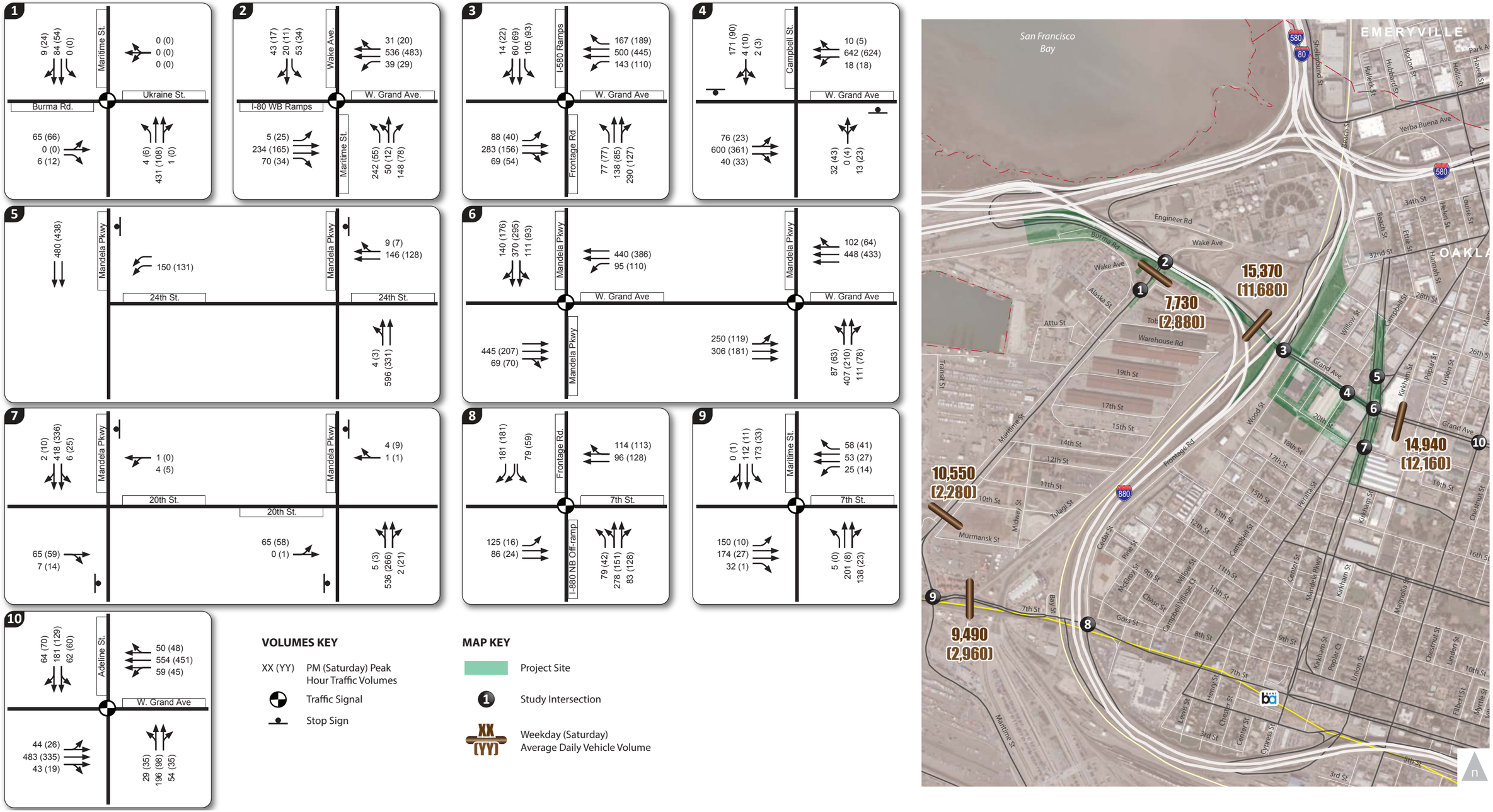

Figure 7.

Existing
Daily and Peak Hour Traffic Volumes, Lane Configurations and Traffic Control

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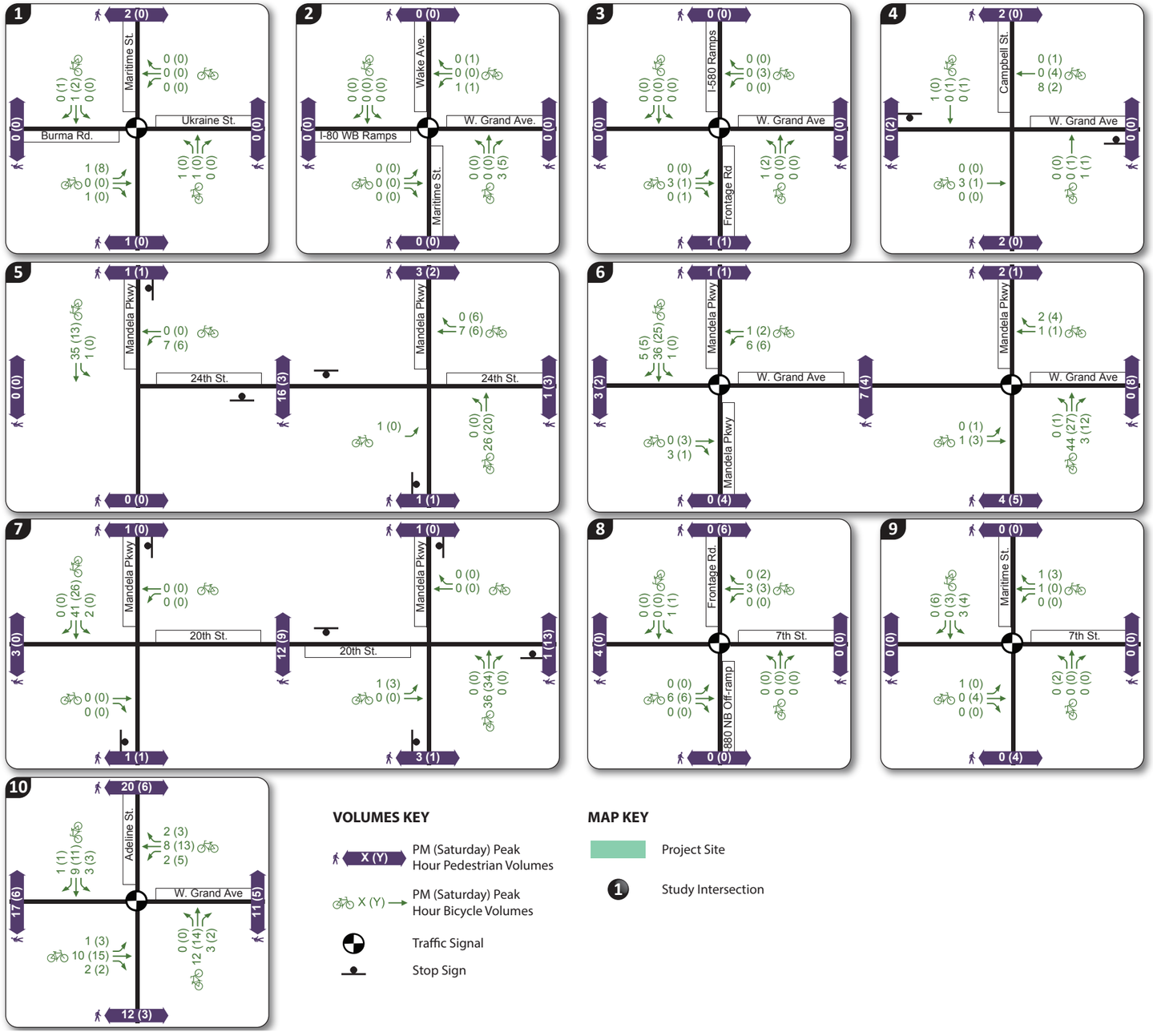


Figure 8.

Existing
Pedestrian and Bicycle Volumes

Graphics for Connection Report\WC12-2992_8_ExPedBikeVols

FEHR PEERS

TABLE 4
EXISTING PEAK HOUR INTERSECTION LEVEL OF SERVICE

	Intersection	Control[1]	Peak Hour	Delay[2]	LOS[3]
1	Burma Road/Maritime Street	Signal	PM SAT	13.4 12.0	B B
2	I-80 Ramps/West Grand Avenue/Maritime Street/Wake Avenue[4]	Signal	PM SAT	26.1 32.5	C C
3	West Grand Avenue/Frontage Road/I-80 Ramps[5]	Signal	PM SAT	39.6 37.7	D D
4	West Grand Avenue/Campbell Street	SSSC	PM SAT	<10 (84.2) <10 (20.4)	A (F) A (C)
5A	24th Street/Mandela Parkway Southbound	SSSC	PM SAT	<10 (10.7) <10 (10.7)	A (B) A (B)
5B	24th Street/Mandela Parkway Northbound	SSSC	PM SAT	<10 (16.3) <10 (12.7)	A (C) A (B)
6A	West Grand Avenue/Mandela Parkway Southbound	Signal	PM SAT	16.6 14.5	B B
6B	West Grand Avenue/Mandela Parkway Northbound	Signal	PM SAT	16.9 18.4	B B
7A	20th Street/Mandela Parkway Southbound	SSSC	PM SAT	<10 (13.3) <10 (12.7)	A (B) A (B)
7B	20th Street/Mandela Parkway Northbound	SSSC	PM SAT	<10 (12.0) <10 (10.3)	A (B) A (B)
8	7th Street/I-880 Northbound Off-Ramp/Frontage Road[6]	Signal	PM SAT	26.4 18.3	C B
9	7th Street/Maritime Street	Signal	PM SAT	**59.1** 33.5	**E** C
10	West Grand Avenue/Adeline Street	Signal	PM SAT	14.9 14.5	B B

Notes: **Bold** text indicates potentially unacceptable intersection operations.

1. Signal = Signalized Intersection; SSSC = Side-street stop-controlled intersections; traffic on the main street does not stop while traffic on the side-street is controlled by a stop sign.
2. Delay presented in seconds per vehicle; for side-street stop-controlled intersections, delay presented in Intersection average (worst approach).
3. LOS = Level of Service.
4. Delay presented in table for intersection average. Delay/LOS for specific movements from the off-ramp as follows:
    a. PM Peak Hour: EB left = 43.2/D, EB thru = 24.5/C, EB right = 22.9/C
    b. Sat Peak Hour: EB left = 68.5/E, EB thru = 29.8/C, EB right = 28.2/C
5. Delay presented in table for intersection average. Delay/LOS for specific movements from the off-ramp as follows:
    a. PM Peak Hour: NB left = 40.4/D, NB thru/right = 39.6/D, SB left = 41.9/D, SB thru-right = 35.7/D

b. Sat Peak Hour: NB left = 39.6/D, NB thru-right = 36.6/D, SB left = 40.0/D, SB thru-right = 35.9/D

6. Delay presented in table for intersection average. Delay/LOS for specific movements from the off-ramp as follows:
   a. PM Peak Hour: NB left = 24.2/C, NB thru/right = 25.3/C
   b. Sat Peak Hour: NB left = 11.4/B, NB thru-right = 12.1/B

Source: Fehr & Peers, October 2014.

TABLE 5
EXISTING CONDITIONS DAILY ROADWAY SEGMENT ANALYSIS

Roadway Segment	Facility Type	# of Lanes	Average Weekday					Saturday				
			Bikes	Peds	Vehicles	% Trucks	PCE LOS	Bikes	Peds	Vehicles	% Trucks	PCE LOS
Grand Avenue, west of Frontage Road	Arterial	4	20	10	15,370	14%	A	20	30	11,680	8%	A
Grand Avenue, east of Mandela Parkway	Arterial	6	50	210	14,940	7%	A	50	300	12,160	4%	A
Maritime Street, south of Grand Avenue	Arterial	6	20	10	7,730	45%	A	10	30	2,880	15%	A
Maritime Street, north of 7th Street	Arterial	6	30	10	10,550	50%	A	20	50	2,880	17%	A
7th Street, east of Maritime Street	Arterial	4	20	40	9,490	60%	A	10	10	7,563	20%	A

Source: Fehr & Peers, October 2014.

3.0 PROJECT CHARACTERISTICS

This chapter provides an overview the project, focusing on the vehicle trip generating components of the project and addresses the proposed trip generation, distribution, and assignment characteristics. This allows for an evaluation of the impacts on the surrounding roadway network. Impacts to bicycle and pedestrian facilities are discussed in Chapter 8. The amount of traffic associated with the project was estimated using a three-step process:

1. **Trip Generation** – The *amount* of vehicle traffic entering/exiting the project site was estimated.
2. **Trip Distribution** – The *direction* trips would use to approach and depart the site was projected.
3. **Trip Assignment** – Trips were then *assigned* to specific roadway segments and intersection turning movements.

3.1 PROJECT DESCRIPTION

Although the primary purposes of the project is to provide a new bicycle and pedestrian facility that would not be expected to generate new vehicle traffic, there are project elements that could generate vehicle trips, including the Wood Street parking lot. The project would also result in intersection modifications that would change some travel patterns volumes in the study area. The following further describes the project components.

The project is a new Class 1 path located in the City of Oakland, within Alameda County connecting Mandela Parkway to the Bay Bridge Trail. The path is an elevated structure for most of its distance to provide access across existing freeways, railways and industrial areas. It is an independent structure, except over the railroad tracks where it would be on the West Grand Avenue overcrossing structure.

The project could also include Class 2 bike lanes and a 100-space parking lot at the east end of the Class 1 path, if funding is available. The Class 2 bike lanes would extend along surface streets near the east touchdown of the path, providing connections to Mandela Parkway and to the proposed Wood Street parking lot.

The path has been divided into the following five segments described below from east to west.

Segment 1 – At-Grade Connection to Mandela Parkway

The Class 1 path would be at-grade along the south side of West Grand Avenue, between Mandela Parkway and Campbell Street. This segment would be approximately 450 feet long and 17 feet wide. There would be a landscaped median on the north side of the path to separate the path from vehicular traffic. Campbell and Willow Streets at West Grand Avenue would be converted to cul-de-sacs to prevent vehicular traffic from crossing the new Class 1 path on the south side of West Grand Avenue. Closure of Campbell Street and the redistribution of existing traffic flows are considered in this assessment. Willow Street is a minor intersection that carries low traffic volumes at its intersection with West Grand Avenue and was not explicitly considered in the analysis.

Segment 2 – Separate Elevated Structure East

From Campbell Street, the Class 1 path would continue for approximately 1,050 feet as a separate structure along the south side of West Grand Avenue, with a width of 17 feet. After the Wood Street crossing, the bike path would continue on the West Grand Avenue overcrossing (refer to Segment 3 below). Construction of this segment would require permanently closing or vacating the existing Grand Avenue Alley. Grand Avenue Alley is the narrow one-way street on the south side of Grand Avenue, between Mandela Parkway and Wood Street.

Segment 3 – West Grand Avenue Overcrossing

After the Wood Street overcrossing, the Class 1 path would continue on the West Grand Avenue overcrossing for approximately 780 feet within a width of 14 feet. It would cross over the frontage road and railroad tracks (narrow gauge tracks or spur line), under the I-880 freeway structures, and over the Burlington Northern & Santa Fe Railroad and Union Pacific railroad tracks. The width of the travel lanes and striped median would be reduced to provide enough width for the path using the existing West Grand Avenue roadway structure. After the railroad crossings, the path would continue as a separate structure on the south side of West Grand Avenue (refer to Segment 4). Construction of a new structure over the railroad tracks is not feasible.

Segment 4 – Separate Elevated Structure West

After the railroad crossing, the Class 1 would continue for approximately 3,400 feet as a separate structure on the south side of West Grand Avenue with a 17 foot cross section. It would cross over Maritime Street and continue to the touchdown near the Caltrans maintenance facility. East of the Caltrans maintenance facility, the path would descend with a switchback curve.

This segment could also include two ramps, from the elevated structure to Maritime Street, that could be constructed after the Class 1 path if funding is available. On the east side of Maritime Street, there could be a 700-foot-long ramp extending to Burma Road. On the west side of Maritime Street, there could be a 250-foot-long ramp extending to a roof-top landing and rest stop on the planned Oakland Maritime Support Services building.

Segment 5 – At-Grade Connection to Bay Bridge Trail

From the west touchdown, the Class 1 path would continue another 350 feet at grade level below the I-880/80 connection and connect to the existing Bay Bridge Trail (also known as Segment 2 path).

3.1.1 CLASS 2 BIKE LANES

The project could also include Class 2 bike lane along surface streets near the east touchdown of the Class 1 path, providing connections to Mandela Parkway and the proposed Wood Street parking lot. The width of the Class 2 bike lanes, extending along each side of the street, would be 5 feet. The Class 2 bike lanes, which cover approximately 4,650 linear feet, would be constructed after the Class 1 path, if funding is available. Class 2 bike lanes would extend along the following surface streets:

- 20th Street, from Mandela Parkway (one block south of West Grand Avenue) to Wood Street
- Wood Street, from 20th Street to 24th Street
- Willow Street, from 20th Street to West Grand Avenue
- Campbell Street, from 20th Street to West Grand Avenue

3.1.2 WOOD STREET PARKING LOT

The project could include construction of a new 100-space parking lot located on the west side of Wood Street, north of West Grand Avenue, and beneath the east side of the I-880 freeway. The parking lot would cover 0.48 acres (21,217 square feet). The Wood Street parking lot would be constructed after the Class 1 path, if funding is available.

3.2 PROJECT TRIP GENERATION

Trip generation refers to the process of estimating the amount of vehicular traffic a project would add to the surrounding roadway system. Estimates are typically created on a daily basis and for the peak one-hour period during the morning and evening commute periods when traffic volumes on the adjacent

streets are highest. For this project, estimates for weekend conditions were also prepared since higher levels of activity are expected on weekends than weekdays.

The project itself is not expected to generate vehicle traffic, as bicycle and pedestrian facilities are proposed to accommodate pedestrian and bicycle travel through the area. However, portions of the project could shift existing travel patterns, and generate new vehicle trips.

The closure of the south leg of Campbell Street at Grand Avenue would shift existing traffic that currently uses the south leg of the intersection to other roadway connections. Additionally, the Wood Street parking lot would accommodate path users that chose to drive to the area, park their vehicle, and then use the path. It is expected that some of these users would be those who currently park in other locations in the vicinity, such as in the Ikea and Target parking lots and parking areas off Burma Road. However, for the purpose of this assessment, all vehicle trips to the Wood Street parking lot are considered new trips.

To estimate the potential vehicle trip generation of the Wood Street parking lot, use of the Bay Bridge bicycle/pedestrian path was reviewed based on data collected by Caltrans in Fall of 2013[5]. The data shows that on a typical weekday, between approximately 300 pedestrians and 320 bicyclists use the Bay Bridge Path. On weekends, approximately 2,250 pedestrians and 1,800 bicyclists were observed using the path. Less than 10 percent of the daily activity was observed during the evening peak hour. On weekends, activity is dispersed throughout the day.

Based on the number of people using the Bay Bridge Path, estimates of how many pedestrian/bicycle trips on the Bay Bridge Path do not involve a vehicle, observations on the number of people in each vehicle that are parking in off-site retail lots, and the number of parking spaces available at the Wood Street lot, weekday and weekend daily and peak hour vehicle trip generation was estimated, as presented in **Table 6.** It is expected that the Wood Street parking lot could generate 400 weekday trips, including 10 morning and 50 evening peak hour trips. On a weekend, there could be 1,500 vehicle trips to the parking lot, including 150 peak hour trips.

[5] Source: Rodney Oto, Caltrans District 4. Bicycle and pedestrian counts on Bay Bridge for October 2013. Information received via email on May 7, 2014.

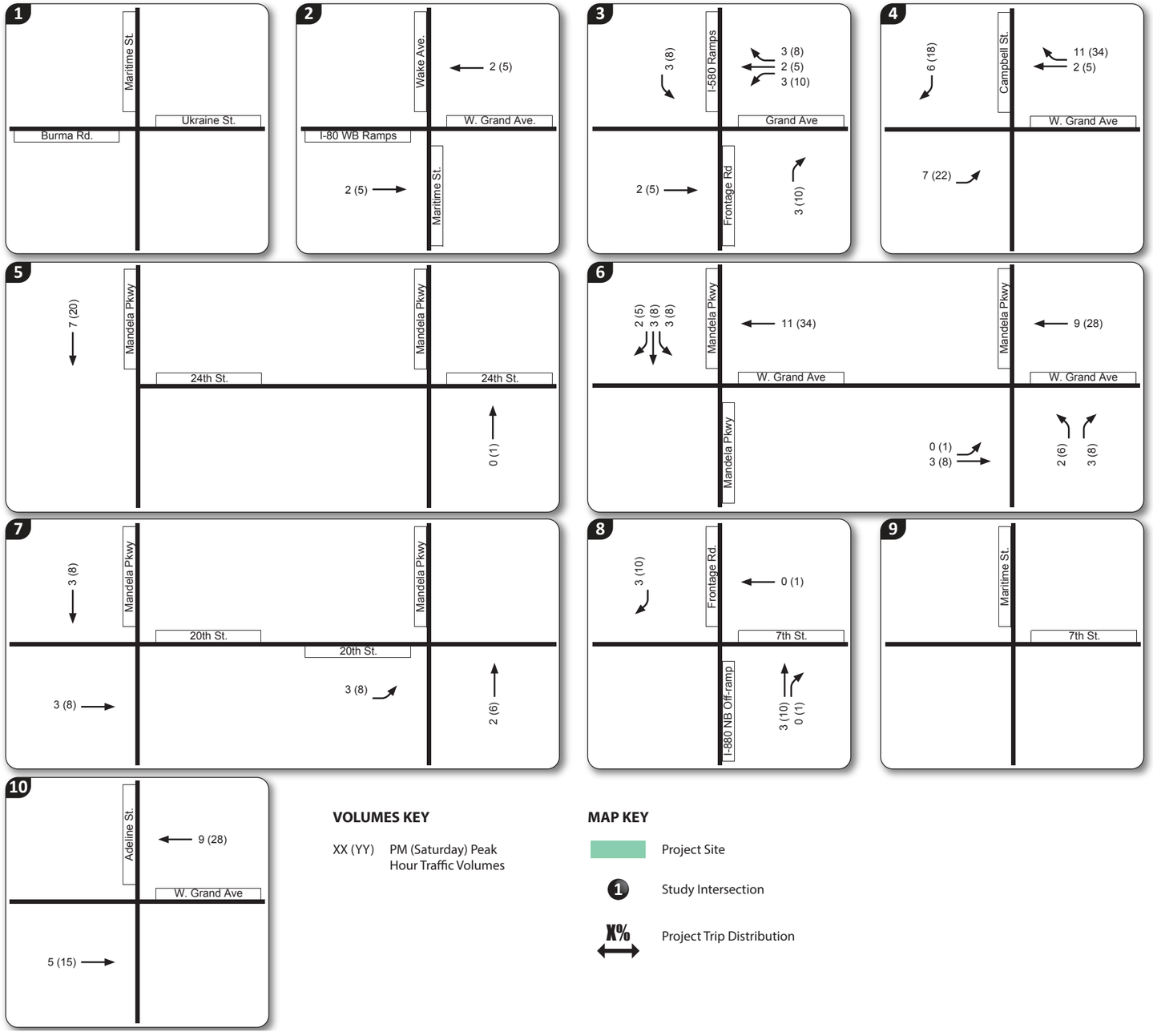
TABLE 6
WOOD STREET PARKING LOT VEHICLE TRIP GENERATION

Use	Weekday							Weekend			
	Daily	AM Peak Hour			PM Peak Hour			Daily	Peak Hour		
		In	Out	Total	In	Out	Total		In	Out	Total
Wood Street Parking Lot – 100 Spaces	400	5	5	10	25	25	50	1,500	75	75	150

Source: Fehr & Peers, October 2014

3.3 PROJECT TRIP DISTRIBUTION AND ASSIGNMENT

Based on the location of the site, surrounding land uses, roadway network, and relative population distribution within the greater East Bay and San Francisco, trip distribution percentages were developed. Population densities within the immediate vicinity (Oakland, Emeryville, and Berkeley) were weighed more heavily than population densities farther away (Richmond, Hayward, San Francisco). New trips to/from the Wood Street parking lot were assigned to the roadway network based on the local access characteristics and the project trip distribution estimates. Project trip distribution percentages and vehicle routes to/from the study area are depicted on **Figure 9** along with the resulting the project trip assignment.



VOLUMES KEY

XX (YY) PM (Saturday) Peak Hour Traffic Volumes

MAP KEY

Project Site

1 Study Intersection

X% Project Trip Distribution

Figure 9.

Project Trip Distribution and Project Trip Assignment

Graphics for Connection Report\WC12-2992_9_PTA

4.0 EXISTING WITH PROJECT TRAFFIC CONDITIONS

This chapter evaluates potential off-site traffic impacts under Existing with Project conditions.

4.1 EXISTING WITH PROJECT TRAFFIC VOLUMES

The project traffic volumes on Figure 9 were added to the existing traffic volumes from Figure 8 to estimate the Existing with Project traffic volumes, as shown on **Figure 10**. The with project volumes on Figure 10 also reflect traffic shifts from the closure of the southern leg of Campbell Street at Grand Avenue. The other potential roadway closures associated with the project are of minor streets that would not appreciably change traffic flows on the arterial or collector street network.

Intersection improvements at the Grand Avenue/Mandela Street intersection to accommodate enhanced bicycle and pedestrian facilities were also considered in the analysis. The lane configurations used in the analysis of Existing with Project conditions are also shown on Figure 10.

4.2 ANALYSIS OF EXISTING WITH PROJECT CONDITIONS

Existing with Project conditions were evaluated using the same methods described in Chapter 1. Traffic signal timings and truck percentages were not adjusted from the existing condition. The Existing with Project analysis results are presented in **Table 7** based on the traffic volumes presented on Figure 10. Table 7 also includes the operations results for Existing conditions for reference purposes. The addition of project traffic would increase average delay at the study intersections slightly, but would not cause overall intersection operations to degrade to unacceptable levels. Traffic shifts associated with the Campbell Street closure would improve operations at the Campbell Street/Grand Avenue intersection and would not degrade the operations of adjacent intersections. Peak hour signal warrants would continue to be satisfied at the Campbell Street/Grand Avenue intersection when considering the southbound right-turn movement. Signalization is not recommended.

The Maritime Street at 7th Street intersection currently operates at a deficient LOS E. However, the project is not projected to add vehicle traffic to this intersection; therefore, the project impact is less-than-significant.

Peak hour traffic signal warrants would not be satisfied at the other unsignalized intersections with the addition of project traffic.

TABLE 7
EXISTING WITH PROJECT PEAK HOUR INTERSECTION LEVEL OF SERVICE

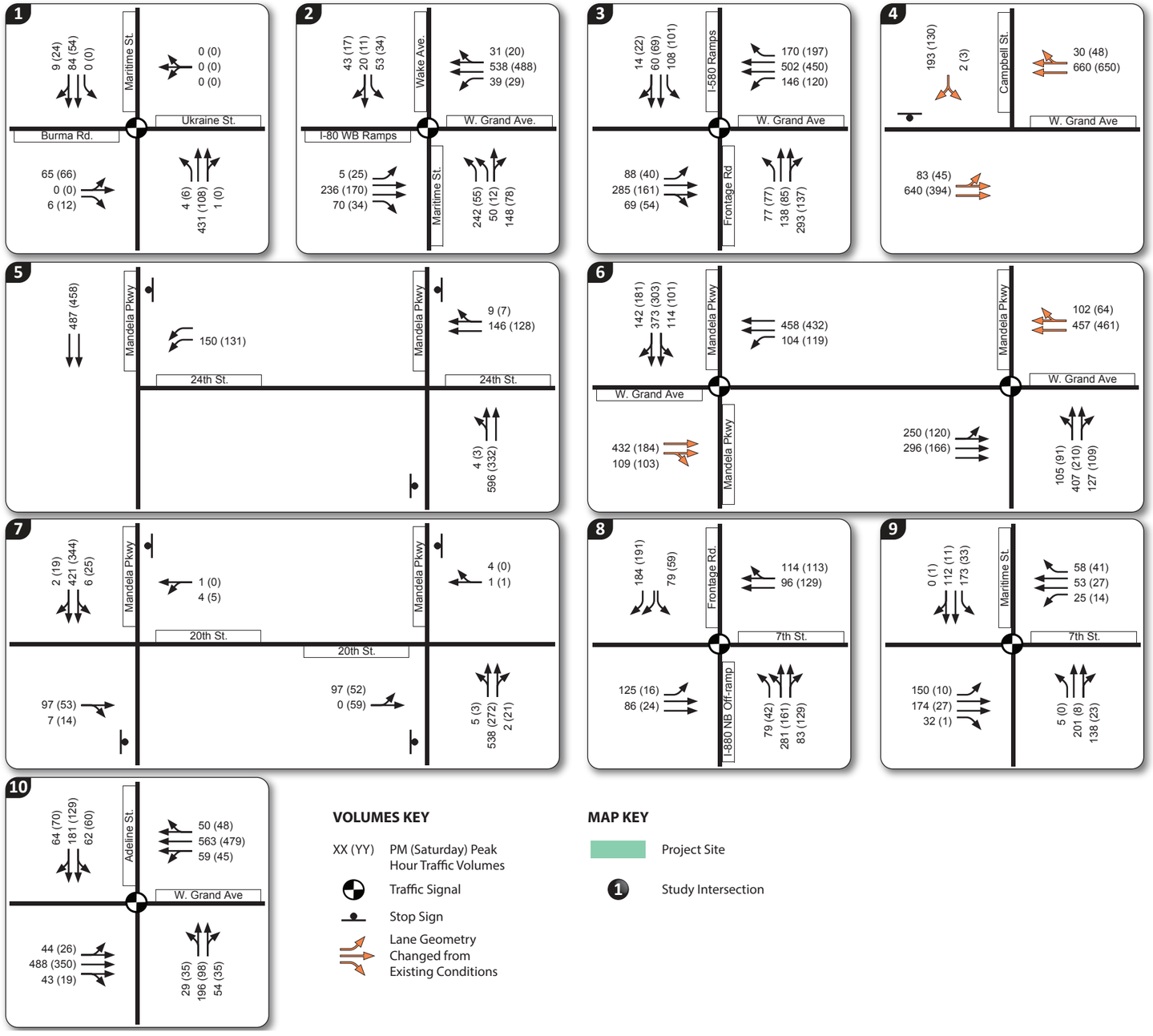
	Intersection	Control[1]	Peak Hour	Existing		Existing With Project		Significant Impact?
				Delay[2]	LOS[3]	Delay[2]	LOS[3]	
1	Burma Road/Maritime Street	Signal	PM SAT	13.4 12.0	B B	13.4 12.0	B B	No No
2	I-80 Ramps/West Grand Avenue/ Maritime Street/Wake Avenue[4&7]	Signal	PM SAT	26.1 32.5	C C	26.1 32.6	C C	No No
3	West Grand Avenue/Frontage Road/I-80 Ramps[5&8]	Signal	PM SAT	39.6 37.7	D D	39.8 38.0	D D	No No
4	West Grand Avenue/Campbell Street	SSSC	PM SAT	<10 (84.2) <10 (20.4)	A (F) A (C)	<10 (11.3) <10 (10.7)	A (B) A (B)	No No
5A	24th Street/Mandela Parkway Southbound	SSSC	PM SAT	<10 (10.7) <10 (10.7)	A (B) A (B)	<10 (10.7) <10 (10.8)	A (B) A (B)	No No
5B	24th Street/Mandela Parkway Northbound	SSSC	PM SAT	<10 (16.3) <10 (12.7)	A (C) A (B)	<10 (16.2) <10 (12.6)	A (C) A (B)	No No
6A	West Grand Avenue/Mandela Parkway Southbound	Signal	PM SAT	16.6 14.5	B B	17.1 14.8	B B	No No
6B	West Grand Avenue/Mandela Parkway Northbound	Signal	PM SAT	16.9 18.4	B B	17.5 19.6	B B	No No
7A	20th Street/Mandela Parkway Southbound	SSSC	PM SAT	<10 (13.3) <10 (12.7)	A (B) A (B)	<10 (14.2) <10 (14.9)	A (B) A (B)	No No
7B	20th Street/Mandela Parkway Northbound	SSSC	PM SAT	<10 (12.0) <10 (10.3)	A (B) A (B)	<10 (12.6) <10 (11.9)	A (B) A (B)	No No
8	7th Street/I-880 Northbound Off-Ramp/Frontage Road[6&9]	Signal	PM SAT	26.4 18.3	C B	26.4 18.3	C B	No No
9	7th Street/Maritime Street	Signal	PM SAT	**59.1** 33.5	**E** C	**59.1** 33.5	**E** C	No No
10	West Grand Avenue/Adeline Street	Signal	PM SAT	14.9 14.5	B B	15.0 14.6	B B	No No

Notes: **Bold** text indicates potentially unacceptable intersection operations.

1. Signal = Signalized Intersection; SSSC = Side-street stop-controlled intersections; traffic on the main street does not stop while traffic on the side-street is controlled by a stop sign.
2. Delay presented in seconds per vehicle; for side-street stop-controlled intersections, delay presented in Intersection average (worst approach).
3. LOS = Level of Service.
4. Delay presented in table for Intersection 2 average delay/LOS. Existing Delay/LOS for specific movements from the off-ramp as follows:

   a. PM Peak Hour: EB left = 43.2/D, EB thru = 24.5/C, EB right = 22.9/C
   b. Sat Peak Hour: EB left = 68.5/E, EB thru = 29.8/C, EB right = 28.2/C
5. Delay presented in table for Intersection 3 average delay/LOS. Existing Delay/LOS for specific movements from the off-ramp as follows:
   a. PM Peak Hour: NB left = 40.4/D, NB thru/right = 39.6/D, SB left = 41.9/D, SB thru-right = 35.7/D
   b. Sat Peak Hour: NB left = 39.6/D, NB thru-right = 36.6/D, SB left = 40.0/D, SB thru-right = 35.9/D
6. Delay presented in table for Intersection 8 average delay/LOS. Existing Delay/LOS for specific movements from the off-ramp as follows:
   a. PM Peak Hour: NB left = 24.2/C, NB thru/right = 25.3/C
   b. Sat Peak Hour: NB left = 11.4/B, NB thru-right = 12.1/B
7. Delay presented in table for Intersection 2 average delay/LOS. Existing + Project Delay/LOS for specific movements from the off-ramp as follows:
   a. PM Peak Hour: EB left = 43.2/D, EB thru = 24.5/C, EB right = 22.9/C
   b. Sat Peak Hour: EB left = 68.6/E, EB thru = 29.8/C, EB right = 28.2/C
8. Delay presented in table for Intersection 3 average delay/LOS. Existing + Project Delay/LOS for specific movements from the off-ramp as follows:
   a. PM Peak Hour: NB left = 40.4/D, NB thru/right = 39.7/D, SB left = 42.3/D, SB thru-right = 35.7/D
   b. Sat Peak Hour: NB left = 39.6/D, NB thru-right = 36.7/D, SB left = 40.7/D, SB thru-right = 35.9/D
9. Delay presented in table for Intersection 8 average delay/LOS. Existing + Project Delay/LOS for specific movements from the off-ramp as follows:
   a. PM Peak Hour: NB left = 24.2/C, NB thru/right = 25.3/C
   b. Sat Peak Hour: NB left = 11.4/B, NB thru-right = 12.1/B

Source: Fehr & Peers, October 2014.



VOLUMES KEY

XX (YY) PM (Saturday) Peak Hour Traffic Volumes

Traffic Signal

Stop Sign

Lane Geometry Changed from Existing Conditions

MAP KEY

Project Site

1 Study Intersection

Figure 10.

Existing with Project
Peak Hour Volumes, Lane Configurations and Traffic Control

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5.0 NEAR-TERM CONDITIONS

This chapter presents the results of the level of service calculations under near-term conditions without and with the project. Near-term without Project conditions are defined as conditions around the time the project is expected to be completed and occupied within the next five to ten years. Traffic volumes for Near-term without Project conditions comprise existing volumes plus traffic generated by approved but not yet constructed and occupied developments in the area. Near-term with Project conditions are defined as Near-term without Project conditions plus net new traffic generated by the proposed project, and potential traffic shifts associated with the Campbell Street partial closure. Conditions with development of the Gateway Park project are also presented.

5.1 NEAR-TERM INTERSECTION VOLUMES

Traffic volumes for the near-term condition were developed based on a review of historical traffic counts, and review of traffic forecasts contained in the Oakland Army Base Project Initial Study/Addendum (2012) and the West Oakland Specific Plan EIR (2014). Several intersections evaluated in this project were also evaluated within those documents. Those forecasts were prepared using the then current version (June 2011) of the Alameda CTC Countywide Travel Demand Model (the Model) which is consistent with Association of Bay Area Governments' (ABAG) Projections 2009, the latest MTC Regional Transportation Plan, and the latest Alameda Countywide Plan. The 2012 Army Base Addendum contained forecasts of 2020 and 2035 conditions for the weekday morning and evening peak hours, while the 2014 EIR only contained 2035 forecasts for the weekday morning and evening peak hours. Based on our review of the forecasts and historical traffic counts, we developed a growth rate to apply to all study intersections.

Traffic counts at the same intersections collected on numerous dates within the last ten years indicate little to negative traffic growth in the study area. Greater levels of growth were projected in the 2012 and 2014 environmental documents.

For this analysis, existing (2013) traffic counts at intersections along the Grand Avenue and Mandela Parkway corridors were increased by a 2 percent annual growth rate for seven years to estimate 2020 conditions. For the two intersections on 7th Street, a 4 percent annual growth rate was applied. The same growth rate was applied to weekday PM and Saturday peak hour traffic volumes. The resulting Near-term without Project traffic volumes as shown on **Figure 11**. Project traffic was then added to develop Near-term with Project traffic volumes, as shown on **Figure 12**.

5.1.1 NEAR-TERM WITH GATEWAY PARK

The Gateway Park project could also be constructed within the near-term time frame, although that project is separate from the Path project. As it is unknown when both projects may be constructed, an analysis of near-term conditions with Gateway Park, without and with the Path project was conducted to assess the near-term impacts of the Path should the Park be constructed.

Gateway Park is located in the City of Oakland at the east touchdown of the SFOBB. Access to the bicycle/pedestrian connection on the new East Span of the Bay Bridge would be provided from the Park area as well as access to existing and planned segments of the San Francisco Bay Trail.

The trip generating potential of the Park was calculated using the average and maximum rates documented by ITE for Regional Park, which is the land use most similar to the proposed project, based on the park acreage. The potential range of trip generation for Gateway Park is shown in **Table 8,** which may overstate the potential trip generation as much of the park acreage is not used for active or passive recreation. The ITE rates suggest that weekday daily trip generation could range between 780 trips and 6,640 trips, and weekend trip generation could range between 1,090 and 7,500 daily trips. Weekday evening peak hour trip generation could range between 35 and 190 trips, while weekend peak hour trip generation could range between 70 and 395 trips.

TABLE 8
GATEWAY PARK
TYPICAL DAY VEHICLE TRIP GENERATION ESTIMATE RANGE – ITE RATES

Use	Size	Weekday			Weekend	
		Daily	AM Peak Hour	PM Peak Hour	Daily	Weekend Peak Hour
Regional Park – Average Rate	170 Acres	780	26	34	1,090	71
Regional Park – Maximum Rate	170 Acres	6,640	102	187	7,500	394

Source: Fehr & Peers, October 2014

Given the potential variability in vehicle trip generation for the park, the vehicle trip generating characteristics of a similar use in the East Bay region were reviewed for a weekend day when the trip generating potential of the project is expected to be highest for comparison purposes only. Traffic counts at the University Avenue/ West Frontage Road intersection from 2009 were obtained for the Saturday peak hour as this intersection provides the primary vehicle access to the Berkeley Marina, and adjacent Eastshore State Park and Cesar Chavez Park. This area contains active and passive recreation areas similar

to the proposed project, such as walking trails and a fishing pier with a total of approximately 170 acres of active and passive recreation areas – similar to the proposed project.

The area also contains many uses not proposed within the project site, including a marina, hotel and restaurants. The trip generating potential of the marina, hotel and restaurants, based on their estimated size and ITE trip generation rates, was subtracted from the overall vehicle counts to the area to estimate park-only vehicle trip generation. The ITE trip generation estimates from Table 8 were then compared to the estimated trip generating potential of the passive land uses at the Berkeley Marina, and the resulting trip generation is similar to the ITE prediction for Regional Park based on the maximum observed rate. Weekday PM peak period (4:00 to 6:00 PM) data was also reviewed, but as the count was conducted in January (when it is dark at 5:00 PM), park uses were found to generate less than the ITE average for regional park. It is expected that a traffic count conducted between late-spring and fall would yield higher vehicle trip generation.

In addition to the review of ITE trip generation rates and traffic count data, projected visitor information for the park was also reviewed based on information contained in *Gateway Park Programming & Governance Considerations Report, May 22, 2013* prepared by HR&A. Projections of annual park visitors were made under several scenarios, including passive to active uses, with a projected range of annual visitors between 250,000 to 2,000,000 people. The expected level of weekday and weekend vehicle trip generation on a daily and peak hour basis was calculated assuming that park attendance would vary throughout the year depending on a number of factors including the number of hours of daylight and weather. The following assumptions were used:

- Off-peak weekday demand half of peak weekday demand
- Off-peak weekend demand 80 percent of peak weekend demand
- 90 percent of person visits arrive/depart via private vehicle
- Average vehicle occupancy is 2 people per vehicle on weekday
- Average vehicle occupancy is 3 people per vehicle on weekend
- Staff/Maintenance activities would increase vehicle trip generation by 10 percent on a weekday and 5 percent on a weekend

The range of daily trip generation estimates are presented in **Table 9** and the range of peak hour trip generation estimates are presented in **Table 10.** The daily level of trip generation predicted by the maximum ITE Regional Park rate exceed the calculated trip generation for 2,000,000 annual visitors. Weekday PM and Saturday afternoon ITE trip generation is within the range of calculated trip generation for 1,000,000 to 1,500,000 annual visitors.

TABLE 9
GATEWAY PARK
DAILY TRIP GENERATION ESTIMATE RANGE – BASED ON ANNUAL VISITORS

Number of Annual Visitors	Off-Peak Weekday	Off-Peak Weekend	Peak Weekday	Peak Weekend
250,000	440	350	640	690
500,000	880	690	1,290	1,370
1,000,000	1,760	1,380	2,580	2,750
1,500,000	2,640	2,070	3,870	4,120
2,000,000	3,530	2,760	5,150	5,490

Source: Fehr & Peers, October 2014

TABLE 10
GATEWAY PARK
PEAK HOUR TRIP GENERATION ESTIMATE RANGE – BASED ON ANNUAL VISITORS

Number of Annual Visitors	Off-Peak Weekday	Off-Peak Weekend	Peak Weekday	Peak Weekend
250,000	40	46	58	90
500,000	79	90	116	178
1,000,000	158	179	232	358
1,500,000	238	269	348	536
2,000,000	318	359	464	714

Source: Fehr & Peers, October 2014

To estimate near-term conditions with the Gateway Park project, the peak hour trip generation developed using the ITE maximum rates for regional park uses were assigned to the roadway network based on similar trip distribution percentages developed for the analysis of the Path project, and added to the Near-term without Project traffic volumes. The resulting volumes are shown on **Figure 13.** Trips generated by the path project were then added to estimate Near-term conditions with both the Gateway Park and Path projects, as shown on **Figure 14**.

5.1.2 EAST SPAN BICYCLE AND PEDESTRIAN FORECASTS

Bicycle and pedestrian activity within the Park, pathways connecting to the Park, and on the East Span of the Bay Bridge was estimated based on existing volumes on the East Span path and using the approach documented in *SFOBB West Span Bicycle/Pedestrian/Maintenance Path PSR Project – Forecasting and Traffic Analysis Methodology, November 28, 2011* (provided in Appendix D). The approach uses observations of bicycle and pedestrian activity on Bay Area bridges with bicycle/pedestrian facilities, including the East Span of the Bay Bridge, and Golden Gate, Dumbarton and Carquinez bridges; the likelihood of existing trans-bay transit riders who access their home origin transit stop by bicycle switching to an all bicycle commute; new bicycle commuters; potential tourist activity; and demand from development on Treasure Island. Other approaches were considered, such as using a regional travel demand model, but the available modeling tools do not reflect a bicycle/pedestrian connection over the Bay Bridge in future years and do not forecast recreation/tourist based pedestrian and bicycle activity.

Based on this approach, a range of bicycle and pedestrian activity around the Park and East Span were estimated, as presented in **Table 11**, for near-term conditions prior to the completion of the West Span Bicycle and Pedestrian Path, and in **Table 12** for the cumulative condition, when it would be feasible to walk or ride a bicycle between Oakland and San Francisco. The low end of the range reflects observed bicycle and pedestrian activity on the partial East Span from October 2013.

In the near-term, daily pedestrian and bicycle activity within the Park and East Span could range from approximately 620 to 2,270 people. It is expected that the majority of these people would arrive to the park in a vehicle and park. A small percentage would park in the Wood Street lot or other available parking in the area and walk or ride their bikes to the Park and an even smaller percentage are likely to start their bike or walk trip from their home or place of work. In the cumulative condition when it would be feasible to walk or ride a bike between Oakland and San Francisco, some people may consider commuting via bicycle over the Bay Bridge, which is expected to range between 750 and 1,500 people on a typical weekday. Tourism and other recreational activity would likely increase, especially on weekends.

TABLE 11
NEAR-TERM EAST SPAN BICYCLE AND PEDESTRIAN FORECAST RANGE

Source of Activity	Weekday			Weekend	
	Daily	AM Peak Hour	PM Peak Hour	Daily	Peak Hour
Tourism/Recreation – Pedestrian[1]	300 – 1,070	10	40 – 200	2,250 – 3,270	290 – 420

TABLE 11
NEAR-TERM EAST SPAN BICYCLE AND PEDESTRIAN FORECAST RANGE

Source of Activity	Weekday			Weekend	
	Daily	AM Peak Hour	PM Peak Hour	Daily	Peak Hour
Tourism/Recreation – Bicycle[1]	320 – 500	20	50 – 90	1,800 – 1,830	220 – 330
Treasure Island Development – Bicycle [2]	0 – 700	0 – 30	0 – 40	0 – 700	0 – 40
Total Near-term Pedestrian/ Bicycle Activity Range	**620 – 2,270**	**30 – 60**	**90 – 330**	**4,050 – 5,800**	**540 – 790**

Notes: 1. The low end of the range is based on counts of activity on the East Span prior to the completion of the Park and the connection to Yerba Buena Island. Maximum of the Near-term activity range is assumed to be 20 percent of observed activity on the Golden Gate Bridge on a weekday and 30 percent of observed activity on a weekend.
2. Based on the trip generation, mode choice and project trip distribution from the *Treasure Island and Yerba Buena Island Redevelopment Plan Transportation Impact Study*, July 7, 2010. Range is from 0 as it is uncertain when the Treasure Island Development would be fully-built out.

Source: Fehr & Peers, October 2014

TABLE 12
CUMULATIVE EAST SPAN BICYCLE AND PEDESTRIAN FORECAST RANGE

Source of Activity	Weekday			Weekend	
	Daily	AM Peak Hour	PM Peak Hour	Daily	Peak Hour
Tourism/Recreation – Pedestrian[1]	300 – 1,610	20	40 - 300	2,250 – 4,350	290 – 560
Tourism/Recreation – Bicycle[1]	320 – 750	30	50 - 140	1,800 -2,440	220 – 440
Treasure Island Development – Bicycle [2]	0 – 700	0 – 30	0 – 40	0 – 700	0 – 40
Commute Trips – Bicycle[3]	750 – 1,490	50 – 210	50 – 270	250 – 750	50 – 140
Total Pedestrian/Bicycle Activity	**1,370 – 4,550**	**100 – 290**	**140 – 750**	**4,300 – 8,240**	**560 – 1,180**

Notes: 1. The low end of the range is based on counts of activity on the East Span prior to the completion of the Park and the connection to Yerba Buena Island. Maximum of the range is assumed to be 30 percent of observed activity on the Golden Gate Bridge on a weekday and 40 percent of observed activity on a weekend.
2. Based on the trip generation, mode choice and project trip distribution from the *Treasure Island and Yerba Buena Island Redevelopment Plan Transportation Impact Study*, July 7, 2010.
3. Based on estimates of existing commuters who ride their bicycles to a BART station within 15 miles of either the touchdown of either the east span or west span that might switch to only bike commuting, and the number of transbay buses each hour and estimates of bus bicycle rack activity.

Source: Fehr & Peers, October 2014

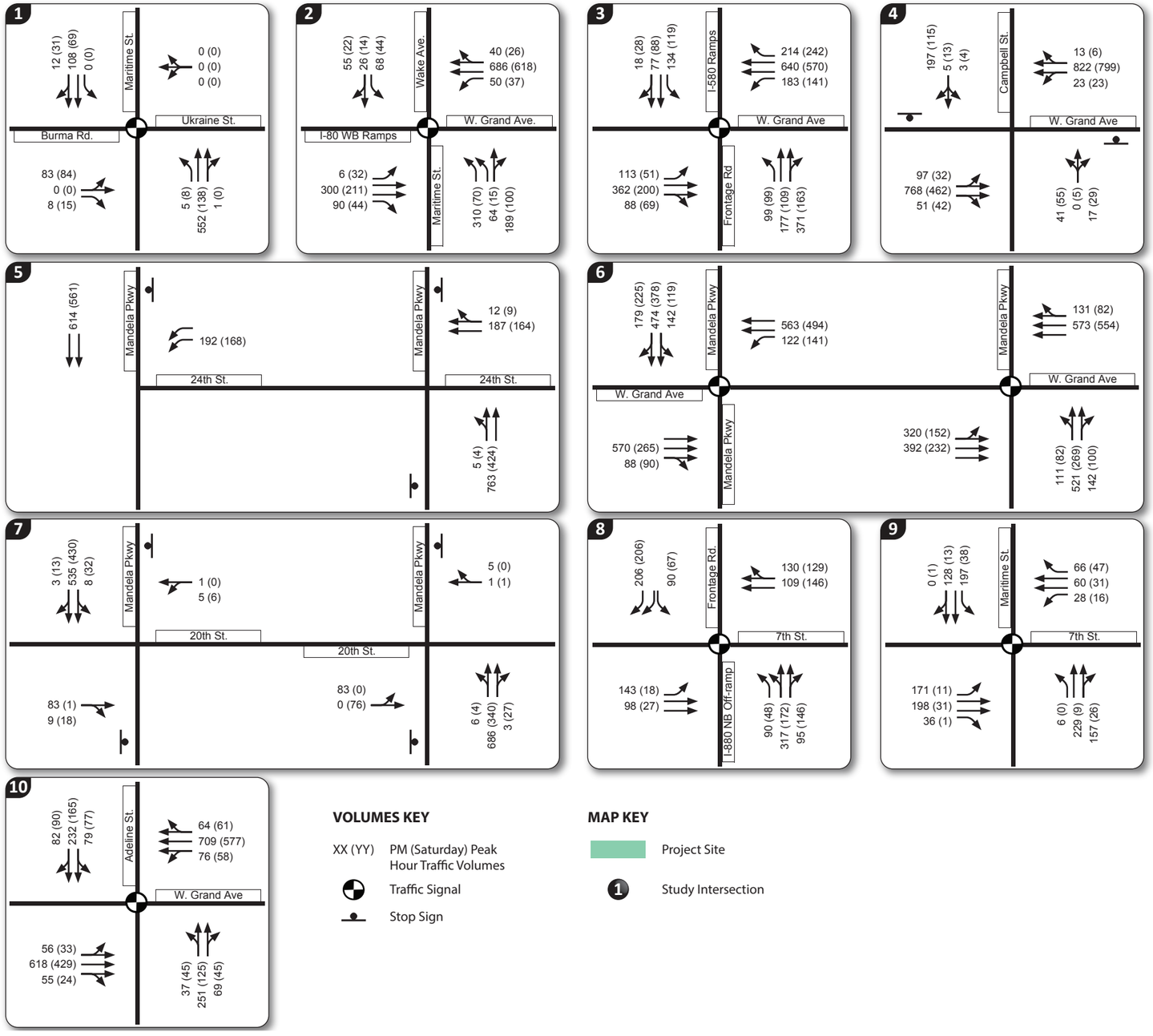

Figure 11.

Near-Term without Project
Peak Hour Volumes, Lane Configurations and Traffic Control

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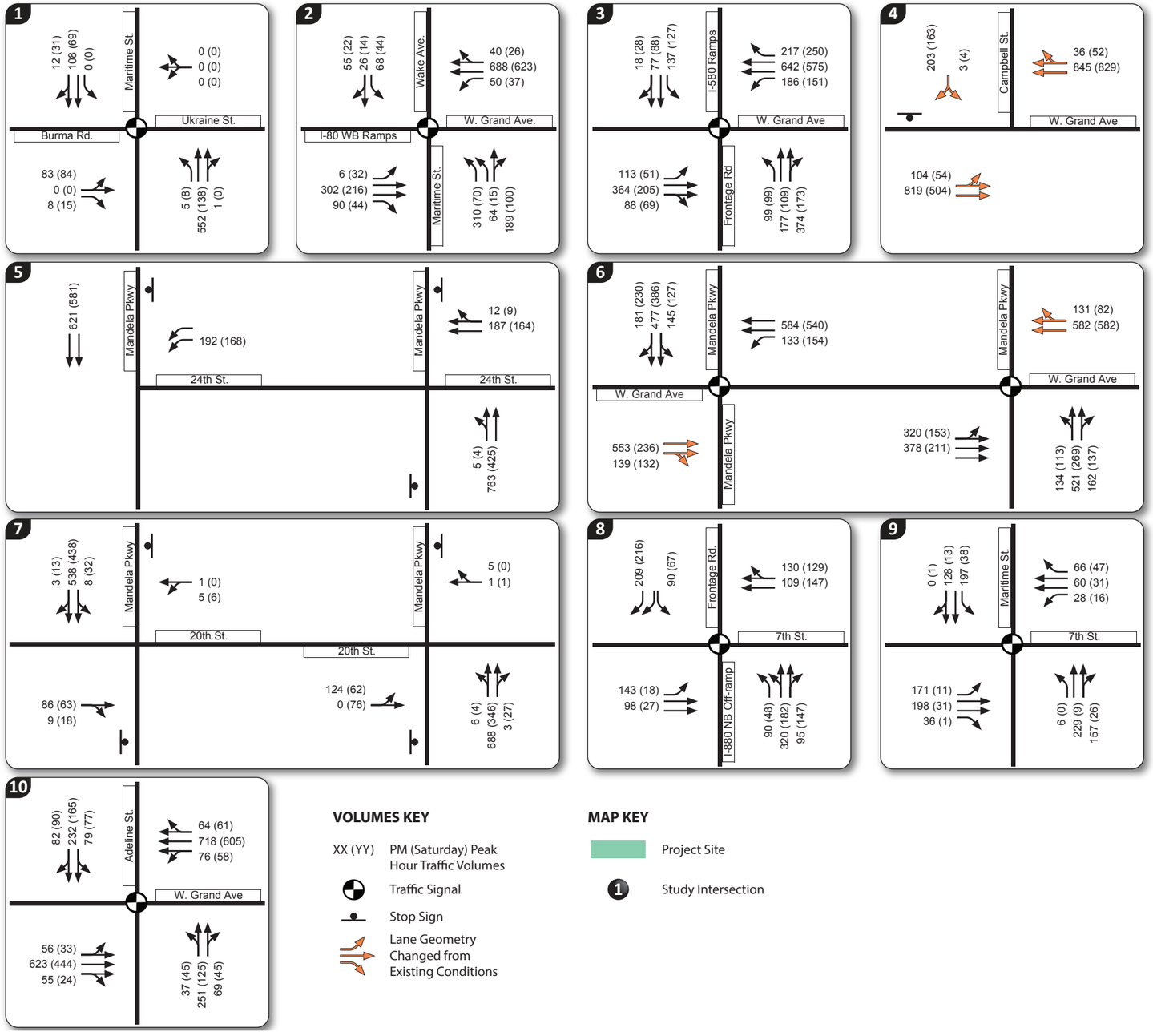

Figure 12.

Near-Term with Project
Peak Hour Volumes, Lane Configurations and Traffic Control

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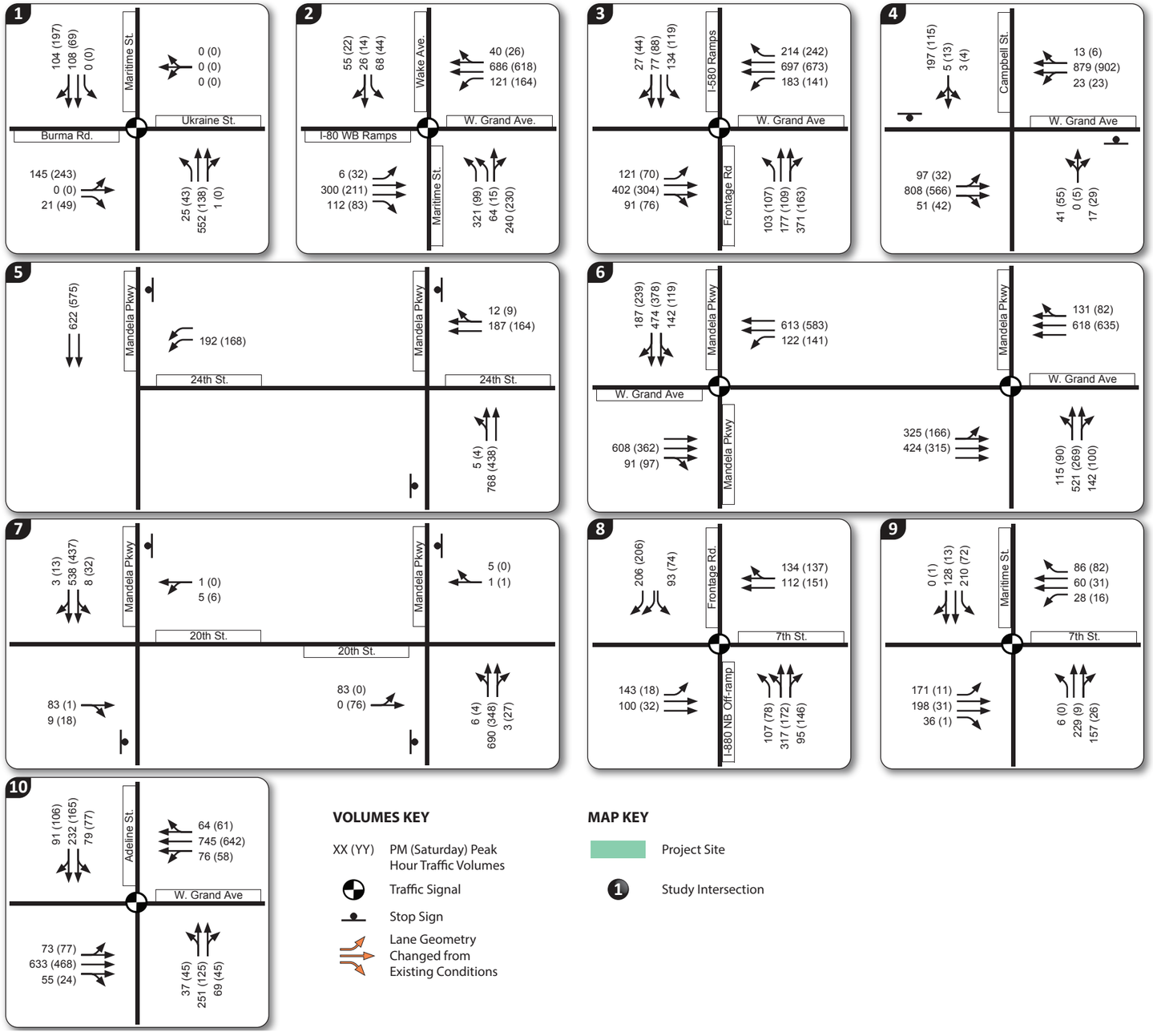

Figure 13.

Near-Term with Park and without Project
Peak Hour Volumes, Lane Configurations and Traffic Control

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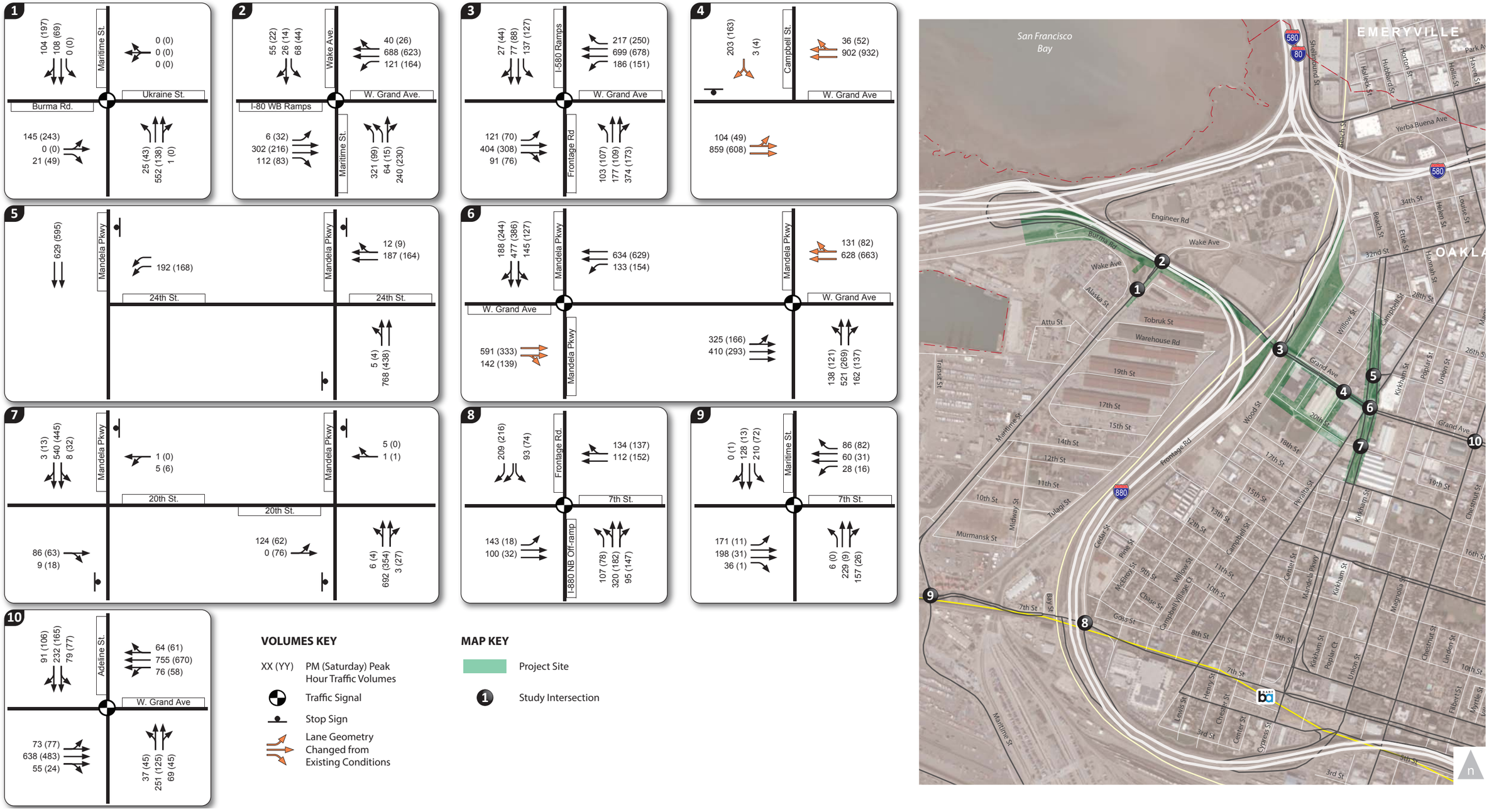

Figure 14.

Near-Term with Park and with Project
Peak Hour Volumes, Lane Configurations and Traffic Control

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5.2 BACKGROUND ROADWAY IMPROVEMENTS

No improvements were assumed at any of the study intersections for the analysis of near-term conditions without the project. Improvements at the Grand Avenue/Mandela Street intersection to better accommodate enhanced bicycle and pedestrian facilities and closure of the southern leg of the Campbell Street intersection with West Grand Avenue were considered in the analysis of project conditions.

5.3 NEAR-TERM INTERSECTION LEVELS OF SERVICE

Level of service calculations were conducted to evaluate intersection operations under near-term conditions both without and with the Path project, and for conditions considering development of the Gateway Park. Traffic signal timings and heavy vehicle percentages were unchanged from the analysis of Existing conditions. The LOS results are summarized in **Table 13** and **Table 14**. The corresponding LOS calculation sheets are included in **Appendix B**.

The results of the LOS calculations indicate that the 7th Street/Maritime Street intersection would continue to operate at an unacceptable level of service in the near-term condition. The project is not expected to increase traffic at this intersection. Considering development of the Gateway Park project in the near-term conditions, the side-street movement at the Grand Avenue/Campbell Street intersection would experience increased delay. With the closure of the south leg of the intersection and associated vehicle diversions, delay for the side-street movements would decrease. Peak hour signal warrants would continue to be satisfied at the Campbell Street/Grand Avenue intersection when considering the southbound right-turn movement. Signalization is not recommended.

Operations of the 7th Street/Maritime Street intersection would further worsen with the Gateway Park project, but the Path project is not expected to increase traffic at this intersection. The Gateway Park project would slightly increase delay at the Grand Avenue/Frontage Road intersection, although it would operate at LOS E, which is considered acceptable for this intersection. With the addition of project traffic, operations would remain at LOS E.

The remaining study intersections are projected to operate at an overall level of service D or better during both the AM and PM peak hours without or with the Path project and the Gateway Park project.

Peak hour traffic signal warrants would not be satisfied at the other unsignalized intersections with the addition of project traffic.

TABLE 13
NEAR-TERM PEAK HOUR INTERSECTION LEVEL OF SERVICE

	Intersection	Control[1]	Peak Hour	Near-term without Project		Near-Term with Project		Significant Impact?
				Delay[2]	LOS[3]	Delay[2]	LOS[3]	
1	Burma Road/Maritime Street	Signal	PM SAT	14.4 12.2	B B	14.4 12.2	B B	No No
2	I-80 Ramps/West Grand Avenue/ Maritime Street/Wake Avenue[4&7]	Signal	PM SAT	29.4 34.6	C C	29.4 34.7	C C	No No
3	West Grand Avenue/Frontage Road/I-80 Ramps[5&8]	Signal	PM SAT	54.1 45.9	D D	54.5 46.6	D D	No No
4	West Grand Avenue/Campbell Street	SSSC	PM SAT	<10 (106.3) <10 (42.0)	A (F) A (E)	<10 (13.7) <10 (11.8)	A (B) A (B)	No No
5A	24th Street/Mandela Parkway Southbound	SSSC	PM SAT	<10 (11.5) <10 (11.6)	A (B) A (B)	<10 (11.6) <10 (11.7)	A (B) A (B)	No No
5B	24th Street/Mandela Parkway Northbound	SSSC	PM SAT	<10 (21.7) <10 (14.5)	A (C) A (B)	<10 (21.7) <10 (14.5)	A (C) A (B)	No No
6A	West Grand Avenue/Mandela Parkway Southbound	Signal	PM SAT	17.8 15.2	B B	18.7 15.6	B B	No No
6B	West Grand Avenue/Mandela Parkway Northbound	Signal	PM SAT	18.1 19.1	B B	18.7 20.4	B C	No No
7A	20th Street/Mandela Parkway Southbound	SSSC	PM SAT	<10 (15.8) <10 (16.3)	A (C) A (C)	<10 (18.4) <10 (19.4)	A (C) A (C)	No No
7B	20th Street/Mandela Parkway Northbound	SSSC	PM SAT	<10 (13.7) <10 (13.6)	A (B) A (B)	<10 (14.7) <10 (13.6)	A (B) A (B)	No No
8	7th Street/I-880 Northbound Off-Ramp/Frontage Road[6&9]	Signal	PM SAT	28.5 19.6	C B	28.6 19.6	C B	No No
9	7th Street/Maritime Street	Signal	PM SAT	**69.3** 33.6	**E** C	**69.3** 33.6	**E** C	No No
10	West Grand Avenue/Adeline Street	Signal	PM SAT	15.8 14.8	B B	15.9 14.9	B B	No No

Notes: **Bold** text indicates potentially unacceptable intersection operations.

1. Signal = Signalized Intersection; SSSC = Side-street stop-controlled intersections; traffic on the main street does not stop while traffic on the side-street is controlled by a stop sign.
2. Delay presented in seconds per vehicle; for side-street stop-controlled intersections, delay presented in Intersection average (worst approach).
3. LOS = Level of Service.
4. Delay presented in table for Intersection 2 average delay/LOS. Near-term Delay/LOS for specific movements from the off-ramp as follows:

   a. PM Peak Hour: EB left = 53.3/D, EB thru = 26.3/C, EB right = 24.2/C
   b. Sat Peak Hour: EB left = 57.2/E, EB thru = 28.6/C, EB right = 26.8/C
5. Delay presented in table for Intersection 3 average delay/LOS. Near-Term Delay/LOS for specific movements from the off-ramp as follows:
   a. PM Peak Hour: NB left = 43.2/D, NB thru/right = 42.2/D, SB left = 45.8/D, SB thru-right = 36.1/D
   b. Sat Peak Hour: NB left = 41.9/D, NB thru-right = 37.5/D, SB left = 42.6/D, SB thru-right = 26.5/D
6. Delay presented in table for Intersection 8 average delay/LOS. Near-Term Delay/LOS for specific movements from the off-ramp as follows:
   a. PM Peak Hour: NB left = 27.2/C, NB thru/right = 29.2/C
   b. Sat Peak Hour: NB left = 12.3/B, NB thru-right = 13.2/B
7. Delay presented in table for Intersection 2 average delay/LOS. Near-Term + Project Delay/LOS for specific movements from the off-ramp as follows:
   a. PM Peak Hour: EB left = 53.3/D, EB thru = 26.3/C, EB right = 24.1/C
   b. Sat Peak Hour: EB left = 58.4/E, EB thru = 28.6/C, EB right = 26.8/C
8. Delay presented in table for Intersection 3 average delay/LOS. Near-Term + Project Delay/LOS for specific movements from the off-ramp as follows:
   a. PM Peak Hour: NB left = 43.2/D, NB thru/right = 42.2/D, SB left = 46.3/D, SB thru-right = 36.1/D
   b. Sat Peak Hour: NB left = 41.9/D, NB thru-right = 37.6/D, SB left = 43.5/D, SB thru-right = 36.5/D
9. Delay presented in table for Intersection 8 average delay/LOS. Near-Term + Project Delay/LOS for specific movements from the off-ramp as follows:
   a. PM Peak Hour: NB left = 27.1/C, NB thru/right = 29.3/C
   b. Sat Peak Hour: NB left = 12.3/B, NB thru-right = 13.3/B

Source: Fehr & Peers, October 2014.

TABLE 14
NEAR-TERM WITH GATEWAY PARK PEAK HOUR INTERSECTION LEVEL OF SERVICE

	Intersection	Control[1]	Peak Hour	Near-term without Project		Near-Term with Project		Significant Impact?
				Delay[2]	LOS[3]	Delay[2]	LOS[3]	
1	Burma Road/Maritime Street	Signal	PM SAT	14.2 13.7	B B	14.4 13.7	B B	No No
2	I-80 Ramps/West Grand Avenue/ Maritime Street/Wake Avenue[4&7]	Signal	PM SAT	30.9 50.9	C C	30.9 50.8	C D	No No
3	West Grand Avenue/Frontage Road/I-80 Ramps[5&8]	Signal	PM SAT	64.5 63.8	E E	64.9 64.6	E E	No No
4	West Grand Avenue/Campbell Street	SSSC	PM SAT	<10 (97.8) <10 (67.8)	A (F) A (E)	<10 (13.7) <10 (12.1)	A (B) A (B)	No No
5A	24th Street/Mandela Parkway Southbound	SSSC	PM SAT	<10 (11.6) <10 (11.7)	A (B) A (B)	<10 (11.6) <10 (11.8)	A (B) A (B)	No No
5B	24th Street/Mandela Parkway Northbound	SSSC	PM SAT	<10 (21.7) <10 (14.5)	A (C) A (B)	<10 (21.9) <10 (14.8)	A (C) A (B)	No No
6A	West Grand Avenue/Mandela Parkway Southbound	Signal	PM SAT	17.7 15.3	B B	18.8 15.9	B B	No No
6B	West Grand Avenue/Mandela Parkway Northbound	Signal	PM SAT	18.1 18.5	B B	18.8 20.4	B C	No No

TABLE 14
NEAR-TERM WITH GATEWAY PARK PEAK HOUR INTERSECTION LEVEL OF SERVICE

	Intersection	Control[1]	Peak Hour	Near-term without Project		Near-Term with Project		Significant Impact?
				Delay[2]	LOS[3]	Delay[2]	LOS[3]	
7A	20th Street/Mandela Parkway Southbound	SSSC	PM SAT	<10 (15.8) <10 (16.5)	A (C) A (C)	<10 (18.4) <10 (19.6)	A (C) A (C)	No No
7B	20th Street/Mandela Parkway Northbound	SSSC	PM SAT	<10 (13.7) <10 (13.7)	A (B) A (B)	<10 (14.8) <10 (13.6)	A (B) A (B)	No No
8	7th Street/I-880 Northbound Off-Ramp/Frontage Road[6&9]	Signal	PM SAT	28.8 20.3	C B	28.8 20.3	C C	No No
9	7th Street/Maritime Street	Signal	PM SAT	**76.1** 35.4	**E** D	**76.1** 35.4	**E** D	No No
10	West Grand Avenue/Adeline Street	Signal	PM SAT	16.2 15.3	B B	16.3 15.4	B B	No No

Notes: **Bold** text indicates potentially unacceptable intersection operations.

1. Signal = Signalized Intersection; SSSC = Side-street stop-controlled intersections; traffic on the main street does not stop while traffic on the side-street is controlled by a stop sign.
2. Delay presented in seconds per vehicle; for side-street stop-controlled intersections, delay presented in Intersection average (worst approach).
3. LOS = Level of Service.
4. Delay presented in table for Intersection 2 average delay/LOS. Near-Term + Park Delay/LOS for specific movements from the off-ramp as follows:
    a. PM Peak Hour: EB left = 54.6/D, EB thru = 31.5/C, EB right = 28.9/C
    b. Sat Peak Hour: EB left = 57.9/E, EB thru = 31.2/C, EB right = 29.4/C
5. Delay presented in table for Intersection 3 average delay/LOS. Near-Term + Park Delay/LOS for specific movements from the off-ramp as follows:
    a. PM Peak Hour: NB left = 43.8/D, NB thru/right = 42.2/D, SB left = 45.8/D, SB thru-right = 36.3/D
    b. Sat Peak Hour: NB left = 42.9/D, NB thru-right = 37.5/D, SB left = 42.6/D, SB thru-right = 36.7/D
6. Delay presented in table for Intersection 8 average delay/LOS. Near-Term + Park Delay/LOS for specific movements from the off-ramp as follows:
    a. PM Peak Hour: NB left = 29.1/C, NB thru/right = 29.5/C
    b. Sat Peak Hour: NB left = 13.1/B, NB thru-right = 13.4/B
7. Delay presented in table for Intersection 2 average delay/LOS. Near-Term + Park + Project Delay/LOS for specific movements from the off-ramp as follows:
    a. PM Peak Hour: EB left = 54.6/D, EB thru = 31.6/C, EB right = 28.9/C
    b. Sat Peak Hour: EB left = 58.0/E, EB thru = 31.2/C, EB right = 29.4/C
8. Delay presented in table for Intersection 3 average delay/LOS. Near-Term + Park + Project Delay/LOS for specific movements from the off-ramp as follows:
    a. PM Peak Hour: NB left = 43.8/D, NB thru/right = 42.2/D, SB left = 46.3/D, SB thru-right = 36.3/D
    b. Sat Peak Hour: NB left = 42.9/D, NB thru-right = 37.6/D, SB left = 43.5/D, SB thru-right = 36.7/D
9. Delay presented in table for Intersection 8 average delay/LOS. Near-Term + Park + Project Delay/LOS for specific movements from the off-ramp as follows:
    a. PM Peak Hour: NB left = 29.1/C, NB thru/right = 29.7/C
    b. Sat Peak Hour: NB left = 13.0/B, NB thru-right = 13.5/B

Source: Fehr & Peers, October 2014.

6.0 CUMULATIVE CONDITIONS

This chapter presents the results of the level of service calculations under Cumulative conditions without and with the project.

6.1 CUMULATIVE INTERSECTION VOLUMES

Traffic volumes for the Cumulative condition were based on a similar approach to the near-term forecasts. Traffic forecasts from the near-term condition for intersections along the Grand Avenue and Mandela Parkway corridors were increased by 20 percent to forecast cumulative conditions. For the two intersections on 7th Street, 40 percent growth was used to forecast cumulative volumes. The same growth rate was applied to weekday PM and Saturday peak hour traffic volumes. Estimated traffic volumes from the Gateway Park project were then added to the resulting forecasts to develop Cumulative without Project traffic volumes as shown on **Figure 15**. Path project traffic was then added to develop Cumulative with Project traffic volumes, as shown on **Figure 16**.

6.2 CUMULATIVE ROADWAY IMPROVEMENTS

Class 2 bicycle lanes are proposed to be installed on Adeline Street and West Grand Avenue within the study area. With the installation of bicycle lanes, a reduction in the number of vehicle travel lanes would occur - commonly referred to as a road-diet. The resulting lane configurations are shown on Figure 15 for the Cumulative without Project condition.

Intersection improvements at the Grand Avenue/Mandela Street intersection to accommodate enhanced bicycle and pedestrian facilities were considered in the analysis of project conditions. The resulting lane configurations are shown on Figure 16 for the Cumulative with Project condition.

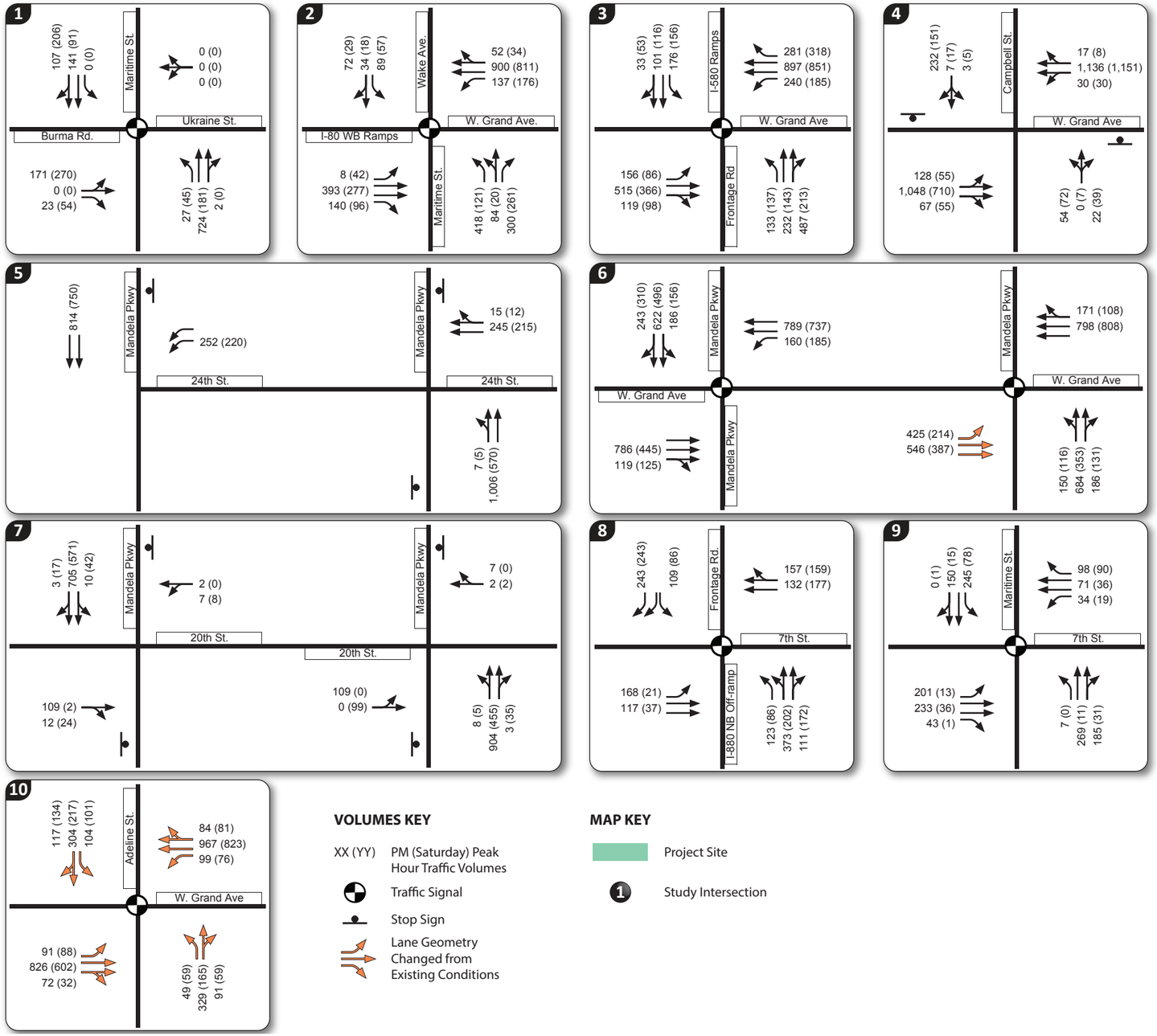


Figure 15.

Cumulative without Project
Peak Hour Volumes, Lane Configurations and Traffic Control

Graphics for Connection Report\WC12-2992_15_CumuVols

FEHR & PEERS

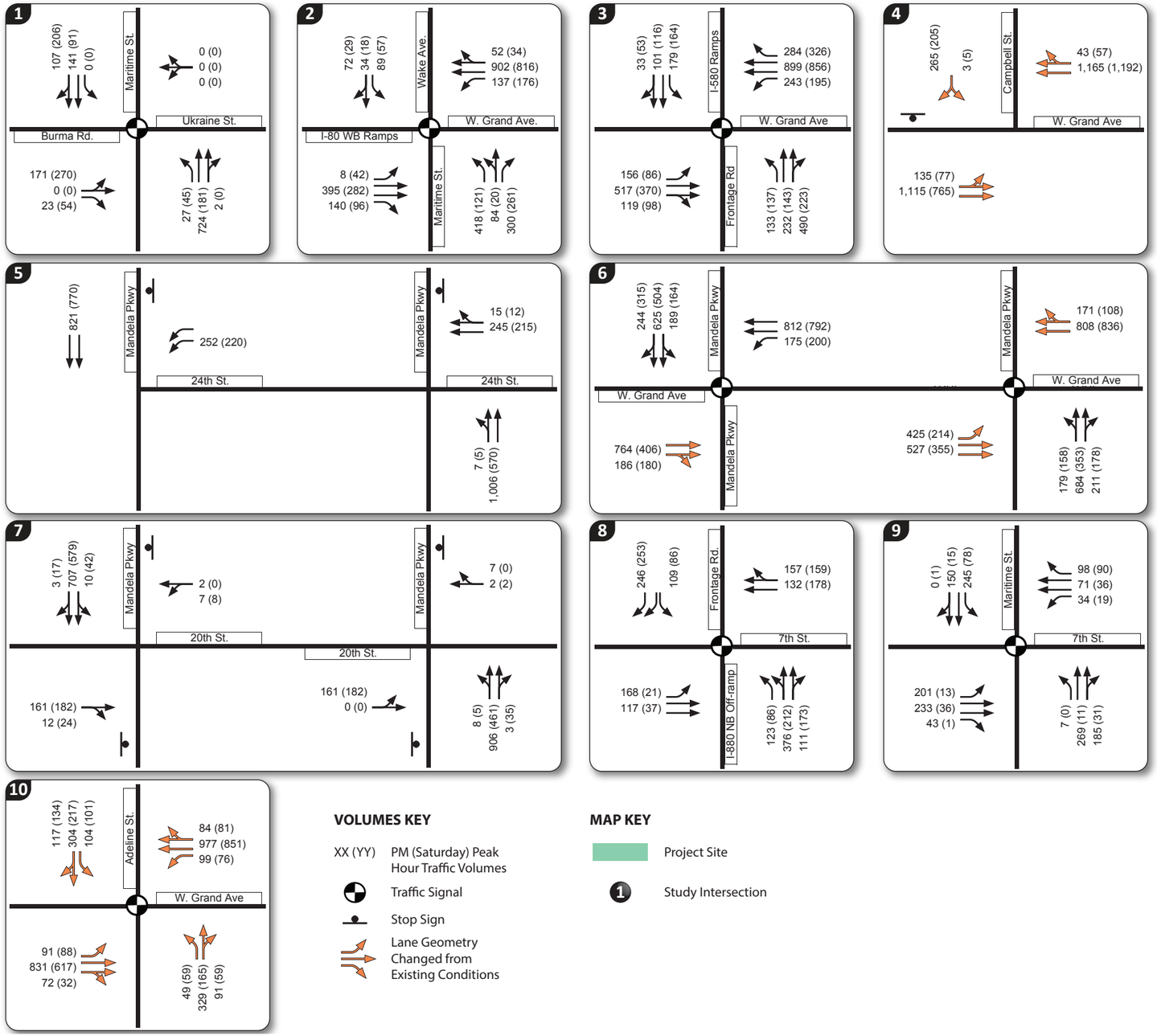


Figure 16.

Cumulative with Project
Peak Hour Volumes, Lane Configurations and Traffic Control

Graphics for Connection Report\WC12-2992_16_Cumu+ProjVols

FEHR & PEERS

6.3 CUMULATIVE INTERSECTION LEVELS OF SERVICE

Level of service calculations were conducted to evaluate intersection operations under Cumulative conditions both without and with the project. Traffic signal timings were optimized to better accommodate the changes to traffic flow projected at the study intersections but heavy vehicle percentages were unchanged from the analysis of Existing conditions. The LOS results are summarized in **Table 15**. The corresponding LOS calculation sheets are included in **Appendix B**.

The results of the LOS calculations indicate that in the Cumulative condition, the Grand Avenue/Frontage Road/I-580 Ramp and 7th Street/Maritime Street intersections would operate at an overall unacceptable service level during at least one peak hour. At the Grand Avenue/Campbell Street intersection, the side-street movements would experience significant delay. Peak hour signal warrants would continue to be satisfied at the Campbell Street/Grand Avenue intersection when considering the southbound right-turn movement. Signalization is not recommended.

With the addition of project traffic, the Grand Avenue/Frontage Road intersection would further degrade, but not to a level of significance. The Mandela Parkway (Northbound)/Grand Avenue intersection would degrade to LOS E in the cumulative condition prior to the addition of project traffic. With the addition of project traffic, operations would degrade to LOS F conditions. The project is not expected to increase traffic at the 7th Street/Maritime Street intersection; therefore, the impact to this intersection from the Path project is less-than-significant.

The remaining study intersections are projected to operate at an overall LOS D or better during both the weekday PM and Saturday afternoon peak hours without or with the Path project in the Cumulative condition. Peak hour traffic signal warrants would not be satisfied at the other unsignalized intersections in the cumulative condition without or with the addition of project traffic.

TABLE 15
CUMULATIVE WITHOUT AND WITH PROJECT PEAK HOUR INTERSECTION LEVEL OF SERVICE

	Intersection	Control[1]	Peak Hour	Cumulative		Cumulative with Project		Significant Impact?
				Delay[2]	LOS[3]	Delay[2]	LOS[3]	
1	Burma Road/Maritime Street	Signal	PM SAT	14.2 13.1	B B	14.3 13.1	B B	No No
2	I-80 Ramps/West Grand Avenue/ Maritime Street/Wake Avenue[4&7]	Signal	PM SAT	29.5 45.2	C C	29.5 45.5	C D	No No

TABLE 15
CUMULATIVE WITHOUT AND WITH PROJECT PEAK HOUR INTERSECTION LEVEL OF SERVICE

	Intersection	Control[1]	Peak Hour	Cumulative		Cumulative with Project		Significant Impact?
				Delay[2]	LOS[3]	Delay[2]	LOS[3]	
3	West Grand Avenue/Frontage Road/I-80 Ramps[5&8]	Signal	PM SAT	**119.4 (v/c=0.91)** **113.5 (v/c=0.74)**	**F** **F**	**120.8 (v/c=0.92)** **114.2 (v/c=0.75)**	**F** **F**	No No
4	West Grand Avenue/Campbell Street	SSSC	PM SAT	19.3 (> 200) 34.0 (> 200)	A (F) A (F)	<10 (16.6) <10 (15.5)	A (C) A (C)	No No
5A	24th Street/Mandela Parkway Southbound	SSSC	PM SAT	<10 (13.4) <10 (12.8)	A (B) A (B)	<10 (13.4) <10 (12.9)	A (B) A (B)	No No
5B	24th Street/Mandela Parkway Northbound	SSSC	PM SAT	<10 (45.5) <10 (17.4)	A (C) A (B)	<10 (45.6) <10 (17.4)	A (E) A (C)	No No
6A	West Grand Avenue/Mandela Parkway Southbound	Signal	PM SAT	23.9 14.5	C B	25.7 15.5	C B	No No
6B	West Grand Avenue/Mandela Parkway Northbound	Signal	PM SAT	79.3 26.8	E C	**98.2 (v/c=1.66)** 42.5	**F** D	Yes No
7A	20th Street/Mandela Parkway Southbound	SSSC	PM SAT	<10 (21.2) <10 (22.4)	A (C) A (C)	<10 (26.9) <10 (27.1)	A (D) A (D)	No No
7B	20th Street/Mandela Parkway Northbound	SSSC	PM SAT	<10 (17.1) <10 (15.8)	A (B) A (B)	<10 (19.7) <10 (15.6)	A (C) A (C)	No No
8	7th Street/I-880 Northbound Off-Ramp/Frontage Road[6&9]	Signal	PM SAT	31.1 19.4	C B	31.2 19.4	C B	No No
9	7th Street/Maritime Street	Signal	PM SAT	**89.0 (v/c=0.75)** 36.7	**F** D	**89.0 (v/c=0.75)** 36.7	**F** D	No No
10	West Grand Avenue/Adeline Street	Signal	PM SAT	52.7 42.3	D D	53.4 44.0	D D	No No

Notes: **Bold** text indicates potentially unacceptable intersection operations.

1. Signal = Signalized Intersection; SSSC = Side-street stop-controlled intersections; traffic on the main street does not stop while traffic on the side-street is controlled by a stop sign.
2. Delay presented in seconds per vehicle; for side-street stop-controlled intersections, delay presented in Intersection average (worst approach).
3. LOS = Level of Service.
4. Delay presented in table for Intersection 2 average delay/LOS. Cumulative without Project Delay/LOS for specific movements from the off-ramp as follows:
    a. PM Peak Hour: EB left = 103.7/F, EB thru = 26.3/C, EB right = 23.5/C
    b. Sat Peak Hour: EB left = 78.7/E, EB thru = 28.2/C, EB right = 26.3/C

5. Delay presented in table for Intersection 3 average delay/LOS. Cumulative without Project Delay/LOS for specific movements from the off-ramp as follows:
    a. PM Peak Hour: NB left = 48.4.6/D, NB thru/right = 63.2/E, SB left = 53.6/D, SB thru-right = 36.5/D
    b. Sat Peak Hour: NB left = 46.5/D, NB thru-right = 38.2/D, SB left = 46.5/D, SB thru-right = 37.0/D
6. Delay presented in table for Intersection 8 average delay/LOS. Cumulative without Project Delay/LOS for specific movements from the off-ramp as follows:
    a. PM Peak Hour: NB left = 31.2/C, NB thru/right = 33.0/C
    b. Sat Peak Hour: NB left = 14.3/B, NB thru-right = 14.8/B
7. Delay presented in table for Intersection 2 average delay/LOS. Cumulative with Project Delay/LOS for specific movements from the off-ramp as follows:
    a. PM Peak Hour: EB left = 103.7/D, EB thru = 26.3/C, EB right = 23.5/C
    b. Sat Peak Hour: EB left = 78.8/E, EB thru = 28.2/C, EB right = 26.2/C
8. Delay presented in table for Intersection 3 average delay/LOS. Cumulative with Project Delay/LOS for specific movements from the off-ramp as follows:
    a. PM Peak Hour: NB left = 48.4/D, NB thru/right = 67.5/E, SB left = 54.8/D, SB thru-right = 36.5/D
    b. Sat Peak Hour: NB left = 46.5/D, NB thru-right = 38.3/D, SB left = 48.0/D, SB thru-right = 37.0/D
9. Delay presented in table for Intersection 8 average delay/LOS. Cumulative with Project Delay/LOS for specific movements from the off-ramp as follows:
    a. PM Peak Hour: NB left = 31.2/C, NB thru/right = 33.2/C
    b. Sat Peak Hour: NB left = 14.3/B, NB thru-right = 14.9/B

Source: Fehr & Peers, October 2014.

6.4 CUMULATIVE INTERSECTION IMPACTS AND MITIGATION MEASURES

This section evaluates the intersection LOS results presented in Table 15 compared to the results with the criteria for significant impacts, and presents mitigation measures for identified impacts.

Impact TR-1: Intersection 3 - West Grand Avenue/Frontage Road/I-80 Ramps

The addition of project-generated vehicle trips during the PM and Saturday peak hours would worsen LOS F conditions, but would not increase the v/c ratio by more than 0.03. Therefore, the impact is considered ***less-than-significant*** based on City of Oakland Significance Criteria 5 and 18 (see Chapter 1).

Mitigation Measure TR-1: Although the impact is less-than-significant, the project would contribute to poor intersections operations. Upgrading the traffic signal equipment at the intersection to provide video detection for vehicles and bicycles would allow for better allocation of the green time to movements, improving the LOS to D for vehicles in both the weekday PM and Saturday afternoon peak hours, as shown in **Table 16.** Should the City of Oakland and Caltrans upgrade the traffic signal equipment at this intersection, the project should make a fair-share contribution to the construction of the improvement.

Impact TR-2: Intersection 6B - West Grand Avenue/Mandela Parkway (Northbound)

The addition of project-generated vehicle trips during the weekday PM peak hours would result in LOS F conditions. This is a ***significant impact*** based on City of Oakland Significance Criteria 2 (see Chapter 1).

Mitigation Measure TR-2: Install protected-permitted phasing for the eastbound left-turn movement and upgrade the traffic signal equipment as necessary to provide video detection for bicyclists. This improvement would result in LOS E conditions during the weekday PM peak hour, as shown in **Table 16.** Implementation of this measure would reduce the project impact to a ***less-than-significant*** level.

TABLE 16
CUMULATIVE WITH PROJECT WITH MITIGATION
PEAK HOUR INTERSECTION LEVEL OF SERVICE

Intersection		Peak Hour	Cumulative without Project		Cumulative With Project		Cumulative With Project With Mitigation	
			Delay[1]	LOS[2]	Delay[1]	LOS[2]	Delay[1]	LOS[2]
3	West Grand Avenue/Frontage Road/I-80 Ramps[3,4&5]	AM	**119.4 (v/c=0.91)**	**F**	**120.8 (v/c=0.92)**	**F**	55.5	E
		PM	**113.5 (v/c=0.74)**	**F**	**114.2 (v/c=0.75)**	**F**	36.9	D
6B	West Grand Avenue/Mandela Parkway Northbound	AM	79.3	E	**98.2 (v/c=1.66)**	**F**	50.4	D
		PM	26.8	C	42.5	D	25.9	C

Notes: **Bold** text indicates potentially unacceptable intersection operations.
1. Delay presented in seconds per vehicle
2. LOS = Level of Service.
3. Delay presented in table for Intersection 3 average delay/LOS. Cumulative without Project Delay/LOS for specific movements from the off-ramp as follows:
    a. PM Peak Hour: NB left = 48.4.6/D, NB thru/right = 63.2/E, SB left = 53.6/D, SB thru-right = 36.5/D
    b. Sat Peak Hour: NB left = 46.5/D, NB thru-right = 38.2/D, SB left = 46.5/D, SB thru-right = 37.0/D
4. Delay presented in table for Intersection 3 average delay/LOS. Cumulative with Project Delay/LOS for specific movements from the off-ramp as follows:
    a. PM Peak Hour: NB left = 48.4/D, NB thru/right = 67.5/E, SB left = 54.8/D, SB thru-right = 36.5/D
    b. Sat Peak Hour: NB left = 46.5/D, NB thru-right = 38.3/D, SB left = 48.0/D, SB thru-right = 37.0/D
5. Delay presented in table for Intersection 3 average delay/LOS. Cumulative with Project With Mitigation Delay/LOS for specific movements from the off-ramp as follows:
    a. PM Peak Hour: NB left = 46.8/D, NB thru/right = 64.3/E, SB left = 62.2/D, SB thru-right = 39.2/D
    b. Sat Peak Hour: NB left = 44.9/D, NB thru-right = 37.1/D, SB left = 45.6/D, SB thru-right = 35.8/D

Source: Fehr & Peers, October 2014.

6.4.1 IMPACTS TO TRANSIT TRAVEL TIME

This section discusses the potential of the project to substantially increase travel times for AC transit buses (Significance Criteria 9). Although the project has the potential to increase traffic volumes along Grand Avenue where AC Transit Route NL and Line 31 operate, implementation of mitigation measures TR-1 and TR-2 could decrease travel time along the corridor by reducing intersection delay. Therefore, the impact to transit travel time is considered ***less-than-significant***.

7.0 ALAMEDA COUNTY TRANSPORTATION COMMISSION ROADWAY ANALYSIS

A separate analysis of regional roadways is required to comply with requirements of the Alameda County Transportation Commission (ACTC). The ACTC requires the analysis of project impacts to Metropolitan Transportation System (MTS) roadways identified in the Congestion Management Plan (CMP) for development projects that would generate more than 100 weekday PM peak hour trips. As the project is not projected to generate more than 100 weekday PM peak hour trips, no analysis of the MTS roadway system was conducted.

8.0 OTHER TRANSPORTATION THRESHOLDS

This chapter discusses conditions in the study area for pedestrians, bicyclists and transit users with the project and reviews traffic safety thresholds and other thresholds as described in Chapter 1.

8.1 TRAFFIC SAFETY THRESHOLDS

The following traffic safety thresholds as set by the City of Oakland were reviewed:

10. Directly or indirectly cause or expose roadway users (e.g., motorists, pedestrians, bus riders, bicyclists) to a permanent and substantial transportation hazard due to a new or existing physical design feature or incompatible uses
11. Directly or indirectly result in a permanent substantial decrease in pedestrian safety
12. Directly or indirectly result in a permanent substantial decrease in bicyclist safety
13. Directly or indirectly result in a permanent substantial decrease in bus rider safety
14. Generate substantial multi-modal traffic traveling across at-grade railroad crossings that cause or expose roadway users (e.g., motorists, pedestrians, bus riders, bicyclists) to a permanent and substantial transportation hazard

The proposed project would increase motor vehicle traffic, pedestrian and bicycle activity in the West Oakland area. The Path project is not expected to attract new bus riders to the transit system in the area.

8.1.1 TRANSPORTATION HAZARDS

The Path project is intended to separate bicycle and pedestrian travel from motor vehicle travel, reducing potential conflicts between different roadway users. Access to the Path from the east would be from West Grand Avenue at Mandela Parkway. Access to the Path from users that park within the Wood Street parking lot would be from new Class 2 bicycle lanes marked on Wood Street, 20th Street, Willow Street and Campbell Street, connecting to the at-grade section of the path between Mandela Parkway and Campbell Street. The Path would provide a physical separation between Path users (pedestrians and bicyclists) and motor vehicle traffic for most of its length, reducing hazards.

At the West Grand Avenue/Frontage Road/I-80 Ramps intersection, the project would add pedestrian and bicycle traffic to an intersection where the current pedestrian accommodations would be insufficient to accommodate increased demand.

Impact TR-3: Intersection 3 - West Grand Avenue/Frontage Road/I-80 Ramps intersection

The Path project would add pedestrian and bicycle traffic to an intersection that provides minimal pedestrian and bicycle accommodations. This is a ***significant impact*** based on City of Oakland Significance Criteria Thresholds 10, 11, and 12.

Mitigation Measure TR-3: Upgrade the marked crosswalk along the south leg of the intersection to be the same width as the Path and provide a refuge area sufficient to accommodate a platoon of 5 to 10 bicyclists or pedestrians. Install a pedestrian and bicycle signals and upgrade the traffic signal equipment as necessary to accommodate the pedestrian and bicycle movement across the intersection. With installation of video detection for both bicyclists and vehicles, the improvements are not projected to degrade the automobile level of service at the intersection. Implementation of this measure would reduce the project impact to a ***less-than-significant*** level.

Path Design

The Path would be constructed in five sections, as described in Chapter 3, with varying widths reflective of right-of-way constraints. As the project is intended to accommodate both bicycle and pedestrian travel, there could be some conflicts between bicyclists and pedestrians. Generally, the path is being designed to provide ten feet for bicyclists (five foot lanes in each direction), a five foot area for pedestrians, and a two foot shy area for fencing within a 17-foot cross section. The Segment 3 overcrossing structure would have a width of fourteen feet (ten foot clear area and four feet for shoulders to accommodate fencing); the width is reduced in this area due to the railroad tracks. The Caltrans *Highway Design Manual* (Chapter 1000) specifies a minimum width of eight feet for a two-way bike path, with ten-feet preferred. Where a path is on a structure, the minimum width of the path is fourteen feet, to provide ten feet for travel and a four foot shoulder area.

The Path as currently proposed would meet or exceed Caltrans standards for Class 1 path design. The volume of pedestrian and bicycle travel expected along the Path is expected to be less than 10 percent of the total pedestrian and bicycle traffic that is expected through the Park area and the East Span of the Bay Bridge, as presented in Chapter 4, with higher levels of bicycle activity than pedestrian activity. This level of activity would result in 140 to 450 Path users on a typical weekday and 430 to 830 Path users on a weekend day, with less activity during an individual hour.

A Trail Level of Service (LOS) Calculator as developed by North Carolina State University and Toole Design Group, based on the Federal Highway Administration *Shared-Use Path Level of Service Calculator—A User's Guide,* July 2006, was used to assess the Pedestrian/Bicycle LOS on the Path, which considers factors such as bicyclist passing, desired buffer space between path users, and the mix of bicyclists, pedestrians, runners and child bicyclists. Based on the weekend peak hour pedestrian/bicycle volume estimate

(between 60 and 120 trail users in a peak hour) on the Path, the Trail LOS is B for the segments with a 17-foot cross section and LOS C for segments with a 14-foot cross section, meaning that pedestrians and bicyclists can generally travel fairly unimpeded along the Path, although some bicyclists may have to wait to pass a slower moving bicyclist. Trail operations would be better during other times of day and week.

Approximately 500 users per hour could be accommodated on the Path at LOS D condition, which is considered the functional capacity of a trail. When these conditions are experienced, bicyclists are likely to avoid peak periods or adjust expectations of path operations. Segment 3 of the Path constrains the volume of pedestrian and bicycle travel that could be accommodated along the entire Path corridor.

Bicycle/Pedestrian conflicts could exist where the Path would connect to the existing Bay Bridge Trail, below the I-880/I-80 connection.

Impact TR-4: Pedestrian/Bicycle Conflicts – Connection of Path to Existing Bay Bridge Trail

The Path project would add a connection to the existing Bay Bridge Trail, resulting in bicycle/pedestrian conflicts at the intersection. As this could create a hazard for pedestrians and bicyclists, this is a potentially ***significant impact*** based on City of Oakland Significance Criteria Threshold 10.

Mitigation Measure TR-4: Provide additional Path width in the vicinity of the Bay Bridge Trail intersection, directional signage and striping, and potentially a bicycle stop sign on the Path at the Bay Trail connection. Implementation of this measure would reduce the Pedestrian Safety impact to a ***less-than-significant*** level.

8.1.2 PEDESTRIAN SAFETY

The project would add a separated bicycle and pedestrian path connecting West Oakland to the Bay Bridge Trail that would be open at all times. Sidewalks and paths are provided in the project vicinity along Grand Avenue and Mandela Parkway, connecting to the Path, as well as crosswalks and pedestrian signals. Some Path pedestrians could use the Wood Street parking lot. Although sidewalks are provided on some of the streets around the parking lot, they are discontinuous in the area.

Impact TR-5: Pedestrian Safety

The Path project could add pedestrian demand between the Wood Street parking lot and the start of the Path at Mandela Parkway, a distance of approximately 1/4-mile. As sidewalks are discontinuous in this area and street lighting is intermittent, this is a

potentially ***significant impact*** based on City of Oakland Significance Criteria Threshold 11.

Mitigation Measure TR-5: Identify the pedestrian path of travel between the Wood Street parking lot and the Path. Install sidewalks, crosswalks, pedestrian scale lighting, and way-finding elements as necessary along the pedestrian path of travel. Implementation of this measure would reduce the Pedestrian Safety impact to a ***less-than-significant*** level.

8.1.3 BICYCLE SAFETY

The project would add a separated bicycle and pedestrian path connecting West Oakland to the Bay Bridge Trail which would enhance bicycle safety by adding a separated bicycle facility where there currently is none. The Path would have lighting and access provided 24-hours a day. Some Path bicyclists could use the Wood Street parking lot and access the Path from the Class 2 bicycle facilities proposed on the streets connecting the Wood Street parking lot and the Path.

Segment 4 of the Path contains a 180 degree curve on a 2 percent grade to transition from the elevated structure to grade level. Based on guidance provided in the Caltrans *Highway Design Manual*, 5 percent grade is the maximum allowed for short segments, and 2 percent is recommended for sustained grades.

Impact TR-6a: Bicycle Safety

The Path project would add bicycle demand between the Wood Street parking lot and the start of the Path at Mandela Parkway, a distance of approximately 1/4-mile. The project could add Class 2 bicycle facilities in this area, if funding is available. If the Wood Street parking lot was constructed without the accompanying bicycle facilities, this is a potentially ***significant impact*** based on City of Oakland Significance Criteria Threshold 12 as new bicyclists demand would be added to an area without facilities to serve them.

Mitigation Measure TR-6a: When the Wood Street parking lot is constructed, construct bicycle facilities connecting the parking lot to the path, including crossing treatments, way-finding elements, and lighting as necessary along the path of travel. Implementation of this measure would reduce this Bicycle Safety impact to a ***less-than-significant*** level.

Impact TR-6b: Bicycle Safety

Based on information contained in Chapter 1000 of the Caltrans *Highway Design Manual*, the minimum design speed for a bicycle path is 20 miles per hour, with the minimum

radius of curvature at that design speed of 90 feet, which is not met with the current design.

Mitigation Measure TR-6b: Warning signs should be installed at the curve approaches for Segment 4 and clear lines of sight maintained between path sections. Consider providing a wider cross-section through the curve area. Implementation of this measure would reduce this Bicycle Safety impact to a ***less-than-significant*** level.

8.1.4 BUS RIDER SAFETY

The project is not expected to have a significant demand for public transit, nor would it change any existing transit facility. Therefore, the impact to bus rider safety is considered a ***less-than-significant.***

8.2 OTHER THRESHOLDS

The following additional transportation-related thresholds as set by the City of Oakland were reviewed:

15. Fundamentally conflict with adopted City policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities adopted for the purpose of avoiding or mitigating an environmental effect and actually result in a physical change in the environment
16. Result in a substantial, though temporary, adverse effect on the circulation system during construction of the project
17. Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks

8.2.1 CONSISTENCY WITH ADOPTED POLICIES, PLANS OR PROGRAMS SUPPORTING ALTERNATIVE TRANSPORTATION

The discussion of consistency with adopted policies, plans or programs supporting alternative transportation is based on application of Significance Threshold 15. A discussion of applicable policies and plans is provided below. In general, the proposed project is consistent with these policies, plans and programs, and would not cause a significant impact by conflicting with adopted policies, plans, or programs supporting public transit, bicycle, or pedestrian.

The City of Oakland General Plan Land Use Transportation Element (LUTE) and the City's Complete Streets Policy (84204 CMS), states a strong preference for encouraging the use of non-automobile transportation modes, such as transit, bicycling, and walking. The proposed project would encourage the use of non-

automobile transportation modes by providing additional bicycle and pedestrian facilities within the City of Oakland.

The proposed project would add Class 1 and Class 2 bicycle facilities along the West Grand Avenue corridor consistent with the City's *Bicycle Master Plan*. In addition, Recommendations TR-3, TR-4 and TR-5 would improve access, circulation, safety, and comfort for pedestrian and bicyclists further encouraging the use of these modes in the project vicinity. Based on our review, the Path project would not conflict with adopted City policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities. This is a ***less-than-significant*** impact, and no mitigation measures are required.

8.2.2 CONSTRUCTION-PERIOD IMPACTS

Project construction is expected to take place over a two-year period between 2017 and 2019. During the construction period, temporary and intermittent transportation impacts may result from truck movements as well as construction worker vehicles to and from the project site. The construction-related traffic may temporary reduce capacities of roadways in the project vicinity because of the slower movements and larger turning radii of construction trucks compared to passenger vehicles.

The City of Oakland Construction Traffic and Parking Standard Condition of Approval (SCA) requires that a Construction Traffic Management Plan be developed as part of a larger Construction Management Plan to address potentially significant impacts during the project's construction. Thus, with the implementation of this SCA, the proposed project would not result in a substantial, though temporary, adverse effect on the circulation system during construction of the project. This is a ***less-than-significant*** impact, and no mitigation measures are required.

8.2.3 CHANGES IN AIR TRAFFIC PATTERNS

The Oakland International Airport is located about seven miles southeast of the project site. The project would be at the same level as existing structures in the area and are not expected to interfere with current flight patterns of Oakland International Airport or other nearby airports. Therefore, the proposed project would not result in changes to air traffic patterns. This is a ***less-than-significant*** impact, and no mitigation measures are required.

APPENDIX A: INTERSECTION COUNT DATA SHEETS

ALL TRAFFIC DATA

City of Oakland
All Vehicles on Unshifted
Peds & Bikes on Bank 1
Heavy Trucks on Bank 2

(916) 771-8700
orders@atdtraffic.com

File Name : 13-7630-001 Maritime Street-Burma Road.ppd
Date : 10/29/2013

Unshifted Count = All Vehicles

	Maritime Street Southbound					Driveway Westbound					Maritime Street Northbound					Burma Road Eastbound						
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total	Uturn Total
16:00	0	24	2	0	26	0	0	0	0	0	1	71	0	0	72	14	0	2	0	16	114	0
16:15	0	25	5	0	30	0	0	0	0	0	2	103	1	0	106	21	0	3	0	24	160	0
16:30	0	21	1	0	22	0	0	0	0	0	1	115	0	0	116	10	0	1	0	11	149	0
16:45	0	19	0	0	19	0	0	0	0	0	1	125	0	0	126	14	0	1	0	15	160	0
Total	0	89	8	0	97	0	0	0	0	0	5	414	1	0	420	59	0	7	0	66	583	0
17:00	0	19	3	0	22	0	0	0	0	0	0	88	0	0	88	20	0	1	0	21	131	0
17:15	0	24	1	0	25	0	0	0	0	0	0	58	0	0	58	39	0	3	0	42	125	0
17:30	0	46	2	0	48	0	0	0	0	0	0	59	0	0	59	36	0	1	0	37	144	0
17:45	1	44	1	1	47	0	0	1	0	1	1	36	0	0	37	21	0	0	0	21	106	1
Total	1	133	7	1	142	0	0	1	0	1	1	241	0	0	242	116	0	5	0	121	506	1
Grand Total	1	222	15	1	239	0	0	1	0	1	6	655	1	0	662	175	0	12	0	187	1089	1
Apprch %	0.4%	92.9%	6.3%	0.4%		0.0%	0.0%	100.0%	0.0%		0.9%	98.9%	0.2%	0.0%		93.6%	0.0%	6.4%	0.0%			
Total %	0.1%	20.4%	1.4%	0.1%	21.9%	0.0%	0.0%	0.1%	0.0%	0.1%	0.6%	60.1%	0.1%	0.0%	60.8%	16.1%	0.0%	1.1%	0.0%	17.2%	100.0%	

PM PEAK HOUR	Maritime Street Southbound					Driveway Westbound					Maritime Street Northbound					Burma Road Eastbound					
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total
Peak Hour Analysis From 16:15 to 17:15																					
Peak Hour For Entire Intersection Begins at 16:15																					
16:15	0	25	5	0	30	0	0	0	0	0	2	103	1	0	106	21	0	3	0	24	160
16:30	0	21	1	0	22	0	0	0	0	0	1	115	0	0	116	10	0	1	0	11	149
16:45	0	19	0	0	19	0	0	0	0	0	1	125	0	0	126	14	0	1	0	15	160
17:00	0	19	3	0	22	0	0	0	0	0	0	88	0	0	88	20	0	1	0	21	131
Total Volume	0	84	9	0	93	0	0	0	0	0	4	431	1	0	436	65	0	6	0	71	600
% App Total	0.0%	90.3%	9.7%	0.0%		0.0%	0.0%	0.0%	0.0%		0.9%	98.9%	0.2%	0.0%		91.5%	0.0%	8.5%	0.0%		
PHF	.000	.840	.450	.000	.775	.000	.000	.000	.000	.000	.500	.862	.250	.000	.865	.774	.000	.500	.000	.740	.938

ALL TRAFFIC DATA

City of Oakland
All Vehicles on Unshifted
Peds & Bikes on Bank 1
Heavy Trucks on Bank 2

(916) 771-8700
orders@atdtraffic.com

File Name : 13-7630-002 Maritime Street-West Grand Avenue.ppd
Date : 10/29/2013

Unshifted Count = All Vehicles

	Wake Avenue Southbound					West Grand Avenue Westbound					Maritime Street Northbound					I-80 Ramps Eastbound						
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total	Uturn Total
16:00	13	10	11	0	34	6	111	6	0	123	32	20	30	0	82	3	47	12	1	63	302	1
16:15	24	5	26	0	55	7	103	6	0	116	53	28	40	0	121	1	39	16	0	56	348	0
16:30	21	6	15	0	42	7	115	7	0	129	62	29	39	0	130	1	54	7	2	64	365	2
16:45	12	8	12	0	32	7	111	12	0	130	68	19	44	0	131	0	49	7	1	57	350	1
Total	70	29	64	0	163	27	440	31	0	498	215	96	153	0	464	5	189	42	4	240	1365	4
17:00	17	4	16	0	37	9	150	7	0	166	72	16	29	0	117	3	55	8	3	69	389	3
17:15	18	4	8	0	30	9	131	8	0	148	43	8	42	0	93	1	59	13	2	75	346	2
17:30	6	4	7	0	17	14	144	4	0	162	59	7	33	0	99	1	71	34	2	108	386	2
17:45	8	2	4	0	14	15	106	5	0	126	29	5	29	0	63	1	65	27	2	95	298	2
Total	49	14	35	0	98	47	531	24	0	602	203	36	133	0	372	6	250	82	9	347	1419	9
Grand Total	119	43	99	0	261	74	971	55	0	1100	418	132	286	0	836	11	439	124	13	587	2784	13
Apprch %	45.6%	16.5%	37.9%	0.0%		6.7%	88.3%	5.0%	0.0%		50.0%	15.8%	34.2%	0.0%		1.9%	74.8%	21.1%	2.2%			
Total %	4.3%	1.5%	3.6%	0.0%	9.4%	2.7%	34.9%	2.0%	0.0%	39.5%	15.0%	4.7%	10.3%	0.0%	30.0%	0.4%	15.8%	4.5%	0.5%	21.1%	100.0%	

PM PEAK HOUR	Wake Avenue Southbound					West Grand Avenue Westbound					Maritime Street Northbound					I-80 Ramps Eastbound					
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total
Peak Hour Analysis From 16:45 to 17:45																					
Peak Hour For Entire Intersection Begins at 16:45																					
16:45	12	8	12	0	32	7	111	12	0	130	68	19	44	0	131	0	49	7	1	57	350
17:00	17	4	16	0	37	9	150	7	0	166	72	16	29	0	117	3	55	8	3	69	389
17:15	18	4	8	0	30	9	131	8	0	148	43	8	42	0	93	1	59	13	2	75	346
17:30	6	4	7	0	17	14	144	4	0	162	59	7	33	0	99	1	71	34	2	108	386
Total Volume	53	20	43	0	116	39	536	31	0	606	242	50	148	0	440	5	234	62	8	309	1471
% App Total	45.7%	17.2%	37.1%	0.0%		6.4%	88.4%	5.1%	0.0%		55.0%	11.4%	33.6%	0.0%		1.6%	75.7%	20.1%	2.6%		
PHF	.736	.625	.672	.000	.784	.696	.893	.646	.000	.913	.840	.658	.841	.000	.840	.417	.824	.456	.667	.715	.945

ALL TRAFFIC DATA

City of Oakland
All Vehicles on Unshifted
Peds & Bikes on Bank 1
Heavy Trucks on Bank 2

(916) 771-8700
orders@atdtraffic.com

File Name : 13-7630-003 Frontage Road-West Grand Avenue.ppd
Date : 10/29/2013

Unshifted Count = All Vehicles

	I-80 Ramps Southbound					West Grand Avenue Westbound					Frontage Road Northbound					West Grand Avenue Eastbound						
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total	Uturn Total
16:00	21	17	2	0	40	26	100	54	0	180	16	33	47	0	96	22	47	18	0	87	403	0
16:15	14	17	4	0	35	31	114	50	0	195	12	50	66	0	128	24	65	21	0	110	468	0
16:30	14	11	4	0	29	34	115	38	0	187	15	34	62	0	111	23	67	20	0	110	437	0
16:45	23	13	2	0	38	46	93	36	0	175	20	46	79	0	145	22	67	13	0	102	460	0
Total	72	58	12	0	142	137	422	178	0	737	63	163	254	0	480	91	246	72	0	409	1768	0
17:00	22	14	6	0	42	43	130	41	0	214	21	35	69	0	125	17	65	21	1	104	485	1
17:15	30	12	1	0	43	30	143	49	0	222	18	34	64	0	116	22	75	21	0	118	499	0
17:30	30	21	5	0	56	24	134	41	0	199	18	23	78	0	119	26	76	14	0	116	490	0
17:45	27	16	2	0	45	38	123	37	0	198	12	24	65	0	101	13	68	14	0	95	439	0
Total	109	63	14	0	186	135	530	168	0	833	69	116	276	0	461	78	284	70	1	433	1913	1
Grand Total	181	121	26	0	328	272	952	346	0	1570	132	279	530	0	941	169	530	142	1	842	3681	1
Apprch %	55.2%	36.9%	7.9%	0.0%		17.3%	60.6%	22.0%	0.0%		14.0%	29.6%	56.3%	0.0%		20.1%	62.9%	16.9%	0.1%			
Total %	4.9%	3.3%	0.7%	0.0%	8.9%	7.4%	25.9%	9.4%	0.0%	42.7%	3.6%	7.6%	14.4%	0.0%	25.6%	4.6%	14.4%	3.9%	0.0%	22.9%	100.0%	

PM PEAK HOUR	I-80 Ramps Southbound					West Grand Avenue Westbound					Frontage Road Northbound					West Grand Avenue Eastbound					
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total
Peak Hour Analysis From 16:45 to 17:45																					
Peak Hour For Entire Intersection Begins at 16:45																					
16:45	23	13	2	0	38	46	93	36	0	175	20	46	79	0	145	22	67	13	0	102	460
17:00	22	14	6	0	42	43	130	41	0	214	21	35	69	0	125	17	65	21	1	104	485
17:15	30	12	1	0	43	30	143	49	0	222	18	34	64	0	116	22	75	21	0	118	499
17:30	30	21	5	0	56	24	134	41	0	199	18	23	78	0	119	26	76	14	0	116	490
Total Volume	105	60	14	0	179	143	500	167	0	810	77	138	290	0	505	87	283	69	1	440	1934
% App Total	58.7%	33.5%	7.8%	0.0%		17.7%	61.7%	20.6%	0.0%		15.2%	27.3%	57.4%	0.0%		19.8%	64.3%	15.7%	0.2%		
PHF	.875	.714	.583	.000	.799	.777	.874	.852	.000	.912	.917	.750	.918	.000	.871	.837	.931	.821	.250	.932	.969

ALL TRAFFIC DATA

City of Oakland
All Vehicles on Unshifted
Peds & Bikes on Bank 1
Heavy Trucks on Bank 2

(916) 771-8700
orders@atdtraffic.com

File Name : 13-7630-004 Campbell Street-West Grand Avenue.ppd
Date : 10/29/2013

Unshifted Count = All Vehicles

	Campbell Street Southbound					West Grand Avenue Westbound					Campbell Street Northbound					West Grand Avenue Eastbound						
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total	Uturn Total
16:00	0	0	28	0	28	4	148	1	1	154	9	1	9	0	19	7	104	11	3	125	326	4
16:15	0	0	32	0	32	5	157	2	0	164	6	0	6	0	12	14	122	10	1	147	355	1
16:30	1	0	38	0	39	2	148	2	1	153	8	0	2	0	10	16	135	5	3	159	361	4
16:45	1	0	38	0	39	1	159	3	1	164	5	0	0	0	5	13	141	10	10	174	382	11
Total	2	0	136	0	138	12	612	8	3	635	28	1	17	0	46	50	502	36	17	605	1424	20
17:00	0	1	47	0	48	6	151	3	0	160	13	0	3	0	16	14	135	6	6	161	385	6
17:15	0	1	48	0	49	3	173	2	1	179	7	0	4	0	11	11	163	13	6	193	432	7
17:30	1	2	38	0	41	5	159	2	1	167	7	0	6	0	13	12	161	11	4	188	409	5
17:45	1	1	31	0	33	4	151	0	0	155	16	1	2	0	19	8	140	18	4	170	377	4
Total	2	5	164	0	171	18	634	7	2	661	43	1	15	0	59	45	599	48	20	712	1603	22
Grand Total	4	5	300	0	309	30	1246	15	5	1296	71	2	32	0	105	95	1101	84	37	1317	3027	42
Apprch %	1.3%	1.6%	97.1%	0.0%		2.3%	96.1%	1.2%	0.4%		67.6%	1.9%	30.5%	0.0%		7.2%	83.6%	6.4%	2.8%			
Total %	0.1%	0.2%	9.9%	0.0%	10.2%	1.0%	41.2%	0.5%	0.2%	42.8%	2.3%	0.1%	1.1%	0.0%	3.5%	3.1%	36.4%	2.8%	1.2%	43.5%	100.0%	

PM PEAK HOUR	Campbell Street Southbound					West Grand Avenue Westbound					Campbell Street Northbound					West Grand Avenue Eastbound					
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total
Peak Hour Analysis From 16:45 to 17:45																					
Peak Hour For Entire Intersection Begins at 16:45																					
16:45	1	0	38	0	39	1	159	3	1	164	5	0	0	0	5	13	141	10	10	174	382
17:00	0	1	47	0	48	6	151	3	0	160	13	0	3	0	16	14	135	6	6	161	385
17:15	0	1	48	0	49	3	173	2	1	179	7	0	4	0	11	11	163	13	6	193	432
17:30	1	2	38	0	41	5	159	2	1	167	7	0	6	0	13	12	161	11	4	188	409
Total Volume	2	4	171	0	177	15	642	10	3	670	32	0	13	0	45	50	600	40	26	716	1608
% App Total	1.1%	2.3%	96.6%	0.0%		2.2%	95.8%	1.5%	0.4%		71.1%	0.0%	28.9%	0.0%		7.0%	83.8%	5.6%	3.6%		
PHF	.500	.500	.891	.000	.903	.625	.928	.833	.750	.936	.615	.000	.542	.000	.703	.893	.920	.769	.650	.927	.931

ALL TRAFFIC DATA

City of Oakland
All Vehicles on Unshifted
Peds & Bikes on Bank 1
Heavy Trucks on Bank 2

(916) 771-8700
orders@atdtraffic.com

File Name : 13-7630-005 Mandela Parkway-24th Street.ppd
Date : 10/29/2013

Unshifted Count = All Vehicles

	Mandela Parkway Southbound					24th Street Westbound					Mandela Parkway Northbound					Eastbound						
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total	Uturn Total
16:00	0	73	0	0	73	30	0	5	0	35	0	94	0	1	95	0	0	0	0	0	203	1
16:15	0	106	0	0	106	35	0	1	0	36	0	118	0	0	118	0	0	0	0	0	260	0
16:30	0	112	0	0	112	39	0	3	0	42	0	107	0	1	108	0	0	0	0	0	262	1
16:45	0	110	0	0	110	30	0	6	0	36	0	131	0	1	132	0	0	0	0	0	278	1
Total	0	401	0	0	401	134	0	15	0	149	0	450	0	3	453	0	0	0	0	0	1003	3
17:00	0	129	0	0	129	36	0	3	0	39	0	139	0	0	139	0	0	0	0	0	307	0
17:15	0	123	0	0	123	43	0	1	0	44	0	151	0	0	151	0	0	0	0	0	318	0
17:30	0	118	0	0	118	34	0	1	0	35	0	153	0	2	155	0	0	0	0	0	308	2
17:45	0	110	0	0	110	33	0	4	0	37	0	153	0	2	155	0	0	0	0	0	302	2
Total	0	480	0	0	480	146	0	9	0	155	0	596	0	4	600	0	0	0	0	0	1235	4
Grand Total	0	881	0	0	881	280	0	24	0	304	0	1046	0	7	1053	0	0	0	0	0	2238	7
Apprch %	0.0%	100.0%	0.0%	0.0%		92.1%	0.0%	7.9%	0.0%		0.0%	99.3%	0.0%	0.7%		0.0%	0.0%	0.0%	0.0%			
Total %	0.0%	39.4%	0.0%	0.0%	39.4%	12.5%	0.0%	1.1%	0.0%	13.6%	0.0%	46.7%	0.0%	0.3%	47.1%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	

PM PEAK HOUR	Mandela Parkway Southbound					24th Street Westbound					Mandela Parkway Northbound					Eastbound					
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total
Peak Hour Analysis From 17:00 to 18:00																					
Peak Hour For Entire Intersection Begins at 17:00																					
17:00	0	129	0	0	129	36	0	3	0	39	0	139	0	0	139	0	0	0	0	0	307
17:15	0	123	0	0	123	43	0	1	0	44	0	151	0	0	151	0	0	0	0	0	318
17:30	0	118	0	0	118	34	0	1	0	35	0	153	0	2	155	0	0	0	0	0	308
17:45	0	110	0	0	110	33	0	4	0	37	0	153	0	2	155	0	0	0	0	0	302
Total Volume	0	480	0	0	480	146	0	9	0	155	0	596	0	4	600	0	0	0	0	0	1235
% App Total	0.0%	100.0%	0.0%	0.0%		94.2%	0.0%	5.8%	0.0%		0.0%	99.3%	0.0%	0.7%		0.0%	0.0%	0.0%	0.0%		
PHF	.000	.930	.000	.000	.930	.849	.000	.563	.000	.881	.000	.974	.000	.500	.968	.000	.000	.000	.000	.000	.971

All Traffic Data

(916) 771-8700
orders@atdtraffic.com

City of Oakland
All Vehicles on Unshifted Tab
Bicycles on Bank 1 Tab
Heavy Trucks on Bank 2 Tab

File Name : 13-7630-006 Mandela Parkway-West Grand Avenue
Site Code : 00000000
Start Date : 10/29/2013
Page No : 1

Groups Printed- Unshifted

	Mandela Parkway Southbound						West Grand Avenue Westbound						Mandela Parkway Northbound						Peralta Street Northeastbound						West Grand Avenue Eastbound					
Start Time	Left	Thru	Bear Right	Right	Uturns	App. Total	Left	Bear Left	Thru	Right	Uturns	App. Total	Hard Left	Left	Thru	Right	Uturns	App. Total	Hard Left	Bear Left	Bear Right	Hard Right	App. Total	Left	Thru	Right	Hard Right	App. Total	Int. Total
16:00	23	46	6	29	0	104	13	8	113	20	0	154	0	12	61	26	0	99	0	0	0	0	0	43	50	17	7	117	474
16:15	16	68	7	48	1	140	9	11	101	28	1	150	0	17	68	16	1	102	0	0	0	0	0	55	64	5	2	126	518
16:30	29	75	17	31	1	153	7	5	112	25	0	149	0	21	79	31	0	131	0	0	0	0	0	51	70	19	4	144	577
16:45	18	76	10	38	2	144	7	9	111	28	0	155	0	15	75	28	0	118	0	0	0	0	0	52	76	13	0	141	558
Total	86	265	40	146	4	541	36	33	437	101	1	608	0	65	283	101	1	450	0	0	0	0	0	201	260	54	13	528	2127
17:00	29	80	10	43	0	162	5	13	93	29	0	140	0	26	92	32	0	150	0	0	0	0	0	56	68	14	3	141	593
17:15	24	84	11	42	3	164	12	11	121	23	0	167	0	24	102	22	0	148	0	0	0	0	0	62	90	11	1	164	643
17:30	30	76	13	34	1	154	13	10	109	22	0	154	0	19	116	31	0	166	0	0	0	0	0	62	89	19	3	173	647
17:45	22	86	10	21	2	141	14	16	117	28	1	176	0	18	97	26	0	141	0	0	0	0	0	64	59	14	4	141	599
Total	105	326	44	140	6	621	44	50	440	102	1	637	0	87	407	111	0	605	0	0	0	0	0	244	306	58	11	619	2482
Grand Total	191	591	84	286	10	1162	80	83	877	203	2	1245	0	152	690	212	1	1055	0	0	0	0	0	445	566	112	24	1147	4609
Apprch %	16.4	50.9	7.2	24.6	0.9		6.4	6.7	70.4	16.3	0.2		0	14.4	65.4	20.1	0.1		0	0	0	0		38.8	49.3	9.8	2.1		
Total %	4.1	12.8	1.8	6.2	0.2	25.2	1.7	1.8	19	4.4	0	27	0	3.3	15	4.6	0	22.9	0	0	0	0	0	9.7	12.3	2.4	0.5	24.9	

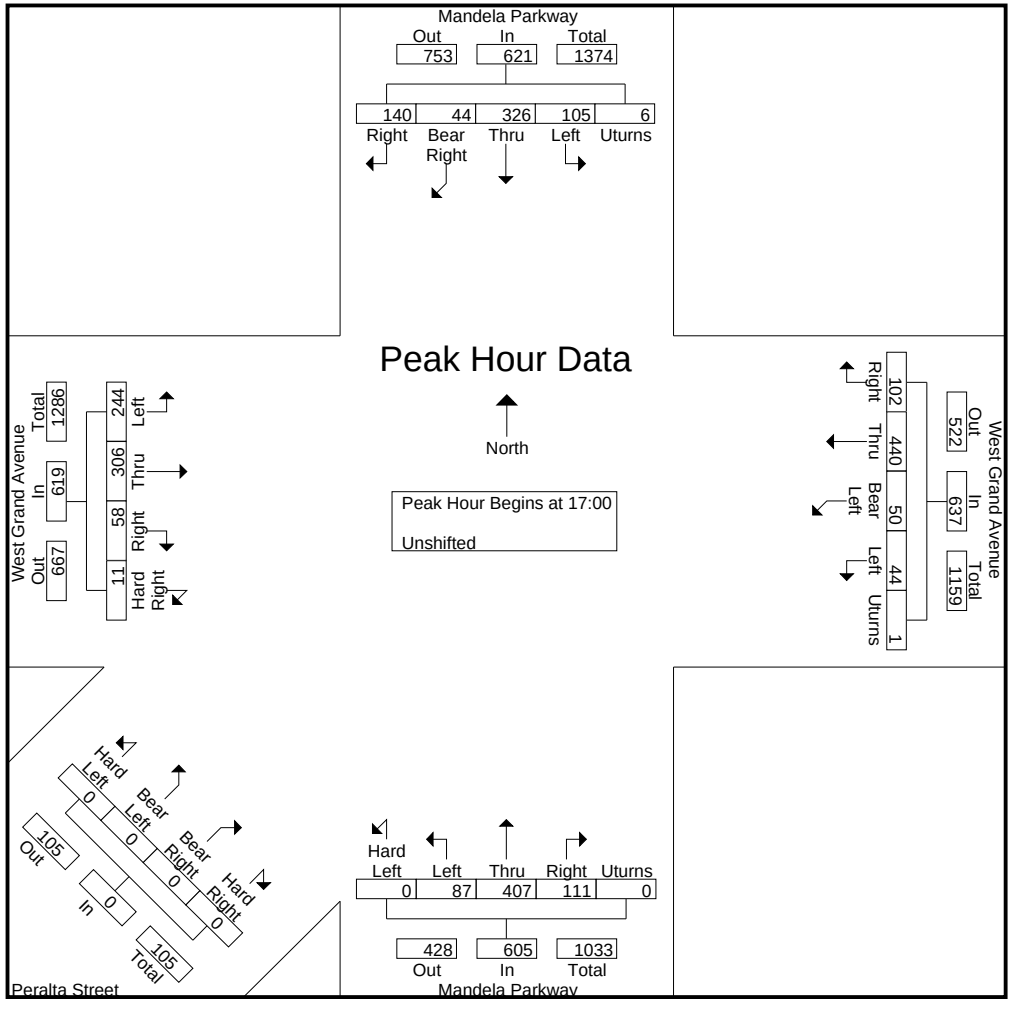
	Mandela Parkway Southbound						West Grand Avenue Westbound						Mandela Parkway Northbound						Peralta Street Northeastbound						West Grand Avenue Eastbound					
Start Time	Left	Thru	Bear Right	Right	Uturns	App. Total	Left	Bear Left	Thru	Right	Uturns	App. Total	Hard Left	Left	Thru	Right	Uturns	App. Total	Hard Left	Bear Left	Bear Right	Hard Right	App. Total	Left	Thru	Right	Hard Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																														
Peak Hour for Entire Intersection Begins at 17:00																														
17:00	**29**	**80**	**10**	**43**	0	162	5	13	93	**29**	0	140	0	**26**	92	**32**	0	150	0	0	0	0	0	56	68	14	3	141	593
17:15	24	84	11	42	**3**	**164**	12	11	**121**	23	0	167	0	24	102	22	0	148	0	0	0	0	0	62	**90**	11	1	164	643
17:30	**30**	76	**13**	34	1	154	13	10	109	22	0	154	0	19	**116**	31	0	**166**	0	0	0	0	0	62	89	**19**	3	**173**	**647**
17:45	22	**86**	10	21	2	141	**14**	**16**	117	28	**1**	**176**	0	18	97	26	0	141	0	0	0	0	0	**64**	59	14	**4**	141	599
Total Volume	105	326	44	140	6	621	44	50	440	102	1	637	0	87	407	111	0	605	0	0	0	0	0	244	306	58	11	619	2482
% App. Total	16.9	52.5	7.1	22.5	1		6.9	7.8	69.1	16	0.2		0	14.4	67.3	18.3	0		0	0	0	0		39.4	49.4	9.4	1.8		
PHF	.875	.948	.846	.814	.500	.947	.786	.781	.909	.879	.250	.905	.000	.837	.877	.867	.000	.911	.000	.000	.000	.000	.000	.953	.850	.763	.688	.895	.959

All Traffic Data

(916) 771-8700
orders@atdtraffic.com

City of Oakland
All Vehicles on Unshifted Tab
Bicycles on Bank 1 Tab
Heavy Trucks on Bank 2 Tab

File Name : 13-7630-006 Mandela Parkway-West Grand Avenue
Site Code : 00000000
Start Date : 10/29/2013
Page No : 2



All Traffic Data

(916) 771-8700
orders@atdtraffic.com

City of Oakland
All Vehicles on Unshifted Tab
Bicycles on Bank 1 Tab
Heavy Trucks on Bank 2 Tab

File Name : 13-7630-006 Mandela Parkway-West Grand Avenue
Site Code : 00000000
Start Date : 10/29/2013

	Mandela Parkway Southbound						West Grand Avenue Westbound						Mandela Parkway Northbound						Peralta Street Northeastbound					West Grand Avenue Eastbound					
Start Time	Left	Thru	Bear Right	Right	Uturns	App. Total	Left	Bear Left	Thru	Right	Uturns	App. Total	Hard Left	Left	Thru	Right	Uturns	App. Total	Hard Left	Bear Left	Bear Right	Hard Right	App. Total	Left	Thru	Right	Hard Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																													
Peak Hour for Entire Intersection Begins at 17:00																													
17:00	**29**	**80**	**10**	43	0	162	5	13	93	29	0	140	0	26	92	32	0	150	0	0	0	0	0	56	68	14	3	141	593
17:15	24	84	11	42	**3**	**164**	12	11	**121**	23	0	167	0	24	102	22	0	148	0	0	0	0	0	62	**90**	11	1	164	643
17:30	**30**	76	**13**	34	1	154	13	10	109	22	0	154	0	19	**116**	31	0	**166**	0	0	0	0	0	62	89	**19**	3	**173**	**647**
17:45	22	**86**	10	21	2	141	**14**	**16**	117	28	**1**	**176**	0	18	97	26	0	141	0	0	0	0	0	**64**	59	14	**4**	141	599
Total Volume	105	326	44	140	6	621	44	50	440	102	1	637	0	87	407	111	0	605	0	0	0	0	0	244	306	58	11	619	2482
% App. Total	16.9	52.5	7.1	22.5	1		6.9	7.8	69.1	16	0.2		0	14.4	67.3	18.3	0		0	0	0	0		39.4	49.4	9.4	1.8		
PHF	.875	.948	.846	.814	.500	.947	.786	.781	.909	.879	.250	.905	.000	.837	.877	.867	.000	.911	.000	.000	.000	.000	.000	.953	.850	.763	.688	.895	.959

All Traffic Data

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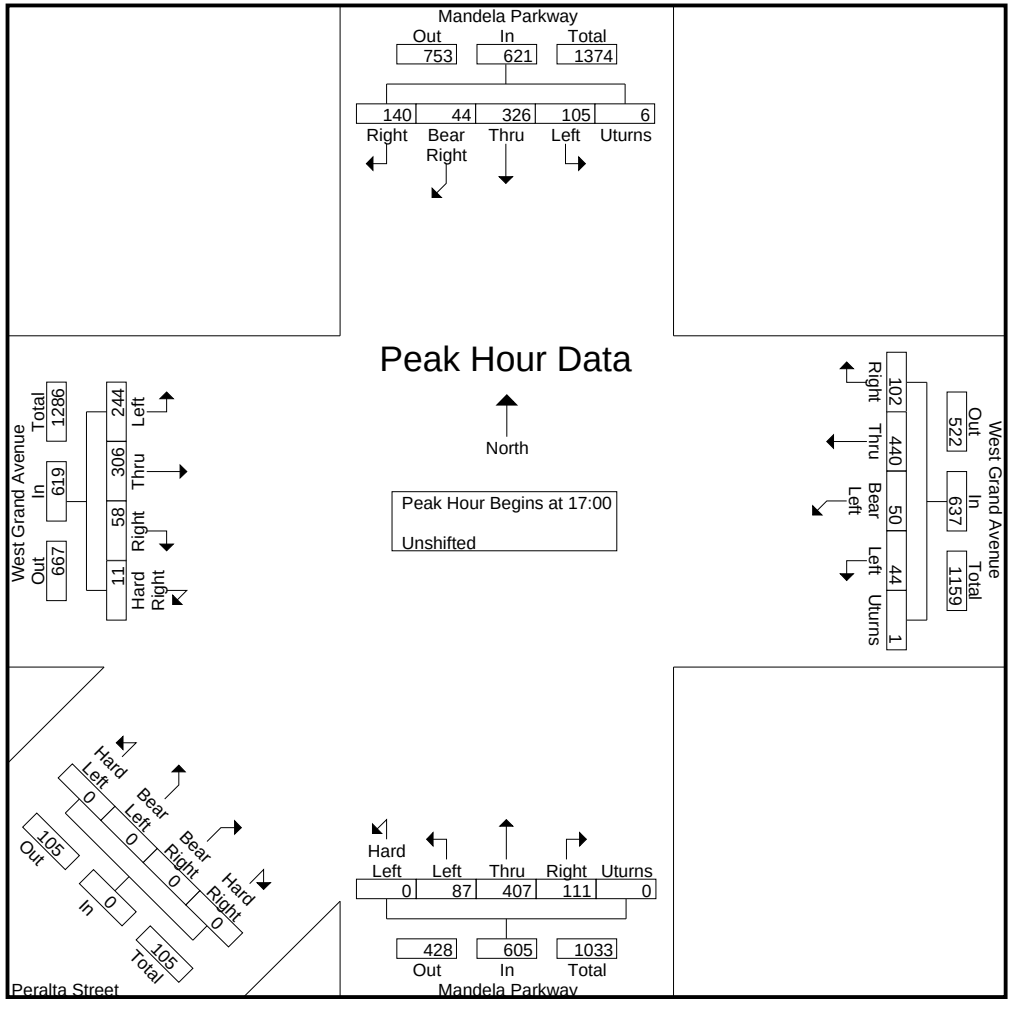
City of Oakland
All Vehicles on Unshifted Tab
Bicycles on Bank 1 Tab
Heavy Trucks on Bank 2 Tab

File Name : 13-7630-006 Mandela Parkway-West Grand Avenue
Site Code : 00000000
Start Date : 10/29/2013
Page No : 4



ALL TRAFFIC DATA

City of Oakland
All Vehicles on Unshifted
Peds & Bikes on Bank 1
Heavy Trucks on Bank 2

(916) 771-8700
orders@atdtraffic.com

File Name : 13-7630-007 Mandela Parkway-20th Street.ppd
Date : 10/29/2013

Unshifted Count = All Vehicles

	Mandela Parkway Southbound					20th Street Westbound					Mandela Parkway Northbound					20th Street Eastbound						
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total	Uturn Total
16:00	2	72	1	0	75	1	0	1	0	2	0	79	0	1	80	20	0	4	0	24	181	1
16:15	3	80	1	0	84	0	0	2	0	2	1	86	0	0	87	11	0	0	0	11	184	0
16:30	0	98	0	2	100	1	0	3	0	4	1	112	0	0	113	15	0	3	0	18	235	2
16:45	0	95	0	2	97	0	0	1	0	1	0	99	2	0	101	12	0	0	0	12	211	2
Total	5	345	2	4	356	2	0	7	0	9	2	376	2	1	381	58	0	7	0	65	811	5
17:00	1	96	0	0	97	2	1	1	0	4	1	139	1	1	142	16	0	4	0	20	263	1
17:15	0	107	2	0	109	0	0	2	0	2	1	124	0	0	125	16	0	0	0	16	252	0
17:30	1	107	0	0	108	1	0	0	0	1	1	151	1	0	153	18	0	1	0	19	281	0
17:45	2	108	0	2	112	1	0	1	0	2	0	122	0	1	123	15	0	2	0	17	254	3
Total	4	418	2	2	426	4	1	4	0	9	3	536	2	2	543	65	0	7	0	72	1050	4
Grand Total	9	763	4	6	782	6	1	11	0	18	5	912	4	3	924	123	0	14	0	137	1861	9
Apprch %	1.2%	97.6%	0.5%	0.8%		33.3%	5.6%	61.1%	0.0%		0.5%	98.7%	0.4%	0.3%		89.8%	0.0%	10.2%	0.0%			
Total %	0.5%	41.0%	0.2%	0.3%	42.0%	0.3%	0.1%	0.6%	0.0%	1.0%	0.3%	49.0%	0.2%	0.2%	49.7%	6.6%	0.0%	0.8%	0.0%	7.4%	100.0%	

PM PEAK HOUR	Mandela Parkway Southbound					20th Street Westbound					Mandela Parkway Northbound					20th Street Eastbound					
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total
Peak Hour Analysis From 17:00 to 18:00																					
Peak Hour For Entire Intersection Begins at 17:00																					
17:00	1	96	0	0	97	2	1	1	0	4	1	139	1	1	142	16	0	4	0	20	263
17:15	0	107	2	0	109	0	0	2	0	2	1	124	0	0	125	16	0	0	0	16	252
17:30	1	107	0	0	108	1	0	0	0	1	1	151	1	0	153	18	0	1	0	19	281
17:45	2	108	0	2	112	1	0	1	0	2	0	122	0	1	123	15	0	2	0	17	254
Total Volume	4	418	2	2	426	4	1	4	0	9	3	536	2	2	543	65	0	7	0	72	1050
% App Total	0.9%	98.1%	0.5%	0.5%		44.4%	11.1%	44.4%	0.0%		0.6%	98.7%	0.4%	0.4%		90.3%	0.0%	9.7%	0.0%		
PHF	.500	.968	.250	.250	.951	.500	.250	.500	.000	.563	.750	.887	.500	.500	.887	.903	.000	.438	.000	.900	.934

ALL TRAFFIC DATA

City of Oakland
All Vehicles on Unshifted
Peds & Bikes on Bank 1
Heavy Trucks on Bank 2

(916) 771-8700
orders@atdtraffic.com

File Name : 13-7630-008 I-880 NB Off-Ramp-7th Street.ppd
Date : 10/29/2013

Unshifted Count = All Vehicles

	Frontage Road Southbound					7th Street Westbound					I-880 NB Off-Ramp Northbound					7th Street Eastbound						
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total	Uturn Total
16:00	17	0	36	0	53	0	28	26	0	54	31	44	20	0	95	25	9	0	0	34	236	0
16:15	19	0	47	0	66	0	15	43	0	58	22	63	26	0	111	36	16	0	0	52	287	0
16:30	19	0	36	0	55	0	27	17	0	44	20	60	20	0	100	32	21	0	0	53	252	0
16:45	23	0	47	0	70	0	25	21	0	46	21	97	17	0	135	33	28	0	0	61	312	0
Total	78	0	166	0	244	0	95	107	0	202	94	264	83	0	441	126	74	0	0	200	1087	0
17:00	18	0	51	0	69	0	29	36	0	65	16	58	20	0	94	24	21	0	0	45	273	0
17:15	28	0	40	0	68	0	24	24	0	48	17	75	22	0	114	14	11	0	0	25	255	0
17:30	27	0	26	0	53	0	20	25	0	45	19	82	19	0	120	9	15	0	0	24	242	0
17:45	21	0	37	0	58	0	37	21	0	58	11	64	33	0	108	14	16	0	0	30	254	0
Total	94	0	154	0	248	0	110	106	0	216	63	279	94	0	436	61	63	0	0	124	1024	0
Grand Total	172	0	320	0	492	0	205	213	0	418	157	543	177	0	877	187	137	0	0	324	2111	0
Apprch %	35.0%	0.0%	65.0%	0.0%		0.0%	49.0%	51.0%	0.0%		17.9%	61.9%	20.2%	0.0%		57.7%	42.3%	0.0%	0.0%			
Total %	8.1%	0.0%	15.2%	0.0%	23.3%	0.0%	9.7%	10.1%	0.0%	19.8%	7.4%	25.7%	8.4%	0.0%	41.5%	8.9%	6.5%	0.0%	0.0%	15.3%	100.0%	

PM PEAK HOUR	Frontage Road Southbound					7th Street Westbound					I-880 NB Off-Ramp Northbound					7th Street Eastbound					
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total
Peak Hour Analysis From 16:15 to 17:15																					
Peak Hour For Entire Intersection Begins at 16:15																					
16:15	19	0	47	0	66	0	15	43	0	58	22	63	26	0	111	36	16	0	0	52	287
16:30	19	0	36	0	55	0	27	17	0	44	20	60	20	0	100	32	21	0	0	53	252
16:45	23	0	47	0	70	0	25	21	0	46	21	97	17	0	135	33	28	0	0	61	312
17:00	18	0	51	0	69	0	29	36	0	65	16	58	20	0	94	24	21	0	0	45	273
Total Volume	79	0	181	0	260	0	96	117	0	213	79	278	83	0	440	125	86	0	0	211	1124
% App Total	30.4%	0.0%	69.6%	0.0%		0.0%	45.1%	54.9%	0.0%		18.0%	63.2%	18.9%	0.0%		59.2%	40.8%	0.0%	0.0%		
PHF	.859	.000	.887	.000	.929	.000	.828	.680	.000	.819	.898	.716	.798	.000	.815	.868	.768	.000	.000	.865	.901

ALL TRAFFIC DATA

City of Oakland
All Vehicles on Unshifted
Peds & Bikes on Bank 1
Heavy Trucks on Bank 2

(916) 771-8700
orders@atdtraffic.com

File Name : 13-7630-009 Maritime Street-7th Street.ppd
Date : 10/29/2013

Unshifted Count = All Vehicles

	Maritime Street Southbound					7th Street Westbound					Maritime Street Northbound					7th Street Eastbound						
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total	Uturn Total
16:00	41	37	0	0	78	9	21	9	0	39	3	46	30	0	79	31	26	11	0	68	264	0
16:15	35	26	0	0	61	6	21	11	1	39	1	37	33	0	71	44	47	15	0	106	277	1
16:30	58	34	0	0	92	5	6	17	0	28	1	62	45	0	108	27	48	4	0	79	307	0
16:45	39	15	0	0	54	4	5	21	0	30	0	56	30	0	86	48	53	2	0	103	273	0
Total	173	112	0	0	285	24	53	58	1	136	5	201	138	0	344	150	174	32	0	356	1121	1
17:00	38	13	1	0	52	7	2	18	0	27	1	34	29	0	64	15	20	0	0	35	178	0
17:15	33	8	0	0	41	5	12	11	0	28	0	19	22	0	41	7	10	0	0	17	127	0
17:30	28	9	1	0	38	6	9	15	1	31	0	14	15	0	29	5	9	2	0	16	114	1
17:45	34	6	0	0	40	6	19	16	0	41	0	11	23	0	34	6	8	0	0	14	129	0
Total	133	36	2	0	171	24	42	60	1	127	1	78	89	0	168	33	47	2	0	82	548	1
Grand Total	306	148	2	0	456	48	95	118	2	263	6	279	227	0	512	183	221	34	0	438	1669	2
Apprch %	67.1%	32.5%	0.4%	0.0%		18.3%	36.1%	44.9%	0.8%		1.2%	54.5%	44.3%	0.0%		41.8%	50.5%	7.8%	0.0%			
Total %	18.3%	8.9%	0.1%	0.0%	27.3%	2.9%	5.7%	7.1%	0.1%	15.8%	0.4%	16.7%	13.6%	0.0%	30.7%	11.0%	13.2%	2.0%	0.0%	26.2%	100.0%	

PM PEAK HOUR	Maritime Street Southbound					7th Street Westbound					Maritime Street Northbound					7th Street Eastbound					
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total
Peak Hour Analysis From 16:00 to 17:00																					
Peak Hour For Entire Intersection Begins at 16:00																					
16:00	41	37	0	0	78	9	21	9	0	39	3	46	30	0	79	31	26	11	0	68	264
16:15	35	26	0	0	61	6	21	11	1	39	1	37	33	0	71	44	47	15	0	106	277
16:30	58	34	0	0	92	5	6	17	0	28	1	62	45	0	108	27	48	4	0	79	307
16:45	39	15	0	0	54	4	5	21	0	30	0	56	30	0	86	48	53	2	0	103	273
Total Volume	173	112	0	0	285	24	53	58	1	136	5	201	138	0	344	150	174	32	0	356	1121
% App Total	60.7%	39.3%	0.0%	0.0%		17.6%	39.0%	42.6%	0.7%		1.5%	58.4%	40.1%	0.0%		42.1%	48.9%	9.0%	0.0%		
PHF	.746	.757	.000	.000	.774	.667	.631	.690	.250	.872	.417	.810	.767	.000	.796	.781	.821	.533	.000	.840	.913

ALL TRAFFIC DATA

City of Oakland
All Vehicles on Unshifted
Peds & Bikes on Bank 1
Heavy Trucks on Bank 2

(916) 771-8700
orders@atdtraffic.com

File Name : 13-7630-010 Adeline Street-West Grand Avenue.ppd
Date : 10/29/2013

Unshifted Count = All Vehicles

	Adeline Street Southbound					West Grand Avenue Westbound					Adeline Street Northbound					West Grand Avenue Eastbound						
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total	Uturn Total
16:00	14	48	19	0	81	17	124	14	2	157	3	35	28	0	66	9	96	6	0	111	415	2
16:15	14	31	9	0	54	12	123	8	1	144	5	36	20	0	61	8	92	5	0	105	364	1
16:30	21	56	17	0	94	13	113	11	0	137	6	53	19	0	78	11	122	6	2	141	450	2
16:45	15	42	21	0	78	16	125	12	2	155	8	41	15	0	64	11	103	10	0	124	421	2
Total	64	177	66	0	307	58	485	45	5	593	22	165	82	0	269	39	413	27	2	481	1650	7
17:00	20	45	13	0	78	13	133	11	2	159	3	51	11	0	65	13	116	8	0	137	439	2
17:15	11	50	13	0	74	13	163	9	1	186	8	62	12	0	82	7	119	12	0	138	480	1
17:30	16	44	17	0	77	11	133	18	1	163	10	42	16	0	68	13	145	13	0	171	479	1
17:45	14	35	14	0	63	13	147	14	1	175	6	39	7	0	52	18	102	7	0	127	417	1
Total	61	174	57	0	292	50	576	52	5	683	27	194	46	0	267	51	482	40	0	573	1815	5
Grand Total	125	351	123	0	599	108	1061	97	10	1276	49	359	128	0	536	90	895	67	2	1054	3465	12
Apprch %	20.9%	58.6%	20.5%	0.0%		8.5%	83.2%	7.6%	0.8%		9.1%	67.0%	23.9%	0.0%		8.5%	84.9%	6.4%	0.2%			
Total %	3.6%	10.1%	3.5%	0.0%	17.3%	3.1%	30.6%	2.8%	0.3%	36.8%	1.4%	10.4%	3.7%	0.0%	15.5%	2.6%	25.8%	1.9%	0.1%	30.4%	100.0%	

PM PEAK HOUR	Adeline Street Southbound					West Grand Avenue Westbound					Adeline Street Northbound					West Grand Avenue Eastbound					
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total
Peak Hour Analysis From 16:45 to 17:45																					
Peak Hour For Entire Intersection Begins at 16:45																					
16:45	15	42	21	0	78	16	125	12	2	155	8	41	15	0	64	11	103	10	0	124	421
17:00	20	45	13	0	78	13	133	11	2	159	3	51	11	0	65	13	116	8	0	137	439
17:15	11	50	13	0	74	13	163	9	1	186	8	62	12	0	82	7	119	12	0	138	480
17:30	16	44	17	0	77	11	133	18	1	163	10	42	16	0	68	13	145	13	0	171	479
Total Volume	62	181	64	0	307	53	554	50	6	663	29	196	54	0	279	44	483	43	0	570	1819
% App Total	20.2%	59.0%	20.8%	0.0%		8.0%	83.6%	7.5%	0.9%		10.4%	70.3%	19.4%	0.0%		7.7%	84.7%	7.5%	0.0%		
PHF	.775	.905	.762	.000	.984	.828	.850	.694	.750	.891	.725	.790	.844	.000	.851	.846	.833	.827	.000	.833	.947

ALL TRAFFIC DATA

City of Oakland
All Vehicles on Unshifted
Peds & Bikes on Bank 1
Heavy Trucks on Bank 2

(916) 771-8700
orders@atdtraffic.com

File Name : 13-7630-001 Maritime Street-Burma Road.ppd
Date : 10/26/2013

Unshifted Count = All Vehicles

	Maritime Street Southbound					Driveway Westbound					Maritime Street Northbound					Burma Road Eastbound						
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total	Uturn Total
14:00	0	14	6	0	20	0	0	0	0	0	7	18	0	0	25	5	0	2	0	7	52	0
14:15	2	9	9	2	22	0	0	1	0	1	3	15	1	0	19	17	0	4	0	21	63	2
14:30	0	11	12	0	23	0	0	2	0	2	1	9	0	0	10	11	0	1	0	12	47	0
14:45	2	10	8	3	23	0	0	2	0	2	7	16	1	0	24	19	0	5	0	24	73	3
Total	4	44	35	5	88	0	0	5	0	5	18	58	2	0	78	52	0	12	0	64	235	5
15:00	0	7	8	0	15	0	0	1	0	1	2	9	0	0	11	26	0	4	0	30	57	0
15:15	0	3	7	1	11	0	0	0	0	0	0	5	0	1	6	42	0	2	0	44	61	2
15:30	0	6	13	0	19	0	0	0	0	0	9	6	0	0	15	15	0	3	0	18	52	0
15:45	0	13	14	0	27	0	0	0	0	0	1	18	0	0	19	18	0	2	0	20	66	0
Total	0	29	42	1	72	0	0	1	0	1	12	38	0	1	51	101	0	11	0	112	236	2
16:00	0	9	6	1	16	0	0	3	0	3	2	15	0	0	17	15	0	1	0	16	52	1
16:15	0	11	11	0	22	0	0	1	0	1	3	13	0	0	16	14	1	5	0	20	59	0
16:30	0	10	6	1	17	0	0	0	0	0	0	13	1	0	14	17	0	2	0	19	50	1
16:45	0	3	8	0	11	0	0	0	0	0	2	34	0	0	36	15	0	1	0	16	63	0
Total	0	33	31	2	66	0	0	4	0	4	7	75	1	0	83	61	1	9	0	71	224	2
17:00	0	9	7	0	16	0	0	0	0	0	1	36	0	0	37	19	0	5	0	24	77	0
17:15	0	16	3	0	19	0	0	0	0	0	2	24	0	0	26	24	0	3	0	27	72	0
17:30	0	26	6	0	32	0	0	0	0	0	1	14	0	0	15	8	0	3	0	11	58	0
17:45	0	15	2	0	17	0	0	0	0	0	1	11	0	0	12	15	0	2	0	17	46	0
Total	0	66	18	0	84	0	0	0	0	0	5	85	0	0	90	66	0	13	0	79	253	0
Grand Total	4	172	126	8	310	0	0	10	0	10	42	256	3	1	302	280	1	45	0	326	948	9
Apprch %	1.3%	55.5%	40.6%	2.6%		0.0%	0.0%	100.0%	0.0%		13.9%	84.8%	1.0%	0.3%		85.9%	0.3%	13.8%	0.0%			
Total %	0.4%	18.1%	13.3%	0.8%	32.7%	0.0%	0.0%	1.1%	0.0%	1.1%	4.4%	27.0%	0.3%	0.1%	31.9%	29.5%	0.1%	4.7%	0.0%	34.4%	100.0%	

PM PEAK HOUR	Maritime Street Southbound					Driveway Westbound					Maritime Street Northbound					Burma Road Eastbound					
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total
Peak Hour Analysis From 16:45 to 17:45																					
Peak Hour For Entire Intersection Begins at 16:45																					
16:45	0	3	8	0	11	0	0	0	0	0	2	34	0	0	36	15	0	1	0	16	63
17:00	0	9	7	0	16	0	0	0	0	0	1	36	0	0	37	19	0	5	0	24	77
17:15	0	16	3	0	19	0	0	0	0	0	2	24	0	0	26	24	0	3	0	27	72
17:30	0	26	6	0	32	0	0	0	0	0	1	14	0	0	15	8	0	3	0	11	58
Total Volume	0	54	24	0	78	0	0	0	0	0	6	108	0	0	114	66	0	12	0	78	270
% App Total	0.0%	69.2%	30.8%	0.0%		0.0%	0.0%	0.0%	0.0%		5.3%	94.7%	0.0%	0.0%		84.6%	0.0%	15.4%	0.0%		
PHF	.000	.519	.750	.000	.609	.000	.000	.000	.000	.000	.750	.750	.000	.000	.770	.688	.000	.600	.000	.722	.877

ALL TRAFFIC DATA

City of Oakland
All Vehicles on Unshifted
Peds & Bikes on Bank 1
Heavy Trucks on Bank 2

(916) 771-8700
orders@atdtraffic.com

File Name : 13-7630-002 Maritime Street-West Grand Avenue.ppd
Date : 10/26/2013

Unshifted Count = All Vehicles

	Wake Avenue Southbound					West Grand Avenue Westbound					Maritime Street Northbound					I-80 Ramps Eastbound						
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total	Uturn Total
14:00	9	6	4	0	19	9	109	11	0	129	11	1	12	0	24	4	40	7	1	52	224	1
14:15	5	1	1	0	7	15	104	7	0	126	16	3	16	0	35	1	51	3	3	58	226	3
14:30	7	3	5	0	15	8	136	8	1	153	6	4	11	0	21	5	43	13	3	64	253	4
14:45	12	6	3	0	21	10	118	5	0	133	15	5	18	0	38	3	29	7	2	41	233	2
Total	33	16	13	0	62	42	467	31	1	541	48	13	57	0	118	13	163	30	9	215	936	10
15:00	6	1	2	0	9	7	117	3	0	127	18	3	16	0	37	1	42	9	2	54	227	2
15:15	9	1	7	0	17	3	112	4	0	119	16	0	33	0	49	3	51	5	6	65	250	6
15:30	8	2	4	0	14	16	117	10	0	143	8	2	11	0	21	5	37	5	1	48	226	1
15:45	5	3	6	0	14	11	97	3	0	111	14	5	18	0	37	3	42	13	1	59	221	1
Total	28	7	19	0	54	37	443	20	0	500	56	10	78	0	144	12	172	32	10	226	924	10
16:00	8	4	6	0	18	2	95	3	0	100	13	4	17	0	34	2	44	8	1	55	207	1
16:15	1	4	2	0	7	7	104	3	0	114	13	2	13	0	28	2	45	12	1	60	209	1
16:30	4	1	5	0	10	3	85	2	0	90	12	6	12	0	30	2	31	11	1	45	175	1
16:45	2	0	0	0	2	9	106	2	0	117	24	3	21	0	48	0	38	3	4	45	212	4
Total	15	9	13	0	37	21	390	10	0	421	62	15	63	0	140	6	158	34	7	205	803	7
17:00	9	1	0	0	10	5	121	5	1	132	28	3	24	0	55	2	50	10	2	64	261	3
17:15	2	0	4	0	6	9	113	4	0	126	16	5	27	0	48	1	45	11	2	59	239	2
17:30	5	3	7	0	15	12	102	3	0	117	10	1	12	0	23	2	44	17	2	65	220	2
17:45	5	4	3	0	12	6	114	1	0	121	9	2	15	0	26	4	37	6	2	49	208	2
Total	21	8	14	0	43	32	450	13	1	496	63	11	78	0	152	9	176	44	8	237	928	9
Grand Total	97	40	59	0	196	132	1750	74	2	1958	229	49	276	0	554	40	669	140	34	883	3591	36
Apprch %	49.5%	20.4%	30.1%	0.0%		6.7%	89.4%	3.8%	0.1%		41.3%	8.8%	49.8%	0.0%		4.5%	75.8%	15.9%	3.9%			
Total %	2.7%	1.1%	1.6%	0.0%	5.5%	3.7%	48.7%	2.1%	0.1%	54.5%	6.4%	1.4%	7.7%	0.0%	15.4%	1.1%	18.6%	3.9%	0.9%	24.6%	100.0%	

PM PEAK HOUR	Wake Avenue Southbound					West Grand Avenue Westbound					Maritime Street Northbound					I-80 Ramps Eastbound					
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total
Peak Hour Analysis From 14:30 to 15:30																					
Peak Hour For Entire Intersection Begins at 14:30																					
14:30	7	3	5	0	15	8	136	8	1	153	6	4	11	0	21	5	43	13	3	64	253
14:45	12	6	3	0	21	10	118	5	0	133	15	5	18	0	38	3	29	7	2	41	233
15:00	6	1	2	0	9	7	117	3	0	127	18	3	16	0	37	1	42	9	2	54	227
15:15	9	1	7	0	17	3	112	4	0	119	16	0	33	0	49	3	51	5	6	65	250
Total Volume	34	11	17	0	62	28	483	20	1	532	55	12	78	0	145	12	165	34	13	224	963
% App Total	54.8%	17.7%	27.4%	0.0%		5.3%	90.8%	3.8%	0.2%		37.9%	8.3%	53.8%	0.0%		5.4%	73.7%	15.2%	5.8%		
PHF	.708	.458	.607	.000	.738	.700	.888	.625	.250	.869	.764	.600	.591	.000	.740	.600	.809	.654	.542	.862	.952

ALL TRAFFIC DATA

City of Oakland
All Vehicles on Unshifted
Peds & Bikes on Bank 1
Heavy Trucks on Bank 2

(916) 771-8700
orders@atdtraffic.com

File Name : 13-7630-003 Frontage Road-West Grand Avenue.ppd
Date : 10/26/2013

Unshifted Count = All Vehicles

	I-80 Ramps Southbound					West Grand Avenue Westbound					Frontage Road Northbound					West Grand Avenue Eastbound						
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total	Uturn Total
14:00	24	20	8	0	52	29	108	52	1	190	12	13	35	0	60	15	33	12	0	60	362	1
14:15	23	19	7	0	49	30	99	44	0	173	17	12	37	0	66	6	47	17	2	72	360	2
14:30	21	15	4	0	40	22	123	52	0	197	33	35	30	0	98	8	38	9	0	55	390	0
14:45	25	15	3	0	43	28	115	41	0	184	15	25	25	0	65	9	38	16	0	63	355	0
Total	93	69	22	0	184	109	445	189	1	744	77	85	127	0	289	38	156	54	2	250	1467	3
15:00	9	9	1	0	19	37	111	40	0	188	13	26	32	0	71	7	46	11	0	64	342	0
15:15	25	17	5	0	47	41	99	37	0	177	15	15	24	0	54	18	46	27	0	91	369	0
15:30	24	13	7	0	44	36	99	42	0	177	27	40	39	0	106	10	33	15	0	58	385	0
15:45	25	13	1	0	39	27	93	32	0	152	17	18	28	0	63	7	43	12	0	62	316	0
Total	83	52	14	0	149	141	402	151	0	694	72	99	123	0	294	42	168	65	0	275	1412	0
16:00	26	8	1	0	35	34	88	44	0	166	12	13	28	0	53	11	40	12	0	63	317	0
16:15	17	12	7	0	36	21	84	24	0	129	21	17	31	0	69	7	44	8	0	59	293	0
16:30	20	11	0	0	31	26	78	49	0	153	17	23	26	0	66	8	32	12	0	52	302	0
16:45	14	12	4	0	30	28	86	39	0	153	19	22	19	0	60	16	34	7	0	57	300	0
Total	77	43	12	0	132	109	336	156	0	601	69	75	104	0	248	42	150	39	0	231	1212	0
17:00	20	14	3	0	37	27	111	35	0	173	20	17	26	0	63	20	48	15	0	83	356	0
17:15	18	10	3	0	31	20	102	36	0	158	16	15	24	0	55	19	45	12	0	76	320	0
17:30	15	9	3	0	27	24	100	42	0	166	15	17	16	0	48	8	34	17	0	59	300	0
17:45	17	15	4	0	36	24	101	35	1	161	15	21	29	0	65	9	35	13	0	57	319	1
Total	70	48	13	0	131	95	414	148	1	658	66	70	95	0	231	56	162	57	0	275	1295	1
Grand Total	323	212	61	0	596	454	1597	644	2	2697	284	329	449	0	1062	178	636	215	2	1031	5386	4
Apprch %	54.2%	35.6%	10.2%	0.0%		16.8%	59.2%	23.9%	0.1%		26.7%	31.0%	42.3%	0.0%		17.3%	61.7%	20.9%	0.2%			
Total %	6.0%	3.9%	1.1%	0.0%	11.1%	8.4%	29.7%	12.0%	0.0%	50.1%	5.3%	6.1%	8.3%	0.0%	19.7%	3.3%	11.8%	4.0%	0.0%	19.1%	100.0%	

PM PEAK HOUR	I-80 Ramps Southbound					West Grand Avenue Westbound					Frontage Road Northbound					West Grand Avenue Eastbound					
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total
Peak Hour Analysis From 14:00 to 15:00																					
Peak Hour For Entire Intersection Begins at 14:00																					
14:00	24	20	8	0	52	29	108	52	1	190	12	13	35	0	60	15	33	12	0	60	362
14:15	23	19	7	0	49	30	99	44	0	173	17	12	37	0	66	6	47	17	2	72	360
14:30	21	15	4	0	40	22	123	52	0	197	33	35	30	0	98	8	38	9	0	55	390
14:45	25	15	3	0	43	28	115	41	0	184	15	25	25	0	65	9	38	16	0	63	355
Total Volume	93	69	22	0	184	109	445	189	1	744	77	85	127	0	289	38	156	54	2	250	1467
% App Total	50.5%	37.5%	12.0%	0.0%		14.7%	59.8%	25.4%	0.1%		26.6%	29.4%	43.9%	0.0%		15.2%	62.4%	21.6%	0.8%		
PHF	.930	.863	.688	.000	.885	.908	.904	.909	.250	.944	.583	.607	.858	.000	.737	.633	.830	.794	.250	.868	.940

ALL TRAFFIC DATA

City of Oakland
All Vehicles on Unshifted
Peds & Bikes on Bank 1
Heavy Trucks on Bank 2

(916) 771-8700
orders@atdtraffic.com

File Name : 13-7630-004 Campbell Street-West Grand Avenue.ppd
Date : 10/26/2013

Unshifted Count = All Vehicles

	Campbell Street Southbound					West Grand Avenue Westbound					Campbell Street Northbound					West Grand Avenue Eastbound						
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total	Uturn Total
14:00	0	4	25	0	29	6	159	2	1	168	11	2	8	0	21	4	88	7	2	101	319	3
14:15	1	3	21	0	25	2	142	0	1	145	7	0	6	0	13	2	104	13	2	121	304	3
14:30	1	1	23	0	25	2	159	0	1	162	11	2	7	0	20	3	83	7	3	96	303	4
14:45	1	2	21	0	24	5	164	3	0	172	14	0	2	0	16	3	86	6	4	99	311	4
Total	3	10	90	0	103	15	624	5	3	647	43	4	23	0	70	12	361	33	11	417	1237	14
15:00	0	2	30	0	32	1	147	1	1	150	5	0	5	0	10	2	83	9	3	97	289	4
15:15	0	2	24	0	26	2	139	0	2	143	14	1	7	0	22	4	92	7	5	108	299	7
15:30	0	0	27	0	27	5	133	0	0	138	18	0	5	0	23	5	87	9	0	101	289	0
15:45	0	3	27	0	30	4	117	1	0	122	5	0	3	0	8	2	91	7	1	101	261	1
Total	0	7	108	0	115	12	536	2	3	553	42	1	20	0	63	13	353	32	9	407	1138	12
16:00	0	2	23	0	25	3	131	1	0	135	14	1	3	0	18	4	90	7	5	106	284	5
16:15	0	2	19	0	21	3	108	1	1	113	3	0	7	0	10	2	89	6	2	99	243	3
16:30	1	2	20	0	23	1	126	0	0	127	9	0	6	0	15	5	62	10	6	83	248	6
16:45	0	1	16	0	17	7	127	2	0	136	19	1	6	0	26	2	64	6	3	75	254	3
Total	1	7	78	0	86	14	492	4	1	511	45	2	22	0	69	13	305	29	16	363	1029	17
17:00	1	0	23	0	24	2	136	1	0	139	2	0	3	0	5	2	95	3	1	101	269	1
17:15	0	2	25	0	27	1	136	2	0	139	8	0	3	0	11	1	83	3	2	89	266	2
17:30	1	0	17	0	18	1	138	0	0	139	21	1	8	0	30	3	64	6	0	73	260	0
17:45	0	1	21	0	22	3	115	1	1	120	13	2	8	0	23	1	82	5	0	88	253	1
Total	2	3	86	0	91	7	525	4	1	537	44	3	22	0	69	7	324	17	3	351	1048	4
Grand Total	6	27	362	0	395	48	2177	15	8	2248	174	10	87	0	271	45	1343	111	39	1538	4452	47
Apprch %	1.5%	6.8%	91.6%	0.0%		2.1%	96.8%	0.7%	0.4%		64.2%	3.7%	32.1%	0.0%		2.9%	87.3%	7.2%	2.5%			
Total %	0.1%	0.6%	8.1%	0.0%	8.9%	1.1%	48.9%	0.3%	0.2%	50.5%	3.9%	0.2%	2.0%	0.0%	6.1%	1.0%	30.2%	2.5%	0.9%	34.5%	100.0%	

PM PEAK HOUR	Campbell Street Southbound					West Grand Avenue Westbound					Campbell Street Northbound					West Grand Avenue Eastbound					
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total
Peak Hour Analysis From 14:00 to 15:00																					
Peak Hour For Entire Intersection Begins at 14:00																					
14:00	0	4	25	0	29	6	159	2	1	168	11	2	8	0	21	4	88	7	2	101	319
14:15	1	3	21	0	25	2	142	0	1	145	7	0	6	0	13	2	104	13	2	121	304
14:30	1	1	23	0	25	2	159	0	1	162	11	2	7	0	20	3	83	7	3	96	303
14:45	1	2	21	0	24	5	164	3	0	172	14	0	2	0	16	3	86	6	4	99	311
Total Volume	3	10	90	0	103	15	624	5	3	647	43	4	23	0	70	12	361	33	11	417	1237
% App Total	2.9%	9.7%	87.4%	0.0%		2.3%	96.4%	0.8%	0.5%		61.4%	5.7%	32.9%	0.0%		2.9%	86.6%	7.9%	2.6%		
PHF	.750	.625	.900	.000	.888	.625	.951	.417	.750	.940	.768	.500	.719	.000	.833	.750	.868	.635	.688	.862	.969

ALL TRAFFIC DATA

City of Oakland
All Vehicles on Unshifted
Peds & Bikes on Bank 1
Heavy Trucks on Bank 2

(916) 771-8700
orders@atdtraffic.com

File Name : 13-7630-005 Mandela Parkway-24th Street.ppd
Date : 10/26/2013

Unshifted Count = All Vehicles

	Mandela Parkway Southbound					24th Street Westbound					Mandela Parkway Northbound					Eastbound						
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total	Uturn Total
14:00	0	107	0	0	107	42	0	0	0	42	0	110	0	2	112	0	0	0	0	0	261	2
14:15	0	88	0	0	88	31	0	2	0	33	0	85	0	1	86	0	0	0	0	0	207	1
14:30	0	107	0	0	107	39	0	4	0	43	0	75	0	0	75	0	0	0	0	0	225	0
14:45	0	97	0	0	97	32	0	0	0	32	0	78	0	0	78	0	0	0	0	0	207	0
Total	0	399	0	0	399	144	0	6	0	150	0	348	0	3	351	0	0	0	0	0	900	3
15:00	0	118	0	0	118	35	0	2	0	37	0	83	0	1	84	0	0	0	0	0	239	1
15:15	0	120	0	0	120	28	0	2	0	30	0	75	0	1	76	0	0	0	0	0	226	1
15:30	0	103	0	0	103	33	0	3	0	36	0	95	0	1	96	0	0	0	0	0	235	1
15:45	0	100	0	0	100	26	0	5	0	31	0	66	0	0	66	0	0	0	0	0	197	0
Total	0	441	0	0	441	122	0	12	0	134	0	319	0	3	322	0	0	0	0	0	897	3
16:00	0	107	0	0	107	30	0	2	0	32	0	78	0	0	78	0	0	0	0	0	217	0
16:15	0	100	0	0	100	33	0	1	0	34	0	65	0	0	65	0	0	0	0	0	199	0
16:30	0	96	0	0	96	26	0	3	0	29	0	60	0	0	60	0	0	0	0	0	185	0
16:45	0	89	0	0	89	36	0	0	0	36	0	56	0	1	57	0	0	0	0	0	182	1
Total	0	392	0	0	392	125	0	6	0	131	0	259	0	1	260	0	0	0	0	0	783	1
17:00	0	89	0	0	89	34	0	0	0	34	0	57	0	0	57	0	0	0	0	0	180	0
17:15	0	58	0	0	58	26	0	3	0	29	0	71	0	0	71	0	0	0	0	0	158	0
17:30	0	112	0	0	112	20	0	4	0	24	0	72	0	2	74	0	0	0	0	0	210	2
17:45	0	92	0	0	92	24	0	2	0	26	0	73	0	1	74	0	0	0	0	0	192	1
Total	0	351	0	0	351	104	0	9	0	113	0	273	0	3	276	0	0	0	0	0	740	3
Grand Total	0	1583	0	0	1583	495	0	33	0	528	0	1199	0	10	1209	0	0	0	0	0	3320	10
Apprch %	0.0%	100.0%	0.0%	0.0%		93.8%	0.0%	6.3%	0.0%		0.0%	99.2%	0.0%	0.8%		0.0%	0.0%	0.0%	0.0%			
Total %	0.0%	47.7%	0.0%	0.0%	47.7%	14.9%	0.0%	1.0%	0.0%	15.9%	0.0%	36.1%	0.0%	0.3%	36.4%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	

PM PEAK HOUR	Mandela Parkway Southbound					24th Street Westbound					Mandela Parkway Northbound					Eastbound					
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total
Peak Hour Analysis From 14:45 to 15:45																					
Peak Hour For Entire Intersection Begins at 14:45																					
14:45	0	97	0	0	97	32	0	0	0	32	0	78	0	0	78	0	0	0	0	0	207
15:00	0	118	0	0	118	35	0	2	0	37	0	83	0	1	84	0	0	0	0	0	239
15:15	0	120	0	0	120	28	0	2	0	30	0	75	0	1	76	0	0	0	0	0	226
15:30	0	103	0	0	103	33	0	3	0	36	0	95	0	1	96	0	0	0	0	0	235
Total Volume	0	438	0	0	438	128	0	7	0	135	0	331	0	3	334	0	0	0	0	0	907
% App Total	0.0%	100.0%	0.0%	0.0%		94.8%	0.0%	5.2%	0.0%		0.0%	99.1%	0.0%	0.9%		0.0%	0.0%	0.0%	0.0%		
PHF	.000	.913	.000	.000	.913	.914	.000	.583	.000	.912	.000	.871	.000	.750	.870	.000	.000	.000	.000	.000	.949

All Traffic Data

(916) 771-8700
orders@atdtraffic.com

City of Oakland
All Vehicles on Unshifted Tab
Bicycles on Bank 1 Tab
Heavy Trucks on Bank 2 Tab

File Name : 13-7630-006 Mandela Parkway-West Grand Avenue
Site Code : 00000000
Start Date : 10/26/2013
Page No : 1

Groups Printed- Unshifted

	Mandela Parkway Southbound						West Grand Avenue Westbound						Mandela Parkway Northbound						Peralta Street Northeastbound					West Grand Avenue Eastbound						
Start Time	Left	Thru	Bear Right	Right	Uturns	App. Total	Left	Bear Left	Thru	Right	Uturns	App. Total	Hard Left	Left	Thru	Right	Uturns	App. Total	Hard Left	Bear Left	Bear Right	Hard Right	App. Total	Left	Thru	Right	Hard Right	Uturns	App. Total	Int. Total
14:00	22	57	19	47	4	149	8	12	100	24	0	144	0	18	73	23	0	114	0	0	0	0	0	39	50	8	0	0	97	504
14:15	21	46	16	36	4	123	8	9	89	14	0	120	1	14	46	18	0	79	0	0	0	0	0	47	41	19	1	1	109	431
14:30	19	64	11	44	2	140	20	11	101	11	1	144	0	15	47	13	0	75	0	0	0	1	1	35	37	17	6	0	95	455
14:45	14	51	10	55	0	130	9	14	102	20	0	145	0	16	54	26	0	96	0	0	0	1	1	26	43	7	5	0	81	453
Total	76	218	56	182	10	542	45	46	392	69	1	553	1	63	220	80	0	364	0	0	0	2	2	147	171	51	12	1	382	1843
15:00	24	79	13	34	2	152	16	11	105	17	0	149	0	15	54	19	0	88	0	0	0	1	1	33	42	15	5	0	95	485
15:15	27	60	7	43	5	142	9	19	78	16	0	122	0	15	55	20	0	90	0	0	0	0	0	25	59	14	1	0	99	453
15:30	20	46	19	45	1	131	11	15	85	15	0	126	0	8	54	19	0	81	0	0	0	0	0	34	47	8	3	0	92	430
15:45	27	59	17	29	0	132	9	13	70	12	0	104	0	19	42	15	0	76	0	0	0	0	0	29	42	16	6	0	93	405
Total	98	244	56	151	8	557	45	58	338	60	0	501	0	57	205	73	0	335	0	0	0	1	1	121	190	53	15	0	379	1773
16:00	27	62	10	42	3	144	4	10	66	12	0	92	0	19	61	17	0	97	0	0	0	0	0	30	46	10	3	0	89	422
16:15	20	61	13	31	1	126	9	6	67	15	0	97	0	17	52	13	0	82	0	0	1	0	1	35	49	15	4	0	103	409
16:30	16	64	16	27	0	123	7	7	87	13	0	114	0	18	45	14	1	78	0	0	0	0	0	28	34	6	1	0	69	384
16:45	16	52	11	44	0	123	7	7	71	11	0	96	0	21	34	15	0	70	0	0	0	0	0	29	33	7	0	0	69	358
Total	79	239	50	144	4	516	27	30	291	51	0	399	0	75	192	59	1	327	0	0	1	0	1	122	162	38	8	0	330	1573
17:00	15	55	6	42	0	118	11	9	77	16	1	114	0	16	41	24	0	81	0	0	0	0	0	26	53	18	0	0	97	410
17:15	13	35	10	28	0	86	2	11	98	13	0	124	0	16	38	24	0	78	0	0	0	0	0	32	43	13	1	0	89	377
17:30	15	75	8	32	1	131	13	4	91	11	0	119	1	17	60	20	0	98	0	0	0	0	0	18	40	5	4	0	67	415
17:45	16	51	13	39	0	119	10	9	66	13	1	99	0	13	51	21	1	86	0	0	0	0	0	30	48	8	6	0	92	396
Total	59	216	37	141	1	454	36	33	332	53	2	456	1	62	190	89	1	343	0	0	0	0	0	106	184	44	11	0	345	1598
Grand Total	312	917	199	618	23	2069	153	167	1353	233	3	1909	2	257	807	301	2	1369	0	0	1	3	4	496	707	186	46	1	1436	6787
Apprch %	15.1	44.3	9.6	29.9	1.1		8	8.7	70.9	12.2	0.2		0.1	18.8	58.9	22	0.1		0	0	25	75		34.5	49.2	13	3.2	0.1		
Total %	4.6	13.5	2.9	9.1	0.3	30.5	2.3	2.5	19.9	3.4	0	28.1	0	3.8	11.9	4.4	0	20.2	0	0	0	0	0.1	7.3	10.4	2.7	0.7	0	21.2	

All Traffic Data

(916) 771-8700
orders@atdtraffic.com

City of Oakland
All Vehicles on Unshifted Tab
Bicycles on Bank 1 Tab
Heavy Trucks on Bank 2 Tab

File Name : 13-7630-006 Mandela Parkway-West Grand Avenue
Site Code : 00000000
Start Date : 10/26/2013

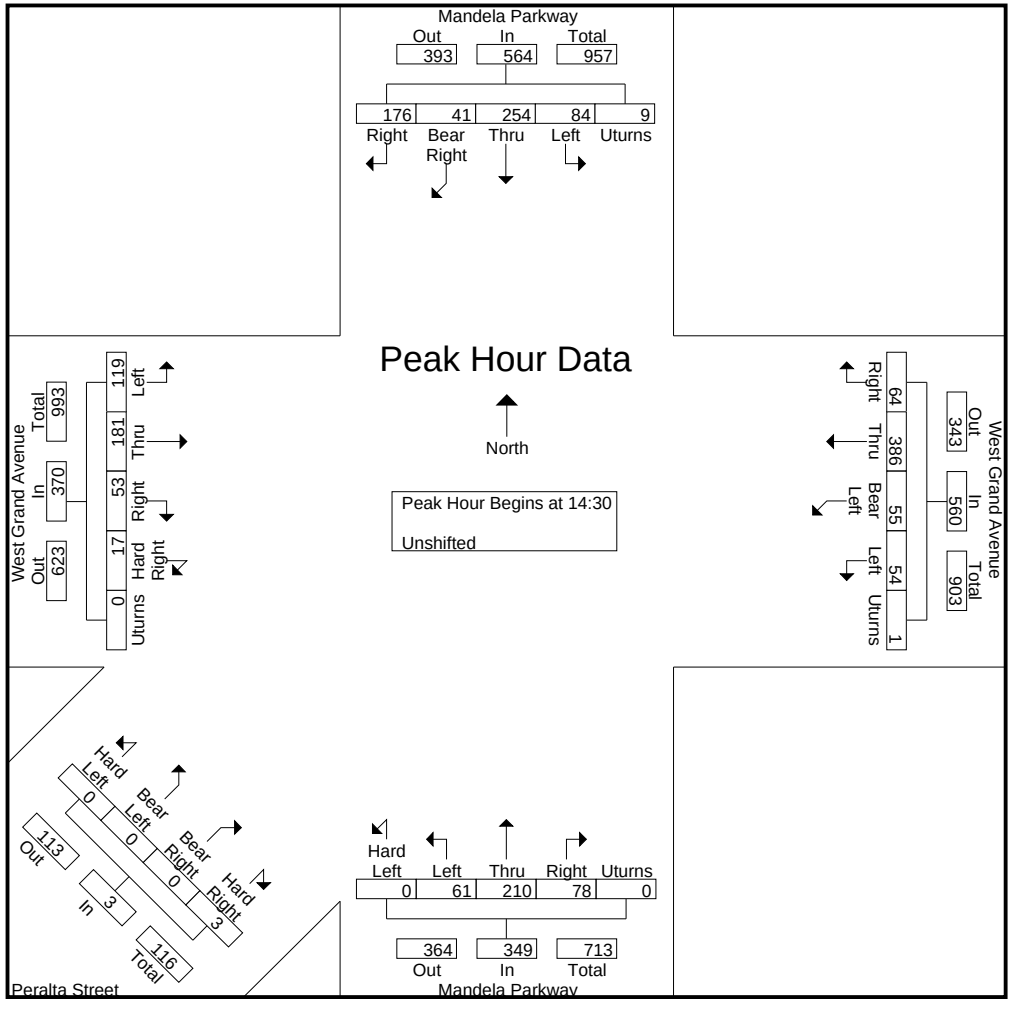
	Mandela Parkway Southbound						West Grand Avenue Westbound						Mandela Parkway Northbound						Peralta Street Northeastbound					West Grand Avenue Eastbound						
Start Time	Left	Thru	Bear Right	Right	Uturns	App. Total	Left	Bear Left	Thru	Right	Uturns	App. Total	Hard Left	Left	Thru	Right	Uturns	App. Total	Hard Left	Bear Left	Bear Right	Hard Right	App. Total	Left	Thru	Right	Hard Right	Uturns	App. Total	Int. Total
Peak Hour Analysis From 14:00 to 17:45 - Peak 1 of 1																														
Peak Hour for Entire Intersection Begins at 14:30																														
14:30	19	64	11	44	2	140	**20**	11	101	11	**1**	144	0	15	47	13	0	75	0	0	0	**1**	**1**	**35**	37	**17**	**6**	0	95	455
14:45	14	51	10	**55**	0	130	9	14	102	**20**	0	145	0	**16**	54	**26**	0	**96**	0	0	0	1	1	26	43	7	5	0	81	453
15:00	24	**79**	**13**	34	2	**152**	16	11	**105**	17	0	**149**	0	15	54	19	0	88	0	0	0	1	1	33	42	15	5	0	95	**485**
15:15	**27**	60	7	43	**5**	142	9	**19**	78	16	0	122	0	15	**55**	20	0	90	0	0	0	0	0	25	**59**	14	1	0	**99**	453
Total Volume	84	254	41	176	9	564	54	55	386	64	1	560	0	61	210	78	0	349	0	0	0	3	3	119	181	53	17	0	370	1846
% App. Total	14.9	45	7.3	31.2	1.6		9.6	9.8	68.9	11.4	0.2		0	17.5	60.2	22.3	0		0	0	0	100		32.2	48.9	14.3	4.6	0		
PHF	.778	.804	.788	.800	.450	.928	.675	.724	.919	.800	.250	.940	.000	.953	.955	.750	.000	.909	.000	.000	.000	.750	.750	.850	.767	.779	.708	.000	.934	.952

All Traffic Data

(916) 771-8700
orders@atdtraffic.com

City of Oakland
All Vehicles on Unshifted Tab
Bicycles on Bank 1 Tab
Heavy Trucks on Bank 2 Tab

File Name : 13-7630-006 Mandela Parkway-West Grand Avenue
Site Code : 00000000
Start Date : 10/26/2013
Page No : 3



ALL TRAFFIC DATA

City of Oakland
All Vehicles on Unshifted
Peds & Bikes on Bank 1
Heavy Trucks on Bank 2

(916) 771-8700
orders@atdtraffic.com

File Name : 13-7630-007 Mandela Parkway-20th Street.ppd
Date : 10/26/2013

Unshifted Count = All Vehicles

	Mandela Parkway Southbound					20th Street Westbound					Mandela Parkway Northbound					20th Street Eastbound						
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total	Uturn Total
14:00	1	70	3	0	74	1	0	3	0	4	0	92	1	1	94	15	0	4	0	19	191	1
14:15	2	66	3	2	73	1	0	2	0	3	1	62	6	0	69	10	0	3	0	13	158	2
14:30	4	95	2	4	105	1	0	4	0	5	0	62	9	0	71	5	0	3	0	8	189	4
14:45	5	59	2	4	70	1	0	3	0	4	2	71	2	0	75	17	1	6	0	24	173	4
Total	12	290	10	10	322	4	0	12	0	16	3	287	18	1	309	47	1	16	0	64	711	11
15:00	2	99	4	4	109	1	0	0	0	1	1	66	6	0	73	22	0	3	0	25	208	4
15:15	1	83	2	1	87	2	0	2	0	4	0	67	4	0	71	14	0	2	0	16	178	1
15:30	1	65	1	0	67	0	0	3	0	3	1	70	4	1	76	15	1	4	0	20	166	1
15:45	1	80	1	1	83	1	1	1	0	3	1	63	5	0	69	13	0	4	0	17	172	1
Total	5	327	8	6	346	4	1	6	0	11	3	266	19	1	289	64	1	13	0	78	724	7
16:00	0	74	2	2	78	1	0	4	0	5	0	78	1	0	79	7	0	3	0	10	172	2
16:15	0	81	1	1	83	0	0	1	0	1	0	72	0	0	72	15	0	2	0	17	173	1
16:30	2	76	1	0	79	2	0	1	0	3	0	60	5	0	65	9	0	4	0	13	160	0
16:45	1	68	0	1	70	1	0	2	0	3	1	56	0	0	57	14	0	3	0	17	147	1
Total	3	299	4	4	310	4	0	8	0	12	1	266	6	0	273	45	0	12	0	57	652	4
17:00	1	77	2	3	83	0	0	0	0	0	1	50	0	0	51	23	0	0	0	23	157	3
17:15	3	45	1	0	49	1	0	3	0	4	0	67	1	0	68	14	0	7	0	21	142	0
17:30	0	89	1	1	91	0	0	2	0	2	1	74	0	0	75	15	0	8	0	23	191	1
17:45	0	67	2	0	69	3	0	3	0	6	0	73	1	0	74	16	0	5	0	21	170	0
Total	4	278	6	4	292	4	0	8	0	12	2	264	2	0	268	68	0	20	0	88	660	4
Grand Total	24	1194	28	24	1270	16	1	34	0	51	9	1083	45	2	1139	224	2	61	0	287	2747	26
Apprch %	1.9%	94.0%	2.2%	1.9%		31.4%	2.0%	66.7%	0.0%		0.8%	95.1%	4.0%	0.2%		78.0%	0.7%	21.3%	0.0%			
Total %	0.9%	43.5%	1.0%	0.9%	46.2%	0.6%	0.0%	1.2%	0.0%	1.9%	0.3%	39.4%	1.6%	0.1%	41.5%	8.2%	0.1%	2.2%	0.0%	10.4%	100.0%	

PM PEAK HOUR	Mandela Parkway Southbound					20th Street Westbound					Mandela Parkway Northbound					20th Street Eastbound					
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total
Peak Hour Analysis From 14:30 to 15:30																					
Peak Hour For Entire Intersection Begins at 14:30																					
14:30	4	95	2	4	105	1	0	4	0	5	0	62	9	0	71	5	0	3	0	8	189
14:45	5	59	2	4	70	1	0	3	0	4	2	71	2	0	75	17	1	6	0	24	173
15:00	2	99	4	4	109	1	0	0	0	1	1	66	6	0	73	22	0	3	0	25	208
15:15	1	83	2	1	87	2	0	2	0	4	0	67	4	0	71	14	0	2	0	16	178
Total Volume	12	336	10	13	371	5	0	9	0	14	3	266	21	0	290	58	1	14	0	73	748
% App Total	3.2%	90.6%	2.7%	3.5%		35.7%	0.0%	64.3%	0.0%		1.0%	91.7%	7.2%	0.0%		79.5%	1.4%	19.2%	0.0%		
PHF	.600	.848	.625	.813	.851	.625	.000	.563	.000	.700	.375	.937	.583	.000	.967	.659	.250	.583	.000	.730	.899

ALL TRAFFIC DATA

City of Oakland
All Vehicles on Unshifted
Peds & Bikes on Bank 1
Heavy Trucks on Bank 2

(916) 771-8700
orders@atdtraffic.com

File Name : 13-7630-008 I-880 NB Off-Ramp-7th Street.ppd
Date : 10/26/2013

Unshifted Count = All Vehicles

	Frontage Road Southbound					7th Street Westbound					I-880 NB Off-Ramp Northbound					7th Street Eastbound						
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total	Uturn Total
14:00	25	0	38	0	63	0	19	19	0	38	12	33	29	0	74	6	8	0	0	14	189	0
14:15	22	0	36	0	58	0	22	18	0	40	8	39	26	0	73	4	7	0	0	11	182	0
14:30	20	0	27	0	47	0	31	38	0	69	8	40	31	0	79	7	5	0	0	12	207	0
14:45	14	0	37	0	51	0	35	25	0	60	17	32	31	0	80	6	10	0	0	16	207	0
Total	81	0	138	0	219	0	107	100	0	207	45	144	117	0	306	23	30	0	0	53	785	0
15:00	14	0	43	0	57	0	36	28	0	64	6	29	32	0	67	4	5	0	0	9	197	0
15:15	19	0	54	0	73	0	30	18	0	48	13	30	30	0	73	1	2	0	0	3	197	0
15:30	12	0	47	0	59	0	27	42	0	69	6	60	35	0	101	5	7	0	0	12	241	0
15:45	14	0	28	0	42	0	25	20	0	45	6	29	18	0	53	4	3	0	0	7	147	0
Total	59	0	172	0	231	0	118	108	0	226	31	148	115	0	294	14	17	0	0	31	782	0
16:00	11	0	31	0	42	0	14	14	0	28	10	36	22	0	68	1	12	0	0	13	151	0
16:15	8	0	28	0	36	0	29	24	0	53	9	32	17	0	58	3	8	0	0	11	158	0
16:30	7	0	26	0	33	0	25	30	0	55	6	31	18	0	55	2	4	0	0	6	149	0
16:45	12	0	20	0	32	0	29	26	0	55	4	26	24	0	54	6	4	0	0	10	151	0
Total	38	0	105	0	143	0	97	94	0	191	29	125	81	0	235	12	28	0	0	40	609	0
17:00	18	0	23	0	41	0	19	12	0	31	5	29	16	0	50	6	12	0	0	18	140	0
17:15	15	0	27	0	42	0	24	20	0	44	2	36	27	0	65	2	5	0	0	7	158	0
17:30	12	0	24	0	36	0	13	19	0	32	1	26	15	0	42	2	7	0	0	9	119	0
17:45	17	0	35	0	52	0	24	20	0	44	7	29	13	0	49	5	8	0	0	13	158	0
Total	62	0	109	0	171	0	80	71	0	151	15	120	71	0	206	15	32	0	0	47	575	0
Grand Total	240	0	524	0	764	0	402	373	0	775	120	537	384	0	1041	64	107	0	0	171	2751	0
Apprch %	31.4%	0.0%	68.6%	0.0%		0.0%	51.9%	48.1%	0.0%		11.5%	51.6%	36.9%	0.0%		37.4%	62.6%	0.0%	0.0%			
Total %	8.7%	0.0%	19.0%	0.0%	27.8%	0.0%	14.6%	13.6%	0.0%	28.2%	4.4%	19.5%	14.0%	0.0%	37.8%	2.3%	3.9%	0.0%	0.0%	6.2%	100.0%	

PM PEAK HOUR	Frontage Road Southbound					7th Street Westbound					I-880 NB Off-Ramp Northbound					7th Street Eastbound					
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total
Peak Hour Analysis From 14:45 to 15:45																					
Peak Hour For Entire Intersection Begins at 14:45																					
14:45	14	0	37	0	51	0	35	25	0	60	17	32	31	0	80	6	10	0	0	16	207
15:00	14	0	43	0	57	0	36	28	0	64	6	29	32	0	67	4	5	0	0	9	197
15:15	19	0	54	0	73	0	30	18	0	48	13	30	30	0	73	1	2	0	0	3	197
15:30	12	0	47	0	59	0	27	42	0	69	6	60	35	0	101	5	7	0	0	12	241
Total Volume	59	0	181	0	240	0	128	113	0	241	42	151	128	0	321	16	24	0	0	40	842
% App Total	24.6%	0.0%	75.4%	0.0%		0.0%	53.1%	46.9%	0.0%		13.1%	47.0%	39.9%	0.0%		40.0%	60.0%	0.0%	0.0%		
PHF	.776	.000	.838	.000	.822	.000	.889	.673	.000	.873	.618	.629	.914	.000	.795	.667	.600	.000	.000	.625	.873

ALL TRAFFIC DATA

City of Oakland
All Vehicles on Unshifted
Peds & Bikes on Bank 1
Heavy Trucks on Bank 2

(916) 771-8700
orders@atdtraffic.com

File Name : 13-7630-009 Maritime Street-7th Street.ppd
Date : 10/26/2013

Unshifted Count = All Vehicles

	Maritime Street Southbound					7th Street Westbound					Maritime Street Northbound					7th Street Eastbound						
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total	Uturn Total
14:00	9	2	1	0	12	0	6	11	0	17	0	2	4	0	6	0	9	0	1	10	45	1
14:15	12	2	0	0	14	4	4	9	0	17	0	2	7	0	9	4	3	0	0	7	47	0
14:30	5	2	0	0	7	6	9	7	1	23	0	1	6	0	7	1	6	0	0	7	44	1
14:45	7	5	0	0	12	2	8	14	1	25	0	3	6	0	9	4	9	1	0	14	60	1
Total	33	11	1	0	45	12	27	41	2	82	0	8	23	0	31	9	27	1	1	38	196	3
15:00	9	5	1	0	15	1	9	5	0	15	1	2	2	0	5	1	5	0	0	6	41	0
15:15	7	0	0	0	7	1	7	15	0	23	0	3	2	0	5	0	1	0	0	1	36	0
15:30	8	2	1	0	11	5	3	4	3	15	0	1	0	0	1	4	5	0	0	9	36	3
15:45	10	1	0	0	11	4	7	2	2	15	0	1	0	0	1	4	6	0	0	10	37	2
Total	34	8	2	0	44	11	26	26	5	68	1	7	4	0	12	9	17	0	0	26	150	5
16:00	6	3	0	0	9	4	4	10	0	18	0	2	3	0	5	1	7	0	0	8	40	0
16:15	9	1	0	0	10	3	9	5	0	17	0	0	2	0	2	7	11	1	0	19	48	0
16:30	6	3	1	0	10	1	7	6	0	14	1	0	3	0	4	4	9	0	0	13	41	0
16:45	12	1	0	0	13	3	7	4	1	15	0	0	2	0	2	6	12	0	0	18	48	1
Total	33	8	1	0	42	11	27	25	1	64	1	2	10	0	13	18	39	1	0	58	177	1
17:00	14	2	2	0	18	0	2	3	0	5	0	2	2	0	4	7	17	0	0	24	51	0
17:15	7	1	0	0	8	2	4	5	0	11	0	5	1	0	6	0	5	0	0	5	30	0
17:30	8	7	1	0	16	1	7	2	0	10	0	6	5	0	11	4	5	0	0	9	46	0
17:45	8	2	0	0	10	3	8	1	0	12	0	4	1	0	5	9	7	0	0	16	43	0
Total	37	12	3	0	52	6	21	11	0	38	0	17	9	0	26	20	34	0	0	54	170	0
Grand Total	137	39	7	0	183	40	101	103	8	252	2	34	46	0	82	56	117	2	1	176	693	9
Apprch %	74.9%	21.3%	3.8%	0.0%		15.9%	40.1%	40.9%	3.2%		2.4%	41.5%	56.1%	0.0%		31.8%	66.5%	1.1%	0.6%			
Total %	19.8%	5.6%	1.0%	0.0%	26.4%	5.8%	14.6%	14.9%	1.2%	36.4%	0.3%	4.9%	6.6%	0.0%	11.8%	8.1%	16.9%	0.3%	0.1%	25.4%	100.0%	

PM PEAK HOUR	Maritime Street Southbound					7th Street Westbound					Maritime Street Northbound					7th Street Eastbound					
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total
Peak Hour Analysis From 14:00 to 15:00																					
Peak Hour For Entire Intersection Begins at 14:00																					
14:00	9	2	1	0	12	0	6	11	0	17	0	2	4	0	6	0	9	0	1	10	45
14:15	12	2	0	0	14	4	4	9	0	17	0	2	7	0	9	4	3	0	0	7	47
14:30	5	2	0	0	7	6	9	7	1	23	0	1	6	0	7	1	6	0	0	7	44
14:45	7	5	0	0	12	2	8	14	1	25	0	3	6	0	9	4	9	1	0	14	60
Total Volume	33	11	1	0	45	12	27	41	2	82	0	8	23	0	31	9	27	1	1	38	196
% App Total	73.3%	24.4%	2.2%	0.0%		14.6%	32.9%	50.0%	2.4%		0.0%	25.8%	74.2%	0.0%		23.7%	71.1%	2.6%	2.6%		
PHF	.688	.550	.250	.000	.804	.500	.750	.732	.500	.820	.000	.667	.821	.000	.861	.563	.750	.250	.250	.679	.817

ALL TRAFFIC DATA

City of Oakland
All Vehicles on Unshifted
Peds & Bikes on Bank 1
Heavy Trucks on Bank 2

(916) 771-8700
orders@atdtraffic.com

File Name : 13-7630-010 Adeline Street-West Grand Avenue.ppd
Date : 10/26/2013

Unshifted Count = All Vehicles

	Adeline Street Southbound					West Grand Avenue Westbound					Adeline Street Northbound					West Grand Avenue Eastbound						
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total	Uturn Total
14:00	12	28	9	1	50	8	134	10	2	154	6	32	10	0	48	7	73	7	0	87	339	3
14:15	11	26	13	0	50	8	104	9	1	122	5	22	12	0	39	11	67	5	1	84	295	2
14:30	10	40	21	0	71	8	125	11	4	148	9	23	11	0	43	3	69	3	0	75	337	4
14:45	20	28	17	0	65	14	112	10	1	137	6	28	9	0	43	5	77	9	0	91	336	1
Total	53	122	60	1	236	38	475	40	8	561	26	105	42	0	173	26	286	24	1	337	1307	10
15:00	14	30	12	0	56	9	122	10	0	141	11	27	9	0	47	12	85	1	0	98	342	0
15:15	16	31	20	0	67	8	92	17	1	118	9	20	6	0	35	5	104	6	1	116	336	2
15:30	13	46	18	0	77	13	100	10	1	124	6	29	8	0	43	8	75	5	1	89	333	2
15:45	9	31	5	0	45	6	88	14	1	109	6	18	8	0	32	5	91	6	0	102	288	1
Total	52	138	55	0	245	36	402	51	3	492	32	94	31	0	157	30	355	18	2	405	1299	5
16:00	18	37	10	0	65	7	78	12	2	99	9	22	5	0	36	10	71	8	1	90	290	3
16:15	8	46	9	0	63	7	83	9	1	100	6	27	2	0	35	10	79	7	0	96	294	1
16:30	9	32	16	0	57	8	92	9	1	110	8	20	10	0	38	11	58	2	0	71	276	1
16:45	12	31	11	0	54	9	79	4	4	96	6	18	7	0	31	10	59	3	0	72	253	4
Total	47	146	46	0	239	31	332	34	8	405	29	87	24	0	140	41	267	20	1	329	1113	9
17:00	8	30	17	0	55	10	85	10	2	107	4	21	8	0	33	4	79	4	0	87	282	2
17:15	15	26	9	0	50	12	105	10	6	133	7	33	7	0	47	7	68	7	0	82	312	6
17:30	7	32	11	0	50	7	106	5	6	124	7	32	10	0	49	11	76	2	0	89	312	6
17:45	11	23	5	0	39	19	98	14	1	132	8	27	12	0	47	7	72	10	0	89	307	1
Total	41	111	42	0	194	48	394	39	15	496	26	113	37	0	176	29	295	23	0	347	1213	15
Grand Total	193	517	203	1	914	153	1603	164	34	1954	113	399	134	0	646	126	1203	85	4	1418	4932	39
Apprch %	21.1%	56.6%	22.2%	0.1%		7.8%	82.0%	8.4%	1.7%		17.5%	61.8%	20.7%	0.0%		8.9%	84.8%	6.0%	0.3%			
Total %	3.9%	10.5%	4.1%	0.0%	18.5%	3.1%	32.5%	3.3%	0.7%	39.6%	2.3%	8.1%	2.7%	0.0%	13.1%	2.6%	24.4%	1.7%	0.1%	28.8%	100.0%	

PM PEAK HOUR	Adeline Street Southbound					West Grand Avenue Westbound					Adeline Street Northbound					West Grand Avenue Eastbound					
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total
Peak Hour Analysis From 14:30 to 15:30																					
Peak Hour For Entire Intersection Begins at 14:30																					
14:30	10	40	21	0	71	8	125	11	4	148	9	23	11	0	43	3	69	3	0	75	337
14:45	20	28	17	0	65	14	112	10	1	137	6	28	9	0	43	5	77	9	0	91	336
15:00	14	30	12	0	56	9	122	10	0	141	11	27	9	0	47	12	85	1	0	98	342
15:15	16	31	20	0	67	8	92	17	1	118	9	20	6	0	35	5	104	6	1	116	336
Total Volume	60	129	70	0	259	39	451	48	6	544	35	98	35	0	168	25	335	19	1	380	1351
% App Total	23.2%	49.8%	27.0%	0.0%		7.2%	82.9%	8.8%	1.1%		20.8%	58.3%	20.8%	0.0%		6.6%	88.2%	5.0%	0.3%		
PHF	.750	.806	.833	.000	.912	.696	.902	.706	.375	.919	.795	.875	.795	.000	.894	.521	.805	.528	.250	.819	.988

APPENDIX B: LEVEL OF SERVICE CALCULATION WORKSHEETS

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	65	0	6	0	0	0	4	431	1	0	84	9
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0				5.0	5.0			5.0	
Lane Util. Factor		1.00	1.00				1.00	0.95			0.95	
Frpb, ped/bikes		1.00	0.99				1.00	1.00			1.00	
Flpb, ped/bikes		1.00	1.00				1.00	1.00			1.00	
Frt		1.00	0.85				1.00	1.00			0.98	
Flt Protected		0.95	1.00				0.95	1.00			1.00	
Satd. Flow (prot)		1767	1199				1202	2735			2463	
Flt Permitted		0.76	1.00				0.69	1.00			1.00	
Satd. Flow (perm)		1408	1199				873	2735			2463	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.92
Adj. Flow (vph)	69	0	6	0	0	0	4	459	1	0	89	10
RTOR Reduction (vph)	0	0	4	0	0	0	0	0	0	0	6	0
Lane Group Flow (vph)	0	69	2	0	0	0	4	460	0	0	93	0
Confl. Peds. (#/hr)	2		1	1		2	1		2	2		1
Confl. Bikes (#/hr)									1			1
Heavy Vehicles (%)	2%	0%	33%	0%	0%	0%	50%	32%	0%	0%	49%	0%
Turn Type	Perm	NA	Perm				Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2			6		
Actuated Green, G (s)		29.0	29.0				31.0	31.0			31.0	
Effective Green, g (s)		29.0	29.0				31.0	31.0			31.0	
Actuated g/C Ratio		0.41	0.41				0.44	0.44			0.44	
Clearance Time (s)		5.0	5.0				5.0	5.0			5.0	
Lane Grp Cap (vph)		583	496				386	1211			1090	
v/s Ratio Prot								c0.17			0.04	
v/s Ratio Perm		c0.05	0.00				0.00					
v/c Ratio		0.12	0.01				0.01	0.38			0.09	
Uniform Delay, d1		12.6	12.0				10.9	13.1			11.3	
Progression Factor		1.00	1.00				1.00	1.00			1.00	
Incremental Delay, d2		0.4	0.0				0.0	0.9			0.2	
Delay (s)		13.0	12.1				11.0	14.0			11.4	
Level of Service		B	B				B	B			B	
Approach Delay (s)		13.0			0.0			13.9			11.4	
Approach LOS		B			A			B			B	

Intersection Summary			
HCM 2000 Control Delay	13.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.25		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	51.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	5	234	70	39	536	31	242	50	148	53	20	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	0.90	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.97	1.00	0.95	1.00	
Satd. Flow (prot)	1504	3505	1495	1433	3359		1618	1345	1302	1517	1398	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.97	1.00	0.95	1.00	
Satd. Flow (perm)	1504	3505	1495	1433	3359		1618	1345	1302	1517	1398	
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)	5	246	74	41	564	33	255	53	156	56	21	45
RTOR Reduction (vph)	0	0	57	0	4	0	0	0	126	0	34	0
Lane Group Flow (vph)	5	246	17	41	593	0	153	155	30	56	32	0
Heavy Vehicles (%)	20%	3%	8%	26%	3%	68%	6%	76%	24%	19%	50%	9%
Turn Type	Prot	NA	Perm	Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		6	6		2	2	
Permitted Phases			4						6			
Actuated Green, G (s)	1.0	16.9	16.9	4.9	20.8		14.5	14.5	14.5	18.8	18.8	
Effective Green, g (s)	1.0	16.9	16.9	4.9	20.8		14.5	14.5	14.5	18.8	18.8	
Actuated g/C Ratio	0.01	0.23	0.23	0.07	0.28		0.19	0.19	0.19	0.25	0.25	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	20	788	336	93	930		312	259	251	379	349	
v/s Ratio Prot	0.00	0.07		c0.03	c0.18		0.09	c0.12		c0.04	0.02	
v/s Ratio Perm			0.01						0.02			
v/c Ratio	0.25	0.31	0.05	0.44	0.64		0.49	0.60	0.12	0.15	0.09	
Uniform Delay, d1	36.7	24.3	22.8	33.8	23.8		27.0	27.6	25.0	21.9	21.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	6.5	0.2	0.1	3.3	1.4		1.2	3.7	0.2	0.8	0.5	
Delay (s)	43.2	24.5	22.9	37.1	25.3		28.2	31.3	25.2	22.7	22.1	
Level of Service	D	C	C	D	C		C	C	C	C	C	
Approach Delay (s)		24.4			26.1			28.3			22.4	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	26.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	75.1	Sum of lost time (s)	20.0
Intersection Capacity Utilization	46.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	88	283	69	143	500	167	77	138	290	105	60	14
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	1.00	0.85	1.00	0.90		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1433	3223		1626	3438	1495	1444	2823		1612	2833	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1433	3223		1626	3438	1495	1444	2823		1612	2833	
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)	91	292	71	147	515	172	79	142	299	108	62	14
RTOR Reduction (vph)	0	22	0	0	0	142	0	252	0	0	12	0
Lane Group Flow (vph)	91	341	0	147	515	30	79	189	0	108	64	0
Confl. Peds. (#/hr)			1	1								
Confl. Bikes (#/hr)			3									
Heavy Vehicles (%)	26%	8%	10%	11%	5%	8%	25%	23%	11%	12%	18%	50%
Turn Type	Split	NA		Split	NA	Perm	Split	NA		Split	NA	
Protected Phases	4	4		8	8		2	2		6	6	
Permitted Phases						8						
Actuated Green, G (s)	29.0	29.0		17.0	17.0	17.0	15.0	15.0		15.0	15.0	
Effective Green, g (s)	29.0	29.0		17.0	17.0	17.0	15.0	15.0		15.0	15.0	
Actuated g/C Ratio	0.30	0.30		0.18	0.18	0.18	0.16	0.16		0.16	0.16	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	432	973		287	608	264	225	441		251	442	
v/s Ratio Prot	0.06	c0.11		0.09	c0.15		0.05	c0.07		c0.07	0.02	
v/s Ratio Perm						0.02						
v/c Ratio	0.21	0.35		0.51	0.85	0.12	0.35	0.43		0.43	0.15	
Uniform Delay, d1	25.0	26.1		35.7	38.2	33.2	36.2	36.6		36.6	35.0	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.1	1.0		6.4	13.7	0.9	4.3	3.0		5.3	0.7	
Delay (s)	26.1	27.1		42.1	51.9	34.1	40.4	39.6		41.9	35.7	
Level of Service	C	C		D	D	C	D	D		D	D	
Approach Delay (s)		26.9			46.5			39.8			39.3	
Approach LOS		C			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	39.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	96.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	67.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	76	600	40	18	642	10	32	0	13	2	4	171
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	82	645	43	19	690	11	34	0	14	2	4	184
Pedestrians								2			2	
Lane Width (ft)								12.0			12.0	
Walking Speed (ft/s)								4.0			4.0	
Percent Blockage								0			0	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		1120			405							
pX, platoon unblocked	0.92						0.92	0.92		0.92	0.92	0.92
vC, conflicting volume	703			690			1402	1574	346	1236	1590	353
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	516			690			1272	1458	346	1093	1475	137
tC, single (s)	4.9			4.1			7.9	6.5	7.1	7.5	6.5	7.1
tC, 2 stage (s)												
tF (s)	2.6			2.2			3.7	4.0	3.4	3.5	4.0	3.4
p0 queue free %	89			98			48	100	98	98	96	77
cM capacity (veh/h)	759			912			67	105	632	139	103	793

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total	404	366	365	356	48	190
Volume Left	82	0	19	0	34	2
Volume Right	0	43	0	11	14	184
cSH	759	1700	912	1700	90	658
Volume to Capacity	0.11	0.22	0.02	0.21	0.54	0.29
Queue Length 95th (ft)	9	0	2	0	60	30
Control Delay (s)	3.2	0.0	0.7	0.0	84.2	12.7
Lane LOS	A		A		F	B
Approach Delay (s)	1.7		0.4		84.2	12.7
Approach LOS					F	B

Intersection Summary				
Average Delay	4.6			
Intersection Capacity Utilization	66.2%	ICU Level of Service	C	
Analysis Period (min)	15			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	150	0	0	0	0	480
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	155	0	0	0	0	495
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			444			
pX, platoon unblocked						
vC, conflicting volume	247	0			0	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	247	0			0	
tC, single (s)	6.9	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	78	100			100	
cM capacity (veh/h)	714	1091			1636	

Direction, Lane #	WB 1	WB 2	SB 1	SB 2
Volume Total	77	77	247	247
Volume Left	77	77	0	0
Volume Right	0	0	0	0
cSH	714	714	1700	1700
Volume to Capacity	0.11	0.11	0.15	0.15
Queue Length 95th (ft)	9	9	0	0
Control Delay (s)	10.7	10.7	0.0	0.0
Lane LOS	B	B		
Approach Delay (s)	10.7		0.0	
Approach LOS	B			

Intersection Summary				
Average Delay	2.5			
Intersection Capacity Utilization	28.5%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	445	69	95	440	0	0	0	0	111	370	140
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0		5.0	5.0						5.0	
Lane Util. Factor		0.91		1.00	0.95						0.95	
Frpb, ped/bikes		1.00		1.00	1.00						0.99	
Flpb, ped/bikes		1.00		1.00	1.00						1.00	
Frt		0.98		1.00	1.00						0.97	
Flt Protected		1.00		0.95	1.00						0.99	
Satd. Flow (prot)		4813		1770	3471						3375	
Flt Permitted		1.00		0.42	1.00						0.99	
Satd. Flow (perm)		4813		788	3471						3375	
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)	0	464	72	99	458	0	0	0	0	116	385	146
RTOR Reduction (vph)	0	19	0	0	0	0	0	0	0	0	24	0
Lane Group Flow (vph)	0	517	0	99	458	0	0	0	0	0	623	0
Confl. Peds. (#/hr)										7		3
Confl. Bikes (#/hr)						1						36
Heavy Vehicles (%)	6%	6%	3%	2%	4%	1%	3%	4%	1%	4%	1%	1%
Turn Type		NA		Perm	NA					Perm	NA	
Protected Phases		2			6						4	
Permitted Phases				6						4		
Actuated Green, G (s)		51.0		51.0	51.0						49.0	
Effective Green, g (s)		51.0		51.0	51.0						49.0	
Actuated g/C Ratio		0.46		0.46	0.46						0.45	
Clearance Time (s)		5.0		5.0	5.0						5.0	
Vehicle Extension (s)		3.0		3.0	3.0						3.0	
Lane Grp Cap (vph)		2231		365	1609						1503	
v/s Ratio Prot		0.11			c0.13							
v/s Ratio Perm				0.13							0.18	
v/c Ratio		0.23		0.27	0.28						0.41	
Uniform Delay, d1		17.7		18.1	18.2						20.7	
Progression Factor		1.00		0.50	0.49						1.00	
Incremental Delay, d2		0.2		1.8	0.4						0.8	
Delay (s)		18.0		10.8	9.3						21.6	
Level of Service		B		B	A						C	
Approach Delay (s)		18.0			9.6			0.0			21.6	
Approach LOS		B			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	16.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.35		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	55.4%	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												
Volume (veh/h)	0	65	7	4	1	0	0	0	0	6	418	2
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	0	70	8	4	1	0	0	0	0	6	449	2
Pedestrians		3						1				
Lane Width (ft)		12.0						0.0				
Walking Speed (ft/s)		4.0						4.0				
Percent Blockage		0						0				
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											655	
pX, platoon unblocked												
vC, conflicting volume	467	466	230	281	468	0	455			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	467	466	230	281	468	0	455			0		
tC, single (s)	7.7	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	86	99	99	100	100	100			100		
cM capacity (veh/h)	461	494	777	575	493	1091	1114			1636		

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	77	5	231	227
Volume Left	0	4	6	0
Volume Right	8	0	0	2
cSH	512	556	1636	1700
Volume to Capacity	0.15	0.01	0.00	0.13
Queue Length 95th (ft)	13	1	0	0
Control Delay (s)	13.3	11.5	0.2	0.0
Lane LOS	B	B	A	
Approach Delay (s)	13.3	11.5	0.1	
Approach LOS	B	B		

Intersection Summary				
Average Delay	2.1			
Intersection Capacity Utilization	22.8%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	125	86	0	0	96	114	79	278	83	79	0	181
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0		5.0	5.0		5.0		5.0
Lane Util. Factor	1.00	0.95			0.95		0.91	0.91		1.00		0.88
Frpb, ped/bikes	1.00	1.00			0.99		1.00	1.00		1.00		1.00
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00		1.00		1.00
Frt	1.00	1.00			0.92		1.00	0.97		1.00		0.85
Flt Protected	0.95	1.00			1.00		0.95	1.00		0.95		1.00
Satd. Flow (prot)	1160	3195			2746		1014	2888		1570		2349
Flt Permitted	0.95	1.00			1.00		0.95	1.00		0.95		1.00
Satd. Flow (perm)	1160	3195			2746		1014	2888		1570		2349
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	139	96	0	0	107	127	88	309	92	88	0	201
RTOR Reduction (vph)	0	0	0	0	111	0	0	20	0	0	0	174
Lane Group Flow (vph)	139	96	0	0	123	0	79	390	0	88	0	27
Confl. Peds. (#/hr)							4					4
Confl. Bikes (#/hr)			6			3						
Heavy Vehicles (%)	40%	13%	0%	0%	18%	21%	62%	15%	13%	15%	0%	21%
Parking (#/hr)	0											
Turn Type	Split	NA			NA		Split	NA		Prot		Prot
Protected Phases	4	4			8		2	2		6		6
Permitted Phases												
Actuated Green, G (s)	13.9	13.9			8.4		17.2	17.2		9.3		9.3
Effective Green, g (s)	13.9	13.9			8.4		17.2	17.2		9.3		9.3
Actuated g/C Ratio	0.20	0.20			0.12		0.25	0.25		0.14		0.14
Clearance Time (s)	5.0	5.0			5.0		5.0	5.0		5.0		5.0
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0		3.0
Lane Grp Cap (vph)	234	645			335		253	722		212		317
v/s Ratio Prot	c0.12	0.03			c0.04		0.08	c0.13		c0.06		0.01
v/s Ratio Perm												
v/c Ratio	0.59	0.15			0.37		0.31	0.54		0.42		0.09
Uniform Delay, d1	24.9	22.6			27.8		21.0	22.4		27.3		26.0
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00		1.00
Incremental Delay, d2	4.0	0.1			0.7		3.2	2.9		1.3		0.1
Delay (s)	28.9	22.7			28.4		24.2	25.3		28.6		26.1
Level of Service	C	C			C		C	C		C		C
Approach Delay (s)		26.4			28.4			25.1			26.9	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	26.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	68.8	Sum of lost time (s)	20.0
Intersection Capacity Utilization	43.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	150	174	32	25	53	58	5	201	138	173	112	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1245	2375	832	1107	2201	1062	1003	1970		1203	1870	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1245	2375	832	1107	2201	1062	1003	1970		1203	1870	
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	165	191	35	27	58	64	5	221	152	190	123	0
RTOR Reduction (vph)	0	0	24	0	0	56	0	104	0	0	0	0
Lane Group Flow (vph)	165	191	11	27	58	8	5	269	0	190	123	0
Confl. Bikes (#/hr)						1						
Heavy Vehicles (%)	45%	52%	94%	63%	64%	50%	80%	79%	62%	50%	93%	0%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8						
Actuated Green, G (s)	39.0	39.0	39.0	15.0	15.0	15.0	29.0	29.0		17.0	17.0	
Effective Green, g (s)	39.0	39.0	39.0	15.0	15.0	15.0	29.0	29.0		17.0	17.0	
Actuated g/C Ratio	0.32	0.32	0.32	0.12	0.12	0.12	0.24	0.24		0.14	0.14	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	404	771	270	138	275	132	242	476		170	264	
v/s Ratio Prot	c0.13	c0.08		0.02	0.03		0.00	c0.14		c0.16	0.07	
v/s Ratio Perm			0.01			0.01						
v/c Ratio	0.41	0.25	0.04	0.20	0.21	0.06	0.02	0.57		1.12	0.47	
Uniform Delay, d1	31.5	29.7	27.7	47.1	47.2	46.3	34.7	40.0		51.5	47.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	3.0	0.8	0.3	3.1	1.7	0.9	0.2	4.8		104.1	5.8	
Delay (s)	34.6	30.5	28.0	50.2	48.9	47.2	34.8	44.8		155.6	53.1	
Level of Service	C	C	C	D	D	D	C	D		F	D	
Approach Delay (s)		32.0			48.4			44.6			115.3	
Approach LOS		C			D			D			F	

Intersection Summary			
HCM 2000 Control Delay	59.1	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	47.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	44	483	43	59	554	50	29	196	54	62	181	64
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0			5.0			5.0	
Lane Util. Factor		0.91			0.91			0.95			0.95	
Frpb, ped/bikes		1.00			1.00			1.00			0.99	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		0.99			0.99			0.97			0.97	
Flt Protected		1.00			1.00			0.99			0.99	
Satd. Flow (prot)		4857			4989			3362			3301	
Flt Permitted		0.84			0.83			0.90			0.84	
Satd. Flow (perm)		4105			4170			3050			2808	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	46	508	45	62	583	53	31	206	57	65	191	67
RTOR Reduction (vph)	0	15	0	0	15	0	0	21	0	0	23	0
Lane Group Flow (vph)	0	584	0	0	683	0	0	273	0	0	300	0
Confl. Peds. (#/hr)	20		12	12		20	17		11	11		17
Confl. Bikes (#/hr)			10			8			12			9
Heavy Vehicles (%)	2%	5%	7%	2%	2%	2%	2%	3%	4%	2%	3%	9%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		18.8			18.8			33.6			33.6	
Effective Green, g (s)		18.8			18.8			33.6			33.6	
Actuated g/C Ratio		0.30			0.30			0.54			0.54	
Clearance Time (s)		5.0			5.0			5.0			5.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		1236			1256			1642			1512	
v/s Ratio Prot												
v/s Ratio Perm		0.14			c0.16			0.09			c0.11	
v/c Ratio		0.47			0.54			0.17			0.20	
Uniform Delay, d1		17.8			18.2			7.3			7.4	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		0.3			0.5			0.2			0.3	
Delay (s)		18.0			18.7			7.5			7.7	
Level of Service		B			B			A			A	
Approach Delay (s)		18.0			18.7			7.5			7.7	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	14.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.32		
Actuated Cycle Length (s)	62.4	Sum of lost time (s)	10.0
Intersection Capacity Utilization	87.6%	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												
Volume (veh/h)	0	0	0	0	146	9	4	596	0	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	0	0	0	0	151	9	4	614	0	0	0	0
Pedestrians		16			1						3	
Lane Width (ft)		0.0			12.0						0.0	
Walking Speed (ft/s)		4.0			4.0						4.0	
Percent Blockage		0			0						0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								536				
pX, platoon unblocked												
vC, conflicting volume	419	640	16	624	640	311	16			615		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	419	640	16	624	640	311	16			615		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	62	99	100			100		
cM capacity (veh/h)	362	395	1066	373	395	690	1615			973		

Direction, Lane #	WB 1	WB 2	NB 1	NB 2
Volume Total	100	59	209	410
Volume Left	0	0	4	0
Volume Right	0	9	0	0
cSH	395	423	1615	1700
Volume to Capacity	0.25	0.14	0.00	0.24
Queue Length 95th (ft)	25	12	0	0
Control Delay (s)	17.2	14.9	0.2	0.0
Lane LOS	C	B	A	
Approach Delay (s)	16.3		0.1	
Approach LOS	C			

Intersection Summary				
Average Delay	3.4			
Intersection Capacity Utilization	28.5%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	250	306	0	0	448	102	87	407	111	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0			5.0				
Lane Util. Factor		0.91			0.91			0.95				
Frpb, ped/bikes		1.00			1.00			0.99				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		1.00			0.97			0.97				
Flt Protected		0.98			1.00			0.99				
Satd. Flow (prot)		4784			4862			3350				
Flt Permitted		0.67			1.00			0.99				
Satd. Flow (perm)		3277			4862			3350				
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)	260	319	0	0	467	106	91	424	116	0	0	0
RTOR Reduction (vph)	0	0	0	0	33	0	0	18	0	0	0	0
Lane Group Flow (vph)	0	579	0	0	540	0	0	613	0	0	0	0
Confl. Peds. (#/hr)	2					2			4	4		
Confl. Bikes (#/hr)			1						44			
Heavy Vehicles (%)	6%	6%	3%	2%	4%	1%	3%	4%	1%	4%	1%	1%
Turn Type	Perm	NA			NA		Perm	NA				
Protected Phases		2			6			8				
Permitted Phases	2						8					
Actuated Green, G (s)		51.0			51.0			49.0				
Effective Green, g (s)		51.0			51.0			49.0				
Actuated g/C Ratio		0.46			0.46			0.45				
Clearance Time (s)		5.0			5.0			5.0				
Vehicle Extension (s)		3.0			3.0			3.0				
Lane Grp Cap (vph)		1519			2254			1492				
v/s Ratio Prot					0.11							
v/s Ratio Perm		c0.18						0.18				
v/c Ratio		0.38			0.24			0.41				
Uniform Delay, d1		19.2			17.8			20.7				
Progression Factor		0.56			1.00			1.00				
Incremental Delay, d2		0.7			0.3			0.2				
Delay (s)		11.5			18.1			20.9				
Level of Service		B			B			C				
Approach Delay (s)		11.5			18.1			20.9			0.0	
Approach LOS		B			B			C			A	

Intersection Summary			
HCM 2000 Control Delay	16.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	70.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	65	0	0	0	1	4	5	536	2	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	70	0	0	0	1	4	5	576	2	0	0	0
Pedestrians		12			1						1	
Lane Width (ft)		12.0			12.0						0.0	
Walking Speed (ft/s)		4.0			4.0						4.0	
Percent Blockage		1			0						0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											608	
pX, platoon unblocked												
vC, conflicting volume	317	602	12	589	601	291	12			579		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	317	602	12	589	601	291	12			579		
tC, single (s)	7.7	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	88	100	100	100	100	99	100			100		
cM capacity (veh/h)	580	410	1061	391	411	711	1604			1004		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	70	5	294	290
Volume Left	70	0	5	0
Volume Right	0	4	0	2
cSH	580	620	1604	1700
Volume to Capacity	0.12	0.01	0.00	0.17
Queue Length 95th (ft)	10	1	0	0
Control Delay (s)	12.0	10.9	0.2	0.0
Lane LOS	B	B	A	
Approach Delay (s)	12.0	10.9	0.1	
Approach LOS	B	B		

Intersection Summary				
Average Delay	1.4			
Intersection Capacity Utilization	32.0%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	66	0	12	0	0	0	6	108	0	0	54	24
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0				5.0	5.0			5.0	
Lane Util. Factor		1.00	1.00				1.00	0.95			0.95	
Frpb, ped/bikes		1.00	1.00				1.00	1.00			0.99	
Flpb, ped/bikes		1.00	1.00				1.00	1.00			1.00	
Frt		1.00	0.85				1.00	1.00			0.95	
Flt Protected		0.95	1.00				0.95	1.00			1.00	
Satd. Flow (prot)		1805	1615				1543	3471			3138	
Flt Permitted		0.76	1.00				0.70	1.00			1.00	
Satd. Flow (perm)		1439	1615				1132	3471			3138	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	75	0	14	0	0	0	7	123	0	0	61	27
RTOR Reduction (vph)	0	0	8	0	0	0	0	0	0	0	15	0
Lane Group Flow (vph)	0	75	6	0	0	0	7	123	0	0	73	0
Confl. Bikes (#/hr)												2
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	17%	4%	0%	0%	13%	0%
Turn Type	Perm	NA	Perm				Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2			6		
Actuated Green, G (s)		30.0	30.0				30.0	30.0			30.0	
Effective Green, g (s)		30.0	30.0				30.0	30.0			30.0	
Actuated g/C Ratio		0.43	0.43				0.43	0.43			0.43	
Clearance Time (s)		5.0	5.0				5.0	5.0			5.0	
Lane Grp Cap (vph)		616	692				485	1487			1344	
v/s Ratio Prot								c0.04			0.02	
v/s Ratio Perm		c0.05	0.00				0.01					
v/c Ratio		0.12	0.01				0.01	0.08			0.05	
Uniform Delay, d1		12.1	11.5				11.5	11.8			11.7	
Progression Factor		1.00	1.00				1.00	1.00			1.00	
Incremental Delay, d2		0.4	0.0				0.1	0.1			0.1	
Delay (s)		12.5	11.5				11.6	12.0			11.8	
Level of Service		B	B				B	B			B	
Approach Delay (s)		12.3			0.0			11.9			11.8	
Approach LOS		B			A			B			B	

Intersection Summary			
HCM 2000 Control Delay	12.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.10		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	17.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	25	165	34	29	483	20	55	12	78	34	11	17
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	0.91	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.97	1.00	0.95	1.00	
Satd. Flow (prot)	1357	3471	1524	1687	3409		1649	1455	1495	1433	1342	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.97	1.00	0.95	1.00	
Satd. Flow (perm)	1357	3471	1524	1687	3409		1649	1455	1495	1433	1342	
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)	27	179	37	32	525	22	60	13	85	37	12	18
RTOR Reduction (vph)	0	0	29	0	2	0	0	0	47	0	17	0
Lane Group Flow (vph)	27	179	8	32	545	0	36	37	38	37	13	0
Heavy Vehicles (%)	33%	4%	6%	7%	4%	35%	4%	50%	8%	26%	45%	18%
Turn Type	Prot	NA	Perm	Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		6	6		2	2	
Permitted Phases			4						6			
Actuated Green, G (s)	2.9	19.1	19.1	4.1	20.3		40.6	40.6	40.6	6.5	6.5	
Effective Green, g (s)	2.9	19.1	19.1	4.1	20.3		40.6	40.6	40.6	6.5	6.5	
Actuated g/C Ratio	0.03	0.21	0.21	0.05	0.22		0.45	0.45	0.45	0.07	0.07	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	43	734	322	76	766		741	654	672	103	96	
v/s Ratio Prot	c0.02	0.05		0.02	c0.16		0.02	0.03		c0.03	0.01	
v/s Ratio Perm			0.01						c0.03			
v/c Ratio	0.63	0.24	0.02	0.42	0.71		0.05	0.06	0.06	0.36	0.14	
Uniform Delay, d1	43.2	29.6	28.2	41.9	32.3		14.0	14.0	14.0	39.9	39.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	25.3	0.2	0.0	3.7	3.1		0.1	0.2	0.2	2.1	0.7	
Delay (s)	68.5	29.8	28.2	45.7	35.4		14.1	14.2	14.2	42.1	39.9	
Level of Service	E	C	C	D	D		B	B	B	D	D	
Approach Delay (s)		33.8			36.0			14.2			41.1	
Approach LOS		C			D			B			D	

Intersection Summary			
HCM 2000 Control Delay	32.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	90.3	Sum of lost time (s)	20.0
Intersection Capacity Utilization	38.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	40	156	54	110	445	189	77	85	127	93	69	22
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.96		1.00	1.00	0.85	1.00	0.91		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1626	3254		1703	3505	1543	1583	3042		1736	2926	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1626	3254		1703	3505	1543	1583	3042		1736	2926	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	43	166	57	117	473	201	82	90	135	99	73	23
RTOR Reduction (vph)	0	36	0	0	0	165	0	114	0	0	19	0
Lane Group Flow (vph)	43	187	0	117	473	36	82	111	0	99	77	0
Confl. Peds. (#/hr)			1	1								
Confl. Bikes (#/hr)			1			3						
Heavy Vehicles (%)	11%	4%	13%	6%	3%	3%	14%	5%	10%	4%	12%	41%
Turn Type	Split	NA		Split	NA	Perm	Split	NA		Split	NA	
Protected Phases	4	4		8	8		2	2		6	6	
Permitted Phases						8						
Actuated Green, G (s)	29.0	29.0		17.0	17.0	17.0	15.0	15.0		15.0	15.0	
Effective Green, g (s)	29.0	29.0		17.0	17.0	17.0	15.0	15.0		15.0	15.0	
Actuated g/C Ratio	0.30	0.30		0.18	0.18	0.18	0.16	0.16		0.16	0.16	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	491	982		301	620	273	247	475		271	457	
v/s Ratio Prot	0.03	c0.06		0.07	c0.13		c0.05	0.04		c0.06	0.03	
v/s Ratio Perm						0.02						
v/c Ratio	0.09	0.19		0.39	0.76	0.13	0.33	0.23		0.37	0.17	
Uniform Delay, d1	24.0	24.8		34.9	37.6	33.3	36.0	35.5		36.2	35.1	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.4	0.4		3.8	8.6	1.0	3.6	1.2		3.8	0.8	
Delay (s)	24.4	25.2		38.7	46.2	34.3	39.6	36.6		40.0	35.9	
Level of Service	C	C		D	D	C	D	D		D	D	
Approach Delay (s)		25.1			42.1			37.4			38.0	
Approach LOS		C			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	37.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.38		
Actuated Cycle Length (s)	96.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	58.5%	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												
Volume (veh/h)	23	361	33	18	624	5	43	4	23	3	10	90
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	24	372	34	19	643	5	44	4	24	3	10	93
Pedestrians		2										
Lane Width (ft)		12.0										
Walking Speed (ft/s)		4.0										
Percent Blockage		0										
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		1120			405							
pX, platoon unblocked	0.93						0.93	0.93		0.93	0.93	0.93
vC, conflicting volume	648			406			895	1122	203	942	1137	326
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	469			406			735	979	203	785	995	122
tC, single (s)	4.9			4.2			7.5	6.5	7.0	8.2	6.5	7.0
tC, 2 stage (s)												
tF (s)	2.6			2.3			3.5	4.0	3.3	3.8	4.0	3.3
p0 queue free %	97			98			81	98	97	98	95	89
cM capacity (veh/h)	792			1114			236	223	798	201	219	837

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total	210	220	340	327	72	106
Volume Left	24	0	19	0	44	3
Volume Right	0	34	0	5	24	93
cSH	792	1700	1114	1700	306	612
Volume to Capacity	0.03	0.13	0.02	0.19	0.24	0.17
Queue Length 95th (ft)	2	0	1	0	22	16
Control Delay (s)	1.4	0.0	0.6	0.0	20.4	12.1
Lane LOS	A		A		C	B
Approach Delay (s)	0.7		0.3		20.4	12.1
Approach LOS					C	B

Intersection Summary				
Average Delay	2.6			
Intersection Capacity Utilization	47.7%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	131	0	0	0	0	438
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	151	0	0	0	0	503
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			444			
pX, platoon unblocked						
vC, conflicting volume	252	0			0	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	252	0			0	
tC, single (s)	6.9	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	79	100			100	
cM capacity (veh/h)	707	1091			1636	

Direction, Lane #	WB 1	WB 2	SB 1	SB 2
Volume Total	75	75	252	252
Volume Left	75	75	0	0
Volume Right	0	0	0	0
cSH	707	707	1700	1700
Volume to Capacity	0.11	0.11	0.15	0.15
Queue Length 95th (ft)	9	9	0	0
Control Delay (s)	10.7	10.7	0.0	0.0
Lane LOS	B	B		
Approach Delay (s)	10.7		0.0	
Approach LOS	B			

Intersection Summary			
Average Delay	2.5		
Intersection Capacity Utilization	22.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	207	70	110	386	0	0	0	0	93	295	176
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0		5.0	5.0						5.0	
Lane Util. Factor		0.91		1.00	0.95						0.95	
Frpb, ped/bikes		1.00		1.00	1.00						0.99	
Flpb, ped/bikes		1.00		1.00	1.00						1.00	
Frt		0.96		1.00	1.00						0.95	
Flt Protected		1.00		0.95	1.00						0.99	
Satd. Flow (prot)		4677		1765	3539						3259	
Flt Permitted		1.00		0.56	1.00						0.99	
Satd. Flow (perm)		4677		1050	3539						3259	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	0	220	74	117	411	0	0	0	0	99	314	187
RTOR Reduction (vph)	0	43	0	0	0	0	0	0	0	0	47	0
Lane Group Flow (vph)	0	251	0	117	411	0	0	0	0	0	553	0
Confl. Peds. (#/hr)			4	4						4		2
Confl. Bikes (#/hr)			3			2						21
Heavy Vehicles (%)	3%	7%	4%	2%	2%	2%	2%	1%	1%	2%	5%	3%
Turn Type		NA		Perm	NA					Perm	NA	
Protected Phases		2			6						4	
Permitted Phases				6						4		
Actuated Green, G (s)		46.0		46.0	46.0						54.0	
Effective Green, g (s)		46.0		46.0	46.0						54.0	
Actuated g/C Ratio		0.42		0.42	0.42						0.49	
Clearance Time (s)		5.0		5.0	5.0						5.0	
Vehicle Extension (s)		3.0		3.0	3.0						3.0	
Lane Grp Cap (vph)		1955		439	1479						1599	
v/s Ratio Prot		0.05			c0.12							
v/s Ratio Perm				0.11							0.17	
v/c Ratio		0.13		0.27	0.28						0.35	
Uniform Delay, d1		19.7		21.0	21.1						17.2	
Progression Factor		1.00		0.36	0.36						1.00	
Incremental Delay, d2		0.1		0.3	0.1						0.6	
Delay (s)		19.8		7.9	7.7						17.8	
Level of Service		B		A	A						B	
Approach Delay (s)		19.8			7.7			0.0			17.8	
Approach LOS		B			A			A			B	

Intersection Summary			
HCM 2000 Control Delay	14.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.31		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	75.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	59	14	5	0	0	0	0	0	25	336	10
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	66	16	6	0	0	0	0	0	28	373	11
Pedestrians								1				
Lane Width (ft)								0.0				
Walking Speed (ft/s)								4.0				
Percent Blockage								0				
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											655	
pX, platoon unblocked												
vC, conflicting volume	434	434	193	292	440	0	384			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	434	434	193	292	440	0	384			0		
tC, single (s)	7.7	6.5	6.9	7.6	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.3	3.6	4.0	3.3	2.2			2.2		
p0 queue free %	100	87	98	99	100	100	100			98		
cM capacity (veh/h)	485	509	822	548	505	1091	1185			1636		

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	81	6	214	198
Volume Left	0	6	28	0
Volume Right	16	0	0	11
cSH	549	548	1636	1700
Volume to Capacity	0.15	0.01	0.02	0.12
Queue Length 95th (ft)	13	1	1	0
Control Delay (s)	12.7	11.6	1.1	0.0
Lane LOS	B	B	A	
Approach Delay (s)	12.7	11.6	0.6	
Approach LOS	B	B		

Intersection Summary				
Average Delay	2.6			
Intersection Capacity Utilization	21.3%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	16	24	0	0	128	113	42	151	128	59	0	181
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0		5.0	5.0		4.0		4.0
Lane Util. Factor	1.00	0.95			0.95		0.91	0.91		1.00		0.88
Frpb, ped/bikes	1.00	1.00			0.99		1.00	1.00		1.00		1.00
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00		1.00		1.00
Frt	1.00	1.00			0.93		1.00	0.93		1.00		0.85
Flt Protected	0.95	1.00			1.00		0.95	1.00		0.95		1.00
Satd. Flow (prot)	1624	3471			3078		1441	2983		1543		2682
Flt Permitted	0.95	1.00			1.00		0.95	1.00		0.95		1.00
Satd. Flow (perm)	1624	3471			3078		1441	2983		1543		2682
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Adj. Flow (vph)	18	28	0	0	147	130	48	174	147	68	0	208
RTOR Reduction (vph)	0	0	0	0	110	0	0	95	0	0	0	192
Lane Group Flow (vph)	18	28	0	0	167	0	43	231	0	68	0	16
Confl. Peds. (#/hr)	6					6						
Confl. Bikes (#/hr)			6			3						
Heavy Vehicles (%)	0%	4%	0%	0%	9%	7%	14%	7%	9%	17%	0%	6%
Parking (#/hr)	0											
Turn Type	Split	NA			NA		Split	NA		Prot		Prot
Protected Phases	4	4			8		2	2		6		6
Permitted Phases												
Actuated Green, G (s)	2.3	2.3			8.0		18.4	18.4		4.1		4.1
Effective Green, g (s)	2.3	2.3			8.0		18.4	18.4		4.1		4.1
Actuated g/C Ratio	0.04	0.04			0.15		0.36	0.36		0.08		0.08
Clearance Time (s)	5.0	5.0			5.0		5.0	5.0		4.0		4.0
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0		3.0
Lane Grp Cap (vph)	72	154			475		511	1059		122		212
v/s Ratio Prot	c0.01	0.01			c0.05		0.03	c0.08		c0.04		0.01
v/s Ratio Perm												
v/c Ratio	0.25	0.18			0.35		0.08	0.22		0.56		0.08
Uniform Delay, d1	23.9	23.8			19.6		11.1	11.7		23.0		22.1
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00		1.00
Incremental Delay, d2	1.8	0.6			0.5		0.3	0.5		5.4		0.2
Delay (s)	25.7	24.4			20.0		11.4	12.1		28.4		22.3
Level of Service	C	C			C		B	B		C		C
Approach Delay (s)		24.9			20.0			12.1			23.8	
Approach LOS		C			C			B			C	

Intersection Summary			
HCM 2000 Control Delay	18.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	51.8	Sum of lost time (s)	19.0
Intersection Capacity Utilization	36.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	10	27	1	14	27	41	0	8	23	33	11	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0		5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.99		1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00		1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.89		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		1.00		0.95	1.00	
Satd. Flow (prot)	1805	3610	793	1357	3471	1328		2621		1703	2362	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		1.00		0.95	1.00	
Satd. Flow (perm)	1805	3610	793	1357	3471	1328		2621		1703	2362	
Peak-hour factor, PHF	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Adj. Flow (vph)	12	33	1	17	33	50	0	10	28	40	13	1
RTOR Reduction (vph)	0	0	1	0	0	32	0	21	0	0	1	0
Lane Group Flow (vph)	12	33	0	17	33	18	0	17	0	40	13	0
Confl. Peds. (#/hr)			4	4								
Confl. Bikes (#/hr)			4			2						3
Heavy Vehicles (%)	0%	0%	100%	33%	4%	20%	0%	38%	17%	6%	55%	0%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8						
Actuated Green, G (s)	10.0	39.0	39.0	15.0	44.0	44.0		30.0		16.0	42.0	
Effective Green, g (s)	10.0	39.0	39.0	15.0	44.0	44.0		30.0		16.0	42.0	
Actuated g/C Ratio	0.08	0.32	0.32	0.12	0.37	0.37		0.25		0.13	0.35	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0		5.0		5.0	5.0	
Lane Grp Cap (vph)	150	1173	257	169	1272	486		655		227	826	
v/s Ratio Prot	0.01	0.01		c0.01	0.01			c0.01		c0.02	0.01	
v/s Ratio Perm			0.00			c0.01						
v/c Ratio	0.08	0.03	0.00	0.10	0.03	0.04		0.03		0.18	0.02	
Uniform Delay, d1	50.8	27.6	27.3	46.5	24.3	24.4		34.0		46.2	25.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2	1.0	0.0	0.0	1.2	0.0	0.1		0.1		1.7	0.0	
Delay (s)	51.8	27.6	27.4	47.7	24.3	24.5		34.0		47.8	25.5	
Level of Service	D	C	C	D	C	C		C		D	C	
Approach Delay (s)		33.9			28.4			34.0			42.1	
Approach LOS		C			C			C			D	

Intersection Summary			
HCM 2000 Control Delay	33.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.07		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	51.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	26	335	19	45	451	48	35	98	35	60	129	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0			5.0			5.0	
Lane Util. Factor		0.91			0.91			0.95			0.95	
Frpb, ped/bikes		1.00			1.00			1.00			0.99	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		0.99			0.99			0.97			0.96	
Flt Protected		1.00			1.00			0.99			0.99	
Satd. Flow (prot)		4949			4961			3444			3319	
Flt Permitted		0.88			0.87			0.87			0.86	
Satd. Flow (perm)		4364			4353			3040			2895	
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	26	338	19	45	456	48	35	99	35	61	130	71
RTOR Reduction (vph)	0	10	0	0	19	0	0	15	0	0	31	0
Lane Group Flow (vph)	0	373	0	0	530	0	0	154	0	0	231	0
Confl. Peds. (#/hr)	6		3	3		6	6		5	5		6
Confl. Bikes (#/hr)			15			13			14			11
Heavy Vehicles (%)	0%	4%	0%	0%	3%	0%	0%	0%	0%	2%	4%	0%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		15.6			15.6			33.8			33.8	
Effective Green, g (s)		15.6			15.6			33.8			33.8	
Actuated g/C Ratio		0.26			0.26			0.57			0.57	
Clearance Time (s)		5.0			5.0			5.0			5.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		1146			1143			1729			1647	
v/s Ratio Prot												
v/s Ratio Perm		0.09			c0.12			0.05			c0.08	
v/c Ratio		0.33			0.46			0.09			0.14	
Uniform Delay, d1		17.7			18.4			5.8			6.0	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		0.2			0.3			0.1			0.2	
Delay (s)		17.8			18.7			5.9			6.2	
Level of Service		B			B			A			A	
Approach Delay (s)		17.8			18.7			5.9			6.2	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	14.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.24		
Actuated Cycle Length (s)	59.4	Sum of lost time (s)	10.0
Intersection Capacity Utilization	77.6%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	128	7	3	331	0	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	0	0	0	0	147	8	3	380	0	0	0	0
Pedestrians		3			3						2	
Lane Width (ft)		0.0			12.0						0.0	
Walking Speed (ft/s)		4.0			4.0						4.0	
Percent Blockage		0			0						0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								536				
pX, platoon unblocked												
vC, conflicting volume	284	393	3	390	393	195	3			383		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	284	393	3	390	393	195	3			383		
tC, single (s)	7.5	6.5	6.9	7.6	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	73	99	100			100		
cM capacity (veh/h)	509	544	1086	533	544	817	1632			1183		

Direction, Lane #	WB 1	WB 2	NB 1	NB 2
Volume Total	98	57	130	254
Volume Left	0	0	3	0
Volume Right	0	8	0	0
cSH	544	570	1632	1700
Volume to Capacity	0.18	0.10	0.00	0.15
Queue Length 95th (ft)	16	8	0	0
Control Delay (s)	13.1	12.0	0.2	0.0
Lane LOS	B	B	A	
Approach Delay (s)	12.7		0.1	
Approach LOS	B			

Intersection Summary				
Average Delay	3.7			
Intersection Capacity Utilization	22.5%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	119	181	0	0	433	64	64	210	78	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0			5.0				
Lane Util. Factor		0.91			0.91			0.95				
Frpb, ped/bikes		1.00			1.00			0.99				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		1.00			0.98			0.97				
Flt Protected		0.98			1.00			0.99				
Satd. Flow (prot)		4824			4978			3393				
Flt Permitted		0.68			1.00			0.99				
Satd. Flow (perm)		3360			4978			3393				
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	127	193	0	0	461	68	68	223	83	0	0	0
RTOR Reduction (vph)	0	0	0	0	17	0	0	24	0	0	0	0
Lane Group Flow (vph)	0	320	0	0	512	0	0	350	0	0	0	0
Confl. Peds. (#/hr)	1					1			8			
Confl. Bikes (#/hr)			2			2			27			
Heavy Vehicles (%)	3%	7%	4%	2%	2%	2%	2%	1%	1%	2%	5%	3%
Turn Type	Perm	NA			NA		Perm	NA				
Protected Phases		2			6			8				
Permitted Phases	2						8					
Actuated Green, G (s)		46.0			46.0			54.0				
Effective Green, g (s)		46.0			46.0			54.0				
Actuated g/C Ratio		0.42			0.42			0.49				
Clearance Time (s)		5.0			5.0			5.0				
Vehicle Extension (s)		3.0			3.0			3.0				
Lane Grp Cap (vph)		1405			2081			1665				
v/s Ratio Prot					c0.10							
v/s Ratio Perm		0.10						0.10				
v/c Ratio		0.23			0.25			0.21				
Uniform Delay, d1		20.6			20.8			15.9				
Progression Factor		0.81			1.00			1.00				
Incremental Delay, d2		0.4			0.1			0.1				
Delay (s)		17.1			20.8			16.0				
Level of Service		B			C			B				
Approach Delay (s)		17.1			20.8			16.0			0.0	
Approach LOS		B			C			B			A	

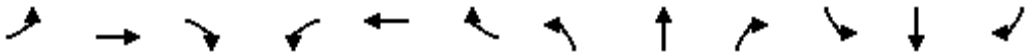
Intersection Summary			
HCM 2000 Control Delay	18.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.23		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	43.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	58	1	0	0	1	9	3	266	21	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	64	1	0	0	1	10	3	296	23	0	0	0
Pedestrians		9			13							
Lane Width (ft)		12.0			12.0							
Walking Speed (ft/s)		4.0			4.0							
Percent Blockage		1			1							
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											608	
pX, platoon unblocked												
vC, conflicting volume	174	348	9	327	336	172	9			332		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	174	348	9	327	336	172	9			332		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	91	100	100	100	100	99	100			100		
cM capacity (veh/h)	745	568	1069	590	576	838	1612			1225		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	66	11	151	171
Volume Left	64	0	3	0
Volume Right	0	10	0	23
cSH	741	802	1612	1700
Volume to Capacity	0.09	0.01	0.00	0.10
Queue Length 95th (ft)	7	1	0	0
Control Delay (s)	10.3	9.6	0.2	0.0
Lane LOS	B	A	A	
Approach Delay (s)	10.3	9.6	0.1	
Approach LOS	B	A		

Intersection Summary				
Average Delay	2.0			
Intersection Capacity Utilization	26.6%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	127	0	19	0	0	0	24	431	1	0	84	101
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0				5.0	5.0			5.0	
Lane Util. Factor		1.00	1.00				1.00	0.95			0.95	
Frpb, ped/bikes		1.00	0.96				1.00	1.00			0.97	
Flpb, ped/bikes		0.98	1.00				0.98	1.00			1.00	
Frt		1.00	0.85				1.00	1.00			0.92	
Flt Protected		0.95	1.00				0.95	1.00			1.00	
Satd. Flow (prot)		1739	1164				1181	2735			2624	
Flt Permitted		0.76	1.00				0.63	1.00			1.00	
Satd. Flow (perm)		1386	1164				779	2735			2624	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.92
Adj. Flow (vph)	135	0	20	0	0	0	26	459	1	0	89	110
RTOR Reduction (vph)	0	0	12	0	0	0	0	0	0	0	61	0
Lane Group Flow (vph)	0	135	8	0	0	0	26	460	0	0	138	0
Confl. Peds. (#/hr)	20		20	20		20	20		20	20		20
Confl. Bikes (#/hr)			20			20			20			20
Heavy Vehicles (%)	2%	0%	33%	0%	0%	0%	50%	32%	0%	0%	49%	0%
Turn Type	Perm	NA	Perm	Perm			Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2			6		
Actuated Green, G (s)		29.0	29.0				31.0	31.0			31.0	
Effective Green, g (s)		29.0	29.0				31.0	31.0			31.0	
Actuated g/C Ratio		0.41	0.41				0.44	0.44			0.44	
Clearance Time (s)		5.0	5.0				5.0	5.0			5.0	
Lane Grp Cap (vph)		574	482				344	1211			1162	
v/s Ratio Prot								c0.17			0.05	
v/s Ratio Perm		c0.10	0.01				0.03					
v/c Ratio		0.24	0.02				0.08	0.38			0.12	
Uniform Delay, d1		13.3	12.1				11.2	13.1			11.5	
Progression Factor		1.00	1.00				1.00	1.00			1.00	
Incremental Delay, d2		1.0	0.1				0.4	0.9			0.2	
Delay (s)		14.3	12.2				11.7	14.0			11.7	
Level of Service		B	B				B	B			B	
Approach Delay (s)		14.0			0.0			13.8			11.7	
Approach LOS		B			A			B			B	

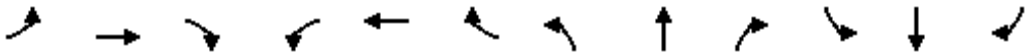
Intersection Summary			
HCM 2000 Control Delay	13.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.31		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	51.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	5	234	92	110	536	31	253	50	199	53	20	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.96	1.00	1.00		1.00	1.00	0.97	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	0.90	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.97	1.00	0.95	1.00	
Satd. Flow (prot)	1504	3505	1433	1433	3359		1618	1355	1267	1517	1398	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.97	1.00	0.95	1.00	
Satd. Flow (perm)	1504	3505	1433	1433	3359		1618	1355	1267	1517	1398	
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)	5	246	97	116	564	33	266	53	209	56	21	45
RTOR Reduction (vph)	0	0	78	0	3	0	0	0	168	0	35	0
Lane Group Flow (vph)	5	246	19	116	594	0	157	162	41	56	31	0
Confl. Peds. (#/hr)			20						20			
Heavy Vehicles (%)	20%	3%	8%	26%	3%	68%	6%	76%	24%	19%	50%	9%
Turn Type	Prot	NA	Perm	Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		6	6		2	2	
Permitted Phases			4						6			
Actuated Green, G (s)	1.0	16.0	16.0	9.9	24.9		16.0	16.0	16.0	18.8	18.8	
Effective Green, g (s)	1.0	16.0	16.0	9.9	24.9		16.0	16.0	16.0	18.8	18.8	
Actuated g/C Ratio	0.01	0.20	0.20	0.12	0.31		0.20	0.20	0.20	0.23	0.23	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	18	694	284	175	1036		320	268	251	353	325	
v/s Ratio Prot	0.00	0.07		c0.08	c0.18		0.10	c0.12		c0.04	0.02	
v/s Ratio Perm			0.01						0.03			
v/c Ratio	0.28	0.35	0.07	0.66	0.57		0.49	0.60	0.17	0.16	0.10	
Uniform Delay, d1	39.5	27.9	26.3	33.8	23.4		28.7	29.5	26.8	24.7	24.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	8.3	0.3	0.1	9.1	0.8		1.2	3.8	0.3	1.0	0.6	
Delay (s)	47.7	28.2	26.4	42.9	24.2		29.9	33.3	27.1	25.6	24.9	
Level of Service	D	C	C	D	C		C	C	C	C	C	
Approach Delay (s)		28.0			27.2			29.8			25.2	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	28.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	80.7	Sum of lost time (s)	20.0
Intersection Capacity Utilization	51.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	96	323	72	143	557	167	81	138	290	105	60	23
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	1.00	0.85	1.00	0.90		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1433	3232		1626	3438	1495	1444	2823		1612	2725	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1433	3232		1626	3438	1495	1444	2823		1612	2725	
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)	99	333	74	147	574	172	84	142	299	108	62	24
RTOR Reduction (vph)	0	20	0	0	0	142	0	252	0	0	20	0
Lane Group Flow (vph)	99	387	0	147	574	30	84	189	0	108	66	0
Confl. Peds. (#/hr)			1	1								
Confl. Bikes (#/hr)			3									
Heavy Vehicles (%)	26%	8%	10%	11%	5%	8%	25%	23%	11%	12%	18%	50%
Turn Type	Split	NA		Split	NA	Perm	Split	NA		Split	NA	
Protected Phases	4	4		8	8		2	2		6	6	
Permitted Phases						8						
Actuated Green, G (s)	29.0	29.0		17.0	17.0	17.0	15.0	15.0		15.0	15.0	
Effective Green, g (s)	29.0	29.0		17.0	17.0	17.0	15.0	15.0		15.0	15.0	
Actuated g/C Ratio	0.30	0.30		0.18	0.18	0.18	0.16	0.16		0.16	0.16	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	432	976		287	608	264	225	441		251	425	
v/s Ratio Prot	0.07	c0.12		0.09	c0.17		0.06	c0.07		c0.07	0.02	
v/s Ratio Perm						0.02						
v/c Ratio	0.23	0.40		0.51	0.94	0.12	0.37	0.43		0.43	0.15	
Uniform Delay, d1	25.1	26.6		35.7	39.0	33.2	36.3	36.6		36.6	35.0	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.2	1.2		6.4	25.0	0.9	4.7	3.0		5.3	0.8	
Delay (s)	26.4	27.8		42.1	64.1	34.1	41.0	39.6		41.9	35.8	
Level of Service	C	C		D	E	C	D	D		D	D	
Approach Delay (s)		27.5			54.7			39.9			39.2	
Approach LOS		C			D			D			D	

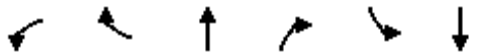
Intersection Summary			
HCM 2000 Control Delay	43.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	96.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	67.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	66	640	40	18	699	10	32	0	13	2	4	171
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	71	688	43	19	752	11	34	0	14	2	4	184
Pedestrians								2			2	
Lane Width (ft)								12.0			12.0	
Walking Speed (ft/s)								4.0			4.0	
Percent Blockage								0			0	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		1120			405							
pX, platoon unblocked	0.92						0.92	0.92		0.92	0.92	0.92
vC, conflicting volume	764			733			1454	1657	368	1298	1673	383
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	558			733			1311	1532	368	1140	1550	141
tC, single (s)	4.9			4.1			7.9	6.5	7.1	7.5	6.5	7.1
tC, 2 stage (s)												
tF (s)	2.6			2.2			3.7	4.0	3.4	3.5	4.0	3.4
p0 queue free %	90			98			44	100	98	98	95	76
cM capacity (veh/h)	720			879			61	95	611	128	92	780

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total	415	387	395	387	48	190
Volume Left	71	0	19	0	34	2
Volume Right	0	43	0	11	14	184
cSH	720	1700	879	1700	83	636
Volume to Capacity	0.10	0.23	0.02	0.23	0.58	0.30
Queue Length 95th (ft)	8	0	2	0	65	31
Control Delay (s)	2.9	0.0	0.7	0.0	96.5	13.1
Lane LOS	A		A		F	B
Approach Delay (s)	1.5		0.4		96.5	13.1
Approach LOS					F	B

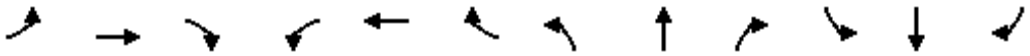
Intersection Summary			
Average Delay	4.7		
Intersection Capacity Utilization	68.6%	ICU Level of Service	C
Analysis Period (min)	15		



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	150	0	0	0	0	488
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	155	0	0	0	0	503
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			444			
pX, platoon unblocked						
vC, conflicting volume	252	0			0	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	252	0			0	
tC, single (s)	6.9	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	78	100			100	
cM capacity (veh/h)	710	1091			1636	

Direction, Lane #	WB 1	WB 2	SB 1	SB 2
Volume Total	77	77	252	252
Volume Left	77	77	0	0
Volume Right	0	0	0	0
cSH	710	710	1700	1700
Volume to Capacity	0.11	0.11	0.15	0.15
Queue Length 95th (ft)	9	9	0	0
Control Delay (s)	10.7	10.7	0.0	0.0
Lane LOS	B	B		
Approach Delay (s)	10.7		0.0	
Approach LOS	B			

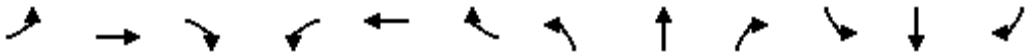
Intersection Summary			
Average Delay	2.5		
Intersection Capacity Utilization	28.6%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	483	72	95	490	0	0	0	0	111	370	148
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0		5.0	5.0						5.0	
Lane Util. Factor		0.91		1.00	0.95						0.95	
Frpb, ped/bikes		1.00		1.00	1.00						0.99	
Flpb, ped/bikes		1.00		1.00	1.00						1.00	
Frt		0.98		1.00	1.00						0.96	
Flt Protected		1.00		0.95	1.00						0.99	
Satd. Flow (prot)		4816		1770	3471						3370	
Flt Permitted		1.00		0.40	1.00						0.99	
Satd. Flow (perm)		4816		745	3471						3370	
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)	0	503	75	99	510	0	0	0	0	116	385	154
RTOR Reduction (vph)	0	18	0	0	0	0	0	0	0	0	27	0
Lane Group Flow (vph)	0	560	0	99	510	0	0	0	0	0	628	0
Confl. Peds. (#/hr)										7		3
Confl. Bikes (#/hr)						1						36
Heavy Vehicles (%)	6%	6%	3%	2%	4%	1%	3%	4%	1%	4%	1%	1%
Turn Type		NA		Perm	NA					Perm	NA	
Protected Phases		2			6						4	
Permitted Phases				6						4		
Actuated Green, G (s)		51.0		51.0	51.0						49.0	
Effective Green, g (s)		51.0		51.0	51.0						49.0	
Actuated g/C Ratio		0.46		0.46	0.46						0.45	
Clearance Time (s)		5.0		5.0	5.0						5.0	
Vehicle Extension (s)		3.0		3.0	3.0						3.0	
Lane Grp Cap (vph)		2232		345	1609						1501	
v/s Ratio Prot		0.12			c0.15							
v/s Ratio Perm				0.13							0.19	
v/c Ratio		0.25		0.29	0.32						0.42	
Uniform Delay, d1		17.9		18.3	18.5						20.8	
Progression Factor		1.00		0.47	0.46						1.00	
Incremental Delay, d2		0.3		2.0	0.5						0.9	
Delay (s)		18.2		10.6	9.0						21.7	
Level of Service		B		B	A						C	
Approach Delay (s)		18.2			9.2			0.0			21.7	
Approach LOS		B			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	16.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	56.2%	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												
Volume (veh/h)	0	65	7	4	1	0	0	0	0	6	421	2
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	0	70	8	4	1	0	0	0	0	6	453	2
Pedestrians		3						1				
Lane Width (ft)		12.0						0.0				
Walking Speed (ft/s)		4.0						4.0				
Percent Blockage		0						0				
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											655	
pX, platoon unblocked												
vC, conflicting volume	470	470	231	283	471	0	458			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	470	470	231	283	471	0	458			0		
tC, single (s)	7.7	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	86	99	99	100	100	100			100		
cM capacity (veh/h)	459	492	775	573	491	1091	1111			1636		

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	77	5	233	228
Volume Left	0	4	6	0
Volume Right	8	0	0	2
cSH	510	555	1636	1700
Volume to Capacity	0.15	0.01	0.00	0.13
Queue Length 95th (ft)	13	1	0	0
Control Delay (s)	13.3	11.6	0.2	0.0
Lane LOS	B	B	A	
Approach Delay (s)	13.3	11.6	0.1	
Approach LOS	B	B		

Intersection Summary				
Average Delay	2.1			
Intersection Capacity Utilization	22.8%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	125	88	0	0	99	118	96	278	83	82	0	181
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0		5.0	5.0		5.0		5.0
Lane Util. Factor	1.00	0.95			0.95		0.91	0.91		1.00		0.88
Frpb, ped/bikes	1.00	1.00			0.99		1.00	1.00		1.00		1.00
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00		1.00		1.00
Frt	1.00	1.00			0.92		1.00	0.97		1.00		0.85
Flt Protected	0.95	1.00			1.00		0.95	1.00		0.95		1.00
Satd. Flow (prot)	1160	3195			2745		1014	2882		1570		2349
Flt Permitted	0.95	1.00			1.00		0.95	1.00		0.95		1.00
Satd. Flow (perm)	1160	3195			2745		1014	2882		1570		2349
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	139	98	0	0	110	131	107	309	92	91	0	201
RTOR Reduction (vph)	0	0	0	0	115	0	0	20	0	0	0	173
Lane Group Flow (vph)	139	98	0	0	126	0	96	392	0	91	0	28
Confl. Peds. (#/hr)							4					4
Confl. Bikes (#/hr)			6			3						
Heavy Vehicles (%)	40%	13%	0%	0%	18%	21%	62%	15%	13%	15%	0%	21%
Parking (#/hr)	0											
Turn Type	Split	NA			NA		Split	NA		Prot		custom
Protected Phases	4	4			8		2	2		6		6
Permitted Phases												
Actuated Green, G (s)	13.9	13.9			8.5		17.2	17.2		9.5		9.5
Effective Green, g (s)	13.9	13.9			8.5		17.2	17.2		9.5		9.5
Actuated g/C Ratio	0.20	0.20			0.12		0.25	0.25		0.14		0.14
Clearance Time (s)	5.0	5.0			5.0		5.0	5.0		5.0		5.0
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0		3.0
Lane Grp Cap (vph)	233	642			337		252	717		215		322
v/s Ratio Prot	c0.12	0.03			c0.05		0.09	c0.14		c0.06		0.01
v/s Ratio Perm												
v/c Ratio	0.60	0.15			0.37		0.38	0.55		0.42		0.09
Uniform Delay, d1	25.1	22.7			27.9		21.5	22.6		27.3		26.0
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00		1.00
Incremental Delay, d2	4.1	0.1			0.7		4.3	3.0		1.3		0.1
Delay (s)	29.1	22.9			28.6		25.9	25.5		28.6		26.1
Level of Service	C	C			C		C	C		C		C
Approach Delay (s)		26.5			28.6			25.6			26.9	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	26.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	69.1	Sum of lost time (s)	20.0
Intersection Capacity Utilization	43.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	150	174	32	25	53	78	5	201	138	186	112	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1245	2375	832	1107	2201	1062	1003	1970		1203	1870	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1245	2375	832	1107	2201	1062	1003	1970		1203	1870	
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	165	191	35	27	58	86	5	221	152	204	123	0
RTOR Reduction (vph)	0	0	24	0	0	75	0	104	0	0	0	0
Lane Group Flow (vph)	165	191	11	27	58	11	5	269	0	204	123	0
Confl. Bikes (#/hr)						1						
Heavy Vehicles (%)	45%	52%	94%	63%	64%	50%	80%	79%	62%	50%	93%	0%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8						
Actuated Green, G (s)	39.0	39.0	39.0	15.0	15.0	15.0	29.0	29.0		17.0	17.0	
Effective Green, g (s)	39.0	39.0	39.0	15.0	15.0	15.0	29.0	29.0		17.0	17.0	
Actuated g/C Ratio	0.32	0.32	0.32	0.12	0.12	0.12	0.24	0.24		0.14	0.14	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	404	771	270	138	275	132	242	476		170	264	
v/s Ratio Prot	c0.13	c0.08		0.02	0.03		0.00	c0.14		c0.17	0.07	
v/s Ratio Perm			0.01			0.01						
v/c Ratio	0.41	0.25	0.04	0.20	0.21	0.08	0.02	0.57		1.20	0.47	
Uniform Delay, d1	31.5	29.7	27.7	47.1	47.2	46.4	34.7	40.0		51.5	47.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	3.0	0.8	0.3	3.1	1.7	1.2	0.2	4.8		133.0	5.8	
Delay (s)	34.6	30.5	28.0	50.2	48.9	47.6	34.8	44.8		184.5	53.1	
Level of Service	C	C	C	D	D	D	C	D		F	D	
Approach Delay (s)		32.0			48.5			44.6			135.1	
Approach LOS		C			D			D			F	

Intersection Summary			
HCM 2000 Control Delay	64.6	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	48.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	61	498	43	59	590	50	29	196	54	62	181	73
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0			5.0			5.0	
Lane Util. Factor		0.91			0.91			0.95			0.95	
Frpb, ped/bikes		1.00			1.00			1.00			0.99	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		0.99			0.99			0.97			0.97	
Flt Protected		0.99			1.00			0.99			0.99	
Satd. Flow (prot)		4858			4994			3362			3282	
Flt Permitted		0.80			0.83			0.90			0.84	
Satd. Flow (perm)		3911			4170			3046			2797	
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)	64	524	45	62	621	53	31	206	57	65	191	77
RTOR Reduction (vph)	0	14	0	0	14	0	0	21	0	0	28	0
Lane Group Flow (vph)	0	619	0	0	722	0	0	273	0	0	305	0
Confl. Peds. (#/hr)	20		12	12		20	17		11	11		17
Confl. Bikes (#/hr)			10			8			12			9
Heavy Vehicles (%)	2%	5%	7%	2%	2%	2%	2%	3%	4%	2%	3%	9%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		19.5			19.5			33.5			33.5	
Effective Green, g (s)		19.5			19.5			33.5			33.5	
Actuated g/C Ratio		0.31			0.31			0.53			0.53	
Clearance Time (s)		5.0			5.0			5.0			5.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		1210			1290			1619			1487	
v/s Ratio Prot												
v/s Ratio Perm		0.16			c0.17			0.09			c0.11	
v/c Ratio		0.51			0.56			0.17			0.21	
Uniform Delay, d1		17.8			18.2			7.6			7.8	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		0.4			0.5			0.2			0.3	
Delay (s)		18.2			18.7			7.8			8.1	
Level of Service		B			B			A			A	
Approach Delay (s)		18.2			18.7			7.8			8.1	
Approach LOS		B			B			A			A	

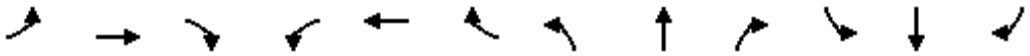
Intersection Summary			
HCM 2000 Control Delay	15.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	63.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	88.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	146	9	4	601	0	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	0	0	0	0	151	9	4	620	0	0	0	0
Pedestrians		16			1						3	
Lane Width (ft)		0.0			12.0						0.0	
Walking Speed (ft/s)		4.0			4.0						4.0	
Percent Blockage		0			0						0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								536				
pX, platoon unblocked												
vC, conflicting volume	422	645	16	629	645	314	16			621		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	422	645	16	629	645	314	16			621		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	62	99	100			100		
cM capacity (veh/h)	359	392	1066	370	392	687	1615			969		

Direction, Lane #	WB 1	WB 2	NB 1	NB 2
Volume Total	100	59	211	413
Volume Left	0	0	4	0
Volume Right	0	9	0	0
cSH	392	420	1615	1700
Volume to Capacity	0.26	0.14	0.00	0.24
Queue Length 95th (ft)	25	12	0	0
Control Delay (s)	17.3	15.0	0.2	0.0
Lane LOS	C	B	A	
Approach Delay (s)	16.4		0.1	
Approach LOS	C			

Intersection Summary				
Average Delay	3.4			
Intersection Capacity Utilization	28.6%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	255	338	0	0	493	102	91	407	111	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0			5.0				
Lane Util. Factor		0.91			0.91			0.95				
Frpb, ped/bikes		1.00			1.00			0.99				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		1.00			0.97			0.97				
Flt Protected		0.98			1.00			0.99				
Satd. Flow (prot)		4789			4872			3350				
Flt Permitted		0.67			1.00			0.99				
Satd. Flow (perm)		3253			4872			3350				
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)	266	352	0	0	514	106	95	424	116	0	0	0
RTOR Reduction (vph)	0	0	0	0	28	0	0	17	0	0	0	0
Lane Group Flow (vph)	0	618	0	0	592	0	0	618	0	0	0	0
Confl. Peds. (#/hr)	2					2			4	4		
Confl. Bikes (#/hr)			1						44			
Heavy Vehicles (%)	6%	6%	3%	2%	4%	1%	3%	4%	1%	4%	1%	1%
Turn Type	Perm	NA			NA		Perm	NA				
Protected Phases		2			6			8				
Permitted Phases	2						8					
Actuated Green, G (s)		51.0			51.0			49.0				
Effective Green, g (s)		51.0			51.0			49.0				
Actuated g/C Ratio		0.46			0.46			0.45				
Clearance Time (s)		5.0			5.0			5.0				
Vehicle Extension (s)		3.0			3.0			3.0				
Lane Grp Cap (vph)		1508			2258			1492				
v/s Ratio Prot					0.12							
v/s Ratio Perm		c0.19						0.18				
v/c Ratio		0.41			0.26			0.41				
Uniform Delay, d1		19.5			18.0			20.7				
Progression Factor		0.53			1.00			1.00				
Incremental Delay, d2		0.8			0.3			0.2				
Delay (s)		11.2			18.3			20.9				
Level of Service		B			B			C				
Approach Delay (s)		11.2			18.3			20.9			0.0	
Approach LOS		B			B			C			A	

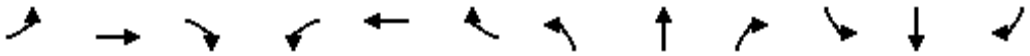
Intersection Summary			
HCM 2000 Control Delay	16.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	70.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	65	0	0	0	1	4	5	540	2	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	70	0	0	0	1	4	5	581	2	0	0	0
Pedestrians		12			1						1	
Lane Width (ft)		12.0			12.0						0.0	
Walking Speed (ft/s)		4.0			4.0						4.0	
Percent Blockage		1			0						0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											608	
pX, platoon unblocked												
vC, conflicting volume	319	607	12	593	605	293	12			584		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	319	607	12	593	605	293	12			584		
tC, single (s)	7.7	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	88	100	100	100	100	99	100			100		
cM capacity (veh/h)	578	408	1061	389	409	708	1604			1000		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	70	5	296	292
Volume Left	70	0	5	0
Volume Right	0	4	0	2
cSH	578	618	1604	1700
Volume to Capacity	0.12	0.01	0.00	0.17
Queue Length 95th (ft)	10	1	0	0
Control Delay (s)	12.1	10.9	0.2	0.0
Lane LOS	B	B	A	
Approach Delay (s)	12.1	10.9	0.1	
Approach LOS	B	B		

Intersection Summary				
Average Delay	1.4			
Intersection Capacity Utilization	32.1%	ICU Level of Service	A	
Analysis Period (min)	15			

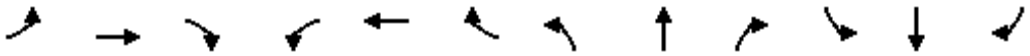


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	225	0	46	0	0	0	41	108	0	0	54	190
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0				5.0	5.0			5.0	
Lane Util. Factor		1.00	1.00				1.00	0.95			0.95	
Frpb, ped/bikes		1.00	0.96				1.00	1.00			0.95	
Flpb, ped/bikes		0.98	1.00				0.98	1.00			1.00	
Frt		1.00	0.85				1.00	1.00			0.88	
Flt Protected		0.95	1.00				0.95	1.00			1.00	
Satd. Flow (prot)		1773	1549				1516	3471			2951	
Flt Permitted		0.76	1.00				0.58	1.00			1.00	
Satd. Flow (perm)		1414	1549				928	3471			2951	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	256	0	52	0	0	0	47	123	0	0	61	216
RTOR Reduction (vph)	0	0	30	0	0	0	0	0	0	0	123	0
Lane Group Flow (vph)	0	256	22	0	0	0	47	123	0	0	154	0
Confl. Peds. (#/hr)	20		20	20		20	20		20	20		20
Confl. Bikes (#/hr)			20			20			20			20
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	17%	4%	0%	0%	13%	0%
Turn Type	Perm	NA	Perm	Perm			Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2			6		
Actuated Green, G (s)		30.0	30.0				30.0	30.0			30.0	
Effective Green, g (s)		30.0	30.0				30.0	30.0			30.0	
Actuated g/C Ratio		0.43	0.43				0.43	0.43			0.43	
Clearance Time (s)		5.0	5.0				5.0	5.0			5.0	
Lane Grp Cap (vph)		606	663				397	1487			1264	
v/s Ratio Prot								0.04			c0.05	
v/s Ratio Perm		c0.18	0.01				0.05					
v/c Ratio		0.42	0.03				0.12	0.08			0.12	
Uniform Delay, d1		14.0	11.6				12.0	11.8			12.1	
Progression Factor		1.00	1.00				1.00	1.00			1.00	
Incremental Delay, d2		2.2	0.1				0.6	0.1			0.2	
Delay (s)		16.1	11.7				12.6	12.0			12.3	
Level of Service		B	B				B	B			B	
Approach Delay (s)		15.4			0.0			12.1			12.3	
Approach LOS		B			A			B			B	

Intersection Summary			
HCM 2000 Control Delay	13.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.27		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	59.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

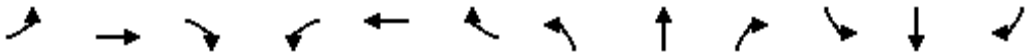
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	25	165	73	156	483	20	84	12	208	34	11	17
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.96	1.00	1.00		1.00	1.00	0.97	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	0.91	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.96	1.00	0.95	1.00	
Satd. Flow (prot)	1357	3471	1460	1687	3409		1649	1506	1451	1433	1342	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.96	1.00	0.95	1.00	
Satd. Flow (perm)	1357	3471	1460	1687	3409		1649	1506	1451	1433	1342	
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)	27	179	79	170	525	22	91	13	226	37	12	18
RTOR Reduction (vph)	0	0	63	0	2	0	0	0	129	0	17	0
Lane Group Flow (vph)	27	179	16	170	545	0	52	52	97	37	13	0
Confl. Peds. (#/hr)			20						20			
Heavy Vehicles (%)	33%	4%	6%	7%	4%	35%	4%	50%	8%	26%	45%	18%
Turn Type	Prot	NA	Perm	Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		6	6		2	2	
Permitted Phases			4						6			
Actuated Green, G (s)	3.0	18.4	18.4	8.2	23.6		40.0	40.0	40.0	6.6	6.6	
Effective Green, g (s)	3.0	18.4	18.4	8.2	23.6		40.0	40.0	40.0	6.6	6.6	
Actuated g/C Ratio	0.03	0.20	0.20	0.09	0.25		0.43	0.43	0.43	0.07	0.07	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	43	685	288	148	863		707	646	622	101	95	
v/s Ratio Prot	0.02	0.05		c0.10	c0.16		0.03	0.03		c0.03	0.01	
v/s Ratio Perm			0.01						c0.07			
v/c Ratio	0.63	0.26	0.05	1.15	0.63		0.07	0.08	0.16	0.37	0.14	
Uniform Delay, d1	44.5	31.6	30.3	42.5	30.9		15.7	15.7	16.3	41.3	40.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	25.3	0.2	0.1	119.5	1.5		0.2	0.2	0.5	2.2	0.7	
Delay (s)	69.8	31.9	30.4	162.0	32.4		15.9	16.0	16.8	43.6	41.3	
Level of Service	E	C	C	F	C		B	B	B	D	D	
Approach Delay (s)		35.1			63.2			16.5			42.6	
Approach LOS		D			E			B			D	

Intersection Summary			
HCM 2000 Control Delay	45.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	93.2	Sum of lost time (s)	20.0
Intersection Capacity Utilization	55.7%	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												
Volume (vph)	59	260	61	110	548	189	85	85	127	93	69	38
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	1.00	0.85	1.00	0.91		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1626	3309		1703	3505	1543	1583	3042		1736	2796	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1626	3309		1703	3505	1543	1583	3042		1736	2796	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	63	277	65	117	583	201	90	90	135	99	73	40
RTOR Reduction (vph)	0	21	0	0	0	165	0	114	0	0	34	0
Lane Group Flow (vph)	63	321	0	117	583	36	90	111	0	99	79	0
Confl. Peds. (#/hr)			1	1								
Confl. Bikes (#/hr)			1			3						
Heavy Vehicles (%)	11%	4%	13%	6%	3%	3%	14%	5%	10%	4%	12%	41%
Turn Type	Split	NA		Split	NA	Perm	Split	NA		Split	NA	
Protected Phases	4	4		8	8		2	2		6	6	
Permitted Phases						8						
Actuated Green, G (s)	29.0	29.0		17.0	17.0	17.0	15.0	15.0		15.0	15.0	
Effective Green, g (s)	29.0	29.0		17.0	17.0	17.0	15.0	15.0		15.0	15.0	
Actuated g/C Ratio	0.30	0.30		0.18	0.18	0.18	0.16	0.16		0.16	0.16	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	491	999		301	620	273	247	475		271	436	
v/s Ratio Prot	0.04	c0.10		0.07	c0.17		c0.06	0.04		c0.06	0.03	
v/s Ratio Perm						0.02						
v/c Ratio	0.13	0.32		0.39	0.94	0.13	0.36	0.23		0.37	0.18	
Uniform Delay, d1	24.3	25.9		34.9	39.0	33.3	36.2	35.5		36.2	35.2	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.5	0.9		3.8	24.1	1.0	4.1	1.2		3.8	0.9	
Delay (s)	24.9	26.7		38.7	63.1	34.3	40.4	36.6		40.0	36.1	
Level of Service	C	C		D	E	C	D	D		D	D	
Approach Delay (s)		26.5			53.5			37.7			37.9	
Approach LOS		C			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	43.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	96.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	58.5%	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												
Volume (veh/h)	23	465	33	18	727	5	43	4	23	3	10	90
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	24	479	34	19	749	5	44	4	24	3	10	93
Pedestrians		2										
Lane Width (ft)		12.0										
Walking Speed (ft/s)		4.0										
Percent Blockage		0										
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		1120			405							
pX, platoon unblocked	0.91						0.91	0.91		0.91	0.91	0.91
vC, conflicting volume	755			513			1056	1336	257	1102	1350	379
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	530			513			861	1169	257	912	1185	117
tC, single (s)	4.9			4.2			7.5	6.5	7.0	8.2	6.5	7.0
tC, 2 stage (s)												
tF (s)	2.6			2.3			3.5	4.0	3.3	3.8	4.0	3.3
p0 queue free %	97			98			76	98	97	98	94	89
cM capacity (veh/h)	727			1014			184	168	736	154	165	825

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total	263	274	393	380	72	106
Volume Left	24	0	19	0	44	3
Volume Right	0	34	0	5	24	93
cSH	727	1700	1014	1700	242	544
Volume to Capacity	0.03	0.16	0.02	0.22	0.30	0.20
Queue Length 95th (ft)	3	0	1	0	30	18
Control Delay (s)	1.3	0.0	0.6	0.0	26.0	13.2
Lane LOS	A		A		D	B
Approach Delay (s)	0.6		0.3		26.0	13.2
Approach LOS					D	B

Intersection Summary				
Average Delay	2.6			
Intersection Capacity Utilization	50.5%	ICU Level of Service		A
Analysis Period (min)	15			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	131	0	0	0	0	452
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	151	0	0	0	0	520
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			444			
pX, platoon unblocked						
vC, conflicting volume	260	0			0	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	260	0			0	
tC, single (s)	6.9	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	78	100			100	
cM capacity (veh/h)	699	1091			1636	

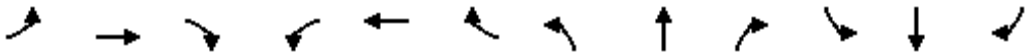
Direction, Lane #	WB 1	WB 2	SB 1	SB 2
Volume Total	75	75	260	260
Volume Left	75	75	0	0
Volume Right	0	0	0	0
cSH	699	699	1700	1700
Volume to Capacity	0.11	0.11	0.15	0.15
Queue Length 95th (ft)	9	9	0	0
Control Delay (s)	10.8	10.8	0.0	0.0
Lane LOS	B	B		
Approach Delay (s)	10.8		0.0	
Approach LOS	B			

Intersection Summary			
Average Delay	2.4		
Intersection Capacity Utilization	22.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	304	77	110	475	0	0	0	0	93	295	190
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0		5.0	5.0						5.0	
Lane Util. Factor		0.91		1.00	0.95						0.95	
Frpb, ped/bikes		1.00		1.00	1.00						0.99	
Flpb, ped/bikes		1.00		1.00	1.00						1.00	
Frt		0.97		1.00	1.00						0.95	
Flt Protected		1.00		0.95	1.00						0.99	
Satd. Flow (prot)		4711		1766	3539						3251	
Flt Permitted		1.00		0.50	1.00						0.99	
Satd. Flow (perm)		4711		924	3539						3251	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	0	323	82	117	505	0	0	0	0	99	314	202
RTOR Reduction (vph)	0	41	0	0	0	0	0	0	0	0	54	0
Lane Group Flow (vph)	0	364	0	117	505	0	0	0	0	0	561	0
Confl. Peds. (#/hr)			4	4						4		2
Confl. Bikes (#/hr)			3			2						21
Heavy Vehicles (%)	3%	7%	4%	2%	2%	2%	2%	1%	1%	2%	5%	3%
Turn Type		NA		Perm	NA					Perm	NA	
Protected Phases		2			6						4	
Permitted Phases				6						4		
Actuated Green, G (s)		46.0		46.0	46.0						54.0	
Effective Green, g (s)		46.0		46.0	46.0						54.0	
Actuated g/C Ratio		0.42		0.42	0.42						0.49	
Clearance Time (s)		5.0		5.0	5.0						5.0	
Vehicle Extension (s)		3.0		3.0	3.0						3.0	
Lane Grp Cap (vph)		1970		386	1479						1595	
v/s Ratio Prot		0.08			c0.14							
v/s Ratio Perm				0.13							0.17	
v/c Ratio		0.18		0.30	0.34						0.35	
Uniform Delay, d1		20.2		21.3	21.7						17.2	
Progression Factor		1.00		0.34	0.33						1.00	
Incremental Delay, d2		0.2		0.4	0.1						0.6	
Delay (s)		20.4		7.7	7.4						17.8	
Level of Service		C		A	A						B	
Approach Delay (s)		20.4			7.5			0.0			17.8	
Approach LOS		C			A			A			B	

Intersection Summary			
HCM 2000 Control Delay	14.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.35		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	75.3%	ICU Level of Service	D
Analysis Period (min)	15		

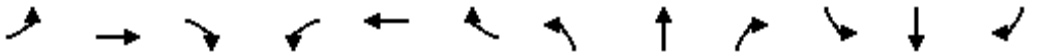
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	59	14	5	0	0	0	0	0	25	343	10
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	66	16	6	0	0	0	0	0	28	381	11
Pedestrians								1				
Lane Width (ft)								0.0				
Walking Speed (ft/s)								4.0				
Percent Blockage								0				
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											655	
pX, platoon unblocked												
vC, conflicting volume	442	442	197	295	448	0	392			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	442	442	197	295	448	0	392			0		
tC, single (s)	7.7	6.5	6.9	7.6	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.3	3.6	4.0	3.3	2.2			2.2		
p0 queue free %	100	87	98	99	100	100	100			98		
cM capacity (veh/h)	479	504	817	544	500	1091	1177			1636		

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	81	6	218	202
Volume Left	0	6	28	0
Volume Right	16	0	0	11
cSH	544	544	1636	1700
Volume to Capacity	0.15	0.01	0.02	0.12
Queue Length 95th (ft)	13	1	1	0
Control Delay (s)	12.8	11.7	1.0	0.0
Lane LOS	B	B	A	
Approach Delay (s)	12.8	11.7	0.5	
Approach LOS	B	B		

Intersection Summary				
Average Delay	2.6			
Intersection Capacity Utilization	21.5%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	16	29	0	0	133	121	72	151	128	66	0	181
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0		5.0	5.0		4.0		4.0
Lane Util. Factor	1.00	0.95			0.95		0.91	0.91		1.00		0.88
Frpb, ped/bikes	1.00	1.00			0.99		1.00	1.00		1.00		1.00
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00		1.00		1.00
Frt	1.00	1.00			0.93		1.00	0.93		1.00		0.85
Flt Protected	0.95	1.00			1.00		0.95	1.00		0.95		1.00
Satd. Flow (prot)	1624	3471			3075		1441	2982		1543		2682
Flt Permitted	0.95	1.00			1.00		0.95	1.00		0.95		1.00
Satd. Flow (perm)	1624	3471			3075		1441	2982		1543		2682
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Adj. Flow (vph)	18	33	0	0	153	139	83	174	147	76	0	208
RTOR Reduction (vph)	0	0	0	0	118	0	0	96	0	0	0	192
Lane Group Flow (vph)	18	33	0	0	174	0	75	233	0	76	0	16
Confl. Peds. (#/hr)	6					6						
Confl. Bikes (#/hr)			6			3						
Heavy Vehicles (%)	0%	4%	0%	0%	9%	7%	14%	7%	9%	17%	0%	6%
Parking (#/hr)	0											
Turn Type	Split	NA			NA		Split	NA		Prot		custom
Protected Phases	4	4			8		2	2		6		6
Permitted Phases												
Actuated Green, G (s)	3.5	3.5			8.1		18.4	18.4		4.1		4.1
Effective Green, g (s)	3.5	3.5			8.1		18.4	18.4		4.1		4.1
Actuated g/C Ratio	0.07	0.07			0.15		0.35	0.35		0.08		0.08
Clearance Time (s)	5.0	5.0			5.0		5.0	5.0		4.0		4.0
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0		3.0
Lane Grp Cap (vph)	107	228			469		499	1033		119		207
v/s Ratio Prot	c0.01	0.01			c0.06		0.05	c0.08		c0.05		0.01
v/s Ratio Perm												
v/c Ratio	0.17	0.14			0.37		0.15	0.23		0.64		0.08
Uniform Delay, d1	23.4	23.4			20.2		12.0	12.3		23.8		22.7
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00		1.00
Incremental Delay, d2	0.7	0.3			0.5		0.6	0.5		10.7		0.2
Delay (s)	24.2	23.7			20.7		12.6	12.8		34.5		22.9
Level of Service	C	C			C		B	B		C		C
Approach Delay (s)		23.9			20.7			12.8			26.0	
Approach LOS		C			C			B			C	

Intersection Summary			
HCM 2000 Control Delay	19.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	53.1	Sum of lost time (s)	19.0
Intersection Capacity Utilization	37.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	10	27	1	14	27	76	0	8	23	67	11	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0		5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.99		1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00		1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.89		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		1.00		0.95	1.00	
Satd. Flow (prot)	1805	3610	793	1357	3471	1328		2621		1703	2362	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		1.00		0.95	1.00	
Satd. Flow (perm)	1805	3610	793	1357	3471	1328		2621		1703	2362	
Peak-hour factor, PHF	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Adj. Flow (vph)	12	33	1	17	33	93	0	10	28	82	13	1
RTOR Reduction (vph)	0	0	1	0	0	59	0	21	0	0	1	0
Lane Group Flow (vph)	12	33	0	17	33	34	0	17	0	82	13	0
Confl. Peds. (#/hr)			4	4								
Confl. Bikes (#/hr)			4			2						3
Heavy Vehicles (%)	0%	0%	100%	33%	4%	20%	0%	38%	17%	6%	55%	0%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8						
Actuated Green, G (s)	10.0	39.0	39.0	15.0	44.0	44.0		30.0		16.0	42.0	
Effective Green, g (s)	10.0	39.0	39.0	15.0	44.0	44.0		30.0		16.0	42.0	
Actuated g/C Ratio	0.08	0.32	0.32	0.12	0.37	0.37		0.25		0.13	0.35	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0		5.0		5.0	5.0	
Lane Grp Cap (vph)	150	1173	257	169	1272	486		655		227	826	
v/s Ratio Prot	0.01	0.01		c0.01	0.01			c0.01		c0.05	0.01	
v/s Ratio Perm			0.00			c0.03						
v/c Ratio	0.08	0.03	0.00	0.10	0.03	0.07		0.03		0.36	0.02	
Uniform Delay, d1	50.8	27.6	27.3	46.5	24.3	24.7		34.0		47.3	25.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2	1.0	0.0	0.0	1.2	0.0	0.3		0.1		4.4	0.0	
Delay (s)	51.8	27.6	27.4	47.7	24.3	25.0		34.0		51.8	25.5	
Level of Service	D	C	C	D	C	C		C		D	C	
Approach Delay (s)		33.9			27.5			34.0			47.9	
Approach LOS		C			C			C			D	

Intersection Summary			
HCM 2000 Control Delay	35.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.11		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	51.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	70	374	19	45	516	48	35	98	35	60	129	86
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0			5.0			5.0	
Lane Util. Factor		0.91			0.91			0.95			0.95	
Frpb, ped/bikes		1.00			1.00			1.00			0.99	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		0.99			0.99			0.97			0.95	
Flt Protected		0.99			1.00			0.99			0.99	
Satd. Flow (prot)		4949			4969			3444			3301	
Flt Permitted		0.78			0.87			0.87			0.87	
Satd. Flow (perm)		3891			4342			3029			2888	
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	71	378	19	45	521	48	35	99	35	61	130	87
RTOR Reduction (vph)	0	7	0	0	17	0	0	16	0	0	39	0
Lane Group Flow (vph)	0	461	0	0	597	0	0	153	0	0	239	0
Confl. Peds. (#/hr)	6		3	3		6	6		5	5		6
Confl. Bikes (#/hr)			15			13			14			11
Heavy Vehicles (%)	0%	4%	0%	0%	3%	0%	0%	0%	0%	2%	4%	0%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		16.8			16.8			33.7			33.7	
Effective Green, g (s)		16.8			16.8			33.7			33.7	
Actuated g/C Ratio		0.28			0.28			0.56			0.56	
Clearance Time (s)		5.0			5.0			5.0			5.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		1080			1205			1687			1608	
v/s Ratio Prot												
v/s Ratio Perm		0.12			c0.14			0.05			c0.08	
v/c Ratio		0.43			0.50			0.09			0.15	
Uniform Delay, d1		17.9			18.3			6.3			6.5	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		0.3			0.3			0.1			0.2	
Delay (s)		18.2			18.6			6.4			6.7	
Level of Service		B			B			A			A	
Approach Delay (s)		18.2			18.6			6.4			6.7	
Approach LOS		B			B			A			A	

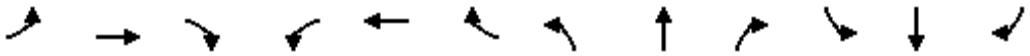
Intersection Summary			
HCM 2000 Control Delay	15.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.26		
Actuated Cycle Length (s)	60.5	Sum of lost time (s)	10.0
Intersection Capacity Utilization	80.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	128	7	3	345	0	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	0	0	0	0	147	8	3	397	0	0	0	0
Pedestrians		3			3						2	
Lane Width (ft)		0.0			12.0						0.0	
Walking Speed (ft/s)		4.0			4.0						4.0	
Percent Blockage		0			0						0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								536				
pX, platoon unblocked												
vC, conflicting volume	292	409	3	406	409	203	3			400		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	292	409	3	406	409	203	3			400		
tC, single (s)	7.5	6.5	6.9	7.6	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	72	99	100			100		
cM capacity (veh/h)	499	532	1086	519	532	808	1632			1167		

Direction, Lane #	WB 1	WB 2	NB 1	NB 2
Volume Total	98	57	136	264
Volume Left	0	0	3	0
Volume Right	0	8	0	0
cSH	532	559	1632	1700
Volume to Capacity	0.18	0.10	0.00	0.16
Queue Length 95th (ft)	17	8	0	0
Control Delay (s)	13.3	12.2	0.2	0.0
Lane LOS	B	B	A	
Approach Delay (s)	12.9		0.1	
Approach LOS	B			

Intersection Summary				
Average Delay	3.6			
Intersection Capacity Utilization	22.9%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	133	264	0	0	514	64	72	210	78	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0			5.0				
Lane Util. Factor		0.91			0.91			0.95				
Frpb, ped/bikes		1.00			1.00			0.99				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		1.00			0.98			0.97				
Flt Protected		0.98			1.00			0.99				
Satd. Flow (prot)		4828			4993			3392				
Flt Permitted		0.68			1.00			0.99				
Satd. Flow (perm)		3324			4993			3392				
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	141	281	0	0	547	68	77	223	83	0	0	0
RTOR Reduction (vph)	0	0	0	0	14	0	0	23	0	0	0	0
Lane Group Flow (vph)	0	422	0	0	601	0	0	360	0	0	0	0
Confl. Peds. (#/hr)	1					1			8			
Confl. Bikes (#/hr)			2			2			27			
Heavy Vehicles (%)	3%	7%	4%	2%	2%	2%	2%	1%	1%	2%	5%	3%
Turn Type	Perm	NA			NA		Perm	NA				
Protected Phases		2			6			8				
Permitted Phases	2						8					
Actuated Green, G (s)		46.0			46.0			54.0				
Effective Green, g (s)		46.0			46.0			54.0				
Actuated g/C Ratio		0.42			0.42			0.49				
Clearance Time (s)		5.0			5.0			5.0				
Vehicle Extension (s)		3.0			3.0			3.0				
Lane Grp Cap (vph)		1390			2087			1665				
v/s Ratio Prot					0.12							
v/s Ratio Perm		c0.13						0.11				
v/c Ratio		0.30			0.29			0.22				
Uniform Delay, d1		21.3			21.2			15.9				
Progression Factor		0.63			1.00			1.00				
Incremental Delay, d2		0.6			0.1			0.1				
Delay (s)		14.0			21.2			16.0				
Level of Service		B			C			B				
Approach Delay (s)		14.0			21.2			16.0			0.0	
Approach LOS		B			C			B			A	

Intersection Summary			
HCM 2000 Control Delay	17.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.26		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	45.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

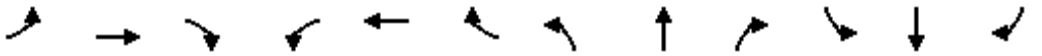
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	58	1	0	0	1	9	3	274	21	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	64	1	0	0	1	10	3	304	23	0	0	0
Pedestrians		9			13							
Lane Width (ft)		12.0			12.0							
Walking Speed (ft/s)		4.0			4.0							
Percent Blockage		1			1							
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											608	
pX, platoon unblocked												
vC, conflicting volume	178	356	9	336	345	177	9			341		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	178	356	9	336	345	177	9			341		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	91	100	100	100	100	99	100			100		
cM capacity (veh/h)	739	561	1069	582	570	833	1612			1216		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	66	11	156	176
Volume Left	64	0	3	0
Volume Right	0	10	0	23
cSH	735	796	1612	1700
Volume to Capacity	0.09	0.01	0.00	0.10
Queue Length 95th (ft)	7	1	0	0
Control Delay (s)	10.4	9.6	0.2	0.0
Lane LOS	B	A	A	
Approach Delay (s)	10.4	9.6	0.1	
Approach LOS	B	A		

Intersection Summary				
Average Delay	2.0			
Intersection Capacity Utilization	26.7%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	65	0	6	0	0	0	4	431	1	0	84	9
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0				5.0	5.0			5.0	
Lane Util. Factor		1.00	1.00				1.00	0.95			0.95	
Frpb, ped/bikes		1.00	0.99				1.00	1.00			1.00	
Flpb, ped/bikes		1.00	1.00				1.00	1.00			1.00	
Frt		1.00	0.85				1.00	1.00			0.98	
Flt Protected		0.95	1.00				0.95	1.00			1.00	
Satd. Flow (prot)		1767	1199				1202	2735			2463	
Flt Permitted		0.76	1.00				0.69	1.00			1.00	
Satd. Flow (perm)		1408	1199				873	2735			2463	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.92
Adj. Flow (vph)	69	0	6	0	0	0	4	459	1	0	89	10
RTOR Reduction (vph)	0	0	4	0	0	0	0	0	0	0	6	0
Lane Group Flow (vph)	0	69	2	0	0	0	4	460	0	0	93	0
Confl. Peds. (#/hr)	2		1	1		2	1		2	2		1
Confl. Bikes (#/hr)									1			1
Heavy Vehicles (%)	2%	0%	33%	0%	0%	0%	50%	32%	0%	0%	49%	0%
Turn Type	Perm	NA	Perm	Perm			Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2			6		
Actuated Green, G (s)		29.0	29.0				31.0	31.0			31.0	
Effective Green, g (s)		29.0	29.0				31.0	31.0			31.0	
Actuated g/C Ratio		0.41	0.41				0.44	0.44			0.44	
Clearance Time (s)		5.0	5.0				5.0	5.0			5.0	
Lane Grp Cap (vph)		583	496				386	1211			1090	
v/s Ratio Prot								c0.17			0.04	
v/s Ratio Perm		c0.05	0.00				0.00					
v/c Ratio		0.12	0.01				0.01	0.38			0.09	
Uniform Delay, d1		12.6	12.0				10.9	13.1			11.3	
Progression Factor		1.00	1.00				1.00	1.00			1.00	
Incremental Delay, d2		0.4	0.0				0.0	0.9			0.2	
Delay (s)		13.0	12.1				11.0	14.0			11.4	
Level of Service		B	B				B	B			B	
Approach Delay (s)		13.0			0.0			13.9			11.4	
Approach LOS		B			A			B			B	

Intersection Summary			
HCM 2000 Control Delay	13.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.25		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	51.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	5	236	70	39	538	31	242	50	148	53	20	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	0.90	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.97	1.00	0.95	1.00	
Satd. Flow (prot)	1504	3505	1495	1433	3359		1618	1345	1302	1517	1398	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.97	1.00	0.95	1.00	
Satd. Flow (perm)	1504	3505	1495	1433	3359		1618	1345	1302	1517	1398	
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)	5	248	74	41	566	33	255	53	156	56	21	45
RTOR Reduction (vph)	0	0	57	0	4	0	0	0	126	0	34	0
Lane Group Flow (vph)	5	248	17	41	595	0	153	155	30	56	32	0
Heavy Vehicles (%)	20%	3%	8%	26%	3%	68%	6%	76%	24%	19%	50%	9%
Turn Type	Prot	NA	Perm	Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		6	6		2	2	
Permitted Phases			4						6			
Actuated Green, G (s)	1.0	16.9	16.9	4.9	20.8		14.5	14.5	14.5	18.8	18.8	
Effective Green, g (s)	1.0	16.9	16.9	4.9	20.8		14.5	14.5	14.5	18.8	18.8	
Actuated g/C Ratio	0.01	0.23	0.23	0.07	0.28		0.19	0.19	0.19	0.25	0.25	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	20	788	336	93	930		312	259	251	379	349	
v/s Ratio Prot	0.00	0.07		c0.03	c0.18		0.09	c0.12		c0.04	0.02	
v/s Ratio Perm			0.01						0.02			
v/c Ratio	0.25	0.31	0.05	0.44	0.64		0.49	0.60	0.12	0.15	0.09	
Uniform Delay, d1	36.7	24.3	22.8	33.8	23.9		27.0	27.6	25.0	21.9	21.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	6.5	0.2	0.1	3.3	1.5		1.2	3.7	0.2	0.8	0.5	
Delay (s)	43.2	24.5	22.9	37.1	25.4		28.2	31.3	25.2	22.7	22.1	
Level of Service	D	C	C	D	C		C	C	C	C	C	
Approach Delay (s)		24.4			26.1			28.3			22.4	
Approach LOS		C			C			C			C	

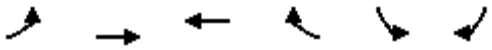
Intersection Summary			
HCM 2000 Control Delay	26.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	75.1	Sum of lost time (s)	20.0
Intersection Capacity Utilization	46.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	88	285	69	146	502	170	77	138	293	108	60	14
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	0.98		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	1.00	0.85	1.00	0.90		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1433	3180		1626	3438	1495	1444	2823		1612	2833	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1433	3180		1626	3438	1495	1444	2823		1612	2833	
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)	91	294	71	151	518	175	79	142	302	111	62	14
RTOR Reduction (vph)	0	22	0	0	0	144	0	255	0	0	12	0
Lane Group Flow (vph)	91	343	0	151	518	31	79	189	0	111	64	0
Confl. Peds. (#/hr)			20	1								
Confl. Bikes (#/hr)			75									
Heavy Vehicles (%)	26%	8%	10%	11%	5%	8%	25%	23%	11%	12%	18%	50%
Turn Type	Split	NA		Split	NA	Perm	Split	NA		Split	NA	
Protected Phases	4	4		8	8		2	2		6	6	
Permitted Phases						8						
Actuated Green, G (s)	29.0	29.0		17.0	17.0	17.0	15.0	15.0		15.0	15.0	
Effective Green, g (s)	29.0	29.0		17.0	17.0	17.0	15.0	15.0		15.0	15.0	
Actuated g/C Ratio	0.30	0.30		0.18	0.18	0.18	0.16	0.16		0.16	0.16	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	432	960		287	608	264	225	441		251	442	
v/s Ratio Prot	0.06	c0.11		0.09	c0.15		0.05	c0.07		c0.07	0.02	
v/s Ratio Perm						0.02						
v/c Ratio	0.21	0.36		0.53	0.85	0.12	0.35	0.43		0.44	0.15	
Uniform Delay, d1	25.0	26.2		35.8	38.3	33.2	36.2	36.6		36.7	35.0	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.1	1.0		6.7	14.1	0.9	4.3	3.0		5.6	0.7	
Delay (s)	26.1	27.2		42.6	52.3	34.1	40.4	39.7		42.3	35.7	
Level of Service	C	C		D	D	C	D	D		D	D	
Approach Delay (s)		27.0			46.8			39.8			39.6	
Approach LOS		C			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	39.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	96.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	68.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	83	640	660	30	2	193
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	89	688	710	32	2	208
Pedestrians					2	
Lane Width (ft)					12.0	
Walking Speed (ft/s)					4.0	
Percent Blockage					0	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		1120	405			
pX, platoon unblocked	0.92				0.92	0.92
vC, conflicting volume	744				1250	373
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	556				1105	154
tC, single (s)	4.9				6.8	7.1
tC, 2 stage (s)						
tF (s)	2.6				3.5	3.4
p0 queue free %	88				99	73
cM capacity (veh/h)	727				168	771

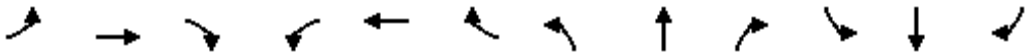
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	319	459	473	269	210
Volume Left	89	0	0	0	2
Volume Right	0	0	0	32	208
cSH	727	1700	1700	1700	743
Volume to Capacity	0.12	0.27	0.28	0.16	0.28
Queue Length 95th (ft)	10	0	0	0	29
Control Delay (s)	4.1	0.0	0.0	0.0	11.7
Lane LOS	A				B
Approach Delay (s)	1.7		0.0		11.7
Approach LOS					B

Intersection Summary			
Average Delay	2.2		
Intersection Capacity Utilization	61.4%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	150	0	0	0	0	487
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	155	0	0	0	0	502
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			444			
pX, platoon unblocked						
vC, conflicting volume	251	0			0	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	251	0			0	
tC, single (s)	6.9	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	78	100			100	
cM capacity (veh/h)	710	1091			1636	

Direction, Lane #	WB 1	WB 2	SB 1	SB 2
Volume Total	77	77	251	251
Volume Left	77	77	0	0
Volume Right	0	0	0	0
cSH	710	710	1700	1700
Volume to Capacity	0.11	0.11	0.15	0.15
Queue Length 95th (ft)	9	9	0	0
Control Delay (s)	10.7	10.7	0.0	0.0
Lane LOS	B	B		
Approach Delay (s)	10.7		0.0	
Approach LOS	B			

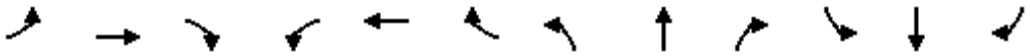
Intersection Summary			
Average Delay	2.5		
Intersection Capacity Utilization	28.5%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	432	109	104	458	0	0	0	0	114	373	142
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0		5.0	5.0						5.0	
Lane Util. Factor		0.95		1.00	0.95						0.95	
Frpb, ped/bikes		1.00		1.00	1.00						0.99	
Flpb, ped/bikes		1.00		1.00	1.00						1.00	
Frt		0.97		1.00	1.00						0.97	
Flt Protected		1.00		0.95	1.00						0.99	
Satd. Flow (prot)		3321		1770	3471						3374	
Flt Permitted		1.00		0.38	1.00						0.99	
Satd. Flow (perm)		3321		713	3471						3374	
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)	0	450	114	108	477	0	0	0	0	119	389	148
RTOR Reduction (vph)	0	20	0	0	0	0	0	0	0	0	24	0
Lane Group Flow (vph)	0	544	0	108	477	0	0	0	0	0	632	0
Confl. Peds. (#/hr)										7		3
Confl. Bikes (#/hr)						1						36
Heavy Vehicles (%)	6%	6%	3%	2%	4%	1%	3%	4%	1%	4%	1%	1%
Turn Type		NA		Perm	NA					Perm	NA	
Protected Phases		2			6						4	
Permitted Phases				6						4		
Actuated Green, G (s)		51.0		51.0	51.0						49.0	
Effective Green, g (s)		51.0		51.0	51.0						49.0	
Actuated g/C Ratio		0.46		0.46	0.46						0.45	
Clearance Time (s)		5.0		5.0	5.0						5.0	
Vehicle Extension (s)		3.0		3.0	3.0						3.0	
Lane Grp Cap (vph)		1539		330	1609						1502	
v/s Ratio Prot		c0.16			0.14							
v/s Ratio Perm				0.15							0.19	
v/c Ratio		0.35		0.33	0.30						0.42	
Uniform Delay, d1		18.9		18.7	18.3						20.8	
Progression Factor		1.00		0.49	0.48						1.00	
Incremental Delay, d2		0.6		2.5	0.4						0.9	
Delay (s)		19.6		11.5	9.3						21.7	
Level of Service		B		B	A						C	
Approach Delay (s)		19.6			9.7			0.0			21.7	
Approach LOS		B			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	17.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	61.2%	ICU Level of Service	B
Analysis Period (min)	15		

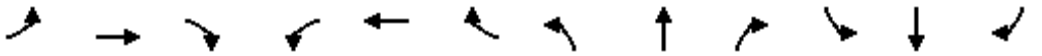
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	97	7	4	1	0	0	0	0	6	421	2
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	0	104	8	4	1	0	0	0	0	6	453	2
Pedestrians		3						1				
Lane Width (ft)		12.0						0.0				
Walking Speed (ft/s)		4.0						4.0				
Percent Blockage		0						0				
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											655	
pX, platoon unblocked												
vC, conflicting volume	470	470	231	300	471	0	458			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	470	470	231	300	471	0	458			0		
tC, single (s)	7.7	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	79	99	99	100	100	100			100		
cM capacity (veh/h)	459	492	775	523	491	1091	1111			1636		

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	112	5	233	228
Volume Left	0	4	6	0
Volume Right	8	0	0	2
cSH	504	517	1636	1700
Volume to Capacity	0.22	0.01	0.00	0.13
Queue Length 95th (ft)	21	1	0	0
Control Delay (s)	14.2	12.0	0.2	0.0
Lane LOS	B	B	A	
Approach Delay (s)	14.2	12.0	0.1	
Approach LOS	B	B		

Intersection Summary				
Average Delay	2.9			
Intersection Capacity Utilization	24.5%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	125	86	0	0	96	114	79	281	83	79	0	184
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0		5.0	5.0		5.0		5.0
Lane Util. Factor	1.00	0.95			0.95		0.91	0.91		1.00		0.88
Frpb, ped/bikes	1.00	1.00			0.99		1.00	1.00		1.00		1.00
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00		1.00		1.00
Frt	1.00	1.00			0.92		1.00	0.97		1.00		0.85
Flt Protected	0.95	1.00			1.00		0.95	1.00		0.95		1.00
Satd. Flow (prot)	1160	3195			2746		1014	2889		1570		2349
Flt Permitted	0.95	1.00			1.00		0.95	1.00		0.95		1.00
Satd. Flow (perm)	1160	3195			2746		1014	2889		1570		2349
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	139	96	0	0	107	127	88	312	92	88	0	204
RTOR Reduction (vph)	0	0	0	0	111	0	0	20	0	0	0	176
Lane Group Flow (vph)	139	96	0	0	123	0	79	394	0	88	0	28
Confl. Peds. (#/hr)							4					4
Confl. Bikes (#/hr)			6			3						
Heavy Vehicles (%)	40%	13%	0%	0%	18%	21%	62%	15%	13%	15%	0%	21%
Parking (#/hr)	0											
Turn Type	Split	NA			NA		Split	NA		Prot		custom
Protected Phases	4	4			8		2	2		6		6
Permitted Phases												
Actuated Green, G (s)	13.9	13.9			8.4		17.2	17.2		9.3		9.3
Effective Green, g (s)	13.9	13.9			8.4		17.2	17.2		9.3		9.3
Actuated g/C Ratio	0.20	0.20			0.12		0.25	0.25		0.14		0.14
Clearance Time (s)	5.0	5.0			5.0		5.0	5.0		5.0		5.0
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0		3.0
Lane Grp Cap (vph)	234	645			335		253	722		212		317
v/s Ratio Prot	c0.12	0.03			c0.04		0.08	c0.14		c0.06		0.01
v/s Ratio Perm												
v/c Ratio	0.59	0.15			0.37		0.31	0.55		0.42		0.09
Uniform Delay, d1	24.9	22.6			27.8		21.0	22.4		27.3		26.0
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00		1.00
Incremental Delay, d2	4.0	0.1			0.7		3.2	2.9		1.3		0.1
Delay (s)	28.9	22.7			28.4		24.2	25.3		28.6		26.2
Level of Service	C	C			C		C	C		C		C
Approach Delay (s)		26.4			28.4			25.2			26.9	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	26.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	68.8	Sum of lost time (s)	20.0
Intersection Capacity Utilization	43.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	150	174	32	25	53	58	5	201	138	173	112	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1245	2375	832	1107	2201	1062	1003	1970		1203	1870	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1245	2375	832	1107	2201	1062	1003	1970		1203	1870	
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	165	191	35	27	58	64	5	221	152	190	123	0
RTOR Reduction (vph)	0	0	24	0	0	56	0	104	0	0	0	0
Lane Group Flow (vph)	165	191	11	27	58	8	5	269	0	190	123	0
Confl. Bikes (#/hr)						1						
Heavy Vehicles (%)	45%	52%	94%	63%	64%	50%	80%	79%	62%	50%	93%	0%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8						
Actuated Green, G (s)	39.0	39.0	39.0	15.0	15.0	15.0	29.0	29.0		17.0	17.0	
Effective Green, g (s)	39.0	39.0	39.0	15.0	15.0	15.0	29.0	29.0		17.0	17.0	
Actuated g/C Ratio	0.32	0.32	0.32	0.12	0.12	0.12	0.24	0.24		0.14	0.14	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	404	771	270	138	275	132	242	476		170	264	
v/s Ratio Prot	c0.13	c0.08		0.02	0.03		0.00	c0.14		c0.16	0.07	
v/s Ratio Perm			0.01			0.01						
v/c Ratio	0.41	0.25	0.04	0.20	0.21	0.06	0.02	0.57		1.12	0.47	
Uniform Delay, d1	31.5	29.7	27.7	47.1	47.2	46.3	34.7	40.0		51.5	47.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	3.0	0.8	0.3	3.1	1.7	0.9	0.2	4.8		104.1	5.8	
Delay (s)	34.6	30.5	28.0	50.2	48.9	47.2	34.8	44.8		155.6	53.1	
Level of Service	C	C	C	D	D	D	C	D		F	D	
Approach Delay (s)		32.0			48.4			44.6			115.3	
Approach LOS		C			D			D			F	

Intersection Summary			
HCM 2000 Control Delay	59.1	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	47.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	44	488	43	59	563	50	29	196	54	62	181	64
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0			5.0			5.0	
Lane Util. Factor		0.91			0.91			0.95			0.95	
Frpb, ped/bikes		1.00			1.00			1.00			0.99	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		0.99			0.99			0.97			0.97	
Flt Protected		1.00			1.00			0.99			0.99	
Satd. Flow (prot)		4858			4990			3362			3301	
Flt Permitted		0.84			0.83			0.90			0.84	
Satd. Flow (perm)		4103			4172			3050			2807	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	46	514	45	62	593	53	31	206	57	65	191	67
RTOR Reduction (vph)	0	15	0	0	15	0	0	21	0	0	23	0
Lane Group Flow (vph)	0	590	0	0	693	0	0	273	0	0	300	0
Confl. Peds. (#/hr)	20		12	12		20	17		11	11		17
Confl. Bikes (#/hr)			10			8			12			9
Heavy Vehicles (%)	2%	5%	7%	2%	2%	2%	2%	3%	4%	2%	3%	9%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		18.9			18.9			33.6			33.6	
Effective Green, g (s)		18.9			18.9			33.6			33.6	
Actuated g/C Ratio		0.30			0.30			0.54			0.54	
Clearance Time (s)		5.0			5.0			5.0			5.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		1240			1261			1639			1509	
v/s Ratio Prot												
v/s Ratio Perm		0.14			c0.17			0.09			c0.11	
v/c Ratio		0.48			0.55			0.17			0.20	
Uniform Delay, d1		17.8			18.2			7.3			7.5	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		0.3			0.5			0.2			0.3	
Delay (s)		18.1			18.7			7.6			7.8	
Level of Service		B			B			A			A	
Approach Delay (s)		18.1			18.7			7.6			7.8	
Approach LOS		B			B			A			A	

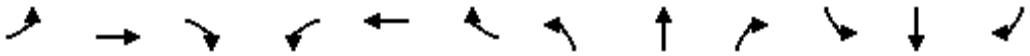
Intersection Summary			
HCM 2000 Control Delay	15.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.32		
Actuated Cycle Length (s)	62.5	Sum of lost time (s)	10.0
Intersection Capacity Utilization	87.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	146	9	4	596	0	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	0	0	0	0	151	9	4	614	0	0	0	0
Pedestrians		16			1						3	
Lane Width (ft)		0.0			12.0						0.0	
Walking Speed (ft/s)		4.0			4.0						4.0	
Percent Blockage		0			0						0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								536				
pX, platoon unblocked												
vC, conflicting volume	419	640	16	624	640	311	16			615		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	419	640	16	624	640	311	16			615		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	62	99	100			100		
cM capacity (veh/h)	362	395	1066	373	395	690	1615			973		

Direction, Lane #	WB 1	WB 2	NB 1	NB 2
Volume Total	100	59	209	410
Volume Left	0	0	4	0
Volume Right	0	9	0	0
cSH	395	423	1615	1700
Volume to Capacity	0.25	0.14	0.00	0.24
Queue Length 95th (ft)	25	12	0	0
Control Delay (s)	17.2	14.9	0.2	0.0
Lane LOS	C	B	A	
Approach Delay (s)	16.3		0.1	
Approach LOS	C			

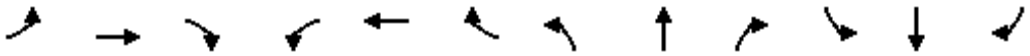
Intersection Summary				
Average Delay	3.4			
Intersection Capacity Utilization	28.5%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	250	296	0	0	457	102	105	407	127	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0			5.0				
Lane Util. Factor		0.91			0.95			0.95				
Frpb, ped/bikes		1.00			1.00			0.99				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		1.00			0.97			0.97				
Flt Protected		0.98			1.00			0.99				
Satd. Flow (prot)		4782			3385			3339				
Flt Permitted		0.66			1.00			0.99				
Satd. Flow (perm)		3240			3385			3339				
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)	260	308	0	0	476	106	109	424	132	0	0	0
RTOR Reduction (vph)	0	0	0	0	17	0	0	20	0	0	0	0
Lane Group Flow (vph)	0	568	0	0	565	0	0	645	0	0	0	0
Confl. Peds. (#/hr)	2					2			4	4		
Confl. Bikes (#/hr)			1						44			
Heavy Vehicles (%)	6%	6%	3%	2%	4%	1%	3%	4%	1%	4%	1%	1%
Turn Type	Perm	NA			NA		Perm	NA				
Protected Phases		2			6			8				
Permitted Phases	2						8					
Actuated Green, G (s)		51.0			51.0			49.0				
Effective Green, g (s)		51.0			51.0			49.0				
Actuated g/C Ratio		0.46			0.46			0.45				
Clearance Time (s)		5.0			5.0			5.0				
Vehicle Extension (s)		3.0			3.0			3.0				
Lane Grp Cap (vph)		1502			1569			1487				
v/s Ratio Prot					0.17							
v/s Ratio Perm		c0.18						0.19				
v/c Ratio		0.38			0.36			0.43				
Uniform Delay, d1		19.2			19.0			21.0				
Progression Factor		0.53			1.00			1.00				
Incremental Delay, d2		0.7			0.6			0.2				
Delay (s)		10.9			19.6			21.2				
Level of Service		B			B			C				
Approach Delay (s)		10.9			19.6			21.2			0.0	
Approach LOS		B			B			C			A	

Intersection Summary			
HCM 2000 Control Delay	17.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	71.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	97	0	0	0	1	4	5	538	2	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	104	0	0	0	1	4	5	578	2	0	0	0
Pedestrians		12			1						1	
Lane Width (ft)		12.0			12.0						0.0	
Walking Speed (ft/s)		4.0			4.0						4.0	
Percent Blockage		1			0						0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											608	
pX, platoon unblocked												
vC, conflicting volume	318	604	12	591	603	292	12			582		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	318	604	12	591	603	292	12			582		
tC, single (s)	7.7	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	82	100	100	100	100	99	100			100		
cM capacity (veh/h)	579	409	1061	390	410	710	1604			1002		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	104	5	295	291
Volume Left	104	0	5	0
Volume Right	0	4	0	2
cSH	579	619	1604	1700
Volume to Capacity	0.18	0.01	0.00	0.17
Queue Length 95th (ft)	16	1	0	0
Control Delay (s)	12.6	10.9	0.2	0.0
Lane LOS	B	B	A	
Approach Delay (s)	12.6	10.9	0.1	
Approach LOS	B	B		

Intersection Summary				
Average Delay	2.0			
Intersection Capacity Utilization	33.8%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	66	0	12	0	0	0	6	108	0	0	54	24
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0				5.0	5.0			5.0	
Lane Util. Factor		1.00	1.00				1.00	0.95			0.95	
Frpb, ped/bikes		1.00	1.00				1.00	1.00			0.99	
Flpb, ped/bikes		1.00	1.00				1.00	1.00			1.00	
Frt		1.00	0.85				1.00	1.00			0.95	
Flt Protected		0.95	1.00				0.95	1.00			1.00	
Satd. Flow (prot)		1805	1615				1543	3471			3138	
Flt Permitted		0.76	1.00				0.70	1.00			1.00	
Satd. Flow (perm)		1439	1615				1132	3471			3138	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	75	0	14	0	0	0	7	123	0	0	61	27
RTOR Reduction (vph)	0	0	8	0	0	0	0	0	0	0	15	0
Lane Group Flow (vph)	0	75	6	0	0	0	7	123	0	0	73	0
Confl. Bikes (#/hr)												2
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	17%	4%	0%	0%	13%	0%
Turn Type	Perm	NA	Perm	Perm			Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2			6		
Actuated Green, G (s)		30.0	30.0				30.0	30.0			30.0	
Effective Green, g (s)		30.0	30.0				30.0	30.0			30.0	
Actuated g/C Ratio		0.43	0.43				0.43	0.43			0.43	
Clearance Time (s)		5.0	5.0				5.0	5.0			5.0	
Lane Grp Cap (vph)		616	692				485	1487			1344	
v/s Ratio Prot								c0.04			0.02	
v/s Ratio Perm		c0.05	0.00				0.01					
v/c Ratio		0.12	0.01				0.01	0.08			0.05	
Uniform Delay, d1		12.1	11.5				11.5	11.8			11.7	
Progression Factor		1.00	1.00				1.00	1.00			1.00	
Incremental Delay, d2		0.4	0.0				0.1	0.1			0.1	
Delay (s)		12.5	11.5				11.6	12.0			11.8	
Level of Service		B	B				B	B			B	
Approach Delay (s)		12.3			0.0			11.9			11.8	
Approach LOS		B			A			B			B	

Intersection Summary			
HCM 2000 Control Delay	12.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.10		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	17.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	25	170	34	29	488	20	55	12	78	34	11	17
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	0.91	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.97	1.00	0.95	1.00	
Satd. Flow (prot)	1357	3471	1524	1687	3410		1649	1455	1495	1433	1342	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.97	1.00	0.95	1.00	
Satd. Flow (perm)	1357	3471	1524	1687	3410		1649	1455	1495	1433	1342	
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)	27	185	37	32	530	22	60	13	85	37	12	18
RTOR Reduction (vph)	0	0	29	0	2	0	0	0	47	0	17	0
Lane Group Flow (vph)	27	185	8	32	550	0	36	37	38	37	13	0
Heavy Vehicles (%)	33%	4%	6%	7%	4%	35%	4%	50%	8%	26%	45%	18%
Turn Type	Prot	NA	Perm	Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		6	6		2	2	
Permitted Phases			4						6			
Actuated Green, G (s)	2.9	19.3	19.3	4.1	20.5		40.7	40.7	40.7	6.5	6.5	
Effective Green, g (s)	2.9	19.3	19.3	4.1	20.5		40.7	40.7	40.7	6.5	6.5	
Actuated g/C Ratio	0.03	0.21	0.21	0.05	0.23		0.45	0.45	0.45	0.07	0.07	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	43	739	324	76	771		740	653	671	102	96	
v/s Ratio Prot	c0.02	0.05		0.02	c0.16		0.02	0.03		c0.03	0.01	
v/s Ratio Perm			0.01						c0.03			
v/c Ratio	0.63	0.25	0.02	0.42	0.71		0.05	0.06	0.06	0.36	0.14	
Uniform Delay, d1	43.3	29.6	28.2	42.1	32.3		14.0	14.1	14.1	40.1	39.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	25.3	0.2	0.0	3.7	3.1		0.1	0.2	0.2	2.2	0.7	
Delay (s)	68.6	29.8	28.2	45.8	35.5		14.2	14.3	14.3	42.3	40.1	
Level of Service	E	C	C	D	D		B	B	B	D	D	
Approach Delay (s)		33.8			36.0			14.2			41.3	
Approach LOS		C			D			B			D	

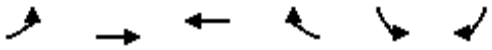
Intersection Summary			
HCM 2000 Control Delay	32.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	90.6	Sum of lost time (s)	20.0
Intersection Capacity Utilization	38.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	40	161	54	120	450	197	77	85	137	101	69	22
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	0.98		1.00	1.00	0.98	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.96		1.00	1.00	0.85	1.00	0.91		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1626	3201		1703	3505	1543	1583	3030		1736	2926	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1626	3201		1703	3505	1543	1583	3030		1736	2926	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	43	171	57	128	479	210	82	90	146	107	73	23
RTOR Reduction (vph)	0	34	0	0	0	173	0	123	0	0	19	0
Lane Group Flow (vph)	43	194	0	128	479	37	82	113	0	107	77	0
Confl. Peds. (#/hr)			20	1								
Confl. Bikes (#/hr)			75			3						
Heavy Vehicles (%)	11%	4%	13%	6%	3%	3%	14%	5%	10%	4%	12%	41%
Turn Type	Split	NA		Split	NA	Perm	Split	NA		Split	NA	
Protected Phases	4	4		8	8		2	2		6	6	
Permitted Phases						8						
Actuated Green, G (s)	29.0	29.0		17.0	17.0	17.0	15.0	15.0		15.0	15.0	
Effective Green, g (s)	29.0	29.0		17.0	17.0	17.0	15.0	15.0		15.0	15.0	
Actuated g/C Ratio	0.30	0.30		0.18	0.18	0.18	0.16	0.16		0.16	0.16	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	491	966		301	620	273	247	473		271	457	
v/s Ratio Prot	0.03	c0.06		0.08	c0.14		c0.05	0.04		c0.06	0.03	
v/s Ratio Perm						0.02						
v/c Ratio	0.09	0.20		0.43	0.77	0.14	0.33	0.24		0.39	0.17	
Uniform Delay, d1	24.0	24.9		35.2	37.7	33.3	36.0	35.5		36.4	35.1	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.4	0.5		4.4	9.1	1.0	3.6	1.2		4.3	0.8	
Delay (s)	24.4	25.4		39.5	46.7	34.3	39.6	36.7		40.7	35.9	
Level of Service	C	C		D	D	C	D	D		D	D	
Approach Delay (s)		25.2			42.4			37.4			38.4	
Approach LOS		C			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	38.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	96.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	59.8%	ICU Level of Service	B
Analysis Period (min)	15		

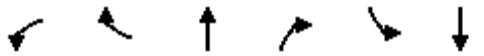
c Critical Lane Group



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	45	394	650	48	3	130
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	46	406	670	49	3	134
Pedestrians		2				
Lane Width (ft)		12.0				
Walking Speed (ft/s)		4.0				
Percent Blockage		0				
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		1120	405			
pX, platoon unblocked	0.92				0.92	0.92
vC, conflicting volume	720				991	362
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	522				816	133
tC, single (s)	4.9				7.5	7.0
tC, 2 stage (s)						
tF (s)	2.6				3.8	3.3
p0 queue free %	94				99	84
cM capacity (veh/h)	743				223	816

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	182	271	447	273	137
Volume Left	46	0	0	0	3
Volume Right	0	0	0	49	134
cSH	743	1700	1700	1700	770
Volume to Capacity	0.06	0.16	0.26	0.16	0.18
Queue Length 95th (ft)	5	0	0	0	16
Control Delay (s)	3.1	0.0	0.0	0.0	10.7
Lane LOS	A				B
Approach Delay (s)	1.2		0.0		10.7
Approach LOS					B

Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	50.4%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	131	0	0	0	0	458
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	151	0	0	0	0	526
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			444			
pX, platoon unblocked						
vC, conflicting volume	263	0			0	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	263	0			0	
tC, single (s)	6.9	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	78	100			100	
cM capacity (veh/h)	695	1091			1636	

Direction, Lane #	WB 1	WB 2	SB 1	SB 2
Volume Total	75	75	263	263
Volume Left	75	75	0	0
Volume Right	0	0	0	0
cSH	695	695	1700	1700
Volume to Capacity	0.11	0.11	0.15	0.15
Queue Length 95th (ft)	9	9	0	0
Control Delay (s)	10.8	10.8	0.0	0.0
Lane LOS	B	B		
Approach Delay (s)	10.8		0.0	
Approach LOS	B			

Intersection Summary			
Average Delay	2.4		
Intersection Capacity Utilization	23.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	184	103	119	432	0	0	0	0	101	303	181
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0		5.0	5.0						5.0	
Lane Util. Factor		0.95		1.00	0.95						0.95	
Frpb, ped/bikes		0.99		1.00	1.00						0.99	
Flpb, ped/bikes		1.00		1.00	1.00						1.00	
Frt		0.95		1.00	1.00						0.95	
Flt Protected		1.00		0.95	1.00						0.99	
Satd. Flow (prot)		3204		1765	3539						3260	
Flt Permitted		1.00		0.55	1.00						0.99	
Satd. Flow (perm)		3204		1021	3539						3260	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	0	196	110	127	460	0	0	0	0	107	322	193
RTOR Reduction (vph)	0	64	0	0	0	0	0	0	0	0	47	0
Lane Group Flow (vph)	0	242	0	127	460	0	0	0	0	0	575	0
Confl. Peds. (#/hr)			4	4						4		2
Confl. Bikes (#/hr)			3			2						21
Heavy Vehicles (%)	3%	7%	4%	2%	2%	2%	2%	1%	1%	2%	5%	3%
Turn Type		NA		Perm	NA					Perm	NA	
Protected Phases		2			6						4	
Permitted Phases				6						4		
Actuated Green, G (s)		46.0		46.0	46.0						54.0	
Effective Green, g (s)		46.0		46.0	46.0						54.0	
Actuated g/C Ratio		0.42		0.42	0.42						0.49	
Clearance Time (s)		5.0		5.0	5.0						5.0	
Vehicle Extension (s)		3.0		3.0	3.0						3.0	
Lane Grp Cap (vph)		1339		426	1479						1600	
v/s Ratio Prot		0.08			c0.13							
v/s Ratio Perm				0.12							0.18	
v/c Ratio		0.18		0.30	0.31						0.36	
Uniform Delay, d1		20.1		21.3	21.4						17.3	
Progression Factor		1.00		0.39	0.39						1.00	
Incremental Delay, d2		0.3		0.4	0.1						0.6	
Delay (s)		20.4		8.7	8.6						17.9	
Level of Service		C		A	A						B	
Approach Delay (s)		20.4			8.6			0.0			17.9	
Approach LOS		C			A			A			B	

Intersection Summary			
HCM 2000 Control Delay	14.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	75.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	58	53	14	5	0	9	0	0	0	25	344	19
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	64	59	16	6	0	10	0	0	0	28	382	21
Pedestrians								1				
Lane Width (ft)								0.0				
Walking Speed (ft/s)								4.0				
Percent Blockage								0				
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											655	
pX, platoon unblocked												
vC, conflicting volume	458	448	203	293	459	0	403			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	458	448	203	293	459	0	403			0		
tC, single (s)	7.7	6.5	6.9	7.6	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.3	3.6	4.0	3.3	2.2			2.2		
p0 queue free %	86	88	98	99	100	99	100			98		
cM capacity (veh/h)	462	500	811	552	493	1091	1166			1636		

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	139	16	219	212
Volume Left	64	6	28	0
Volume Right	16	10	0	21
cSH	502	809	1636	1700
Volume to Capacity	0.28	0.02	0.02	0.12
Queue Length 95th (ft)	28	1	1	0
Control Delay (s)	14.9	9.5	1.0	0.0
Lane LOS	B	A	A	
Approach Delay (s)	14.9	9.5	0.5	
Approach LOS	B	A		

Intersection Summary				
Average Delay	4.2			
Intersection Capacity Utilization	27.6%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	16	24	0	0	129	113	42	161	129	59	0	191
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0		5.0	5.0		4.0		4.0
Lane Util. Factor	1.00	0.95			0.95		0.91	0.91		1.00		0.88
Frpb, ped/bikes	1.00	1.00			0.99		1.00	1.00		1.00		1.00
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00		1.00		1.00
Frt	1.00	1.00			0.93		1.00	0.93		1.00		0.85
Flt Protected	0.95	1.00			1.00		0.95	1.00		0.95		1.00
Satd. Flow (prot)	1624	3471			3079		1441	2990		1543		2682
Flt Permitted	0.95	1.00			1.00		0.95	1.00		0.95		1.00
Satd. Flow (perm)	1624	3471			3079		1441	2990		1543		2682
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Adj. Flow (vph)	18	28	0	0	148	130	48	185	148	68	0	220
RTOR Reduction (vph)	0	0	0	0	110	0	0	95	0	0	0	203
Lane Group Flow (vph)	18	28	0	0	168	0	43	243	0	68	0	17
Confl. Peds. (#/hr)	6					6						
Confl. Bikes (#/hr)			6			3						
Heavy Vehicles (%)	0%	4%	0%	0%	9%	7%	14%	7%	9%	17%	0%	6%
Parking (#/hr)	0											
Turn Type	Split	NA			NA		Split	NA		Prot		custom
Protected Phases	4	4			8		2	2		6		6
Permitted Phases												
Actuated Green, G (s)	2.3	2.3			8.0		18.4	18.4		4.1		4.1
Effective Green, g (s)	2.3	2.3			8.0		18.4	18.4		4.1		4.1
Actuated g/C Ratio	0.04	0.04			0.15		0.36	0.36		0.08		0.08
Clearance Time (s)	5.0	5.0			5.0		5.0	5.0		4.0		4.0
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0		3.0
Lane Grp Cap (vph)	72	154			475		511	1062		122		212
v/s Ratio Prot	c0.01	0.01			c0.05		0.03	c0.08		c0.04		0.01
v/s Ratio Perm												
v/c Ratio	0.25	0.18			0.35		0.08	0.23		0.56		0.08
Uniform Delay, d1	23.9	23.8			19.6		11.1	11.7		23.0		22.1
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00		1.00
Incremental Delay, d2	1.8	0.6			0.5		0.3	0.5		5.4		0.2
Delay (s)	25.7	24.4			20.0		11.4	12.2		28.4		22.3
Level of Service	C	C			C		B	B		C		C
Approach Delay (s)		24.9			20.0			12.1			23.7	
Approach LOS		C			C			B			C	

Intersection Summary			
HCM 2000 Control Delay	18.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	51.8	Sum of lost time (s)	19.0
Intersection Capacity Utilization	36.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	10	27	1	14	27	41	0	8	23	33	11	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0		5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.99		1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00		1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.89		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		1.00		0.95	1.00	
Satd. Flow (prot)	1805	3610	793	1357	3471	1328		2621		1703	2362	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		1.00		0.95	1.00	
Satd. Flow (perm)	1805	3610	793	1357	3471	1328		2621		1703	2362	
Peak-hour factor, PHF	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Adj. Flow (vph)	12	33	1	17	33	50	0	10	28	40	13	1
RTOR Reduction (vph)	0	0	1	0	0	32	0	21	0	0	1	0
Lane Group Flow (vph)	12	33	0	17	33	18	0	17	0	40	13	0
Confl. Peds. (#/hr)			4	4								
Confl. Bikes (#/hr)			4			2						3
Heavy Vehicles (%)	0%	0%	100%	33%	4%	20%	0%	38%	17%	6%	55%	0%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8						
Actuated Green, G (s)	10.0	39.0	39.0	15.0	44.0	44.0		30.0		16.0	42.0	
Effective Green, g (s)	10.0	39.0	39.0	15.0	44.0	44.0		30.0		16.0	42.0	
Actuated g/C Ratio	0.08	0.32	0.32	0.12	0.37	0.37		0.25		0.13	0.35	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0		5.0		5.0	5.0	
Lane Grp Cap (vph)	150	1173	257	169	1272	486		655		227	826	
v/s Ratio Prot	0.01	0.01		c0.01	0.01			c0.01		c0.02	0.01	
v/s Ratio Perm			0.00			c0.01						
v/c Ratio	0.08	0.03	0.00	0.10	0.03	0.04		0.03		0.18	0.02	
Uniform Delay, d1	50.8	27.6	27.3	46.5	24.3	24.4		34.0		46.2	25.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2	1.0	0.0	0.0	1.2	0.0	0.1		0.1		1.7	0.0	
Delay (s)	51.8	27.6	27.4	47.7	24.3	24.5		34.0		47.8	25.5	
Level of Service	D	C	C	D	C	C		C		D	C	
Approach Delay (s)		33.9			28.4			34.0			42.1	
Approach LOS		C			C			C			D	

Intersection Summary			
HCM 2000 Control Delay	33.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.07		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	51.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	26	350	19	45	479	48	35	98	35	60	129	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0			5.0			5.0	
Lane Util. Factor		0.91			0.91			0.95			0.95	
Frpb, ped/bikes		1.00			1.00			1.00			0.99	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		0.99			0.99			0.97			0.96	
Flt Protected		1.00			1.00			0.99			0.99	
Satd. Flow (prot)		4950			4965			3444			3319	
Flt Permitted		0.88			0.88			0.87			0.86	
Satd. Flow (perm)		4366			4361			3038			2893	
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	26	354	19	45	484	48	35	99	35	61	130	71
RTOR Reduction (vph)	0	9	0	0	18	0	0	15	0	0	31	0
Lane Group Flow (vph)	0	390	0	0	559	0	0	154	0	0	231	0
Confl. Peds. (#/hr)	6		3	3		6	6		5	5		6
Confl. Bikes (#/hr)			15			13			14			11
Heavy Vehicles (%)	0%	4%	0%	0%	3%	0%	0%	0%	0%	2%	4%	0%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		16.3			16.3			33.8			33.8	
Effective Green, g (s)		16.3			16.3			33.8			33.8	
Actuated g/C Ratio		0.27			0.27			0.56			0.56	
Clearance Time (s)		5.0			5.0			5.0			5.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		1184			1182			1708			1627	
v/s Ratio Prot												
v/s Ratio Perm		0.09			c0.13			0.05			c0.08	
v/c Ratio		0.33			0.47			0.09			0.14	
Uniform Delay, d1		17.5			18.3			6.1			6.3	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		0.2			0.3			0.1			0.2	
Delay (s)		17.7			18.6			6.2			6.4	
Level of Service		B			B			A			A	
Approach Delay (s)		17.7			18.6			6.2			6.4	
Approach LOS		B			B			A			A	

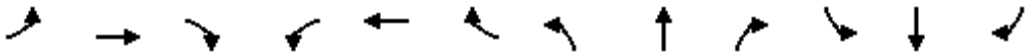
Intersection Summary			
HCM 2000 Control Delay	14.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.25		
Actuated Cycle Length (s)	60.1	Sum of lost time (s)	10.0
Intersection Capacity Utilization	78.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	128	7	3	332	0	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	0	0	0	0	147	8	3	382	0	0	0	0
Pedestrians		3			3						2	
Lane Width (ft)		0.0			12.0						0.0	
Walking Speed (ft/s)		4.0			4.0						4.0	
Percent Blockage		0			0						0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								536				
pX, platoon unblocked												
vC, conflicting volume	284	395	3	392	395	196	3			385		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	284	395	3	392	395	196	3			385		
tC, single (s)	7.5	6.5	6.9	7.6	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	73	99	100			100		
cM capacity (veh/h)	508	543	1086	532	543	817	1632			1182		

Direction, Lane #	WB 1	WB 2	NB 1	NB 2
Volume Total	98	57	131	254
Volume Left	0	0	3	0
Volume Right	0	8	0	0
cSH	543	570	1632	1700
Volume to Capacity	0.18	0.10	0.00	0.15
Queue Length 95th (ft)	16	8	0	0
Control Delay (s)	13.1	12.0	0.2	0.0
Lane LOS	B	B	A	
Approach Delay (s)	12.7		0.1	
Approach LOS	B			

Intersection Summary				
Average Delay	3.7			
Intersection Capacity Utilization	23.1%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	120	166	0	0	461	64	91	210	109	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0			5.0				
Lane Util. Factor		0.91			0.95			0.95				
Frpb, ped/bikes		1.00			1.00			0.99				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		1.00			0.98			0.96				
Flt Protected		0.98			1.00			0.99				
Satd. Flow (prot)		4823			3469			3357				
Flt Permitted		0.67			1.00			0.99				
Satd. Flow (perm)		3286			3469			3357				
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	128	177	0	0	490	68	97	223	116	0	0	0
RTOR Reduction (vph)	0	0	0	0	10	0	0	34	0	0	0	0
Lane Group Flow (vph)	0	305	0	0	548	0	0	402	0	0	0	0
Confl. Peds. (#/hr)	1					1			8			
Confl. Bikes (#/hr)			2			2			27			
Heavy Vehicles (%)	3%	7%	4%	2%	2%	2%	2%	1%	1%	2%	5%	3%
Turn Type	Perm	NA			NA		Perm	NA				
Protected Phases		2			6			8				
Permitted Phases	2						8					
Actuated Green, G (s)		46.0			46.0			54.0				
Effective Green, g (s)		46.0			46.0			54.0				
Actuated g/C Ratio		0.42			0.42			0.49				
Clearance Time (s)		5.0			5.0			5.0				
Vehicle Extension (s)		3.0			3.0			3.0				
Lane Grp Cap (vph)		1374			1450			1647				
v/s Ratio Prot					c0.16							
v/s Ratio Perm		0.09						0.12				
v/c Ratio		0.22			0.38			0.24				
Uniform Delay, d1		20.5			22.1			16.2				
Progression Factor		0.94			1.00			1.00				
Incremental Delay, d2		0.4			0.2			0.1				
Delay (s)		19.7			22.3			16.3				
Level of Service		B			C			B				
Approach Delay (s)		19.7			22.3			16.3			0.0	
Approach LOS		B			C			B			A	

Intersection Summary			
HCM 2000 Control Delay	19.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.31		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	49.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

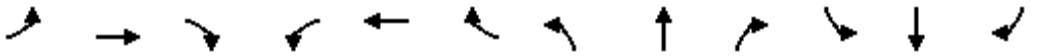
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	52	59	0	0	1	0	3	272	21	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	58	66	0	0	1	0	3	302	23	0	0	0
Pedestrians		9			13							
Lane Width (ft)		12.0			12.0							
Walking Speed (ft/s)		4.0			4.0							
Percent Blockage		1			1							
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											608	
pX, platoon unblocked												
vC, conflicting volume	167	354	9	366	343	176	9			339		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	167	354	9	366	343	176	9			339		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	92	88	100	100	100	100	100			100		
cM capacity (veh/h)	762	563	1069	506	571	834	1612			1219		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	123	1	154	174
Volume Left	58	0	3	0
Volume Right	0	0	0	23
cSH	641	571	1612	1700
Volume to Capacity	0.19	0.00	0.00	0.10
Queue Length 95th (ft)	18	0	0	0
Control Delay (s)	11.9	11.3	0.2	0.0
Lane LOS	B	B	A	
Approach Delay (s)	11.9	11.3	0.1	
Approach LOS	B	B		

Intersection Summary				
Average Delay	3.3			
Intersection Capacity Utilization	29.4%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	83	0	8	0	0	0	5	552	1	0	108	12
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0				5.0	5.0			5.0	
Lane Util. Factor		1.00	1.00				1.00	0.95			0.95	
Frpb, ped/bikes		1.00	0.99				1.00	1.00			1.00	
Flpb, ped/bikes		1.00	1.00				1.00	1.00			1.00	
Frt		1.00	0.85				1.00	1.00			0.98	
Flt Protected		0.95	1.00				0.95	1.00			1.00	
Satd. Flow (prot)		1767	1199				1202	2735			2463	
Flt Permitted		0.76	1.00				0.67	1.00			1.00	
Satd. Flow (perm)		1408	1199				849	2735			2463	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.92
Adj. Flow (vph)	88	0	9	0	0	0	5	587	1	0	115	13
RTOR Reduction (vph)	0	0	5	0	0	0	0	0	0	0	7	0
Lane Group Flow (vph)	0	88	4	0	0	0	5	588	0	0	121	0
Confl. Peds. (#/hr)	2		1	1		2	1		2	2		1
Confl. Bikes (#/hr)									1			1
Heavy Vehicles (%)	2%	0%	33%	0%	0%	0%	50%	32%	0%	0%	49%	0%
Turn Type	Perm	NA	Perm	Perm			Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2			6		
Actuated Green, G (s)		29.0	29.0				31.0	31.0			31.0	
Effective Green, g (s)		29.0	29.0				31.0	31.0			31.0	
Actuated g/C Ratio		0.41	0.41				0.44	0.44			0.44	
Clearance Time (s)		5.0	5.0				5.0	5.0			5.0	
Lane Grp Cap (vph)		583	496				375	1211			1090	
v/s Ratio Prot								c0.21			0.05	
v/s Ratio Perm		c0.06	0.00				0.01					
v/c Ratio		0.15	0.01				0.01	0.49			0.11	
Uniform Delay, d1		12.8	12.0				10.9	13.8			11.4	
Progression Factor		1.00	1.00				1.00	1.00			1.00	
Incremental Delay, d2		0.5	0.0				0.1	1.4			0.2	
Delay (s)		13.4	12.1				11.0	15.2			11.6	
Level of Service		B	B				B	B			B	
Approach Delay (s)		13.2			0.0			15.2			11.6	
Approach LOS		B			A			B			B	

Intersection Summary			
HCM 2000 Control Delay	14.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.32		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	51.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



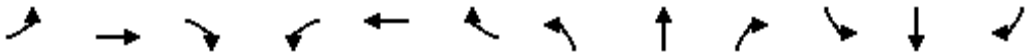
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	6	300	90	50	686	40	310	64	189	68	26	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	0.90	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.97	1.00	0.95	1.00	
Satd. Flow (prot)	1504	3505	1495	1433	3359		1618	1346	1302	1517	1398	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.97	1.00	0.95	1.00	
Satd. Flow (perm)	1504	3505	1495	1433	3359		1618	1346	1302	1517	1398	
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)	6	316	95	53	722	42	326	67	199	72	27	58
RTOR Reduction (vph)	0	0	71	0	3	0	0	0	155	0	45	0
Lane Group Flow (vph)	6	316	24	53	761	0	196	197	44	72	40	0
Heavy Vehicles (%)	20%	3%	8%	26%	3%	68%	6%	76%	24%	19%	50%	9%
Turn Type	Prot	NA	Perm	Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		6	6		2	2	
Permitted Phases			4						6			
Actuated Green, G (s)	1.0	20.8	20.8	5.6	25.4		18.7	18.7	18.7	18.8	18.8	
Effective Green, g (s)	1.0	20.8	20.8	5.6	25.4		18.7	18.7	18.7	18.8	18.8	
Actuated g/C Ratio	0.01	0.25	0.25	0.07	0.30		0.22	0.22	0.22	0.22	0.22	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	17	868	370	95	1016		360	300	290	339	313	
v/s Ratio Prot	0.00	0.09		c0.04	c0.23		0.12	c0.15		c0.05	0.03	
v/s Ratio Perm			0.02						0.03			
v/c Ratio	0.35	0.36	0.06	0.56	0.75		0.54	0.66	0.15	0.21	0.13	
Uniform Delay, d1	41.1	26.1	24.1	38.0	26.4		28.8	29.7	26.2	26.5	26.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	12.2	0.3	0.1	6.9	3.1		1.7	5.1	0.2	1.4	0.8	
Delay (s)	53.3	26.3	24.2	44.9	29.4		30.5	34.8	26.5	27.9	26.8	
Level of Service	D	C	C	D	C		C	C	C	C	C	
Approach Delay (s)		26.2			30.4			30.6			27.3	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	29.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	83.9	Sum of lost time (s)	20.0
Intersection Capacity Utilization	53.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	113	362	88	183	640	214	99	177	371	134	77	18
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	1.00	0.85	1.00	0.90		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1433	3223		1626	3438	1495	1444	2823		1612	2822	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1433	3223		1626	3438	1495	1444	2823		1612	2822	
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)	116	373	91	189	660	221	102	182	382	138	79	19
RTOR Reduction (vph)	0	22	0	0	0	182	0	322	0	0	16	0
Lane Group Flow (vph)	116	442	0	189	660	39	102	242	0	138	82	0
Confl. Peds. (#/hr)			1	1								
Confl. Bikes (#/hr)			3									
Heavy Vehicles (%)	26%	8%	10%	11%	5%	8%	25%	23%	11%	12%	18%	50%
Turn Type	Split	NA		Split	NA	Perm	Split	NA		Split	NA	
Protected Phases	4	4		8	8		2	2		6	6	
Permitted Phases						8						
Actuated Green, G (s)	29.0	29.0		17.0	17.0	17.0	15.0	15.0		15.0	15.0	
Effective Green, g (s)	29.0	29.0		17.0	17.0	17.0	15.0	15.0		15.0	15.0	
Actuated g/C Ratio	0.30	0.30		0.18	0.18	0.18	0.16	0.16		0.16	0.16	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	432	973		287	608	264	225	441		251	440	
v/s Ratio Prot	0.08	c0.14		0.12	c0.19		0.07	c0.09		c0.09	0.03	
v/s Ratio Perm						0.03						
v/c Ratio	0.27	0.45		0.66	1.09	0.15	0.45	0.55		0.55	0.19	
Uniform Delay, d1	25.4	27.1		36.8	39.5	33.4	36.8	37.4		37.4	35.2	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.5	1.5		11.3	61.9	1.2	6.5	4.8		8.4	0.9	
Delay (s)	27.0	28.6		48.1	101.4	34.6	43.2	42.2		45.8	36.1	
Level of Service	C	C		D	F	C	D	D		D	D	
Approach Delay (s)		28.3			78.2			42.4			41.8	
Approach LOS		C			E			D			D	

Intersection Summary			
HCM 2000 Control Delay	54.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	96.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	75.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	97	768	51	23	822	13	41	0	17	3	5	197
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	104	826	55	25	884	14	44	0	18	3	5	212
Pedestrians								2			2	
Lane Width (ft)								12.0			12.0	
Walking Speed (ft/s)								4.0			4.0	
Percent Blockage								0			0	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		1120			405							
pX, platoon unblocked	0.90						0.90	0.90		0.90	0.90	0.90
vC, conflicting volume	900			883			1770	2013	442	1582	2034	451
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	659			883			1629	1900	442	1419	1923	158
tC, single (s)	4.9			4.1			7.9	6.5	7.1	7.5	6.5	7.1
tC, 2 stage (s)												
tF (s)	2.6			2.2			3.7	4.0	3.4	3.5	4.0	3.4
p0 queue free %	84			97			0	100	97	96	89	72
cM capacity (veh/h)	636			774			28	51	546	73	49	744

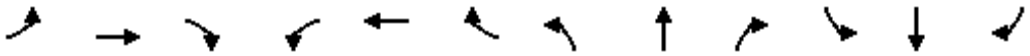
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total	517	468	467	456	62	220
Volume Left	104	0	25	0	44	3
Volume Right	0	55	0	14	18	212
cSH	636	1700	774	1700	39	502
Volume to Capacity	0.16	0.28	0.03	0.27	1.58	0.44
Queue Length 95th (ft)	15	0	2	0	162	55
Control Delay (s)	4.4	0.0	0.9	0.0	514.4	17.6
Lane LOS	A		A		F	C
Approach Delay (s)	2.3		0.5		514.4	17.6
Approach LOS					F	C

Intersection Summary				
Average Delay	17.7			
Intersection Capacity Utilization	78.8%	ICU Level of Service	D	
Analysis Period (min)	15			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	192	0	0	0	0	614
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	198	0	0	0	0	633
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			444			
pX, platoon unblocked						
vC, conflicting volume	316	0			0	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	316	0			0	
tC, single (s)	6.9	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	69	100			100	
cM capacity (veh/h)	646	1091			1636	

Direction, Lane #	WB 1	WB 2	SB 1	SB 2
Volume Total	99	99	316	316
Volume Left	99	99	0	0
Volume Right	0	0	0	0
cSH	646	646	1700	1700
Volume to Capacity	0.15	0.15	0.19	0.19
Queue Length 95th (ft)	13	13	0	0
Control Delay (s)	11.6	11.6	0.0	0.0
Lane LOS	B	B		
Approach Delay (s)	11.6		0.0	
Approach LOS	B			

Intersection Summary			
Average Delay	2.8		
Intersection Capacity Utilization	34.2%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	570	88	122	563	0	0	0	0	142	474	179
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0		5.0	5.0						5.0	
Lane Util. Factor		0.91		1.00	0.95						0.95	
Frpb, ped/bikes		1.00		1.00	1.00						0.99	
Flpb, ped/bikes		1.00		1.00	1.00						1.00	
Frt		0.98		1.00	1.00						0.97	
Flt Protected		1.00		0.95	1.00						0.99	
Satd. Flow (prot)		4813		1770	3471						3376	
Flt Permitted		1.00		0.35	1.00						0.99	
Satd. Flow (perm)		4813		643	3471						3376	
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)	0	594	92	127	586	0	0	0	0	148	494	186
RTOR Reduction (vph)	0	19	0	0	0	0	0	0	0	0	24	0
Lane Group Flow (vph)	0	667	0	127	586	0	0	0	0	0	804	0
Confl. Peds. (#/hr)										7		3
Confl. Bikes (#/hr)						1						36
Heavy Vehicles (%)	6%	6%	3%	2%	4%	1%	3%	4%	1%	4%	1%	1%
Turn Type		NA		Perm	NA					Perm	NA	
Protected Phases		2			6						4	
Permitted Phases				6						4		
Actuated Green, G (s)		51.0		51.0	51.0						49.0	
Effective Green, g (s)		51.0		51.0	51.0						49.0	
Actuated g/C Ratio		0.46		0.46	0.46						0.45	
Clearance Time (s)		5.0		5.0	5.0						5.0	
Vehicle Extension (s)		3.0		3.0	3.0						3.0	
Lane Grp Cap (vph)		2231		298	1609						1503	
v/s Ratio Prot		0.14			0.17							
v/s Ratio Perm				c0.20							0.24	
v/c Ratio		0.30		0.43	0.36						0.53	
Uniform Delay, d1		18.4		19.7	19.0						22.2	
Progression Factor		1.00		0.51	0.46						1.00	
Incremental Delay, d2		0.3		4.2	0.6						1.4	
Delay (s)		18.7		14.2	9.3						23.6	
Level of Service		B		B	A						C	
Approach Delay (s)		18.7			10.2			0.0			23.6	
Approach LOS		B			B			A			C	

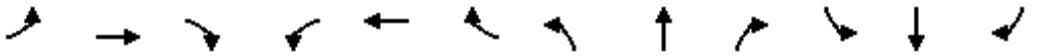
Intersection Summary			
HCM 2000 Control Delay	17.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	59.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	83	9	5	1	0	0	0	0	8	535	3
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	0	89	10	5	1	0	0	0	0	9	575	3
Pedestrians		3						1				
Lane Width (ft)		12.0						0.0				
Walking Speed (ft/s)		4.0						4.0				
Percent Blockage		0						0				
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											655	
pX, platoon unblocked												
vC, conflicting volume	598	597	293	360	599	0	581			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	598	597	293	360	599	0	581			0		
tC, single (s)	7.7	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	79	99	99	100	100	100			99		
cM capacity (veh/h)	370	416	707	471	415	1091	1000			1636		

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	99	6	296	291
Volume Left	0	5	9	0
Volume Right	10	0	0	3
cSH	433	461	1636	1700
Volume to Capacity	0.23	0.01	0.01	0.17
Queue Length 95th (ft)	22	1	0	0
Control Delay (s)	15.8	12.9	0.3	0.0
Lane LOS	C	B	A	
Approach Delay (s)	15.8	12.9	0.1	
Approach LOS	C	B		

Intersection Summary				
Average Delay	2.5			
Intersection Capacity Utilization	27.0%	ICU Level of Service	A	
Analysis Period (min)	15			



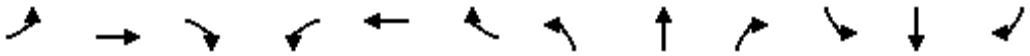
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	143	98	0	0	109	130	90	317	95	90	0	206
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0		5.0	5.0		5.0		5.0
Lane Util. Factor	1.00	0.95			0.95		0.91	0.91		1.00		0.88
Frpb, ped/bikes	1.00	1.00			0.99		1.00	1.00		1.00		1.00
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00		1.00		1.00
Frt	1.00	1.00			0.92		1.00	0.97		1.00		0.85
Flt Protected	0.95	1.00			1.00		0.95	1.00		0.95		1.00
Satd. Flow (prot)	1160	3195			2745		1014	2888		1570		2349
Flt Permitted	0.95	1.00			1.00		0.95	1.00		0.95		1.00
Satd. Flow (perm)	1160	3195			2745		1014	2888		1570		2349
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	159	109	0	0	121	144	100	352	106	100	0	229
RTOR Reduction (vph)	0	0	0	0	126	0	0	21	0	0	0	197
Lane Group Flow (vph)	159	109	0	0	139	0	90	447	0	100	0	32
Confl. Peds. (#/hr)							4					4
Confl. Bikes (#/hr)			6			3						
Heavy Vehicles (%)	40%	13%	0%	0%	18%	21%	62%	15%	13%	15%	0%	21%
Parking (#/hr)	0											
Turn Type	Split	NA			NA		Split	NA		Prot		custom
Protected Phases	4	4			8		2	2		6		6
Permitted Phases												
Actuated Green, G (s)	15.7	15.7			8.9		17.2	17.2		10.0		10.0
Effective Green, g (s)	15.7	15.7			8.9		17.2	17.2		10.0		10.0
Actuated g/C Ratio	0.22	0.22			0.12		0.24	0.24		0.14		0.14
Clearance Time (s)	5.0	5.0			5.0		5.0	5.0		5.0		5.0
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0		3.0
Lane Grp Cap (vph)	253	698			340		242	691		218		327
v/s Ratio Prot	c0.14	0.03			c0.05		0.09	c0.15		c0.06		0.01
v/s Ratio Perm												
v/c Ratio	0.63	0.16			0.41		0.37	0.65		0.46		0.10
Uniform Delay, d1	25.4	22.7			29.0		22.8	24.6		28.4		27.0
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00		1.00
Incremental Delay, d2	4.8	0.1			0.8		4.3	4.6		1.5		0.1
Delay (s)	30.2	22.8			29.8		27.1	29.2		29.9		27.1
Level of Service	C	C			C		C	C		C		C
Approach Delay (s)		27.2			29.8			28.9			28.0	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	28.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	71.8	Sum of lost time (s)	20.0
Intersection Capacity Utilization	46.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	171	198	36	28	60	66	6	229	157	197	128	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1245	2375	832	1107	2201	1062	1003	1970		1203	1870	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1245	2375	832	1107	2201	1062	1003	1970		1203	1870	
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	188	218	40	31	66	73	7	252	173	216	141	0
RTOR Reduction (vph)	0	0	27	0	0	64	0	102	0	0	0	0
Lane Group Flow (vph)	188	218	13	31	66	9	7	323	0	216	141	0
Confl. Bikes (#/hr)						1						
Heavy Vehicles (%)	45%	52%	94%	63%	64%	50%	80%	79%	62%	50%	93%	0%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8						
Actuated Green, G (s)	39.0	39.0	39.0	15.0	15.0	15.0	29.0	29.0		17.0	17.0	
Effective Green, g (s)	39.0	39.0	39.0	15.0	15.0	15.0	29.0	29.0		17.0	17.0	
Actuated g/C Ratio	0.32	0.32	0.32	0.12	0.12	0.12	0.24	0.24		0.14	0.14	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	404	771	270	138	275	132	242	476		170	264	
v/s Ratio Prot	c0.15	c0.09		0.03	0.03		0.01	c0.16		c0.18	0.08	
v/s Ratio Perm			0.02			0.01						
v/c Ratio	0.47	0.28	0.05	0.22	0.24	0.07	0.03	0.68		1.27	0.53	
Uniform Delay, d1	32.2	30.1	27.8	47.3	47.4	46.3	34.7	41.3		51.5	47.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	3.8	0.9	0.3	3.7	2.1	1.0	0.2	7.6		159.7	7.5	
Delay (s)	36.0	31.0	28.1	51.0	49.4	47.3	35.0	48.9		211.2	55.4	
Level of Service	D	C	C	D	D	D	C	D		F	E	
Approach Delay (s)		32.9			48.8			48.7			149.6	
Approach LOS		C			D			D			F	

Intersection Summary			
HCM 2000 Control Delay	69.3	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	51.8%	ICU Level of Service	A
Analysis Period (min)	15		

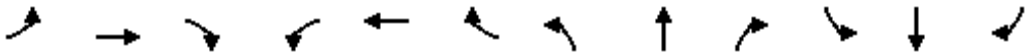
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	56	618	55	76	709	64	37	251	69	79	232	82
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0			5.0			5.0	
Lane Util. Factor		0.91			0.91			0.95			0.95	
Frpb, ped/bikes		1.00			1.00			1.00			0.99	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		0.99			0.99			0.97			0.97	
Flt Protected		1.00			1.00			0.99			0.99	
Satd. Flow (prot)		4858			4989			3362			3300	
Flt Permitted		0.80			0.79			0.88			0.81	
Satd. Flow (perm)		3922			3955			2991			2694	
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)	59	651	58	80	746	67	39	264	73	83	244	86
RTOR Reduction (vph)	0	14	0	0	14	0	0	22	0	0	25	0
Lane Group Flow (vph)	0	754	0	0	879	0	0	354	0	0	388	0
Confl. Peds. (#/hr)	20		12	12		20	17		11	11		17
Confl. Bikes (#/hr)			10			8			12			9
Heavy Vehicles (%)	2%	5%	7%	2%	2%	2%	2%	3%	4%	2%	3%	9%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		23.2			23.2			33.4			33.4	
Effective Green, g (s)		23.2			23.2			33.4			33.4	
Actuated g/C Ratio		0.35			0.35			0.50			0.50	
Clearance Time (s)		5.0			5.0			5.0			5.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		1366			1377			1499			1351	
v/s Ratio Prot												
v/s Ratio Perm		0.19			c0.22			0.12			c0.14	
v/c Ratio		0.55			0.64			0.24			0.29	
Uniform Delay, d1		17.5			18.2			9.4			9.7	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		0.5			1.0			0.4			0.5	
Delay (s)		18.0			19.2			9.8			10.2	
Level of Service		B			B			A			B	
Approach Delay (s)		18.0			19.2			9.8			10.2	
Approach LOS		B			B			A			B	

Intersection Summary			
HCM 2000 Control Delay	15.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	66.6	Sum of lost time (s)	10.0
Intersection Capacity Utilization	93.3%	ICU Level of Service	F
Analysis Period (min)	15		

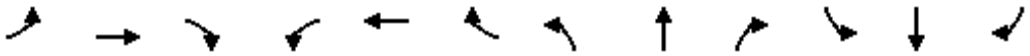
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	187	12	5	763	0	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	0	0	0	0	193	12	5	787	0	0	0	0
Pedestrians		16			1						3	
Lane Width (ft)		0.0			12.0						0.0	
Walking Speed (ft/s)		4.0			4.0						4.0	
Percent Blockage		0			0						0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								536				
pX, platoon unblocked												
vC, conflicting volume	531	814	16	798	814	397	16			788		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	531	814	16	798	814	397	16			788		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	38	98	100			100		
cM capacity (veh/h)	216	313	1066	279	313	607	1615			840		

Direction, Lane #	WB 1	WB 2	NB 1	NB 2
Volume Total	129	77	267	524
Volume Left	0	0	5	0
Volume Right	0	12	0	0
cSH	313	340	1615	1700
Volume to Capacity	0.41	0.23	0.00	0.31
Queue Length 95th (ft)	48	21	0	0
Control Delay (s)	24.3	18.6	0.2	0.0
Lane LOS	C	C	A	
Approach Delay (s)	22.2		0.1	
Approach LOS	C			

Intersection Summary				
Average Delay	4.6			
Intersection Capacity Utilization	34.2%	ICU Level of Service	A	
Analysis Period (min)	15			

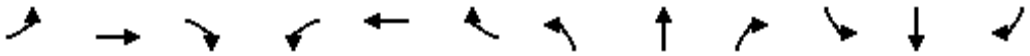


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	320	392	0	0	573	131	111	521	142	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0			5.0				
Lane Util. Factor		0.91			0.91			0.95				
Frpb, ped/bikes		1.00			1.00			0.99				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		1.00			0.97			0.97				
Flt Protected		0.98			1.00			0.99				
Satd. Flow (prot)		4784			4862			3350				
Flt Permitted		0.66			1.00			0.99				
Satd. Flow (perm)		3215			4862			3350				
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)	333	408	0	0	597	136	116	543	148	0	0	0
RTOR Reduction (vph)	0	0	0	0	34	0	0	18	0	0	0	0
Lane Group Flow (vph)	0	741	0	0	699	0	0	789	0	0	0	0
Confl. Peds. (#/hr)	2					2			4	4		
Confl. Bikes (#/hr)			1						44			
Heavy Vehicles (%)	6%	6%	3%	2%	4%	1%	3%	4%	1%	4%	1%	1%
Turn Type	Perm	NA			NA		Perm	NA				
Protected Phases		2			6			8				
Permitted Phases	2						8					
Actuated Green, G (s)		51.0			51.0			49.0				
Effective Green, g (s)		51.0			51.0			49.0				
Actuated g/C Ratio		0.46			0.46			0.45				
Clearance Time (s)		5.0			5.0			5.0				
Vehicle Extension (s)		3.0			3.0			3.0				
Lane Grp Cap (vph)		1490			2254			1492				
v/s Ratio Prot					0.14							
v/s Ratio Perm		c0.23						0.24				
v/c Ratio		1.24dl			0.31			0.53				
Uniform Delay, d1		20.6			18.5			22.1				
Progression Factor		0.56			1.00			1.00				
Incremental Delay, d2		1.1			0.4			0.3				
Delay (s)		12.6			18.8			22.5				
Level of Service		B			B			C				
Approach Delay (s)		12.6			18.8			22.5			0.0	
Approach LOS		B			B			C			A	

Intersection Summary			
HCM 2000 Control Delay	18.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	78.5%	ICU Level of Service	D
Analysis Period (min)	15		

dl Defacto Left Lane. Recode with 1 though lane as a left lane.

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	83	0	0	0	1	5	6	686	3	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	89	0	0	0	1	5	6	738	3	0	0	0
Pedestrians		12			1						1	
Lane Width (ft)		12.0			12.0						0.0	
Walking Speed (ft/s)		4.0			4.0						4.0	
Percent Blockage		1			0						0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											608	
pX, platoon unblocked												
vC, conflicting volume	401	767	12	753	765	372	12			742		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	401	767	12	753	765	372	12			742		
tC, single (s)	7.7	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	82	100	100	100	100	99	100			100		
cM capacity (veh/h)	503	330	1061	298	331	630	1604			874		

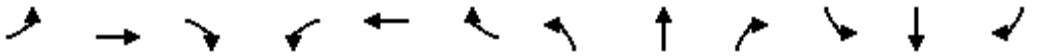
Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	89	6	375	372
Volume Left	89	0	6	0
Volume Right	0	5	0	3
cSH	503	548	1604	1700
Volume to Capacity	0.18	0.01	0.00	0.22
Queue Length 95th (ft)	16	1	0	0
Control Delay (s)	13.7	11.7	0.2	0.0
Lane LOS	B	B	A	
Approach Delay (s)	13.7	11.7	0.1	
Approach LOS	B	B		

Intersection Summary				
Average Delay	1.6			
Intersection Capacity Utilization	37.2%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	84	0	15	0	0	0	8	138	0	0	69	31
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0				5.0	5.0			5.0	
Lane Util. Factor		1.00	1.00				1.00	0.95			0.95	
Frpb, ped/bikes		1.00	1.00				1.00	1.00			0.99	
Flpb, ped/bikes		1.00	1.00				1.00	1.00			1.00	
Frt		1.00	0.85				1.00	1.00			0.95	
Flt Protected		0.95	1.00				0.95	1.00			1.00	
Satd. Flow (prot)		1805	1615				1543	3471			3138	
Flt Permitted		0.76	1.00				0.68	1.00			1.00	
Satd. Flow (perm)		1439	1615				1105	3471			3138	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	95	0	17	0	0	0	9	157	0	0	78	35
RTOR Reduction (vph)	0	0	10	0	0	0	0	0	0	0	20	0
Lane Group Flow (vph)	0	95	7	0	0	0	9	157	0	0	93	0
Confl. Bikes (#/hr)												2
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	17%	4%	0%	0%	13%	0%
Turn Type	Perm	NA	Perm	Perm			Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2			6		
Actuated Green, G (s)		30.0	30.0				30.0	30.0			30.0	
Effective Green, g (s)		30.0	30.0				30.0	30.0			30.0	
Actuated g/C Ratio		0.43	0.43				0.43	0.43			0.43	
Clearance Time (s)		5.0	5.0				5.0	5.0			5.0	
Lane Grp Cap (vph)		616	692				473	1487			1344	
v/s Ratio Prot								c0.05			0.03	
v/s Ratio Perm		c0.07	0.00				0.01					
v/c Ratio		0.15	0.01				0.02	0.11			0.07	
Uniform Delay, d1		12.2	11.5				11.5	12.0			11.8	
Progression Factor		1.00	1.00				1.00	1.00			1.00	
Incremental Delay, d2		0.5	0.0				0.1	0.1			0.1	
Delay (s)		12.8	11.5				11.6	12.1			11.9	
Level of Service		B	B				B	B			B	
Approach Delay (s)		12.6			0.0			12.1			11.9	
Approach LOS		B			A			B			B	

Intersection Summary			
HCM 2000 Control Delay	12.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.13		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	19.6%	ICU Level of Service	A
Analysis Period (min)	15		

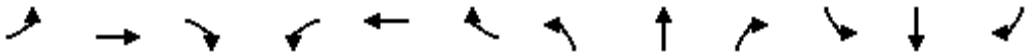
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	32	211	44	37	618	26	70	15	100	44	14	22
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	0.91	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.97	1.00	0.95	1.00	
Satd. Flow (prot)	1357	3471	1524	1687	3410		1649	1457	1495	1433	1343	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.97	1.00	0.95	1.00	
Satd. Flow (perm)	1357	3471	1524	1687	3410		1649	1457	1495	1433	1343	
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)	35	229	48	40	672	28	76	16	109	48	15	24
RTOR Reduction (vph)	0	0	35	0	2	0	0	0	64	0	22	0
Lane Group Flow (vph)	35	229	13	40	698	0	46	46	45	48	17	0
Heavy Vehicles (%)	33%	4%	6%	7%	4%	35%	4%	50%	8%	26%	45%	18%
Turn Type	Prot	NA	Perm	Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		6	6		2	2	
Permitted Phases			4						6			
Actuated Green, G (s)	4.5	26.1	26.1	4.1	25.7		40.9	40.9	40.9	7.3	7.3	
Effective Green, g (s)	4.5	26.1	26.1	4.1	25.7		40.9	40.9	40.9	7.3	7.3	
Actuated g/C Ratio	0.05	0.27	0.27	0.04	0.26		0.42	0.42	0.42	0.07	0.07	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	62	920	404	70	890		685	605	621	106	99	
v/s Ratio Prot	c0.03	0.07		0.02	c0.20		0.03	c0.03		c0.03	0.01	
v/s Ratio Perm			0.01						0.03			
v/c Ratio	0.56	0.25	0.03	0.57	0.78		0.07	0.08	0.07	0.45	0.17	
Uniform Delay, d1	46.0	28.4	26.8	46.3	33.8		17.3	17.3	17.3	43.6	42.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	11.2	0.1	0.0	10.8	4.6		0.2	0.2	0.2	3.1	0.8	
Delay (s)	57.2	28.6	26.8	57.1	38.3		17.5	17.6	17.6	46.7	43.5	
Level of Service	E	C	C	E	D		B	B	B	D	D	
Approach Delay (s)		31.5			39.4			17.5			45.3	
Approach LOS		C			D			B			D	

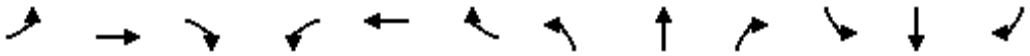
Intersection Summary			
HCM 2000 Control Delay	34.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	98.4	Sum of lost time (s)	20.0
Intersection Capacity Utilization	42.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	51	200	69	141	570	242	99	109	163	119	88	28
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.96		1.00	1.00	0.85	1.00	0.91		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1626	3255		1703	3505	1543	1583	3043		1736	2923	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1626	3255		1703	3505	1543	1583	3043		1736	2923	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	54	213	73	150	606	257	105	116	173	127	94	30
RTOR Reduction (vph)	0	35	0	0	0	211	0	146	0	0	25	0
Lane Group Flow (vph)	54	251	0	150	606	46	105	143	0	127	99	0
Confl. Peds. (#/hr)			1	1								
Confl. Bikes (#/hr)			1			3						
Heavy Vehicles (%)	11%	4%	13%	6%	3%	3%	14%	5%	10%	4%	12%	41%
Turn Type	Split	NA		Split	NA	Perm	Split	NA		Split	NA	
Protected Phases	4	4		8	8		2	2		6	6	
Permitted Phases						8						
Actuated Green, G (s)	29.0	29.0		17.0	17.0	17.0	15.0	15.0		15.0	15.0	
Effective Green, g (s)	29.0	29.0		17.0	17.0	17.0	15.0	15.0		15.0	15.0	
Actuated g/C Ratio	0.30	0.30		0.18	0.18	0.18	0.16	0.16		0.16	0.16	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	491	983		301	620	273	247	475		271	456	
v/s Ratio Prot	0.03	c0.08		0.09	c0.17		c0.07	0.05		c0.07	0.03	
v/s Ratio Perm						0.03						
v/c Ratio	0.11	0.26		0.50	0.98	0.17	0.43	0.30		0.47	0.22	
Uniform Delay, d1	24.2	25.3		35.7	39.3	33.5	36.6	35.9		36.9	35.4	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.5	0.6		5.8	31.0	1.3	5.3	1.6		5.7	1.1	
Delay (s)	24.6	26.0		41.4	70.3	34.8	41.9	37.5		42.6	36.5	
Level of Service	C	C		D	E	C	D	D		D	D	
Approach Delay (s)		25.8			57.0			38.7			39.6	
Approach LOS		C			E			D			D	

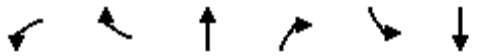
Intersection Summary			
HCM 2000 Control Delay	45.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	96.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	63.5%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	32	462	42	23	799	6	55	5	29	4	13	115
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	33	476	43	24	824	6	57	5	30	4	13	119
Pedestrians		2										
Lane Width (ft)		12.0										
Walking Speed (ft/s)		4.0										
Percent Blockage		0										
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		1120			405							
pX, platoon unblocked	0.90						0.90	0.90		0.90	0.90	0.90
vC, conflicting volume	830			520			1150	1441	260	1211	1460	417
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	599			520			954	1275	260	1021	1296	142
tC, single (s)	4.9			4.2			7.5	6.5	7.0	8.2	6.5	7.0
tC, 2 stage (s)												
tF (s)	2.6			2.3			3.5	4.0	3.3	3.8	4.0	3.3
p0 queue free %	95			98			60	96	96	97	90	85
cM capacity (veh/h)	673			1009			143	141	733	122	137	791

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total	271	281	436	418	92	136
Volume Left	33	0	24	0	57	4
Volume Right	0	43	0	6	30	119
cSH	673	1700	1009	1700	194	484
Volume to Capacity	0.05	0.17	0.02	0.25	0.47	0.28
Queue Length 95th (ft)	4	0	2	0	57	29
Control Delay (s)	1.8	0.0	0.7	0.0	39.2	15.3
Lane LOS	A		A		E	C
Approach Delay (s)	0.9		0.4		39.2	15.3
Approach LOS					E	C

Intersection Summary			
Average Delay	4.0		
Intersection Capacity Utilization	62.5%	ICU Level of Service	B
Analysis Period (min)	15		



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	168	0	0	0	0	561
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	193	0	0	0	0	645
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			444			
pX, platoon unblocked						
vC, conflicting volume	322	0			0	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	322	0			0	
tC, single (s)	6.9	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	70	100			100	
cM capacity (veh/h)	638	1091			1636	

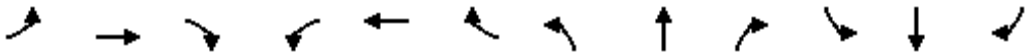
Direction, Lane #	WB 1	WB 2	SB 1	SB 2
Volume Total	97	97	322	322
Volume Left	97	97	0	0
Volume Right	0	0	0	0
cSH	638	638	1700	1700
Volume to Capacity	0.15	0.15	0.19	0.19
Queue Length 95th (ft)	13	13	0	0
Control Delay (s)	11.6	11.6	0.0	0.0
Lane LOS	B	B		
Approach Delay (s)	11.6		0.0	
Approach LOS	B			

Intersection Summary			
Average Delay	2.7		
Intersection Capacity Utilization	27.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	265	90	141	494	0	0	0	0	119	378	225
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0		5.0	5.0						5.0	
Lane Util. Factor		0.91		1.00	0.95						0.95	
Frpb, ped/bikes		1.00		1.00	1.00						0.99	
Flpb, ped/bikes		1.00		1.00	1.00						1.00	
Frt		0.96		1.00	1.00						0.95	
Flt Protected		1.00		0.95	1.00						0.99	
Satd. Flow (prot)		4676		1766	3539						3260	
Flt Permitted		1.00		0.52	1.00						0.99	
Satd. Flow (perm)		4676		958	3539						3260	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	0	282	96	150	526	0	0	0	0	127	402	239
RTOR Reduction (vph)	0	56	0	0	0	0	0	0	0	0	47	0
Lane Group Flow (vph)	0	322	0	150	526	0	0	0	0	0	721	0
Confl. Peds. (#/hr)			4	4						4		2
Confl. Bikes (#/hr)			3			2						21
Heavy Vehicles (%)	3%	7%	4%	2%	2%	2%	2%	1%	1%	2%	5%	3%
Turn Type		NA		Perm	NA					Perm	NA	
Protected Phases		2			6						4	
Permitted Phases				6						4		
Actuated Green, G (s)		46.0		46.0	46.0						54.0	
Effective Green, g (s)		46.0		46.0	46.0						54.0	
Actuated g/C Ratio		0.42		0.42	0.42						0.49	
Clearance Time (s)		5.0		5.0	5.0						5.0	
Vehicle Extension (s)		3.0		3.0	3.0						3.0	
Lane Grp Cap (vph)		1955		400	1479						1600	
v/s Ratio Prot		0.07			0.15							
v/s Ratio Perm				c0.16							0.22	
v/c Ratio		0.16		0.38	0.36						0.45	
Uniform Delay, d1		20.0		22.1	21.9						18.3	
Progression Factor		1.00		0.36	0.34						1.00	
Incremental Delay, d2		0.2		0.6	0.1						0.9	
Delay (s)		20.2		8.5	7.6						19.2	
Level of Service		C		A	A						B	
Approach Delay (s)		20.2			7.8			0.0			19.2	
Approach LOS		C			A			A			B	

Intersection Summary			
HCM 2000 Control Delay	15.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	77.0%	ICU Level of Service	D
Analysis Period (min)	15		

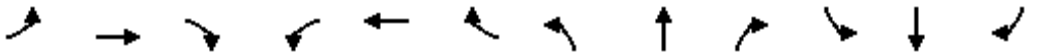
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	74	1	18	6	0	12	0	0	0	32	430	13
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	82	1	20	7	0	13	0	0	0	36	478	14
Pedestrians								1				
Lane Width (ft)								0.0				
Walking Speed (ft/s)								4.0				
Percent Blockage								0				
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											655	
pX, platoon unblocked												
vC, conflicting volume	569	556	247	332	563	0	492			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	569	556	247	332	563	0	492			0		
tC, single (s)	7.7	6.5	6.9	7.6	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.3	3.6	4.0	3.3	2.2			2.2		
p0 queue free %	78	100	97	99	100	99	100			98		
cM capacity (veh/h)	381	432	759	562	428	1091	1082			1636		

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	103	20	274	253
Volume Left	82	7	36	0
Volume Right	20	13	0	14
cSH	422	830	1636	1700
Volume to Capacity	0.24	0.02	0.02	0.15
Queue Length 95th (ft)	24	2	2	0
Control Delay (s)	16.3	9.4	1.1	0.0
Lane LOS	C	A	A	
Approach Delay (s)	16.3	9.4	0.6	
Approach LOS	C	A		

Intersection Summary				
Average Delay	3.3			
Intersection Capacity Utilization	31.1%	ICU Level of Service	A	
Analysis Period (min)	15			

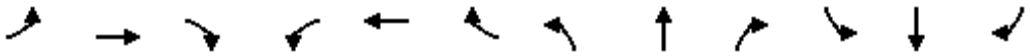


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	18	27	0	0	146	129	48	172	146	67	0	206
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0		5.0	5.0		4.0		4.0
Lane Util. Factor	1.00	0.95			0.95		0.91	0.91		1.00		0.88
Frpb, ped/bikes	1.00	1.00			0.99		1.00	1.00		1.00		1.00
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00		1.00		1.00
Frt	1.00	1.00			0.93		1.00	0.93		1.00		0.85
Flt Protected	0.95	1.00			1.00		0.95	1.00		0.95		1.00
Satd. Flow (prot)	1624	3471			3079		1441	2982		1543		2682
Flt Permitted	0.95	1.00			1.00		0.95	1.00		0.95		1.00
Satd. Flow (perm)	1624	3471			3079		1441	2982		1543		2682
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Adj. Flow (vph)	21	31	0	0	168	148	55	198	168	77	0	237
RTOR Reduction (vph)	0	0	0	0	125	0	0	110	0	0	0	219
Lane Group Flow (vph)	21	31	0	0	191	0	49	262	0	77	0	18
Confl. Peds. (#/hr)	6					6						
Confl. Bikes (#/hr)			6			3						
Heavy Vehicles (%)	0%	4%	0%	0%	9%	7%	14%	7%	9%	17%	0%	6%
Parking (#/hr)	0											
Turn Type	Split	NA			NA		Split	NA		Prot		custom
Protected Phases	4	4			8		2	2		6		6
Permitted Phases												
Actuated Green, G (s)	3.6	3.6			8.4		18.4	18.4		4.1		4.1
Effective Green, g (s)	3.6	3.6			8.4		18.4	18.4		4.1		4.1
Actuated g/C Ratio	0.07	0.07			0.16		0.34	0.34		0.08		0.08
Clearance Time (s)	5.0	5.0			5.0		5.0	5.0		4.0		4.0
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0		3.0
Lane Grp Cap (vph)	109	233			483		495	1025		118		205
v/s Ratio Prot	c0.01	0.01			c0.06		0.03	c0.09		c0.05		0.01
v/s Ratio Perm												
v/c Ratio	0.19	0.13			0.40		0.10	0.26		0.65		0.09
Uniform Delay, d1	23.6	23.5			20.3		11.9	12.6		24.0		23.0
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00		1.00
Incremental Delay, d2	0.9	0.3			0.5		0.4	0.6		12.2		0.2
Delay (s)	24.4	23.7			20.8		12.3	13.2		36.2		23.2
Level of Service	C	C			C		B	B		D		C
Approach Delay (s)		24.0			20.8			13.1			26.4	
Approach LOS		C			C			B			C	

Intersection Summary			
HCM 2000 Control Delay	19.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.33		
Actuated Cycle Length (s)	53.5	Sum of lost time (s)	19.0
Intersection Capacity Utilization	38.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	11	31	1	16	31	47	0	9	26	38	13	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0		5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.99		1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00		1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.89		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		1.00		0.95	1.00	
Satd. Flow (prot)	1805	3610	793	1357	3471	1328		2621		1703	2356	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		1.00		0.95	1.00	
Satd. Flow (perm)	1805	3610	793	1357	3471	1328		2621		1703	2356	
Peak-hour factor, PHF	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Adj. Flow (vph)	13	38	1	20	38	57	0	11	32	46	16	1
RTOR Reduction (vph)	0	0	1	0	0	36	0	24	0	0	1	0
Lane Group Flow (vph)	13	38	0	20	38	21	0	19	0	46	16	0
Confl. Peds. (#/hr)			4	4								
Confl. Bikes (#/hr)			4			2						3
Heavy Vehicles (%)	0%	0%	100%	33%	4%	20%	0%	38%	17%	6%	55%	0%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8						
Actuated Green, G (s)	10.0	39.0	39.0	15.0	44.0	44.0		30.0		16.0	42.0	
Effective Green, g (s)	10.0	39.0	39.0	15.0	44.0	44.0		30.0		16.0	42.0	
Actuated g/C Ratio	0.08	0.32	0.32	0.12	0.37	0.37		0.25		0.13	0.35	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0		5.0		5.0	5.0	
Lane Grp Cap (vph)	150	1173	257	169	1272	486		655		227	824	
v/s Ratio Prot	0.01	0.01		c0.01	0.01			c0.01		c0.03	0.01	
v/s Ratio Perm			0.00			c0.02						
v/c Ratio	0.09	0.03	0.00	0.12	0.03	0.04		0.03		0.20	0.02	
Uniform Delay, d1	50.8	27.6	27.3	46.6	24.3	24.5		34.0		46.3	25.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2	1.1	0.1	0.0	1.4	0.0	0.2		0.1		2.0	0.0	
Delay (s)	51.9	27.7	27.4	48.1	24.4	24.6		34.1		48.3	25.6	
Level of Service	D	C	C	D	C	C		C		D	C	
Approach Delay (s)		33.7			28.6			34.1			42.2	
Approach LOS		C			C			C			D	

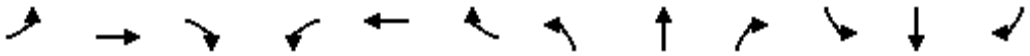
Intersection Summary			
HCM 2000 Control Delay	33.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.07		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	51.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	33	429	24	58	577	61	45	125	45	77	165	90
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0			5.0			5.0	
Lane Util. Factor		0.91			0.91			0.95			0.95	
Frpb, ped/bikes		1.00			1.00			1.00			0.99	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		0.99			0.99			0.97			0.96	
Flt Protected		1.00			1.00			0.99			0.99	
Satd. Flow (prot)		4950			4961			3443			3319	
Flt Permitted		0.86			0.85			0.85			0.84	
Satd. Flow (perm)		4278			4250			2952			2819	
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	33	433	24	59	583	62	45	126	45	78	167	91
RTOR Reduction (vph)	0	9	0	0	18	0	0	21	0	0	37	0
Lane Group Flow (vph)	0	481	0	0	686	0	0	195	0	0	299	0
Confl. Peds. (#/hr)	6		3	3		6	6		5	5		6
Confl. Bikes (#/hr)			15			13			14			11
Heavy Vehicles (%)	0%	4%	0%	0%	3%	0%	0%	0%	0%	2%	4%	0%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		18.7			18.7			33.6			33.6	
Effective Green, g (s)		18.7			18.7			33.6			33.6	
Actuated g/C Ratio		0.30			0.30			0.54			0.54	
Clearance Time (s)		5.0			5.0			5.0			5.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		1284			1275			1592			1520	
v/s Ratio Prot												
v/s Ratio Perm		0.11			c0.16			0.07			c0.11	
v/c Ratio		0.37			0.54			0.12			0.20	
Uniform Delay, d1		17.2			18.2			7.1			7.4	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		0.2			0.4			0.2			0.3	
Delay (s)		17.4			18.6			7.2			7.7	
Level of Service		B			B			A			A	
Approach Delay (s)		17.4			18.6			7.2			7.7	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	14.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.32		
Actuated Cycle Length (s)	62.3	Sum of lost time (s)	10.0
Intersection Capacity Utilization	81.9%	ICU Level of Service	D
Analysis Period (min)	15		

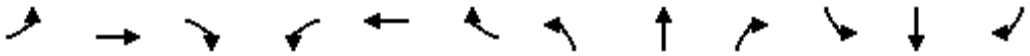
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	164	9	4	424	0	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	0	0	0	0	189	10	5	487	0	0	0	0
Pedestrians		3			3						2	
Lane Width (ft)		0.0			12.0						0.0	
Walking Speed (ft/s)		4.0			4.0						4.0	
Percent Blockage		0			0						0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								536				
pX, platoon unblocked												
vC, conflicting volume	362	503	3	500	503	249	3			490		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	362	503	3	500	503	249	3			490		
tC, single (s)	7.5	6.5	6.9	7.6	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	60	99	100			100		
cM capacity (veh/h)	388	472	1086	444	472	756	1632			1081		

Direction, Lane #	WB 1	WB 2	NB 1	NB 2
Volume Total	126	73	167	325
Volume Left	0	0	5	0
Volume Right	0	10	0	0
cSH	472	498	1632	1700
Volume to Capacity	0.27	0.15	0.00	0.19
Queue Length 95th (ft)	27	13	0	0
Control Delay (s)	15.4	13.5	0.2	0.0
Lane LOS	C	B	A	
Approach Delay (s)	14.7		0.1	
Approach LOS	B			

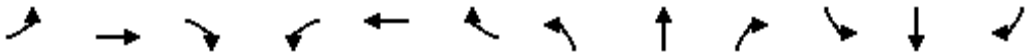
Intersection Summary				
Average Delay	4.3			
Intersection Capacity Utilization	27.0%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	152	232	0	0	554	82	82	269	100	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0			5.0				
Lane Util. Factor		0.91			0.91			0.95				
Frpb, ped/bikes		1.00			1.00			0.99				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		1.00			0.98			0.97				
Flt Protected		0.98			1.00			0.99				
Satd. Flow (prot)		4824			4978			3393				
Flt Permitted		0.66			1.00			0.99				
Satd. Flow (perm)		3245			4978			3393				
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	162	247	0	0	589	87	87	286	106	0	0	0
RTOR Reduction (vph)	0	0	0	0	17	0	0	24	0	0	0	0
Lane Group Flow (vph)	0	409	0	0	659	0	0	455	0	0	0	0
Confl. Peds. (#/hr)	1					1			8			
Confl. Bikes (#/hr)			2			2			27			
Heavy Vehicles (%)	3%	7%	4%	2%	2%	2%	2%	1%	1%	2%	5%	3%
Turn Type	Perm	NA			NA		Perm	NA				
Protected Phases		2			6			8				
Permitted Phases	2						8					
Actuated Green, G (s)		46.0			46.0			54.0				
Effective Green, g (s)		46.0			46.0			54.0				
Actuated g/C Ratio		0.42			0.42			0.49				
Clearance Time (s)		5.0			5.0			5.0				
Vehicle Extension (s)		3.0			3.0			3.0				
Lane Grp Cap (vph)		1357			2081			1665				
v/s Ratio Prot					c0.13							
v/s Ratio Perm		0.13						0.13				
v/c Ratio		0.30			0.32			0.27				
Uniform Delay, d1		21.3			21.5			16.5				
Progression Factor		0.82			1.00			1.00				
Incremental Delay, d2		0.6			0.1			0.1				
Delay (s)		18.0			21.5			16.6				
Level of Service		B			C			B				
Approach Delay (s)		18.0			21.5			16.6			0.0	
Approach LOS		B			C			B			A	

Intersection Summary			
HCM 2000 Control Delay	19.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.29		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	49.7%	ICU Level of Service	A
Analysis Period (min)	15		

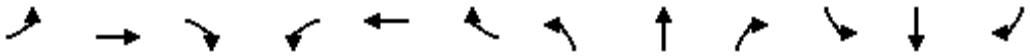
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	76	0	0	1	0	4	340	27	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	84	0	0	1	0	4	378	30	0	0	0
Pedestrians		9			13							
Lane Width (ft)		12.0			12.0							
Walking Speed (ft/s)		4.0			4.0							
Percent Blockage		1			1							
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											608	
pX, platoon unblocked												
vC, conflicting volume	207	439	9	457	424	217	9			421		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	207	439	9	457	424	217	9			421		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	83	100	100	100	100	100			100		
cM capacity (veh/h)	714	504	1069	417	514	785	1612			1137		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	84	1	193	219
Volume Left	0	0	4	0
Volume Right	0	0	0	30
cSH	504	514	1612	1700
Volume to Capacity	0.17	0.00	0.00	0.13
Queue Length 95th (ft)	15	0	0	0
Control Delay (s)	13.6	12.0	0.2	0.0
Lane LOS	B	B	A	
Approach Delay (s)	13.6	12.0	0.1	
Approach LOS	B	B		

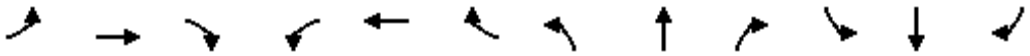
Intersection Summary				
Average Delay	2.4			
Intersection Capacity Utilization	22.1%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	145	0	21	0	0	0	25	552	1	0	108	104
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0				5.0	5.0			5.0	
Lane Util. Factor		1.00	1.00				1.00	0.95			0.95	
Frpb, ped/bikes		1.00	0.96				1.00	1.00			0.97	
Flpb, ped/bikes		0.98	1.00				0.98	1.00			1.00	
Frt		1.00	0.85				1.00	1.00			0.93	
Flt Protected		0.95	1.00				0.95	1.00			1.00	
Satd. Flow (prot)		1739	1164				1181	2735			2599	
Flt Permitted		0.76	1.00				0.61	1.00			1.00	
Satd. Flow (perm)		1386	1164				758	2735			2599	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.92
Adj. Flow (vph)	154	0	22	0	0	0	27	587	1	0	115	113
RTOR Reduction (vph)	0	0	13	0	0	0	0	0	0	0	63	0
Lane Group Flow (vph)	0	154	9	0	0	0	27	588	0	0	165	0
Confl. Peds. (#/hr)	20		20	20		20	20		20	20		20
Confl. Bikes (#/hr)			20			20			20			20
Heavy Vehicles (%)	2%	0%	33%	0%	0%	0%	50%	32%	0%	0%	49%	0%
Turn Type	Perm	NA	Perm	Perm			Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2			6		
Actuated Green, G (s)		29.0	29.0				31.0	31.0			31.0	
Effective Green, g (s)		29.0	29.0				31.0	31.0			31.0	
Actuated g/C Ratio		0.41	0.41				0.44	0.44			0.44	
Clearance Time (s)		5.0	5.0				5.0	5.0			5.0	
Lane Grp Cap (vph)		574	482				335	1211			1150	
v/s Ratio Prot								c0.21			0.06	
v/s Ratio Perm		c0.11	0.01				0.04					
v/c Ratio		0.27	0.02				0.08	0.49			0.14	
Uniform Delay, d1		13.5	12.1				11.3	13.8			11.6	
Progression Factor		1.00	1.00				1.00	1.00			1.00	
Incremental Delay, d2		1.1	0.1				0.5	1.4			0.3	
Delay (s)		14.7	12.2				11.7	15.2			11.9	
Level of Service		B	B				B	B			B	
Approach Delay (s)		14.3			0.0			15.1			11.9	
Approach LOS		B			A			B			B	

Intersection Summary			
HCM 2000 Control Delay	14.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.38		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	51.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group



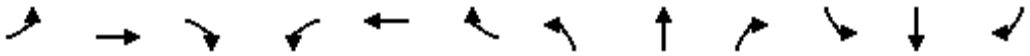
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	6	300	112	121	686	40	321	64	240	68	26	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.96	1.00	1.00		1.00	1.00	0.97	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	0.90	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.97	1.00	0.95	1.00	
Satd. Flow (prot)	1504	3505	1435	1433	3359		1618	1356	1265	1517	1398	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.97	1.00	0.95	1.00	
Satd. Flow (perm)	1504	3505	1435	1433	3359		1618	1356	1265	1517	1398	
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)	6	316	118	127	722	42	338	67	253	72	27	58
RTOR Reduction (vph)	0	0	94	0	3	0	0	0	197	0	46	0
Lane Group Flow (vph)	6	316	24	127	761	0	199	206	56	72	39	0
Confl. Peds. (#/hr)			20						20			
Heavy Vehicles (%)	20%	3%	8%	26%	3%	68%	6%	76%	24%	19%	50%	9%
Turn Type	Prot	NA	Perm	Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		6	6		2	2	
Permitted Phases			4						6			
Actuated Green, G (s)	1.1	18.5	18.5	12.9	30.3		19.8	19.8	19.8	18.6	18.6	
Effective Green, g (s)	1.1	18.5	18.5	12.9	30.3		19.8	19.8	19.8	18.6	18.6	
Actuated g/C Ratio	0.01	0.21	0.21	0.14	0.34		0.22	0.22	0.22	0.21	0.21	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	18	722	295	205	1133		356	298	278	314	289	
v/s Ratio Prot	0.00	0.09		c0.09	c0.23		0.12	c0.15		c0.05	0.03	
v/s Ratio Perm			0.02						0.04			
v/c Ratio	0.33	0.44	0.08	0.62	0.67		0.56	0.69	0.20	0.23	0.13	
Uniform Delay, d1	44.0	31.1	28.8	36.1	25.5		31.1	32.2	28.5	29.6	29.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	10.6	0.4	0.1	5.5	1.6		1.9	6.8	0.4	1.7	1.0	
Delay (s)	54.6	31.5	28.9	41.6	27.1		33.0	38.9	28.9	31.3	30.0	
Level of Service	D	C	C	D	C		C	D	C	C	C	
Approach Delay (s)		31.1			29.1			33.3			30.6	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	30.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	89.8	Sum of lost time (s)	20.0
Intersection Capacity Utilization	57.5%	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												
Volume (vph)	121	402	91	183	697	214	103	177	371	134	77	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	1.00	0.85	1.00	0.90		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1433	3230		1626	3438	1495	1444	2823		1612	2744	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1433	3230		1626	3438	1495	1444	2823		1612	2744	
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)	125	414	94	189	719	221	106	182	382	138	79	28
RTOR Reduction (vph)	0	20	0	0	0	182	0	322	0	0	24	0
Lane Group Flow (vph)	125	488	0	189	719	39	106	242	0	138	83	0
Confl. Peds. (#/hr)			1	1								
Confl. Bikes (#/hr)			3									
Heavy Vehicles (%)	26%	8%	10%	11%	5%	8%	25%	23%	11%	12%	18%	50%
Turn Type	Split	NA		Split	NA	Perm	Split	NA		Split	NA	
Protected Phases	4	4		8	8		2	2		6	6	
Permitted Phases						8						
Actuated Green, G (s)	29.0	29.0		17.0	17.0	17.0	15.0	15.0		15.0	15.0	
Effective Green, g (s)	29.0	29.0		17.0	17.0	17.0	15.0	15.0		15.0	15.0	
Actuated g/C Ratio	0.30	0.30		0.18	0.18	0.18	0.16	0.16		0.16	0.16	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	432	975		287	608	264	225	441		251	428	
v/s Ratio Prot	0.09	c0.15		0.12	c0.21		0.07	c0.09		c0.09	0.03	
v/s Ratio Perm						0.03						
v/c Ratio	0.29	0.50		0.66	1.18	0.15	0.47	0.55		0.55	0.19	
Uniform Delay, d1	25.6	27.5		36.8	39.5	33.4	36.9	37.4		37.4	35.2	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.7	1.8		11.3	98.2	1.2	6.9	4.8		8.4	1.0	
Delay (s)	27.3	29.4		48.1	137.7	34.6	43.8	42.2		45.8	36.3	
Level of Service	C	C		D	F	C	D	D		D	D	
Approach Delay (s)		29.0			102.5			42.5			41.6	
Approach LOS		C			F			D			D	

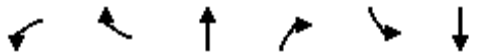
Intersection Summary			
HCM 2000 Control Delay	64.5	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	96.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	75.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	87	808	51	23	879	13	41	0	17	3	5	197
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	94	869	55	25	945	14	44	0	18	3	5	212
Pedestrians								2			2	
Lane Width (ft)								12.0			12.0	
Walking Speed (ft/s)								4.0			4.0	
Percent Blockage								0			0	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		1120			405							
pX, platoon unblocked	0.88						0.88	0.88		0.88	0.88	0.88
vC, conflicting volume	961			926			1822	2096	464	1643	2116	482
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	693			926			1667	1977	464	1465	2000	151
tC, single (s)	4.9			4.1			7.9	6.5	7.1	7.5	6.5	7.1
tC, 2 stage (s)												
tF (s)	2.6			2.2			3.7	4.0	3.4	3.5	4.0	3.4
p0 queue free %	85			97			0	100	97	95	88	71
cM capacity (veh/h)	604			745			26	45	528	67	44	742

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total	528	489	497	487	62	220
Volume Left	94	0	25	0	44	3
Volume Right	0	55	0	14	18	212
cSH	604	1700	745	1700	36	482
Volume to Capacity	0.15	0.29	0.03	0.29	1.73	0.46
Queue Length 95th (ft)	14	0	3	0	169	59
Control Delay (s)	4.2	0.0	0.9	0.0	592.8	18.6
Lane LOS	A		A		F	C
Approach Delay (s)	2.2		0.5		592.8	18.6
Approach LOS					F	C

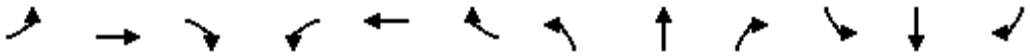
Intersection Summary				
Average Delay	19.2			
Intersection Capacity Utilization	81.2%	ICU Level of Service	D	
Analysis Period (min)	15			



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	192	0	0	0	0	622
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	198	0	0	0	0	641
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			444			
pX, platoon unblocked						
vC, conflicting volume	321	0			0	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	321	0			0	
tC, single (s)	6.9	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	69	100			100	
cM capacity (veh/h)	642	1091			1636	

Direction, Lane #	WB 1	WB 2	SB 1	SB 2
Volume Total	99	99	321	321
Volume Left	99	99	0	0
Volume Right	0	0	0	0
cSH	642	642	1700	1700
Volume to Capacity	0.15	0.15	0.19	0.19
Queue Length 95th (ft)	14	14	0	0
Control Delay (s)	11.6	11.6	0.0	0.0
Lane LOS	B	B		
Approach Delay (s)	11.6		0.0	
Approach LOS	B			

Intersection Summary			
Average Delay	2.7		
Intersection Capacity Utilization	34.4%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	608	91	122	613	0	0	0	0	142	474	187
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0		5.0	5.0						5.0	
Lane Util. Factor		0.91		1.00	0.95						0.95	
Frpb, ped/bikes		1.00		1.00	1.00						0.99	
Flpb, ped/bikes		1.00		1.00	1.00						1.00	
Frt		0.98		1.00	1.00						0.97	
Flt Protected		1.00		0.95	1.00						0.99	
Satd. Flow (prot)		4815		1770	3471						3371	
Flt Permitted		1.00		0.33	1.00						0.99	
Satd. Flow (perm)		4815		607	3471						3371	
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)	0	633	95	127	639	0	0	0	0	148	494	195
RTOR Reduction (vph)	0	18	0	0	0	0	0	0	0	0	26	0
Lane Group Flow (vph)	0	710	0	127	639	0	0	0	0	0	811	0
Confl. Peds. (#/hr)										7		3
Confl. Bikes (#/hr)						1						36
Heavy Vehicles (%)	6%	6%	3%	2%	4%	1%	3%	4%	1%	4%	1%	1%
Turn Type		NA		Perm	NA					Perm	NA	
Protected Phases		2			6						4	
Permitted Phases				6						4		
Actuated Green, G (s)		51.0		51.0	51.0						49.0	
Effective Green, g (s)		51.0		51.0	51.0						49.0	
Actuated g/C Ratio		0.46		0.46	0.46						0.45	
Clearance Time (s)		5.0		5.0	5.0						5.0	
Vehicle Extension (s)		3.0		3.0	3.0						3.0	
Lane Grp Cap (vph)		2232		281	1609						1501	
v/s Ratio Prot		0.15			0.18							
v/s Ratio Perm				c0.21							0.24	
v/c Ratio		0.32		0.45	0.40						0.54	
Uniform Delay, d1		18.6		20.0	19.4						22.3	
Progression Factor		1.00		0.49	0.44						1.00	
Incremental Delay, d2		0.4		4.9	0.7						1.4	
Delay (s)		18.9		14.8	9.2						23.7	
Level of Service		B		B	A						C	
Approach Delay (s)		18.9			10.1			0.0			23.7	
Approach LOS		B			B			A			C	

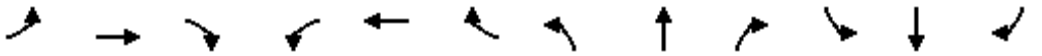
Intersection Summary			
HCM 2000 Control Delay	17.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	60.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	83	9	5	1	0	0	0	0	8	538	3
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	0	89	10	5	1	0	0	0	0	9	578	3
Pedestrians		3						1				
Lane Width (ft)		12.0						0.0				
Walking Speed (ft/s)		4.0						4.0				
Percent Blockage		0						0				
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											655	
pX, platoon unblocked												
vC, conflicting volume	601	600	295	362	602	0	585			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	601	600	295	362	602	0	585			0		
tC, single (s)	7.7	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	78	99	99	100	100	100			99		
cM capacity (veh/h)	368	414	706	470	413	1091	997			1636		

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	99	6	298	292
Volume Left	0	5	9	0
Volume Right	10	0	0	3
cSH	431	459	1636	1700
Volume to Capacity	0.23	0.01	0.01	0.17
Queue Length 95th (ft)	22	1	0	0
Control Delay (s)	15.8	13.0	0.3	0.0
Lane LOS	C	B	A	
Approach Delay (s)	15.8	13.0	0.1	
Approach LOS	C	B		

Intersection Summary				
Average Delay	2.5			
Intersection Capacity Utilization	27.1%	ICU Level of Service	A	
Analysis Period (min)	15			



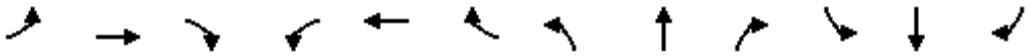
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	143	100	0	0	112	134	107	317	95	93	0	206
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0		5.0	5.0		5.0		5.0
Lane Util. Factor	1.00	0.95			0.95		0.91	0.91		1.00		0.88
Frpb, ped/bikes	1.00	1.00			0.99		1.00	1.00		1.00		1.00
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00		1.00		1.00
Frt	1.00	1.00			0.92		1.00	0.97		1.00		0.85
Flt Protected	0.95	1.00			1.00		0.95	1.00		0.95		1.00
Satd. Flow (prot)	1160	3195			2744		1014	2883		1570		2349
Flt Permitted	0.95	1.00			1.00		0.95	1.00		0.95		1.00
Satd. Flow (perm)	1160	3195			2744		1014	2883		1570		2349
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	159	111	0	0	124	149	119	352	106	103	0	229
RTOR Reduction (vph)	0	0	0	0	131	0	0	21	0	0	0	197
Lane Group Flow (vph)	159	111	0	0	142	0	107	449	0	103	0	32
Confl. Peds. (#/hr)							4					4
Confl. Bikes (#/hr)			6			3						
Heavy Vehicles (%)	40%	13%	0%	0%	18%	21%	62%	15%	13%	15%	0%	21%
Parking (#/hr)	0											
Turn Type	Split	NA			NA		Split	NA		Prot		custom
Protected Phases	4	4			8		2	2		6		6
Permitted Phases												
Actuated Green, G (s)	15.8	15.8			8.9		17.2	17.2		10.1		10.1
Effective Green, g (s)	15.8	15.8			8.9		17.2	17.2		10.1		10.1
Actuated g/C Ratio	0.22	0.22			0.12		0.24	0.24		0.14		0.14
Clearance Time (s)	5.0	5.0			5.0		5.0	5.0		5.0		5.0
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0		3.0
Lane Grp Cap (vph)	254	701			339		242	688		220		329
v/s Ratio Prot	c0.14	0.03			c0.05		0.11	c0.16		c0.07		0.01
v/s Ratio Perm												
v/c Ratio	0.63	0.16			0.42		0.44	0.65		0.47		0.10
Uniform Delay, d1	25.4	22.7			29.2		23.3	24.7		28.5		27.0
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00		1.00
Incremental Delay, d2	4.8	0.1			0.8		5.8	4.8		1.6		0.1
Delay (s)	30.2	22.8			30.0		29.1	29.5		30.1		27.1
Level of Service	C	C			C		C	C		C		C
Approach Delay (s)		27.2			30.0			29.4			28.0	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	28.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	72.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	47.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	171	198	36	28	60	86	6	229	157	210	128	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1245	2375	832	1107	2201	1062	1003	1970		1203	1870	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1245	2375	832	1107	2201	1062	1003	1970		1203	1870	
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	188	218	40	31	66	95	7	252	173	231	141	0
RTOR Reduction (vph)	0	0	27	0	0	83	0	102	0	0	0	0
Lane Group Flow (vph)	188	218	13	31	66	12	7	323	0	231	141	0
Confl. Bikes (#/hr)						1						
Heavy Vehicles (%)	45%	52%	94%	63%	64%	50%	80%	79%	62%	50%	93%	0%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8						
Actuated Green, G (s)	39.0	39.0	39.0	15.0	15.0	15.0	29.0	29.0		17.0	17.0	
Effective Green, g (s)	39.0	39.0	39.0	15.0	15.0	15.0	29.0	29.0		17.0	17.0	
Actuated g/C Ratio	0.32	0.32	0.32	0.12	0.12	0.12	0.24	0.24		0.14	0.14	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	404	771	270	138	275	132	242	476		170	264	
v/s Ratio Prot	c0.15	c0.09		0.03	0.03		0.01	c0.16		c0.19	0.08	
v/s Ratio Perm			0.02			0.01						
v/c Ratio	0.47	0.28	0.05	0.22	0.24	0.09	0.03	0.68		1.36	0.53	
Uniform Delay, d1	32.2	30.1	27.8	47.3	47.4	46.5	34.7	41.3		51.5	47.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	3.8	0.9	0.3	3.7	2.1	1.3	0.2	7.6		194.7	7.5	
Delay (s)	36.0	31.0	28.1	51.0	49.4	47.8	35.0	48.9		246.2	55.4	
Level of Service	D	C	C	D	D	D	C	D		F	E	
Approach Delay (s)		32.9			48.9			48.7			173.9	
Approach LOS		C			D			D			F	

Intersection Summary			
HCM 2000 Control Delay	76.1	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	52.5%	ICU Level of Service	A
Analysis Period (min)	15		

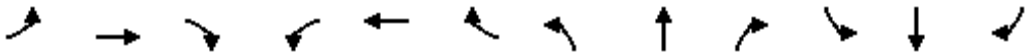
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	73	633	55	76	745	64	37	251	69	79	232	91
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0			5.0			5.0	
Lane Util. Factor		0.91			0.91			0.95			0.95	
Frpb, ped/bikes		1.00			1.00			1.00			0.99	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		0.99			0.99			0.97			0.97	
Flt Protected		1.00			1.00			0.99			0.99	
Satd. Flow (prot)		4858			4993			3362			3285	
Flt Permitted		0.75			0.79			0.88			0.81	
Satd. Flow (perm)		3682			3945			2985			2686	
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)	77	666	58	80	784	67	39	264	73	83	244	96
RTOR Reduction (vph)	0	13	0	0	13	0	0	23	0	0	29	0
Lane Group Flow (vph)	0	788	0	0	918	0	0	353	0	0	394	0
Confl. Peds. (#/hr)	20		12	12		20	17		11	11		17
Confl. Bikes (#/hr)			10			8			12			9
Heavy Vehicles (%)	2%	5%	7%	2%	2%	2%	2%	3%	4%	2%	3%	9%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		24.1			24.1			33.3			33.3	
Effective Green, g (s)		24.1			24.1			33.3			33.3	
Actuated g/C Ratio		0.36			0.36			0.49			0.49	
Clearance Time (s)		5.0			5.0			5.0			5.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		1316			1410			1474			1327	
v/s Ratio Prot												
v/s Ratio Perm		0.21			c0.23			0.12			c0.15	
v/c Ratio		0.60			0.65			0.24			0.30	
Uniform Delay, d1		17.7			18.1			9.8			10.1	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		0.7			1.1			0.4			0.6	
Delay (s)		18.4			19.2			10.2			10.7	
Level of Service		B			B			B			B	
Approach Delay (s)		18.4			19.2			10.2			10.7	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM 2000 Control Delay	16.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	67.4	Sum of lost time (s)	10.0
Intersection Capacity Utilization	94.4%	ICU Level of Service	F
Analysis Period (min)	15		

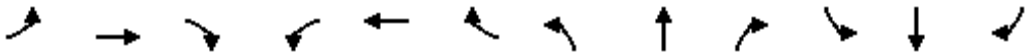
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	187	12	5	768	0	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	0	0	0	0	193	12	5	792	0	0	0	0
Pedestrians		16			1						3	
Lane Width (ft)		0.0			12.0						0.0	
Walking Speed (ft/s)		4.0			4.0						4.0	
Percent Blockage		0			0						0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								536				
pX, platoon unblocked												
vC, conflicting volume	534	819	16	803	819	400	16			793		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	534	819	16	803	819	400	16			793		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	38	98	100			100		
cM capacity (veh/h)	214	311	1066	277	311	605	1615			836		

Direction, Lane #	WB 1	WB 2	NB 1	NB 2
Volume Total	129	77	269	528
Volume Left	0	0	5	0
Volume Right	0	12	0	0
cSH	311	338	1615	1700
Volume to Capacity	0.41	0.23	0.00	0.31
Queue Length 95th (ft)	49	21	0	0
Control Delay (s)	24.5	18.8	0.2	0.0
Lane LOS	C	C	A	
Approach Delay (s)	22.3		0.1	
Approach LOS	C			

Intersection Summary				
Average Delay	4.6			
Intersection Capacity Utilization	34.4%	ICU Level of Service	A	
Analysis Period (min)	15			

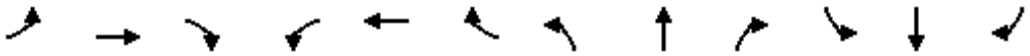


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	325	424	0	0	618	131	115	521	142	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0			5.0				
Lane Util. Factor		0.91			0.91			0.95				
Frpb, ped/bikes		1.00			1.00			0.99				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		1.00			0.97			0.97				
Flt Protected		0.98			1.00			0.99				
Satd. Flow (prot)		4788			4870			3350				
Flt Permitted		0.66			1.00			0.99				
Satd. Flow (perm)		3217			4870			3350				
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)	339	442	0	0	644	136	120	543	148	0	0	0
RTOR Reduction (vph)	0	0	0	0	30	0	0	17	0	0	0	0
Lane Group Flow (vph)	0	781	0	0	751	0	0	794	0	0	0	0
Confl. Peds. (#/hr)	2					2			4	4		
Confl. Bikes (#/hr)			1						44			
Heavy Vehicles (%)	6%	6%	3%	2%	4%	1%	3%	4%	1%	4%	1%	1%
Turn Type	Perm	NA			NA		Perm	NA				
Protected Phases		2			6			8				
Permitted Phases	2						8					
Actuated Green, G (s)		51.0			51.0			49.0				
Effective Green, g (s)		51.0			51.0			49.0				
Actuated g/C Ratio		0.46			0.46			0.45				
Clearance Time (s)		5.0			5.0			5.0				
Vehicle Extension (s)		3.0			3.0			3.0				
Lane Grp Cap (vph)		1491			2257			1492				
v/s Ratio Prot					0.15							
v/s Ratio Perm		c0.24						0.24				
v/c Ratio		1.35dl			0.33			0.53				
Uniform Delay, d1		20.9			18.7			22.2				
Progression Factor		0.54			1.00			1.00				
Incremental Delay, d2		1.3			0.4			0.4				
Delay (s)		12.5			19.1			22.5				
Level of Service		B			B			C				
Approach Delay (s)		12.5			19.1			22.5			0.0	
Approach LOS		B			B			C			A	

Intersection Summary			
HCM 2000 Control Delay	18.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	78.9%	ICU Level of Service	D
Analysis Period (min)	15		

dl Defacto Left Lane. Recode with 1 though lane as a left lane.

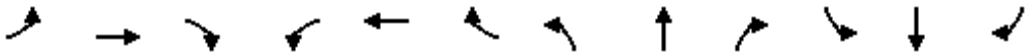
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	83	0	0	0	1	5	6	690	3	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	89	0	0	0	1	5	6	742	3	0	0	0
Pedestrians		12			1						1	
Lane Width (ft)		12.0			12.0						0.0	
Walking Speed (ft/s)		4.0			4.0						4.0	
Percent Blockage		1			0						0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											608	
pX, platoon unblocked												
vC, conflicting volume	403	771	12	757	769	375	12			746		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	403	771	12	757	769	375	12			746		
tC, single (s)	7.7	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	82	100	100	100	100	99	100			100		
cM capacity (veh/h)	501	328	1061	296	329	628	1604			870		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	89	6	377	374
Volume Left	89	0	6	0
Volume Right	0	5	0	3
cSH	501	545	1604	1700
Volume to Capacity	0.18	0.01	0.00	0.22
Queue Length 95th (ft)	16	1	0	0
Control Delay (s)	13.7	11.7	0.2	0.0
Lane LOS	B	B	A	
Approach Delay (s)	13.7	11.7	0.1	
Approach LOS	B	B		

Intersection Summary				
Average Delay	1.6			
Intersection Capacity Utilization	37.3%	ICU Level of Service	A	
Analysis Period (min)	15			

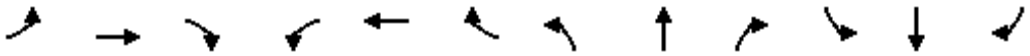


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	243	0	49	0	0	0	43	138	0	0	69	197
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0				5.0	5.0			5.0	
Lane Util. Factor		1.00	1.00				1.00	0.95			0.95	
Frpb, ped/bikes		1.00	0.96				1.00	1.00			0.95	
Flpb, ped/bikes		0.98	1.00				0.98	1.00			1.00	
Frt		1.00	0.85				1.00	1.00			0.89	
Flt Protected		0.95	1.00				0.95	1.00			1.00	
Satd. Flow (prot)		1773	1549				1517	3471			2963	
Flt Permitted		0.76	1.00				0.57	1.00			1.00	
Satd. Flow (perm)		1414	1549				907	3471			2963	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	276	0	56	0	0	0	49	157	0	0	78	224
RTOR Reduction (vph)	0	0	32	0	0	0	0	0	0	0	128	0
Lane Group Flow (vph)	0	276	24	0	0	0	49	157	0	0	174	0
Confl. Peds. (#/hr)	20		20	20		20	20		20	20		20
Confl. Bikes (#/hr)			20			20			20			20
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	17%	4%	0%	0%	13%	0%
Turn Type	Perm	NA	Perm	Perm			Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2			6		
Actuated Green, G (s)		30.0	30.0				30.0	30.0			30.0	
Effective Green, g (s)		30.0	30.0				30.0	30.0			30.0	
Actuated g/C Ratio		0.43	0.43				0.43	0.43			0.43	
Clearance Time (s)		5.0	5.0				5.0	5.0			5.0	
Lane Grp Cap (vph)		606	663				388	1487			1269	
v/s Ratio Prot								0.05			c0.06	
v/s Ratio Perm		c0.20	0.02				0.05					
v/c Ratio		0.46	0.04				0.13	0.11			0.14	
Uniform Delay, d1		14.2	11.6				12.1	12.0			12.1	
Progression Factor		1.00	1.00				1.00	1.00			1.00	
Incremental Delay, d2		2.5	0.1				0.7	0.1			0.2	
Delay (s)		16.7	11.7				12.8	12.1			12.4	
Level of Service		B	B				B	B			B	
Approach Delay (s)		15.8			0.0			12.3			12.4	
Approach LOS		B			A			B			B	

Intersection Summary			
HCM 2000 Control Delay	13.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	59.3%	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												
Volume (vph)	32	211	83	164	618	26	99	15	230	44	14	22
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.96	1.00	1.00		1.00	1.00	0.97	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	0.91	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.96	1.00	0.95	1.00	
Satd. Flow (prot)	1357	3471	1468	1687	3410		1649	1502	1449	1433	1343	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.96	1.00	0.95	1.00	
Satd. Flow (perm)	1357	3471	1468	1687	3410		1649	1502	1449	1433	1343	
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)	35	229	90	178	672	28	108	16	250	48	15	24
RTOR Reduction (vph)	0	0	69	0	2	0	0	0	149	0	22	0
Lane Group Flow (vph)	35	229	21	178	698	0	62	62	101	48	17	0
Confl. Peds. (#/hr)			20						20			
Heavy Vehicles (%)	33%	4%	6%	7%	4%	35%	4%	50%	8%	26%	45%	18%
Turn Type	Prot	NA	Perm	Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		6	6		2	2	
Permitted Phases			4						6			
Actuated Green, G (s)	4.6	23.8	23.8	8.3	27.5		40.4	40.4	40.4	7.3	7.3	
Effective Green, g (s)	4.6	23.8	23.8	8.3	27.5		40.4	40.4	40.4	7.3	7.3	
Actuated g/C Ratio	0.05	0.24	0.24	0.08	0.28		0.40	0.40	0.40	0.07	0.07	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	62	827	350	140	939		667	608	586	104	98	
v/s Ratio Prot	0.03	0.07		c0.11	c0.20		0.04	0.04		c0.03	0.01	
v/s Ratio Perm			0.01						c0.07			
v/c Ratio	0.56	0.28	0.06	1.27	0.74		0.09	0.10	0.17	0.46	0.17	
Uniform Delay, d1	46.6	31.0	29.4	45.8	32.9		18.4	18.4	19.0	44.4	43.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	11.2	0.2	0.1	166.4	3.2		0.3	0.3	0.6	3.2	0.8	
Delay (s)	57.9	31.2	29.4	212.1	36.1		18.6	18.8	19.6	47.6	44.2	
Level of Service	E	C	C	F	D		B	B	B	D	D	
Approach Delay (s)		33.4			71.8			19.3			46.1	
Approach LOS		C			E			B			D	

Intersection Summary			
HCM 2000 Control Delay	50.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	99.8	Sum of lost time (s)	20.0
Intersection Capacity Utilization	59.6%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			



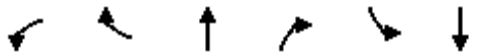
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	70	304	76	141	673	242	107	109	163	119	88	44
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	1.00	0.85	1.00	0.91		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1626	3300		1703	3505	1543	1583	3043		1736	2819	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1626	3300		1703	3505	1543	1583	3043		1736	2819	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	74	323	81	150	716	257	114	116	173	127	94	47
RTOR Reduction (vph)	0	23	0	0	0	211	0	146	0	0	40	0
Lane Group Flow (vph)	74	381	0	150	716	46	114	143	0	127	101	0
Confl. Peds. (#/hr)			1	1								
Confl. Bikes (#/hr)			1			3						
Heavy Vehicles (%)	11%	4%	13%	6%	3%	3%	14%	5%	10%	4%	12%	41%
Turn Type	Split	NA		Split	NA	Perm	Split	NA		Split	NA	
Protected Phases	4	4		8	8		2	2		6	6	
Permitted Phases						8						
Actuated Green, G (s)	29.0	29.0		17.0	17.0	17.0	15.0	15.0		15.0	15.0	
Effective Green, g (s)	29.0	29.0		17.0	17.0	17.0	15.0	15.0		15.0	15.0	
Actuated g/C Ratio	0.30	0.30		0.18	0.18	0.18	0.16	0.16		0.16	0.16	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	491	996		301	620	273	247	475		271	440	
v/s Ratio Prot	0.05	c0.12		0.09	c0.20		c0.07	0.05		c0.07	0.04	
v/s Ratio Perm						0.03						
v/c Ratio	0.15	0.38		0.50	1.15	0.17	0.46	0.30		0.47	0.23	
Uniform Delay, d1	24.5	26.4		35.7	39.5	33.5	36.8	35.9		36.9	35.4	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.6	1.1		5.8	87.0	1.3	6.1	1.6		5.7	1.2	
Delay (s)	25.1	27.5		41.4	126.5	34.8	42.9	37.5		42.6	36.7	
Level of Service	C	C		D	F	C	D	D		D	D	
Approach Delay (s)		27.2			94.2			39.0			39.5	
Approach LOS		C			F			D			D	

Intersection Summary			
HCM 2000 Control Delay	63.8	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	96.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	63.5%	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												
Volume (veh/h)	32	566	42	23	902	6	55	5	29	4	13	115
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	33	584	43	24	930	6	57	5	30	4	13	119
Pedestrians		2										
Lane Width (ft)		12.0										
Walking Speed (ft/s)		4.0										
Percent Blockage		0										
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		1120			405							
pX, platoon unblocked	0.88						0.88	0.88		0.88	0.88	0.88
vC, conflicting volume	936			627			1311	1655	313	1371	1673	470
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	655			627			1080	1471	313	1148	1492	125
tC, single (s)	4.9			4.2			7.5	6.5	7.0	8.2	6.5	7.0
tC, 2 stage (s)												
tF (s)	2.6			2.3			3.5	4.0	3.3	3.8	4.0	3.3
p0 queue free %	95			97			48	95	96	96	87	85
cM capacity (veh/h)	619			918			109	104	676	92	101	790

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total	325	335	489	471	92	136
Volume Left	33	0	24	0	57	4
Volume Right	0	43	0	6	30	119
cSH	619	1700	918	1700	149	415
Volume to Capacity	0.05	0.20	0.03	0.28	0.61	0.33
Queue Length 95th (ft)	4	0	2	0	82	35
Control Delay (s)	1.8	0.0	0.7	0.0	61.5	17.8
Lane LOS	A		A		F	C
Approach Delay (s)	0.9		0.4		61.5	17.8
Approach LOS					F	C

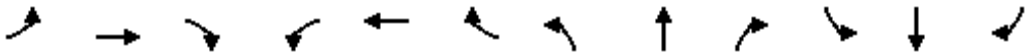
Intersection Summary			
Average Delay	4.9		
Intersection Capacity Utilization	65.3%	ICU Level of Service	C
Analysis Period (min)	15		



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	168	0	0	0	0	575
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	193	0	0	0	0	661
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			444			
pX, platoon unblocked						
vC, conflicting volume	330	0			0	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	330	0			0	
tC, single (s)	6.9	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	69	100			100	
cM capacity (veh/h)	631	1091			1636	

Direction, Lane #	WB 1	WB 2	SB 1	SB 2
Volume Total	97	97	330	330
Volume Left	97	97	0	0
Volume Right	0	0	0	0
cSH	631	631	1700	1700
Volume to Capacity	0.15	0.15	0.19	0.19
Queue Length 95th (ft)	13	13	0	0
Control Delay (s)	11.7	11.7	0.0	0.0
Lane LOS	B	B		
Approach Delay (s)	11.7		0.0	
Approach LOS	B			

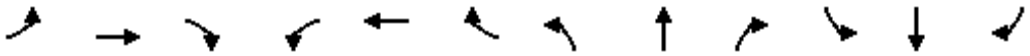
Intersection Summary			
Average Delay	2.7		
Intersection Capacity Utilization	27.4%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	362	97	141	583	0	0	0	0	119	378	239
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0		5.0	5.0						5.0	
Lane Util. Factor		0.91		1.00	0.95						0.95	
Frpb, ped/bikes		1.00		1.00	1.00						0.99	
Flpb, ped/bikes		1.00		1.00	1.00						1.00	
Frt		0.97		1.00	1.00						0.95	
Flt Protected		1.00		0.95	1.00						0.99	
Satd. Flow (prot)		4705		1766	3539						3253	
Flt Permitted		1.00		0.44	1.00						0.99	
Satd. Flow (perm)		4705		825	3539						3253	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	0	385	103	150	620	0	0	0	0	127	402	254
RTOR Reduction (vph)	0	44	0	0	0	0	0	0	0	0	52	0
Lane Group Flow (vph)	0	444	0	150	620	0	0	0	0	0	731	0
Confl. Peds. (#/hr)			4	4						4		2
Confl. Bikes (#/hr)			3			2						21
Heavy Vehicles (%)	3%	7%	4%	2%	2%	2%	2%	1%	1%	2%	5%	3%
Turn Type		NA		Perm	NA					Perm	NA	
Protected Phases		2			6						4	
Permitted Phases				6						4		
Actuated Green, G (s)		46.0		46.0	46.0						54.0	
Effective Green, g (s)		46.0		46.0	46.0						54.0	
Actuated g/C Ratio		0.42		0.42	0.42						0.49	
Clearance Time (s)		5.0		5.0	5.0						5.0	
Vehicle Extension (s)		3.0		3.0	3.0						3.0	
Lane Grp Cap (vph)		1967		345	1479						1596	
v/s Ratio Prot		0.09			0.18							
v/s Ratio Perm				c0.18							0.22	
v/c Ratio		0.23		0.43	0.42						0.46	
Uniform Delay, d1		20.6		22.8	22.6						18.4	
Progression Factor		1.00		0.35	0.32						1.00	
Incremental Delay, d2		0.3		0.8	0.2						0.9	
Delay (s)		20.8		8.9	7.5						19.3	
Level of Service		C		A	A						B	
Approach Delay (s)		20.8			7.8			0.0			19.3	
Approach LOS		C			A			A			B	

Intersection Summary			
HCM 2000 Control Delay	15.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	77.0%	ICU Level of Service	D
Analysis Period (min)	15		

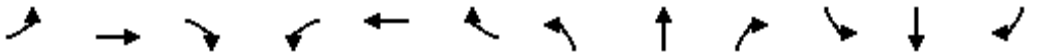
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	74	1	18	6	0	12	0	0	0	32	437	13
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	82	1	20	7	0	13	0	0	0	36	486	14
Pedestrians								1				
Lane Width (ft)								0.0				
Walking Speed (ft/s)								4.0				
Percent Blockage								0				
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											655	
pX, platoon unblocked												
vC, conflicting volume	577	564	251	335	571	0	500			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	577	564	251	335	571	0	500			0		
tC, single (s)	7.7	6.5	6.9	7.6	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.3	3.6	4.0	3.3	2.2			2.2		
p0 queue free %	78	100	97	99	100	99	100			98		
cM capacity (veh/h)	376	428	755	558	424	1091	1075			1636		

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	103	20	278	257
Volume Left	82	7	36	0
Volume Right	20	13	0	14
cSH	417	828	1636	1700
Volume to Capacity	0.25	0.02	0.02	0.15
Queue Length 95th (ft)	24	2	2	0
Control Delay (s)	16.5	9.5	1.1	0.0
Lane LOS	C	A	A	
Approach Delay (s)	16.5	9.5	0.6	
Approach LOS	C	A		

Intersection Summary				
Average Delay	3.3			
Intersection Capacity Utilization	31.3%	ICU Level of Service	A	
Analysis Period (min)	15			

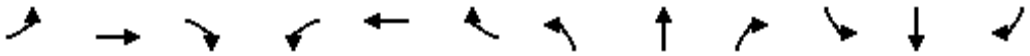


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	18	32	0	0	151	137	78	172	146	74	0	206
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0		5.0	5.0		4.0		4.0
Lane Util. Factor	1.00	0.95			0.95		0.91	0.91		1.00		0.88
Frpb, ped/bikes	1.00	1.00			0.99		1.00	1.00		1.00		1.00
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00		1.00		1.00
Frt	1.00	1.00			0.93		1.00	0.93		1.00		0.85
Flt Protected	0.95	1.00			1.00		0.95	1.00		0.95		1.00
Satd. Flow (prot)	1624	3471			3076		1441	2981		1543		2682
Flt Permitted	0.95	1.00			1.00		0.95	1.00		0.95		1.00
Satd. Flow (perm)	1624	3471			3076		1441	2981		1543		2682
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Adj. Flow (vph)	21	37	0	0	174	157	90	198	168	85	0	237
RTOR Reduction (vph)	0	0	0	0	132	0	0	111	0	0	0	219
Lane Group Flow (vph)	21	37	0	0	199	0	81	264	0	85	0	18
Confl. Peds. (#/hr)	6					6						
Confl. Bikes (#/hr)			6			3						
Heavy Vehicles (%)	0%	4%	0%	0%	9%	7%	14%	7%	9%	17%	0%	6%
Parking (#/hr)	0											
Turn Type	Split	NA			NA		Split	NA		Prot		custom
Protected Phases	4	4			8		2	2		6		6
Permitted Phases												
Actuated Green, G (s)	3.6	3.6			8.7		18.4	18.4		4.1		4.1
Effective Green, g (s)	3.6	3.6			8.7		18.4	18.4		4.1		4.1
Actuated g/C Ratio	0.07	0.07			0.16		0.34	0.34		0.08		0.08
Clearance Time (s)	5.0	5.0			5.0		5.0	5.0		4.0		4.0
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0		3.0
Lane Grp Cap (vph)	108	232			497		492	1019		117		204
v/s Ratio Prot	c0.01	0.01			c0.06		0.06	c0.09		c0.06		0.01
v/s Ratio Perm												
v/c Ratio	0.19	0.16			0.40		0.16	0.26		0.73		0.09
Uniform Delay, d1	23.7	23.7			20.2		12.3	12.8		24.3		23.1
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00		1.00
Incremental Delay, d2	0.9	0.3			0.5		0.7	0.6		20.0		0.2
Delay (s)	24.6	24.0			20.7		13.1	13.4		44.3		23.3
Level of Service	C	C			C		B	B		D		C
Approach Delay (s)		24.2			20.7			13.3			28.8	
Approach LOS		C			C			B			C	

Intersection Summary			
HCM 2000 Control Delay	20.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	53.8	Sum of lost time (s)	19.0
Intersection Capacity Utilization	39.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	11	31	1	16	31	82	0	9	26	72	13	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0		5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.99		1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00		1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.89		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		1.00		0.95	1.00	
Satd. Flow (prot)	1805	3610	793	1357	3471	1328		2621		1703	2356	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		1.00		0.95	1.00	
Satd. Flow (perm)	1805	3610	793	1357	3471	1328		2621		1703	2356	
Peak-hour factor, PHF	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Adj. Flow (vph)	13	38	1	20	38	100	0	11	32	88	16	1
RTOR Reduction (vph)	0	0	1	0	0	63	0	24	0	0	1	0
Lane Group Flow (vph)	13	38	0	20	38	37	0	19	0	88	16	0
Confl. Peds. (#/hr)			4	4								
Confl. Bikes (#/hr)			4			2						3
Heavy Vehicles (%)	0%	0%	100%	33%	4%	20%	0%	38%	17%	6%	55%	0%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8						
Actuated Green, G (s)	10.0	39.0	39.0	15.0	44.0	44.0		30.0		16.0	42.0	
Effective Green, g (s)	10.0	39.0	39.0	15.0	44.0	44.0		30.0		16.0	42.0	
Actuated g/C Ratio	0.08	0.32	0.32	0.12	0.37	0.37		0.25		0.13	0.35	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0		5.0		5.0	5.0	
Lane Grp Cap (vph)	150	1173	257	169	1272	486		655		227	824	
v/s Ratio Prot	0.01	0.01		c0.01	0.01			c0.01		c0.05	0.01	
v/s Ratio Perm			0.00			c0.03						
v/c Ratio	0.09	0.03	0.00	0.12	0.03	0.08		0.03		0.39	0.02	
Uniform Delay, d1	50.8	27.6	27.3	46.6	24.3	24.8		34.0		47.5	25.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2	1.1	0.1	0.0	1.4	0.0	0.3		0.1		4.9	0.0	
Delay (s)	51.9	27.7	27.4	48.1	24.4	25.1		34.1		52.5	25.6	
Level of Service	D	C	C	D	C	C		C		D	C	
Approach Delay (s)		33.7			27.8			34.1			48.1	
Approach LOS		C			C			C			D	

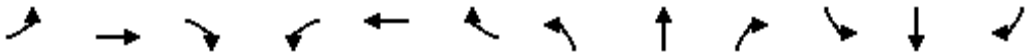
Intersection Summary			
HCM 2000 Control Delay	35.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.12		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	51.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	77	468	24	58	642	61	45	125	45	77	165	106
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0			5.0			5.0	
Lane Util. Factor		0.91			0.91			0.95			0.95	
Frpb, ped/bikes		1.00			1.00			1.00			0.99	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		0.99			0.99			0.97			0.95	
Flt Protected		0.99			1.00			0.99			0.99	
Satd. Flow (prot)		4950			4967			3443			3304	
Flt Permitted		0.75			0.85			0.85			0.84	
Satd. Flow (perm)		3742			4227			2940			2815	
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	78	473	24	59	648	62	45	126	45	78	167	107
RTOR Reduction (vph)	0	8	0	0	16	0	0	21	0	0	49	0
Lane Group Flow (vph)	0	567	0	0	753	0	0	195	0	0	303	0
Confl. Peds. (#/hr)	6		3	3		6	6		5	5		6
Confl. Bikes (#/hr)			15			13			14			11
Heavy Vehicles (%)	0%	4%	0%	0%	3%	0%	0%	0%	0%	2%	4%	0%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		19.8			19.8			33.5			33.5	
Effective Green, g (s)		19.8			19.8			33.5			33.5	
Actuated g/C Ratio		0.31			0.31			0.53			0.53	
Clearance Time (s)		5.0			5.0			5.0			5.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		1170			1322			1555			1489	
v/s Ratio Prot												
v/s Ratio Perm		0.15			c0.18			0.07			c0.11	
v/c Ratio		0.48			0.57			0.13			0.20	
Uniform Delay, d1		17.6			18.2			7.5			7.9	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		0.3			0.6			0.2			0.3	
Delay (s)		17.9			18.8			7.7			8.2	
Level of Service		B			B			A			A	
Approach Delay (s)		17.9			18.8			7.7			8.2	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	15.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	63.3	Sum of lost time (s)	10.0
Intersection Capacity Utilization	84.7%	ICU Level of Service	E
Analysis Period (min)	15		

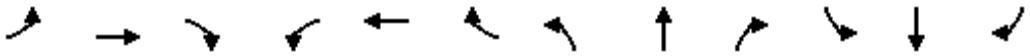
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	164	9	4	438	0	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	0	0	0	0	189	10	5	503	0	0	0	0
Pedestrians		3			3						2	
Lane Width (ft)		0.0			12.0						0.0	
Walking Speed (ft/s)		4.0			4.0						4.0	
Percent Blockage		0			0						0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								536				
pX, platoon unblocked												
vC, conflicting volume	371	519	3	516	519	257	3			506		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	371	519	3	516	519	257	3			506		
tC, single (s)	7.5	6.5	6.9	7.6	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	59	99	100			100		
cM capacity (veh/h)	379	462	1086	433	462	747	1632			1066		

Direction, Lane #	WB 1	WB 2	NB 1	NB 2
Volume Total	126	73	172	336
Volume Left	0	0	5	0
Volume Right	0	10	0	0
cSH	462	488	1632	1700
Volume to Capacity	0.27	0.15	0.00	0.20
Queue Length 95th (ft)	27	13	0	0
Control Delay (s)	15.7	13.7	0.2	0.0
Lane LOS	C	B	A	
Approach Delay (s)	14.9		0.1	
Approach LOS	B			

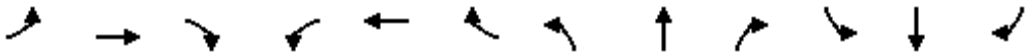
Intersection Summary				
Average Delay	4.3			
Intersection Capacity Utilization	27.4%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	166	315	0	0	635	82	90	269	100	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0			5.0				
Lane Util. Factor		0.91			0.91			0.95				
Frpb, ped/bikes		1.00			1.00			0.99				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		1.00			0.98			0.97				
Flt Protected		0.98			1.00			0.99				
Satd. Flow (prot)		4827			4990			3393				
Flt Permitted		0.65			1.00			0.99				
Satd. Flow (perm)		3212			4990			3393				
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	177	335	0	0	676	87	96	286	106	0	0	0
RTOR Reduction (vph)	0	0	0	0	15	0	0	23	0	0	0	0
Lane Group Flow (vph)	0	512	0	0	748	0	0	465	0	0	0	0
Confl. Peds. (#/hr)	1					1			8			
Confl. Bikes (#/hr)			2			2			27			
Heavy Vehicles (%)	3%	7%	4%	2%	2%	2%	2%	1%	1%	2%	5%	3%
Turn Type	Perm	NA			NA		Perm	NA				
Protected Phases		2			6			8				
Permitted Phases	2						8					
Actuated Green, G (s)		46.0			46.0			54.0				
Effective Green, g (s)		46.0			46.0			54.0				
Actuated g/C Ratio		0.42			0.42			0.49				
Clearance Time (s)		5.0			5.0			5.0				
Vehicle Extension (s)		3.0			3.0			3.0				
Lane Grp Cap (vph)		1343			2086			1665				
v/s Ratio Prot					0.15							
v/s Ratio Perm		c0.16						0.14				
v/c Ratio		0.38			0.36			0.28				
Uniform Delay, d1		22.1			21.9			16.5				
Progression Factor		0.65			1.00			1.00				
Incremental Delay, d2		0.8			0.1			0.1				
Delay (s)		15.2			22.0			16.6				
Level of Service		B			C			B				
Approach Delay (s)		15.2			22.0			16.6			0.0	
Approach LOS		B			C			B			A	

Intersection Summary			
HCM 2000 Control Delay	18.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.33		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	52.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group



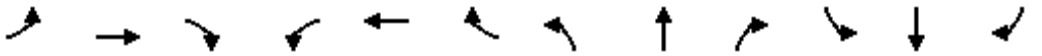
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	76	0	0	1	0	4	348	27	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	84	0	0	1	0	4	387	30	0	0	0
Pedestrians		9			13							
Lane Width (ft)		12.0			12.0							
Walking Speed (ft/s)		4.0			4.0							
Percent Blockage		1			1							
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											608	
pX, platoon unblocked												
vC, conflicting volume	212	448	9	466	433	221	9			430		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	212	448	9	466	433	221	9			430		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	83	100	100	100	100	100			100		
cM capacity (veh/h)	708	498	1069	411	508	780	1612			1128		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	84	1	198	223
Volume Left	0	0	4	0
Volume Right	0	0	0	30
cSH	498	508	1612	1700
Volume to Capacity	0.17	0.00	0.00	0.13
Queue Length 95th (ft)	15	0	0	0
Control Delay (s)	13.7	12.1	0.2	0.0
Lane LOS	B	B	A	
Approach Delay (s)	13.7	12.1	0.1	
Approach LOS	B	B		

Intersection Summary				
Average Delay	2.4			
Intersection Capacity Utilization	22.3%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	83	0	8	0	0	0	5	552	1	0	108	12
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0				5.0	5.0			5.0	
Lane Util. Factor		1.00	1.00				1.00	0.95			0.95	
Frpb, ped/bikes		1.00	0.99				1.00	1.00			1.00	
Flpb, ped/bikes		1.00	1.00				1.00	1.00			1.00	
Frt		1.00	0.85				1.00	1.00			0.98	
Flt Protected		0.95	1.00				0.95	1.00			1.00	
Satd. Flow (prot)		1767	1199				1202	2735			2463	
Flt Permitted		0.76	1.00				0.67	1.00			1.00	
Satd. Flow (perm)		1408	1199				849	2735			2463	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.92
Adj. Flow (vph)	88	0	9	0	0	0	5	587	1	0	115	13
RTOR Reduction (vph)	0	0	5	0	0	0	0	0	0	0	7	0
Lane Group Flow (vph)	0	88	4	0	0	0	5	588	0	0	121	0
Confl. Peds. (#/hr)	2		1	1		2	1		2	2		1
Confl. Bikes (#/hr)									1			1
Heavy Vehicles (%)	2%	0%	33%	0%	0%	0%	50%	32%	0%	0%	49%	0%
Turn Type	Perm	NA	Perm	Perm			Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2			6		
Actuated Green, G (s)		29.0	29.0				31.0	31.0			31.0	
Effective Green, g (s)		29.0	29.0				31.0	31.0			31.0	
Actuated g/C Ratio		0.41	0.41				0.44	0.44			0.44	
Clearance Time (s)		5.0	5.0				5.0	5.0			5.0	
Lane Grp Cap (vph)		583	496				375	1211			1090	
v/s Ratio Prot								c0.21			0.05	
v/s Ratio Perm		c0.06	0.00				0.01					
v/c Ratio		0.15	0.01				0.01	0.49			0.11	
Uniform Delay, d1		12.8	12.0				10.9	13.8			11.4	
Progression Factor		1.00	1.00				1.00	1.00			1.00	
Incremental Delay, d2		0.5	0.0				0.1	1.4			0.2	
Delay (s)		13.4	12.1				11.0	15.2			11.6	
Level of Service		B	B				B	B			B	
Approach Delay (s)		13.2			0.0			15.2			11.6	
Approach LOS		B			A			B			B	

Intersection Summary			
HCM 2000 Control Delay	14.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.32		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	51.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



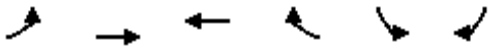
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	6	302	90	50	688	40	310	64	189	68	26	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	0.90	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.97	1.00	0.95	1.00	
Satd. Flow (prot)	1504	3505	1495	1433	3360		1618	1346	1302	1517	1398	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.97	1.00	0.95	1.00	
Satd. Flow (perm)	1504	3505	1495	1433	3360		1618	1346	1302	1517	1398	
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)	6	318	95	53	724	42	326	67	199	72	27	58
RTOR Reduction (vph)	0	0	71	0	3	0	0	0	155	0	45	0
Lane Group Flow (vph)	6	318	24	53	763	0	196	197	44	72	40	0
Heavy Vehicles (%)	20%	3%	8%	26%	3%	68%	6%	76%	24%	19%	50%	9%
Turn Type	Prot	NA	Perm	Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		6	6		2	2	
Permitted Phases			4						6			
Actuated Green, G (s)	1.0	20.9	20.9	5.6	25.5		18.7	18.7	18.7	18.7	18.7	
Effective Green, g (s)	1.0	20.9	20.9	5.6	25.5		18.7	18.7	18.7	18.7	18.7	
Actuated g/C Ratio	0.01	0.25	0.25	0.07	0.30		0.22	0.22	0.22	0.22	0.22	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	17	873	372	95	1021		360	300	290	338	311	
v/s Ratio Prot	0.00	0.09		c0.04	c0.23		0.12	c0.15		c0.05	0.03	
v/s Ratio Perm			0.02						0.03			
v/c Ratio	0.35	0.36	0.06	0.56	0.75		0.54	0.66	0.15	0.21	0.13	
Uniform Delay, d1	41.1	26.0	24.0	38.0	26.3		28.8	29.7	26.2	26.6	26.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	12.2	0.3	0.1	6.9	3.0		1.7	5.1	0.2	1.4	0.9	
Delay (s)	53.3	26.3	24.1	44.9	29.3		30.5	34.8	26.5	28.0	26.9	
Level of Service	D	C	C	D	C		C	C	C	C	C	
Approach Delay (s)		26.2			30.3			30.6			27.4	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	29.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	83.9	Sum of lost time (s)	20.0
Intersection Capacity Utilization	53.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	113	364	88	186	642	217	99	177	374	137	77	18
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	0.98		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	1.00	0.85	1.00	0.90		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1433	3179		1626	3438	1495	1444	2823		1612	2822	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1433	3179		1626	3438	1495	1444	2823		1612	2822	
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)	116	375	91	192	662	224	102	182	386	141	79	19
RTOR Reduction (vph)	0	22	0	0	0	184	0	326	0	0	16	0
Lane Group Flow (vph)	116	444	0	192	662	40	102	242	0	141	82	0
Confl. Peds. (#/hr)			20	1								
Confl. Bikes (#/hr)			75									
Heavy Vehicles (%)	26%	8%	10%	11%	5%	8%	25%	23%	11%	12%	18%	50%
Turn Type	Split	NA		Split	NA	Perm	Split	NA		Split	NA	
Protected Phases	4	4		8	8		2	2		6	6	
Permitted Phases						8						
Actuated Green, G (s)	29.0	29.0		17.0	17.0	17.0	15.0	15.0		15.0	15.0	
Effective Green, g (s)	29.0	29.0		17.0	17.0	17.0	15.0	15.0		15.0	15.0	
Actuated g/C Ratio	0.30	0.30		0.18	0.18	0.18	0.16	0.16		0.16	0.16	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	432	960		287	608	264	225	441		251	440	
v/s Ratio Prot	0.08	c0.14		0.12	c0.19		0.07	c0.09		c0.09	0.03	
v/s Ratio Perm						0.03						
v/c Ratio	0.27	0.46		0.67	1.09	0.15	0.45	0.55		0.56	0.19	
Uniform Delay, d1	25.4	27.2		36.9	39.5	33.4	36.8	37.4		37.5	35.2	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.5	1.6		11.7	63.0	1.2	6.5	4.9		8.8	0.9	
Delay (s)	27.0	28.8		48.6	102.5	34.6	43.2	42.2		46.3	36.1	
Level of Service	C	C		D	F	C	D	D		D	D	
Approach Delay (s)		28.4			78.8			42.4			42.1	
Approach LOS		C			E			D			D	

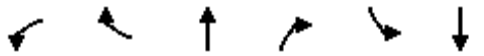
Intersection Summary			
HCM 2000 Control Delay	54.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	96.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	75.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	104	819	845	36	3	203
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	112	881	909	39	3	218
Pedestrians					2	
Lane Width (ft)					12.0	
Walking Speed (ft/s)					4.0	
Percent Blockage					0	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		1120	405			
pX, platoon unblocked	0.89				0.89	0.89
vC, conflicting volume	949				1594	476
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	700				1423	169
tC, single (s)	4.9				6.8	7.1
tC, 2 stage (s)						
tF (s)	2.6				3.5	3.4
p0 queue free %	82				97	70
cM capacity (veh/h)	605				94	728

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	405	587	606	342	222
Volume Left	112	0	0	0	3
Volume Right	0	0	0	39	218
cSH	605	1700	1700	1700	663
Volume to Capacity	0.18	0.35	0.36	0.20	0.33
Queue Length 95th (ft)	17	0	0	0	37
Control Delay (s)	5.4	0.0	0.0	0.0	13.1
Lane LOS	A				B
Approach Delay (s)	2.2		0.0		13.1
Approach LOS					B

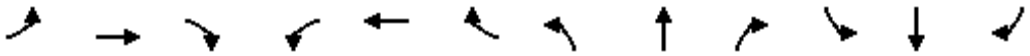
Intersection Summary			
Average Delay	2.4		
Intersection Capacity Utilization	72.9%	ICU Level of Service	C
Analysis Period (min)	15		



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	192	0	0	0	0	621
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	198	0	0	0	0	640
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			444			
pX, platoon unblocked						
vC, conflicting volume	320	0			0	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	320	0			0	
tC, single (s)	6.9	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	69	100			100	
cM capacity (veh/h)	643	1091			1636	

Direction, Lane #	WB 1	WB 2	SB 1	SB 2
Volume Total	99	99	320	320
Volume Left	99	99	0	0
Volume Right	0	0	0	0
cSH	643	643	1700	1700
Volume to Capacity	0.15	0.15	0.19	0.19
Queue Length 95th (ft)	14	14	0	0
Control Delay (s)	11.6	11.6	0.0	0.0
Lane LOS	B	B		
Approach Delay (s)	11.6		0.0	
Approach LOS	B			

Intersection Summary			
Average Delay	2.7		
Intersection Capacity Utilization	34.2%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	553	139	133	584	0	0	0	0	145	477	181
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0		5.0	5.0						5.0	
Lane Util. Factor		0.95		1.00	0.95						0.95	
Frpb, ped/bikes		1.00		1.00	1.00						0.99	
Flpb, ped/bikes		1.00		1.00	1.00						1.00	
Frt		0.97		1.00	1.00						0.97	
Flt Protected		1.00		0.95	1.00						0.99	
Satd. Flow (prot)		3322		1770	3471						3375	
Flt Permitted		1.00		0.30	1.00						0.99	
Satd. Flow (perm)		3322		555	3471						3375	
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)	0	576	145	139	608	0	0	0	0	151	497	189
RTOR Reduction (vph)	0	20	0	0	0	0	0	0	0	0	24	0
Lane Group Flow (vph)	0	701	0	139	608	0	0	0	0	0	813	0
Confl. Peds. (#/hr)										7		3
Confl. Bikes (#/hr)						1						36
Heavy Vehicles (%)	6%	6%	3%	2%	4%	1%	3%	4%	1%	4%	1%	1%
Turn Type		NA		Perm	NA					Perm	NA	
Protected Phases		2			6						4	
Permitted Phases				6						4		
Actuated Green, G (s)		51.0		51.0	51.0						49.0	
Effective Green, g (s)		51.0		51.0	51.0						49.0	
Actuated g/C Ratio		0.46		0.46	0.46						0.45	
Clearance Time (s)		5.0		5.0	5.0						5.0	
Vehicle Extension (s)		3.0		3.0	3.0						3.0	
Lane Grp Cap (vph)		1540		257	1609						1503	
v/s Ratio Prot		0.21			0.18							
v/s Ratio Perm				c0.25							0.24	
v/c Ratio		0.45		0.54	0.38						0.54	
Uniform Delay, d1		20.1		21.1	19.2						22.3	
Progression Factor		1.00		0.51	0.45						1.00	
Incremental Delay, d2		1.0		7.1	0.6						1.4	
Delay (s)		21.0		17.9	9.3						23.7	
Level of Service		C		B	A						C	
Approach Delay (s)		21.0			10.9			0.0			23.7	
Approach LOS		C			B			A			C	

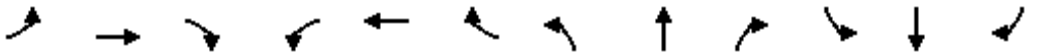
Intersection Summary			
HCM 2000 Control Delay	18.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	67.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	38	86	9	5	1	0	0	0	0	8	538	3
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	41	92	10	5	1	0	0	0	0	9	578	3
Pedestrians		3						1				
Lane Width (ft)		12.0						0.0				
Walking Speed (ft/s)		4.0						4.0				
Percent Blockage		0						0				
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											655	
pX, platoon unblocked												
vC, conflicting volume	601	600	295	363	602	0	585			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	601	600	295	363	602	0	585			0		
tC, single (s)	7.7	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	89	78	99	99	100	100	100			99		
cM capacity (veh/h)	368	414	706	465	413	1091	997			1636		

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	143	6	298	292
Volume Left	41	5	9	0
Volume Right	10	0	0	3
cSH	411	455	1636	1700
Volume to Capacity	0.35	0.01	0.01	0.17
Queue Length 95th (ft)	38	1	0	0
Control Delay (s)	18.4	13.0	0.3	0.0
Lane LOS	C	B	A	
Approach Delay (s)	18.4	13.0	0.1	
Approach LOS	C	B		

Intersection Summary				
Average Delay	3.8			
Intersection Capacity Utilization	28.9%	ICU Level of Service	A	
Analysis Period (min)	15			



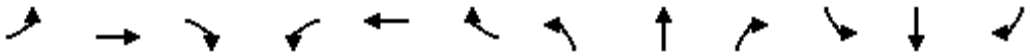
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	143	98	0	0	109	130	90	320	95	90	0	209
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0		5.0	5.0		5.0		5.0
Lane Util. Factor	1.00	0.95			0.95		0.91	0.91		1.00		0.88
Frpb, ped/bikes	1.00	1.00			0.99		1.00	1.00		1.00		1.00
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00		1.00		1.00
Frt	1.00	1.00			0.92		1.00	0.97		1.00		0.85
Flt Protected	0.95	1.00			1.00		0.95	1.00		0.95		1.00
Satd. Flow (prot)	1160	3195			2745		1014	2889		1570		2349
Flt Permitted	0.95	1.00			1.00		0.95	1.00		0.95		1.00
Satd. Flow (perm)	1160	3195			2745		1014	2889		1570		2349
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	159	109	0	0	121	144	100	356	106	100	0	232
RTOR Reduction (vph)	0	0	0	0	126	0	0	21	0	0	0	200
Lane Group Flow (vph)	159	109	0	0	139	0	90	451	0	100	0	32
Confl. Peds. (#/hr)							4					4
Confl. Bikes (#/hr)			6			3						
Heavy Vehicles (%)	40%	13%	0%	0%	18%	21%	62%	15%	13%	15%	0%	21%
Parking (#/hr)	0											
Turn Type	Split	NA			NA		Split	NA		Prot		custom
Protected Phases	4	4			8		2	2		6		6
Permitted Phases												
Actuated Green, G (s)	15.7	15.7			8.9		17.2	17.2		10.0		10.0
Effective Green, g (s)	15.7	15.7			8.9		17.2	17.2		10.0		10.0
Actuated g/C Ratio	0.22	0.22			0.12		0.24	0.24		0.14		0.14
Clearance Time (s)	5.0	5.0			5.0		5.0	5.0		5.0		5.0
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0		3.0
Lane Grp Cap (vph)	253	698			340		242	692		218		327
v/s Ratio Prot	c0.14	0.03			c0.05		0.09	c0.16		c0.06		0.01
v/s Ratio Perm												
v/c Ratio	0.63	0.16			0.41		0.37	0.65		0.46		0.10
Uniform Delay, d1	25.4	22.7			29.0		22.8	24.6		28.4		27.0
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00		1.00
Incremental Delay, d2	4.8	0.1			0.8		4.3	4.7		1.5		0.1
Delay (s)	30.2	22.8			29.8		27.1	29.3		29.9		27.1
Level of Service	C	C			C		C	C		C		C
Approach Delay (s)		27.2			29.8			29.0			28.0	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	28.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	71.8	Sum of lost time (s)	20.0
Intersection Capacity Utilization	46.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	171	198	36	28	60	66	6	229	157	197	128	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1245	2375	832	1107	2201	1062	1003	1970		1203	1870	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1245	2375	832	1107	2201	1062	1003	1970		1203	1870	
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	188	218	40	31	66	73	7	252	173	216	141	0
RTOR Reduction (vph)	0	0	27	0	0	64	0	102	0	0	0	0
Lane Group Flow (vph)	188	218	13	31	66	9	7	323	0	216	141	0
Confl. Bikes (#/hr)						1						
Heavy Vehicles (%)	45%	52%	94%	63%	64%	50%	80%	79%	62%	50%	93%	0%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8						
Actuated Green, G (s)	39.0	39.0	39.0	15.0	15.0	15.0	29.0	29.0		17.0	17.0	
Effective Green, g (s)	39.0	39.0	39.0	15.0	15.0	15.0	29.0	29.0		17.0	17.0	
Actuated g/C Ratio	0.32	0.32	0.32	0.12	0.12	0.12	0.24	0.24		0.14	0.14	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	404	771	270	138	275	132	242	476		170	264	
v/s Ratio Prot	c0.15	c0.09		0.03	0.03		0.01	c0.16		c0.18	0.08	
v/s Ratio Perm			0.02			0.01						
v/c Ratio	0.47	0.28	0.05	0.22	0.24	0.07	0.03	0.68		1.27	0.53	
Uniform Delay, d1	32.2	30.1	27.8	47.3	47.4	46.3	34.7	41.3		51.5	47.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	3.8	0.9	0.3	3.7	2.1	1.0	0.2	7.6		159.7	7.5	
Delay (s)	36.0	31.0	28.1	51.0	49.4	47.3	35.0	48.9		211.2	55.4	
Level of Service	D	C	C	D	D	D	C	D		F	E	
Approach Delay (s)		32.9			48.8			48.7			149.6	
Approach LOS		C			D			D			F	

Intersection Summary			
HCM 2000 Control Delay	69.3	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	51.8%	ICU Level of Service	A
Analysis Period (min)	15		

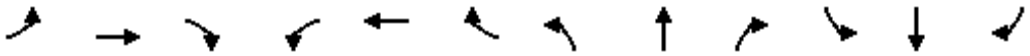
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	56	623	55	76	718	64	37	251	69	79	232	82
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0			5.0			5.0	
Lane Util. Factor		0.91			0.91			0.95			0.95	
Frpb, ped/bikes		1.00			1.00			1.00			0.99	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		0.99			0.99			0.97			0.97	
Flt Protected		1.00			1.00			0.99			0.99	
Satd. Flow (prot)		4858			4990			3362			3300	
Flt Permitted		0.80			0.79			0.88			0.81	
Satd. Flow (perm)		3920			3959			2990			2693	
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)	59	656	58	80	756	67	39	264	73	83	244	86
RTOR Reduction (vph)	0	14	0	0	14	0	0	23	0	0	25	0
Lane Group Flow (vph)	0	759	0	0	889	0	0	353	0	0	388	0
Confl. Peds. (#/hr)	20		12	12		20	17		11	11		17
Confl. Bikes (#/hr)			10			8			12			9
Heavy Vehicles (%)	2%	5%	7%	2%	2%	2%	2%	3%	4%	2%	3%	9%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		23.6			23.6			33.4			33.4	
Effective Green, g (s)		23.6			23.6			33.4			33.4	
Actuated g/C Ratio		0.35			0.35			0.50			0.50	
Clearance Time (s)		5.0			5.0			5.0			5.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		1380			1394			1490			1342	
v/s Ratio Prot												
v/s Ratio Perm		0.19			c0.22			0.12			c0.14	
v/c Ratio		0.55			0.64			0.24			0.29	
Uniform Delay, d1		17.4			18.1			9.6			9.8	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		0.5			1.0			0.4			0.5	
Delay (s)		17.9			19.1			9.9			10.4	
Level of Service		B			B			A			B	
Approach Delay (s)		17.9			19.1			9.9			10.4	
Approach LOS		B			B			A			B	

Intersection Summary			
HCM 2000 Control Delay	15.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	67.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	93.5%	ICU Level of Service	F
Analysis Period (min)	15		

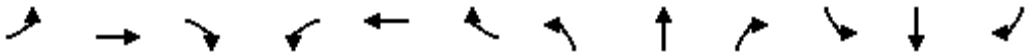
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	187	12	5	763	0	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	0	0	0	0	193	12	5	787	0	0	0	0
Pedestrians		16			1						3	
Lane Width (ft)		0.0			12.0						0.0	
Walking Speed (ft/s)		4.0			4.0						4.0	
Percent Blockage		0			0						0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								536				
pX, platoon unblocked												
vC, conflicting volume	531	814	16	798	814	397	16			788		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	531	814	16	798	814	397	16			788		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	38	98	100			100		
cM capacity (veh/h)	216	313	1066	279	313	607	1615			840		

Direction, Lane #	WB 1	WB 2	NB 1	NB 2
Volume Total	129	77	267	524
Volume Left	0	0	5	0
Volume Right	0	12	0	0
cSH	313	340	1615	1700
Volume to Capacity	0.41	0.23	0.00	0.31
Queue Length 95th (ft)	48	21	0	0
Control Delay (s)	24.3	18.6	0.2	0.0
Lane LOS	C	C	A	
Approach Delay (s)	22.2		0.1	
Approach LOS	C			

Intersection Summary				
Average Delay	4.6			
Intersection Capacity Utilization	34.2%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	320	378	0	0	582	131	134	521	162	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0			5.0				
Lane Util. Factor		0.91			0.95			0.95				
Frpb, ped/bikes		1.00			1.00			0.99				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		1.00			0.97			0.97				
Flt Protected		0.98			1.00			0.99				
Satd. Flow (prot)		4782			3385			3339				
Flt Permitted		0.66			1.00			0.99				
Satd. Flow (perm)		3233			3385			3339				
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)	333	394	0	0	606	136	140	543	169	0	0	0
RTOR Reduction (vph)	0	0	0	0	18	0	0	20	0	0	0	0
Lane Group Flow (vph)	0	727	0	0	724	0	0	832	0	0	0	0
Confl. Peds. (#/hr)	2					2			4	4		
Confl. Bikes (#/hr)			1						44			
Heavy Vehicles (%)	6%	6%	3%	2%	4%	1%	3%	4%	1%	4%	1%	1%
Turn Type	Perm	NA			NA		Perm	NA				
Protected Phases		2			6			8				
Permitted Phases	2						8					
Actuated Green, G (s)		51.0			51.0			49.0				
Effective Green, g (s)		51.0			51.0			49.0				
Actuated g/C Ratio		0.46			0.46			0.45				
Clearance Time (s)		5.0			5.0			5.0				
Vehicle Extension (s)		3.0			3.0			3.0				
Lane Grp Cap (vph)		1498			1569			1487				
v/s Ratio Prot					0.21							
v/s Ratio Perm		c0.22						0.25				
v/c Ratio		1.39dl			0.46			0.56				
Uniform Delay, d1		20.4			20.1			22.5				
Progression Factor		0.51			1.00			1.00				
Incremental Delay, d2		1.0			1.0			0.5				
Delay (s)		11.3			21.1			23.0				
Level of Service		B			C			C				
Approach Delay (s)		11.3			21.1			23.0			0.0	
Approach LOS		B			C			C			A	

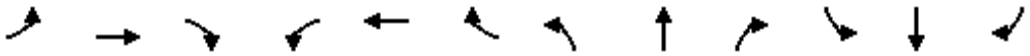
Intersection Summary			
HCM 2000 Control Delay	18.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	79.7%	ICU Level of Service	D
Analysis Period (min)	15		

dl Defacto Left Lane. Recode with 1 though lane as a left lane.
c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	124	0	0	0	1	5	6	688	3	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	133	0	0	0	1	5	6	740	3	0	0	0
Pedestrians		12			1						1	
Lane Width (ft)		12.0			12.0						0.0	
Walking Speed (ft/s)		4.0			4.0						4.0	
Percent Blockage		1			0						0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											608	
pX, platoon unblocked												
vC, conflicting volume	402	769	12	755	767	374	12			744		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	402	769	12	755	767	374	12			744		
tC, single (s)	7.7	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	73	100	100	100	100	99	100			100		
cM capacity (veh/h)	502	329	1061	297	330	629	1604			872		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	133	6	376	373
Volume Left	133	0	6	0
Volume Right	0	5	0	3
cSH	502	546	1604	1700
Volume to Capacity	0.27	0.01	0.00	0.22
Queue Length 95th (ft)	26	1	0	0
Control Delay (s)	14.7	11.7	0.2	0.0
Lane LOS	B	B	A	
Approach Delay (s)	14.7	11.7	0.1	
Approach LOS	B	B		

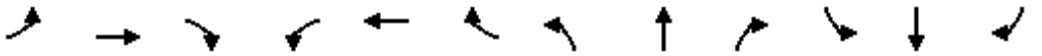
Intersection Summary				
Average Delay	2.4			
Intersection Capacity Utilization	39.5%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	84	0	15	0	0	0	8	138	0	0	69	31
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0				5.0	5.0			5.0	
Lane Util. Factor		1.00	1.00				1.00	0.95			0.95	
Frpb, ped/bikes		1.00	1.00				1.00	1.00			0.99	
Flpb, ped/bikes		1.00	1.00				1.00	1.00			1.00	
Frt		1.00	0.85				1.00	1.00			0.95	
Flt Protected		0.95	1.00				0.95	1.00			1.00	
Satd. Flow (prot)		1805	1615				1543	3471			3138	
Flt Permitted		0.76	1.00				0.68	1.00			1.00	
Satd. Flow (perm)		1439	1615				1105	3471			3138	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	95	0	17	0	0	0	9	157	0	0	78	35
RTOR Reduction (vph)	0	0	10	0	0	0	0	0	0	0	20	0
Lane Group Flow (vph)	0	95	7	0	0	0	9	157	0	0	93	0
Confl. Bikes (#/hr)												2
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	17%	4%	0%	0%	13%	0%
Turn Type	Perm	NA	Perm	Perm			Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2			6		
Actuated Green, G (s)		30.0	30.0				30.0	30.0			30.0	
Effective Green, g (s)		30.0	30.0				30.0	30.0			30.0	
Actuated g/C Ratio		0.43	0.43				0.43	0.43			0.43	
Clearance Time (s)		5.0	5.0				5.0	5.0			5.0	
Lane Grp Cap (vph)		616	692				473	1487			1344	
v/s Ratio Prot								c0.05			0.03	
v/s Ratio Perm		c0.07	0.00				0.01					
v/c Ratio		0.15	0.01				0.02	0.11			0.07	
Uniform Delay, d1		12.2	11.5				11.5	12.0			11.8	
Progression Factor		1.00	1.00				1.00	1.00			1.00	
Incremental Delay, d2		0.5	0.0				0.1	0.1			0.1	
Delay (s)		12.8	11.5				11.6	12.1			11.9	
Level of Service		B	B				B	B			B	
Approach Delay (s)		12.6			0.0			12.1			11.9	
Approach LOS		B			A			B			B	

Intersection Summary			
HCM 2000 Control Delay	12.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.13		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	19.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group



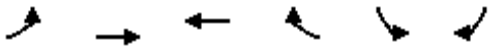
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	32	216	44	37	623	26	70	15	100	44	14	22
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	0.91	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.97	1.00	0.95	1.00	
Satd. Flow (prot)	1357	3471	1524	1687	3410		1649	1457	1495	1433	1343	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.97	1.00	0.95	1.00	
Satd. Flow (perm)	1357	3471	1524	1687	3410		1649	1457	1495	1433	1343	
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)	35	235	48	40	677	28	76	16	109	48	15	24
RTOR Reduction (vph)	0	0	35	0	2	0	0	0	64	0	22	0
Lane Group Flow (vph)	35	235	13	40	703	0	46	46	45	48	17	0
Heavy Vehicles (%)	33%	4%	6%	7%	4%	35%	4%	50%	8%	26%	45%	18%
Turn Type	Prot	NA	Perm	Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		6	6		2	2	
Permitted Phases			4						6			
Actuated Green, G (s)	4.5	26.2	26.2	4.1	25.8		40.9	40.9	40.9	7.3	7.3	
Effective Green, g (s)	4.5	26.2	26.2	4.1	25.8		40.9	40.9	40.9	7.3	7.3	
Actuated g/C Ratio	0.05	0.27	0.27	0.04	0.26		0.42	0.42	0.42	0.07	0.07	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	61	923	405	70	893		684	604	620	106	99	
v/s Ratio Prot	c0.03	0.07		0.02	c0.21		0.03	c0.03		c0.03	0.01	
v/s Ratio Perm			0.01						0.03			
v/c Ratio	0.57	0.25	0.03	0.57	0.79		0.07	0.08	0.07	0.45	0.17	
Uniform Delay, d1	46.1	28.5	26.8	46.3	33.8		17.3	17.4	17.4	43.7	42.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	12.4	0.1	0.0	10.8	4.6		0.2	0.2	0.2	3.1	0.8	
Delay (s)	58.4	28.6	26.8	57.1	38.4		17.5	17.6	17.6	46.7	43.6	
Level of Service	E	C	C	E	D		B	B	B	D	D	
Approach Delay (s)		31.6			39.4			17.6			45.3	
Approach LOS		C			D			B			D	

Intersection Summary			
HCM 2000 Control Delay	34.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	98.5	Sum of lost time (s)	20.0
Intersection Capacity Utilization	43.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	51	205	69	151	575	250	99	109	173	127	88	28
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	0.98		1.00	1.00	0.98	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.96		1.00	1.00	0.85	1.00	0.91		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1626	3200		1703	3505	1543	1583	3033		1736	2923	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1626	3200		1703	3505	1543	1583	3033		1736	2923	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	54	218	73	161	612	266	105	116	184	135	94	30
RTOR Reduction (vph)	0	34	0	0	0	219	0	155	0	0	25	0
Lane Group Flow (vph)	54	257	0	161	612	47	105	145	0	135	99	0
Confl. Peds. (#/hr)			20	1								
Confl. Bikes (#/hr)			75			3						
Heavy Vehicles (%)	11%	4%	13%	6%	3%	3%	14%	5%	10%	4%	12%	41%
Turn Type	Split	NA		Split	NA	Perm	Split	NA		Split	NA	
Protected Phases	4	4		8	8		2	2		6	6	
Permitted Phases						8						
Actuated Green, G (s)	29.0	29.0		17.0	17.0	17.0	15.0	15.0		15.0	15.0	
Effective Green, g (s)	29.0	29.0		17.0	17.0	17.0	15.0	15.0		15.0	15.0	
Actuated g/C Ratio	0.30	0.30		0.18	0.18	0.18	0.16	0.16		0.16	0.16	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	491	966		301	620	273	247	473		271	456	
v/s Ratio Prot	0.03	c0.08		0.09	c0.17		c0.07	0.05		c0.08	0.03	
v/s Ratio Perm						0.03						
v/c Ratio	0.11	0.27		0.53	0.99	0.17	0.43	0.31		0.50	0.22	
Uniform Delay, d1	24.2	25.4		35.9	39.4	33.5	36.6	35.9		37.1	35.4	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.5	0.7		6.7	33.1	1.4	5.3	1.7		6.4	1.1	
Delay (s)	24.6	26.1		42.6	72.5	34.9	41.9	37.6		43.5	36.5	
Level of Service	C	C		D	E	C	D	D		D	D	
Approach Delay (s)		25.9			58.2			38.7			40.1	
Approach LOS		C			E			D			D	

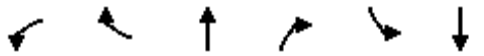
Intersection Summary			
HCM 2000 Control Delay	46.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	96.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	64.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	54	504	829	52	4	163
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	56	520	855	54	4	168
Pedestrians		2				
Lane Width (ft)		12.0				
Walking Speed (ft/s)		4.0				
Percent Blockage		0				
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		1120	405			
pX, platoon unblocked	0.89				0.89	0.89
vC, conflicting volume	908				1253	456
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	654				1041	147
tC, single (s)	4.9				7.5	7.0
tC, 2 stage (s)						
tF (s)	2.6				3.8	3.3
p0 queue free %	91				97	78
cM capacity (veh/h)	627				146	774

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	229	346	570	338	172
Volume Left	56	0	0	0	4
Volume Right	0	0	0	54	168
cSH	627	1700	1700	1700	702
Volume to Capacity	0.09	0.20	0.34	0.20	0.25
Queue Length 95th (ft)	7	0	0	0	24
Control Delay (s)	3.6	0.0	0.0	0.0	11.8
Lane LOS	A				B
Approach Delay (s)	1.4		0.0		11.8
Approach LOS					B

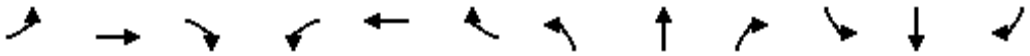
Intersection Summary			
Average Delay	1.7		
Intersection Capacity Utilization	60.8%	ICU Level of Service	B
Analysis Period (min)	15		



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	168	0	0	0	0	581
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	193	0	0	0	0	668
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			444			
pX, platoon unblocked						
vC, conflicting volume	334	0			0	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	334	0			0	
tC, single (s)	6.9	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	69	100			100	
cM capacity (veh/h)	628	1091			1636	

Direction, Lane #	WB 1	WB 2	SB 1	SB 2
Volume Total	97	97	334	334
Volume Left	97	97	0	0
Volume Right	0	0	0	0
cSH	628	628	1700	1700
Volume to Capacity	0.15	0.15	0.20	0.20
Queue Length 95th (ft)	14	14	0	0
Control Delay (s)	11.8	11.8	0.0	0.0
Lane LOS	B	B		
Approach Delay (s)	11.8		0.0	
Approach LOS	B			

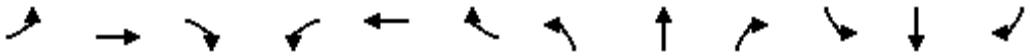
Intersection Summary			
Average Delay	2.6		
Intersection Capacity Utilization	27.5%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	236	132	154	540	0	0	0	0	127	386	230
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0		5.0	5.0						5.0	
Lane Util. Factor		0.95		1.00	0.95						0.95	
Frpb, ped/bikes		0.99		1.00	1.00						0.99	
Flpb, ped/bikes		1.00		1.00	1.00						1.00	
Frt		0.95		1.00	1.00						0.95	
Flt Protected		1.00		0.95	1.00						0.99	
Satd. Flow (prot)		3205		1766	3539						3260	
Flt Permitted		1.00		0.48	1.00						0.99	
Satd. Flow (perm)		3205		900	3539						3260	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	0	251	140	164	574	0	0	0	0	135	411	245
RTOR Reduction (vph)	0	69	0	0	0	0	0	0	0	0	47	0
Lane Group Flow (vph)	0	322	0	164	574	0	0	0	0	0	744	0
Confl. Peds. (#/hr)			4	4						4		2
Confl. Bikes (#/hr)			3			2						21
Heavy Vehicles (%)	3%	7%	4%	2%	2%	2%	2%	1%	1%	2%	5%	3%
Turn Type		NA		Perm	NA					Perm	NA	
Protected Phases		2			6						4	
Permitted Phases				6						4		
Actuated Green, G (s)		46.0		46.0	46.0						54.0	
Effective Green, g (s)		46.0		46.0	46.0						54.0	
Actuated g/C Ratio		0.42		0.42	0.42						0.49	
Clearance Time (s)		5.0		5.0	5.0						5.0	
Vehicle Extension (s)		3.0		3.0	3.0						3.0	
Lane Grp Cap (vph)		1340		376	1479						1600	
v/s Ratio Prot		0.10			0.16							
v/s Ratio Perm				c0.18							0.23	
v/c Ratio		0.24		0.44	0.39						0.47	
Uniform Delay, d1		20.7		22.8	22.2						18.5	
Progression Factor		1.00		0.38	0.38						1.00	
Incremental Delay, d2		0.4		0.7	0.2						1.0	
Delay (s)		21.1		9.3	8.5						19.4	
Level of Service		C		A	A						B	
Approach Delay (s)		21.1			8.7			0.0			19.4	
Approach LOS		C			A			A			B	

Intersection Summary			
HCM 2000 Control Delay	15.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	77.7%	ICU Level of Service	D
Analysis Period (min)	15		

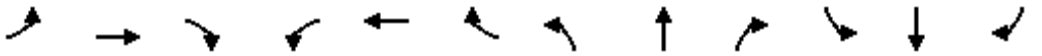
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	74	63	18	6	0	12	0	0	0	32	438	13
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	82	70	20	7	0	13	0	0	0	36	487	14
Pedestrians								1				
Lane Width (ft)								0.0				
Walking Speed (ft/s)								4.0				
Percent Blockage								0				
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											655	
pX, platoon unblocked												
vC, conflicting volume	578	565	252	370	572	0	501			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	578	565	252	370	572	0	501			0		
tC, single (s)	7.7	6.5	6.9	7.6	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.3	3.6	4.0	3.3	2.2			2.2		
p0 queue free %	78	84	97	99	100	99	100			98		
cM capacity (veh/h)	375	427	754	462	423	1091	1074			1636		

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	172	20	279	258
Volume Left	82	7	36	0
Volume Right	20	13	0	14
cSH	421	750	1636	1700
Volume to Capacity	0.41	0.03	0.02	0.15
Queue Length 95th (ft)	49	2	2	0
Control Delay (s)	19.4	9.9	1.1	0.0
Lane LOS	C	A	A	
Approach Delay (s)	19.4	9.9	0.6	
Approach LOS	C	A		

Intersection Summary				
Average Delay	5.3			
Intersection Capacity Utilization	33.2%	ICU Level of Service	A	
Analysis Period (min)	15			

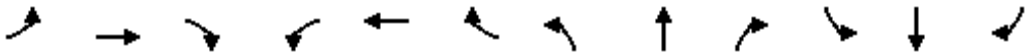


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	18	27	0	0	147	129	48	182	147	67	0	216
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0		5.0	5.0		4.0		4.0
Lane Util. Factor	1.00	0.95			0.95		0.91	0.91		1.00		0.88
Frpb, ped/bikes	1.00	1.00			0.99		1.00	1.00		1.00		1.00
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00		1.00		1.00
Frt	1.00	1.00			0.93		1.00	0.93		1.00		0.85
Flt Protected	0.95	1.00			1.00		0.95	1.00		0.95		1.00
Satd. Flow (prot)	1624	3471			3080		1441	2988		1543		2682
Flt Permitted	0.95	1.00			1.00		0.95	1.00		0.95		1.00
Satd. Flow (perm)	1624	3471			3080		1441	2988		1543		2682
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Adj. Flow (vph)	21	31	0	0	169	148	55	209	169	77	0	248
RTOR Reduction (vph)	0	0	0	0	125	0	0	111	0	0	0	229
Lane Group Flow (vph)	21	31	0	0	192	0	49	273	0	77	0	19
Confl. Peds. (#/hr)	6					6						
Confl. Bikes (#/hr)			6			3						
Heavy Vehicles (%)	0%	4%	0%	0%	9%	7%	14%	7%	9%	17%	0%	6%
Parking (#/hr)	0											
Turn Type	Split	NA			NA		Split	NA		Prot		custom
Protected Phases	4	4			8		2	2		6		6
Permitted Phases												
Actuated Green, G (s)	3.6	3.6			8.4		18.4	18.4		4.1		4.1
Effective Green, g (s)	3.6	3.6			8.4		18.4	18.4		4.1		4.1
Actuated g/C Ratio	0.07	0.07			0.16		0.34	0.34		0.08		0.08
Clearance Time (s)	5.0	5.0			5.0		5.0	5.0		4.0		4.0
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0		3.0
Lane Grp Cap (vph)	109	233			483		495	1027		118		205
v/s Ratio Prot	c0.01	0.01			c0.06		0.03	c0.09		c0.05		0.01
v/s Ratio Perm												
v/c Ratio	0.19	0.13			0.40		0.10	0.27		0.65		0.09
Uniform Delay, d1	23.6	23.5			20.3		11.9	12.7		24.0		23.0
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00		1.00
Incremental Delay, d2	0.9	0.3			0.5		0.4	0.6		12.2		0.2
Delay (s)	24.4	23.7			20.8		12.3	13.3		36.2		23.2
Level of Service	C	C			C		B	B		D		C
Approach Delay (s)		24.0			20.8			13.2			26.3	
Approach LOS		C			C			B			C	

Intersection Summary			
HCM 2000 Control Delay	19.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	53.5	Sum of lost time (s)	19.0
Intersection Capacity Utilization	39.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	11	31	1	16	31	47	0	9	26	38	13	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0		5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.99		1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00		1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.89		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		1.00		0.95	1.00	
Satd. Flow (prot)	1805	3610	793	1357	3471	1328		2621		1703	2356	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		1.00		0.95	1.00	
Satd. Flow (perm)	1805	3610	793	1357	3471	1328		2621		1703	2356	
Peak-hour factor, PHF	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Adj. Flow (vph)	13	38	1	20	38	57	0	11	32	46	16	1
RTOR Reduction (vph)	0	0	1	0	0	36	0	24	0	0	1	0
Lane Group Flow (vph)	13	38	0	20	38	21	0	19	0	46	16	0
Confl. Peds. (#/hr)			4	4								
Confl. Bikes (#/hr)			4			2						3
Heavy Vehicles (%)	0%	0%	100%	33%	4%	20%	0%	38%	17%	6%	55%	0%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8						
Actuated Green, G (s)	10.0	39.0	39.0	15.0	44.0	44.0		30.0		16.0	42.0	
Effective Green, g (s)	10.0	39.0	39.0	15.0	44.0	44.0		30.0		16.0	42.0	
Actuated g/C Ratio	0.08	0.32	0.32	0.12	0.37	0.37		0.25		0.13	0.35	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0		5.0		5.0	5.0	
Lane Grp Cap (vph)	150	1173	257	169	1272	486		655		227	824	
v/s Ratio Prot	0.01	0.01		c0.01	0.01			c0.01		c0.03	0.01	
v/s Ratio Perm			0.00			c0.02						
v/c Ratio	0.09	0.03	0.00	0.12	0.03	0.04		0.03		0.20	0.02	
Uniform Delay, d1	50.8	27.6	27.3	46.6	24.3	24.5		34.0		46.3	25.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2	1.1	0.1	0.0	1.4	0.0	0.2		0.1		2.0	0.0	
Delay (s)	51.9	27.7	27.4	48.1	24.4	24.6		34.1		48.3	25.6	
Level of Service	D	C	C	D	C	C		C		D	C	
Approach Delay (s)		33.7			28.6			34.1			42.2	
Approach LOS		C			C			C			D	

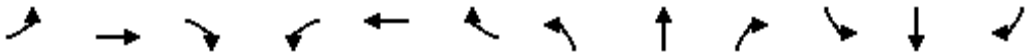
Intersection Summary			
HCM 2000 Control Delay	33.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.07		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	51.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	33	444	24	58	605	61	45	125	45	77	165	90
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0			5.0			5.0	
Lane Util. Factor		0.91			0.91			0.95			0.95	
Frpb, ped/bikes		1.00			1.00			1.00			0.99	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		0.99			0.99			0.97			0.96	
Flt Protected		1.00			1.00			0.99			0.99	
Satd. Flow (prot)		4951			4964			3443			3319	
Flt Permitted		0.86			0.85			0.85			0.84	
Satd. Flow (perm)		4276			4255			2951			2817	
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	33	448	24	59	611	62	45	126	45	78	167	91
RTOR Reduction (vph)	0	8	0	0	17	0	0	21	0	0	38	0
Lane Group Flow (vph)	0	497	0	0	715	0	0	195	0	0	298	0
Confl. Peds. (#/hr)	6		3	3		6	6		5	5		6
Confl. Bikes (#/hr)			15			13			14			11
Heavy Vehicles (%)	0%	4%	0%	0%	3%	0%	0%	0%	0%	2%	4%	0%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		19.3			19.3			33.6			33.6	
Effective Green, g (s)		19.3			19.3			33.6			33.6	
Actuated g/C Ratio		0.31			0.31			0.53			0.53	
Clearance Time (s)		5.0			5.0			5.0			5.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		1312			1305			1576			1504	
v/s Ratio Prot												
v/s Ratio Perm		0.12			c0.17			0.07			c0.11	
v/c Ratio		0.38			0.55			0.12			0.20	
Uniform Delay, d1		17.1			18.2			7.3			7.6	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		0.2			0.5			0.2			0.3	
Delay (s)		17.3			18.6			7.5			7.9	
Level of Service		B			B			A			A	
Approach Delay (s)		17.3			18.6			7.5			7.9	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	14.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.33		
Actuated Cycle Length (s)	62.9	Sum of lost time (s)	10.0
Intersection Capacity Utilization	82.7%	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												
Volume (veh/h)	0	0	0	0	164	9	4	425	0	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	0	0	0	0	189	10	5	489	0	0	0	0
Pedestrians		3			3						2	
Lane Width (ft)		0.0			12.0						0.0	
Walking Speed (ft/s)		4.0			4.0						4.0	
Percent Blockage		0			0						0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								536				
pX, platoon unblocked												
vC, conflicting volume	363	504	3	501	504	249	3			492		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	363	504	3	501	504	249	3			492		
tC, single (s)	7.5	6.5	6.9	7.6	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	60	99	100			100		
cM capacity (veh/h)	387	471	1086	444	471	755	1632			1080		

Direction, Lane #	WB 1	WB 2	NB 1	NB 2
Volume Total	126	73	167	326
Volume Left	0	0	5	0
Volume Right	0	10	0	0
cSH	471	497	1632	1700
Volume to Capacity	0.27	0.15	0.00	0.19
Queue Length 95th (ft)	27	13	0	0
Control Delay (s)	15.4	13.5	0.2	0.0
Lane LOS	C	B	A	
Approach Delay (s)	14.7		0.1	
Approach LOS	B			

Intersection Summary				
Average Delay	4.3			
Intersection Capacity Utilization	27.5%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	153	211	0	0	582	82	113	269	137	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0			5.0				
Lane Util. Factor		0.91			0.95			0.95				
Frpb, ped/bikes		1.00			1.00			0.99				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		1.00			0.98			0.96				
Flt Protected		0.98			1.00			0.99				
Satd. Flow (prot)		4823			3468			3359				
Flt Permitted		0.66			1.00			0.99				
Satd. Flow (perm)		3262			3468			3359				
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	163	224	0	0	619	87	120	286	146	0	0	0
RTOR Reduction (vph)	0	0	0	0	10	0	0	33	0	0	0	0
Lane Group Flow (vph)	0	387	0	0	696	0	0	519	0	0	0	0
Confl. Peds. (#/hr)	1					1			8			
Confl. Bikes (#/hr)			2			2			27			
Heavy Vehicles (%)	3%	7%	4%	2%	2%	2%	2%	1%	1%	2%	5%	3%
Turn Type	Perm	NA			NA		Perm	NA				
Protected Phases		2			6			8				
Permitted Phases	2						8					
Actuated Green, G (s)		46.0			46.0			54.0				
Effective Green, g (s)		46.0			46.0			54.0				
Actuated g/C Ratio		0.42			0.42			0.49				
Clearance Time (s)		5.0			5.0			5.0				
Vehicle Extension (s)		3.0			3.0			3.0				
Lane Grp Cap (vph)		1364			1450			1648				
v/s Ratio Prot					c0.20							
v/s Ratio Perm		0.12						0.15				
v/c Ratio		0.28			0.48			0.31				
Uniform Delay, d1		21.1			23.3			16.9				
Progression Factor		0.90			1.00			1.00				
Incremental Delay, d2		0.5			0.3			0.1				
Delay (s)		19.4			23.5			17.0				
Level of Service		B			C			B				
Approach Delay (s)		19.4			23.5			17.0			0.0	
Approach LOS		B			C			B			A	

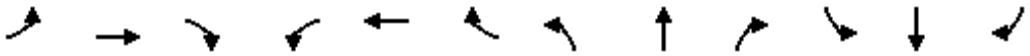
Intersection Summary			
HCM 2000 Control Delay	20.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	57.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	62	76	0	0	1	0	4	346	27	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	69	84	0	0	1	0	4	384	30	0	0	0
Pedestrians		9			13							
Lane Width (ft)		12.0			12.0							
Walking Speed (ft/s)		4.0			4.0							
Percent Blockage		1			1							
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											608	
pX, platoon unblocked												
vC, conflicting volume	211	445	9	464	430	220	9			427		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	211	445	9	464	430	220	9			427		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	90	83	100	100	100	100	100			100		
cM capacity (veh/h)	710	500	1069	412	510	781	1612			1130		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	153	1	197	222
Volume Left	69	0	4	0
Volume Right	0	0	0	30
cSH	576	510	1612	1700
Volume to Capacity	0.27	0.00	0.00	0.13
Queue Length 95th (ft)	27	0	0	0
Control Delay (s)	13.5	12.1	0.2	0.0
Lane LOS	B	B	A	
Approach Delay (s)	13.5	12.1	0.1	
Approach LOS	B	B		

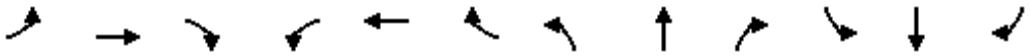
Intersection Summary				
Average Delay	3.7			
Intersection Capacity Utilization	32.3%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	145	0	21	0	0	0	25	552	1	0	108	104
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0				5.0	5.0			5.0	
Lane Util. Factor		1.00	1.00				1.00	0.95			0.95	
Frpb, ped/bikes		1.00	0.96				1.00	1.00			0.97	
Flpb, ped/bikes		0.98	1.00				0.98	1.00			1.00	
Frt		1.00	0.85				1.00	1.00			0.93	
Flt Protected		0.95	1.00				0.95	1.00			1.00	
Satd. Flow (prot)		1739	1164				1181	2735			2599	
Flt Permitted		0.76	1.00				0.61	1.00			1.00	
Satd. Flow (perm)		1386	1164				758	2735			2599	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.92
Adj. Flow (vph)	154	0	22	0	0	0	27	587	1	0	115	113
RTOR Reduction (vph)	0	0	13	0	0	0	0	0	0	0	63	0
Lane Group Flow (vph)	0	154	9	0	0	0	27	588	0	0	165	0
Confl. Peds. (#/hr)	20		20	20		20	20		20	20		20
Confl. Bikes (#/hr)			20			20			20			20
Heavy Vehicles (%)	2%	0%	33%	0%	0%	0%	50%	32%	0%	0%	49%	0%
Turn Type	Perm	NA	Perm	Perm			Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2			6		
Actuated Green, G (s)		29.0	29.0				31.0	31.0			31.0	
Effective Green, g (s)		29.0	29.0				31.0	31.0			31.0	
Actuated g/C Ratio		0.41	0.41				0.44	0.44			0.44	
Clearance Time (s)		5.0	5.0				5.0	5.0			5.0	
Lane Grp Cap (vph)		574	482				335	1211			1150	
v/s Ratio Prot								c0.21			0.06	
v/s Ratio Perm		c0.11	0.01				0.04					
v/c Ratio		0.27	0.02				0.08	0.49			0.14	
Uniform Delay, d1		13.5	12.1				11.3	13.8			11.6	
Progression Factor		1.00	1.00				1.00	1.00			1.00	
Incremental Delay, d2		1.1	0.1				0.5	1.4			0.3	
Delay (s)		14.7	12.2				11.7	15.2			11.9	
Level of Service		B	B				B	B			B	
Approach Delay (s)		14.3			0.0			15.1			11.9	
Approach LOS		B			A			B			B	

Intersection Summary			
HCM 2000 Control Delay	14.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.38		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	51.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

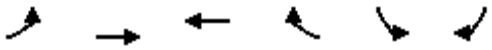


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	6	302	112	121	688	40	321	64	240	68	26	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.96	1.00	1.00		1.00	1.00	0.97	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	0.90	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.97	1.00	0.95	1.00	
Satd. Flow (prot)	1504	3505	1435	1433	3360		1618	1356	1265	1517	1398	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.97	1.00	0.95	1.00	
Satd. Flow (perm)	1504	3505	1435	1433	3360		1618	1356	1265	1517	1398	
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)	6	318	118	127	724	42	338	67	253	72	27	58
RTOR Reduction (vph)	0	0	94	0	3	0	0	0	197	0	46	0
Lane Group Flow (vph)	6	318	24	127	763	0	199	206	56	72	39	0
Confl. Peds. (#/hr)			20						20			
Heavy Vehicles (%)	20%	3%	8%	26%	3%	68%	6%	76%	24%	19%	50%	9%
Turn Type	Prot	NA	Perm	Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		6	6		2	2	
Permitted Phases			4						6			
Actuated Green, G (s)	1.1	18.5	18.5	12.9	30.3		19.8	19.8	19.8	18.6	18.6	
Effective Green, g (s)	1.1	18.5	18.5	12.9	30.3		19.8	19.8	19.8	18.6	18.6	
Actuated g/C Ratio	0.01	0.21	0.21	0.14	0.34		0.22	0.22	0.22	0.21	0.21	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	18	722	295	205	1133		356	298	278	314	289	
v/s Ratio Prot	0.00	0.09		c0.09	c0.23		0.12	c0.15		c0.05	0.03	
v/s Ratio Perm			0.02						0.04			
v/c Ratio	0.33	0.44	0.08	0.62	0.67		0.56	0.69	0.20	0.23	0.13	
Uniform Delay, d1	44.0	31.1	28.8	36.1	25.5		31.1	32.2	28.5	29.6	29.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	10.6	0.4	0.1	5.5	1.6		1.9	6.8	0.4	1.7	1.0	
Delay (s)	54.6	31.6	28.9	41.6	27.1		33.0	38.9	28.9	31.3	30.0	
Level of Service	D	C	C	D	C		C	D	C	C	C	
Approach Delay (s)		31.2			29.2			33.3			30.6	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	30.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	89.8	Sum of lost time (s)	20.0
Intersection Capacity Utilization	57.5%	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												
Volume (vph)	121	404	91	186	699	217	103	177	374	137	77	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	0.98		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	1.00	0.85	1.00	0.90		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1433	3188		1626	3438	1495	1444	2823		1612	2744	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1433	3188		1626	3438	1495	1444	2823		1612	2744	
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)	125	416	94	192	721	224	106	182	386	141	79	28
RTOR Reduction (vph)	0	20	0	0	0	184	0	326	0	0	24	0
Lane Group Flow (vph)	125	490	0	192	721	40	106	242	0	141	83	0
Confl. Peds. (#/hr)			20	1								
Confl. Bikes (#/hr)			75									
Heavy Vehicles (%)	26%	8%	10%	11%	5%	8%	25%	23%	11%	12%	18%	50%
Turn Type	Split	NA		Split	NA	Perm	Split	NA		Split	NA	
Protected Phases	4	4		8	8		2	2		6	6	
Permitted Phases						8						
Actuated Green, G (s)	29.0	29.0		17.0	17.0	17.0	15.0	15.0		15.0	15.0	
Effective Green, g (s)	29.0	29.0		17.0	17.0	17.0	15.0	15.0		15.0	15.0	
Actuated g/C Ratio	0.30	0.30		0.18	0.18	0.18	0.16	0.16		0.16	0.16	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	432	963		287	608	264	225	441		251	428	
v/s Ratio Prot	0.09	c0.15		0.12	c0.21		0.07	c0.09		c0.09	0.03	
v/s Ratio Perm						0.03						
v/c Ratio	0.29	0.51		0.67	1.19	0.15	0.47	0.55		0.56	0.19	
Uniform Delay, d1	25.6	27.6		36.9	39.5	33.4	36.9	37.4		37.5	35.2	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.7	1.9		11.7	99.5	1.2	6.9	4.9		8.8	1.0	
Delay (s)	27.3	29.5		48.6	139.0	34.6	43.8	42.2		46.3	36.3	
Level of Service	C	C		D	F	C	D	D		D	D	
Approach Delay (s)		29.1			103.2			42.5			41.9	
Approach LOS		C			F			D			D	

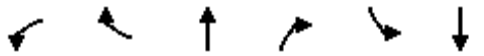
Intersection Summary			
HCM 2000 Control Delay	64.9	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	96.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	75.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	104	859	902	36	3	203
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	112	924	970	39	3	218
Pedestrians					2	
Lane Width (ft)					12.0	
Walking Speed (ft/s)					4.0	
Percent Blockage					0	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		1120	405			
pX, platoon unblocked	0.88				0.88	0.88
vC, conflicting volume	1011				1677	506
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	736				1494	162
tC, single (s)	4.9				6.8	7.1
tC, 2 stage (s)						
tF (s)	2.6				3.5	3.4
p0 queue free %	81				96	70
cM capacity (veh/h)	575				82	725

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	420	616	647	362	222
Volume Left	112	0	0	0	3
Volume Right	0	0	0	39	218
cSH	575	1700	1700	1700	651
Volume to Capacity	0.19	0.36	0.38	0.21	0.34
Queue Length 95th (ft)	18	0	0	0	38
Control Delay (s)	5.6	0.0	0.0	0.0	13.4
Lane LOS	A				B
Approach Delay (s)	2.3		0.0		13.4
Approach LOS					B

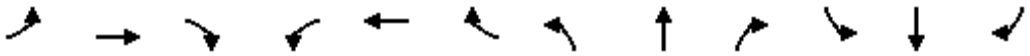
Intersection Summary			
Average Delay	2.3		
Intersection Capacity Utilization	75.6%	ICU Level of Service	D
Analysis Period (min)	15		



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	192	0	0	0	0	629
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	198	0	0	0	0	648
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			444			
pX, platoon unblocked						
vC, conflicting volume	324	0			0	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	324	0			0	
tC, single (s)	6.9	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	69	100			100	
cM capacity (veh/h)	639	1091			1636	

Direction, Lane #	WB 1	WB 2	SB 1	SB 2
Volume Total	99	99	324	324
Volume Left	99	99	0	0
Volume Right	0	0	0	0
cSH	639	639	1700	1700
Volume to Capacity	0.15	0.15	0.19	0.19
Queue Length 95th (ft)	14	14	0	0
Control Delay (s)	11.7	11.7	0.0	0.0
Lane LOS	B	B		
Approach Delay (s)	11.7		0.0	
Approach LOS	B			

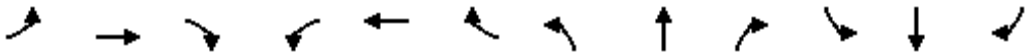
Intersection Summary			
Average Delay	2.7		
Intersection Capacity Utilization	34.4%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	591	142	133	634	0	0	0	0	145	477	188
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0		5.0	5.0						5.0	
Lane Util. Factor		0.95		1.00	0.95						0.95	
Frpb, ped/bikes		1.00		1.00	1.00						0.99	
Flpb, ped/bikes		1.00		1.00	1.00						1.00	
Frt		0.97		1.00	1.00						0.97	
Flt Protected		1.00		0.95	1.00						0.99	
Satd. Flow (prot)		3325		1770	3471						3371	
Flt Permitted		1.00		0.28	1.00						0.99	
Satd. Flow (perm)		3325		516	3471						3371	
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)	0	616	148	139	660	0	0	0	0	151	497	196
RTOR Reduction (vph)	0	19	0	0	0	0	0	0	0	0	26	0
Lane Group Flow (vph)	0	745	0	139	660	0	0	0	0	0	818	0
Confl. Peds. (#/hr)										7		3
Confl. Bikes (#/hr)						1						36
Heavy Vehicles (%)	6%	6%	3%	2%	4%	1%	3%	4%	1%	4%	1%	1%
Turn Type		NA		Perm	NA					Perm	NA	
Protected Phases		2			6						4	
Permitted Phases				6						4		
Actuated Green, G (s)		51.0		51.0	51.0						49.0	
Effective Green, g (s)		51.0		51.0	51.0						49.0	
Actuated g/C Ratio		0.46		0.46	0.46						0.45	
Clearance Time (s)		5.0		5.0	5.0						5.0	
Vehicle Extension (s)		3.0		3.0	3.0						3.0	
Lane Grp Cap (vph)		1541		239	1609						1501	
v/s Ratio Prot		0.22			0.19							
v/s Ratio Perm				c0.27							0.24	
v/c Ratio		0.48		0.58	0.41						0.54	
Uniform Delay, d1		20.4		21.7	19.5						22.3	
Progression Factor		1.00		0.51	0.43						1.00	
Incremental Delay, d2		1.1		8.7	0.7						1.4	
Delay (s)		21.5		19.7	9.1						23.8	
Level of Service		C		B	A						C	
Approach Delay (s)		21.5			11.0			0.0			23.8	
Approach LOS		C			B			A			C	

Intersection Summary			
HCM 2000 Control Delay	18.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	68.2%	ICU Level of Service	C
Analysis Period (min)	15		

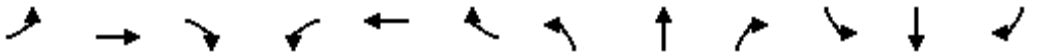
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	38	86	9	5	1	0	0	0	0	8	540	3
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	41	92	10	5	1	0	0	0	0	9	581	3
Pedestrians		3						1				
Lane Width (ft)		12.0						0.0				
Walking Speed (ft/s)		4.0						4.0				
Percent Blockage		0						0				
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											655	
pX, platoon unblocked												
vC, conflicting volume	603	602	296	364	604	0	587			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	603	602	296	364	604	0	587			0		
tC, single (s)	7.7	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	89	78	99	99	100	100	100			99		
cM capacity (veh/h)	367	413	705	464	412	1091	996			1636		

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	143	6	299	294
Volume Left	41	5	9	0
Volume Right	10	0	0	3
cSH	410	454	1636	1700
Volume to Capacity	0.35	0.01	0.01	0.17
Queue Length 95th (ft)	38	1	0	0
Control Delay (s)	18.4	13.0	0.3	0.0
Lane LOS	C	B	A	
Approach Delay (s)	18.4	13.0	0.1	
Approach LOS	C	B		

Intersection Summary				
Average Delay	3.8			
Intersection Capacity Utilization	28.9%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	143	100	0	0	112	134	107	320	95	93	0	209
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0		5.0	5.0		5.0		5.0
Lane Util. Factor	1.00	0.95			0.95		0.91	0.91		1.00		0.88
Frpb, ped/bikes	1.00	1.00			0.99		1.00	1.00		1.00		1.00
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00		1.00		1.00
Frt	1.00	1.00			0.92		1.00	0.97		1.00		0.85
Flt Protected	0.95	1.00			1.00		0.95	1.00		0.95		1.00
Satd. Flow (prot)	1160	3195			2744		1014	2884		1570		2349
Flt Permitted	0.95	1.00			1.00		0.95	1.00		0.95		1.00
Satd. Flow (perm)	1160	3195			2744		1014	2884		1570		2349
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	159	111	0	0	124	149	119	356	106	103	0	232
RTOR Reduction (vph)	0	0	0	0	131	0	0	21	0	0	0	199
Lane Group Flow (vph)	159	111	0	0	142	0	107	453	0	103	0	33
Confl. Peds. (#/hr)							4					4
Confl. Bikes (#/hr)			6			3						
Heavy Vehicles (%)	40%	13%	0%	0%	18%	21%	62%	15%	13%	15%	0%	21%
Parking (#/hr)	0											
Turn Type	Split	NA			NA		Split	NA		Prot		custom
Protected Phases	4	4			8		2	2		6		6
Permitted Phases												
Actuated Green, G (s)	15.8	15.8			8.9		17.2	17.2		10.1		10.1
Effective Green, g (s)	15.8	15.8			8.9		17.2	17.2		10.1		10.1
Actuated g/C Ratio	0.22	0.22			0.12		0.24	0.24		0.14		0.14
Clearance Time (s)	5.0	5.0			5.0		5.0	5.0		5.0		5.0
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0		3.0
Lane Grp Cap (vph)	254	701			339		242	688		220		329
v/s Ratio Prot	c0.14	0.03			c0.05		0.11	c0.16		c0.07		0.01
v/s Ratio Perm												
v/c Ratio	0.63	0.16			0.42		0.44	0.66		0.47		0.10
Uniform Delay, d1	25.4	22.7			29.2		23.3	24.8		28.5		27.0
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00		1.00
Incremental Delay, d2	4.8	0.1			0.8		5.8	4.9		1.6		0.1
Delay (s)	30.2	22.8			30.0		29.1	29.7		30.1		27.1
Level of Service	C	C			C		C	C		C		C
Approach Delay (s)		27.2			30.0			29.5			28.0	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	28.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	72.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	47.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	171	198	36	28	60	86	6	229	157	210	128	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1245	2375	832	1107	2201	1062	1003	1970		1203	1870	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1245	2375	832	1107	2201	1062	1003	1970		1203	1870	
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	188	218	40	31	66	95	7	252	173	231	141	0
RTOR Reduction (vph)	0	0	27	0	0	83	0	102	0	0	0	0
Lane Group Flow (vph)	188	218	13	31	66	12	7	323	0	231	141	0
Confl. Bikes (#/hr)						1						
Heavy Vehicles (%)	45%	52%	94%	63%	64%	50%	80%	79%	62%	50%	93%	0%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8						
Actuated Green, G (s)	39.0	39.0	39.0	15.0	15.0	15.0	29.0	29.0		17.0	17.0	
Effective Green, g (s)	39.0	39.0	39.0	15.0	15.0	15.0	29.0	29.0		17.0	17.0	
Actuated g/C Ratio	0.32	0.32	0.32	0.12	0.12	0.12	0.24	0.24		0.14	0.14	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	404	771	270	138	275	132	242	476		170	264	
v/s Ratio Prot	c0.15	c0.09		0.03	0.03		0.01	c0.16		c0.19	0.08	
v/s Ratio Perm			0.02			0.01						
v/c Ratio	0.47	0.28	0.05	0.22	0.24	0.09	0.03	0.68		1.36	0.53	
Uniform Delay, d1	32.2	30.1	27.8	47.3	47.4	46.5	34.7	41.3		51.5	47.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	3.8	0.9	0.3	3.7	2.1	1.3	0.2	7.6		194.7	7.5	
Delay (s)	36.0	31.0	28.1	51.0	49.4	47.8	35.0	48.9		246.2	55.4	
Level of Service	D	C	C	D	D	D	C	D		F	E	
Approach Delay (s)		32.9			48.9			48.7			173.9	
Approach LOS		C			D			D			F	

Intersection Summary			
HCM 2000 Control Delay	76.1	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	52.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	73	638	55	76	755	64	37	251	69	79	232	91
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0			5.0			5.0	
Lane Util. Factor		0.91			0.91			0.95			0.95	
Frpb, ped/bikes		1.00			1.00			1.00			0.99	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		0.99			0.99			0.97			0.97	
Flt Protected		1.00			1.00			0.99			0.99	
Satd. Flow (prot)		4859			4994			3362			3285	
Flt Permitted		0.75			0.79			0.88			0.81	
Satd. Flow (perm)		3675			3944			2985			2686	
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)	77	672	58	80	795	67	39	264	73	83	244	96
RTOR Reduction (vph)	0	13	0	0	13	0	0	23	0	0	29	0
Lane Group Flow (vph)	0	794	0	0	929	0	0	353	0	0	394	0
Confl. Peds. (#/hr)	20		12	12		20	17		11	11		17
Confl. Bikes (#/hr)			10			8			12			9
Heavy Vehicles (%)	2%	5%	7%	2%	2%	2%	2%	3%	4%	2%	3%	9%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		24.2			24.2			33.3			33.3	
Effective Green, g (s)		24.2			24.2			33.3			33.3	
Actuated g/C Ratio		0.36			0.36			0.49			0.49	
Clearance Time (s)		5.0			5.0			5.0			5.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		1317			1413			1472			1325	
v/s Ratio Prot												
v/s Ratio Perm		0.22			c0.24			0.12			c0.15	
v/c Ratio		0.60			0.66			0.24			0.30	
Uniform Delay, d1		17.7			18.2			9.8			10.2	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		0.8			1.1			0.4			0.6	
Delay (s)		18.5			19.3			10.2			10.7	
Level of Service		B			B			B			B	
Approach Delay (s)		18.5			19.3			10.2			10.7	
Approach LOS		B			B			B			B	

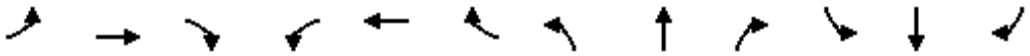
Intersection Summary			
HCM 2000 Control Delay	16.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	67.5	Sum of lost time (s)	10.0
Intersection Capacity Utilization	94.7%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	187	12	5	768	0	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	0	0	0	0	193	12	5	792	0	0	0	0
Pedestrians		16			1						3	
Lane Width (ft)		0.0			12.0						0.0	
Walking Speed (ft/s)		4.0			4.0						4.0	
Percent Blockage		0			0						0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								536				
pX, platoon unblocked												
vC, conflicting volume	534	819	16	803	819	400	16			793		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	534	819	16	803	819	400	16			793		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	38	98	100			100		
cM capacity (veh/h)	214	311	1066	277	311	605	1615			836		

Direction, Lane #	WB 1	WB 2	NB 1	NB 2
Volume Total	129	77	269	528
Volume Left	0	0	5	0
Volume Right	0	12	0	0
cSH	311	338	1615	1700
Volume to Capacity	0.41	0.23	0.00	0.31
Queue Length 95th (ft)	49	21	0	0
Control Delay (s)	24.5	18.8	0.2	0.0
Lane LOS	C	C	A	
Approach Delay (s)	22.3		0.1	
Approach LOS	C			

Intersection Summary				
Average Delay	4.6			
Intersection Capacity Utilization	34.4%	ICU Level of Service	A	
Analysis Period (min)	15			

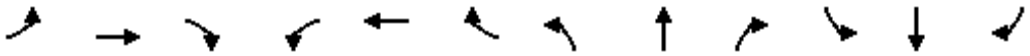


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	325	410	0	0	628	131	138	521	162	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0			5.0				
Lane Util. Factor		0.91			0.95			0.95				
Frpb, ped/bikes		1.00			1.00			0.99				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		1.00			0.97			0.97				
Flt Protected		0.98			1.00			0.99				
Satd. Flow (prot)		4786			3390			3339				
Flt Permitted		0.66			1.00			0.99				
Satd. Flow (perm)		3237			3390			3339				
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)	339	427	0	0	654	136	144	543	169	0	0	0
RTOR Reduction (vph)	0	0	0	0	16	0	0	19	0	0	0	0
Lane Group Flow (vph)	0	766	0	0	774	0	0	837	0	0	0	0
Confl. Peds. (#/hr)	2					2			4	4		
Confl. Bikes (#/hr)			1						44			
Heavy Vehicles (%)	6%	6%	3%	2%	4%	1%	3%	4%	1%	4%	1%	1%
Turn Type	Perm	NA			NA		Perm	NA				
Protected Phases		2			6			8				
Permitted Phases	2						8					
Actuated Green, G (s)		51.0			51.0			49.0				
Effective Green, g (s)		51.0			51.0			49.0				
Actuated g/C Ratio		0.46			0.46			0.45				
Clearance Time (s)		5.0			5.0			5.0				
Vehicle Extension (s)		3.0			3.0			3.0				
Lane Grp Cap (vph)		1500			1571			1487				
v/s Ratio Prot					0.23							
v/s Ratio Perm		c0.24						0.25				
v/c Ratio		1.54dl			0.49			0.56				
Uniform Delay, d1		20.7			20.5			22.6				
Progression Factor		0.48			1.00			1.00				
Incremental Delay, d2		1.1			1.1			0.5				
Delay (s)		11.0			21.6			23.1				
Level of Service		B			C			C				
Approach Delay (s)		11.0			21.6			23.1			0.0	
Approach LOS		B			C			C			A	

Intersection Summary			
HCM 2000 Control Delay	18.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	80.1%	ICU Level of Service	D
Analysis Period (min)	15		

dl Defacto Left Lane. Recode with 1 though lane as a left lane.

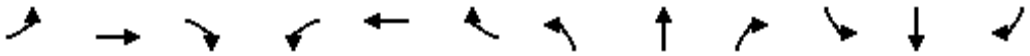
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	124	0	0	0	1	5	6	692	3	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	133	0	0	0	1	5	6	744	3	0	0	0
Pedestrians		12			1						1	
Lane Width (ft)		12.0			12.0						0.0	
Walking Speed (ft/s)		4.0			4.0						4.0	
Percent Blockage		1			0						0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											608	
pX, platoon unblocked												
vC, conflicting volume	404	773	12	760	772	376	12			748		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	404	773	12	760	772	376	12			748		
tC, single (s)	7.7	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	73	100	100	100	100	99	100			100		
cM capacity (veh/h)	500	327	1061	295	328	627	1604			869		

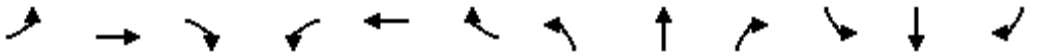
Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	133	6	378	375
Volume Left	133	0	6	0
Volume Right	0	5	0	3
cSH	500	544	1604	1700
Volume to Capacity	0.27	0.01	0.00	0.22
Queue Length 95th (ft)	27	1	0	0
Control Delay (s)	14.8	11.7	0.2	0.0
Lane LOS	B	B	A	
Approach Delay (s)	14.8	11.7	0.1	
Approach LOS	B	B		

Intersection Summary				
Average Delay	2.4			
Intersection Capacity Utilization	39.6%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	243	0	49	0	0	0	43	138	0	0	69	197
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0				5.0	5.0			5.0	
Lane Util. Factor		1.00	1.00				1.00	0.95			0.95	
Frpb, ped/bikes		1.00	0.96				1.00	1.00			0.95	
Flpb, ped/bikes		0.98	1.00				0.98	1.00			1.00	
Frt		1.00	0.85				1.00	1.00			0.89	
Flt Protected		0.95	1.00				0.95	1.00			1.00	
Satd. Flow (prot)		1773	1549				1517	3471			2963	
Flt Permitted		0.76	1.00				0.57	1.00			1.00	
Satd. Flow (perm)		1414	1549				907	3471			2963	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	276	0	56	0	0	0	49	157	0	0	78	224
RTOR Reduction (vph)	0	0	32	0	0	0	0	0	0	0	128	0
Lane Group Flow (vph)	0	276	24	0	0	0	49	157	0	0	174	0
Confl. Peds. (#/hr)	20		20	20		20	20		20	20		20
Confl. Bikes (#/hr)			20			20			20			20
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	17%	4%	0%	0%	13%	0%
Turn Type	Perm	NA	Perm	Perm			Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2			6		
Actuated Green, G (s)		30.0	30.0				30.0	30.0			30.0	
Effective Green, g (s)		30.0	30.0				30.0	30.0			30.0	
Actuated g/C Ratio		0.43	0.43				0.43	0.43			0.43	
Clearance Time (s)		5.0	5.0				5.0	5.0			5.0	
Lane Grp Cap (vph)		606	663				388	1487			1269	
v/s Ratio Prot								0.05			c0.06	
v/s Ratio Perm		c0.20	0.02				0.05					
v/c Ratio		0.46	0.04				0.13	0.11			0.14	
Uniform Delay, d1		14.2	11.6				12.1	12.0			12.1	
Progression Factor		1.00	1.00				1.00	1.00			1.00	
Incremental Delay, d2		2.5	0.1				0.7	0.1			0.2	
Delay (s)		16.7	11.7				12.8	12.1			12.4	
Level of Service		B	B				B	B			B	
Approach Delay (s)		15.8			0.0			12.3			12.4	
Approach LOS		B			A			B			B	

Intersection Summary			
HCM 2000 Control Delay	13.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	59.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			



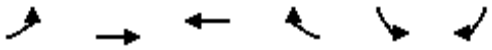
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	32	216	83	164	623	26	99	15	230	44	14	22
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.96	1.00	1.00		1.00	1.00	0.97	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	0.91	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.96	1.00	0.95	1.00	
Satd. Flow (prot)	1357	3471	1468	1687	3410		1649	1502	1449	1433	1343	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.96	1.00	0.95	1.00	
Satd. Flow (perm)	1357	3471	1468	1687	3410		1649	1502	1449	1433	1343	
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)	35	235	90	178	677	28	108	16	250	48	15	24
RTOR Reduction (vph)	0	0	68	0	2	0	0	0	149	0	22	0
Lane Group Flow (vph)	35	235	22	178	703	0	62	62	101	48	17	0
Confl. Peds. (#/hr)			20						20			
Heavy Vehicles (%)	33%	4%	6%	7%	4%	35%	4%	50%	8%	26%	45%	18%
Turn Type	Prot	NA	Perm	Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		6	6		2	2	
Permitted Phases			4						6			
Actuated Green, G (s)	4.6	24.0	24.0	8.3	27.7		40.4	40.4	40.4	7.3	7.3	
Effective Green, g (s)	4.6	24.0	24.0	8.3	27.7		40.4	40.4	40.4	7.3	7.3	
Actuated g/C Ratio	0.05	0.24	0.24	0.08	0.28		0.40	0.40	0.40	0.07	0.07	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	62	833	352	140	944		666	606	585	104	98	
v/s Ratio Prot	0.03	0.07		c0.11	c0.21		0.04	0.04		c0.03	0.01	
v/s Ratio Perm			0.01						c0.07			
v/c Ratio	0.56	0.28	0.06	1.27	0.74		0.09	0.10	0.17	0.46	0.17	
Uniform Delay, d1	46.7	31.0	29.3	45.9	32.9		18.5	18.5	19.1	44.5	43.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	11.2	0.2	0.1	166.4	3.2		0.3	0.3	0.6	3.2	0.8	
Delay (s)	58.0	31.2	29.4	212.2	36.1		18.7	18.9	19.7	47.7	44.3	
Level of Service	E	C	C	F	D		B	B	B	D	D	
Approach Delay (s)		33.3			71.6			19.4			46.2	
Approach LOS		C			E			B			D	

Intersection Summary			
HCM 2000 Control Delay	50.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	59.7%	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												
Volume (vph)	70	308	76	151	678	250	107	109	173	127	88	44
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	0.98		1.00	1.00	0.98	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	1.00	0.85	1.00	0.91		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1626	3256		1703	3505	1543	1583	3033		1736	2819	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1626	3256		1703	3505	1543	1583	3033		1736	2819	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	74	328	81	161	721	266	114	116	184	135	94	47
RTOR Reduction (vph)	0	22	0	0	0	219	0	155	0	0	40	0
Lane Group Flow (vph)	74	387	0	161	721	47	114	145	0	135	101	0
Confl. Peds. (#/hr)			20	1								
Confl. Bikes (#/hr)			75			3						
Heavy Vehicles (%)	11%	4%	13%	6%	3%	3%	14%	5%	10%	4%	12%	41%
Turn Type	Split	NA		Split	NA	Perm	Split	NA		Split	NA	
Protected Phases	4	4		8	8		2	2		6	6	
Permitted Phases						8						
Actuated Green, G (s)	29.0	29.0		17.0	17.0	17.0	15.0	15.0		15.0	15.0	
Effective Green, g (s)	29.0	29.0		17.0	17.0	17.0	15.0	15.0		15.0	15.0	
Actuated g/C Ratio	0.30	0.30		0.18	0.18	0.18	0.16	0.16		0.16	0.16	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	491	983		301	620	273	247	473		271	440	
v/s Ratio Prot	0.05	c0.12		0.09	c0.21		c0.07	0.05		c0.08	0.04	
v/s Ratio Perm						0.03						
v/c Ratio	0.15	0.39		0.53	1.16	0.17	0.46	0.31		0.50	0.23	
Uniform Delay, d1	24.5	26.5		35.9	39.5	33.5	36.8	35.9		37.1	35.4	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.6	1.2		6.7	90.2	1.4	6.1	1.7		6.4	1.2	
Delay (s)	25.1	27.7		42.6	129.7	34.9	42.9	37.6		43.5	36.7	
Level of Service	C	C		D	F	C	D	D		D	D	
Approach Delay (s)		27.3			95.5			39.0			40.0	
Approach LOS		C			F			D			D	

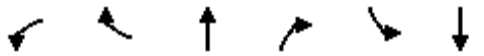
Intersection Summary			
HCM 2000 Control Delay	64.6	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	96.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	64.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	54	608	932	52	4	163
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	56	627	961	54	4	168
Pedestrians		2				
Lane Width (ft)		12.0				
Walking Speed (ft/s)		4.0				
Percent Blockage		0				
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		1120	405			
pX, platoon unblocked	0.87				0.87	0.87
vC, conflicting volume	1014				1412	509
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	710				1169	127
tC, single (s)	4.9				7.5	7.0
tC, 2 stage (s)						
tF (s)	2.6				3.8	3.3
p0 queue free %	90				96	78
cM capacity (veh/h)	576				114	776

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	265	418	641	374	172
Volume Left	56	0	0	0	4
Volume Right	0	0	0	54	168
cSH	576	1700	1700	1700	681
Volume to Capacity	0.10	0.25	0.38	0.22	0.25
Queue Length 95th (ft)	8	0	0	0	25
Control Delay (s)	3.5	0.0	0.0	0.0	12.1
Lane LOS	A				B
Approach Delay (s)	1.4		0.0		12.1
Approach LOS					B

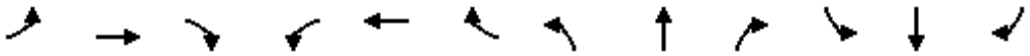
Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	66.5%	ICU Level of Service	C
Analysis Period (min)	15		



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	168	0	0	0	0	595
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	193	0	0	0	0	684
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			444			
pX, platoon unblocked						
vC, conflicting volume	342	0			0	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	342	0			0	
tC, single (s)	6.9	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	69	100			100	
cM capacity (veh/h)	620	1091			1636	

Direction, Lane #	WB 1	WB 2	SB 1	SB 2
Volume Total	97	97	342	342
Volume Left	97	97	0	0
Volume Right	0	0	0	0
cSH	620	620	1700	1700
Volume to Capacity	0.16	0.16	0.20	0.20
Queue Length 95th (ft)	14	14	0	0
Control Delay (s)	11.9	11.9	0.0	0.0
Lane LOS	B	B		
Approach Delay (s)	11.9		0.0	
Approach LOS	B			

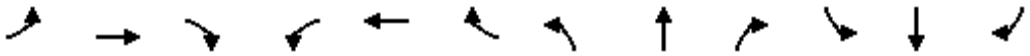
Intersection Summary			
Average Delay	2.6		
Intersection Capacity Utilization	27.9%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	333	139	154	629	0	0	0	0	127	386	244
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0		5.0	5.0						5.0	
Lane Util. Factor		0.95		1.00	0.95						0.95	
Frpb, ped/bikes		0.99		1.00	1.00						0.99	
Flpb, ped/bikes		1.00		1.00	1.00						1.00	
Frt		0.96		1.00	1.00						0.95	
Flt Protected		1.00		0.95	1.00						0.99	
Satd. Flow (prot)		3235		1767	3539						3253	
Flt Permitted		1.00		0.41	1.00						0.99	
Satd. Flow (perm)		3235		756	3539						3253	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	0	354	148	164	669	0	0	0	0	135	411	260
RTOR Reduction (vph)	0	42	0	0	0	0	0	0	0	0	52	0
Lane Group Flow (vph)	0	460	0	164	669	0	0	0	0	0	754	0
Confl. Peds. (#/hr)			4	4						4		2
Confl. Bikes (#/hr)			3			2						21
Heavy Vehicles (%)	3%	7%	4%	2%	2%	2%	2%	1%	1%	2%	5%	3%
Turn Type		NA		Perm	NA					Perm	NA	
Protected Phases		2			6						4	
Permitted Phases				6						4		
Actuated Green, G (s)		46.0		46.0	46.0						54.0	
Effective Green, g (s)		46.0		46.0	46.0						54.0	
Actuated g/C Ratio		0.42		0.42	0.42						0.49	
Clearance Time (s)		5.0		5.0	5.0						5.0	
Vehicle Extension (s)		3.0		3.0	3.0						3.0	
Lane Grp Cap (vph)		1352		316	1479						1596	
v/s Ratio Prot		0.14			0.19							
v/s Ratio Perm				c0.22							0.23	
v/c Ratio		0.34		0.52	0.45						0.47	
Uniform Delay, d1		21.7		23.8	23.0						18.6	
Progression Factor		1.00		0.36	0.35						1.00	
Incremental Delay, d2		0.7		1.3	0.2						1.0	
Delay (s)		22.4		9.9	8.2						19.6	
Level of Service		C		A	A						B	
Approach Delay (s)		22.4			8.6			0.0			19.6	
Approach LOS		C			A			A			B	

Intersection Summary			
HCM 2000 Control Delay	15.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	77.7%	ICU Level of Service	D
Analysis Period (min)	15		

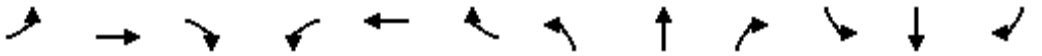
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	74	63	18	6	0	12	0	0	0	32	445	13
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	82	70	20	7	0	13	0	0	0	36	494	14
Pedestrians								1				
Lane Width (ft)								0.0				
Walking Speed (ft/s)								4.0				
Percent Blockage								0				
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											655	
pX, platoon unblocked												
vC, conflicting volume	586	573	255	374	580	0	509			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	586	573	255	374	580	0	509			0		
tC, single (s)	7.7	6.5	6.9	7.6	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.3	3.6	4.0	3.3	2.2			2.2		
p0 queue free %	78	83	97	99	100	99	100			98		
cM capacity (veh/h)	370	423	750	458	419	1091	1066			1636		

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	172	20	283	262
Volume Left	82	7	36	0
Volume Right	20	13	0	14
cSH	416	747	1636	1700
Volume to Capacity	0.41	0.03	0.02	0.15
Queue Length 95th (ft)	50	2	2	0
Control Delay (s)	19.6	10.0	1.1	0.0
Lane LOS	C	A	A	
Approach Delay (s)	19.6	10.0	0.6	
Approach LOS	C	A		

Intersection Summary				
Average Delay	5.3			
Intersection Capacity Utilization	33.4%	ICU Level of Service	A	
Analysis Period (min)	15			

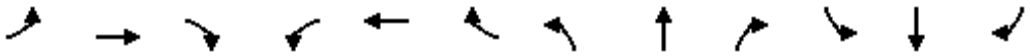


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	18	32	0	0	152	137	78	182	147	74	0	216
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0		5.0	5.0		4.0		4.0
Lane Util. Factor	1.00	0.95			0.95		0.91	0.91		1.00		0.88
Frpb, ped/bikes	1.00	1.00			0.99		1.00	1.00		1.00		1.00
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00		1.00		1.00
Frt	1.00	1.00			0.93		1.00	0.93		1.00		0.85
Flt Protected	0.95	1.00			1.00		0.95	1.00		0.95		1.00
Satd. Flow (prot)	1624	3471			3077		1441	2988		1543		2682
Flt Permitted	0.95	1.00			1.00		0.95	1.00		0.95		1.00
Satd. Flow (perm)	1624	3471			3077		1441	2988		1543		2682
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Adj. Flow (vph)	21	37	0	0	175	157	90	209	169	85	0	248
RTOR Reduction (vph)	0	0	0	0	132	0	0	111	0	0	0	229
Lane Group Flow (vph)	21	37	0	0	200	0	81	276	0	85	0	19
Confl. Peds. (#/hr)	6					6						
Confl. Bikes (#/hr)			6			3						
Heavy Vehicles (%)	0%	4%	0%	0%	9%	7%	14%	7%	9%	17%	0%	6%
Parking (#/hr)	0											
Turn Type	Split	NA			NA		Split	NA		Prot		custom
Protected Phases	4	4			8		2	2		6		6
Permitted Phases												
Actuated Green, G (s)	3.6	3.6			8.7		18.5	18.5		4.1		4.1
Effective Green, g (s)	3.6	3.6			8.7		18.5	18.5		4.1		4.1
Actuated g/C Ratio	0.07	0.07			0.16		0.34	0.34		0.08		0.08
Clearance Time (s)	5.0	5.0			5.0		5.0	5.0		4.0		4.0
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0		3.0
Lane Grp Cap (vph)	108	231			496		494	1025		117		204
v/s Ratio Prot	c0.01	0.01			c0.07		0.06	c0.09		c0.06		0.01
v/s Ratio Perm												
v/c Ratio	0.19	0.16			0.40		0.16	0.27		0.73		0.09
Uniform Delay, d1	23.8	23.7			20.3		12.3	12.8		24.4		23.2
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00		1.00
Incremental Delay, d2	0.9	0.3			0.5		0.7	0.6		20.0		0.2
Delay (s)	24.7	24.1			20.8		13.0	13.5		44.3		23.4
Level of Service	C	C			C		B	B		D		C
Approach Delay (s)		24.3			20.8			13.4			28.7	
Approach LOS		C			C			B			C	

Intersection Summary			
HCM 2000 Control Delay	20.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.35		
Actuated Cycle Length (s)	53.9	Sum of lost time (s)	19.0
Intersection Capacity Utilization	40.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	11	31	1	16	31	82	0	9	26	72	13	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0		5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.99		1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00		1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.89		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		1.00		0.95	1.00	
Satd. Flow (prot)	1805	3610	793	1357	3471	1328		2621		1703	2356	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		1.00		0.95	1.00	
Satd. Flow (perm)	1805	3610	793	1357	3471	1328		2621		1703	2356	
Peak-hour factor, PHF	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Adj. Flow (vph)	13	38	1	20	38	100	0	11	32	88	16	1
RTOR Reduction (vph)	0	0	1	0	0	63	0	24	0	0	1	0
Lane Group Flow (vph)	13	38	0	20	38	37	0	19	0	88	16	0
Confl. Peds. (#/hr)			4	4								
Confl. Bikes (#/hr)			4			2						3
Heavy Vehicles (%)	0%	0%	100%	33%	4%	20%	0%	38%	17%	6%	55%	0%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8						
Actuated Green, G (s)	10.0	39.0	39.0	15.0	44.0	44.0		30.0		16.0	42.0	
Effective Green, g (s)	10.0	39.0	39.0	15.0	44.0	44.0		30.0		16.0	42.0	
Actuated g/C Ratio	0.08	0.32	0.32	0.12	0.37	0.37		0.25		0.13	0.35	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0		5.0		5.0	5.0	
Lane Grp Cap (vph)	150	1173	257	169	1272	486		655		227	824	
v/s Ratio Prot	0.01	0.01		c0.01	0.01			c0.01		c0.05	0.01	
v/s Ratio Perm			0.00			c0.03						
v/c Ratio	0.09	0.03	0.00	0.12	0.03	0.08		0.03		0.39	0.02	
Uniform Delay, d1	50.8	27.6	27.3	46.6	24.3	24.8		34.0		47.5	25.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2	1.1	0.1	0.0	1.4	0.0	0.3		0.1		4.9	0.0	
Delay (s)	51.9	27.7	27.4	48.1	24.4	25.1		34.1		52.5	25.6	
Level of Service	D	C	C	D	C	C		C		D	C	
Approach Delay (s)		33.7			27.8			34.1			48.1	
Approach LOS		C			C			C			D	

Intersection Summary			
HCM 2000 Control Delay	35.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.12		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	51.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	77	483	24	58	670	61	45	125	45	77	165	106
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0			5.0			5.0	
Lane Util. Factor		0.91			0.91			0.95			0.95	
Frpb, ped/bikes		1.00			1.00			1.00			0.99	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		0.99			0.99			0.97			0.95	
Flt Protected		0.99			1.00			0.99			0.99	
Satd. Flow (prot)		4951			4970			3443			3304	
Flt Permitted		0.75			0.85			0.84			0.84	
Satd. Flow (perm)		3733			4233			2938			2813	
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	78	488	24	59	677	62	45	126	45	78	167	107
RTOR Reduction (vph)	0	7	0	0	16	0	0	21	0	0	50	0
Lane Group Flow (vph)	0	583	0	0	782	0	0	195	0	0	302	0
Confl. Peds. (#/hr)	6		3	3		6	6		5	5		6
Confl. Bikes (#/hr)			15			13			14			11
Heavy Vehicles (%)	0%	4%	0%	0%	3%	0%	0%	0%	0%	2%	4%	0%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		20.6			20.6			33.5			33.5	
Effective Green, g (s)		20.6			20.6			33.5			33.5	
Actuated g/C Ratio		0.32			0.32			0.52			0.52	
Clearance Time (s)		5.0			5.0			5.0			5.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		1199			1360			1535			1470	
v/s Ratio Prot												
v/s Ratio Perm		0.16			c0.18			0.07			c0.11	
v/c Ratio		0.49			0.58			0.13			0.21	
Uniform Delay, d1		17.5			18.1			7.8			8.2	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		0.3			0.6			0.2			0.3	
Delay (s)		17.8			18.7			8.0			8.5	
Level of Service		B			B			A			A	
Approach Delay (s)		17.8			18.7			8.0			8.5	
Approach LOS		B			B			A			A	

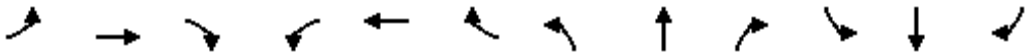
Intersection Summary			
HCM 2000 Control Delay	15.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.35		
Actuated Cycle Length (s)	64.1	Sum of lost time (s)	10.0
Intersection Capacity Utilization	85.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	164	9	4	438	0	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	0	0	0	0	189	10	5	503	0	0	0	0
Pedestrians		3			3						2	
Lane Width (ft)		0.0			12.0						0.0	
Walking Speed (ft/s)		4.0			4.0						4.0	
Percent Blockage		0			0						0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								536				
pX, platoon unblocked												
vC, conflicting volume	371	519	3	516	519	257	3			506		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	371	519	3	516	519	257	3			506		
tC, single (s)	7.5	6.5	6.9	7.6	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	59	99	100			100		
cM capacity (veh/h)	379	462	1086	433	462	747	1632			1066		

Direction, Lane #	WB 1	WB 2	NB 1	NB 2
Volume Total	126	73	172	336
Volume Left	0	0	5	0
Volume Right	0	10	0	0
cSH	462	488	1632	1700
Volume to Capacity	0.27	0.15	0.00	0.20
Queue Length 95th (ft)	27	13	0	0
Control Delay (s)	15.7	13.7	0.2	0.0
Lane LOS	C	B	A	
Approach Delay (s)	14.9		0.1	
Approach LOS	B			

Intersection Summary				
Average Delay	4.3			
Intersection Capacity Utilization	27.9%	ICU Level of Service	A	
Analysis Period (min)	15			

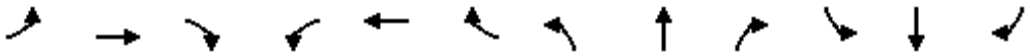


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	166	293	0	0	663	82	121	269	137	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0			5.0				
Lane Util. Factor		0.91			0.95			0.95				
Frpb, ped/bikes		1.00			1.00			0.99				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		1.00			0.98			0.96				
Flt Protected		0.98			1.00			0.99				
Satd. Flow (prot)		4826			3476			3359				
Flt Permitted		0.66			1.00			0.99				
Satd. Flow (perm)		3245			3476			3359				
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	177	312	0	0	705	87	129	286	146	0	0	0
RTOR Reduction (vph)	0	0	0	0	9	0	0	32	0	0	0	0
Lane Group Flow (vph)	0	489	0	0	783	0	0	529	0	0	0	0
Confl. Peds. (#/hr)	1					1			8			
Confl. Bikes (#/hr)			2			2			27			
Heavy Vehicles (%)	3%	7%	4%	2%	2%	2%	2%	1%	1%	2%	5%	3%
Turn Type	Perm	NA			NA		Perm	NA				
Protected Phases		2			6			8				
Permitted Phases	2						8					
Actuated Green, G (s)		46.0			46.0			54.0				
Effective Green, g (s)		46.0			46.0			54.0				
Actuated g/C Ratio		0.42			0.42			0.49				
Clearance Time (s)		5.0			5.0			5.0				
Vehicle Extension (s)		3.0			3.0			3.0				
Lane Grp Cap (vph)		1357			1453			1648				
v/s Ratio Prot					c0.23							
v/s Ratio Perm		0.15						0.16				
v/c Ratio		0.95dl			0.54			0.32				
Uniform Delay, d1		21.9			24.0			16.9				
Progression Factor		0.65			1.00			1.00				
Incremental Delay, d2		0.7			0.4			0.1				
Delay (s)		15.0			24.4			17.0				
Level of Service		B			C			B				
Approach Delay (s)		15.0			24.4			17.0			0.0	
Approach LOS		B			C			B			A	

Intersection Summary			
HCM 2000 Control Delay	19.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	60.4%	ICU Level of Service	B
Analysis Period (min)	15		

dl Defacto Left Lane. Recode with 1 though lane as a left lane.

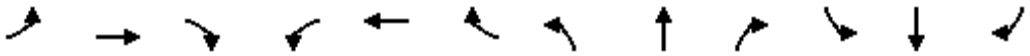
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	62	76	0	0	1	0	4	354	27	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	69	84	0	0	1	0	4	393	30	0	0	0
Pedestrians		9			13							
Lane Width (ft)		12.0			12.0							
Walking Speed (ft/s)		4.0			4.0							
Percent Blockage		1			1							
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											608	
pX, platoon unblocked												
vC, conflicting volume	215	454	9	472	439	225	9			436		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	215	454	9	472	439	225	9			436		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	90	83	100	100	100	100	100			100		
cM capacity (veh/h)	705	494	1069	406	504	776	1612			1122		

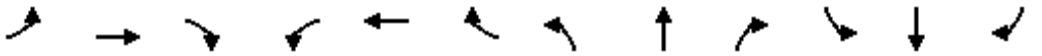
Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	153	1	201	227
Volume Left	69	0	4	0
Volume Right	0	0	0	30
cSH	571	504	1612	1700
Volume to Capacity	0.27	0.00	0.00	0.13
Queue Length 95th (ft)	27	0	0	0
Control Delay (s)	13.6	12.2	0.2	0.0
Lane LOS	B	B	A	
Approach Delay (s)	13.6	12.2	0.1	
Approach LOS	B	B		

Intersection Summary				
Average Delay	3.7			
Intersection Capacity Utilization	32.5%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	109	0	10	0	0	0	7	724	2	0	141	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0				5.0	5.0			5.0	
Lane Util. Factor		1.00	1.00				1.00	0.95			0.95	
Frpb, ped/bikes		1.00	0.99				1.00	1.00			1.00	
Flpb, ped/bikes		1.00	1.00				1.00	1.00			1.00	
Frt		1.00	0.85				1.00	1.00			0.99	
Flt Protected		0.95	1.00				0.95	1.00			1.00	
Satd. Flow (prot)		1767	1199				1202	2735			2461	
Flt Permitted		0.76	1.00				0.65	1.00			1.00	
Satd. Flow (perm)		1408	1199				820	2735			2461	
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)	115	0	11	0	0	0	7	762	2	0	148	16
RTOR Reduction (vph)	0	0	7	0	0	0	0	1	0	0	9	0
Lane Group Flow (vph)	0	115	4	0	0	0	7	763	0	0	155	0
Confl. Peds. (#/hr)	2		1	1		2	1		2	2		1
Confl. Bikes (#/hr)									1			1
Heavy Vehicles (%)	2%	0%	33%	0%	0%	0%	50%	32%	0%	0%	49%	0%
Turn Type	Perm	NA	Perm	Perm			Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2			6		
Actuated Green, G (s)		25.0	25.0				30.0	30.0			30.0	
Effective Green, g (s)		25.0	25.0				30.0	30.0			30.0	
Actuated g/C Ratio		0.38	0.38				0.46	0.46			0.46	
Clearance Time (s)		5.0	5.0				5.0	5.0			5.0	
Lane Grp Cap (vph)		541	461				378	1262			1135	
v/s Ratio Prot								c0.28			0.06	
v/s Ratio Perm		c0.08	0.00				0.01					
v/c Ratio		0.21	0.01				0.02	0.60			0.14	
Uniform Delay, d1		13.4	12.4				9.5	13.1			10.1	
Progression Factor		1.00	1.00				1.00	1.00			1.00	
Incremental Delay, d2		0.9	0.0				0.1	2.2			0.3	
Delay (s)		14.3	12.4				9.6	15.2			10.3	
Level of Service		B	B				A	B			B	
Approach Delay (s)		14.1			0.0			15.2			10.3	
Approach LOS		B			A			B			B	

Intersection Summary			
HCM 2000 Control Delay	14.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	51.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	8	393	118	66	900	52	407	84	249	89	34	72
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	0.90	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.97	1.00	0.95	1.00	
Satd. Flow (prot)	1504	3505	1495	1433	3360		1618	1346	1302	1517	1397	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.97	1.00	0.95	1.00	
Satd. Flow (perm)	1504	3505	1495	1433	3360		1618	1346	1302	1517	1397	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	8	414	124	69	947	55	428	88	262	94	36	76
RTOR Reduction (vph)	0	0	86	0	4	0	0	0	193	0	68	0
Lane Group Flow (vph)	8	414	38	69	998	0	257	259	69	94	44	0
Heavy Vehicles (%)	20%	3%	8%	26%	3%	68%	6%	76%	24%	19%	50%	9%
Turn Type	Prot	NA	Perm	Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		6	6		2	2	
Permitted Phases			4						6			
Actuated Green, G (s)	0.7	24.1	24.1	5.6	29.0		20.9	20.9	20.9	8.2	8.2	
Effective Green, g (s)	0.7	24.1	24.1	5.6	29.0		20.9	20.9	20.9	8.2	8.2	
Actuated g/C Ratio	0.01	0.31	0.31	0.07	0.37		0.27	0.27	0.27	0.10	0.10	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	13	1071	457	101	1236		429	356	345	157	145	
v/s Ratio Prot	0.01	0.12		c0.05	c0.30		0.16	c0.19		c0.06	0.03	
v/s Ratio Perm			0.03						0.05			
v/c Ratio	0.62	0.39	0.08	0.68	0.81		0.60	0.73	0.20	0.60	0.30	
Uniform Delay, d1	38.9	21.5	19.5	35.7	22.4		25.3	26.4	22.5	33.7	32.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	64.0	0.2	0.1	17.4	4.0		2.3	7.2	0.3	15.7	5.3	
Delay (s)	103.0	21.8	19.6	53.1	26.3		27.5	33.6	22.8	49.5	38.0	
Level of Service	F	C	B	D	C		C	C	C	D	D	
Approach Delay (s)		22.5			28.1			27.9			43.2	
Approach LOS		C			C			C			D	

Intersection Summary			
HCM 2000 Control Delay	28.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	78.8	Sum of lost time (s)	20.0
Intersection Capacity Utilization	62.5%	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												
Volume (vph)	148	475	116	240	840	281	129	232	487	176	101	24
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	1.00	0.85	1.00	0.90		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1433	3223		1626	3438	1495	1444	2823		1612	2822	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1433	3223		1626	3438	1495	1444	2823		1612	2822	
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)	153	490	120	247	866	290	133	239	502	181	104	25
RTOR Reduction (vph)	0	23	0	0	0	241	0	349	0	0	21	0
Lane Group Flow (vph)	153	587	0	247	866	49	133	392	0	181	108	0
Confl. Peds. (#/hr)			1	1								
Confl. Bikes (#/hr)			3									
Heavy Vehicles (%)	26%	8%	10%	11%	5%	8%	25%	23%	11%	12%	18%	50%
Turn Type	Split	NA		Split	NA	Perm	Split	NA		Split	NA	
Protected Phases	4	4		8	8		2	2		6	6	
Permitted Phases						8						
Actuated Green, G (s)	29.0	29.0		16.0	16.0	16.0	15.0	15.0		15.0	15.0	
Effective Green, g (s)	29.0	29.0		16.0	16.0	16.0	15.0	15.0		15.0	15.0	
Actuated g/C Ratio	0.31	0.31		0.17	0.17	0.17	0.16	0.16		0.16	0.16	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	437	983		273	579	251	228	445		254	445	
v/s Ratio Prot	0.11	c0.18		0.15	c0.25		0.09	c0.14		c0.11	0.04	
v/s Ratio Perm						0.03						
v/c Ratio	0.35	0.60		0.90	1.50	0.19	0.58	0.88		0.71	0.24	
Uniform Delay, d1	25.7	28.0		38.8	39.5	34.0	37.1	39.1		38.0	35.0	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.2	2.7		34.6	232.1	1.7	10.5	21.3		15.7	1.3	
Delay (s)	27.9	30.7		73.4	271.6	35.7	47.6	60.4		53.6	36.3	
Level of Service	C	C		E	F	D	D	E		D	D	
Approach Delay (s)		30.1			187.9			58.4			46.4	
Approach LOS		C			F			E			D	

Intersection Summary			
HCM 2000 Control Delay	105.1	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	86.0%	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												
Volume (veh/h)	128	1008	67	30	1079	17	54	0	22	3	7	232
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	135	1061	71	32	1136	18	57	0	23	3	7	244
Pedestrians								2			2	
Lane Width (ft)								12.0			12.0	
Walking Speed (ft/s)								4.0			4.0	
Percent Blockage								0			0	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		1120			405							
pX, platoon unblocked	0.88			0.97			0.89	0.89	0.97	0.89	0.89	0.88
vC, conflicting volume	1156			1134			2247	2587	568	2033	2613	579
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	901			1077			2009	2390	494	1770	2419	244
tC, single (s)	4.9			4.1			7.9	6.5	7.1	7.5	6.5	7.1
tC, 2 stage (s)												
tF (s)	2.6			2.2			3.7	4.0	3.4	3.5	4.0	3.4
p0 queue free %	72			95			0	100	95	91	63	62
cM capacity (veh/h)	485			635			9	21	489	35	20	640

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total	665	601	599	586	80	255
Volume Left	135	0	32	0	57	3
Volume Right	0	71	0	18	23	244
cSH	485	1700	635	1700	12	303
Volume to Capacity	0.28	0.35	0.05	0.34	6.66	0.84
Queue Length 95th (ft)	28	0	4	0	Err	180
Control Delay (s)	8.0	0.0	1.4	0.0	Err	56.8
Lane LOS	A		A		F	F
Approach Delay (s)	4.2		0.7		Err	56.8
Approach LOS					F	F

Intersection Summary				
Average Delay	294.5			
Intersection Capacity Utilization	97.5%	ICU Level of Service	F	
Analysis Period (min)	15			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	252	0	0	0	0	806
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	260	0	0	0	0	831
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			444			
pX, platoon unblocked						
vC, conflicting volume	415	0			0	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	415	0			0	
tC, single (s)	6.9	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	54	100			100	
cM capacity (veh/h)	560	1091			1636	

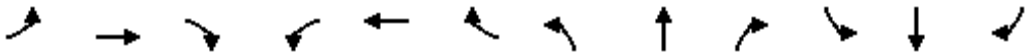
Direction, Lane #	WB 1	WB 2	SB 1	SB 2
Volume Total	130	130	415	415
Volume Left	130	130	0	0
Volume Right	0	0	0	0
cSH	560	560	1700	1700
Volume to Capacity	0.23	0.23	0.24	0.24
Queue Length 95th (ft)	22	22	0	0
Control Delay (s)	13.4	13.4	0.0	0.0
Lane LOS	B	B		
Approach Delay (s)	13.4		0.0	
Approach LOS	B			

Intersection Summary			
Average Delay	3.2		
Intersection Capacity Utilization	42.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	748	116	160	739	0	0	0	0	186	622	235
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0		5.0	5.0						5.0	
Lane Util. Factor		0.91		1.00	0.95						0.95	
Frpb, ped/bikes		1.00		1.00	1.00						0.99	
Flpb, ped/bikes		1.00		1.00	1.00						1.00	
Frt		0.98		1.00	1.00						0.97	
Flt Protected		1.00		0.95	1.00						0.99	
Satd. Flow (prot)		4813		1770	3471						3372	
Flt Permitted		1.00		0.28	1.00						0.99	
Satd. Flow (perm)		4813		516	3471						3372	
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)	0	779	121	167	770	0	0	0	0	194	648	245
RTOR Reduction (vph)	0	20	0	0	0	0	0	0	0	0	26	0
Lane Group Flow (vph)	0	880	0	167	770	0	0	0	0	0	1061	0
Confl. Peds. (#/hr)										7		3
Confl. Bikes (#/hr)						1						36
Heavy Vehicles (%)	6%	6%	3%	2%	4%	1%	3%	4%	1%	4%	1%	1%
Turn Type		NA		Perm	NA					Perm	NA	
Protected Phases		2			6						4	
Permitted Phases				6						4		
Actuated Green, G (s)		59.0		59.0	59.0						36.0	
Effective Green, g (s)		59.0		59.0	59.0						36.0	
Actuated g/C Ratio		0.56		0.56	0.56						0.34	
Clearance Time (s)		5.0		5.0	5.0						5.0	
Vehicle Extension (s)		3.0		3.0	3.0						3.0	
Lane Grp Cap (vph)		2704		289	1950						1156	
v/s Ratio Prot		0.18			0.22							
v/s Ratio Perm				c0.32							0.31	
v/c Ratio		0.33		0.58	0.39						0.92	
Uniform Delay, d1		12.3		14.9	12.9						33.1	
Progression Factor		1.00		0.63	0.48						1.00	
Incremental Delay, d2		0.3		7.5	0.5						12.9	
Delay (s)		12.7		16.8	6.7						46.0	
Level of Service		B		B	A						D	
Approach Delay (s)		12.7			8.5			0.0			46.0	
Approach LOS		B			A			A			D	

Intersection Summary			
HCM 2000 Control Delay	23.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	112.9%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	109	12	7	2	0	0	0	0	10	702	3
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	115	13	7	2	0	0	0	0	11	739	3
Pedestrians		3						1				
Lane Width (ft)		12.0						0.0				
Walking Speed (ft/s)		4.0						4.0				
Percent Blockage		0						0				
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											655	
pX, platoon unblocked												
vC, conflicting volume	766	765	375	462	766	0	745			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	766	765	375	462	766	0	745			0		
tC, single (s)	7.7	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	66	98	98	99	100	100			99		
cM capacity (veh/h)	278	333	627	348	332	1091	870			1636		

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	127	9	380	373
Volume Left	0	7	11	0
Volume Right	13	0	0	3
cSH	349	344	1636	1700
Volume to Capacity	0.36	0.03	0.01	0.22
Queue Length 95th (ft)	41	2	0	0
Control Delay (s)	21.1	15.7	0.3	0.0
Lane LOS	C	C	A	
Approach Delay (s)	21.1	15.7	0.1	
Approach LOS	C	C		

Intersection Summary				
Average Delay	3.3			
Intersection Capacity Utilization	33.2%	ICU Level of Service	A	
Analysis Period (min)	15			

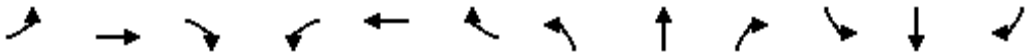
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	168	115	0	0	129	153	106	373	111	106	0	243
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0		5.0	5.0		5.0		5.0
Lane Util. Factor	1.00	0.95			0.95		0.91	0.91		1.00		0.88
Frpb, ped/bikes	1.00	1.00			0.99		1.00	1.00		1.00		1.00
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00		1.00		1.00
Frt	1.00	1.00			0.92		1.00	0.97		1.00		0.85
Flt Protected	0.95	1.00			1.00		0.95	1.00		0.95		1.00
Satd. Flow (prot)	1160	3195			2746		1014	2889		1570		2349
Flt Permitted	0.95	1.00			1.00		0.95	1.00		0.95		1.00
Satd. Flow (perm)	1160	3195			2746		1014	2889		1570		2349
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)	177	121	0	0	136	161	112	393	117	112	0	256
RTOR Reduction (vph)	0	0	0	0	141	0	0	21	0	0	0	220
Lane Group Flow (vph)	177	121	0	0	156	0	101	500	0	112	0	36
Confl. Peds. (#/hr)							4					4
Confl. Bikes (#/hr)			6			3						
Heavy Vehicles (%)	40%	13%	0%	0%	18%	21%	62%	15%	13%	15%	0%	21%
Parking (#/hr)	0											
Turn Type	Split	NA			NA		Split	NA		Prot		custom
Protected Phases	4	4			8		2	2		6		6
Permitted Phases												
Actuated Green, G (s)	17.1	17.1			9.3		18.1	18.1		10.7		10.7
Effective Green, g (s)	17.1	17.1			9.3		18.1	18.1		10.7		10.7
Actuated g/C Ratio	0.23	0.23			0.12		0.24	0.24		0.14		0.14
Clearance Time (s)	5.0	5.0			5.0		5.0	5.0		5.0		5.0
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0		3.0
Lane Grp Cap (vph)	263	726			339		244	695		223		334
v/s Ratio Prot	c0.15	0.04			c0.06		0.10	c0.17		c0.07		0.02
v/s Ratio Perm												
v/c Ratio	0.67	0.17			0.46		0.41	0.72		0.50		0.11
Uniform Delay, d1	26.5	23.3			30.6		24.1	26.2		29.8		28.1
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00		1.00
Incremental Delay, d2	6.6	0.1			1.0		5.1	6.3		1.8		0.1
Delay (s)	33.1	23.4			31.6		29.2	32.6		31.6		28.2
Level of Service	C	C			C		C	C		C		C
Approach Delay (s)		29.2			31.6			32.0			29.3	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	30.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	75.2	Sum of lost time (s)	20.0
Intersection Capacity Utilization	51.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	201	233	43	34	71	78	7	269	185	232	150	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1245	2375	832	1107	2201	1062	1003	1970		1203	1870	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1245	2375	832	1107	2201	1062	1003	1970		1203	1870	
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)	212	245	45	36	75	82	7	283	195	244	158	0
RTOR Reduction (vph)	0	0	30	0	0	72	0	102	0	0	0	0
Lane Group Flow (vph)	212	245	15	36	75	10	7	376	0	244	158	0
Confl. Bikes (#/hr)						1						
Heavy Vehicles (%)	45%	52%	94%	63%	64%	50%	80%	79%	62%	50%	93%	0%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8						
Actuated Green, G (s)	39.0	39.0	39.0	15.0	15.0	15.0	29.0	29.0		17.0	17.0	
Effective Green, g (s)	39.0	39.0	39.0	15.0	15.0	15.0	29.0	29.0		17.0	17.0	
Actuated g/C Ratio	0.32	0.32	0.32	0.12	0.12	0.12	0.24	0.24		0.14	0.14	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	404	771	270	138	275	132	242	476		170	264	
v/s Ratio Prot	c0.17	c0.10		0.03	0.03		0.01	c0.19		c0.20	0.08	
v/s Ratio Perm			0.02			0.01						
v/c Ratio	0.52	0.32	0.05	0.26	0.27	0.08	0.03	0.79		1.44	0.60	
Uniform Delay, d1	33.0	30.5	27.8	47.5	47.6	46.4	34.7	42.6		51.5	48.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	4.8	1.1	0.4	4.5	2.4	1.1	0.2	12.5		226.1	9.6	
Delay (s)	37.8	31.6	28.2	52.0	50.0	47.5	35.0	55.1		277.6	57.9	
Level of Service	D	C	C	D	D	D	C	E		F	E	
Approach Delay (s)		33.9			49.3			54.8			191.3	
Approach LOS		C			D			D			F	

Intersection Summary			
HCM 2000 Control Delay	82.2	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	57.4%	ICU Level of Service	B
Analysis Period (min)	15		

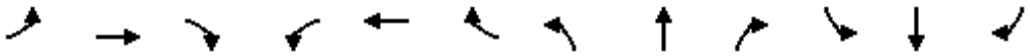
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	74	811	72	99	931	84	49	329	91	104	304	108
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0		4.0	5.0		4.0	5.0		4.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.99		1.00	0.97		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3378		1770	3471		1770	1770		1770	1724	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3378		1770	3471		1770	1770		1770	1724	
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)	78	854	76	104	980	88	52	346	96	109	320	114
RTOR Reduction (vph)	0	7	0	0	7	0	0	10	0	0	13	0
Lane Group Flow (vph)	78	923	0	104	1061	0	52	432	0	109	421	0
Confl. Peds. (#/hr)	20		12	12		20	17		11	11		17
Confl. Bikes (#/hr)			10			8			12			9
Heavy Vehicles (%)	2%	5%	7%	2%	2%	2%	2%	3%	4%	2%	3%	9%
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	5.4	34.8		4.0	33.4		3.9	33.1		4.0	33.2	
Effective Green, g (s)	5.4	34.8		4.0	33.4		3.9	33.1		4.0	33.2	
Actuated g/C Ratio	0.06	0.37		0.04	0.36		0.04	0.35		0.04	0.35	
Clearance Time (s)	4.0	5.0		4.0	5.0		4.0	5.0		4.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	101	1251		75	1234		73	623		75	609	
v/s Ratio Prot	0.04	0.27		c0.06	c0.31		0.03	0.24		c0.06	c0.24	
v/s Ratio Perm												
v/c Ratio	0.77	0.74		1.39	0.86		0.71	0.69		1.45	0.69	
Uniform Delay, d1	43.6	25.6		45.0	28.1		44.4	26.0		45.0	26.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	29.9	2.3		237.1	6.2		27.8	6.2		263.6	6.3	
Delay (s)	73.5	27.9		282.1	34.3		72.3	32.3		308.5	32.3	
Level of Service	E	C		F	C		E	C		F	C	
Approach Delay (s)		31.4			56.3			36.5			87.7	
Approach LOS		C			E			D			F	

Intersection Summary				
HCM 2000 Control Delay	50.8	HCM 2000 Level of Service	D	
HCM 2000 Volume to Capacity ratio	0.83			
Actuated Cycle Length (s)	93.9	Sum of lost time (s)	18.0	
Intersection Capacity Utilization	80.1%	ICU Level of Service	D	
Analysis Period (min)	15			

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	245	15	7	1001	0	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	0	0	0	0	253	15	7	1032	0	0	0	0
Pedestrians		16			1						3	
Lane Width (ft)		0.0			12.0						0.0	
Walking Speed (ft/s)		4.0			4.0						4.0	
Percent Blockage		0			0						0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								536				
pX, platoon unblocked												
vC, conflicting volume	691	1063	16	1047	1063	520	16			1033		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	691	1063	16	1047	1063	520	16			1033		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	100	100	100	0	97	100			100		
cM capacity (veh/h)	0	224	1066	184	224	506	1615			680		

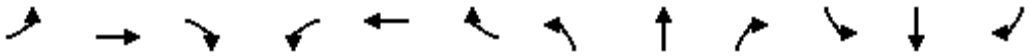
Direction, Lane #	WB 1	WB 2	NB 1	NB 2
Volume Total	168	100	351	688
Volume Left	0	0	7	0
Volume Right	0	15	0	0
cSH	224	245	1615	1700
Volume to Capacity	0.75	0.41	0.00	0.40
Queue Length 95th (ft)	130	47	0	0
Control Delay (s)	57.9	29.4	0.2	0.0
Lane LOS	F	D	A	
Approach Delay (s)	47.3		0.1	
Approach LOS	E			

Intersection Summary				
Average Delay	9.8			
Intersection Capacity Utilization	42.4%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	420	514	0	0	753	171	146	684	186	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0			5.0				
Lane Util. Factor	1.00	0.95			0.91			0.95				
Frpb, ped/bikes	1.00	1.00			1.00			0.99				
Flpb, ped/bikes	1.00	1.00			1.00			1.00				
Frt	1.00	1.00			0.97			0.97				
Flt Protected	0.95	1.00			1.00			0.99				
Satd. Flow (prot)	1702	3406			4862			3347				
Flt Permitted	0.26	1.00			1.00			0.99				
Satd. Flow (perm)	458	3406			4862			3347				
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)	438	535	0	0	784	178	152	712	194	0	0	0
RTOR Reduction (vph)	0	0	0	0	29	0	0	18	0	0	0	0
Lane Group Flow (vph)	438	535	0	0	933	0	0	1040	0	0	0	0
Confl. Peds. (#/hr)	2					2			4	4		
Confl. Bikes (#/hr)			1						44			
Heavy Vehicles (%)	6%	6%	3%	2%	4%	1%	3%	4%	1%	4%	1%	1%
Turn Type	Perm	NA			NA		Perm	NA				
Protected Phases		2			6			8				
Permitted Phases	2						8					
Actuated Green, G (s)	59.0	59.0			59.0			36.0				
Effective Green, g (s)	59.0	59.0			59.0			36.0				
Actuated g/C Ratio	0.56	0.56			0.56			0.34				
Clearance Time (s)	5.0	5.0			5.0			5.0				
Vehicle Extension (s)	3.0	3.0			3.0			3.0				
Lane Grp Cap (vph)	257	1913			2731			1147				
v/s Ratio Prot		0.16			0.19							
v/s Ratio Perm	c0.96							0.31				
v/c Ratio	1.70	0.28			0.34			0.91				
Uniform Delay, d1	23.0	12.0			12.5			32.9				
Progression Factor	0.83	0.51			1.00			1.00				
Incremental Delay, d2	331.7	0.3			0.3			10.3				
Delay (s)	350.7	6.5			12.8			43.2				
Level of Service	F	A			B			D				
Approach Delay (s)		161.4			12.8			43.2			0.0	
Approach LOS		F			B			D			A	

Intersection Summary			
HCM 2000 Control Delay	71.8	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.40		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	112.9%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	109	0	0	0	2	7	8	900	3	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	115	0	0	0	2	7	8	947	3	0	0	0
Pedestrians		12			1						1	
Lane Width (ft)		12.0			12.0						0.0	
Walking Speed (ft/s)		4.0			4.0						4.0	
Percent Blockage		1			0						0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											608	
pX, platoon unblocked												
vC, conflicting volume	512	980	12	967	979	477	12			952		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	512	980	12	967	979	477	12			952		
tC, single (s)	7.7	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	72	100	100	100	99	99	99			100		
cM capacity (veh/h)	414	248	1061	209	248	539	1604			730		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	115	9	482	477
Volume Left	115	0	8	0
Volume Right	0	7	0	3
cSH	414	428	1604	1700
Volume to Capacity	0.28	0.02	0.01	0.28
Queue Length 95th (ft)	28	2	0	0
Control Delay (s)	17.0	13.6	0.2	0.0
Lane LOS	C	B	A	
Approach Delay (s)	17.0	13.6	0.1	
Approach LOS	C	B		

Intersection Summary				
Average Delay	2.0			
Intersection Capacity Utilization	44.6%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	111	0	20	0	0	0	10	181	0	0	91	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0				5.0	5.0			5.0	
Lane Util. Factor		1.00	1.00				1.00	0.95			0.95	
Frpb, ped/bikes		1.00	1.00				1.00	1.00			0.99	
Flpb, ped/bikes		1.00	1.00				1.00	1.00			1.00	
Frt		1.00	0.85				1.00	1.00			0.95	
Flt Protected		0.95	1.00				0.95	1.00			1.00	
Satd. Flow (prot)		1805	1615				1543	3471			3139	
Flt Permitted		0.76	1.00				0.66	1.00			1.00	
Satd. Flow (perm)		1439	1615				1079	3471			3139	
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)	117	0	21	0	0	0	11	191	0	0	96	42
RTOR Reduction (vph)	0	0	13	0	0	0	0	0	0	0	23	0
Lane Group Flow (vph)	0	117	8	0	0	0	11	191	0	0	115	0
Confl. Bikes (#/hr)												2
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	17%	4%	0%	0%	13%	0%
Turn Type	Perm	NA	Perm	Perm			Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2			6		
Actuated Green, G (s)		26.0	26.0				29.0	29.0			29.0	
Effective Green, g (s)		26.0	26.0				29.0	29.0			29.0	
Actuated g/C Ratio		0.40	0.40				0.45	0.45			0.45	
Clearance Time (s)		5.0	5.0				5.0	5.0			5.0	
Lane Grp Cap (vph)		575	646				481	1548			1400	
v/s Ratio Prot								c0.06			0.04	
v/s Ratio Perm		c0.08	0.01				0.01					
v/c Ratio		0.20	0.01				0.02	0.12			0.08	
Uniform Delay, d1		12.7	11.8				10.1	10.5			10.3	
Progression Factor		1.00	1.00				1.00	1.00			1.00	
Incremental Delay, d2		0.8	0.0				0.1	0.2			0.1	
Delay (s)		13.5	11.8				10.2	10.7			10.5	
Level of Service		B	B				B	B			B	
Approach Delay (s)		13.3			0.0			10.7			10.5	
Approach LOS		B			A			B			B	

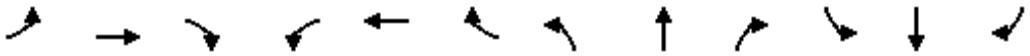
Intersection Summary			
HCM 2000 Control Delay	11.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.16		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	22.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	42	277	57	49	811	34	92	20	131	57	18	29
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	0.91	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.97	1.00	0.95	1.00	
Satd. Flow (prot)	1357	3471	1524	1687	3409		1649	1456	1495	1433	1344	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.97	1.00	0.95	1.00	
Satd. Flow (perm)	1357	3471	1524	1687	3409		1649	1456	1495	1433	1344	
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)	44	292	60	52	854	36	97	21	138	60	19	31
RTOR Reduction (vph)	0	0	41	0	3	0	0	0	90	0	29	0
Lane Group Flow (vph)	44	292	19	52	887	0	58	60	48	60	21	0
Heavy Vehicles (%)	33%	4%	6%	7%	4%	35%	4%	50%	8%	26%	45%	18%
Turn Type	Prot	NA	Perm	Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		6	6		2	2	
Permitted Phases			4						6			
Actuated Green, G (s)	4.6	31.2	31.2	6.3	32.9		35.0	35.0	35.0	8.1	8.1	
Effective Green, g (s)	4.6	31.2	31.2	6.3	32.9		35.0	35.0	35.0	8.1	8.1	
Actuated g/C Ratio	0.05	0.31	0.31	0.06	0.33		0.35	0.35	0.35	0.08	0.08	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	62	1076	472	105	1114		573	506	520	115	108	
v/s Ratio Prot	c0.03	0.08		0.03	c0.26		0.04	c0.04		c0.04	0.02	
v/s Ratio Perm			0.01						0.03			
v/c Ratio	0.71	0.27	0.04	0.50	0.80		0.10	0.12	0.09	0.52	0.20	
Uniform Delay, d1	47.3	26.1	24.2	45.6	30.8		22.2	22.3	22.1	44.4	43.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	31.0	0.1	0.0	3.6	4.0		0.4	0.5	0.4	4.2	0.9	
Delay (s)	78.3	26.3	24.3	49.3	34.8		22.5	22.8	22.5	48.6	44.1	
Level of Service	E	C	C	D	C		C	C	C	D	D	
Approach Delay (s)		31.8			35.6			22.5			46.6	
Approach LOS		C			D			C			D	

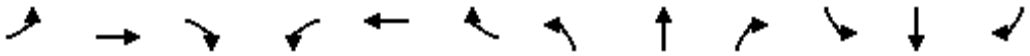
Intersection Summary			
HCM 2000 Control Delay	33.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	100.6	Sum of lost time (s)	20.0
Intersection Capacity Utilization	49.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	67	262	91	185	748	318	129	143	213	156	116	37
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.96		1.00	1.00	0.85	1.00	0.91		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1626	3252		1703	3505	1543	1583	3043		1736	2923	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1626	3252		1703	3505	1543	1583	3043		1736	2923	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	71	276	96	195	787	335	136	151	224	164	122	39
RTOR Reduction (vph)	0	36	0	0	0	279	0	189	0	0	32	0
Lane Group Flow (vph)	71	336	0	195	787	56	136	186	0	164	129	0
Confl. Peds. (#/hr)			1	1								
Confl. Bikes (#/hr)			1			3						
Heavy Vehicles (%)	11%	4%	13%	6%	3%	3%	14%	5%	10%	4%	12%	41%
Turn Type	Split	NA		Split	NA	Perm	Split	NA		Split	NA	
Protected Phases	4	4		8	8		2	2		6	6	
Permitted Phases						8						
Actuated Green, G (s)	29.0	29.0		16.0	16.0	16.0	15.0	15.0		15.0	15.0	
Effective Green, g (s)	29.0	29.0		16.0	16.0	16.0	15.0	15.0		15.0	15.0	
Actuated g/C Ratio	0.31	0.31		0.17	0.17	0.17	0.16	0.16		0.16	0.16	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	496	992		286	590	259	249	480		274	461	
v/s Ratio Prot	0.04	c0.10		0.11	c0.22		c0.09	0.06		c0.09	0.04	
v/s Ratio Perm						0.04						
v/c Ratio	0.14	0.34		0.68	1.33	0.22	0.55	0.39		0.60	0.28	
Uniform Delay, d1	24.0	25.6		37.1	39.5	34.1	36.9	35.9		37.2	35.2	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.6	0.9		12.4	161.6	1.9	8.4	2.4		9.3	1.5	
Delay (s)	24.6	26.5		49.5	201.1	36.0	45.2	38.2		46.5	36.8	
Level of Service	C	C		D	F	D	D	D		D	D	
Approach Delay (s)		26.2			136.7			40.1			41.7	
Approach LOS		C			F			D			D	

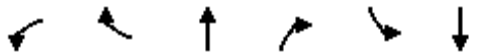
Intersection Summary			
HCM 2000 Control Delay	86.9	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	70.5%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	55	606	55	30	1048	8	72	7	39	5	17	151
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	57	625	57	31	1080	8	74	7	40	5	18	156
Pedestrians		2										
Lane Width (ft)		12.0										
Walking Speed (ft/s)		4.0										
Percent Blockage		0										
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		1120			405							
pX, platoon unblocked	0.87						0.87	0.87		0.87	0.87	0.87
vC, conflicting volume	1089			681			1535	1917	341	1616	1941	546
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	810			681			1321	1759	341	1414	1787	188
tC, single (s)	4.9			4.2			7.5	6.5	7.0	8.2	6.5	7.0
tC, 2 stage (s)												
tF (s)	2.6			2.3			3.5	4.0	3.3	3.8	4.0	3.3
p0 queue free %	89			96			0	89	94	90	72	78
cM capacity (veh/h)	522			874			55	64	649	49	62	713

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total	369	369	571	548	122	178
Volume Left	57	0	31	0	74	5
Volume Right	0	57	0	8	40	156
cSH	522	1700	874	1700	79	294
Volume to Capacity	0.11	0.22	0.04	0.32	1.53	0.61
Queue Length 95th (ft)	9	0	3	0	247	92
Control Delay (s)	3.4	0.0	1.0	0.0	384.1	34.5
Lane LOS	A		A		F	D
Approach Delay (s)	1.7		0.5		384.1	34.5
Approach LOS					F	D

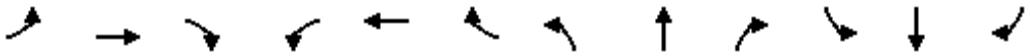
Intersection Summary				
Average Delay	25.3			
Intersection Capacity Utilization	81.1%	ICU Level of Service	D	
Analysis Period (min)	15			



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	220	0	0	0	0	736
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	232	0	0	0	0	775
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			444			
pX, platoon unblocked						
vC, conflicting volume	387	0			0	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	387	0			0	
tC, single (s)	6.9	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	60	100			100	
cM capacity (veh/h)	581	1091			1636	

Direction, Lane #	WB 1	WB 2	SB 1	SB 2
Volume Total	116	116	387	387
Volume Left	116	116	0	0
Volume Right	0	0	0	0
cSH	581	581	1700	1700
Volume to Capacity	0.20	0.20	0.23	0.23
Queue Length 95th (ft)	18	18	0	0
Control Delay (s)	12.7	12.7	0.0	0.0
Lane LOS	B	B		
Approach Delay (s)	12.7		0.0	
Approach LOS	B			

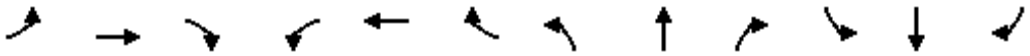
Intersection Summary			
Average Delay	2.9		
Intersection Capacity Utilization	33.3%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	348	118	185	648	0	0	0	0	156	496	296
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0		5.0	5.0						5.0	
Lane Util. Factor		0.91		1.00	0.95						0.95	
Frpb, ped/bikes		1.00		1.00	1.00						0.99	
Flpb, ped/bikes		1.00		1.00	1.00						1.00	
Frt		0.96		1.00	1.00						0.95	
Flt Protected		1.00		0.95	1.00						0.99	
Satd. Flow (prot)		4678		1767	3539						3259	
Flt Permitted		1.00		0.46	1.00						0.99	
Satd. Flow (perm)		4678		857	3539						3259	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	366	124	195	682	0	0	0	0	164	522	312
RTOR Reduction (vph)	0	69	0	0	0	0	0	0	0	0	62	0
Lane Group Flow (vph)	0	421	0	195	682	0	0	0	0	0	936	0
Confl. Peds. (#/hr)			4	4						4		2
Confl. Bikes (#/hr)			3			2						21
Heavy Vehicles (%)	3%	7%	4%	2%	2%	2%	2%	1%	1%	2%	5%	3%
Turn Type		NA		Perm	NA					Perm	NA	
Protected Phases		2			6						4	
Permitted Phases				6						4		
Actuated Green, G (s)		38.0		38.0	38.0						37.0	
Effective Green, g (s)		38.0		38.0	38.0						37.0	
Actuated g/C Ratio		0.45		0.45	0.45						0.44	
Clearance Time (s)		5.0		5.0	5.0						5.0	
Vehicle Extension (s)		3.0		3.0	3.0						3.0	
Lane Grp Cap (vph)		2091		383	1582						1418	
v/s Ratio Prot		0.09			0.19							
v/s Ratio Perm				c0.23							0.29	
v/c Ratio		0.20		0.51	0.43						0.66	
Uniform Delay, d1		14.3		16.8	16.1						19.0	
Progression Factor		1.00		0.41	0.36						1.00	
Incremental Delay, d2		0.2		1.0	0.2						2.4	
Delay (s)		14.5		7.9	5.9						21.4	
Level of Service		B		A	A						C	
Approach Delay (s)		14.5			6.4			0.0			21.4	
Approach LOS		B			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	14.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	103.3%	ICU Level of Service	G
Analysis Period (min)	15		

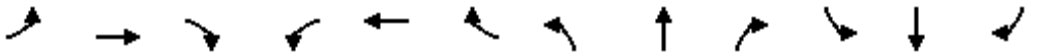
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	97	2	24	8	0	15	0	0	0	42	564	17
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	102	2	25	8	0	16	0	0	0	44	594	18
Pedestrians								1				
Lane Width (ft)								0.0				
Walking Speed (ft/s)								4.0				
Percent Blockage								0				
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											655	
pX, platoon unblocked												
vC, conflicting volume	707	691	307	413	700	0	612			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	707	691	307	413	700	0	612			0		
tC, single (s)	7.7	6.5	6.9	7.6	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.3	3.6	4.0	3.3	2.2			2.2		
p0 queue free %	66	99	96	98	100	99	100			97		
cM capacity (veh/h)	300	360	695	483	356	1091	977			1636		

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	129	24	341	315
Volume Left	102	8	44	0
Volume Right	25	16	0	18
cSH	339	759	1636	1700
Volume to Capacity	0.38	0.03	0.03	0.19
Queue Length 95th (ft)	44	2	2	0
Control Delay (s)	22.1	9.9	1.1	0.0
Lane LOS	C	A	A	
Approach Delay (s)	22.1	9.9	0.6	
Approach LOS	C	A		

Intersection Summary				
Average Delay	4.3			
Intersection Capacity Utilization	37.6%	ICU Level of Service	A	
Analysis Period (min)	15			

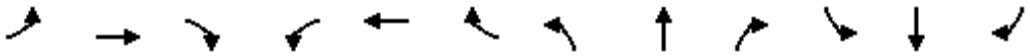


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	21	32	0	0	172	151	56	202	172	79	0	243
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0		5.0	5.0		4.0		4.0
Lane Util. Factor	1.00	0.95			0.95		0.91	0.91		1.00		0.88
Frpb, ped/bikes	1.00	1.00			0.99		1.00	1.00		1.00		1.00
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00		1.00		1.00
Frt	1.00	1.00			0.93		1.00	0.93		1.00		0.85
Flt Protected	0.95	1.00			1.00		0.95	1.00		0.95		1.00
Satd. Flow (prot)	1624	3471			3080		1441	2982		1543		2682
Flt Permitted	0.95	1.00			1.00		0.95	1.00		0.95		1.00
Satd. Flow (perm)	1624	3471			3080		1441	2982		1543		2682
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)	22	34	0	0	181	159	59	213	181	83	0	256
RTOR Reduction (vph)	0	0	0	0	133	0	0	125	0	0	0	231
Lane Group Flow (vph)	22	34	0	0	207	0	53	275	0	83	0	25
Confl. Peds. (#/hr)	6					6						
Confl. Bikes (#/hr)			6			3						
Heavy Vehicles (%)	0%	4%	0%	0%	9%	7%	14%	7%	9%	17%	0%	6%
Parking (#/hr)	0											
Turn Type	Split	NA			NA		Split	NA		Prot		custom
Protected Phases	4	4			8		2	2		6		6
Permitted Phases												
Actuated Green, G (s)	3.6	3.6			8.8		16.4	16.4		5.1		5.1
Effective Green, g (s)	3.6	3.6			8.8		16.4	16.4		5.1		5.1
Actuated g/C Ratio	0.07	0.07			0.17		0.31	0.31		0.10		0.10
Clearance Time (s)	5.0	5.0			5.0		5.0	5.0		4.0		4.0
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0		3.0
Lane Grp Cap (vph)	110	236			512		446	924		148		258
v/s Ratio Prot	c0.01	0.01			c0.07		0.04	c0.09		c0.05		0.01
v/s Ratio Perm												
v/c Ratio	0.20	0.14			0.41		0.12	0.30		0.56		0.10
Uniform Delay, d1	23.3	23.2			19.7		13.1	13.9		22.8		21.8
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00		1.00
Incremental Delay, d2	0.9	0.3			0.5		0.5	0.8		4.8		0.2
Delay (s)	24.2	23.5			20.2		13.6	14.7		27.6		22.0
Level of Service	C	C			C		B	B		C		C
Approach Delay (s)		23.8			20.2			14.6			23.3	
Approach LOS		C			C			B			C	

Intersection Summary			
HCM 2000 Control Delay	19.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.35		
Actuated Cycle Length (s)	52.9	Sum of lost time (s)	19.0
Intersection Capacity Utilization	42.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	13	36	1	19	36	55	0	11	31	44	15	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0		5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.99		1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00		1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.89		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		1.00		0.95	1.00	
Satd. Flow (prot)	1805	3610	794	1357	3471	1328		2621		1703	2356	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		1.00		0.95	1.00	
Satd. Flow (perm)	1805	3610	794	1357	3471	1328		2621		1703	2356	
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)	14	38	1	20	38	58	0	12	33	46	16	1
RTOR Reduction (vph)	0	0	1	0	0	35	0	23	0	0	1	0
Lane Group Flow (vph)	14	38	0	20	38	23	0	22	0	46	16	0
Confl. Peds. (#/hr)			4	4								
Confl. Bikes (#/hr)			4			2						3
Heavy Vehicles (%)	0%	0%	100%	33%	4%	20%	0%	38%	17%	6%	55%	0%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8						
Actuated Green, G (s)	4.0	39.0	39.0	5.0	40.0	40.0		30.0		6.0	32.0	
Effective Green, g (s)	4.0	39.0	39.0	5.0	40.0	40.0		30.0		6.0	32.0	
Actuated g/C Ratio	0.04	0.39	0.39	0.05	0.40	0.40		0.30		0.06	0.32	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0		5.0		5.0	5.0	
Lane Grp Cap (vph)	72	1407	309	67	1388	531		786		102	753	
v/s Ratio Prot	0.01	0.01		c0.01	0.01			c0.01		c0.03	0.01	
v/s Ratio Perm			0.00			c0.02						
v/c Ratio	0.19	0.03	0.00	0.30	0.03	0.04		0.03		0.45	0.02	
Uniform Delay, d1	46.4	18.8	18.6	45.8	18.2	18.3		24.7		45.4	23.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2	5.9	0.0	0.0	11.0	0.0	0.2		0.1		13.7	0.1	
Delay (s)	52.4	18.8	18.6	56.9	18.2	18.5		24.8		59.1	23.3	
Level of Service	D	B	B	E	B	B		C		E	C	
Approach Delay (s)		27.7			25.0			24.8			49.5	
Approach LOS		C			C			C			D	

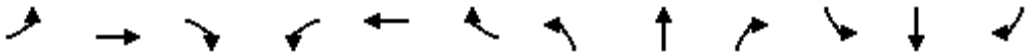
Intersection Summary			
HCM 2000 Control Delay	31.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.08		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	51.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	44	563	32	76	758	81	59	165	59	101	217	118
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0		4.0	5.0		4.0	5.0		4.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.99		1.00	0.96		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1805	3443		1805	3447		1805	1813		1770	1737	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1805	3443		1805	3447		1805	1813		1770	1737	
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	44	569	32	77	766	82	60	167	60	102	219	119
RTOR Reduction (vph)	0	5	0	0	9	0	0	13	0	0	18	0
Lane Group Flow (vph)	44	596	0	77	839	0	60	214	0	102	320	0
Confl. Peds. (#/hr)	6		3	3		6	6		5	5		6
Confl. Bikes (#/hr)			15			13			14			11
Heavy Vehicles (%)	0%	4%	0%	0%	3%	0%	0%	0%	0%	2%	4%	0%
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	3.3	27.5		4.1	28.3		4.4	34.2		4.1	33.9	
Effective Green, g (s)	3.3	27.5		4.1	28.3		4.4	34.2		4.1	33.9	
Actuated g/C Ratio	0.04	0.31		0.05	0.32		0.05	0.39		0.05	0.39	
Clearance Time (s)	4.0	5.0		4.0	5.0		4.0	5.0		4.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	67	1077		84	1109		90	705		82	669	
v/s Ratio Prot	0.02	0.17		c0.04	c0.24		0.03	0.12		c0.06	c0.18	
v/s Ratio Perm												
v/c Ratio	0.66	0.55		0.92	0.76		0.67	0.30		1.24	0.48	
Uniform Delay, d1	41.7	25.1		41.7	26.7		41.0	18.6		41.9	20.3	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	20.8	0.6		70.2	3.0		17.1	1.1		178.6	2.4	
Delay (s)	62.6	25.7		112.0	29.7		58.1	19.7		220.5	22.8	
Level of Service	E	C		F	C		E	B		F	C	
Approach Delay (s)		28.2			36.5			27.7			68.6	
Approach LOS		C			D			C			E	

Intersection Summary			
HCM 2000 Control Delay	39.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	87.9	Sum of lost time (s)	18.0
Intersection Capacity Utilization	74.2%	ICU Level of Service	D
Analysis Period (min)	15		

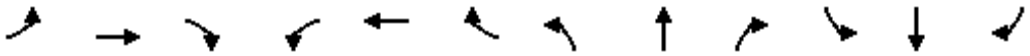
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	215	12	5	556	0	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	0	0	0	226	13	5	585	0	0	0	0
Pedestrians		3			3						2	
Lane Width (ft)		0.0			12.0						0.0	
Walking Speed (ft/s)		4.0			4.0						4.0	
Percent Blockage		0			0						0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								536				
pX, platoon unblocked												
vC, conflicting volume	434	602	3	599	602	298	3			588		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	434	602	3	599	602	298	3			588		
tC, single (s)	7.5	6.5	6.9	7.6	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	45	98	100			100		
cM capacity (veh/h)	283	414	1086	377	414	703	1632			994		

Direction, Lane #	WB 1	WB 2	NB 1	NB 2
Volume Total	151	88	200	390
Volume Left	0	0	5	0
Volume Right	0	13	0	0
cSH	414	440	1632	1700
Volume to Capacity	0.36	0.20	0.00	0.23
Queue Length 95th (ft)	41	18	0	0
Control Delay (s)	18.6	15.2	0.2	0.0
Lane LOS	C	C	A	
Approach Delay (s)	17.4		0.1	
Approach LOS	C			

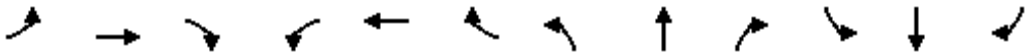
Intersection Summary				
Average Delay	5.1			
Intersection Capacity Utilization	33.3%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	200	304	0	0	727	108	108	353	131	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0			5.0				
Lane Util. Factor	1.00	0.95			0.91			0.95				
Frpb, ped/bikes	1.00	1.00			1.00			0.99				
Flpb, ped/bikes	1.00	1.00			1.00			1.00				
Frt	1.00	1.00			0.98			0.97				
Flt Protected	0.95	1.00			1.00			0.99				
Satd. Flow (prot)	1752	3374			4977			3394				
Flt Permitted	0.27	1.00			1.00			0.99				
Satd. Flow (perm)	495	3374			4977			3394				
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	211	320	0	0	765	114	114	372	138	0	0	0
RTOR Reduction (vph)	0	0	0	0	23	0	0	30	0	0	0	0
Lane Group Flow (vph)	211	320	0	0	856	0	0	594	0	0	0	0
Confl. Peds. (#/hr)	1					1			8			
Confl. Bikes (#/hr)			2			2			27			
Heavy Vehicles (%)	3%	7%	4%	2%	2%	2%	2%	1%	1%	2%	5%	3%
Turn Type	Perm	NA			NA		Perm	NA				
Protected Phases		2			6			8				
Permitted Phases	2						8					
Actuated Green, G (s)	38.0	38.0			38.0			37.0				
Effective Green, g (s)	38.0	38.0			38.0			37.0				
Actuated g/C Ratio	0.45	0.45			0.45			0.44				
Clearance Time (s)	5.0	5.0			5.0			5.0				
Vehicle Extension (s)	3.0	3.0			3.0			3.0				
Lane Grp Cap (vph)	221	1508			2225			1477				
v/s Ratio Prot		0.09			0.17							
v/s Ratio Perm	c0.43							0.17				
v/c Ratio	0.95	0.21			0.38			0.40				
Uniform Delay, d1	22.7	14.4			15.7			16.4				
Progression Factor	0.91	0.77			1.00			1.00				
Incremental Delay, d2	48.3	0.3			0.1			0.2				
Delay (s)	68.9	11.4			15.8			16.6				
Level of Service	E	B			B			B				
Approach Delay (s)		34.3			15.8			16.6			0.0	
Approach LOS		C			B			B			A	

Intersection Summary			
HCM 2000 Control Delay	20.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	103.3%	ICU Level of Service	G
Analysis Period (min)	15		

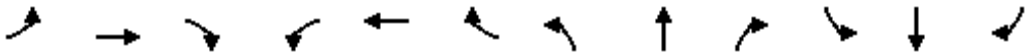
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	99	0	0	2	0	5	447	35	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	104	0	0	2	0	5	471	37	0	0	0
Pedestrians		9			13							
Lane Width (ft)		12.0			12.0							
Walking Speed (ft/s)		4.0			4.0							
Percent Blockage		1			1							
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											608	
pX, platoon unblocked												
vC, conflicting volume	256	540	9	565	521	267	9			520		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	256	540	9	565	521	267	9			520		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	76	100	100	100	100	100			100		
cM capacity (veh/h)	658	442	1069	328	453	730	1612			1045		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	104	2	241	272
Volume Left	0	0	5	0
Volume Right	0	0	0	37
cSH	442	453	1612	1700
Volume to Capacity	0.24	0.00	0.00	0.16
Queue Length 95th (ft)	23	0	0	0
Control Delay (s)	15.6	13.0	0.2	0.0
Lane LOS	C	B	A	
Approach Delay (s)	15.6	13.0	0.1	
Approach LOS	C	B		

Intersection Summary				
Average Delay	2.8			
Intersection Capacity Utilization	25.6%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	171	0	23	0	0	0	27	724	2	0	141	107
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0				5.0	5.0			5.0	
Lane Util. Factor		1.00	1.00				1.00	0.95			0.95	
Frpb, ped/bikes		1.00	0.96				1.00	1.00			0.97	
Flpb, ped/bikes		0.98	1.00				0.98	1.00			1.00	
Frt		1.00	0.85				1.00	1.00			0.94	
Flt Protected		0.95	1.00				0.95	1.00			1.00	
Satd. Flow (prot)		1741	1165				1184	2735			2575	
Flt Permitted		0.76	1.00				0.59	1.00			1.00	
Satd. Flow (perm)		1388	1165				736	2735			2575	
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)	180	0	24	0	0	0	28	762	2	0	148	113
RTOR Reduction (vph)	0	0	15	0	0	0	0	1	0	0	61	0
Lane Group Flow (vph)	0	180	9	0	0	0	28	763	0	0	200	0
Confl. Peds. (#/hr)	20		20	20		20	20		20	20		20
Confl. Bikes (#/hr)			20			20			20			20
Heavy Vehicles (%)	2%	0%	33%	0%	0%	0%	50%	32%	0%	0%	49%	0%
Turn Type	Perm	NA	Perm	Perm			Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2			6		
Actuated Green, G (s)		25.0	25.0				30.0	30.0			30.0	
Effective Green, g (s)		25.0	25.0				30.0	30.0			30.0	
Actuated g/C Ratio		0.38	0.38				0.46	0.46			0.46	
Clearance Time (s)		5.0	5.0				5.0	5.0			5.0	
Lane Grp Cap (vph)		533	448				339	1262			1188	
v/s Ratio Prot								c0.28			0.08	
v/s Ratio Perm		c0.13	0.01				0.04					
v/c Ratio		0.34	0.02				0.08	0.60			0.17	
Uniform Delay, d1		14.1	12.4				9.8	13.1			10.2	
Progression Factor		1.00	1.00				1.00	1.00			1.00	
Incremental Delay, d2		1.7	0.1				0.5	2.2			0.3	
Delay (s)		15.9	12.5				10.3	15.2			10.5	
Level of Service		B	B				B	B			B	
Approach Delay (s)		15.5			0.0			15.1			10.5	
Approach LOS		B			A			B			B	

Intersection Summary			
HCM 2000 Control Delay	14.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	51.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	8	393	140	137	900	52	418	84	300	89	34	72
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.96	1.00	1.00		1.00	1.00	0.97	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	0.90	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.97	1.00	0.95	1.00	
Satd. Flow (prot)	1504	3505	1442	1433	3360		1618	1351	1267	1517	1397	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.97	1.00	0.95	1.00	
Satd. Flow (perm)	1504	3505	1442	1433	3360		1618	1351	1267	1517	1397	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	8	414	147	144	947	55	440	88	316	94	36	76
RTOR Reduction (vph)	0	0	111	0	4	0	0	0	218	0	68	0
Lane Group Flow (vph)	8	414	36	144	998	0	264	264	98	94	44	0
Confl. Peds. (#/hr)			20						20			
Heavy Vehicles (%)	20%	3%	8%	26%	3%	68%	6%	76%	24%	19%	50%	9%
Turn Type	Prot	NA	Perm	Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		6	6		2	2	
Permitted Phases			4						6			
Actuated Green, G (s)	0.7	19.7	19.7	10.7	29.7		21.6	21.6	21.6	8.2	8.2	
Effective Green, g (s)	0.7	19.7	19.7	10.7	29.7		21.6	21.6	21.6	8.2	8.2	
Actuated g/C Ratio	0.01	0.25	0.25	0.13	0.37		0.27	0.27	0.27	0.10	0.10	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	13	860	354	191	1244		435	363	341	155	142	
v/s Ratio Prot	0.01	0.12		c0.10	c0.30		0.16	c0.20		c0.06	0.03	
v/s Ratio Perm			0.03						0.08			
v/c Ratio	0.62	0.48	0.10	0.75	0.80		0.61	0.73	0.29	0.61	0.31	
Uniform Delay, d1	39.6	25.9	23.4	33.5	22.6		25.6	26.6	23.2	34.5	33.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	64.0	0.4	0.1	15.5	3.8		2.4	7.1	0.5	16.4	5.5	
Delay (s)	103.7	26.3	23.5	48.9	26.4		28.0	33.7	23.7	50.8	38.9	
Level of Service	F	C	C	D	C		C	C	C	D	D	
Approach Delay (s)		26.7			29.3			28.2			44.4	
Approach LOS		C			C			C			D	

Intersection Summary			
HCM 2000 Control Delay	29.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	80.2	Sum of lost time (s)	20.0
Intersection Capacity Utilization	65.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

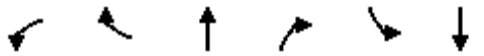
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	156	515	119	240	897	281	133	232	487	176	101	33
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	1.00	0.85	1.00	0.90		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1433	3228		1626	3438	1495	1444	2823		1612	2762	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1433	3228		1626	3438	1495	1444	2823		1612	2762	
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)	161	531	123	247	925	290	137	239	502	181	104	34
RTOR Reduction (vph)	0	21	0	0	0	241	0	340	0	0	29	0
Lane Group Flow (vph)	161	633	0	247	925	49	137	401	0	181	109	0
Confl. Peds. (#/hr)			1	1								
Confl. Bikes (#/hr)			3									
Heavy Vehicles (%)	26%	8%	10%	11%	5%	8%	25%	23%	11%	12%	18%	50%
Turn Type	Split	NA		Split	NA	Perm	Split	NA		Split	NA	
Protected Phases	4	4		8	8		2	2		6	6	
Permitted Phases						8						
Actuated Green, G (s)	29.0	29.0		16.0	16.0	16.0	15.0	15.0		15.0	15.0	
Effective Green, g (s)	29.0	29.0		16.0	16.0	16.0	15.0	15.0		15.0	15.0	
Actuated g/C Ratio	0.31	0.31		0.17	0.17	0.17	0.16	0.16		0.16	0.16	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	437	985		273	579	251	228	445		254	436	
v/s Ratio Prot	0.11	c0.20		0.15	c0.27		0.09	c0.14		c0.11	0.04	
v/s Ratio Perm						0.03						
v/c Ratio	0.37	0.64		0.90	1.60	0.19	0.60	0.90		0.71	0.25	
Uniform Delay, d1	25.8	28.5		38.8	39.5	34.0	37.2	39.3		38.0	35.1	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.4	3.2		34.6	277.0	1.7	11.2	23.9		15.7	1.4	
Delay (s)	28.2	31.7		73.4	316.5	35.7	48.4	63.2		53.6	36.5	
Level of Service	C	C		E	F	D	D	E		D	D	
Approach Delay (s)		31.0			219.7			60.9			46.2	
Approach LOS		C			F			E			D	

Intersection Summary			
HCM 2000 Control Delay	119.4	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	86.0%	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												
Volume (veh/h)	128	1048	67	30	1136	17	54	0	22	3	7	232
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	135	1103	71	32	1196	18	57	0	23	3	7	244
Pedestrians								2			2	
Lane Width (ft)								12.0			12.0	
Walking Speed (ft/s)								4.0			4.0	
Percent Blockage								0			0	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		1120			405							
pX, platoon unblocked	0.87			0.95			0.89	0.89	0.95	0.89	0.89	0.87
vC, conflicting volume	1216			1176			2319	2689	589	2114	2715	609
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	941			1073			1969	2384	454	1740	2413	240
tC, single (s)	4.9			4.1			7.9	6.5	7.1	7.5	6.5	7.1
tC, 2 stage (s)												
tF (s)	2.6			2.2			3.7	4.0	3.4	3.5	4.0	3.4
p0 queue free %	71			95			0	100	95	91	63	62
cM capacity (veh/h)	459			621			9	21	508	36	20	635

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total	686	622	629	616	80	255
Volume Left	135	0	32	0	57	3
Volume Right	0	71	0	18	23	244
cSH	459	1700	621	1700	13	302
Volume to Capacity	0.29	0.37	0.05	0.36	6.36	0.84
Queue Length 95th (ft)	30	0	4	0	Err	182
Control Delay (s)	8.8	0.0	1.4	0.0	Err	57.9
Lane LOS	A		A		F	F
Approach Delay (s)	4.6		0.7		Err	57.9
Approach LOS					F	F

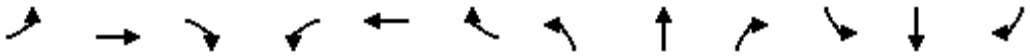
Intersection Summary				
Average Delay	284.4			
Intersection Capacity Utilization	100.2%	ICU Level of Service	G	
Analysis Period (min)	15			



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	252	0	0	0	0	814
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	260	0	0	0	0	839
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			444			
pX, platoon unblocked						
vC, conflicting volume	420	0			0	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	420	0			0	
tC, single (s)	6.9	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	53	100			100	
cM capacity (veh/h)	557	1091			1636	

Direction, Lane #	WB 1	WB 2	SB 1	SB 2
Volume Total	130	130	420	420
Volume Left	130	130	0	0
Volume Right	0	0	0	0
cSH	557	557	1700	1700
Volume to Capacity	0.23	0.23	0.25	0.25
Queue Length 95th (ft)	22	22	0	0
Control Delay (s)	13.4	13.4	0.0	0.0
Lane LOS	B	B		
Approach Delay (s)	13.4		0.0	
Approach LOS	B			

Intersection Summary			
Average Delay	3.2		
Intersection Capacity Utilization	42.5%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	786	119	160	789	0	0	0	0	186	622	243
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0		5.0	5.0						5.0	
Lane Util. Factor		0.91		1.00	0.95						0.95	
Frpb, ped/bikes		1.00		1.00	1.00						0.99	
Flpb, ped/bikes		1.00		1.00	1.00						1.00	
Frt		0.98		1.00	1.00						0.97	
Flt Protected		1.00		0.95	1.00						0.99	
Satd. Flow (prot)		4815		1770	3471						3368	
Flt Permitted		1.00		0.26	1.00						0.99	
Satd. Flow (perm)		4815		488	3471						3368	
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)	0	819	124	167	822	0	0	0	0	194	648	253
RTOR Reduction (vph)	0	19	0	0	0	0	0	0	0	0	27	0
Lane Group Flow (vph)	0	924	0	167	822	0	0	0	0	0	1068	0
Confl. Peds. (#/hr)										7		3
Confl. Bikes (#/hr)						1						36
Heavy Vehicles (%)	6%	6%	3%	2%	4%	1%	3%	4%	1%	4%	1%	1%
Turn Type		NA		Perm	NA					Perm	NA	
Protected Phases		2			6						4	
Permitted Phases				6						4		
Actuated Green, G (s)		59.0		59.0	59.0						36.0	
Effective Green, g (s)		59.0		59.0	59.0						36.0	
Actuated g/C Ratio		0.56		0.56	0.56						0.34	
Clearance Time (s)		5.0		5.0	5.0						5.0	
Vehicle Extension (s)		3.0		3.0	3.0						3.0	
Lane Grp Cap (vph)		2705		274	1950						1154	
v/s Ratio Prot		0.19			0.24							
v/s Ratio Perm				c0.34							0.32	
v/c Ratio		0.34		0.61	0.42						0.93	
Uniform Delay, d1		12.5		15.3	13.2						33.2	
Progression Factor		1.00		0.63	0.47						1.00	
Incremental Delay, d2		0.3		8.9	0.6						13.7	
Delay (s)		12.8		18.5	6.8						47.0	
Level of Service		B		B	A						D	
Approach Delay (s)		12.8			8.8			0.0			47.0	
Approach LOS		B			A			A			D	

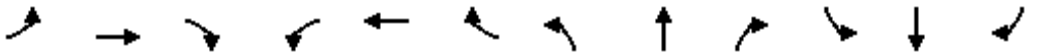
Intersection Summary			
HCM 2000 Control Delay	23.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	114.1%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	109	12	7	2	0	0	0	0	10	705	3
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	115	13	7	2	0	0	0	0	11	742	3
Pedestrians		3						1				
Lane Width (ft)		12.0						0.0				
Walking Speed (ft/s)		4.0						4.0				
Percent Blockage		0						0				
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											655	
pX, platoon unblocked												
vC, conflicting volume	769	768	377	463	769	0	748			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	769	768	377	463	769	0	748			0		
tC, single (s)	7.7	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	65	98	98	99	100	100			99		
cM capacity (veh/h)	276	332	625	347	331	1091	867			1636		

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	127	9	382	374
Volume Left	0	7	11	0
Volume Right	13	0	0	3
cSH	348	343	1636	1700
Volume to Capacity	0.37	0.03	0.01	0.22
Queue Length 95th (ft)	41	2	0	0
Control Delay (s)	21.2	15.8	0.3	0.0
Lane LOS	C	C	A	
Approach Delay (s)	21.2	15.8	0.1	
Approach LOS	C	C		

Intersection Summary				
Average Delay	3.3			
Intersection Capacity Utilization	33.2%	ICU Level of Service	A	
Analysis Period (min)	15			



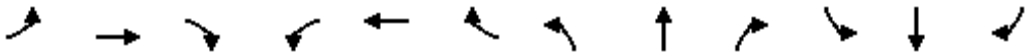
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	168	117	0	0	132	157	123	373	111	109	0	243
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0		5.0	5.0		5.0		5.0
Lane Util. Factor	1.00	0.95			0.95		0.91	0.91		1.00		0.88
Frpb, ped/bikes	1.00	1.00			0.99		1.00	1.00		1.00		1.00
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00		1.00		1.00
Frt	1.00	1.00			0.92		1.00	0.97		1.00		0.85
Flt Protected	0.95	1.00			1.00		0.95	1.00		0.95		1.00
Satd. Flow (prot)	1160	3195			2746		1014	2884		1570		2349
Flt Permitted	0.95	1.00			1.00		0.95	1.00		0.95		1.00
Satd. Flow (perm)	1160	3195			2746		1014	2884		1570		2349
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)	177	123	0	0	139	165	129	393	117	115	0	256
RTOR Reduction (vph)	0	0	0	0	144	0	0	21	0	0	0	219
Lane Group Flow (vph)	177	123	0	0	160	0	116	502	0	115	0	37
Confl. Peds. (#/hr)							4					4
Confl. Bikes (#/hr)			6			3						
Heavy Vehicles (%)	40%	13%	0%	0%	18%	21%	62%	15%	13%	15%	0%	21%
Parking (#/hr)	0											
Turn Type	Split	NA			NA		Split	NA		Prot		custom
Protected Phases	4	4			8		2	2		6		6
Permitted Phases												
Actuated Green, G (s)	17.1	17.1			9.5		18.1	18.1		10.8		10.8
Effective Green, g (s)	17.1	17.1			9.5		18.1	18.1		10.8		10.8
Actuated g/C Ratio	0.23	0.23			0.13		0.24	0.24		0.14		0.14
Clearance Time (s)	5.0	5.0			5.0		5.0	5.0		5.0		5.0
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0		3.0
Lane Grp Cap (vph)	262	723			345		243	691		224		336
v/s Ratio Prot	c0.15	0.04			c0.06		0.11	c0.17		c0.07		0.02
v/s Ratio Perm												
v/c Ratio	0.68	0.17			0.46		0.48	0.73		0.51		0.11
Uniform Delay, d1	26.7	23.5			30.6		24.6	26.4		29.9		28.2
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00		1.00
Incremental Delay, d2	6.7	0.1			1.0		6.6	6.6		2.0		0.1
Delay (s)	33.4	23.6			31.6		31.2	33.0		31.9		28.3
Level of Service	C	C			C		C	C		C		C
Approach Delay (s)		29.4			31.6			32.7			29.4	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	31.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	75.5	Sum of lost time (s)	20.0
Intersection Capacity Utilization	52.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	201	233	43	34	71	98	7	269	185	245	150	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1245	2375	832	1107	2201	1062	1003	1970		1203	1870	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1245	2375	832	1107	2201	1062	1003	1970		1203	1870	
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)	212	245	45	36	75	103	7	283	195	258	158	0
RTOR Reduction (vph)	0	0	30	0	0	90	0	102	0	0	0	0
Lane Group Flow (vph)	212	245	15	36	75	13	7	376	0	258	158	0
Confl. Bikes (#/hr)						1						
Heavy Vehicles (%)	45%	52%	94%	63%	64%	50%	80%	79%	62%	50%	93%	0%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8						
Actuated Green, G (s)	39.0	39.0	39.0	15.0	15.0	15.0	29.0	29.0		17.0	17.0	
Effective Green, g (s)	39.0	39.0	39.0	15.0	15.0	15.0	29.0	29.0		17.0	17.0	
Actuated g/C Ratio	0.32	0.32	0.32	0.12	0.12	0.12	0.24	0.24		0.14	0.14	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	404	771	270	138	275	132	242	476		170	264	
v/s Ratio Prot	c0.17	c0.10		0.03	0.03		0.01	c0.19		c0.21	0.08	
v/s Ratio Perm			0.02			0.01						
v/c Ratio	0.52	0.32	0.05	0.26	0.27	0.10	0.03	0.79		1.52	0.60	
Uniform Delay, d1	33.0	30.5	27.8	47.5	47.6	46.5	34.7	42.6		51.5	48.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	4.8	1.1	0.4	4.5	2.4	1.5	0.2	12.5		260.7	9.6	
Delay (s)	37.8	31.6	28.2	52.0	50.0	48.0	35.0	55.1		312.2	57.9	
Level of Service	D	C	C	D	D	D	C	E		F	E	
Approach Delay (s)		33.9			49.4			54.8			215.6	
Approach LOS		C			D			D			F	

Intersection Summary			
HCM 2000 Control Delay	89.0	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	58.1%	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												
Volume (vph)	91	826	72	99	967	84	49	329	91	104	304	117
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0		4.0	5.0		4.0	5.0		4.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.99		1.00	0.97		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3379		1770	3473		1770	1770		1770	1717	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3379		1770	3473		1770	1770		1770	1717	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	96	869	76	104	1018	88	52	346	96	109	320	123
RTOR Reduction (vph)	0	7	0	0	7	0	0	10	0	0	14	0
Lane Group Flow (vph)	96	938	0	104	1099	0	52	432	0	109	429	0
Confl. Peds. (#/hr)	20		12	12		20	17		11	11		17
Confl. Bikes (#/hr)			10			8			12			9
Heavy Vehicles (%)	2%	5%	7%	2%	2%	2%	2%	3%	4%	2%	3%	9%
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	6.2	34.9		4.0	32.7		3.9	33.1		4.0	33.2	
Effective Green, g (s)	6.2	34.9		4.0	32.7		3.9	33.1		4.0	33.2	
Actuated g/C Ratio	0.07	0.37		0.04	0.35		0.04	0.35		0.04	0.35	
Clearance Time (s)	4.0	5.0		4.0	5.0		4.0	5.0		4.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	116	1254		75	1208		73	623		75	606	
v/s Ratio Prot	0.05	0.28		c0.06	c0.32		0.03	0.24		c0.06	c0.25	
v/s Ratio Perm												
v/c Ratio	0.83	0.75		1.39	0.91		0.71	0.69		1.45	0.71	
Uniform Delay, d1	43.4	25.7		45.0	29.2		44.5	26.1		45.0	26.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	36.2	2.5		237.1	10.3		27.8	6.2		263.6	6.8	
Delay (s)	79.5	28.2		282.1	39.5		72.3	32.3		308.6	33.0	
Level of Service	E	C		F	D		E	C		F	C	
Approach Delay (s)		32.9			60.4			36.5			87.4	
Approach LOS		C			E			D			F	

Intersection Summary			
HCM 2000 Control Delay	52.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	94.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	82.0%	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												
Volume (veh/h)	0	0	0	0	245	15	7	1006	0	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	0	0	0	0	253	15	7	1037	0	0	0	0
Pedestrians		16			1						3	
Lane Width (ft)		0.0			12.0						0.0	
Walking Speed (ft/s)		4.0			4.0						4.0	
Percent Blockage		0			0						0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								536				
pX, platoon unblocked												
vC, conflicting volume	694	1069	16	1053	1069	523	16			1038		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	694	1069	16	1053	1069	523	16			1038		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	100	100	100	0	97	100			100		
cM capacity (veh/h)	0	222	1066	182	222	504	1615			677		

Direction, Lane #	WB 1	WB 2	NB 1	NB 2
Volume Total	168	100	353	691
Volume Left	0	0	7	0
Volume Right	0	15	0	0
cSH	222	243	1615	1700
Volume to Capacity	0.76	0.41	0.00	0.41
Queue Length 95th (ft)	132	47	0	0
Control Delay (s)	58.9	29.7	0.2	0.0
Lane LOS	F	D	A	
Approach Delay (s)	48.0		0.1	
Approach LOS	E			

Intersection Summary				
Average Delay	9.9			
Intersection Capacity Utilization	42.5%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	425	546	0	0	798	171	150	684	186	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0			5.0				
Lane Util. Factor	1.00	0.95			0.91			0.95				
Frpb, ped/bikes	1.00	1.00			1.00			0.99				
Flpb, ped/bikes	1.00	1.00			1.00			1.00				
Frt	1.00	1.00			0.97			0.97				
Flt Protected	0.95	1.00			1.00			0.99				
Satd. Flow (prot)	1702	3406			4868			3346				
Flt Permitted	0.24	1.00			1.00			0.99				
Satd. Flow (perm)	430	3406			4868			3346				
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)	443	569	0	0	831	178	156	712	194	0	0	0
RTOR Reduction (vph)	0	0	0	0	29	0	0	18	0	0	0	0
Lane Group Flow (vph)	443	569	0	0	980	0	0	1044	0	0	0	0
Confl. Peds. (#/hr)	2					2			4	4		
Confl. Bikes (#/hr)			1						44			
Heavy Vehicles (%)	6%	6%	3%	2%	4%	1%	3%	4%	1%	4%	1%	1%
Turn Type	Perm	NA			NA		Perm	NA				
Protected Phases		2			6			8				
Permitted Phases	2						8					
Actuated Green, G (s)	59.0	59.0			59.0			36.0				
Effective Green, g (s)	59.0	59.0			59.0			36.0				
Actuated g/C Ratio	0.56	0.56			0.56			0.34				
Clearance Time (s)	5.0	5.0			5.0			5.0				
Vehicle Extension (s)	3.0	3.0			3.0			3.0				
Lane Grp Cap (vph)	241	1913			2735			1147				
v/s Ratio Prot		0.17			0.20							
v/s Ratio Perm	c1.03							0.31				
v/c Ratio	1.84	0.30			0.36			0.91				
Uniform Delay, d1	23.0	12.1			12.6			33.0				
Progression Factor	0.80	0.49			1.00			1.00				
Incremental Delay, d2	391.5	0.4			0.4			10.6				
Delay (s)	410.0	6.3			13.0			43.5				
Level of Service	F	A			B			D				
Approach Delay (s)		183.0			13.0			43.5			0.0	
Approach LOS		F			B			D			A	

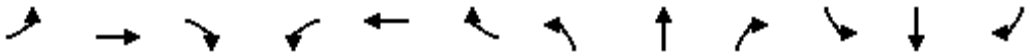
Intersection Summary			
HCM 2000 Control Delay	79.3	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.48		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	114.1%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	109	0	0	0	2	7	8	904	3	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	115	0	0	0	2	7	8	952	3	0	0	0
Pedestrians		12			1						1	
Lane Width (ft)		12.0			12.0						0.0	
Walking Speed (ft/s)		4.0			4.0						4.0	
Percent Blockage		1			0						0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											608	
pX, platoon unblocked												
vC, conflicting volume	514	985	12	971	983	479	12			956		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	514	985	12	971	983	479	12			956		
tC, single (s)	7.7	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	72	100	100	100	99	99	99			100		
cM capacity (veh/h)	412	246	1061	207	247	537	1604			727		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	115	9	484	479
Volume Left	115	0	8	0
Volume Right	0	7	0	3
cSH	412	426	1604	1700
Volume to Capacity	0.28	0.02	0.01	0.28
Queue Length 95th (ft)	28	2	0	0
Control Delay (s)	17.1	13.6	0.2	0.0
Lane LOS	C	B	A	
Approach Delay (s)	17.1	13.6	0.1	
Approach LOS	C	B		

Intersection Summary				
Average Delay	2.0			
Intersection Capacity Utilization	44.7%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	270	0	54	0	0	0	45	181	0	0	91	206
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0				5.0	5.0			5.0	
Lane Util. Factor		1.00	1.00				1.00	0.95			0.95	
Frpb, ped/bikes		1.00	0.96				1.00	1.00			0.96	
Flpb, ped/bikes		0.98	1.00				0.98	1.00			1.00	
Frt		1.00	0.85				1.00	1.00			0.90	
Flt Protected		0.95	1.00				0.95	1.00			1.00	
Satd. Flow (prot)		1776	1550				1520	3471			2983	
Flt Permitted		0.76	1.00				0.56	1.00			1.00	
Satd. Flow (perm)		1415	1550				898	3471			2983	
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)	284	0	57	0	0	0	47	191	0	0	96	217
RTOR Reduction (vph)	0	0	34	0	0	0	0	0	0	0	120	0
Lane Group Flow (vph)	0	284	23	0	0	0	47	191	0	0	193	0
Confl. Peds. (#/hr)	20		20	20		20	20		20	20		20
Confl. Bikes (#/hr)			20			20			20			20
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	17%	4%	0%	0%	13%	0%
Turn Type	Perm	NA	Perm	Perm			Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2			6		
Actuated Green, G (s)		26.0	26.0				29.0	29.0			29.0	
Effective Green, g (s)		26.0	26.0				29.0	29.0			29.0	
Actuated g/C Ratio		0.40	0.40				0.45	0.45			0.45	
Clearance Time (s)		5.0	5.0				5.0	5.0			5.0	
Lane Grp Cap (vph)		566	620				400	1548			1330	
v/s Ratio Prot								0.06			c0.06	
v/s Ratio Perm		c0.20	0.01				0.05					
v/c Ratio		0.50	0.04				0.12	0.12			0.14	
Uniform Delay, d1		14.6	11.9				10.5	10.5			10.7	
Progression Factor		1.00	1.00				1.00	1.00			1.00	
Incremental Delay, d2		3.2	0.1				0.6	0.2			0.2	
Delay (s)		17.8	12.0				11.1	10.7			10.9	
Level of Service		B	B				B	B			B	
Approach Delay (s)		16.8			0.0			10.8			10.9	
Approach LOS		B			A			B			B	

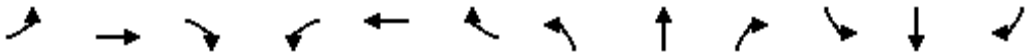
Intersection Summary			
HCM 2000 Control Delay	13.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.31		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	60.8%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	42	277	96	176	811	34	121	20	261	57	18	29
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00		1.00	1.00	0.97	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	0.91	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.97	1.00	0.95	1.00	
Satd. Flow (prot)	1357	3471	1474	1687	3409		1649	1489	1449	1433	1344	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.97	1.00	0.95	1.00	
Satd. Flow (perm)	1357	3471	1474	1687	3409		1649	1489	1449	1433	1344	
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)	44	292	101	185	854	36	127	21	275	60	19	31
RTOR Reduction (vph)	0	0	72	0	3	0	0	0	181	0	28	0
Lane Group Flow (vph)	44	292	29	185	887	0	74	74	94	60	22	0
Confl. Peds. (#/hr)			20						20			
Heavy Vehicles (%)	33%	4%	6%	7%	4%	35%	4%	50%	8%	26%	45%	18%
Turn Type	Prot	NA	Perm	Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		6	6		2	2	
Permitted Phases			4						6			
Actuated Green, G (s)	4.7	29.2	29.2	9.4	33.9		34.6	34.6	34.6	8.2	8.2	
Effective Green, g (s)	4.7	29.2	29.2	9.4	33.9		34.6	34.6	34.6	8.2	8.2	
Actuated g/C Ratio	0.05	0.29	0.29	0.09	0.33		0.34	0.34	0.34	0.08	0.08	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	62	999	424	156	1139		562	508	494	115	108	
v/s Ratio Prot	0.03	0.08		c0.11	c0.26		0.04	0.05		c0.04	0.02	
v/s Ratio Perm			0.02						c0.06			
v/c Ratio	0.71	0.29	0.07	1.19	0.78		0.13	0.15	0.19	0.52	0.20	
Uniform Delay, d1	47.7	28.1	26.2	46.0	30.4		23.0	23.2	23.5	44.7	43.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	31.0	0.2	0.1	130.7	3.4		0.5	0.6	0.9	4.2	0.9	
Delay (s)	78.7	28.2	26.3	176.7	33.8		23.5	23.8	24.4	48.9	44.4	
Level of Service	E	C	C	F	C		C	C	C	D	D	
Approach Delay (s)		32.9			58.4			24.1			46.9	
Approach LOS		C			E			C			D	

Intersection Summary			
HCM 2000 Control Delay	45.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	101.4	Sum of lost time (s)	20.0
Intersection Capacity Utilization	65.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	86	366	98	185	851	318	137	143	213	156	116	53
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	1.00	0.85	1.00	0.91		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1626	3291		1703	3505	1543	1583	3043		1736	2840	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1626	3291		1703	3505	1543	1583	3043		1736	2840	
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)	91	385	103	195	896	335	144	151	224	164	122	56
RTOR Reduction (vph)	0	25	0	0	0	279	0	189	0	0	47	0
Lane Group Flow (vph)	91	463	0	195	896	56	144	186	0	164	131	0
Confl. Peds. (#/hr)			1	1								
Confl. Bikes (#/hr)			1			3						
Heavy Vehicles (%)	11%	4%	13%	6%	3%	3%	14%	5%	10%	4%	12%	41%
Turn Type	Split	NA		Split	NA	Perm	Split	NA		Split	NA	
Protected Phases	4	4		8	8		2	2		6	6	
Permitted Phases						8						
Actuated Green, G (s)	29.0	29.0		16.0	16.0	16.0	15.0	15.0		15.0	15.0	
Effective Green, g (s)	29.0	29.0		16.0	16.0	16.0	15.0	15.0		15.0	15.0	
Actuated g/C Ratio	0.31	0.31		0.17	0.17	0.17	0.16	0.16		0.16	0.16	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	496	1004		286	590	259	249	480		274	448	
v/s Ratio Prot	0.06	c0.14		0.11	c0.26		c0.09	0.06		c0.09	0.05	
v/s Ratio Perm						0.04						
v/c Ratio	0.18	0.46		0.68	1.52	0.22	0.58	0.39		0.60	0.29	
Uniform Delay, d1	24.3	26.7		37.1	39.5	34.1	37.1	35.9		37.2	35.3	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.8	1.5		12.4	242.0	1.9	9.4	2.4		9.3	1.6	
Delay (s)	25.1	28.2		49.5	281.5	36.0	46.5	38.2		46.5	37.0	
Level of Service	C	C		D	F	D	D	D		D	D	
Approach Delay (s)		27.7			192.1			40.5			41.5	
Approach LOS		C			F			D			D	

Intersection Summary			
HCM 2000 Control Delay	113.5	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	70.5%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	55	710	55	30	1151	8	72	7	39	5	17	151
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	57	732	57	31	1187	8	74	7	40	5	18	156
Pedestrians		2										
Lane Width (ft)		12.0										
Walking Speed (ft/s)		4.0										
Percent Blockage		0										
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		1120			405							
pX, platoon unblocked	0.85						0.85	0.85		0.85	0.85	0.85
vC, conflicting volume	1195			789			1695	2130	394	1776	2155	599
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	868			789			1459	1973	394	1554	2002	165
tC, single (s)	4.9			4.2			7.5	6.5	7.0	8.2	6.5	7.0
tC, 2 stage (s)												
tF (s)	2.6			2.3			3.5	4.0	3.3	3.8	4.0	3.3
p0 queue free %	88			96			0	84	93	85	60	78
cM capacity (veh/h)	477			795			36	45	599	35	43	716

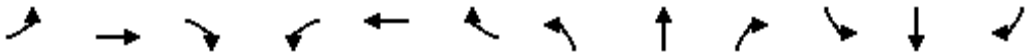
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total	423	423	624	602	122	178
Volume Left	57	0	31	0	74	5
Volume Right	0	57	0	8	40	156
cSH	477	1700	795	1700	54	232
Volume to Capacity	0.12	0.25	0.04	0.35	2.26	0.77
Queue Length 95th (ft)	10	0	3	0	305	137
Control Delay (s)	3.6	0.0	1.0	0.0	741.3	58.5
Lane LOS	A		A		F	F
Approach Delay (s)	1.8		0.5		741.3	58.5
Approach LOS					F	F

Intersection Summary				
Average Delay	43.3			
Intersection Capacity Utilization	86.8%	ICU Level of Service	E	
Analysis Period (min)	15			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	220	0	0	0	0	750
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	232	0	0	0	0	789
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			444			
pX, platoon unblocked						
vC, conflicting volume	395	0			0	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	395	0			0	
tC, single (s)	6.9	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	60	100			100	
cM capacity (veh/h)	574	1091			1636	

Direction, Lane #	WB 1	WB 2	SB 1	SB 2
Volume Total	116	116	395	395
Volume Left	116	116	0	0
Volume Right	0	0	0	0
cSH	574	574	1700	1700
Volume to Capacity	0.20	0.20	0.23	0.23
Queue Length 95th (ft)	19	19	0	0
Control Delay (s)	12.8	12.8	0.0	0.0
Lane LOS	B	B		
Approach Delay (s)	12.8		0.0	
Approach LOS	B			

Intersection Summary			
Average Delay	2.9		
Intersection Capacity Utilization	33.7%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	445	125	185	737	0	0	0	0	156	496	310
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0		5.0	5.0						5.0	
Lane Util. Factor		0.91		1.00	0.95						0.95	
Frpb, ped/bikes		1.00		1.00	1.00						0.99	
Flpb, ped/bikes		1.00		1.00	1.00						1.00	
Frt		0.97		1.00	1.00						0.95	
Flt Protected		1.00		0.95	1.00						0.99	
Satd. Flow (prot)		4700		1767	3539						3254	
Flt Permitted		1.00		0.40	1.00						0.99	
Satd. Flow (perm)		4700		740	3539						3254	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	468	132	195	776	0	0	0	0	164	522	326
RTOR Reduction (vph)	0	60	0	0	0	0	0	0	0	0	62	0
Lane Group Flow (vph)	0	540	0	195	776	0	0	0	0	0	950	0
Confl. Peds. (#/hr)			4	4						4		2
Confl. Bikes (#/hr)			3			2						21
Heavy Vehicles (%)	3%	7%	4%	2%	2%	2%	2%	1%	1%	2%	5%	3%
Turn Type		NA		Perm	NA					Perm	NA	
Protected Phases		2			6						4	
Permitted Phases				6						4		
Actuated Green, G (s)		38.0		38.0	38.0						37.0	
Effective Green, g (s)		38.0		38.0	38.0						37.0	
Actuated g/C Ratio		0.45		0.45	0.45						0.44	
Clearance Time (s)		5.0		5.0	5.0						5.0	
Vehicle Extension (s)		3.0		3.0	3.0						3.0	
Lane Grp Cap (vph)		2101		330	1582						1416	
v/s Ratio Prot		0.11			0.22							
v/s Ratio Perm				c0.26							0.29	
v/c Ratio		0.26		0.59	0.49						0.67	
Uniform Delay, d1		14.7		17.7	16.6						19.1	
Progression Factor		1.00		0.42	0.34						1.00	
Incremental Delay, d2		0.3		2.6	0.2						2.5	
Delay (s)		15.0		10.0	5.9						21.7	
Level of Service		B		A	A						C	
Approach Delay (s)		15.0			6.7			0.0			21.7	
Approach LOS		B			A			A			C	

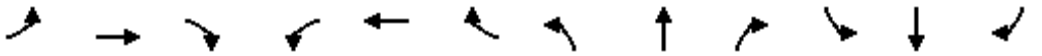
Intersection Summary			
HCM 2000 Control Delay	14.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	105.4%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	97	2	24	8	0	15	0	0	0	42	571	17
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	102	2	25	8	0	16	0	0	0	44	601	18
Pedestrians								1				
Lane Width (ft)								0.0				
Walking Speed (ft/s)								4.0				
Percent Blockage								0				
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											655	
pX, platoon unblocked												
vC, conflicting volume	714	698	310	416	707	0	619			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	714	698	310	416	707	0	619			0		
tC, single (s)	7.7	6.5	6.9	7.6	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.3	3.6	4.0	3.3	2.2			2.2		
p0 queue free %	66	99	96	98	100	99	100			97		
cM capacity (veh/h)	297	357	691	480	353	1091	971			1636		

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	129	24	345	318
Volume Left	102	8	44	0
Volume Right	25	16	0	18
cSH	335	756	1636	1700
Volume to Capacity	0.39	0.03	0.03	0.19
Queue Length 95th (ft)	44	2	2	0
Control Delay (s)	22.4	9.9	1.1	0.0
Lane LOS	C	A	A	
Approach Delay (s)	22.4	9.9	0.6	
Approach LOS	C	A		

Intersection Summary				
Average Delay	4.3			
Intersection Capacity Utilization	37.8%	ICU Level of Service	A	
Analysis Period (min)	15			

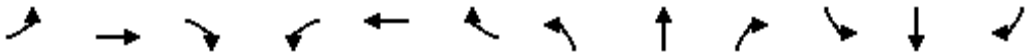


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	21	37	0	0	177	159	86	202	172	86	0	243
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0		5.0	5.0		4.0		4.0
Lane Util. Factor	1.00	0.95			0.95		0.91	0.91		1.00		0.88
Frpb, ped/bikes	1.00	1.00			0.99		1.00	1.00		1.00		1.00
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00		1.00		1.00
Frt	1.00	1.00			0.93		1.00	0.93		1.00		0.85
Flt Protected	0.95	1.00			1.00		0.95	1.00		0.95		1.00
Satd. Flow (prot)	1624	3471			3077		1441	2981		1543		2682
Flt Permitted	0.95	1.00			1.00		0.95	1.00		0.95		1.00
Satd. Flow (perm)	1624	3471			3077		1441	2981		1543		2682
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)	22	39	0	0	186	167	91	213	181	91	0	256
RTOR Reduction (vph)	0	0	0	0	139	0	0	125	0	0	0	231
Lane Group Flow (vph)	22	39	0	0	214	0	82	278	0	91	0	25
Confl. Peds. (#/hr)	6					6						
Confl. Bikes (#/hr)			6			3						
Heavy Vehicles (%)	0%	4%	0%	0%	9%	7%	14%	7%	9%	17%	0%	6%
Parking (#/hr)	0											
Turn Type	Split	NA			NA		Split	NA		Prot		custom
Protected Phases	4	4			8		2	2		6		6
Permitted Phases												
Actuated Green, G (s)	3.6	3.6			8.9		16.4	16.4		5.1		5.1
Effective Green, g (s)	3.6	3.6			8.9		16.4	16.4		5.1		5.1
Actuated g/C Ratio	0.07	0.07			0.17		0.31	0.31		0.10		0.10
Clearance Time (s)	5.0	5.0			5.0		5.0	5.0		4.0		4.0
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0		3.0
Lane Grp Cap (vph)	110	235			516		445	922		148		258
v/s Ratio Prot	c0.01	0.01			c0.07		0.06	c0.09		c0.06		0.01
v/s Ratio Perm												
v/c Ratio	0.20	0.17			0.41		0.18	0.30		0.61		0.10
Uniform Delay, d1	23.3	23.3			19.7		13.4	13.9		23.0		21.8
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00		1.00
Incremental Delay, d2	0.9	0.3			0.5		0.9	0.8		7.4		0.2
Delay (s)	24.2	23.6			20.3		14.3	14.8		30.4		22.0
Level of Service	C	C			C		B	B		C		C
Approach Delay (s)		23.8			20.3			14.7			24.2	
Approach LOS		C			C			B			C	

Intersection Summary			
HCM 2000 Control Delay	19.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	53.0	Sum of lost time (s)	19.0
Intersection Capacity Utilization	43.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	13	36	1	19	36	90	0	11	31	78	15	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0		5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.99		1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00		1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.89		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		1.00		0.95	1.00	
Satd. Flow (prot)	1805	3610	794	1357	3471	1328		2621		1703	2356	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		1.00		0.95	1.00	
Satd. Flow (perm)	1805	3610	794	1357	3471	1328		2621		1703	2356	
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)	14	38	1	20	38	95	0	12	33	82	16	1
RTOR Reduction (vph)	0	0	1	0	0	57	0	23	0	0	1	0
Lane Group Flow (vph)	14	38	0	20	38	38	0	22	0	82	16	0
Confl. Peds. (#/hr)			4	4								
Confl. Bikes (#/hr)			4			2						3
Heavy Vehicles (%)	0%	0%	100%	33%	4%	20%	0%	38%	17%	6%	55%	0%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8						
Actuated Green, G (s)	4.0	39.0	39.0	5.0	40.0	40.0		30.0		6.0	32.0	
Effective Green, g (s)	4.0	39.0	39.0	5.0	40.0	40.0		30.0		6.0	32.0	
Actuated g/C Ratio	0.04	0.39	0.39	0.05	0.40	0.40		0.30		0.06	0.32	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0		5.0		5.0	5.0	
Lane Grp Cap (vph)	72	1407	309	67	1388	531		786		102	753	
v/s Ratio Prot	0.01	0.01		c0.01	0.01			c0.01		c0.05	0.01	
v/s Ratio Perm			0.00			c0.03						
v/c Ratio	0.19	0.03	0.00	0.30	0.03	0.07		0.03		0.80	0.02	
Uniform Delay, d1	46.4	18.8	18.6	45.8	18.2	18.5		24.7		46.4	23.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2	5.9	0.0	0.0	11.0	0.0	0.3		0.1		47.2	0.1	
Delay (s)	52.4	18.8	18.6	56.9	18.2	18.8		24.8		93.6	23.3	
Level of Service	D	B	B	E	B	B		C		F	C	
Approach Delay (s)		27.7			23.6			24.8			81.5	
Approach LOS		C			C			C			F	

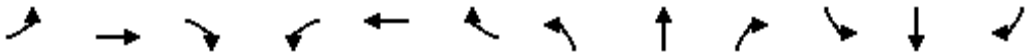
Intersection Summary			
HCM 2000 Control Delay	40.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.12		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	51.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	88	602	32	76	823	81	59	165	59	101	217	134
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0		4.0	5.0		4.0	5.0		4.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.99		1.00	0.96		1.00	0.94	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1805	3445		1805	3451		1805	1813		1770	1729	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1805	3445		1805	3451		1805	1813		1770	1729	
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	89	608	32	77	831	82	60	167	60	102	219	135
RTOR Reduction (vph)	0	5	0	0	8	0	0	13	0	0	22	0
Lane Group Flow (vph)	89	635	0	77	905	0	60	214	0	102	332	0
Confl. Peds. (#/hr)	6		3	3		6	6		5	5		6
Confl. Bikes (#/hr)			15			13			14			11
Heavy Vehicles (%)	0%	4%	0%	0%	3%	0%	0%	0%	0%	2%	4%	0%
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	6.0	32.1		4.0	30.1		6.1	33.0		4.0	30.9	
Effective Green, g (s)	6.0	32.1		4.0	30.1		6.1	33.0		4.0	30.9	
Actuated g/C Ratio	0.07	0.35		0.04	0.33		0.07	0.36		0.04	0.34	
Clearance Time (s)	4.0	5.0		4.0	5.0		4.0	5.0		4.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	118	1213		79	1140		120	656		77	586	
v/s Ratio Prot	c0.05	0.18		0.04	c0.26		0.03	0.12		c0.06	c0.19	
v/s Ratio Perm												
v/c Ratio	0.75	0.52		0.97	0.79		0.50	0.33		1.32	0.57	
Uniform Delay, d1	41.8	23.4		43.5	27.7		41.0	21.0		43.5	24.6	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	23.5	0.4		92.0	3.9		3.3	1.3		211.9	3.9	
Delay (s)	65.4	23.8		135.5	31.6		44.3	22.3		255.4	28.6	
Level of Service	E	C		F	C		D	C		F	C	
Approach Delay (s)		28.9			39.7			26.9			79.3	
Approach LOS		C			D			C			E	

Intersection Summary			
HCM 2000 Control Delay	42.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	91.1	Sum of lost time (s)	18.0
Intersection Capacity Utilization	77.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	215	12	5	570	0	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	0	0	0	226	13	5	600	0	0	0	0
Pedestrians		3			3						2	
Lane Width (ft)		0.0			12.0						0.0	
Walking Speed (ft/s)		4.0			4.0						4.0	
Percent Blockage		0			0						0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								536				
pX, platoon unblocked												
vC, conflicting volume	441	617	3	614	617	305	3			603		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	441	617	3	614	617	305	3			603		
tC, single (s)	7.5	6.5	6.9	7.6	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	44	98	100			100		
cM capacity (veh/h)	275	406	1086	368	406	695	1632			982		

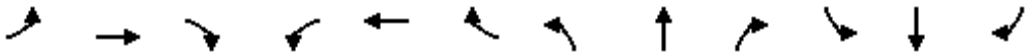
Direction, Lane #	WB 1	WB 2	NB 1	NB 2
Volume Total	151	88	205	400
Volume Left	0	0	5	0
Volume Right	0	13	0	0
cSH	406	432	1632	1700
Volume to Capacity	0.37	0.20	0.00	0.24
Queue Length 95th (ft)	42	19	0	0
Control Delay (s)	19.0	15.5	0.2	0.0
Lane LOS	C	C	A	
Approach Delay (s)	17.7		0.1	
Approach LOS	C			

Intersection Summary				
Average Delay	5.1			
Intersection Capacity Utilization	33.7%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	214	387	0	0	808	108	116	353	131	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0			5.0				
Lane Util. Factor	1.00	0.95			0.91			0.95				
Frpb, ped/bikes	1.00	1.00			1.00			0.99				
Flpb, ped/bikes	1.00	1.00			1.00			1.00				
Frt	1.00	1.00			0.98			0.97				
Flt Protected	0.95	1.00			1.00			0.99				
Satd. Flow (prot)	1752	3374			4987			3393				
Flt Permitted	0.24	1.00			1.00			0.99				
Satd. Flow (perm)	435	3374			4987			3393				
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)	225	407	0	0	851	114	122	372	138	0	0	0
RTOR Reduction (vph)	0	0	0	0	20	0	0	30	0	0	0	0
Lane Group Flow (vph)	225	407	0	0	945	0	0	602	0	0	0	0
Confl. Peds. (#/hr)	1					1			8			
Confl. Bikes (#/hr)			2			2			27			
Heavy Vehicles (%)	3%	7%	4%	2%	2%	2%	2%	1%	1%	2%	5%	3%
Turn Type	Perm	NA			NA		Perm	NA				
Protected Phases		2			6			8				
Permitted Phases	2						8					
Actuated Green, G (s)	38.0	38.0			38.0			37.0				
Effective Green, g (s)	38.0	38.0			38.0			37.0				
Actuated g/C Ratio	0.45	0.45			0.45			0.44				
Clearance Time (s)	5.0	5.0			5.0			5.0				
Vehicle Extension (s)	3.0	3.0			3.0			3.0				
Lane Grp Cap (vph)	194	1508			2229			1476				
v/s Ratio Prot		0.12			0.19							
v/s Ratio Perm	c0.52							0.18				
v/c Ratio	1.16	0.27			0.42			0.41				
Uniform Delay, d1	23.5	14.8			16.0			16.5				
Progression Factor	0.81	0.64			1.00			1.00				
Incremental Delay, d2	112.4	0.4			0.1			0.2				
Delay (s)	131.4	9.9			16.2			16.7				
Level of Service	F	A			B			B				
Approach Delay (s)		53.2			16.2			16.7			0.0	
Approach LOS		D			B			B			A	

Intersection Summary			
HCM 2000 Control Delay	26.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	105.4%	ICU Level of Service	G
Analysis Period (min)	15		

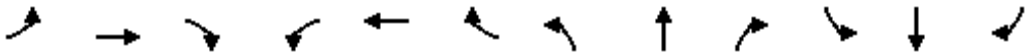
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	99	0	0	2	0	5	455	35	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	104	0	0	2	0	5	479	37	0	0	0
Pedestrians		9			13							
Lane Width (ft)		12.0			12.0							
Walking Speed (ft/s)		4.0			4.0							
Percent Blockage		1			1							
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											608	
pX, platoon unblocked												
vC, conflicting volume	260	548	9	573	530	271	9			529		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	260	548	9	573	530	271	9			529		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	76	100	100	100	100	100			100		
cM capacity (veh/h)	654	437	1069	323	448	725	1612			1037		

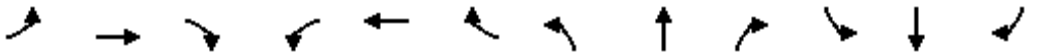
Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	104	2	245	276
Volume Left	0	0	5	0
Volume Right	0	0	0	37
cSH	437	448	1612	1700
Volume to Capacity	0.24	0.00	0.00	0.16
Queue Length 95th (ft)	23	0	0	0
Control Delay (s)	15.8	13.1	0.2	0.0
Lane LOS	C	B	A	
Approach Delay (s)	15.8	13.1	0.1	
Approach LOS	C	B		

Intersection Summary				
Average Delay	2.7			
Intersection Capacity Utilization	25.8%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	109	0	10	0	0	0	7	724	2	0	141	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0				5.0	5.0			5.0	
Lane Util. Factor		1.00	1.00				1.00	0.95			0.95	
Frpb, ped/bikes		1.00	0.99				1.00	1.00			1.00	
Flpb, ped/bikes		1.00	1.00				1.00	1.00			1.00	
Frt		1.00	0.85				1.00	1.00			0.99	
Flt Protected		0.95	1.00				0.95	1.00			1.00	
Satd. Flow (prot)		1767	1199				1202	2735			2461	
Flt Permitted		0.76	1.00				0.65	1.00			1.00	
Satd. Flow (perm)		1408	1199				820	2735			2461	
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)	115	0	11	0	0	0	7	762	2	0	148	16
RTOR Reduction (vph)	0	0	7	0	0	0	0	1	0	0	9	0
Lane Group Flow (vph)	0	115	4	0	0	0	7	763	0	0	155	0
Confl. Peds. (#/hr)	2		1	1		2	1		2	2		1
Confl. Bikes (#/hr)									1			1
Heavy Vehicles (%)	2%	0%	33%	0%	0%	0%	50%	32%	0%	0%	49%	0%
Turn Type	Perm	NA	Perm	Perm			Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2			6		
Actuated Green, G (s)		25.0	25.0				30.0	30.0			30.0	
Effective Green, g (s)		25.0	25.0				30.0	30.0			30.0	
Actuated g/C Ratio		0.38	0.38				0.46	0.46			0.46	
Clearance Time (s)		5.0	5.0				5.0	5.0			5.0	
Lane Grp Cap (vph)		541	461				378	1262			1135	
v/s Ratio Prot								c0.28			0.06	
v/s Ratio Perm		c0.08	0.00				0.01					
v/c Ratio		0.21	0.01				0.02	0.60			0.14	
Uniform Delay, d1		13.4	12.4				9.5	13.1			10.1	
Progression Factor		1.00	1.00				1.00	1.00			1.00	
Incremental Delay, d2		0.9	0.0				0.1	2.2			0.3	
Delay (s)		14.3	12.4				9.6	15.2			10.3	
Level of Service		B	B				A	B			B	
Approach Delay (s)		14.1			0.0			15.2			10.3	
Approach LOS		B			A			B			B	

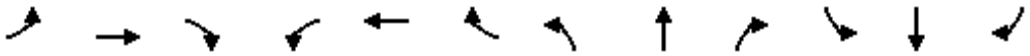
Intersection Summary			
HCM 2000 Control Delay	14.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	51.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	8	395	118	66	902	52	407	84	249	89	34	72
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	0.90	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.97	1.00	0.95	1.00	
Satd. Flow (prot)	1504	3505	1495	1433	3360		1618	1346	1302	1517	1397	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.97	1.00	0.95	1.00	
Satd. Flow (perm)	1504	3505	1495	1433	3360		1618	1346	1302	1517	1397	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	8	416	124	69	949	55	428	88	262	94	36	76
RTOR Reduction (vph)	0	0	86	0	4	0	0	0	193	0	68	0
Lane Group Flow (vph)	8	416	38	69	1000	0	257	259	69	94	44	0
Heavy Vehicles (%)	20%	3%	8%	26%	3%	68%	6%	76%	24%	19%	50%	9%
Turn Type	Prot	NA	Perm	Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		6	6		2	2	
Permitted Phases			4						6			
Actuated Green, G (s)	0.7	24.2	24.2	5.6	29.1		20.9	20.9	20.9	8.2	8.2	
Effective Green, g (s)	0.7	24.2	24.2	5.6	29.1		20.9	20.9	20.9	8.2	8.2	
Actuated g/C Ratio	0.01	0.31	0.31	0.07	0.37		0.26	0.26	0.26	0.10	0.10	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	13	1075	458	101	1239		428	356	344	157	145	
v/s Ratio Prot	0.01	0.12		c0.05	c0.30		0.16	c0.19		c0.06	0.03	
v/s Ratio Perm			0.03						0.05			
v/c Ratio	0.62	0.39	0.08	0.68	0.81		0.60	0.73	0.20	0.60	0.30	
Uniform Delay, d1	39.0	21.5	19.5	35.8	22.4		25.4	26.4	22.5	33.8	32.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	64.0	0.2	0.1	17.4	3.9		2.4	7.2	0.3	15.7	5.3	
Delay (s)	103.0	21.7	19.5	53.2	26.3		27.7	33.6	22.8	49.5	38.0	
Level of Service	F	C	B	D	C		C	C	C	D	D	
Approach Delay (s)		22.4			28.0			28.0			43.3	
Approach LOS		C			C			C			D	

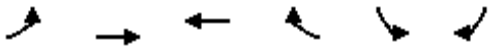
Intersection Summary			
HCM 2000 Control Delay	28.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	78.9	Sum of lost time (s)	20.0
Intersection Capacity Utilization	62.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	148	477	116	243	842	284	129	232	490	179	101	24
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	0.98		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	1.00	0.85	1.00	0.90		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1433	3179		1626	3438	1495	1444	2823		1612	2822	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1433	3179		1626	3438	1495	1444	2823		1612	2822	
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)	153	492	120	251	868	293	133	239	505	185	104	25
RTOR Reduction (vph)	0	22	0	0	0	244	0	339	0	0	21	0
Lane Group Flow (vph)	153	590	0	251	868	49	133	405	0	185	108	0
Confl. Peds. (#/hr)			20	1								
Confl. Bikes (#/hr)			75									
Heavy Vehicles (%)	26%	8%	10%	11%	5%	8%	25%	23%	11%	12%	18%	50%
Turn Type	Split	NA		Split	NA	Perm	Split	NA		Split	NA	
Protected Phases	4	4		8	8		2	2		6	6	
Permitted Phases						8						
Actuated Green, G (s)	29.0	29.0		16.0	16.0	16.0	15.0	15.0		15.0	15.0	
Effective Green, g (s)	29.0	29.0		16.0	16.0	16.0	15.0	15.0		15.0	15.0	
Actuated g/C Ratio	0.31	0.31		0.17	0.17	0.17	0.16	0.16		0.16	0.16	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	437	970		273	579	251	228	445		254	445	
v/s Ratio Prot	0.11	c0.19		0.15	c0.25		0.09	c0.14		c0.11	0.04	
v/s Ratio Perm						0.03						
v/c Ratio	0.35	0.61		0.92	1.50	0.20	0.58	0.91		0.73	0.24	
Uniform Delay, d1	25.7	28.2		38.9	39.5	34.0	37.1	39.3		38.1	35.0	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.2	2.8		37.2	233.6	1.7	10.5	25.4		16.7	1.3	
Delay (s)	27.9	31.0		76.0	273.1	35.7	47.6	64.7		54.8	36.3	
Level of Service	C	C		E	F	D	D	E		D	D	
Approach Delay (s)		30.4			188.8			62.1			47.2	
Approach LOS		C			F			E			D	

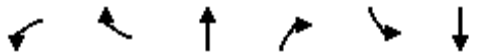
Intersection Summary			
HCM 2000 Control Delay	106.6	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	86.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	135	1075	1108	43	3	265
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	142	1132	1166	45	3	279
Pedestrians					2	
Lane Width (ft)					12.0	
Walking Speed (ft/s)					4.0	
Percent Blockage					0	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		1120	405			
pX, platoon unblocked	0.87				0.89	0.87
vC, conflicting volume	1214				2041	608
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	954				1776	260
tC, single (s)	4.9				6.8	7.1
tC, 2 stage (s)						
tF (s)	2.6				3.5	3.4
p0 queue free %	69				93	55
cM capacity (veh/h)	456				46	621

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	519	754	778	434	282
Volume Left	142	0	0	0	3
Volume Right	0	0	0	45	279
cSH	456	1700	1700	1700	545
Volume to Capacity	0.31	0.44	0.46	0.26	0.52
Queue Length 95th (ft)	33	0	0	0	74
Control Delay (s)	9.3	0.0	0.0	0.0	18.5
Lane LOS	A				C
Approach Delay (s)	3.8		0.0		18.5
Approach LOS					C

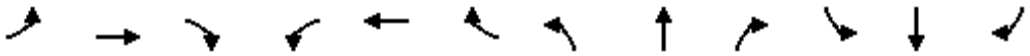
Intersection Summary			
Average Delay	3.6		
Intersection Capacity Utilization	92.2%	ICU Level of Service	F
Analysis Period (min)	15		



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	252	0	0	0	0	813
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	260	0	0	0	0	838
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			444			
pX, platoon unblocked						
vC, conflicting volume	419	0			0	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	419	0			0	
tC, single (s)	6.9	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	53	100			100	
cM capacity (veh/h)	557	1091			1636	

Direction, Lane #	WB 1	WB 2	SB 1	SB 2
Volume Total	130	130	419	419
Volume Left	130	130	0	0
Volume Right	0	0	0	0
cSH	557	557	1700	1700
Volume to Capacity	0.23	0.23	0.25	0.25
Queue Length 95th (ft)	22	22	0	0
Control Delay (s)	13.4	13.4	0.0	0.0
Lane LOS	B	B		
Approach Delay (s)	13.4		0.0	
Approach LOS	B			

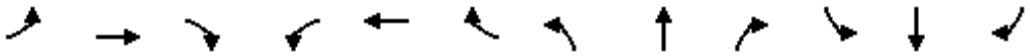
Intersection Summary			
Average Delay	3.2		
Intersection Capacity Utilization	42.4%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	726	183	175	762	0	0	0	0	189	625	237
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0		5.0	5.0						5.0	
Lane Util. Factor		0.95		1.00	0.95						0.95	
Frpb, ped/bikes		0.99		1.00	1.00						0.99	
Flpb, ped/bikes		1.00		1.00	1.00						1.00	
Frt		0.97		1.00	1.00						0.97	
Flt Protected		1.00		0.95	1.00						0.99	
Satd. Flow (prot)		3282		1763	3471						3345	
Flt Permitted		1.00		0.24	1.00						0.99	
Satd. Flow (perm)		3282		441	3471						3345	
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)	0	756	191	182	794	0	0	0	0	197	651	247
RTOR Reduction (vph)	0	21	0	0	0	0	0	0	0	0	26	0
Lane Group Flow (vph)	0	926	0	182	794	0	0	0	0	0	1069	0
Confl. Peds. (#/hr)	20		20	20		20	20		20	20		20
Confl. Bikes (#/hr)			75			75						50
Heavy Vehicles (%)	6%	6%	3%	2%	4%	1%	3%	4%	1%	4%	1%	1%
Turn Type		NA		Perm	NA					Perm	NA	
Protected Phases		2			6						4	
Permitted Phases				6						4		
Actuated Green, G (s)		59.0		59.0	59.0						36.0	
Effective Green, g (s)		59.0		59.0	59.0						36.0	
Actuated g/C Ratio		0.56		0.56	0.56						0.34	
Clearance Time (s)		5.0		5.0	5.0						5.0	
Vehicle Extension (s)		3.0		3.0	3.0						3.0	
Lane Grp Cap (vph)		1844		247	1950						1146	
v/s Ratio Prot		0.28			0.23							
v/s Ratio Perm				c0.41							0.32	
v/c Ratio		0.50		0.74	0.41						0.93	
Uniform Delay, d1		14.0		17.2	13.1						33.3	
Progression Factor		1.00		0.64	0.46						1.00	
Incremental Delay, d2		1.0		14.7	0.5						14.7	
Delay (s)		15.0		25.7	6.6						48.1	
Level of Service		B		C	A						D	
Approach Delay (s)		15.0			10.1			0.0			48.1	
Approach LOS		B			B			A			D	

Intersection Summary			
HCM 2000 Control Delay	25.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	128.6%	ICU Level of Service	H
Analysis Period (min)	15		

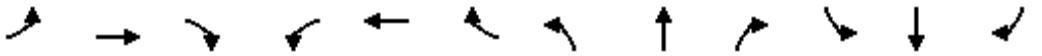
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	161	12	7	2	0	0	0	0	10	705	3
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	169	13	7	2	0	0	0	0	11	742	3
Pedestrians		3						1				
Lane Width (ft)		12.0						0.0				
Walking Speed (ft/s)		4.0						4.0				
Percent Blockage		0						0				
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											655	
pX, platoon unblocked												
vC, conflicting volume	769	768	377	490	769	0	748			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	769	768	377	490	769	0	748			0		
tC, single (s)	7.7	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	49	98	97	99	100	100			99		
cM capacity (veh/h)	276	332	625	271	331	1091	867			1636		

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	182	9	382	374
Volume Left	0	7	11	0
Volume Right	13	0	0	3
cSH	343	282	1636	1700
Volume to Capacity	0.53	0.03	0.01	0.22
Queue Length 95th (ft)	74	3	0	0
Control Delay (s)	26.8	18.2	0.3	0.0
Lane LOS	D	C	A	
Approach Delay (s)	26.8	18.2	0.1	
Approach LOS	D	C		

Intersection Summary				
Average Delay	5.4			
Intersection Capacity Utilization	35.9%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	168	115	0	0	129	153	106	376	111	106	0	246
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0		5.0	5.0		5.0		5.0
Lane Util. Factor	1.00	0.95			0.95		0.91	0.91		1.00		0.88
Frpb, ped/bikes	1.00	1.00			0.99		1.00	1.00		1.00		1.00
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00		1.00		1.00
Frt	1.00	1.00			0.92		1.00	0.97		1.00		0.85
Flt Protected	0.95	1.00			1.00		0.95	1.00		0.95		1.00
Satd. Flow (prot)	1160	3195			2746		1014	2890		1570		2349
Flt Permitted	0.95	1.00			1.00		0.95	1.00		0.95		1.00
Satd. Flow (perm)	1160	3195			2746		1014	2890		1570		2349
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)	177	121	0	0	136	161	112	396	117	112	0	259
RTOR Reduction (vph)	0	0	0	0	141	0	0	21	0	0	0	222
Lane Group Flow (vph)	177	121	0	0	156	0	101	503	0	112	0	37
Confl. Peds. (#/hr)							4					4
Confl. Bikes (#/hr)			6			3						
Heavy Vehicles (%)	40%	13%	0%	0%	18%	21%	62%	15%	13%	15%	0%	21%
Parking (#/hr)	0											
Turn Type	Split	NA			NA		Split	NA		Prot		custom
Protected Phases	4	4			8		2	2		6		6
Permitted Phases												
Actuated Green, G (s)	17.1	17.1			9.3		18.1	18.1		10.7		10.7
Effective Green, g (s)	17.1	17.1			9.3		18.1	18.1		10.7		10.7
Actuated g/C Ratio	0.23	0.23			0.12		0.24	0.24		0.14		0.14
Clearance Time (s)	5.0	5.0			5.0		5.0	5.0		5.0		5.0
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0		3.0
Lane Grp Cap (vph)	263	726			339		244	695		223		334
v/s Ratio Prot	c0.15	0.04			c0.06		0.10	c0.17		c0.07		0.02
v/s Ratio Perm												
v/c Ratio	0.67	0.17			0.46		0.41	0.72		0.50		0.11
Uniform Delay, d1	26.5	23.3			30.6		24.1	26.3		29.8		28.1
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00		1.00
Incremental Delay, d2	6.6	0.1			1.0		5.1	6.5		1.8		0.1
Delay (s)	33.1	23.4			31.6		29.2	32.7		31.6		28.2
Level of Service	C	C			C		C	C		C		C
Approach Delay (s)		29.2			31.6			32.2			29.3	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	30.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	75.2	Sum of lost time (s)	20.0
Intersection Capacity Utilization	51.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	201	233	43	34	71	78	7	269	185	232	150	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1245	2375	832	1107	2201	1062	1003	1970		1203	1870	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1245	2375	832	1107	2201	1062	1003	1970		1203	1870	
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)	212	245	45	36	75	82	7	283	195	244	158	0
RTOR Reduction (vph)	0	0	30	0	0	72	0	102	0	0	0	0
Lane Group Flow (vph)	212	245	15	36	75	10	7	376	0	244	158	0
Confl. Bikes (#/hr)						1						
Heavy Vehicles (%)	45%	52%	94%	63%	64%	50%	80%	79%	62%	50%	93%	0%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8						
Actuated Green, G (s)	39.0	39.0	39.0	15.0	15.0	15.0	29.0	29.0		17.0	17.0	
Effective Green, g (s)	39.0	39.0	39.0	15.0	15.0	15.0	29.0	29.0		17.0	17.0	
Actuated g/C Ratio	0.32	0.32	0.32	0.12	0.12	0.12	0.24	0.24		0.14	0.14	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	404	771	270	138	275	132	242	476		170	264	
v/s Ratio Prot	c0.17	c0.10		0.03	0.03		0.01	c0.19		c0.20	0.08	
v/s Ratio Perm			0.02			0.01						
v/c Ratio	0.52	0.32	0.05	0.26	0.27	0.08	0.03	0.79		1.44	0.60	
Uniform Delay, d1	33.0	30.5	27.8	47.5	47.6	46.4	34.7	42.6		51.5	48.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	4.8	1.1	0.4	4.5	2.4	1.1	0.2	12.5		226.1	9.6	
Delay (s)	37.8	31.6	28.2	52.0	50.0	47.5	35.0	55.1		277.6	57.9	
Level of Service	D	C	C	D	D	D	C	E		F	E	
Approach Delay (s)		33.9			49.3			54.8			191.3	
Approach LOS		C			D			D			F	

Intersection Summary			
HCM 2000 Control Delay	82.2	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	57.4%	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												
Volume (vph)	74	816	72	99	940	84	49	329	91	104	304	108
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0		4.0	5.0		4.0	5.0		4.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	0.99		1.00	0.98	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.99		1.00	0.97		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3355		1770	3445		1770	1761		1770	1711	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3355		1770	3445		1770	1761		1770	1711	
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)	78	859	76	104	989	88	52	346	96	109	320	114
RTOR Reduction (vph)	0	7	0	0	7	0	0	10	0	0	13	0
Lane Group Flow (vph)	78	928	0	104	1070	0	52	432	0	109	421	0
Confl. Peds. (#/hr)	30		30	30		30	30		30	30		30
Confl. Bikes (#/hr)			75			75			20			20
Heavy Vehicles (%)	2%	5%	7%	2%	2%	2%	2%	3%	4%	2%	3%	9%
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	5.4	34.9		4.0	33.5		3.9	33.1		4.0	33.2	
Effective Green, g (s)	5.4	34.9		4.0	33.5		3.9	33.1		4.0	33.2	
Actuated g/C Ratio	0.06	0.37		0.04	0.36		0.04	0.35		0.04	0.35	
Clearance Time (s)	4.0	5.0		4.0	5.0		4.0	5.0		4.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	101	1245		75	1227		73	620		75	604	
v/s Ratio Prot	0.04	0.28		c0.06	c0.31		0.03	0.25		c0.06	c0.25	
v/s Ratio Perm												
v/c Ratio	0.77	0.75		1.39	0.87		0.71	0.70		1.45	0.70	
Uniform Delay, d1	43.7	25.7		45.0	28.2		44.5	26.1		45.0	26.1	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	29.9	2.5		237.1	7.1		27.8	6.4		263.6	6.5	
Delay (s)	73.6	28.2		282.1	35.3		72.3	32.5		308.6	32.6	
Level of Service	E	C		F	D		E	C		F	C	
Approach Delay (s)		31.7			57.0			36.7			88.0	
Approach LOS		C			E			D			F	

Intersection Summary			
HCM 2000 Control Delay	51.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	94.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	81.6%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	245	15	7	1001	0	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	0	0	0	0	253	15	7	1032	0	0	0	0
Pedestrians		16			1						3	
Lane Width (ft)		0.0			12.0						0.0	
Walking Speed (ft/s)		4.0			4.0						4.0	
Percent Blockage		0			0						0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								536				
pX, platoon unblocked												
vC, conflicting volume	691	1063	16	1047	1063	520	16			1033		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	691	1063	16	1047	1063	520	16			1033		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	100	100	100	0	97	100			100		
cM capacity (veh/h)	0	224	1066	184	224	506	1615			680		

Direction, Lane #	WB 1	WB 2	NB 1	NB 2
Volume Total	168	100	351	688
Volume Left	0	0	7	0
Volume Right	0	15	0	0
cSH	224	245	1615	1700
Volume to Capacity	0.75	0.41	0.00	0.40
Queue Length 95th (ft)	130	47	0	0
Control Delay (s)	57.9	29.4	0.2	0.0
Lane LOS	F	D	A	
Approach Delay (s)	47.3		0.1	
Approach LOS	E			

Intersection Summary				
Average Delay	9.8			
Intersection Capacity Utilization	42.4%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	420	495	0	0	762	171	175	684	211	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0			5.0				
Lane Util. Factor	1.00	0.95			0.95			0.95				
Frpb, ped/bikes	1.00	1.00			0.99			0.99				
Flpb, ped/bikes	1.00	1.00			1.00			1.00				
Frt	1.00	1.00			0.97			0.97				
Flt Protected	0.95	1.00			1.00			0.99				
Satd. Flow (prot)	1696	3406			3356			3311				
Flt Permitted	0.23	1.00			1.00			0.99				
Satd. Flow (perm)	408	3406			3356			3311				
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)	438	516	0	0	794	178	182	712	220	0	0	0
RTOR Reduction (vph)	0	0	0	0	18	0	0	20	0	0	0	0
Lane Group Flow (vph)	438	516	0	0	954	0	0	1094	0	0	0	0
Confl. Peds. (#/hr)	20		20	20		20	20		20	20		20
Confl. Bikes (#/hr)			75			75			50			
Heavy Vehicles (%)	6%	6%	3%	2%	4%	1%	3%	4%	1%	4%	1%	1%
Turn Type	Perm	NA			NA		Perm	NA				
Protected Phases		2			6			8				
Permitted Phases	2						8					
Actuated Green, G (s)	59.0	59.0			59.0			36.0				
Effective Green, g (s)	59.0	59.0			59.0			36.0				
Actuated g/C Ratio	0.56	0.56			0.56			0.34				
Clearance Time (s)	5.0	5.0			5.0			5.0				
Vehicle Extension (s)	3.0	3.0			3.0			3.0				
Lane Grp Cap (vph)	229	1913			1885			1135				
v/s Ratio Prot		0.15			0.28							
v/s Ratio Perm	c1.07							0.33				
v/c Ratio	1.91	0.27			0.51			0.96				
Uniform Delay, d1	23.0	11.9			14.1			33.9				
Progression Factor	0.78	0.52			1.00			1.00				
Incremental Delay, d2	423.6	0.3			1.0			18.5				
Delay (s)	441.6	6.5			15.1			52.3				
Level of Service	F	A			B			D				
Approach Delay (s)		206.3			15.1			52.3			0.0	
Approach LOS		F			B			D			A	

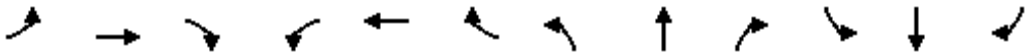
Intersection Summary			
HCM 2000 Control Delay	88.7	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.55		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	128.6%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	161	0	0	0	2	7	8	902	3	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	169	0	0	0	2	7	8	949	3	0	0	0
Pedestrians		12			1						1	
Lane Width (ft)		12.0			12.0						0.0	
Walking Speed (ft/s)		4.0			4.0						4.0	
Percent Blockage		1			0						0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											608	
pX, platoon unblocked												
vC, conflicting volume	513	982	12	969	981	478	12			954		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	513	982	12	969	981	478	12			954		
tC, single (s)	7.7	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	59	100	100	100	99	99	99			100		
cM capacity (veh/h)	413	247	1061	208	247	538	1604			728		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	169	9	483	478
Volume Left	169	0	8	0
Volume Right	0	7	0	3
cSH	413	427	1604	1700
Volume to Capacity	0.41	0.02	0.01	0.28
Queue Length 95th (ft)	49	2	0	0
Control Delay (s)	19.7	13.6	0.2	0.0
Lane LOS	C	B	A	
Approach Delay (s)	19.7	13.6	0.1	
Approach LOS	C	B		

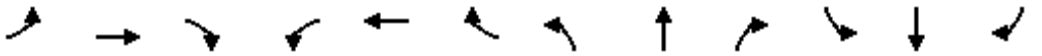
Intersection Summary				
Average Delay	3.1			
Intersection Capacity Utilization	47.5%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	111	0	20	0	0	0	10	181	0	0	91	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0				5.0	5.0			5.0	
Lane Util. Factor		1.00	1.00				1.00	0.95			0.95	
Frpb, ped/bikes		1.00	1.00				1.00	1.00			0.99	
Flpb, ped/bikes		1.00	1.00				1.00	1.00			1.00	
Frt		1.00	0.85				1.00	1.00			0.95	
Flt Protected		0.95	1.00				0.95	1.00			1.00	
Satd. Flow (prot)		1805	1615				1543	3471			3139	
Flt Permitted		0.76	1.00				0.66	1.00			1.00	
Satd. Flow (perm)		1439	1615				1079	3471			3139	
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)	117	0	21	0	0	0	11	191	0	0	96	42
RTOR Reduction (vph)	0	0	13	0	0	0	0	0	0	0	23	0
Lane Group Flow (vph)	0	117	8	0	0	0	11	191	0	0	115	0
Confl. Bikes (#/hr)												2
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	17%	4%	0%	0%	13%	0%
Turn Type	Perm	NA	Perm	Perm			Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2			6		
Actuated Green, G (s)		26.0	26.0				29.0	29.0			29.0	
Effective Green, g (s)		26.0	26.0				29.0	29.0			29.0	
Actuated g/C Ratio		0.40	0.40				0.45	0.45			0.45	
Clearance Time (s)		5.0	5.0				5.0	5.0			5.0	
Lane Grp Cap (vph)		575	646				481	1548			1400	
v/s Ratio Prot								c0.06			0.04	
v/s Ratio Perm		c0.08	0.01				0.01					
v/c Ratio		0.20	0.01				0.02	0.12			0.08	
Uniform Delay, d1		12.7	11.8				10.1	10.5			10.3	
Progression Factor		1.00	1.00				1.00	1.00			1.00	
Incremental Delay, d2		0.8	0.0				0.1	0.2			0.1	
Delay (s)		13.5	11.8				10.2	10.7			10.5	
Level of Service		B	B				B	B			B	
Approach Delay (s)		13.3			0.0			10.7			10.5	
Approach LOS		B			A			B			B	

Intersection Summary			
HCM 2000 Control Delay	11.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.16		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	22.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group



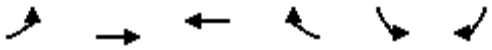
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	42	282	57	49	816	34	92	20	131	57	18	29
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	0.91	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.97	1.00	0.95	1.00	
Satd. Flow (prot)	1357	3471	1524	1687	3409		1649	1456	1495	1433	1344	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.97	1.00	0.95	1.00	
Satd. Flow (perm)	1357	3471	1524	1687	3409		1649	1456	1495	1433	1344	
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)	44	297	60	52	859	36	97	21	138	60	19	31
RTOR Reduction (vph)	0	0	41	0	3	0	0	0	90	0	29	0
Lane Group Flow (vph)	44	297	19	52	892	0	58	60	48	60	21	0
Heavy Vehicles (%)	33%	4%	6%	7%	4%	35%	4%	50%	8%	26%	45%	18%
Turn Type	Prot	NA	Perm	Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		6	6		2	2	
Permitted Phases			4						6			
Actuated Green, G (s)	4.6	31.5	31.5	6.3	33.2		35.0	35.0	35.0	8.1	8.1	
Effective Green, g (s)	4.6	31.5	31.5	6.3	33.2		35.0	35.0	35.0	8.1	8.1	
Actuated g/C Ratio	0.05	0.31	0.31	0.06	0.33		0.35	0.35	0.35	0.08	0.08	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	61	1083	475	105	1121		572	505	518	115	107	
v/s Ratio Prot	c0.03	0.09		0.03	c0.26		0.04	c0.04		c0.04	0.02	
v/s Ratio Perm			0.01						0.03			
v/c Ratio	0.72	0.27	0.04	0.50	0.80		0.10	0.12	0.09	0.52	0.20	
Uniform Delay, d1	47.5	26.1	24.2	45.8	30.8		22.3	22.4	22.2	44.5	43.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	34.1	0.1	0.0	3.6	4.0		0.4	0.5	0.4	4.2	0.9	
Delay (s)	81.6	26.2	24.2	49.4	34.8		22.7	22.9	22.6	48.8	44.3	
Level of Service	F	C	C	D	C		C	C	C	D	D	
Approach Delay (s)		32.0			35.6			22.7			46.7	
Approach LOS		C			D			C			D	

Intersection Summary			
HCM 2000 Control Delay	33.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	100.9	Sum of lost time (s)	20.0
Intersection Capacity Utilization	49.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	67	267	91	195	753	326	129	143	223	164	116	37
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	0.98		1.00	1.00	0.98	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.96		1.00	1.00	0.85	1.00	0.91		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1626	3197		1703	3505	1543	1583	3036		1736	2923	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1626	3197		1703	3505	1543	1583	3036		1736	2923	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	71	281	96	205	793	343	136	151	235	173	122	39
RTOR Reduction (vph)	0	35	0	0	0	285	0	198	0	0	32	0
Lane Group Flow (vph)	71	342	0	205	793	58	136	188	0	173	129	0
Confl. Peds. (#/hr)			20	1								
Confl. Bikes (#/hr)			75			3						
Heavy Vehicles (%)	11%	4%	13%	6%	3%	3%	14%	5%	10%	4%	12%	41%
Turn Type	Split	NA		Split	NA	Perm	Split	NA		Split	NA	
Protected Phases	4	4		8	8		2	2		6	6	
Permitted Phases						8						
Actuated Green, G (s)	29.0	29.0		16.0	16.0	16.0	15.0	15.0		15.0	15.0	
Effective Green, g (s)	29.0	29.0		16.0	16.0	16.0	15.0	15.0		15.0	15.0	
Actuated g/C Ratio	0.31	0.31		0.17	0.17	0.17	0.16	0.16		0.16	0.16	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	496	975		286	590	259	249	479		274	461	
v/s Ratio Prot	0.04	c0.11		0.12	c0.23		c0.09	0.06		c0.10	0.04	
v/s Ratio Perm						0.04						
v/c Ratio	0.14	0.35		0.72	1.34	0.22	0.55	0.39		0.63	0.28	
Uniform Delay, d1	24.0	25.7		37.4	39.5	34.1	36.9	35.9		37.4	35.2	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.6	1.0		14.3	165.9	2.0	8.4	2.4		10.6	1.5	
Delay (s)	24.6	26.7		51.7	205.4	36.1	45.2	38.3		48.0	36.8	
Level of Service	C	C		D	F	D	D	D		D	D	
Approach Delay (s)		26.3			138.6			40.1			42.6	
Approach LOS		C			F			D			D	

Intersection Summary			
HCM 2000 Control Delay	88.0	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	71.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	77	661	1089	57	5	205
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	79	681	1123	59	5	211
Pedestrians		2				
Lane Width (ft)		12.0				
Walking Speed (ft/s)		4.0				
Percent Blockage		0				
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		1120	405			
pX, platoon unblocked	0.86				0.86	0.86
vC, conflicting volume	1181				1652	593
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	878				1426	191
tC, single (s)	4.9				7.5	7.0
tC, 2 stage (s)						
tF (s)	2.6				3.8	3.3
p0 queue free %	83				92	70
cM capacity (veh/h)	478				68	698

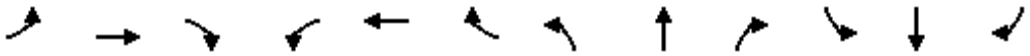
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	307	454	748	433	216
Volume Left	79	0	0	0	5
Volume Right	0	0	0	59	211
cSH	478	1700	1700	1700	572
Volume to Capacity	0.17	0.27	0.44	0.25	0.38
Queue Length 95th (ft)	15	0	0	0	44
Control Delay (s)	5.6	0.0	0.0	0.0	15.1
Lane LOS	A				C
Approach Delay (s)	2.3		0.0		15.1
Approach LOS					C

Intersection Summary			
Average Delay	2.3		
Intersection Capacity Utilization	75.6%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	220	0	0	0	0	756
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	232	0	0	0	0	796
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			444			
pX, platoon unblocked						
vC, conflicting volume	398	0			0	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	398	0			0	
tC, single (s)	6.9	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	60	100			100	
cM capacity (veh/h)	572	1091			1636	

Direction, Lane #	WB 1	WB 2	SB 1	SB 2
Volume Total	116	116	398	398
Volume Left	116	116	0	0
Volume Right	0	0	0	0
cSH	572	572	1700	1700
Volume to Capacity	0.20	0.20	0.23	0.23
Queue Length 95th (ft)	19	19	0	0
Control Delay (s)	12.9	12.9	0.0	0.0
Lane LOS	B	B		
Approach Delay (s)	12.9		0.0	
Approach LOS	B			

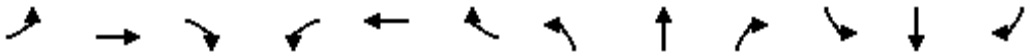
Intersection Summary			
Average Delay	2.9		
Intersection Capacity Utilization	33.8%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	309	173	200	703	0	0	0	0	164	504	301
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0		5.0	5.0						5.0	
Lane Util. Factor		0.95		1.00	0.95						0.95	
Frpb, ped/bikes		0.98		1.00	1.00						0.98	
Flpb, ped/bikes		1.00		0.99	1.00						1.00	
Frt		0.95		1.00	1.00						0.95	
Flt Protected		1.00		0.95	1.00						0.99	
Satd. Flow (prot)		3152		1757	3539						3224	
Flt Permitted		1.00		0.43	1.00						0.99	
Satd. Flow (perm)		3152		789	3539						3224	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	325	182	211	740	0	0	0	0	173	531	317
RTOR Reduction (vph)	0	91	0	0	0	0	0	0	0	0	61	0
Lane Group Flow (vph)	0	416	0	211	740	0	0	0	0	0	960	0
Confl. Peds. (#/hr)	20		20	20		20	20		20	20		20
Confl. Bikes (#/hr)			75			75						50
Heavy Vehicles (%)	3%	7%	4%	2%	2%	2%	2%	1%	1%	2%	5%	3%
Turn Type		NA		Perm	NA					Perm	NA	
Protected Phases		2			6						4	
Permitted Phases				6						4		
Actuated Green, G (s)		38.0		38.0	38.0						37.0	
Effective Green, g (s)		38.0		38.0	38.0						37.0	
Actuated g/C Ratio		0.45		0.45	0.45						0.44	
Clearance Time (s)		5.0		5.0	5.0						5.0	
Vehicle Extension (s)		3.0		3.0	3.0						3.0	
Lane Grp Cap (vph)		1409		352	1582						1403	
v/s Ratio Prot		0.13			0.21							
v/s Ratio Perm				c0.27							0.30	
v/c Ratio		0.30		0.60	0.47						0.68	
Uniform Delay, d1		15.0		17.8	16.4						19.3	
Progression Factor		1.00		0.41	0.39						1.00	
Incremental Delay, d2		0.5		2.3	0.2						2.7	
Delay (s)		15.5		9.6	6.6						22.0	
Level of Service		B		A	A						C	
Approach Delay (s)		15.5			7.2			0.0			22.0	
Approach LOS		B			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	15.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	114.1%	ICU Level of Service	H
Analysis Period (min)	15		

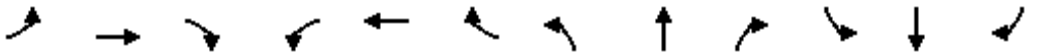
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	182	24	8	0	0	0	0	0	42	572	17
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	192	25	8	0	0	0	0	0	44	602	18
Pedestrians								1				
Lane Width (ft)								0.0				
Walking Speed (ft/s)								4.0				
Percent Blockage								0				
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											655	
pX, platoon unblocked												
vC, conflicting volume	699	699	311	512	708	0	620			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	699	699	311	512	708	0	620			0		
tC, single (s)	7.7	6.5	6.9	7.6	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.3	3.6	4.0	3.3	2.2			2.2		
p0 queue free %	100	46	96	96	100	100	100			97		
cM capacity (veh/h)	309	356	691	237	352	1091	970			1636		

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	217	8	345	319
Volume Left	0	8	44	0
Volume Right	25	0	0	18
cSH	378	237	1636	1700
Volume to Capacity	0.57	0.04	0.03	0.19
Queue Length 95th (ft)	86	3	2	0
Control Delay (s)	26.6	20.7	1.1	0.0
Lane LOS	D	C	A	
Approach Delay (s)	26.6	20.7	0.6	
Approach LOS	D	C		

Intersection Summary				
Average Delay	7.1			
Intersection Capacity Utilization	35.4%	ICU Level of Service	A	
Analysis Period (min)	15			

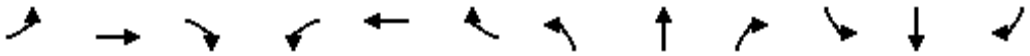


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	21	32	0	0	173	151	56	212	173	79	0	253
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0		5.0	5.0		4.0		4.0
Lane Util. Factor	1.00	0.95			0.95		0.91	0.91		1.00		0.88
Frpb, ped/bikes	1.00	1.00			0.99		1.00	1.00		1.00		1.00
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00		1.00		1.00
Frt	1.00	1.00			0.93		1.00	0.93		1.00		0.85
Flt Protected	0.95	1.00			1.00		0.95	1.00		0.95		1.00
Satd. Flow (prot)	1624	3471			3080		1441	2987		1543		2682
Flt Permitted	0.95	1.00			1.00		0.95	1.00		0.95		1.00
Satd. Flow (perm)	1624	3471			3080		1441	2987		1543		2682
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)	22	34	0	0	182	159	59	223	182	83	0	266
RTOR Reduction (vph)	0	0	0	0	133	0	0	126	0	0	0	240
Lane Group Flow (vph)	22	34	0	0	208	0	53	285	0	83	0	26
Confl. Peds. (#/hr)	6					6						
Confl. Bikes (#/hr)			6			3						
Heavy Vehicles (%)	0%	4%	0%	0%	9%	7%	14%	7%	9%	17%	0%	6%
Parking (#/hr)	0											
Turn Type	Split	NA			NA		Split	NA		Prot		custom
Protected Phases	4	4			8		2	2		6		6
Permitted Phases												
Actuated Green, G (s)	3.6	3.6			8.8		16.4	16.4		5.1		5.1
Effective Green, g (s)	3.6	3.6			8.8		16.4	16.4		5.1		5.1
Actuated g/C Ratio	0.07	0.07			0.17		0.31	0.31		0.10		0.10
Clearance Time (s)	5.0	5.0			5.0		5.0	5.0		4.0		4.0
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0		3.0
Lane Grp Cap (vph)	110	236			512		446	926		148		258
v/s Ratio Prot	c0.01	0.01			c0.07		0.04	c0.10		c0.05		0.01
v/s Ratio Perm												
v/c Ratio	0.20	0.14			0.41		0.12	0.31		0.56		0.10
Uniform Delay, d1	23.3	23.2			19.7		13.1	13.9		22.8		21.8
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00		1.00
Incremental Delay, d2	0.9	0.3			0.5		0.5	0.9		4.8		0.2
Delay (s)	24.2	23.5			20.2		13.6	14.8		27.6		22.0
Level of Service	C	C			C		B	B		C		C
Approach Delay (s)		23.8			20.2			14.7			23.3	
Approach LOS		C			C			B			C	

Intersection Summary			
HCM 2000 Control Delay	19.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.36		
Actuated Cycle Length (s)	52.9	Sum of lost time (s)	19.0
Intersection Capacity Utilization	43.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	13	36	1	19	36	55	0	11	31	44	15	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0		5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.99		1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00		1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.89		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		1.00		0.95	1.00	
Satd. Flow (prot)	1805	3610	794	1357	3471	1328		2621		1703	2356	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		1.00		0.95	1.00	
Satd. Flow (perm)	1805	3610	794	1357	3471	1328		2621		1703	2356	
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)	14	38	1	20	38	58	0	12	33	46	16	1
RTOR Reduction (vph)	0	0	1	0	0	35	0	23	0	0	1	0
Lane Group Flow (vph)	14	38	0	20	38	23	0	22	0	46	16	0
Confl. Peds. (#/hr)			4	4								
Confl. Bikes (#/hr)			4			2						3
Heavy Vehicles (%)	0%	0%	100%	33%	4%	20%	0%	38%	17%	6%	55%	0%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8						
Actuated Green, G (s)	4.0	39.0	39.0	5.0	40.0	40.0		30.0		6.0	32.0	
Effective Green, g (s)	4.0	39.0	39.0	5.0	40.0	40.0		30.0		6.0	32.0	
Actuated g/C Ratio	0.04	0.39	0.39	0.05	0.40	0.40		0.30		0.06	0.32	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0		5.0		5.0	5.0	
Lane Grp Cap (vph)	72	1407	309	67	1388	531		786		102	753	
v/s Ratio Prot	0.01	0.01		c0.01	0.01			c0.01		c0.03	0.01	
v/s Ratio Perm			0.00			c0.02						
v/c Ratio	0.19	0.03	0.00	0.30	0.03	0.04		0.03		0.45	0.02	
Uniform Delay, d1	46.4	18.8	18.6	45.8	18.2	18.3		24.7		45.4	23.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2	5.9	0.0	0.0	11.0	0.0	0.2		0.1		13.7	0.1	
Delay (s)	52.4	18.8	18.6	56.9	18.2	18.5		24.8		59.1	23.3	
Level of Service	D	B	B	E	B	B		C		E	C	
Approach Delay (s)		27.7			25.0			24.8			49.5	
Approach LOS		C			C			C			D	

Intersection Summary			
HCM 2000 Control Delay	31.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.08		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	51.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	44	578	32	76	786	81	59	165	59	101	217	118
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0		4.0	5.0		4.0	5.0		4.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	0.99		1.00	0.98		1.00	0.99		1.00	0.97	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.99		1.00	0.96		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1805	3426		1805	3407		1805	1802		1770	1710	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1805	3426		1805	3407		1805	1802		1770	1710	
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	44	584	32	77	794	82	60	167	60	102	219	119
RTOR Reduction (vph)	0	5	0	0	9	0	0	13	0	0	18	0
Lane Group Flow (vph)	44	611	0	77	867	0	60	214	0	102	320	0
Confl. Peds. (#/hr)	30		30	30		30	30		30	30		30
Confl. Bikes (#/hr)			75			75			20			20
Heavy Vehicles (%)	0%	4%	0%	0%	3%	0%	0%	0%	0%	2%	4%	0%
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	3.3	28.3		4.1	29.1		4.4	34.2		4.1	33.9	
Effective Green, g (s)	3.3	28.3		4.1	29.1		4.4	34.2		4.1	33.9	
Actuated g/C Ratio	0.04	0.32		0.05	0.33		0.05	0.39		0.05	0.38	
Clearance Time (s)	4.0	5.0		4.0	5.0		4.0	5.0		4.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	67	1093		83	1117		89	694		81	653	
v/s Ratio Prot	0.02	0.18		c0.04	c0.25		0.03	0.12		c0.06	c0.19	
v/s Ratio Perm												
v/c Ratio	0.66	0.56		0.93	0.78		0.67	0.31		1.26	0.49	
Uniform Delay, d1	42.1	25.0		42.2	26.9		41.4	19.0		42.3	20.8	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	20.8	0.6		74.1	3.5		18.3	1.2		184.8	2.6	
Delay (s)	63.0	25.7		116.2	30.3		59.7	20.2		227.1	23.5	
Level of Service	E	C		F	C		E	C		F	C	
Approach Delay (s)		28.1			37.3			28.4			70.7	
Approach LOS		C			D			C			E	

Intersection Summary			
HCM 2000 Control Delay	39.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	88.7	Sum of lost time (s)	18.0
Intersection Capacity Utilization	77.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	215	12	5	557	0	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	0	0	0	226	13	5	586	0	0	0	0
Pedestrians		3			3						2	
Lane Width (ft)		0.0			12.0						0.0	
Walking Speed (ft/s)		4.0			4.0						4.0	
Percent Blockage		0			0						0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								536				
pX, platoon unblocked												
vC, conflicting volume	434	603	3	600	603	298	3			589		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	434	603	3	600	603	298	3			589		
tC, single (s)	7.5	6.5	6.9	7.6	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	45	98	100			100		
cM capacity (veh/h)	283	413	1086	376	413	702	1632			993		

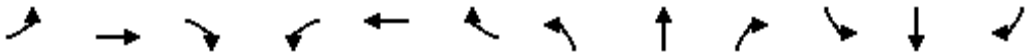
Direction, Lane #	WB 1	WB 2	NB 1	NB 2
Volume Total	151	88	201	391
Volume Left	0	0	5	0
Volume Right	0	13	0	0
cSH	413	439	1632	1700
Volume to Capacity	0.36	0.20	0.00	0.23
Queue Length 95th (ft)	41	18	0	0
Control Delay (s)	18.6	15.2	0.2	0.0
Lane LOS	C	C	A	
Approach Delay (s)	17.4		0.1	
Approach LOS	C			

Intersection Summary				
Average Delay	5.1			
Intersection Capacity Utilization	33.8%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	201	273	0	0	755	108	150	353	178	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0			5.0				
Lane Util. Factor	1.00	0.95			0.95			0.95				
Frpb, ped/bikes	1.00	1.00			1.00			0.99				
Flpb, ped/bikes	1.00	1.00			1.00			1.00				
Frt	1.00	1.00			0.98			0.96				
Flt Protected	0.95	1.00			1.00			0.99				
Satd. Flow (prot)	1752	3374			3467			3361				
Flt Permitted	0.21	1.00			1.00			0.99				
Satd. Flow (perm)	396	3374			3467			3361				
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)	212	287	0	0	795	114	158	372	187	0	0	0
RTOR Reduction (vph)	0	0	0	0	13	0	0	42	0	0	0	0
Lane Group Flow (vph)	212	287	0	0	896	0	0	675	0	0	0	0
Confl. Peds. (#/hr)	1					1			8			
Confl. Bikes (#/hr)			2			2			27			
Heavy Vehicles (%)	3%	7%	4%	2%	2%	2%	2%	1%	1%	2%	5%	3%
Turn Type	Perm	NA			NA		Perm	NA				
Protected Phases		2			6			8				
Permitted Phases	2						8					
Actuated Green, G (s)	38.0	38.0			38.0			37.0				
Effective Green, g (s)	38.0	38.0			38.0			37.0				
Actuated g/C Ratio	0.45	0.45			0.45			0.44				
Clearance Time (s)	5.0	5.0			5.0			5.0				
Vehicle Extension (s)	3.0	3.0			3.0			3.0				
Lane Grp Cap (vph)	177	1508			1549			1463				
v/s Ratio Prot		0.09			0.26							
v/s Ratio Perm	c0.54							0.20				
v/c Ratio	1.20	0.19			0.58			0.46				
Uniform Delay, d1	23.5	14.2			17.5			17.0				
Progression Factor	0.98	0.86			1.00			1.00				
Incremental Delay, d2	127.7	0.3			0.5			0.2				
Delay (s)	150.8	12.5			18.1			17.2				
Level of Service	F	B			B			B				
Approach Delay (s)		71.3			18.1			17.2			0.0	
Approach LOS		E			B			B			A	

Intersection Summary			
HCM 2000 Control Delay	30.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	114.1%	ICU Level of Service	H
Analysis Period (min)	15		

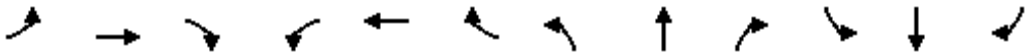
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	182	0	0	0	2	0	5	453	35	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	192	0	0	0	2	0	5	477	37	0	0	0
Pedestrians		9			13							
Lane Width (ft)		12.0			12.0							
Walking Speed (ft/s)		4.0			4.0							
Percent Blockage		1			1							
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											608	
pX, platoon unblocked												
vC, conflicting volume	259	546	9	519	528	270	9			527		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	259	546	9	519	528	270	9			527		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	71	100	100	100	100	100	100			100		
cM capacity (veh/h)	655	438	1069	432	449	726	1612			1039		

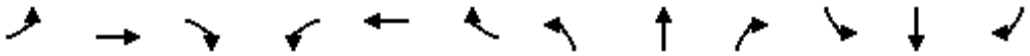
Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	192	2	244	275
Volume Left	192	0	5	0
Volume Right	0	0	0	37
cSH	655	449	1612	1700
Volume to Capacity	0.29	0.00	0.00	0.16
Queue Length 95th (ft)	30	0	0	0
Control Delay (s)	12.8	13.1	0.2	0.0
Lane LOS	B	B	A	
Approach Delay (s)	12.8	13.1	0.1	
Approach LOS	B	B		

Intersection Summary				
Average Delay	3.5			
Intersection Capacity Utilization	37.3%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	171	0	23	0	0	0	27	724	2	0	141	107
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0				5.0	5.0			5.0	
Lane Util. Factor		1.00	1.00				1.00	0.95			0.95	
Frpb, ped/bikes		1.00	0.96				1.00	1.00			0.97	
Flpb, ped/bikes		0.98	1.00				0.98	1.00			1.00	
Frt		1.00	0.85				1.00	1.00			0.94	
Flt Protected		0.95	1.00				0.95	1.00			1.00	
Satd. Flow (prot)		1741	1165				1184	2735			2575	
Flt Permitted		0.76	1.00				0.59	1.00			1.00	
Satd. Flow (perm)		1388	1165				736	2735			2575	
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)	180	0	24	0	0	0	28	762	2	0	148	113
RTOR Reduction (vph)	0	0	15	0	0	0	0	1	0	0	61	0
Lane Group Flow (vph)	0	180	9	0	0	0	28	763	0	0	200	0
Confl. Peds. (#/hr)	20		20	20		20	20		20	20		20
Confl. Bikes (#/hr)			20			20			20			20
Heavy Vehicles (%)	2%	0%	33%	0%	0%	0%	50%	32%	0%	0%	49%	0%
Turn Type	Perm	NA	Perm	Perm			Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2			6		
Actuated Green, G (s)		25.0	25.0				30.0	30.0			30.0	
Effective Green, g (s)		25.0	25.0				30.0	30.0			30.0	
Actuated g/C Ratio		0.38	0.38				0.46	0.46			0.46	
Clearance Time (s)		5.0	5.0				5.0	5.0			5.0	
Lane Grp Cap (vph)		533	448				339	1262			1188	
v/s Ratio Prot								c0.28			0.08	
v/s Ratio Perm		c0.13	0.01				0.04					
v/c Ratio		0.34	0.02				0.08	0.60			0.17	
Uniform Delay, d1		14.1	12.4				9.8	13.1			10.2	
Progression Factor		1.00	1.00				1.00	1.00			1.00	
Incremental Delay, d2		1.7	0.1				0.5	2.2			0.3	
Delay (s)		15.9	12.5				10.3	15.2			10.5	
Level of Service		B	B				B	B			B	
Approach Delay (s)		15.5			0.0			15.1			10.5	
Approach LOS		B			A			B			B	

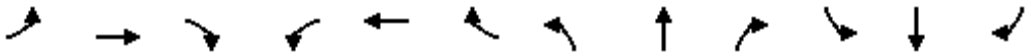
Intersection Summary			
HCM 2000 Control Delay	14.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	51.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	8	395	140	137	902	52	418	84	300	89	34	72
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.96	1.00	1.00		1.00	1.00	0.97	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	0.90	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.97	1.00	0.95	1.00	
Satd. Flow (prot)	1504	3505	1442	1433	3360		1618	1351	1267	1517	1397	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.97	1.00	0.95	1.00	
Satd. Flow (perm)	1504	3505	1442	1433	3360		1618	1351	1267	1517	1397	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	8	416	147	144	949	55	440	88	316	94	36	76
RTOR Reduction (vph)	0	0	111	0	4	0	0	0	218	0	68	0
Lane Group Flow (vph)	8	416	36	144	1000	0	264	264	98	94	44	0
Confl. Peds. (#/hr)			20						20			
Heavy Vehicles (%)	20%	3%	8%	26%	3%	68%	6%	76%	24%	19%	50%	9%
Turn Type	Prot	NA	Perm	Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		6	6		2	2	
Permitted Phases			4						6			
Actuated Green, G (s)	0.7	19.7	19.7	10.7	29.7		21.6	21.6	21.6	8.2	8.2	
Effective Green, g (s)	0.7	19.7	19.7	10.7	29.7		21.6	21.6	21.6	8.2	8.2	
Actuated g/C Ratio	0.01	0.25	0.25	0.13	0.37		0.27	0.27	0.27	0.10	0.10	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	13	860	354	191	1244		435	363	341	155	142	
v/s Ratio Prot	0.01	0.12		c0.10	c0.30		0.16	c0.20		c0.06	0.03	
v/s Ratio Perm			0.03						0.08			
v/c Ratio	0.62	0.48	0.10	0.75	0.80		0.61	0.73	0.29	0.61	0.31	
Uniform Delay, d1	39.6	25.9	23.4	33.5	22.6		25.6	26.6	23.2	34.5	33.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	64.0	0.4	0.1	15.5	3.9		2.4	7.1	0.5	16.4	5.5	
Delay (s)	103.7	26.3	23.5	48.9	26.5		28.0	33.7	23.7	50.8	38.9	
Level of Service	F	C	C	D	C		C	C	C	D	D	
Approach Delay (s)		26.7			29.3			28.2			44.4	
Approach LOS		C			C			C			D	

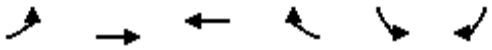
Intersection Summary			
HCM 2000 Control Delay	29.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	80.2	Sum of lost time (s)	20.0
Intersection Capacity Utilization	65.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	156	517	119	243	899	284	133	232	490	179	101	33
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	0.98		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	1.00	0.85	1.00	0.90		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1433	3186		1626	3438	1495	1444	2823		1612	2762	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1433	3186		1626	3438	1495	1444	2823		1612	2762	
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)	161	533	123	251	927	293	137	239	505	185	104	34
RTOR Reduction (vph)	0	21	0	0	0	244	0	331	0	0	29	0
Lane Group Flow (vph)	161	635	0	251	927	49	137	413	0	185	109	0
Confl. Peds. (#/hr)			20	1								
Confl. Bikes (#/hr)			75									
Heavy Vehicles (%)	26%	8%	10%	11%	5%	8%	25%	23%	11%	12%	18%	50%
Turn Type	Split	NA		Split	NA	Perm	Split	NA		Split	NA	
Protected Phases	4	4		8	8		2	2		6	6	
Permitted Phases						8						
Actuated Green, G (s)	29.0	29.0		16.0	16.0	16.0	15.0	15.0		15.0	15.0	
Effective Green, g (s)	29.0	29.0		16.0	16.0	16.0	15.0	15.0		15.0	15.0	
Actuated g/C Ratio	0.31	0.31		0.17	0.17	0.17	0.16	0.16		0.16	0.16	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	437	972		273	579	251	228	445		254	436	
v/s Ratio Prot	0.11	c0.20		0.15	c0.27		0.09	c0.15		c0.11	0.04	
v/s Ratio Perm						0.03						
v/c Ratio	0.37	0.65		0.92	1.60	0.20	0.60	0.93		0.73	0.25	
Uniform Delay, d1	25.8	28.6		38.9	39.5	34.0	37.2	39.5		38.1	35.1	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.4	3.4		37.2	278.5	1.7	11.2	28.0		16.7	1.4	
Delay (s)	28.2	32.1		76.0	318.0	35.7	48.4	67.5		54.8	36.5	
Level of Service	C	C		E	F	D	D	E		D	D	
Approach Delay (s)		31.3			220.5			64.5			46.9	
Approach LOS		C			F			E			D	

Intersection Summary			
HCM 2000 Control Delay	120.8	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	86.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	135	1115	1165	43	3	265
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	142	1174	1226	45	3	279
Pedestrians					2	
Lane Width (ft)					12.0	
Walking Speed (ft/s)					4.0	
Percent Blockage					0	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		1120	405			
pX, platoon unblocked	0.86				0.89	0.86
vC, conflicting volume	1274				2122	638
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	994				1745	256
tC, single (s)	4.9				6.8	7.1
tC, 2 stage (s)						
tF (s)	2.6				3.5	3.4
p0 queue free %	67				93	55
cM capacity (veh/h)	431				47	616

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	533	782	818	454	282
Volume Left	142	0	0	0	3
Volume Right	0	0	0	45	279
cSH	431	1700	1700	1700	543
Volume to Capacity	0.33	0.46	0.48	0.27	0.52
Queue Length 95th (ft)	36	0	0	0	74
Control Delay (s)	10.1	0.0	0.0	0.0	18.6
Lane LOS	B				C
Approach Delay (s)	4.1		0.0		18.6
Approach LOS					C

Intersection Summary			
Average Delay	3.7		
Intersection Capacity Utilization	94.9%	ICU Level of Service	F
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	252	0	0	0	0	821
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	260	0	0	0	0	846
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			444			
pX, platoon unblocked						
vC, conflicting volume	423	0			0	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	423	0			0	
tC, single (s)	6.9	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	53	100			100	
cM capacity (veh/h)	554	1091			1636	

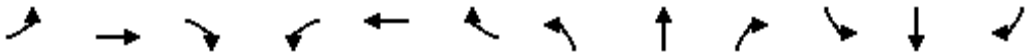
Direction, Lane #	WB 1	WB 2	SB 1	SB 2
Volume Total	130	130	423	423
Volume Left	130	130	0	0
Volume Right	0	0	0	0
cSH	554	554	1700	1700
Volume to Capacity	0.23	0.23	0.25	0.25
Queue Length 95th (ft)	23	23	0	0
Control Delay (s)	13.5	13.5	0.0	0.0
Lane LOS	B	B		
Approach Delay (s)	13.5		0.0	
Approach LOS	B			

Intersection Summary			
Average Delay	3.2		
Intersection Capacity Utilization	42.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	764	186	175	812	0	0	0	0	189	625	244
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0		5.0	5.0						5.0	
Lane Util. Factor		0.95		1.00	0.95						0.95	
Frpb, ped/bikes		0.99		1.00	1.00						0.99	
Flpb, ped/bikes		1.00		1.00	1.00						1.00	
Frt		0.97		1.00	1.00						0.97	
Flt Protected		1.00		0.95	1.00						0.99	
Satd. Flow (prot)		3286		1763	3471						3342	
Flt Permitted		1.00		0.22	1.00						0.99	
Satd. Flow (perm)		3286		412	3471						3342	
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)	0	796	194	182	846	0	0	0	0	197	651	254
RTOR Reduction (vph)	0	20	0	0	0	0	0	0	0	0	27	0
Lane Group Flow (vph)	0	970	0	182	846	0	0	0	0	0	1075	0
Confl. Peds. (#/hr)	20		20	20		20	20		20	20		20
Confl. Bikes (#/hr)			75			75						50
Heavy Vehicles (%)	6%	6%	3%	2%	4%	1%	3%	4%	1%	4%	1%	1%
Turn Type		NA		Perm	NA					Perm	NA	
Protected Phases		2			6						4	
Permitted Phases				6						4		
Actuated Green, G (s)		59.0		59.0	59.0						36.0	
Effective Green, g (s)		59.0		59.0	59.0						36.0	
Actuated g/C Ratio		0.56		0.56	0.56						0.34	
Clearance Time (s)		5.0		5.0	5.0						5.0	
Vehicle Extension (s)		3.0		3.0	3.0						3.0	
Lane Grp Cap (vph)		1846		231	1950						1145	
v/s Ratio Prot		0.30			0.24							
v/s Ratio Perm				c0.44							0.32	
v/c Ratio		0.53		0.79	0.43						0.94	
Uniform Delay, d1		14.3		18.1	13.3						33.4	
Progression Factor		1.00		0.63	0.45						1.00	
Incremental Delay, d2		1.1		19.2	0.6						15.5	
Delay (s)		15.4		30.6	6.5						48.9	
Level of Service		B		C	A						D	
Approach Delay (s)		15.4			10.8			0.0			48.9	
Approach LOS		B			B			A			D	

Intersection Summary			
HCM 2000 Control Delay	25.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	129.6%	ICU Level of Service	H
Analysis Period (min)	15		

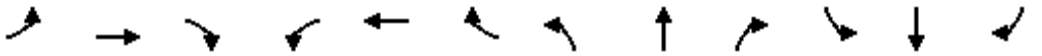
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	161	12	7	2	0	0	0	0	10	707	3
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	169	13	7	2	0	0	0	0	11	744	3
Pedestrians		3						1				
Lane Width (ft)		12.0						0.0				
Walking Speed (ft/s)		4.0						4.0				
Percent Blockage		0						0				
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											655	
pX, platoon unblocked												
vC, conflicting volume	771	770	378	492	771	0	750			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	771	770	378	492	771	0	750			0		
tC, single (s)	7.7	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	49	98	97	99	100	100			99		
cM capacity (veh/h)	275	331	624	270	330	1091	866			1636		

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	182	9	383	375
Volume Left	0	7	11	0
Volume Right	13	0	0	3
cSH	342	281	1636	1700
Volume to Capacity	0.53	0.03	0.01	0.22
Queue Length 95th (ft)	74	3	0	0
Control Delay (s)	26.9	18.3	0.3	0.0
Lane LOS	D	C	A	
Approach Delay (s)	26.9	18.3	0.1	
Approach LOS	D	C		

Intersection Summary				
Average Delay	5.5			
Intersection Capacity Utilization	35.9%	ICU Level of Service	A	
Analysis Period (min)	15			



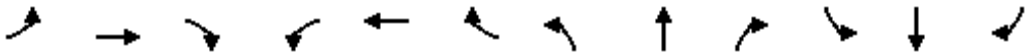
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	168	117	0	0	132	157	123	376	111	109	0	246
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0		5.0	5.0		5.0		5.0
Lane Util. Factor	1.00	0.95			0.95		0.91	0.91		1.00		0.88
Frpb, ped/bikes	1.00	1.00			0.99		1.00	1.00		1.00		1.00
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00		1.00		1.00
Frt	1.00	1.00			0.92		1.00	0.97		1.00		0.85
Flt Protected	0.95	1.00			1.00		0.95	1.00		0.95		1.00
Satd. Flow (prot)	1160	3195			2746		1014	2885		1570		2349
Flt Permitted	0.95	1.00			1.00		0.95	1.00		0.95		1.00
Satd. Flow (perm)	1160	3195			2746		1014	2885		1570		2349
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)	177	123	0	0	139	165	129	396	117	115	0	259
RTOR Reduction (vph)	0	0	0	0	144	0	0	21	0	0	0	222
Lane Group Flow (vph)	177	123	0	0	160	0	116	505	0	115	0	37
Confl. Peds. (#/hr)							4					4
Confl. Bikes (#/hr)			6			3						
Heavy Vehicles (%)	40%	13%	0%	0%	18%	21%	62%	15%	13%	15%	0%	21%
Parking (#/hr)	0											
Turn Type	Split	NA			NA		Split	NA		Prot		custom
Protected Phases	4	4			8		2	2		6		6
Permitted Phases												
Actuated Green, G (s)	17.1	17.1			9.5		18.1	18.1		10.8		10.8
Effective Green, g (s)	17.1	17.1			9.5		18.1	18.1		10.8		10.8
Actuated g/C Ratio	0.23	0.23			0.13		0.24	0.24		0.14		0.14
Clearance Time (s)	5.0	5.0			5.0		5.0	5.0		5.0		5.0
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0		3.0
Lane Grp Cap (vph)	262	723			345		243	691		224		336
v/s Ratio Prot	c0.15	0.04			c0.06		0.11	c0.18		c0.07		0.02
v/s Ratio Perm												
v/c Ratio	0.68	0.17			0.46		0.48	0.73		0.51		0.11
Uniform Delay, d1	26.7	23.5			30.6		24.6	26.5		29.9		28.2
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00		1.00
Incremental Delay, d2	6.7	0.1			1.0		6.6	6.7		2.0		0.1
Delay (s)	33.4	23.6			31.6		31.2	33.2		31.9		28.3
Level of Service	C	C			C		C	C		C		C
Approach Delay (s)		29.4			31.6			32.8			29.4	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	31.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	75.5	Sum of lost time (s)	20.0
Intersection Capacity Utilization	52.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	201	233	43	34	71	98	7	269	185	245	150	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1245	2375	832	1107	2201	1062	1003	1970		1203	1870	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1245	2375	832	1107	2201	1062	1003	1970		1203	1870	
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)	212	245	45	36	75	103	7	283	195	258	158	0
RTOR Reduction (vph)	0	0	30	0	0	90	0	102	0	0	0	0
Lane Group Flow (vph)	212	245	15	36	75	13	7	376	0	258	158	0
Confl. Bikes (#/hr)						1						
Heavy Vehicles (%)	45%	52%	94%	63%	64%	50%	80%	79%	62%	50%	93%	0%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8						
Actuated Green, G (s)	39.0	39.0	39.0	15.0	15.0	15.0	29.0	29.0		17.0	17.0	
Effective Green, g (s)	39.0	39.0	39.0	15.0	15.0	15.0	29.0	29.0		17.0	17.0	
Actuated g/C Ratio	0.32	0.32	0.32	0.12	0.12	0.12	0.24	0.24		0.14	0.14	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	404	771	270	138	275	132	242	476		170	264	
v/s Ratio Prot	c0.17	c0.10		0.03	0.03		0.01	c0.19		c0.21	0.08	
v/s Ratio Perm			0.02			0.01						
v/c Ratio	0.52	0.32	0.05	0.26	0.27	0.10	0.03	0.79		1.52	0.60	
Uniform Delay, d1	33.0	30.5	27.8	47.5	47.6	46.5	34.7	42.6		51.5	48.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	4.8	1.1	0.4	4.5	2.4	1.5	0.2	12.5		260.7	9.6	
Delay (s)	37.8	31.6	28.2	52.0	50.0	48.0	35.0	55.1		312.2	57.9	
Level of Service	D	C	C	D	D	D	C	E		F	E	
Approach Delay (s)		33.9			49.4			54.8			215.6	
Approach LOS		C			D			D			F	

Intersection Summary			
HCM 2000 Control Delay	89.0	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	58.1%	ICU Level of Service	B
Analysis Period (min)	15		

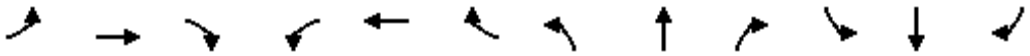
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	91	831	72	99	977	84	49	329	91	104	304	117
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0		4.0	5.0		4.0	5.0		4.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	0.99		1.00	0.98	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.99		1.00	0.97		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3357		1770	3448		1770	1761		1770	1703	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3357		1770	3448		1770	1761		1770	1703	
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)	96	875	76	104	1028	88	52	346	96	109	320	123
RTOR Reduction (vph)	0	7	0	0	7	0	0	10	0	0	14	0
Lane Group Flow (vph)	96	944	0	104	1109	0	52	432	0	109	429	0
Confl. Peds. (#/hr)	30		30	30		30	30		30	30		30
Confl. Bikes (#/hr)			75			75			20			20
Heavy Vehicles (%)	2%	5%	7%	2%	2%	2%	2%	3%	4%	2%	3%	9%
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	7.0	36.3		4.0	33.3		4.0	32.9		4.0	32.9	
Effective Green, g (s)	7.0	36.3		4.0	33.3		4.0	32.9		4.0	32.9	
Actuated g/C Ratio	0.07	0.38		0.04	0.35		0.04	0.35		0.04	0.35	
Clearance Time (s)	4.0	5.0		4.0	5.0		4.0	5.0		4.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	130	1280		74	1206		74	608		74	588	
v/s Ratio Prot	0.05	c0.28		c0.06	c0.32		0.03	0.25		c0.06	c0.25	
v/s Ratio Perm												
v/c Ratio	0.74	0.74		1.41	0.92		0.70	0.71		1.47	0.73	
Uniform Delay, d1	43.2	25.4		45.6	29.7		45.0	27.0		45.6	27.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	19.5	2.3		245.2	11.2		26.0	6.9		272.1	7.7	
Delay (s)	62.7	27.6		290.8	40.9		71.0	33.9		317.7	35.0	
Level of Service	E	C		F	D		E	C		F	C	
Approach Delay (s)		30.8			62.2			37.8			90.8	
Approach LOS		C			E			D			F	

Intersection Summary			
HCM 2000 Control Delay	53.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	95.2	Sum of lost time (s)	18.0
Intersection Capacity Utilization	82.4%	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												
Volume (veh/h)	0	0	0	0	245	15	7	1006	0	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	0	0	0	0	253	15	7	1037	0	0	0	0
Pedestrians		16			1						3	
Lane Width (ft)		0.0			12.0						0.0	
Walking Speed (ft/s)		4.0			4.0						4.0	
Percent Blockage		0			0						0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								536				
pX, platoon unblocked												
vC, conflicting volume	694	1069	16	1053	1069	523	16			1038		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	694	1069	16	1053	1069	523	16			1038		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	100	100	100	0	97	100			100		
cM capacity (veh/h)	0	222	1066	182	222	504	1615			677		

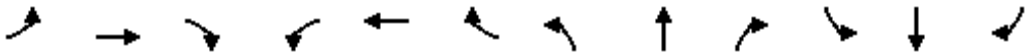
Direction, Lane #	WB 1	WB 2	NB 1	NB 2
Volume Total	168	100	353	691
Volume Left	0	0	7	0
Volume Right	0	15	0	0
cSH	222	243	1615	1700
Volume to Capacity	0.76	0.41	0.00	0.41
Queue Length 95th (ft)	132	47	0	0
Control Delay (s)	58.9	29.7	0.2	0.0
Lane LOS	F	D	A	
Approach Delay (s)	48.0		0.1	
Approach LOS	E			

Intersection Summary				
Average Delay	9.9			
Intersection Capacity Utilization	42.5%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	425	527	0	0	808	171	179	684	211	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0			5.0				
Lane Util. Factor	1.00	0.95			0.95			0.95				
Frpb, ped/bikes	1.00	1.00			1.00			0.99				
Flpb, ped/bikes	1.00	1.00			1.00			1.00				
Frt	1.00	1.00			0.97			0.97				
Flt Protected	0.95	1.00			1.00			0.99				
Satd. Flow (prot)	1702	3406			3389			3336				
Flt Permitted	0.21	1.00			1.00			0.99				
Satd. Flow (perm)	379	3406			3389			3336				
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)	443	549	0	0	842	178	186	712	220	0	0	0
RTOR Reduction (vph)	0	0	0	0	17	0	0	20	0	0	0	0
Lane Group Flow (vph)	443	549	0	0	1003	0	0	1098	0	0	0	0
Confl. Peds. (#/hr)	2					2			4	4		
Confl. Bikes (#/hr)			1						44			
Heavy Vehicles (%)	6%	6%	3%	2%	4%	1%	3%	4%	1%	4%	1%	1%
Turn Type	Perm	NA			NA		Perm	NA				
Protected Phases		2			6			8				
Permitted Phases	2						8					
Actuated Green, G (s)	59.0	59.0			59.0			36.0				
Effective Green, g (s)	59.0	59.0			59.0			36.0				
Actuated g/C Ratio	0.56	0.56			0.56			0.34				
Clearance Time (s)	5.0	5.0			5.0			5.0				
Vehicle Extension (s)	3.0	3.0			3.0			3.0				
Lane Grp Cap (vph)	212	1913			1904			1143				
v/s Ratio Prot		0.16			0.30							
v/s Ratio Perm	c1.17							0.33				
v/c Ratio	2.09	0.29			0.53			0.96				
Uniform Delay, d1	23.0	12.0			14.3			33.8				
Progression Factor	0.76	0.50			1.00			1.00				
Incremental Delay, d2	502.9	0.3			1.0			17.8				
Delay (s)	520.3	6.3			15.4			51.6				
Level of Service	F	A			B			D				
Approach Delay (s)		235.8			15.4			51.6			0.0	
Approach LOS		F			B			D			A	

Intersection Summary			
HCM 2000 Control Delay	98.2	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.66		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	129.6%	ICU Level of Service	H
Analysis Period (min)	15		

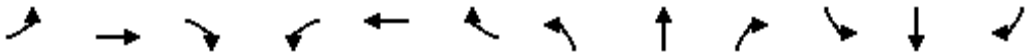
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	161	0	0	0	2	7	8	906	3	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	169	0	0	0	2	7	8	954	3	0	0	0
Pedestrians		12			1						1	
Lane Width (ft)		12.0			12.0						0.0	
Walking Speed (ft/s)		4.0			4.0						4.0	
Percent Blockage		1			0						0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											608	
pX, platoon unblocked												
vC, conflicting volume	515	987	12	973	985	480	12			958		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	515	987	12	973	985	480	12			958		
tC, single (s)	7.7	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	59	100	100	100	99	99	99			100		
cM capacity (veh/h)	411	246	1061	207	246	537	1604			726		

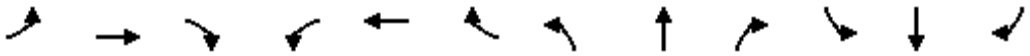
Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	169	9	485	480
Volume Left	169	0	8	0
Volume Right	0	7	0	3
cSH	411	425	1604	1700
Volume to Capacity	0.41	0.02	0.01	0.28
Queue Length 95th (ft)	49	2	0	0
Control Delay (s)	19.7	13.7	0.2	0.0
Lane LOS	C	B	A	
Approach Delay (s)	19.7	13.7	0.1	
Approach LOS	C	B		

Intersection Summary				
Average Delay	3.1			
Intersection Capacity Utilization	47.6%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	270	0	54	0	0	0	45	181	0	0	91	206
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0				5.0	5.0			5.0	
Lane Util. Factor		1.00	1.00				1.00	0.95			0.95	
Frpb, ped/bikes		1.00	0.96				1.00	1.00			0.96	
Flpb, ped/bikes		0.98	1.00				0.98	1.00			1.00	
Frt		1.00	0.85				1.00	1.00			0.90	
Flt Protected		0.95	1.00				0.95	1.00			1.00	
Satd. Flow (prot)		1776	1550				1520	3471			2983	
Flt Permitted		0.76	1.00				0.56	1.00			1.00	
Satd. Flow (perm)		1415	1550				898	3471			2983	
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)	284	0	57	0	0	0	47	191	0	0	96	217
RTOR Reduction (vph)	0	0	34	0	0	0	0	0	0	0	120	0
Lane Group Flow (vph)	0	284	23	0	0	0	47	191	0	0	193	0
Confl. Peds. (#/hr)	20		20	20		20	20		20	20		20
Confl. Bikes (#/hr)			20			20			20			20
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	17%	4%	0%	0%	13%	0%
Turn Type	Perm	NA	Perm	Perm			Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2			6		
Actuated Green, G (s)		26.0	26.0				29.0	29.0			29.0	
Effective Green, g (s)		26.0	26.0				29.0	29.0			29.0	
Actuated g/C Ratio		0.40	0.40				0.45	0.45			0.45	
Clearance Time (s)		5.0	5.0				5.0	5.0			5.0	
Lane Grp Cap (vph)		566	620				400	1548			1330	
v/s Ratio Prot								0.06			c0.06	
v/s Ratio Perm		c0.20	0.01				0.05					
v/c Ratio		0.50	0.04				0.12	0.12			0.14	
Uniform Delay, d1		14.6	11.9				10.5	10.5			10.7	
Progression Factor		1.00	1.00				1.00	1.00			1.00	
Incremental Delay, d2		3.2	0.1				0.6	0.2			0.2	
Delay (s)		17.8	12.0				11.1	10.7			10.9	
Level of Service		B	B				B	B			B	
Approach Delay (s)		16.8			0.0			10.8			10.9	
Approach LOS		B			A			B			B	

Intersection Summary			
HCM 2000 Control Delay	13.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.31		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	60.8%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

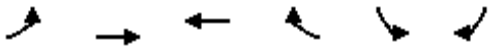


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	42	282	96	176	816	34	121	20	261	57	18	29
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00		1.00	1.00	0.97	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	0.91	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.97	1.00	0.95	1.00	
Satd. Flow (prot)	1357	3471	1474	1687	3409		1649	1489	1449	1433	1344	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.97	1.00	0.95	1.00	
Satd. Flow (perm)	1357	3471	1474	1687	3409		1649	1489	1449	1433	1344	
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)	44	297	101	185	859	36	127	21	275	60	19	31
RTOR Reduction (vph)	0	0	72	0	3	0	0	0	181	0	29	0
Lane Group Flow (vph)	44	297	29	185	892	0	74	74	94	60	21	0
Confl. Peds. (#/hr)			20						20			
Heavy Vehicles (%)	33%	4%	6%	7%	4%	35%	4%	50%	8%	26%	45%	18%
Turn Type	Prot	NA	Perm	Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		6	6		2	2	
Permitted Phases			4						6			
Actuated Green, G (s)	4.7	29.5	29.5	9.4	34.2		34.6	34.6	34.6	8.2	8.2	
Effective Green, g (s)	4.7	29.5	29.5	9.4	34.2		34.6	34.6	34.6	8.2	8.2	
Actuated g/C Ratio	0.05	0.29	0.29	0.09	0.34		0.34	0.34	0.34	0.08	0.08	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	62	1006	427	155	1146		561	506	492	115	108	
v/s Ratio Prot	0.03	0.09		c0.11	c0.26		0.04	0.05		c0.04	0.02	
v/s Ratio Perm			0.02						c0.06			
v/c Ratio	0.71	0.30	0.07	1.19	0.78		0.13	0.15	0.19	0.52	0.20	
Uniform Delay, d1	47.8	28.0	26.1	46.1	30.3		23.2	23.3	23.7	44.9	43.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	31.0	0.2	0.1	133.7	3.4		0.5	0.6	0.9	4.2	0.9	
Delay (s)	78.8	28.2	26.2	179.9	33.8		23.7	23.9	24.5	49.1	44.6	
Level of Service	E	C	C	F	C		C	C	C	D	D	
Approach Delay (s)		32.8			58.8			24.3			47.0	
Approach LOS		C			E			C			D	

Intersection Summary			
HCM 2000 Control Delay	45.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	101.7	Sum of lost time (s)	20.0
Intersection Capacity Utilization	65.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	86	370	98	195	856	326	137	143	223	164	116	53
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	0.98		1.00	1.00	0.98	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	1.00	0.85	1.00	0.91		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1626	3244		1703	3505	1543	1583	3036		1736	2840	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1626	3244		1703	3505	1543	1583	3036		1736	2840	
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)	91	389	103	205	901	343	144	151	235	173	122	56
RTOR Reduction (vph)	0	25	0	0	0	285	0	198	0	0	47	0
Lane Group Flow (vph)	91	467	0	205	901	58	144	188	0	173	131	0
Confl. Peds. (#/hr)			20	1								
Confl. Bikes (#/hr)			75			3						
Heavy Vehicles (%)	11%	4%	13%	6%	3%	3%	14%	5%	10%	4%	12%	41%
Turn Type	Split	NA		Split	NA	Perm	Split	NA		Split	NA	
Protected Phases	4	4		8	8		2	2		6	6	
Permitted Phases						8						
Actuated Green, G (s)	29.0	29.0		16.0	16.0	16.0	15.0	15.0		15.0	15.0	
Effective Green, g (s)	29.0	29.0		16.0	16.0	16.0	15.0	15.0		15.0	15.0	
Actuated g/C Ratio	0.31	0.31		0.17	0.17	0.17	0.16	0.16		0.16	0.16	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	496	990		286	590	259	249	479		274	448	
v/s Ratio Prot	0.06	c0.14		0.12	c0.26		c0.09	0.06		c0.10	0.05	
v/s Ratio Perm						0.04						
v/c Ratio	0.18	0.47		0.72	1.53	0.22	0.58	0.39		0.63	0.29	
Uniform Delay, d1	24.3	26.8		37.4	39.5	34.1	37.1	35.9		37.4	35.3	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.8	1.6		14.3	245.7	2.0	9.4	2.4		10.6	1.6	
Delay (s)	25.1	28.4		51.7	285.2	36.1	46.5	38.3		48.0	37.0	
Level of Service	C	C		D	F	D	D	D		D	D	
Approach Delay (s)		27.9			193.2			40.5			42.4	
Approach LOS		C			F			D			D	

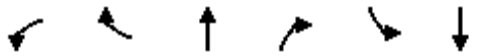
Intersection Summary			
HCM 2000 Control Delay	114.2	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	71.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	77	765	1192	57	5	205
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	79	789	1229	59	5	211
Pedestrians		2				
Lane Width (ft)		12.0				
Walking Speed (ft/s)		4.0				
Percent Blockage		0				
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		1120	405			
pX, platoon unblocked	0.83				0.83	0.83
vC, conflicting volume	1288				1811	646
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	937				1568	164
tC, single (s)	4.9				7.5	7.0
tC, 2 stage (s)						
tF (s)	2.6				3.8	3.3
p0 queue free %	82				90	70
cM capacity (veh/h)	435				51	703

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	342	526	819	468	216
Volume Left	79	0	0	0	5
Volume Right	0	0	0	59	211
cSH	435	1700	1700	1700	539
Volume to Capacity	0.18	0.31	0.48	0.28	0.40
Queue Length 95th (ft)	17	0	0	0	48
Control Delay (s)	6.0	0.0	0.0	0.0	16.1
Lane LOS	A				C
Approach Delay (s)	2.4		0.0		16.1
Approach LOS					C

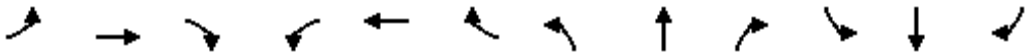
Intersection Summary			
Average Delay	2.3		
Intersection Capacity Utilization	81.3%	ICU Level of Service	D
Analysis Period (min)	15		



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	220	0	0	0	0	770
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	232	0	0	0	0	811
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			444			
pX, platoon unblocked						
vC, conflicting volume	405	0			0	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	405	0			0	
tC, single (s)	6.9	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	59	100			100	
cM capacity (veh/h)	566	1091			1636	

Direction, Lane #	WB 1	WB 2	SB 1	SB 2
Volume Total	116	116	405	405
Volume Left	116	116	0	0
Volume Right	0	0	0	0
cSH	566	566	1700	1700
Volume to Capacity	0.20	0.20	0.24	0.24
Queue Length 95th (ft)	19	19	0	0
Control Delay (s)	13.0	13.0	0.0	0.0
Lane LOS	B	B		
Approach Delay (s)	13.0		0.0	
Approach LOS	B			

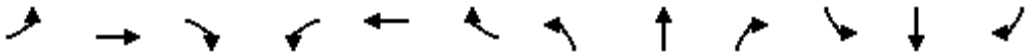
Intersection Summary			
Average Delay	2.9		
Intersection Capacity Utilization	34.2%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	406	180	200	792	0	0	0	0	164	504	315
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0		5.0	5.0						5.0	
Lane Util. Factor		0.95		1.00	0.95						0.95	
Frpb, ped/bikes		0.98		1.00	1.00						0.98	
Flpb, ped/bikes		1.00		0.99	1.00						1.00	
Frt		0.95		1.00	1.00						0.95	
Flt Protected		1.00		0.95	1.00						0.99	
Satd. Flow (prot)		3184		1759	3539						3218	
Flt Permitted		1.00		0.36	1.00						0.99	
Satd. Flow (perm)		3184		667	3539						3218	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	427	189	211	834	0	0	0	0	173	531	332
RTOR Reduction (vph)	0	59	0	0	0	0	0	0	0	0	46	0
Lane Group Flow (vph)	0	557	0	211	834	0	0	0	0	0	990	0
Confl. Peds. (#/hr)	20		20	20		20	20		20	20		20
Confl. Bikes (#/hr)			75			75						50
Heavy Vehicles (%)	3%	7%	4%	2%	2%	2%	2%	1%	1%	2%	5%	3%
Turn Type		NA		Perm	NA					Perm	NA	
Protected Phases		2			6						4	
Permitted Phases				6						4		
Actuated Green, G (s)		38.0		38.0	38.0						37.0	
Effective Green, g (s)		38.0		38.0	38.0						37.0	
Actuated g/C Ratio		0.45		0.45	0.45						0.44	
Clearance Time (s)		5.0		5.0	5.0						5.0	
Vehicle Extension (s)		3.0		3.0	3.0						3.0	
Lane Grp Cap (vph)		1423		298	1582						1400	
v/s Ratio Prot		0.17			0.24							
v/s Ratio Perm				c0.32							0.31	
v/c Ratio		0.39		0.71	0.53						0.71	
Uniform Delay, d1		15.7		19.0	17.0						19.6	
Progression Factor		1.00		0.40	0.36						1.00	
Incremental Delay, d2		0.8		6.0	0.3						3.0	
Delay (s)		16.6		13.7	6.4						22.6	
Level of Service		B		B	A						C	
Approach Delay (s)		16.6			7.9			0.0			22.6	
Approach LOS		B			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	15.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	117.0%	ICU Level of Service	H
Analysis Period (min)	15		

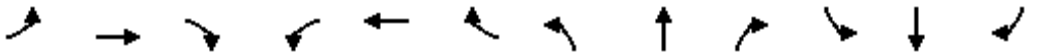
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	182	24	8	0	0	0	0	0	42	579	17
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	192	25	8	0	0	0	0	0	44	609	18
Pedestrians								1				
Lane Width (ft)								0.0				
Walking Speed (ft/s)								4.0				
Percent Blockage								0				
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											655	
pX, platoon unblocked												
vC, conflicting volume	707	707	315	515	716	0	627			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	707	707	315	515	716	0	627			0		
tC, single (s)	7.7	6.5	6.9	7.6	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.3	3.6	4.0	3.3	2.2			2.2		
p0 queue free %	100	46	96	96	100	100	100			97		
cM capacity (veh/h)	305	353	687	234	349	1091	964			1636		

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	217	8	349	323
Volume Left	0	8	44	0
Volume Right	25	0	0	18
cSH	374	234	1636	1700
Volume to Capacity	0.58	0.04	0.03	0.19
Queue Length 95th (ft)	88	3	2	0
Control Delay (s)	27.1	21.0	1.1	0.0
Lane LOS	D	C	A	
Approach Delay (s)	27.1	21.0	0.6	
Approach LOS	D	C		

Intersection Summary				
Average Delay	7.2			
Intersection Capacity Utilization	35.6%	ICU Level of Service	A	
Analysis Period (min)	15			

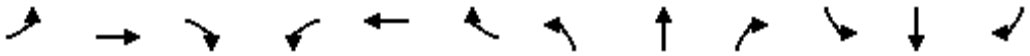


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	21	37	0	0	178	159	86	212	173	86	0	253
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0		5.0	5.0		4.0		4.0
Lane Util. Factor	1.00	0.95			0.95		0.91	0.91		1.00		0.88
Frpb, ped/bikes	1.00	1.00			0.99		1.00	1.00		1.00		1.00
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00		1.00		1.00
Frt	1.00	1.00			0.93		1.00	0.93		1.00		0.85
Flt Protected	0.95	1.00			1.00		0.95	1.00		0.95		1.00
Satd. Flow (prot)	1624	3471			3078		1441	2987		1543		2682
Flt Permitted	0.95	1.00			1.00		0.95	1.00		0.95		1.00
Satd. Flow (perm)	1624	3471			3078		1441	2987		1543		2682
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)	22	39	0	0	187	167	91	223	182	91	0	266
RTOR Reduction (vph)	0	0	0	0	139	0	0	124	0	0	0	240
Lane Group Flow (vph)	22	39	0	0	215	0	82	290	0	91	0	26
Confl. Peds. (#/hr)	6					6						
Confl. Bikes (#/hr)			6			3						
Heavy Vehicles (%)	0%	4%	0%	0%	9%	7%	14%	7%	9%	17%	0%	6%
Parking (#/hr)	0											
Turn Type	Split	NA			NA		Split	NA		Prot		custom
Protected Phases	4	4			8		2	2		6		6
Permitted Phases												
Actuated Green, G (s)	3.6	3.6			8.9		16.4	16.4		5.1		5.1
Effective Green, g (s)	3.6	3.6			8.9		16.4	16.4		5.1		5.1
Actuated g/C Ratio	0.07	0.07			0.17		0.31	0.31		0.10		0.10
Clearance Time (s)	5.0	5.0			5.0		5.0	5.0		4.0		4.0
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0		3.0
Lane Grp Cap (vph)	110	235			516		445	924		148		258
v/s Ratio Prot	c0.01	0.01			c0.07		0.06	c0.10		c0.06		0.01
v/s Ratio Perm												
v/c Ratio	0.20	0.17			0.42		0.18	0.31		0.61		0.10
Uniform Delay, d1	23.3	23.3			19.7		13.4	14.0		23.0		21.9
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00		1.00
Incremental Delay, d2	0.9	0.3			0.5		0.9	0.9		7.4		0.2
Delay (s)	24.2	23.6			20.3		14.3	14.9		30.4		22.0
Level of Service	C	C			C		B	B		C		C
Approach Delay (s)		23.8			20.3			14.8			24.2	
Approach LOS		C			C			B			C	

Intersection Summary			
HCM 2000 Control Delay	19.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	53.0	Sum of lost time (s)	19.0
Intersection Capacity Utilization	44.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	13	36	1	19	36	90	0	11	31	78	15	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0		5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.99		1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00		1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.89		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		1.00		0.95	1.00	
Satd. Flow (prot)	1805	3610	794	1357	3471	1328		2621		1703	2356	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		1.00		0.95	1.00	
Satd. Flow (perm)	1805	3610	794	1357	3471	1328		2621		1703	2356	
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)	14	38	1	20	38	95	0	12	33	82	16	1
RTOR Reduction (vph)	0	0	1	0	0	58	0	23	0	0	1	0
Lane Group Flow (vph)	14	38	0	20	38	37	0	22	0	82	16	0
Confl. Peds. (#/hr)			4	4								
Confl. Bikes (#/hr)			4			2						3
Heavy Vehicles (%)	0%	0%	100%	33%	4%	20%	0%	38%	17%	6%	55%	0%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8						
Actuated Green, G (s)	4.0	39.0	39.0	4.0	39.0	39.0		30.0		7.0	33.0	
Effective Green, g (s)	4.0	39.0	39.0	4.0	39.0	39.0		30.0		7.0	33.0	
Actuated g/C Ratio	0.04	0.39	0.39	0.04	0.39	0.39		0.30		0.07	0.33	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0		5.0		5.0	5.0	
Lane Grp Cap (vph)	72	1407	309	54	1353	517		786		119	777	
v/s Ratio Prot	0.01	0.01		c0.01	0.01			c0.01		c0.05	c0.01	
v/s Ratio Perm			0.00			c0.03						
v/c Ratio	0.19	0.03	0.00	0.37	0.03	0.07		0.03		0.69	0.02	
Uniform Delay, d1	46.4	18.8	18.6	46.8	18.8	19.1		24.7		45.4	22.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2	5.9	0.0	0.0	18.4	0.0	0.3		0.1		27.9	0.0	
Delay (s)	52.4	18.8	18.6	65.2	18.8	19.4		24.8		73.4	22.7	
Level of Service	D	B	B	E	B	B		C		E	C	
Approach Delay (s)		27.7			25.3			24.8			64.7	
Approach LOS		C			C			C			E	

Intersection Summary			
HCM 2000 Control Delay	36.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.12		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	51.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	88	617	32	76	851	81	59	165	59	101	217	134
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0		4.0	5.0		4.0	5.0		4.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	0.99		1.00	0.98		1.00	0.99		1.00	0.97	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.99		1.00	0.96		1.00	0.94	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1805	3430		1805	3414		1805	1801		1770	1699	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1805	3430		1805	3414		1805	1801		1770	1699	
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	89	623	32	77	860	82	60	167	60	102	219	135
RTOR Reduction (vph)	0	4	0	0	8	0	0	13	0	0	22	0
Lane Group Flow (vph)	89	651	0	77	934	0	60	214	0	102	332	0
Confl. Peds. (#/hr)	30		30	30		30	30		30	30		30
Confl. Bikes (#/hr)			75			75			20			20
Heavy Vehicles (%)	0%	4%	0%	0%	3%	0%	0%	0%	0%	2%	4%	0%
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	5.4	31.8		4.0	30.4		3.8	33.4		4.0	33.6	
Effective Green, g (s)	5.4	31.8		4.0	30.4		3.8	33.4		4.0	33.6	
Actuated g/C Ratio	0.06	0.35		0.04	0.33		0.04	0.37		0.04	0.37	
Clearance Time (s)	4.0	5.0		4.0	5.0		4.0	5.0		4.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	106	1195		79	1138		75	659		77	625	
v/s Ratio Prot	c0.05	0.19		0.04	c0.27		0.03	0.12		c0.06	c0.20	
v/s Ratio Perm												
v/c Ratio	0.84	0.54		0.97	0.82		0.80	0.32		1.32	0.53	
Uniform Delay, d1	42.5	23.9		43.5	27.9		43.3	20.8		43.6	22.6	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	41.2	0.5		92.0	4.9		43.9	1.3		211.9	3.2	
Delay (s)	83.7	24.4		135.6	32.8		87.2	22.1		255.5	25.8	
Level of Service	F	C		F	C		F	C		F	C	
Approach Delay (s)		31.5			40.5			35.7			77.2	
Approach LOS		C			D			D			E	

Intersection Summary			
HCM 2000 Control Delay	44.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	91.2	Sum of lost time (s)	18.0
Intersection Capacity Utilization	78.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	215	12	5	570	0	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	0	0	0	226	13	5	600	0	0	0	0
Pedestrians		3			3						2	
Lane Width (ft)		0.0			12.0						0.0	
Walking Speed (ft/s)		4.0			4.0						4.0	
Percent Blockage		0			0						0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								536				
pX, platoon unblocked												
vC, conflicting volume	441	617	3	614	617	305	3			603		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	441	617	3	614	617	305	3			603		
tC, single (s)	7.5	6.5	6.9	7.6	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	44	98	100			100		
cM capacity (veh/h)	275	406	1086	368	406	695	1632			982		

Direction, Lane #	WB 1	WB 2	NB 1	NB 2
Volume Total	151	88	205	400
Volume Left	0	0	5	0
Volume Right	0	13	0	0
cSH	406	432	1632	1700
Volume to Capacity	0.37	0.20	0.00	0.24
Queue Length 95th (ft)	42	19	0	0
Control Delay (s)	19.0	15.5	0.2	0.0
Lane LOS	C	C	A	
Approach Delay (s)	17.7		0.1	
Approach LOS	C			

Intersection Summary				
Average Delay	5.1			
Intersection Capacity Utilization	34.2%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	214	355	0	0	836	108	158	353	178	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0			5.0				
Lane Util. Factor	1.00	0.95			0.95			0.95				
Frpb, ped/bikes	1.00	1.00			1.00			0.99				
Flpb, ped/bikes	1.00	1.00			1.00			1.00				
Frt	1.00	1.00			0.98			0.96				
Flt Protected	0.95	1.00			1.00			0.99				
Satd. Flow (prot)	1752	3374			3473			3361				
Flt Permitted	0.18	1.00			1.00			0.99				
Satd. Flow (perm)	332	3374			3473			3361				
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)	225	374	0	0	880	114	166	372	187	0	0	0
RTOR Reduction (vph)	0	0	0	0	12	0	0	41	0	0	0	0
Lane Group Flow (vph)	225	374	0	0	982	0	0	684	0	0	0	0
Confl. Peds. (#/hr)	1					1			8			
Confl. Bikes (#/hr)			2			2			27			
Heavy Vehicles (%)	3%	7%	4%	2%	2%	2%	2%	1%	1%	2%	5%	3%
Turn Type	Perm	NA			NA		Perm	NA				
Protected Phases		2			6			8				
Permitted Phases	2						8					
Actuated Green, G (s)	38.0	38.0			38.0			37.0				
Effective Green, g (s)	38.0	38.0			38.0			37.0				
Actuated g/C Ratio	0.45	0.45			0.45			0.44				
Clearance Time (s)	5.0	5.0			5.0			5.0				
Vehicle Extension (s)	3.0	3.0			3.0			3.0				
Lane Grp Cap (vph)	148	1508			1552			1463				
v/s Ratio Prot		0.11			0.28							
v/s Ratio Perm	c0.68							0.20				
v/c Ratio	1.52	0.25			0.63			0.47				
Uniform Delay, d1	23.5	14.6			18.1			17.0				
Progression Factor	0.82	0.68			1.00			1.00				
Incremental Delay, d2	262.0	0.3			0.9			0.2				
Delay (s)	281.4	10.3			19.0			17.3				
Level of Service	F	B			B			B				
Approach Delay (s)		112.1			19.0			17.3			0.0	
Approach LOS		F			B			B			A	

Intersection Summary			
HCM 2000 Control Delay	42.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	117.0%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	182	0	0	0	2	0	5	461	35	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	192	0	0	0	2	0	5	485	37	0	0	0
Pedestrians		9			13							
Lane Width (ft)		12.0			12.0							
Walking Speed (ft/s)		4.0			4.0							
Percent Blockage		1			1							
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											608	
pX, platoon unblocked												
vC, conflicting volume	263	555	9	527	536	274	9			535		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	263	555	9	527	536	274	9			535		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	71	100	100	100	100	100	100			100		
cM capacity (veh/h)	650	433	1069	426	444	722	1612			1032		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	192	2	248	279
Volume Left	192	0	5	0
Volume Right	0	0	0	37
cSH	650	444	1612	1700
Volume to Capacity	0.29	0.00	0.00	0.16
Queue Length 95th (ft)	31	0	0	0
Control Delay (s)	12.8	13.1	0.2	0.0
Lane LOS	B	B	A	
Approach Delay (s)	12.8	13.1	0.1	
Approach LOS	B	B		

Intersection Summary				
Average Delay	3.5			
Intersection Capacity Utilization	37.5%	ICU Level of Service	A	
Analysis Period (min)	15			

APPENDIX C: TRAFFIC SIGNAL WARRANT WORKSHEETS

FEHR PEERS

Sheet No 1 of 1

Project Gateway Park Connection
Scenario Existing Conditions
Peak Hour PM

Major Street W. Grand Ave
Minor Street Campbell St.

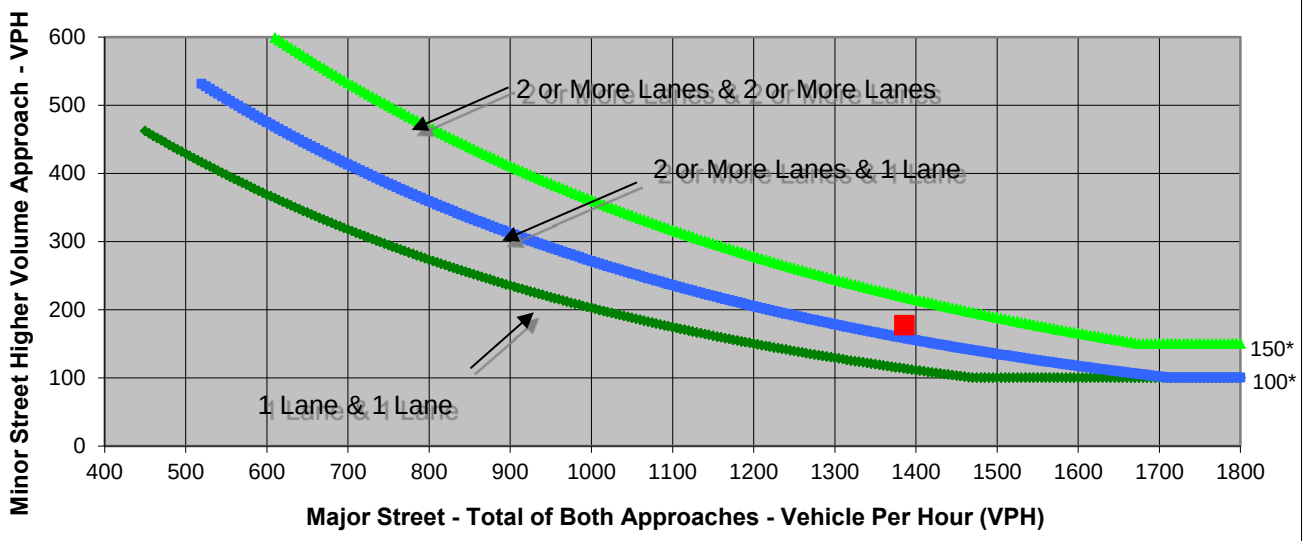
Turn Movement Volumes

	NB	SB	EB	WB
Left	32	2	76	18
Through	0	4	600	642
Right	13	171	40	10
Total	45	177	716	670

Major Street Direction

	North/South
x	East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street W. Grand Ave	Minor Street Campbell St.	Warrant Met
Number of Approach Lanes	**2**	**1**	**YES**
Traffic Volume (VPH) *	**1,386**	**177**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project Gateway Park Connection
Scenario Existing Conditions
Peak Hour PM

Major Street Mandela Parkway Southbound
Minor Street 24th Street

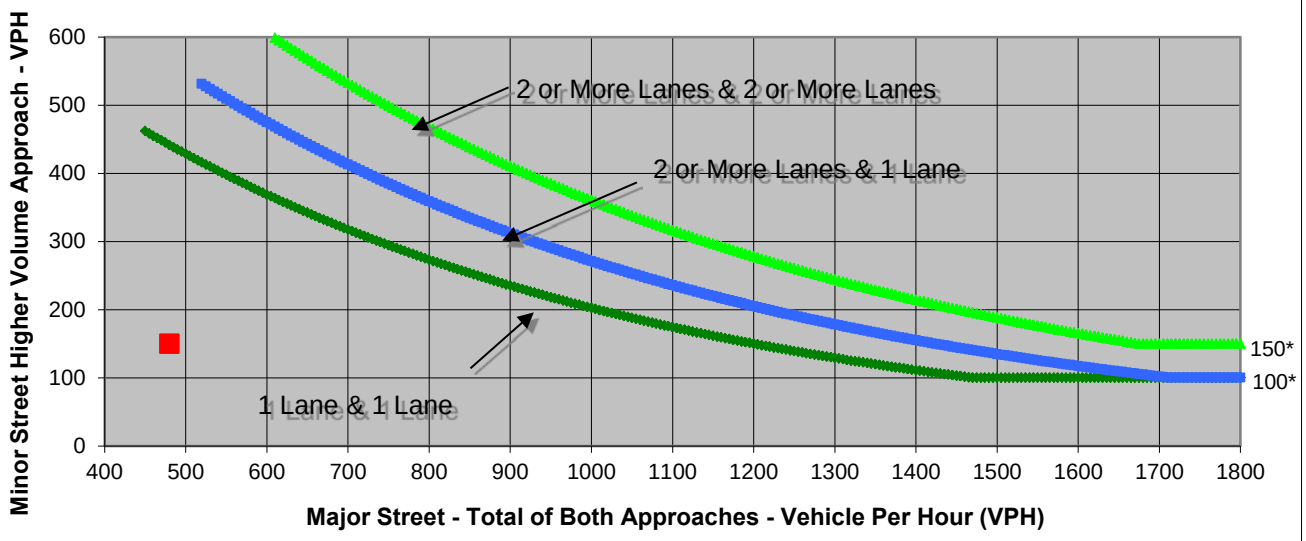
Turn Movement Volumes

	NB	SB	EB	WB
Left	0	0	150	0
Through	0	480	0	0
Right	0	0	0	0
Total	0	480	150	0

Major Street Direction

x North/South
East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	Mandela Parkway Southbound	24th Street	
Number of Approach Lanes	**2**	**2**	**NO**
Traffic Volume (VPH) *	**480**	**150**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project Gateway Park Connection
Scenario Existing Conditions
Peak Hour PM

Major Street Mandela Parkway Southbound
Minor Street 20th Street

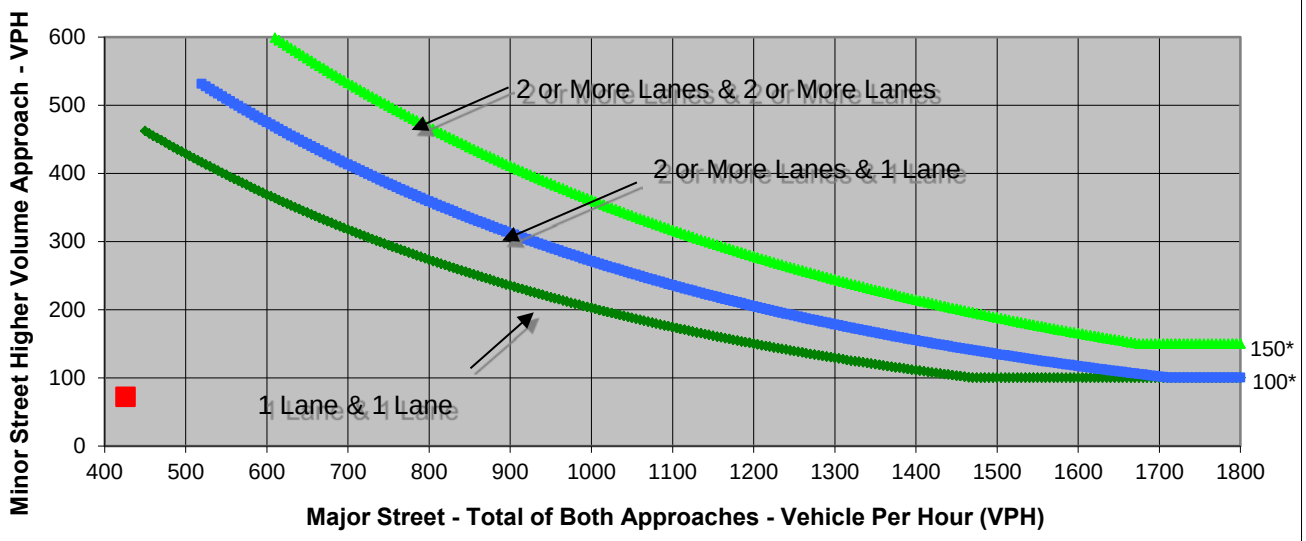
Turn Movement Volumes

	NB	SB	EB	WB
Left	0	6	0	4
Through	0	418	65	1
Right	0	2	7	0
Total	0	426	72	5

Major Street Direction

x North/South
East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	Mandela Parkway Southbound	20th Street	
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**426**	**72**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project Gateway Park Connection
Scenario Existing Conditions
Peak Hour PM

Major Street Mandela Parkway
Minor Street 24th Street

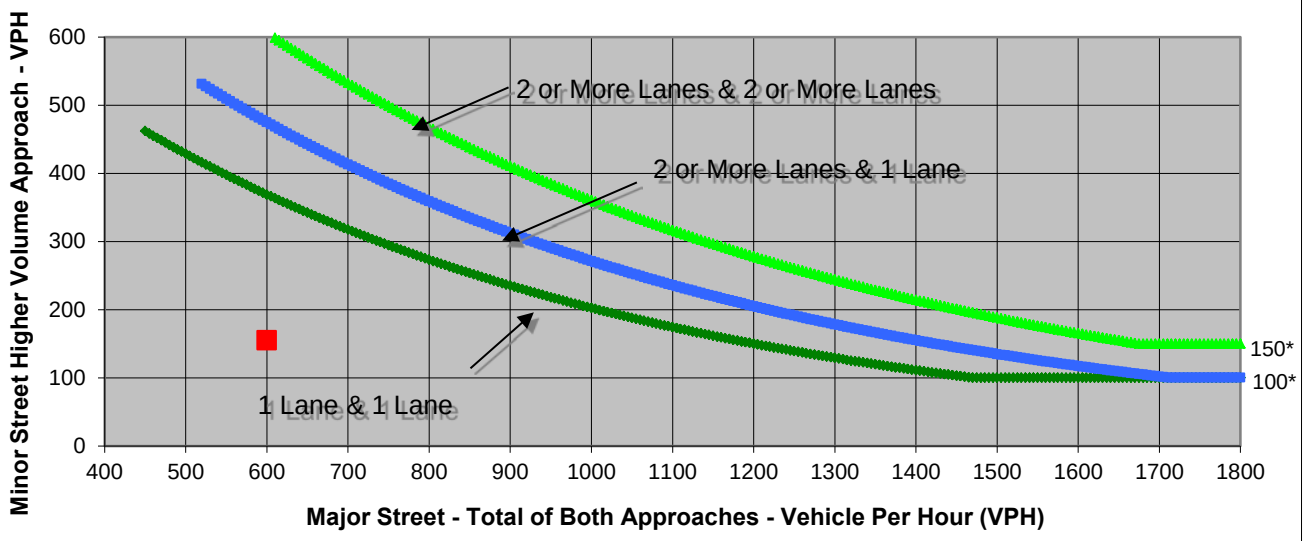
Turn Movement Volumes

	NB	SB	EB	WB
Left	4	0	0	0
Through	596	0	0	146
Right	0	0	0	9
Total	600	0	0	155

Major Street Direction

x North/South
East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	Mandela Parkway	24th Street	
Number of Approach Lanes	**2**	**2**	**NO**
Traffic Volume (VPH) *	**600**	**155**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project Gateway Park Connection
Scenario Existing Conditions
Peak Hour PM

Major Street Mandela Parkway Northbound
Minor Street 20th Street

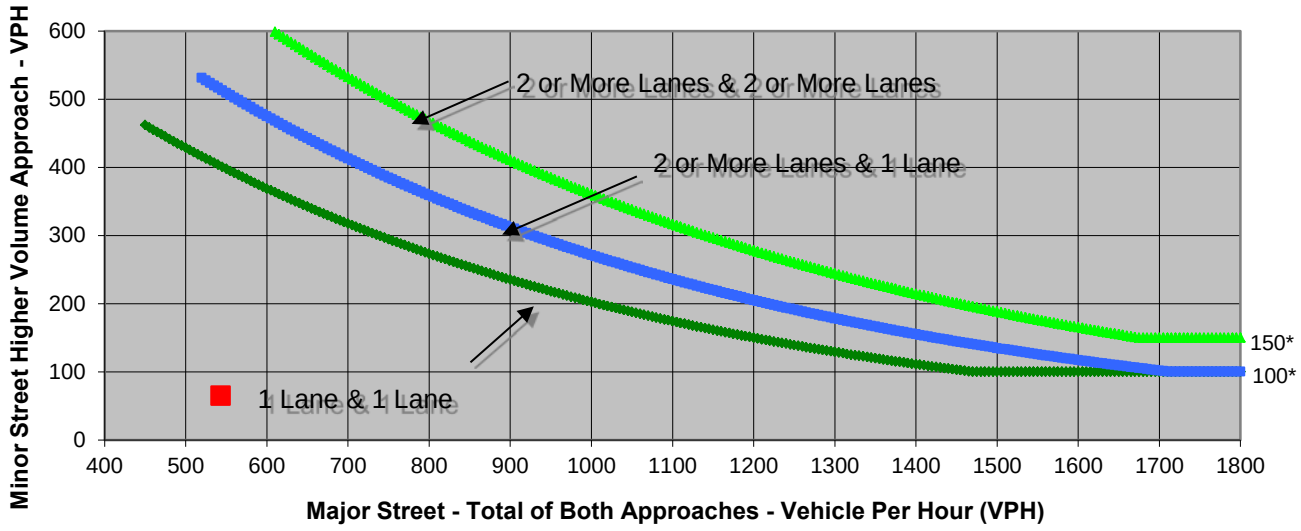
Turn Movement Volumes

	NB	SB	EB	WB
Left	5	0	65	0
Through	536	0	0	1
Right	2	0	0	4
Total	543	0	65	5

Major Street Direction

x North/South
East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	Mandela Parkway Northbound	20th Street	
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**543**	**65**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project Gateway Park Connection
Scenario Existing Conditions
Peak Hour SAT

Major Street W. Grand Ave
Minor Street Campbell St.

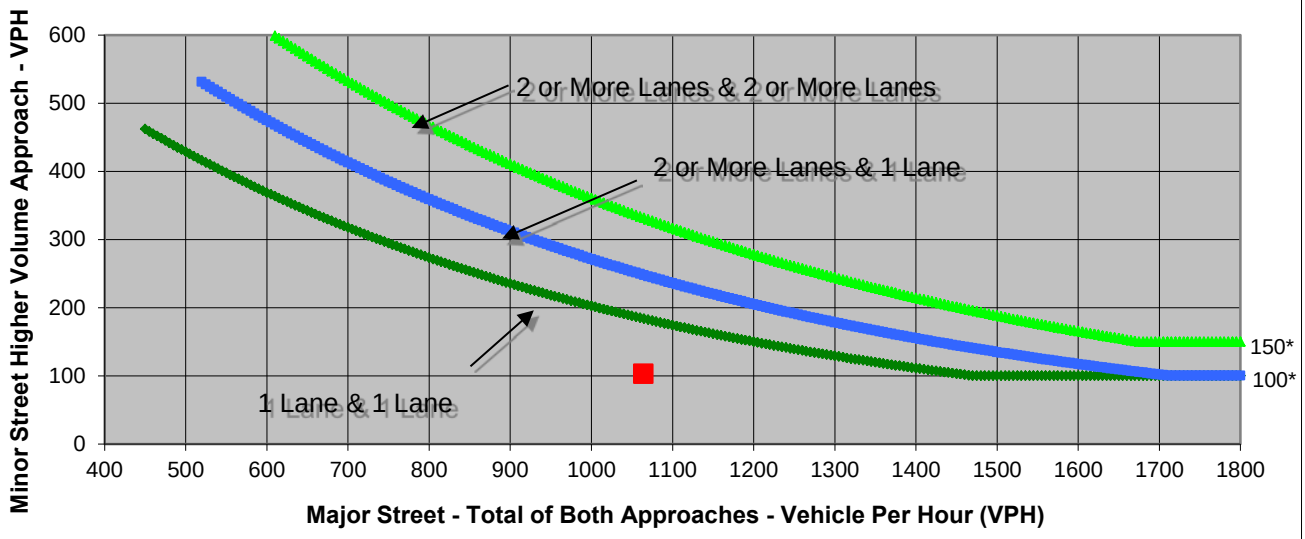
Turn Movement Volumes

	NB	SB	EB	WB
Left	43	3	23	18
Through	4	10	361	624
Right	23	90	33	5
Total	70	103	417	647

Major Street Direction

	North/South
x	East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	W. Grand Ave	Campbell St.	
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**1,064**	**103**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project Gateway Park Connection
Scenario Existing Conditions
Peak Hour SAT

Major Street Mandela Parkway Southbound
Minor Street 24th Street

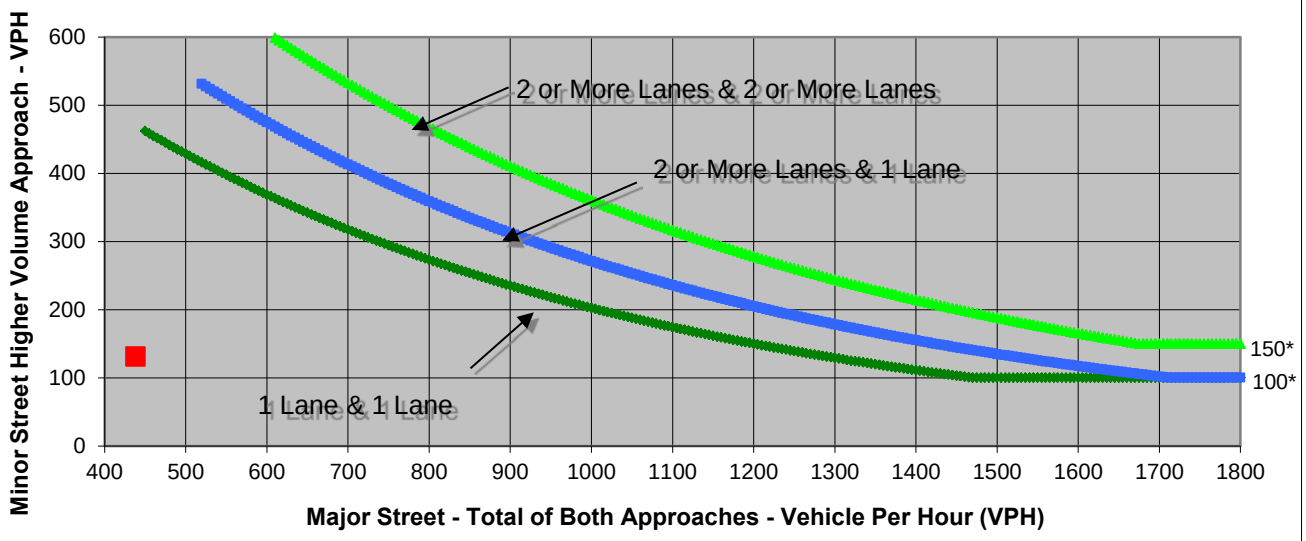
Turn Movement Volumes

	NB	SB	EB	WB
Left	0	0	131	0
Through	0	438	0	0
Right	0	0	0	0
Total	0	438	131	0

Major Street Direction

x North/South
East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	Mandela Parkway Southbound	24th Street	
Number of Approach Lanes	**2**	**2**	**NO**
Traffic Volume (VPH) *	**438**	**131**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project Gateway Park Connection
Scenario Existing Conditions
Peak Hour PM

Major Street Mandela Parkway Southbound
Minor Street 20th Street

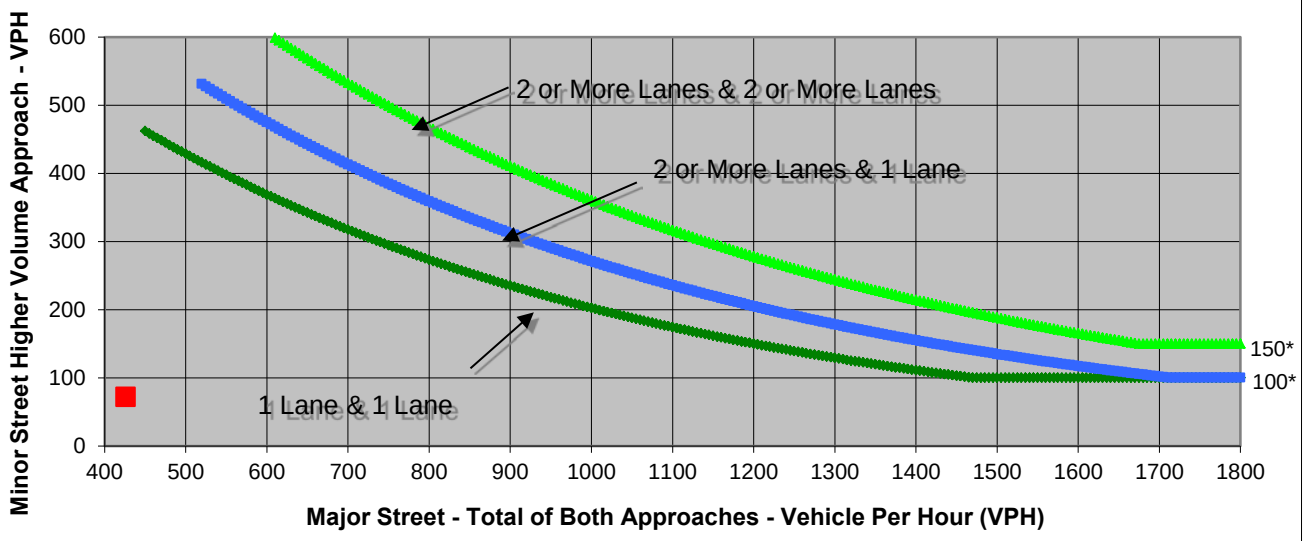
Turn Movement Volumes

	NB	SB	EB	WB
Left	0	6	0	4
Through	0	418	65	1
Right	0	2	7	0
Total	0	426	72	5

Major Street Direction

x North/South
East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	Mandela Parkway Southbound	20th Street	
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**426**	**72**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project Gateway Park Connection
Scenario Existing Conditions
Peak Hour SAT

Major Street Mandela Parkway
Minor Street 24th Street

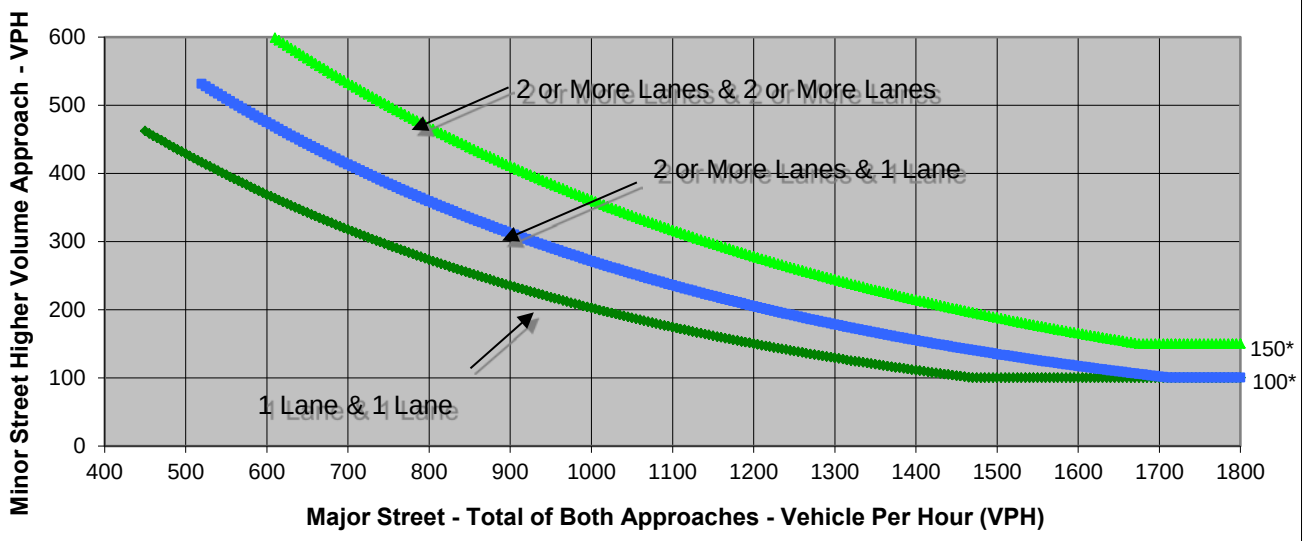
Turn Movement Volumes

	NB	SB	EB	WB
Left	3	0	0	0
Through	331	0	0	128
Right	0	0	0	7
Total	334	0	0	135

Major Street Direction

x North/South
East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	Mandela Parkway	24th Street	
Number of Approach Lanes	**2**	**2**	**NO**
Traffic Volume (VPH) *	**334**	**135**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project Gateway Park Connection
Scenario Existing Conditions
Peak Hour SAT

Major Street Mandela Parkway Northbound
Minor Street 20th Street

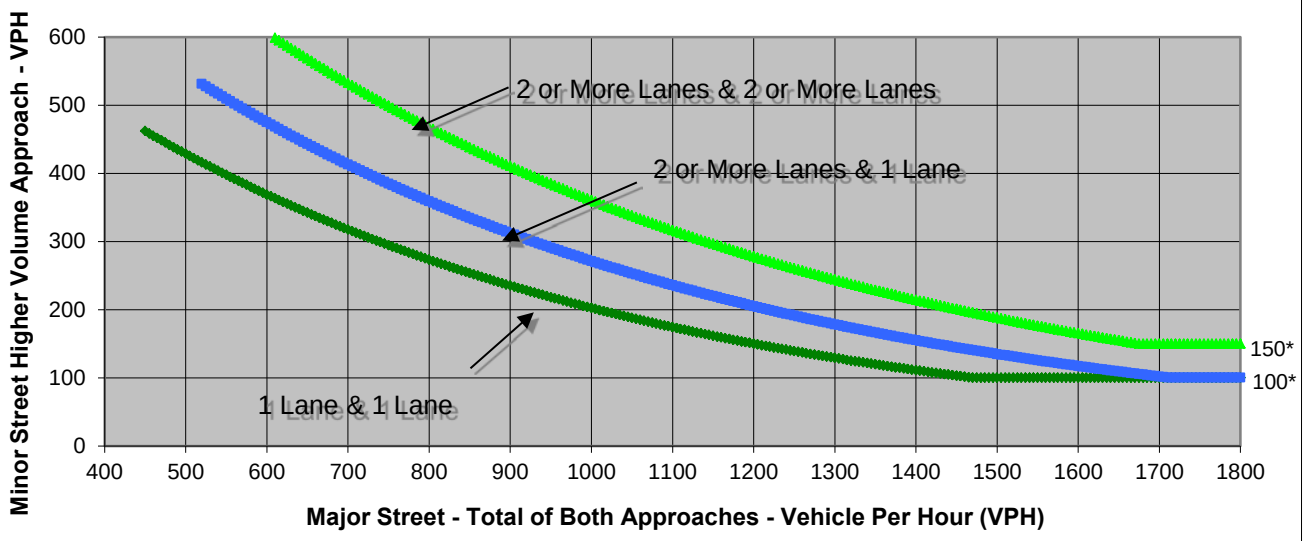
Turn Movement Volumes

	NB	SB	EB	WB
Left	3	0	58	0
Through	266	0	1	1
Right	21	0	0	9
Total	290	0	59	10

Major Street Direction

x North/South
East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	Mandela Parkway Northbound	20th Street	
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**290**	**59**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No	1	of	1
Project	Gateway Park Connection		
Major Street	W. Grand Ave	Scenario	Existing Plus Connection Conditions
Minor Street	Campbell St.	Peak Hour	PM

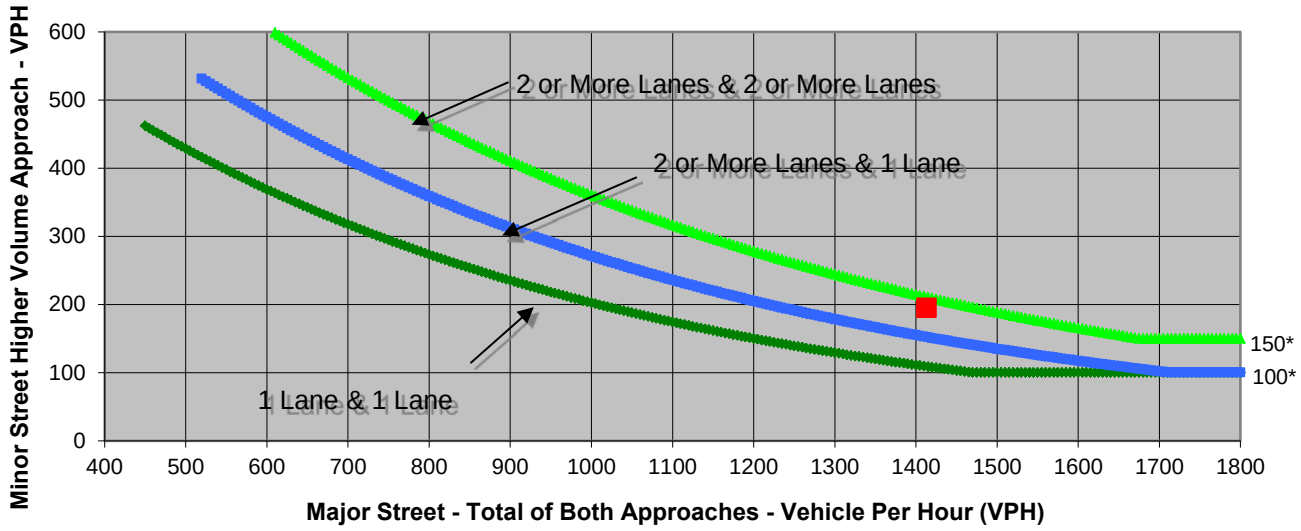
Turn Movement Volumes

	NB	SB	EB	WB
Left	0	2	83	0
Through	0	0	640	660
Right	0	193	0	30
Total	0	195	723	690

Major Street Direction

	North/South
x	East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	W. Grand Ave	Campbell St.	
Number of Approach Lanes	**2**	**1**	**YES**
Traffic Volume (VPH) *	**1,413**	**195**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No	1	of	1
Project	Gateway Park Connection		
Scenario	Existing Plus Connection Conditions		
Peak Hour	PM		

Major Street	Mandela Parkway Southbound
Minor Street	24th Street

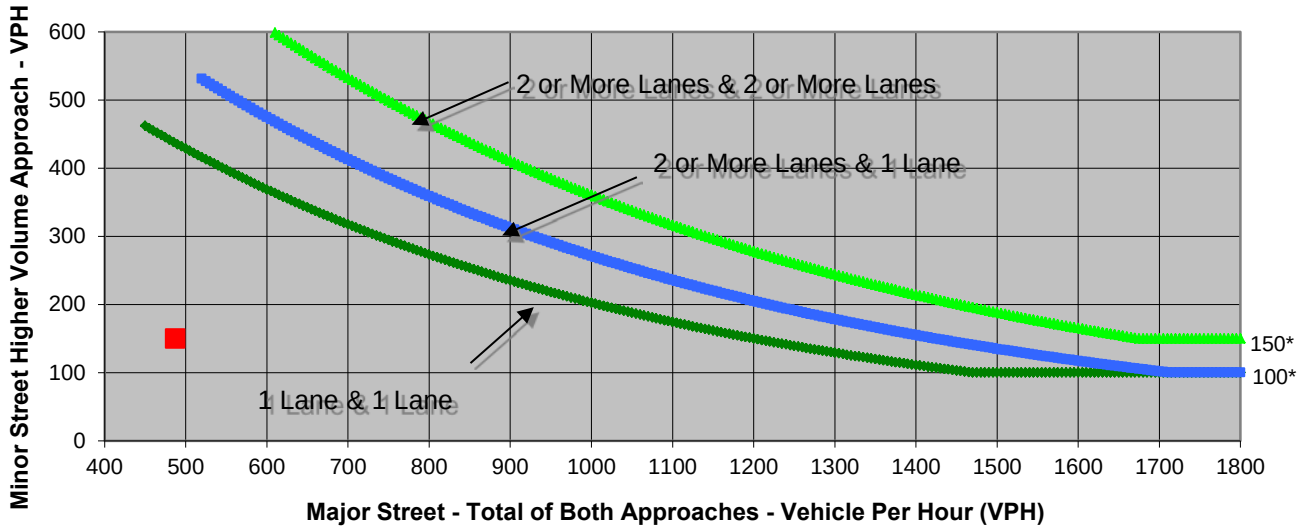
Turn Movement Volumes

	NB	SB	EB	WB
Left	0	0	150	0
Through	0	487	0	0
Right	0	0	0	0
Total	0	487	150	0

Major Street Direction

x	North/South
	East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	Mandela Parkway Southbound	24th Street	
Number of Approach Lanes	**2**	**2**	**NO**
Traffic Volume (VPH) *	**487**	**150**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No	1	of	1
Project	Gateway Park Connection		
Scenario	Existing Plus Connection Conditions		
Peak Hour	PM		

Major Street	Mandela Parkway Southbound
Minor Street	20th Street

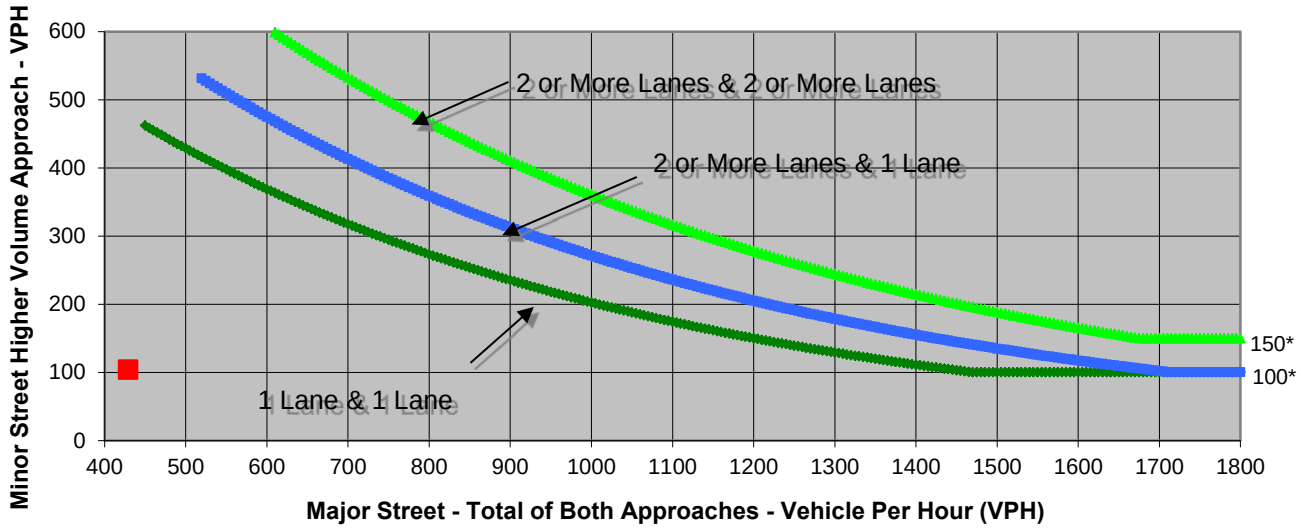
Turn Movement Volumes

	NB	SB	EB	WB
Left	0	6	0	4
Through	0	421	97	1
Right	0	2	7	0
Total	0	429	104	5

Major Street Direction

x	North/South
	East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	Mandela Parkway Southbound	20th Street	
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**429**	**104**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No	1	of	1	
Project	Gateway Park Connection			
Scenario	Existing Plus Connection Conditions			
Peak Hour	PM			

Major Street: Mandela Parkway
Minor Street: 24th Street

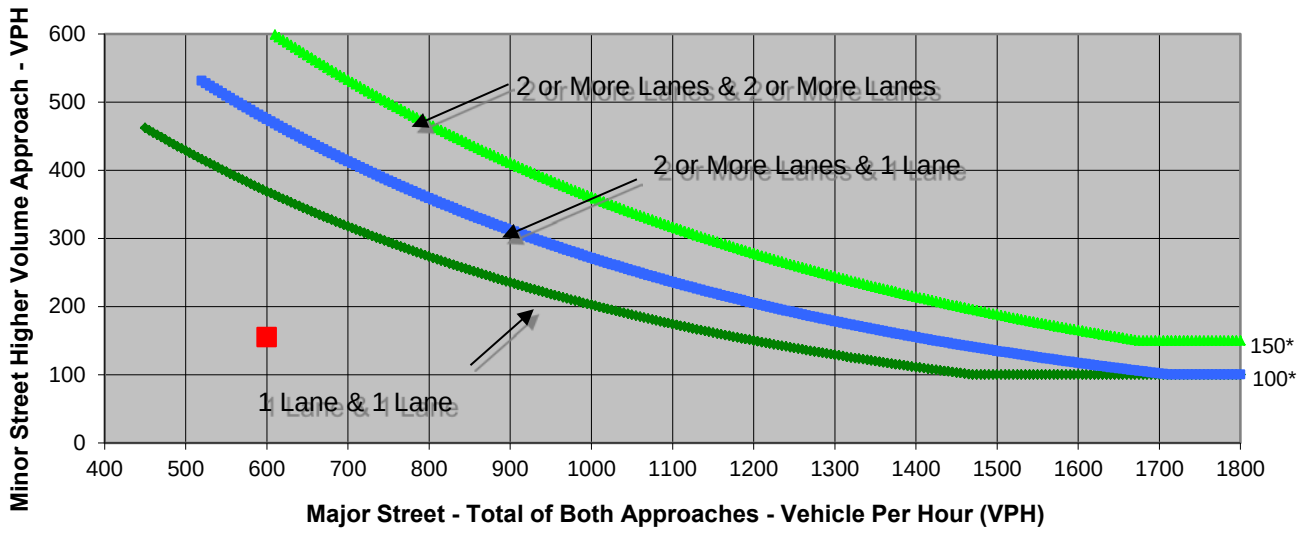
Turn Movement Volumes

	NB	SB	EB	WB
Left	4	0	0	0
Through	596	0	0	146
Right	0	0	0	9
Total	600	0	0	155

Major Street Direction

x	North/South
	East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street Mandela Parkway	Minor Street 24th Street	Warrant Met
Number of Approach Lanes	**2**	**2**	**NO**
Traffic Volume (VPH) *	**600**	**155**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No	1	of	1
Project	Gateway Park Connection		
Scenario	Existing Plus Connection Conditions		
Peak Hour	PM		

Major Street	Mandela Parkway Northbound
Minor Street	20th Street

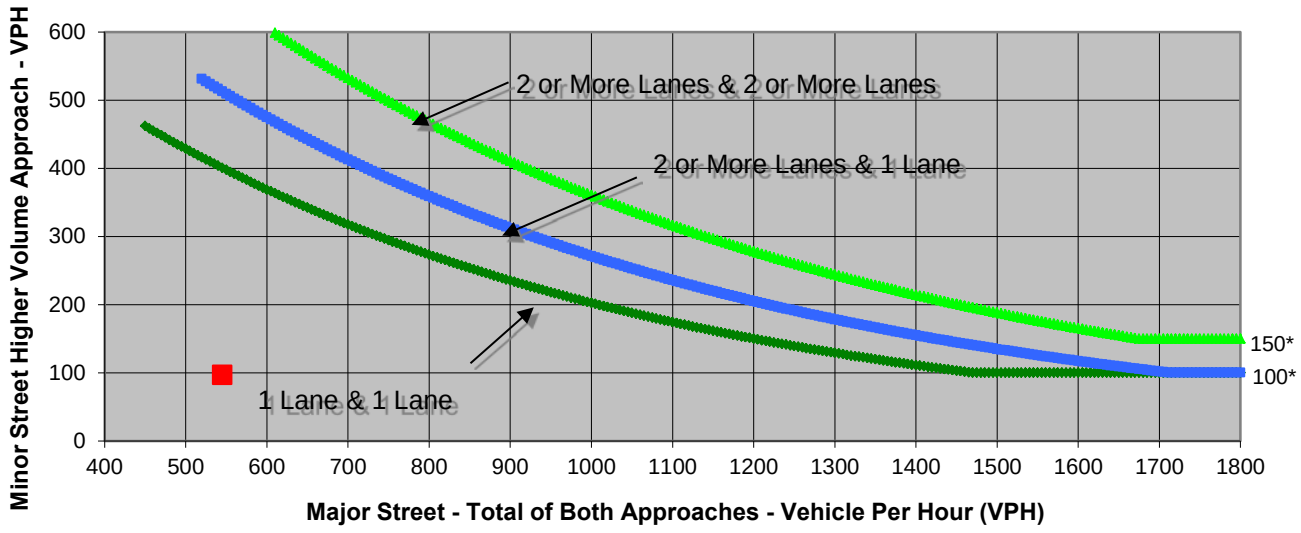
Turn Movement Volumes

	NB	SB	EB	WB
Left	5	0	97	0
Through	538	0	0	1
Right	2	0	0	4
Total	545	0	97	5

Major Street Direction

x	North/South
	East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	Mandela Parkway Northbound	20th Street	
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**545**	**97**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No	1	of	1
Project	Gateway Park Connection		
Major Street	W. Grand Ave	Scenario	Existing Plus Connection Conditions
Minor Street	Campbell St.	Peak Hour	SAT

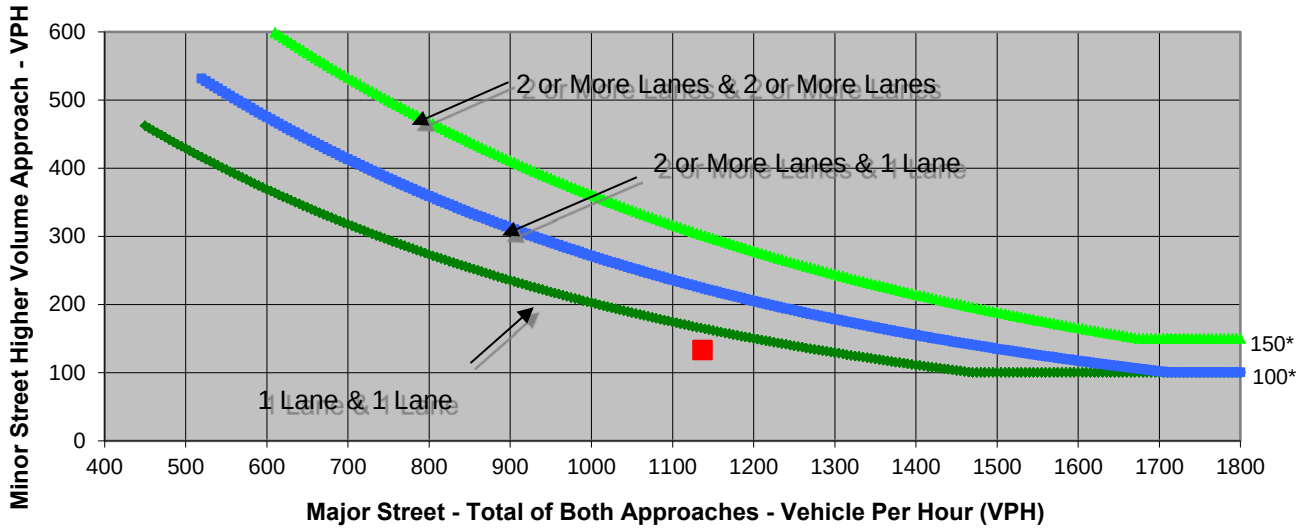
Turn Movement Volumes

	NB	SB	EB	WB
Left	0	3	45	0
Through	0	0	394	650
Right	0	130	0	48
Total	0	133	439	698

Major Street Direction

	North/South
x	East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street W. Grand Ave	Minor Street Campbell St.	Warrant Met
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**1,137**	**133**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project Gateway Park Connection

Major Street Mandela Parkway Southbound
Minor Street 24th Street

Scenario Existing Plus Connection Conditions
Peak Hour SAT

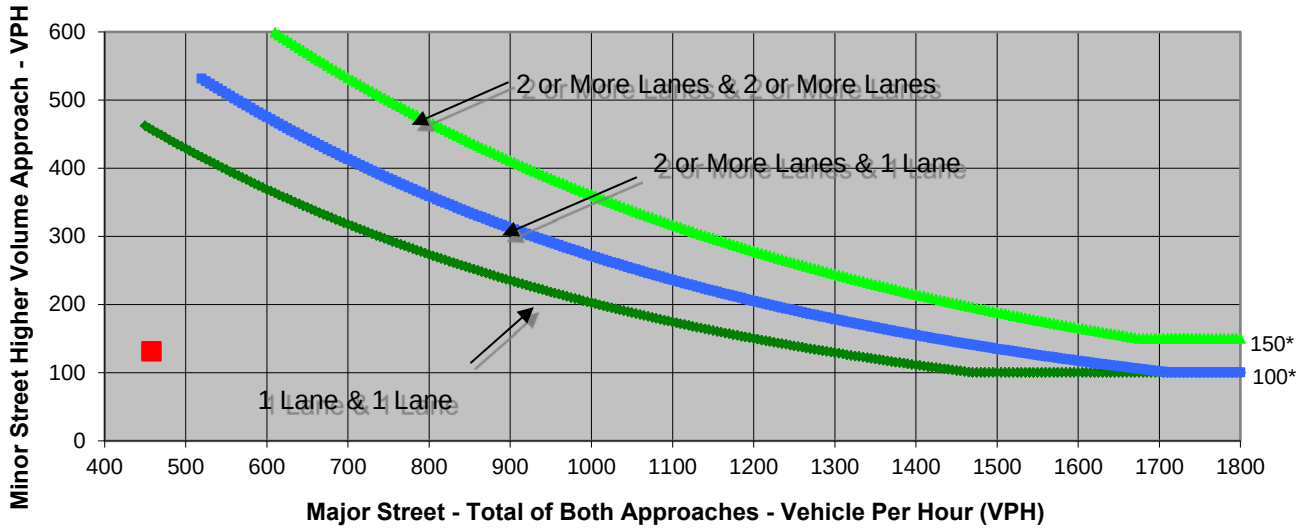
Turn Movement Volumes

	NB	SB	EB	WB
Left	0	0	131	0
Through	0	458	0	0
Right	0	0	0	0
Total	0	458	131	0

Major Street Direction

x North/South
East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	Mandela Parkway Southbound	24th Street	
Number of Approach Lanes	**2**	**2**	**NO**
Traffic Volume (VPH) *	**458**	**131**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project: Gateway Park Connection

Major Street: Mandela Parkway Southbound
Minor Street: 20th Street

Scenario: Existing Plus Connection Conditions
Peak Hour: SAT

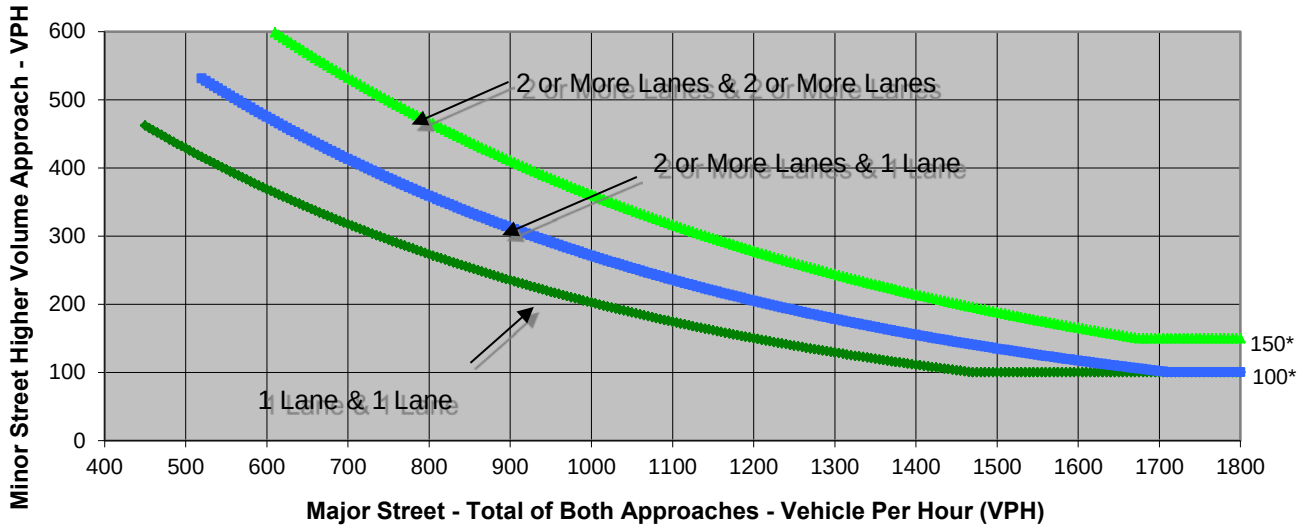
Turn Movement Volumes

	NB	SB	EB	WB
Left	0	25	58	5
Through	0	344	53	0
Right	0	19	14	9
Total	0	388	125	14

Major Street Direction

x North/South
East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	Mandela Parkway Southbound	20th Street	
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**388**	**125**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No	1	of	1	
Project	Gateway Park Connection			
Major Street	Mandela Parkway	Scenario	Existing Plus Connection Conditions	
Minor Street	24th Street	Peak Hour	SAT	

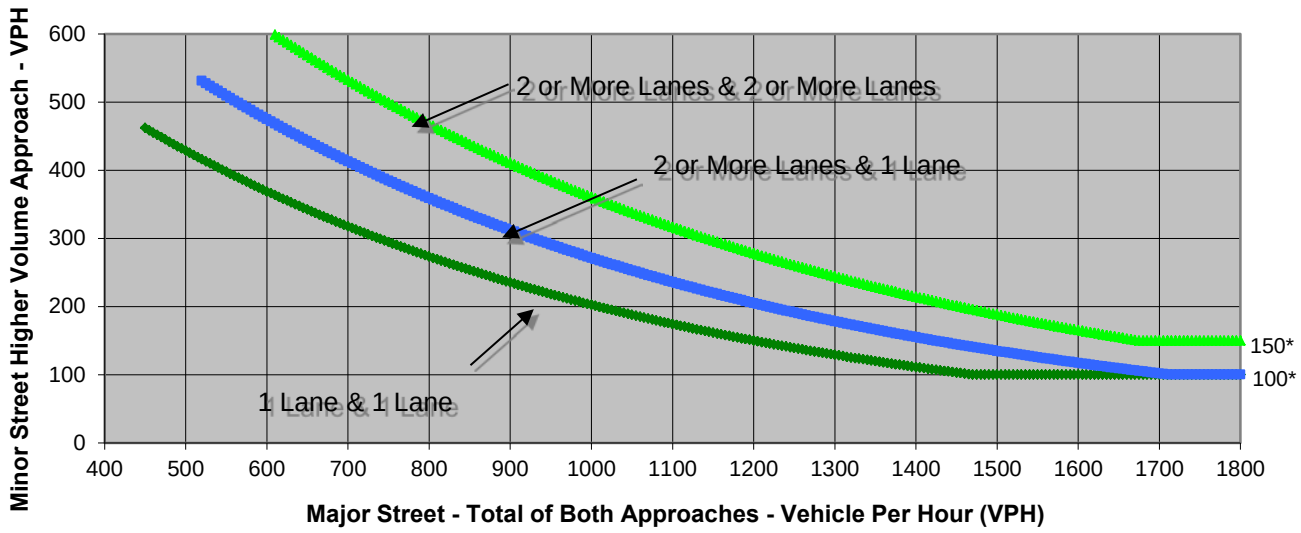
Turn Movement Volumes

	NB	SB	EB	WB
Left	3	0	0	0
Through	332	0	0	128
Right	0	0	0	7
Total	335	0	0	135

Major Street Direction

x	North/South
	East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street Mandela Parkway	Minor Street 24th Street	Warrant Met
Number of Approach Lanes	**2**	**2**	**NO**
Traffic Volume (VPH) *	**335**	**135**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No	1	of	1
Project	Gateway Park Connection		
Scenario	Existing Plus Connection Conditions		
Peak Hour	SAT		

Major Street	Mandela Parkway Northbound
Minor Street	20th Street

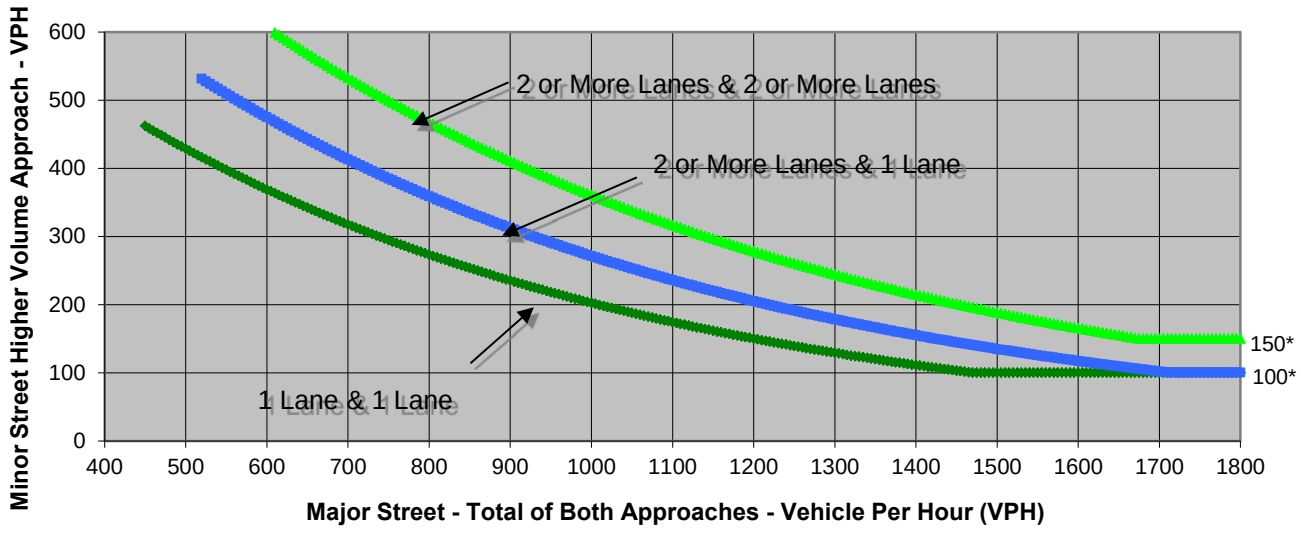
Turn Movement Volumes

	NB	SB	EB	WB
Left	3	0	52	0
Through	272	0	59	1
Right	21	0	0	0
Total	296	0	111	1

Major Street Direction

x	North/South
	East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	Mandela Parkway Northbound	20th Street	
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**296**	**111**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project: Gateway Park Connection

Major Street: W. Grand Ave
Minor Street: Campbell St.

Scenario: Near-Term Conditions
Peak Hour: PM

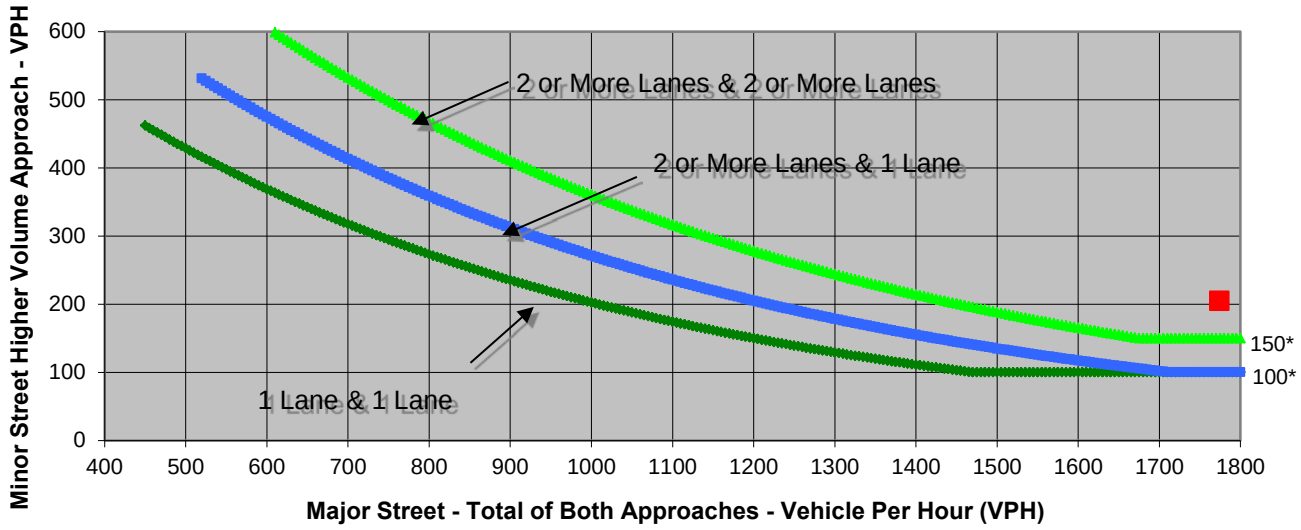
Turn Movement Volumes

	NB	SB	EB	WB
Left	41	3	97	23
Through	0	5	768	822
Right	17	197	51	13
Total	58	205	916	858

Major Street Direction

	North/South
x	East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street W. Grand Ave	Minor Street Campbell St.	Warrant Met
Number of Approach Lanes	**2**	**1**	**YES**
Traffic Volume (VPH) *	**1,774**	**205**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project Gateway Park Connection

Major Street Mandela Parkway Southbound
Minor Street 24th Street

Scenario Near-Term Conditions
Peak Hour PM

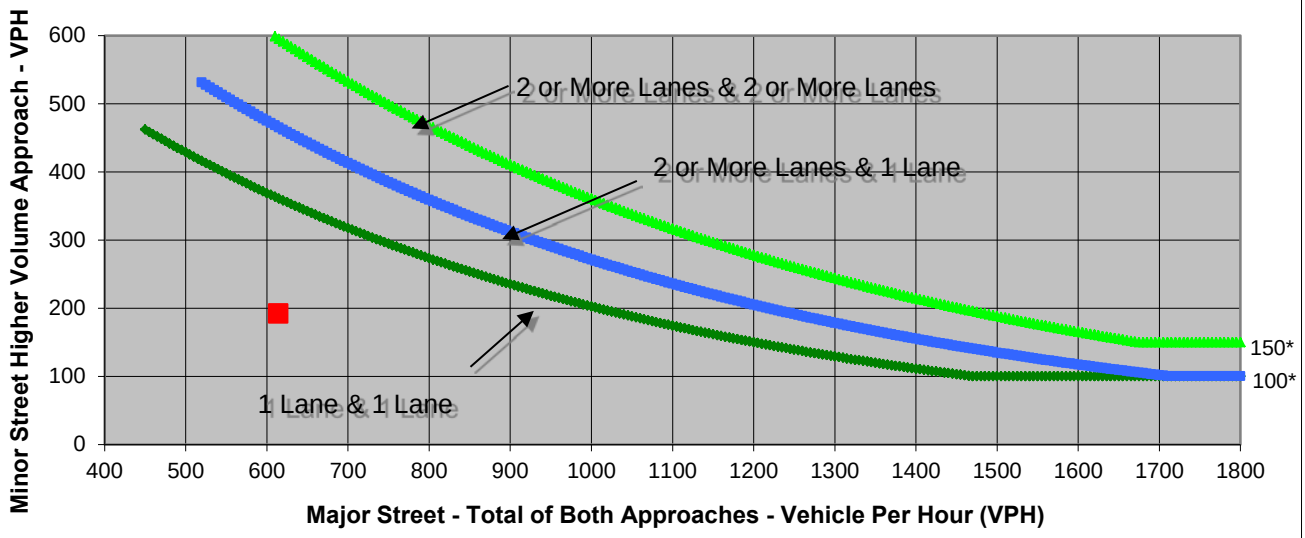
Turn Movement Volumes

	NB	SB	EB	WB
Left	0	0	192	0
Through	0	614	0	0
Right	0	0	0	0
Total	0	614	192	0

Major Street Direction

x North/South
East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	Mandela Parkway Southbound	24th Street	
Number of Approach Lanes	**2**	**2**	**NO**
Traffic Volume (VPH) *	**614**	**192**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project Gateway Park Connection
Scenario Near-Term Conditions
Peak Hour PM

Major Street Mandela Parkway Southbound
Minor Street 20th Street

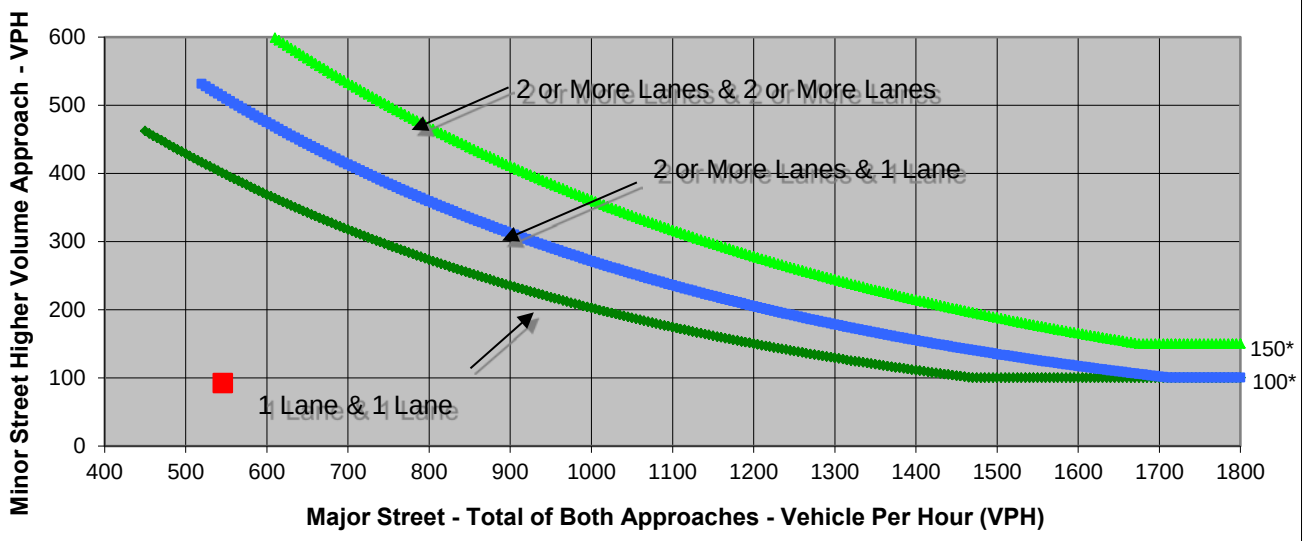
Turn Movement Volumes

	NB	SB	EB	WB
Left	0	8	0	5
Through	0	535	83	1
Right	0	3	9	0
Total	0	546	92	6

Major Street Direction

x North/South
East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	Mandela Parkway Southbound	20th Street	
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**546**	**92**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project Gateway Park Connection
Scenario Near-Term Conditions
Peak Hour PM

Major Street Mandela Parkway
Minor Street 24th Street

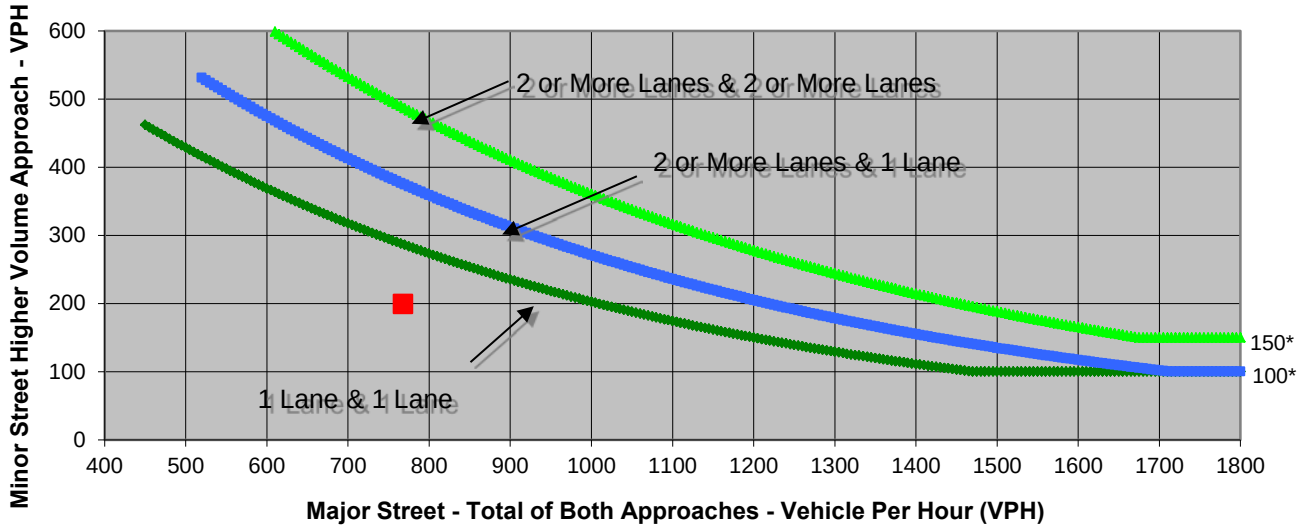
Turn Movement Volumes

	NB	SB	EB	WB
Left	5	0	0	0
Through	763	0	0	187
Right	0	0	0	12
Total	768	0	0	199

Major Street Direction

x North/South
East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	Mandela Parkway	24th Street	
Number of Approach Lanes	**2**	**2**	**NO**
Traffic Volume (VPH) *	**768**	**199**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project Gateway Park Connection
Scenario Near-Term Conditions
Peak Hour PM

Major Street Mandela Parkway Northbound
Minor Street 20th Street

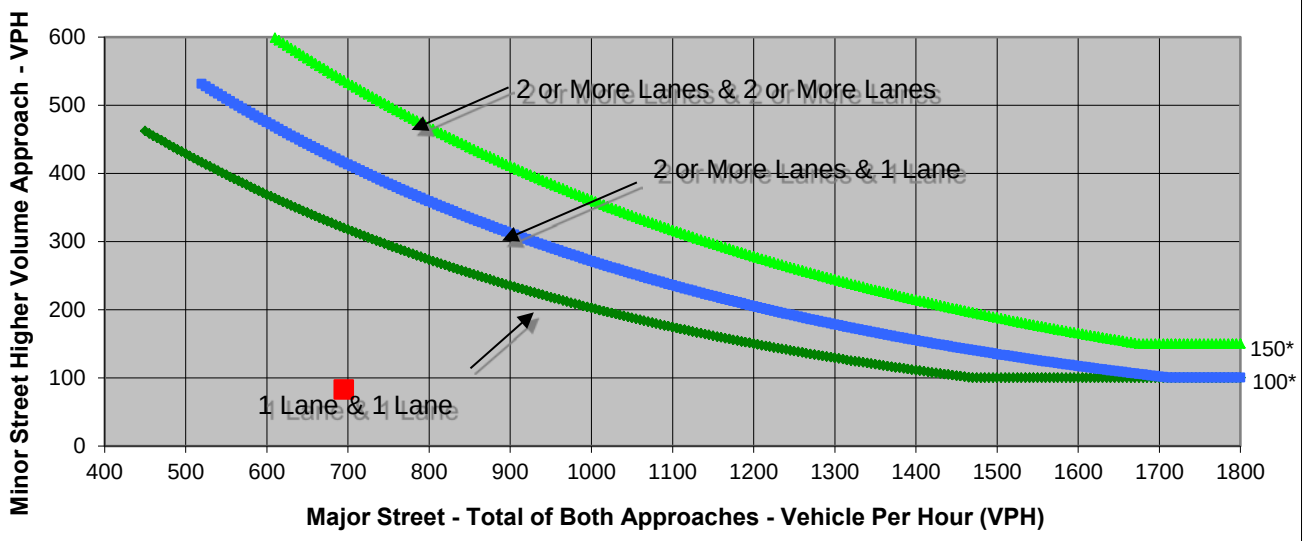
Turn Movement Volumes

	NB	SB	EB	WB
Left	6	0	83	0
Through	686	0	0	1
Right	3	0	0	5
Total	695	0	83	6

Major Street Direction

x North/South
East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	Mandela Parkway Northbound	20th Street	
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**695**	**83**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project Gateway Park Connection
Scenario Near-Term Conditions
Peak Hour SAT

Major Street W. Grand Ave
Minor Street Campbell St.

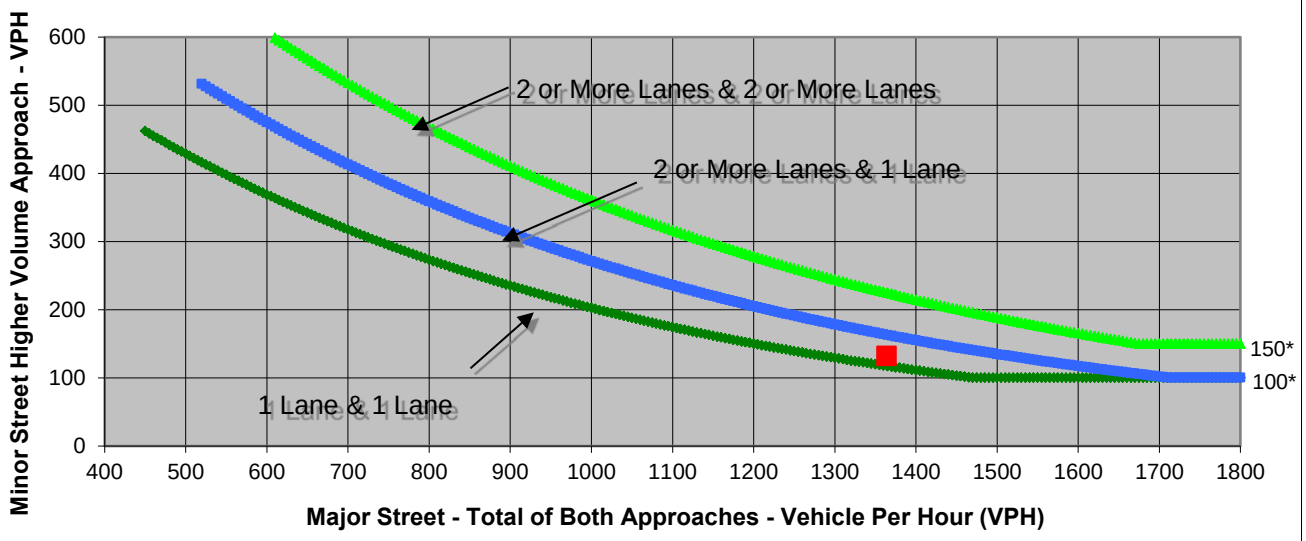
Turn Movement Volumes

	NB	SB	EB	WB
Left	55	4	32	23
Through	5	13	462	799
Right	29	115	42	6
Total	89	132	536	828

Major Street Direction

	North/South
x	East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	W. Grand Ave	Campbell St.	
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**1,364**	**132**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project Gateway Park Connection

Major Street Mandela Parkway Southbound
Minor Street 24th Street

Scenario Near-Term Conditions
Peak Hour SAT

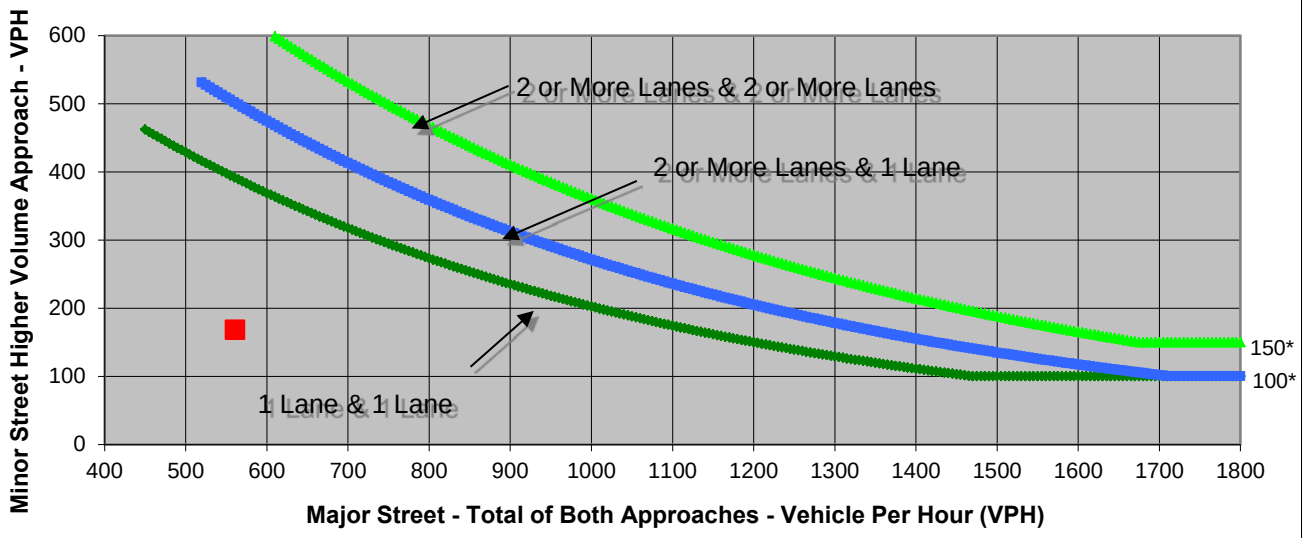
Turn Movement Volumes

	NB	SB	EB	WB
Left	0	0	168	0
Through	0	561	0	0
Right	0	0	0	0
Total	0	561	168	0

Major Street Direction

x North/South
East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	Mandela Parkway Southbound	24th Street	
Number of Approach Lanes	**2**	**2**	**NO**
Traffic Volume (VPH) *	**561**	**168**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project Gateway Park Connection
Scenario Near-Term Conditions
Peak Hour SAT

Major Street Mandela Parkway Southbound
Minor Street 20th Street

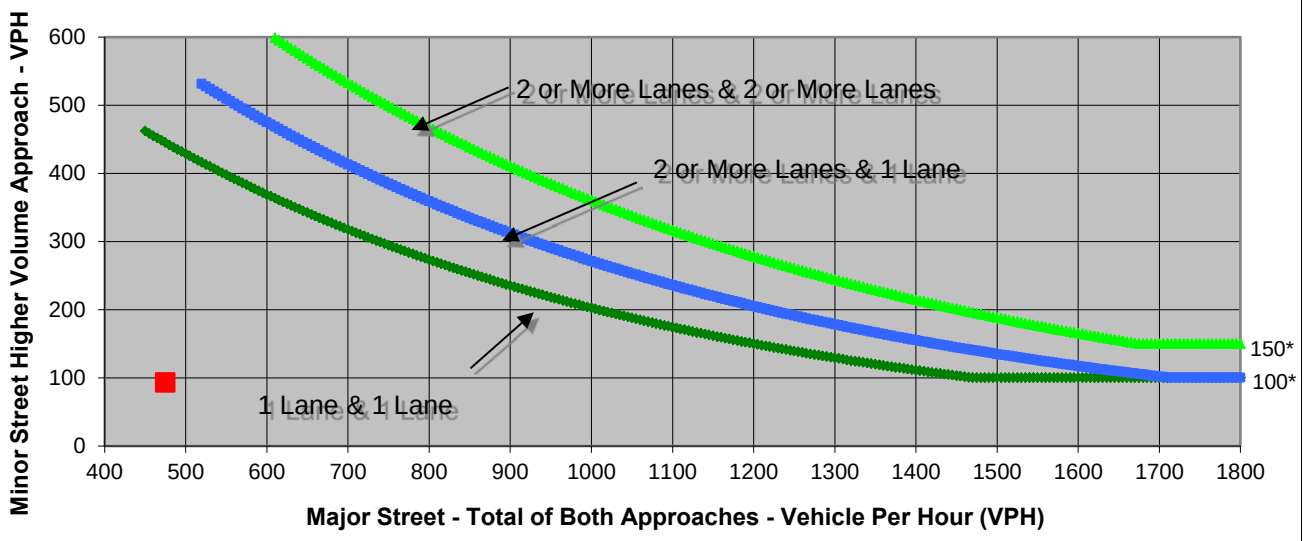
Turn Movement Volumes

	NB	SB	EB	WB
Left	0	32	74	6
Through	0	430	1	0
Right	0	13	18	12
Total	0	475	93	18

Major Street Direction

x North/South
East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	Mandela Parkway Southbound	20th Street	
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**475**	**93**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project Gateway Park Connection
Scenario Near-Term Conditions
Peak Hour SAT

Major Street Mandela Parkway
Minor Street 24th Street

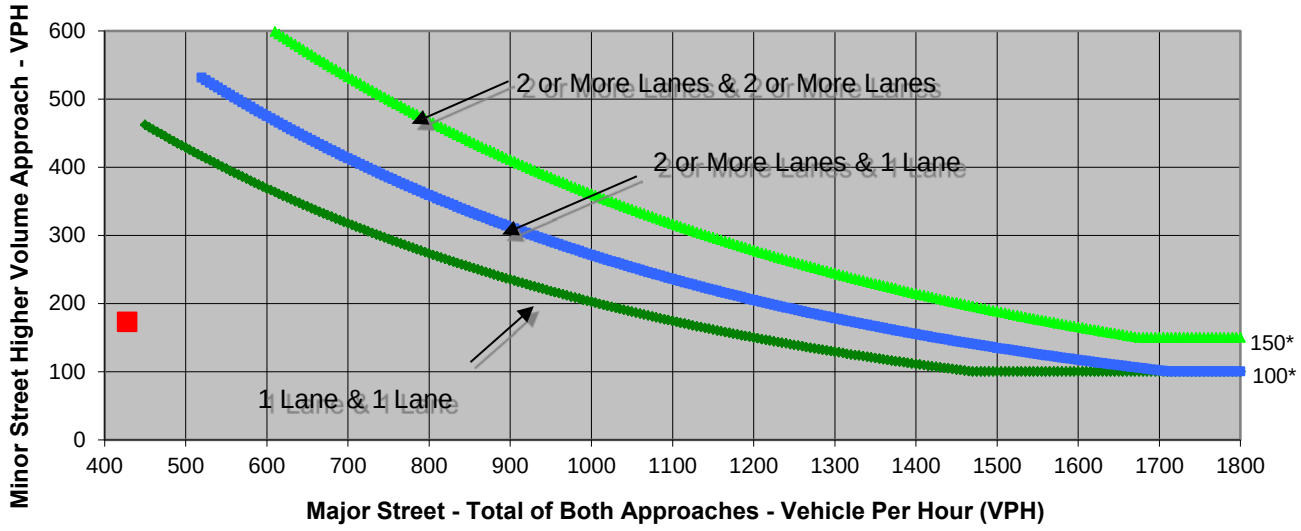
Turn Movement Volumes

	NB	SB	EB	WB
Left	4	0	0	0
Through	424	0	0	164
Right	0	0	0	9
Total	428	0	0	173

Major Street Direction

x	North/South
	East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	Mandela Parkway	24th Street	
Number of Approach Lanes	**2**	**2**	**NO**
Traffic Volume (VPH) *	**428**	**173**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project Gateway Park Connection
Scenario Near-Term Conditions
Peak Hour SAT

Major Street Mandela Parkway Northbound
Minor Street 20th Street

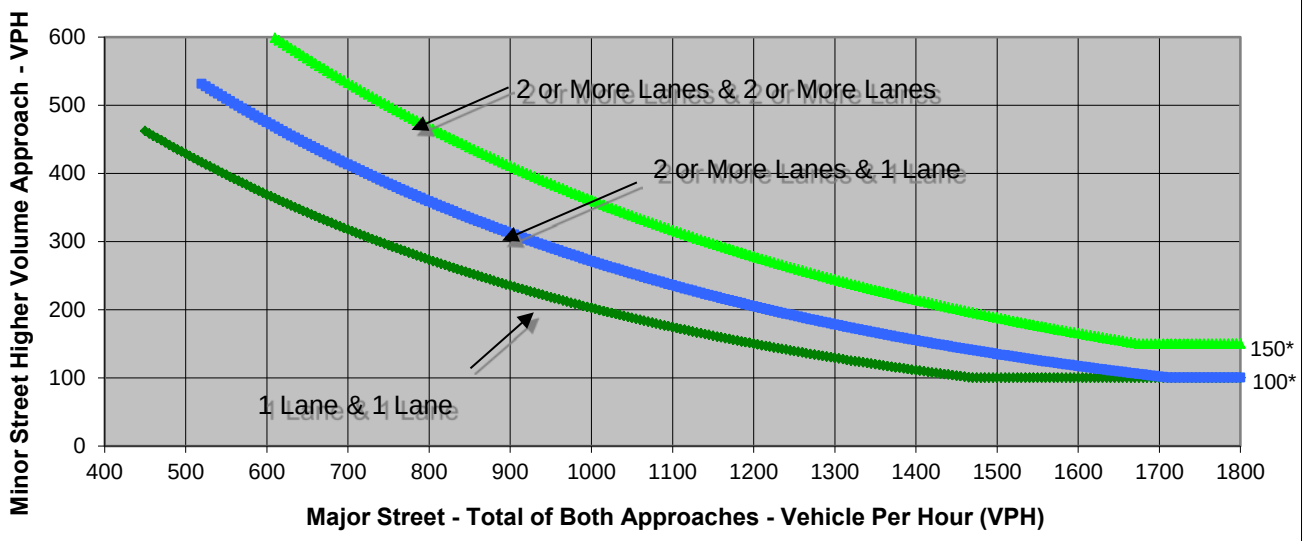
Turn Movement Volumes

	NB	SB	EB	WB
Left	4	0	76	0
Through	340	0	0	1
Right	27	0	0	0
Total	371	0	76	1

Major Street Direction

x North/South
East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	Mandela Parkway Northbound	20th Street	
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**371**	**76**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project: Gateway Park Connection

Major Street: W. Grand Ave
Minor Street: Campbell St.

Scenario: Near-Term with Connection Conditions
Peak Hour: PM

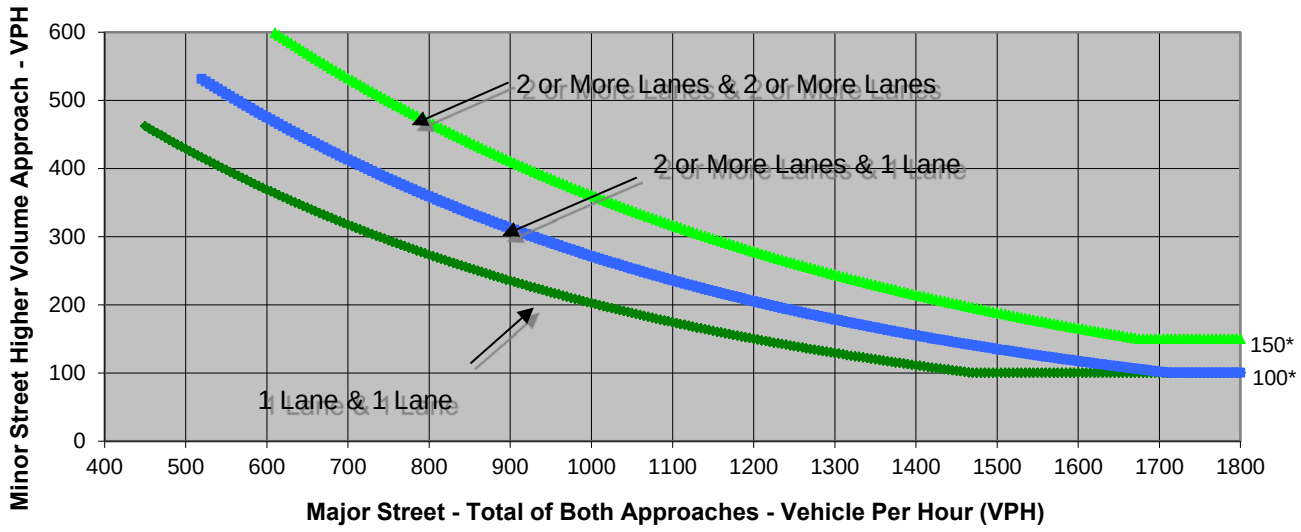
Turn Movement Volumes

	NB	SB	EB	WB
Left	0	3	104	0
Through	0	0	819	845
Right	0	203	0	36
Total	0	206	923	881

Major Street Direction

	North/South
x	East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street W. Grand Ave	Minor Street Campbell St.	Warrant Met
Number of Approach Lanes	**2**	**1**	**YES**
Traffic Volume (VPH) *	**1,804**	**206**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No	1	of	1
Project	Gateway Park Connection		
Scenario	Near-Term with Connection Conditions		
Peak Hour	PM		

Major Street	Mandela Parkway Southbound
Minor Street	24th Street

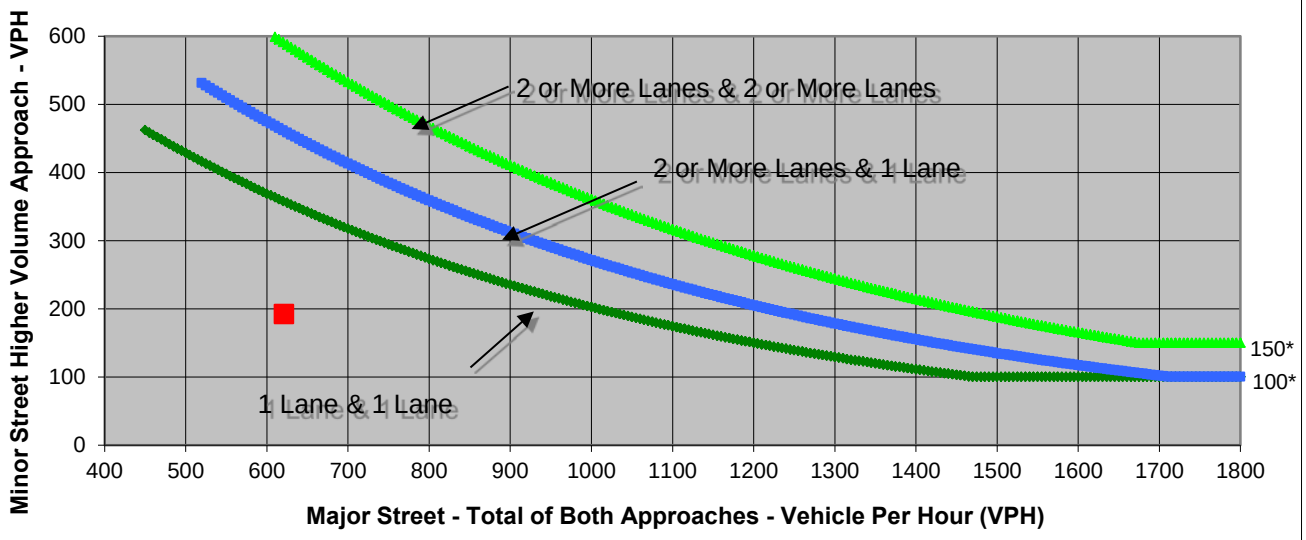
Turn Movement Volumes

	NB	SB	EB	WB
Left	0	0	192	0
Through	0	621	0	0
Right	0	0	0	0
Total	0	621	192	0

Major Street Direction

x	North/South
	East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	Mandela Parkway Southbound	24th Street	
Number of Approach Lanes	**2**	**2**	**NO**
Traffic Volume (VPH) *	**621**	**192**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No	1	of	1
Project	Gateway Park Connection		
Scenario	Near-Term with Connection Conditions		
Peak Hour	PM		

Major Street	Mandela Parkway Southbound
Minor Street	20th Street

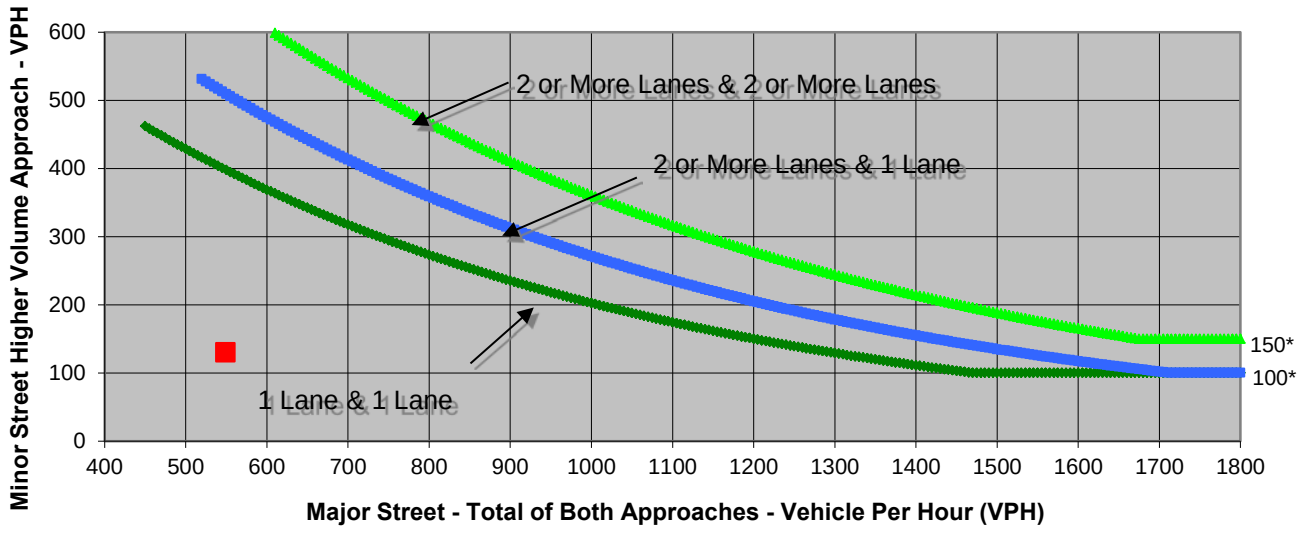
Turn Movement Volumes

	NB	SB	EB	WB
Left	0	8	38	5
Through	0	538	83	1
Right	0	3	9	0
Total	0	549	130	6

Major Street Direction

x	North/South
	East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street Mandela Parkway Southbound	Minor Street 20th Street	Warrant Met
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**549**	**130**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project: Gateway Park Connection

Major Street: Mandela Parkway
Minor Street: 24th Street

Scenario: Near-Term with Connection Conditions
Peak Hour: PM

Turn Movement Volumes

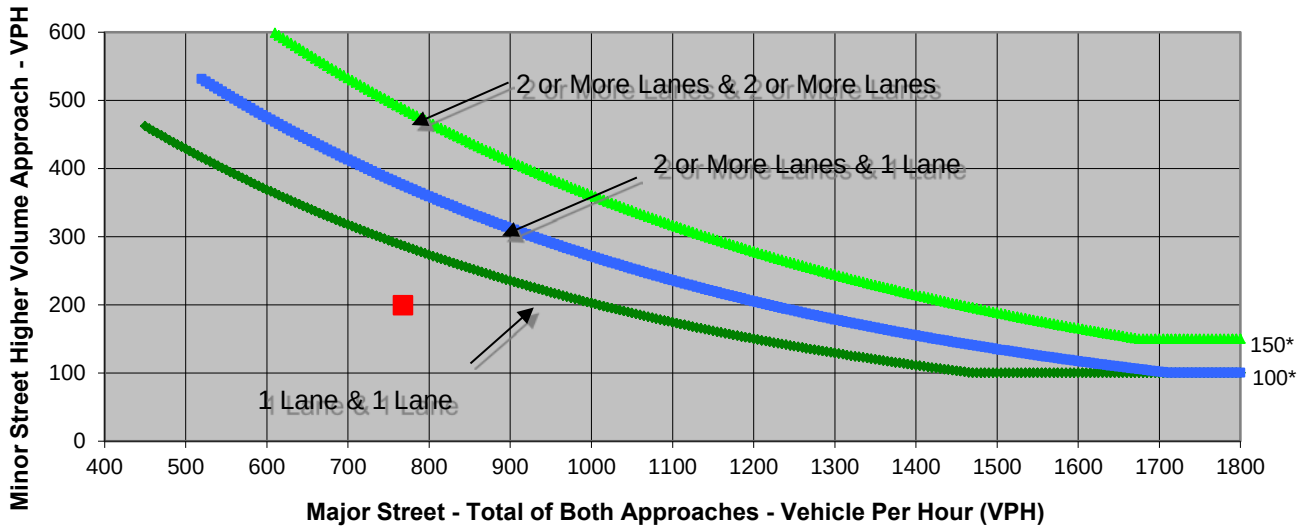
	NB	SB	EB	WB
Left	5	0	0	0
Through	763	0	0	187
Right	0	0	0	12
Total	768	0	0	199

Major Street Direction

x North/South

East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street Mandela Parkway	Minor Street 24th Street	Warrant Met
Number of Approach Lanes	**2**	**2**	**NO**
Traffic Volume (VPH) *	**768**	**199**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No	1	of	1

Project	Gateway Park Connection
Scenario	Near-Term with Connection Conditions
Peak Hour	PM
Major Street	Mandela Parkway Northbound
Minor Street	20th Street

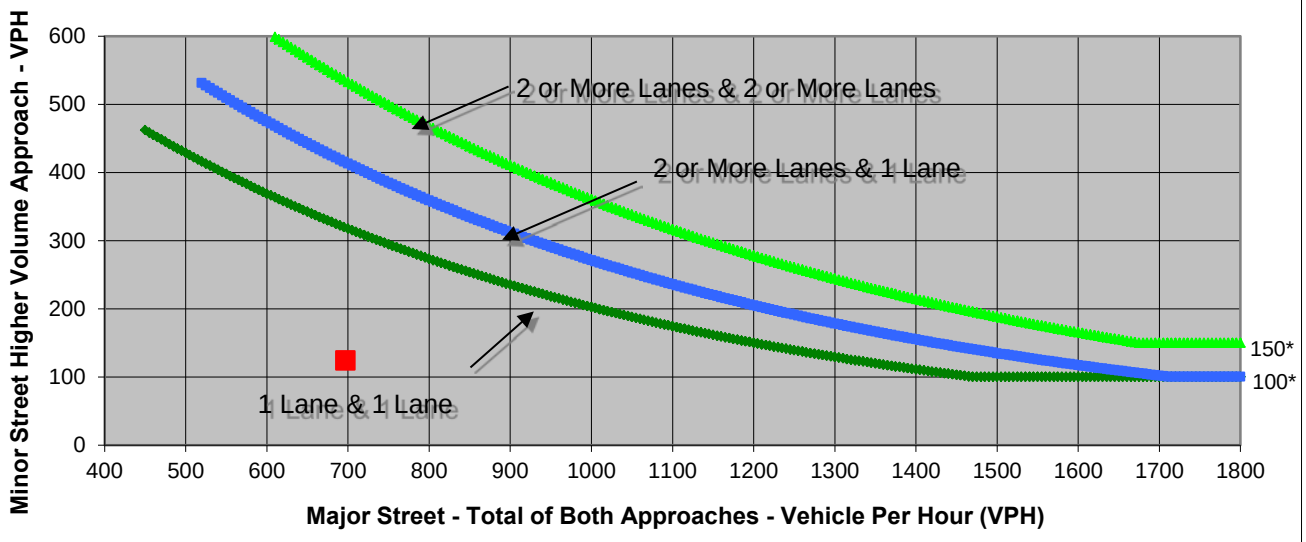
Turn Movement Volumes

	NB	SB	EB	WB
Left	6	0	124	0
Through	688	0	0	1
Right	3	0	0	5
Total	697	0	124	6

Major Street Direction

x	North/South
	East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street Mandela Parkway Northbound	Minor Street 20th Street	Warrant Met
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**697**	**124**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project: Gateway Park Connection

Major Street: W. Grand Ave
Minor Street: Campbell St.

Scenario: Near-Term with Connection Conditions
Peak Hour: SAT

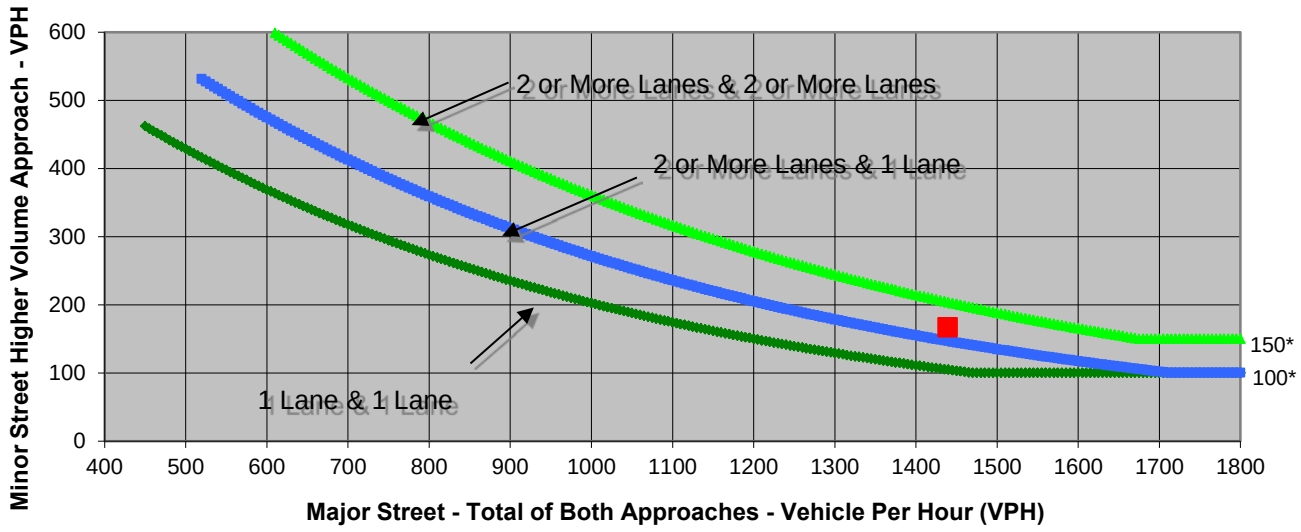
Turn Movement Volumes

	NB	SB	EB	WB
Left	0	4	54	0
Through	0	0	504	829
Right	0	163	0	52
Total	0	167	558	881

Major Street Direction

	North/South
x	East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street W. Grand Ave	Minor Street Campbell St.	Warrant Met
Number of Approach Lanes	**2**	**1**	**YES**
Traffic Volume (VPH) *	**1,439**	**167**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No	1	of	1
Project	Gateway Park Connection		
Scenario	Near-Term with Connection Conditions		
Peak Hour	SAT		

Major Street	Mandela Parkway Southbound
Minor Street	24th Street

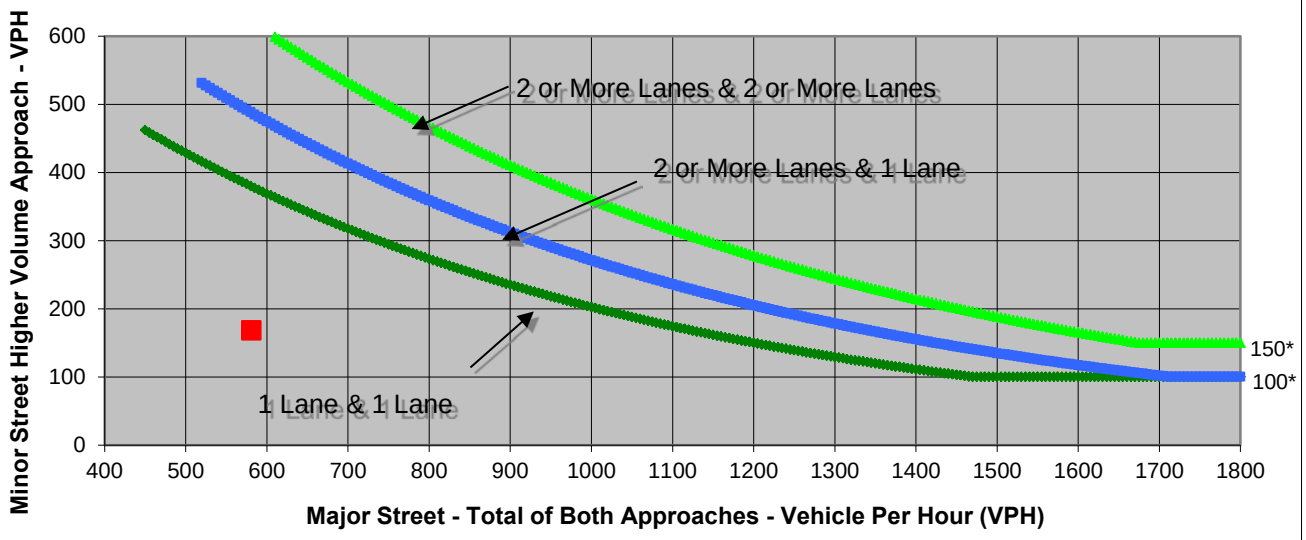
Turn Movement Volumes

	NB	SB	EB	WB
Left	0	0	168	0
Through	0	581	0	0
Right	0	0	0	0
Total	0	581	168	0

Major Street Direction

x	North/South
	East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street Mandela Parkway Southbound	Minor Street 24th Street	Warrant Met
Number of Approach Lanes	**2**	**2**	**NO**
Traffic Volume (VPH) *	**581**	**168**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No	1	of	1

Project	Gateway Park Connection
Scenario	Near-Term with Connection Conditions
Peak Hour	SAT
Major Street	Mandela Parkway Southbound
Minor Street	20th Street

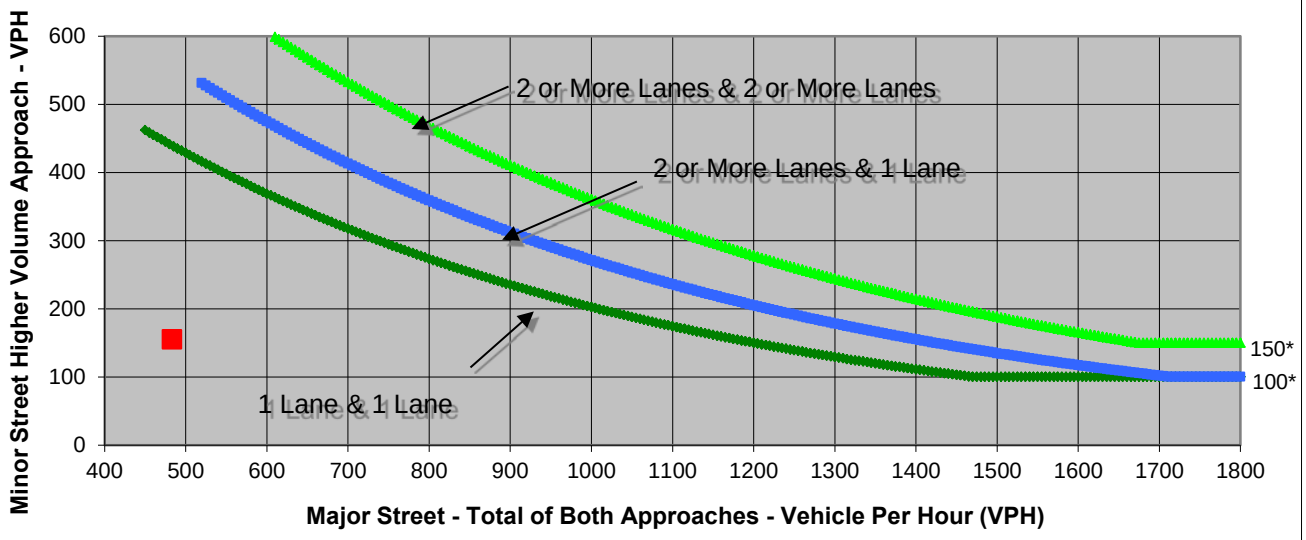
Turn Movement Volumes

	NB	SB	EB	WB
Left	0	32	74	6
Through	0	438	63	0
Right	0	13	18	12
Total	0	483	155	18

Major Street Direction

x	North/South
	East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street Mandela Parkway Southbound	Minor Street 20th Street	Warrant Met
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**483**	**155**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project: Gateway Park Connection

Major Street: Mandela Parkway
Minor Street: 24th Street

Scenario: Near-Term with Connection Conditions
Peak Hour: SAT

Turn Movement Volumes

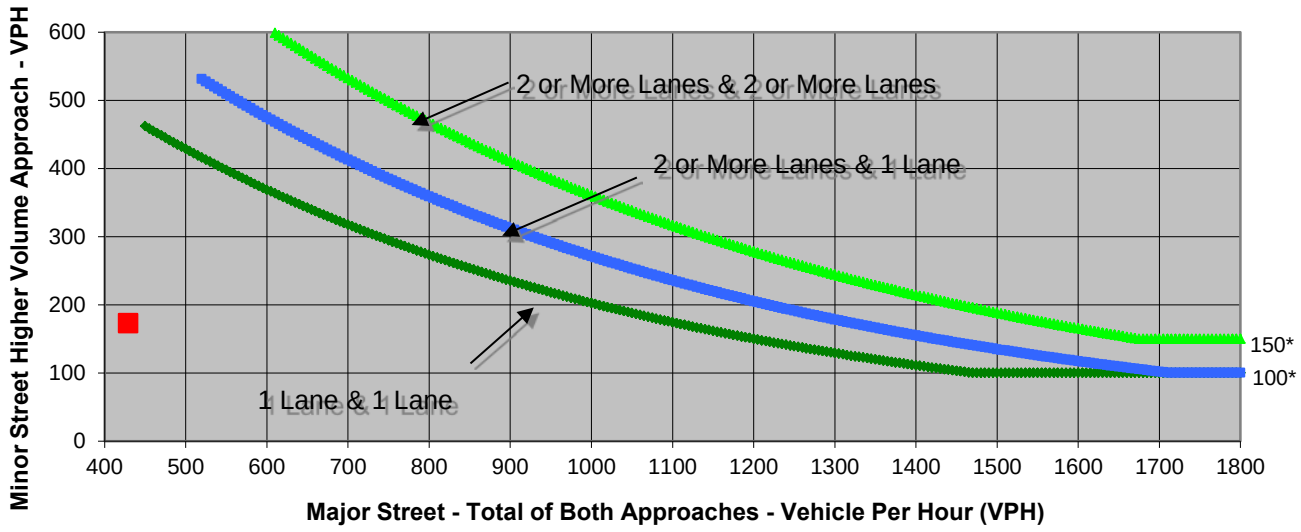
	NB	SB	EB	WB
Left	4	0	0	0
Through	425	0	0	164
Right	0	0	0	9
Total	429	0	0	173

Major Street Direction

x North/South

East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street Mandela Parkway	Minor Street 24th Street	Warrant Met
Number of Approach Lanes	**2**	**2**	**NO**
Traffic Volume (VPH) *	**429**	**173**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project: Gateway Park Connection

Major Street: Mandela Parkway Northbound
Minor Street: 20th Street

Scenario: Near-Term with Connection Conditions
Peak Hour: SAT

Turn Movement Volumes

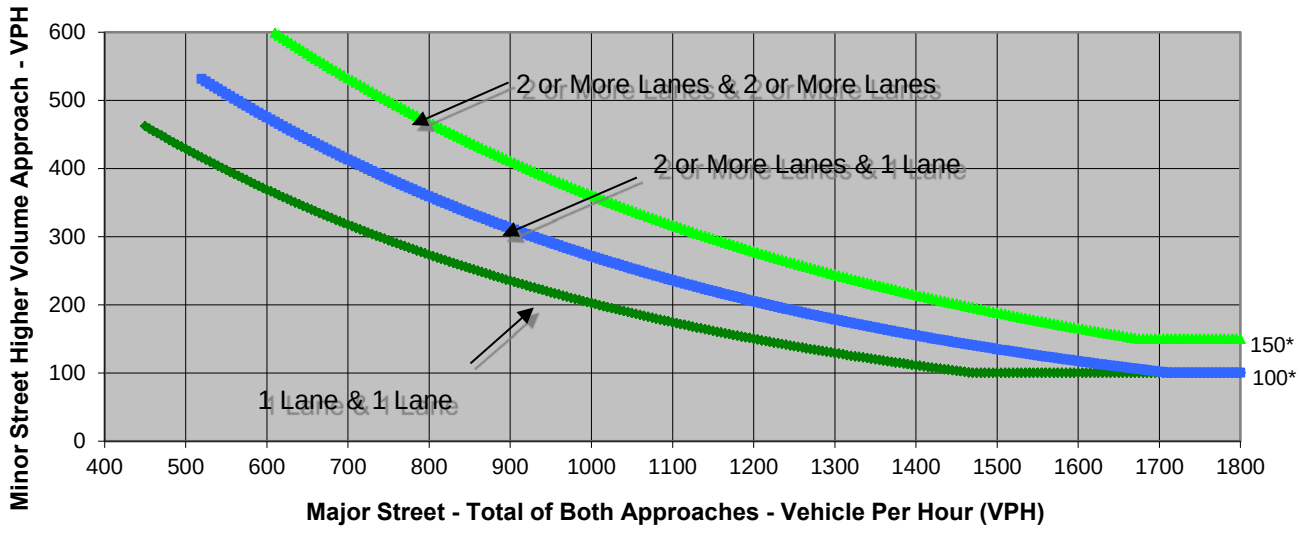
	NB	SB	EB	WB
Left	4	0	62	0
Through	346	0	72	1
Right	27	0	0	0
Total	377	0	134	1

Major Street Direction

x North/South

East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street Mandela Parkway Northbound	Minor Street 20th Street	Warrant Met
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**377**	**134**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project: Gateway Park Connection

Major Street: W. Grand Ave
Minor Street: Campbell St.

Scenario: Near-Term with Connection and Park Conditions
Peak Hour: PM

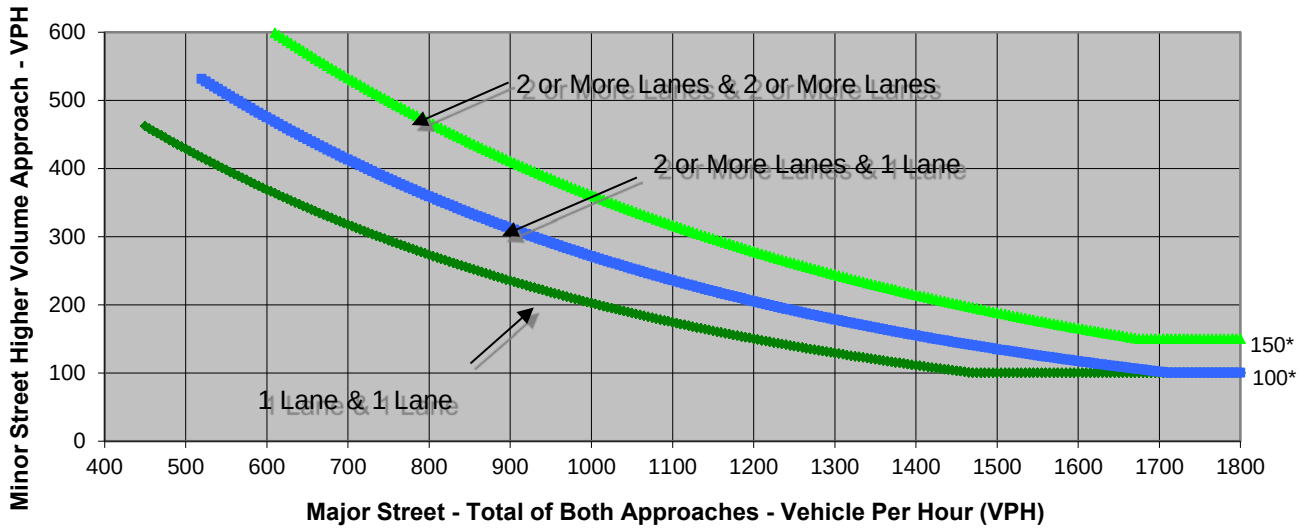
Turn Movement Volumes

	NB	SB	EB	WB
Left	0	3	104	0
Through	0	0	859	902
Right	0	203	0	36
Total	0	206	963	938

Major Street Direction

	North/South
x	East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street W. Grand Ave	Minor Street Campbell St.	Warrant Met
Number of Approach Lanes	**2**	**1**	**YES**
Traffic Volume (VPH) *	**1,901**	**206**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project: Gateway Park Connection

Major Street: Mandela Parkway Southbound
Minor Street: 24th Street

Scenario: Near-Term with Connection and Park Conditions
Peak Hour: PM

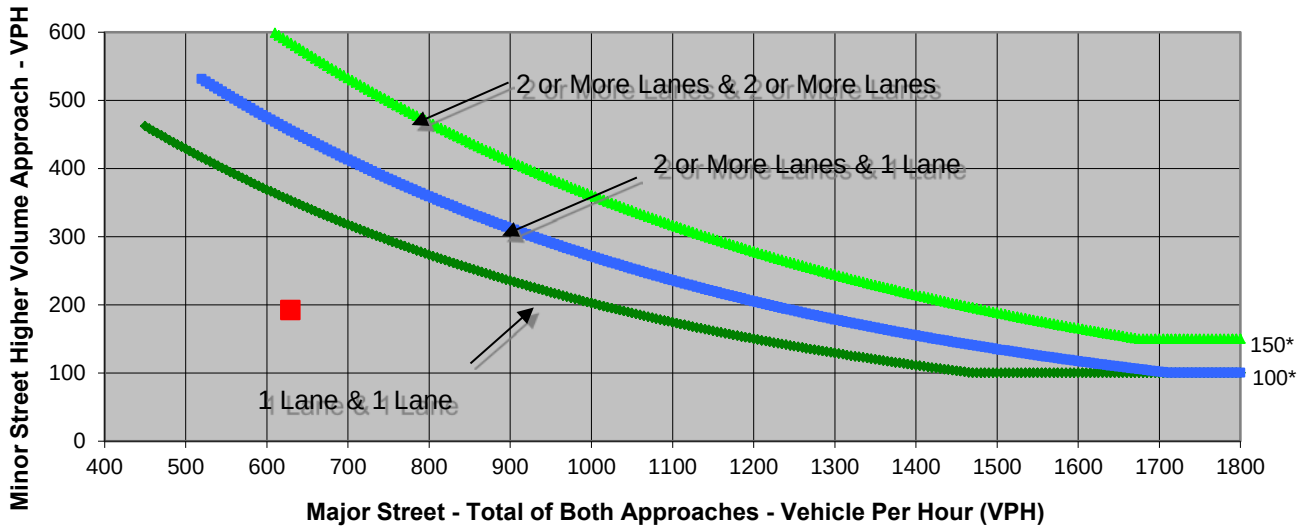
Turn Movement Volumes

	NB	SB	EB	WB
Left	0	0	192	0
Through	0	629	0	0
Right	0	0	0	0
Total	0	629	192	0

Major Street Direction

x North/South
East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street Mandela Parkway Southbound	Minor Street 24th Street	Warrant Met
Number of Approach Lanes	**2**	**2**	**NO**
Traffic Volume (VPH) *	**629**	**192**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project: Gateway Park Connection

Major Street: Mandela Parkway Southbound
Minor Street: 20th Street

Scenario: Near-Term with Connection and Park Conditions
Peak Hour: PM

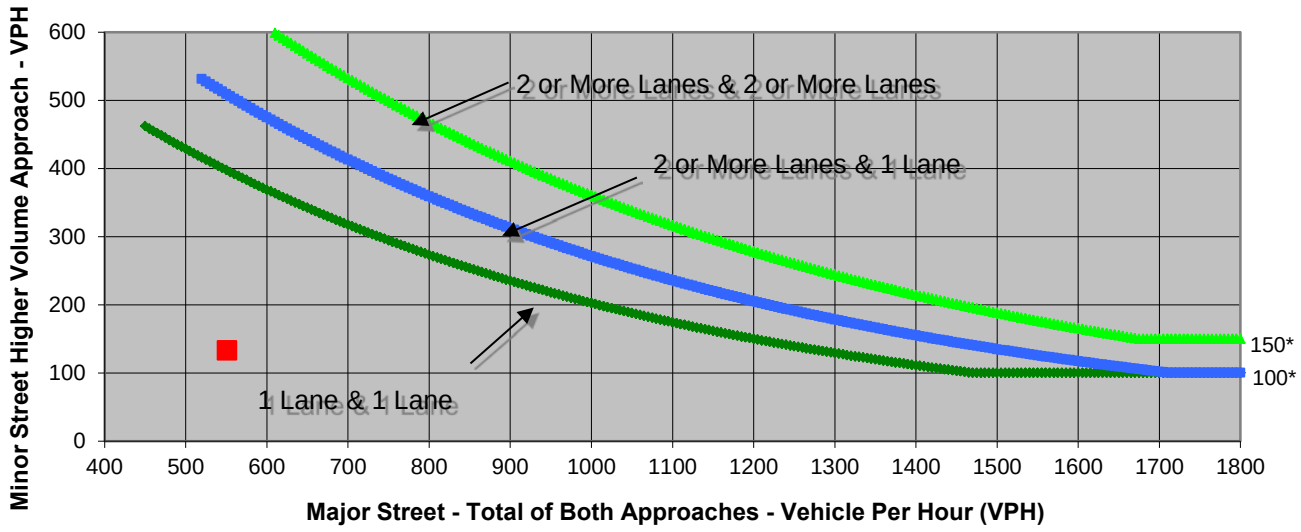
Turn Movement Volumes

	NB	SB	EB	WB
Left	0	8	38	5
Through	0	540	86	1
Right	0	3	9	0
Total	0	551	133	6

Major Street Direction

x North/South
East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street Mandela Parkway Southbound	Minor Street 20th Street	Warrant Met
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**551**	**133**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project: Gateway Park Connection

Major Street: Mandela Parkway Northbound
Minor Street: 24th Street

Scenario: Near-Term with Connection and Park Conditions
Peak Hour: PM

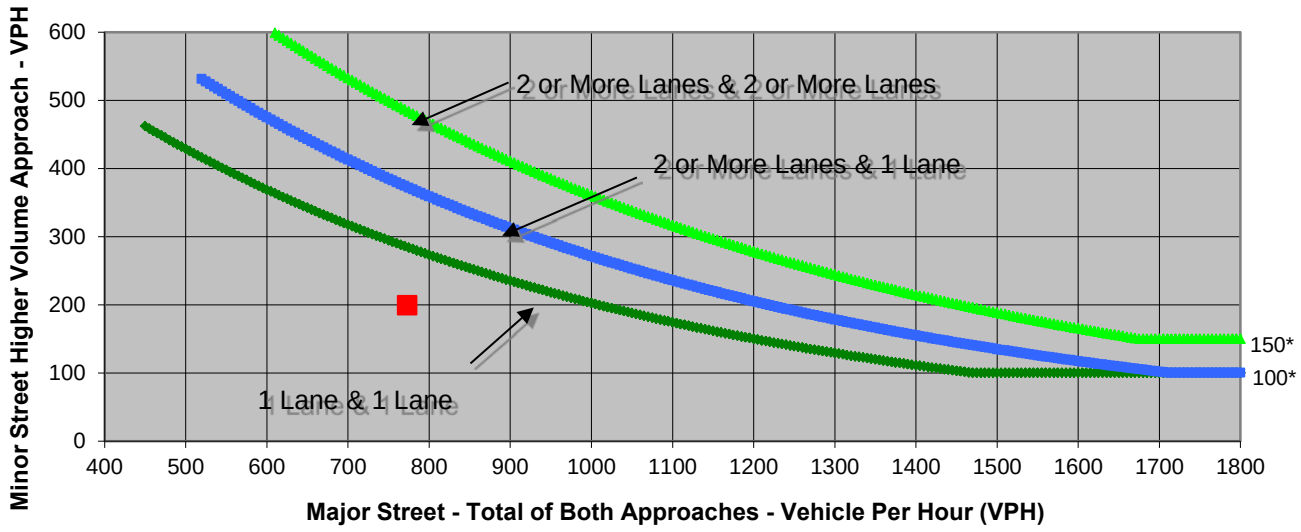
Turn Movement Volumes

	NB	SB	EB	WB
Left	5	0	0	0
Through	768	0	0	187
Right	0	0	0	12
Total	773	0	0	199

Major Street Direction

x North/South
East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street Mandela Parkway Northbound	Minor Street 24th Street	Warrant Met
Number of Approach Lanes	**2**	**2**	**NO**
Traffic Volume (VPH) *	**773**	**199**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project: Gateway Park Connection

Major Street: Mandela Parkway Northbound
Minor Street: 20th Street

Scenario: Near-Term with Connection and Park Conditions
Peak Hour: PM

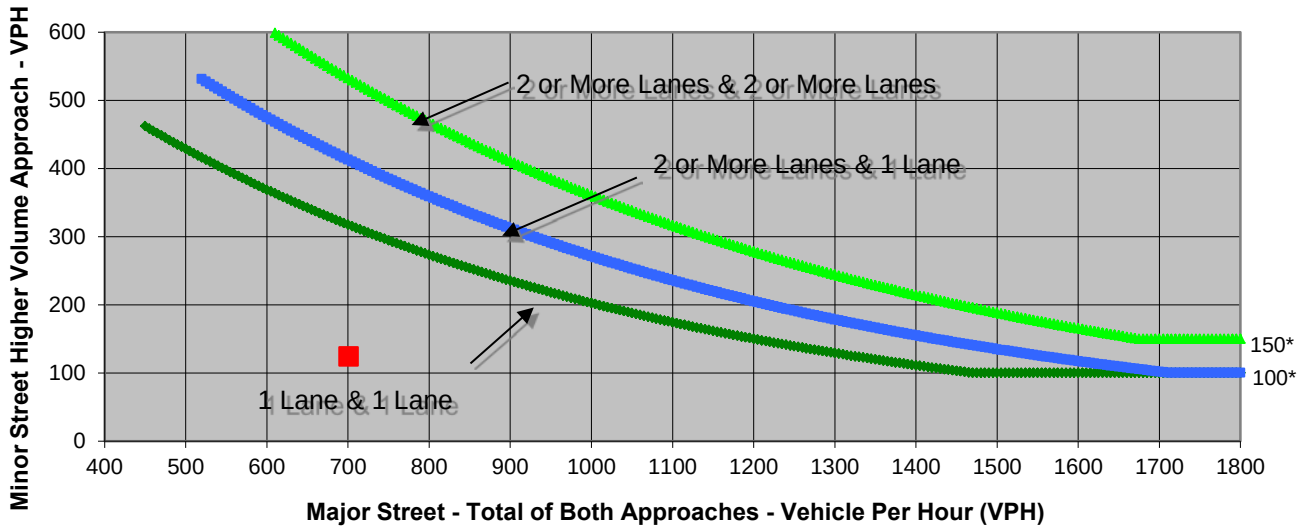
Turn Movement Volumes

	NB	SB	EB	WB
Left	6	0	124	0
Through	692	0	0	1
Right	3	0	0	5
Total	701	0	124	6

Major Street Direction

x North/South
East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street Mandela Parkway Northbound	Minor Street 20th Street	Warrant Met
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**701**	**124**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project: Gateway Park Connection

Major Street: W. Grand Ave
Minor Street: Campbell St.

Scenario: Near-Term with Connection and Park Conditions
Peak Hour: SAT

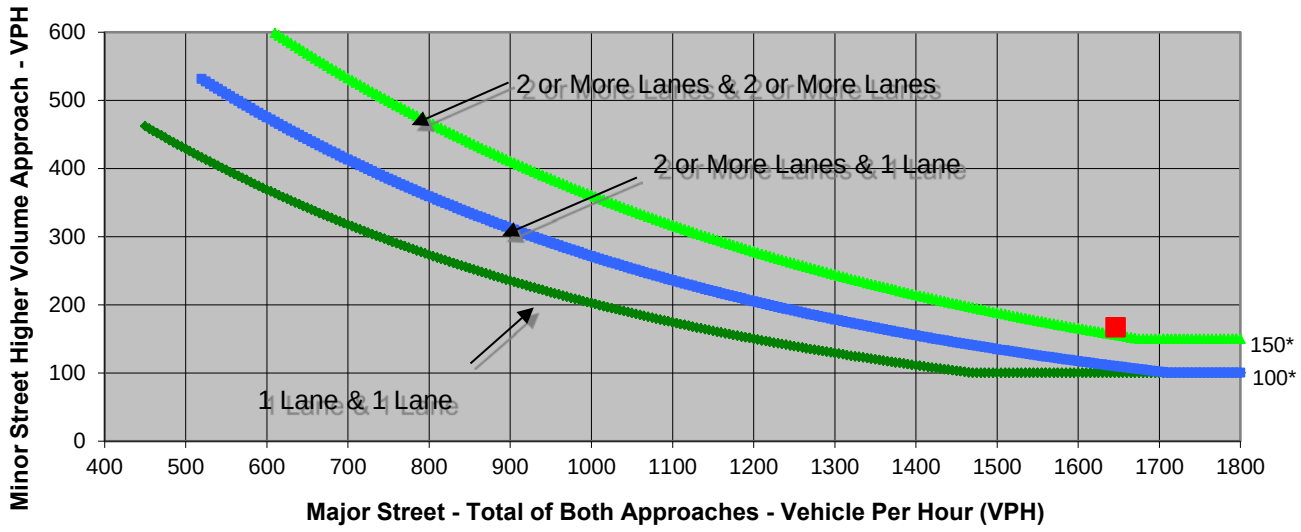
Turn Movement Volumes

	NB	SB	EB	WB
Left	0	4	54	0
Through	0	0	608	932
Right	0	163	0	52
Total	0	167	662	984

Major Street Direction

	North/South
x	East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street W. Grand Ave	Minor Street Campbell St.	Warrant Met
Number of Approach Lanes	**2**	**1**	**YES**
Traffic Volume (VPH) *	**1,646**	**167**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project: Gateway Park Connection

Major Street: Mandela Parkway Southbound
Minor Street: 24th Street

Scenario: Near-Term with Connection and Park Conditions
Peak Hour: SAT

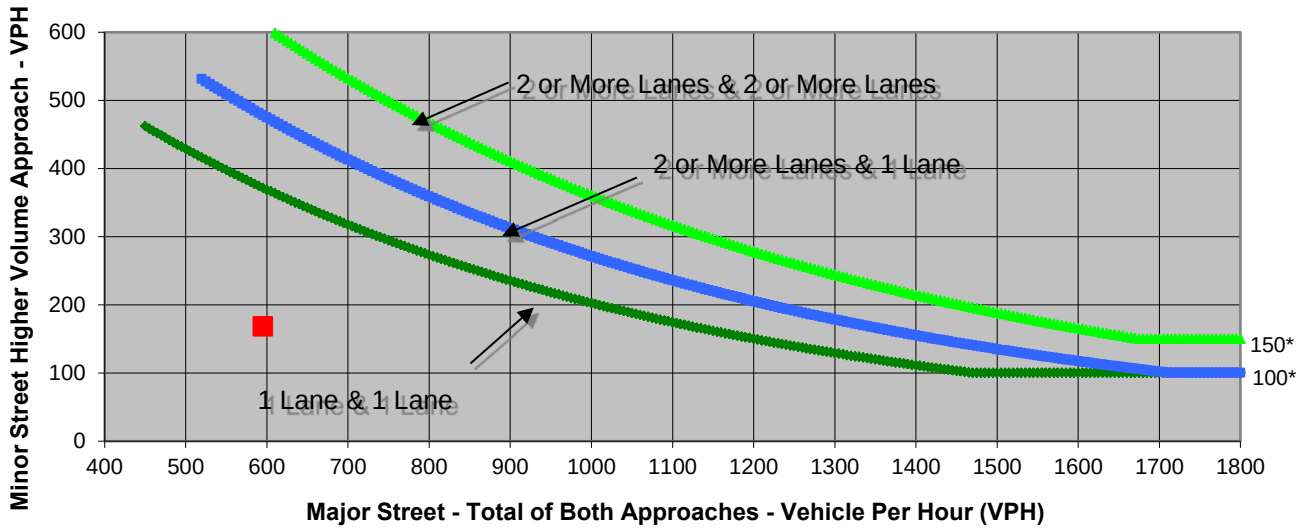
Turn Movement Volumes

	NB	SB	EB	WB
Left	0	0	168	0
Through	0	595	0	0
Right	0	0	0	0
Total	0	595	168	0

Major Street Direction

x	North/South
	East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street Mandela Parkway Southbound	Minor Street 24th Street	Warrant Met
Number of Approach Lanes	**2**	**2**	**NO**
Traffic Volume (VPH) *	**595**	**168**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project: Gateway Park Connection

Major Street: Mandela Parkway Southbound
Minor Street: 20th Street

Scenario: Near-Term with Connection and Park Conditions
Peak Hour: SAT

Turn Movement Volumes

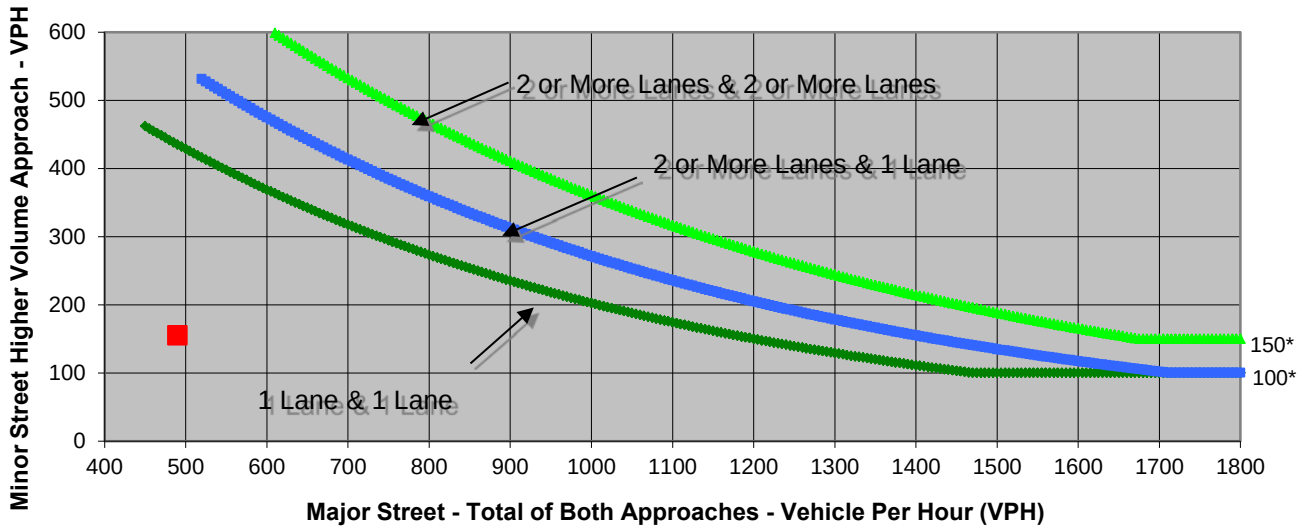
	NB	SB	EB	WB
Left	0	32	74	6
Through	0	445	63	0
Right	0	13	18	12
Total	0	490	155	18

Major Street Direction

x North/South

East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street Mandela Parkway Southbound	Minor Street 20th Street	Warrant Met
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**490**	**155**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project: Gateway Park Connection

Major Street: Mandela Parkway Northbound
Minor Street: 24th Street

Scenario: Near-Term with Connection and Park Conditions
Peak Hour: SAT

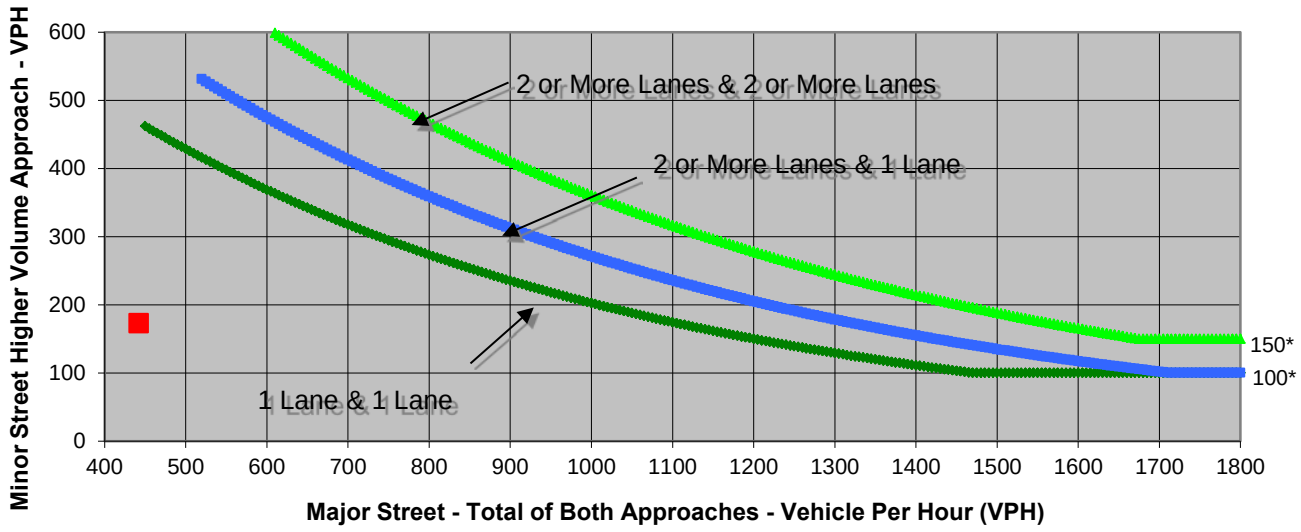
Turn Movement Volumes

	NB	SB	EB	WB
Left	4	0	0	0
Through	438	0	0	164
Right	0	0	0	9
Total	442	0	0	173

Major Street Direction

x North/South
East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street Mandela Parkway Northbound	Minor Street 24th Street	Warrant Met
Number of Approach Lanes	**2**	**2**	**NO**
Traffic Volume (VPH) *	**442**	**173**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project: Gateway Park Connection

Major Street: Mandela Parkway Northbound
Minor Street: 20th Street

Scenario: Near-Term with Connection and Park Conditions
Peak Hour: SAT

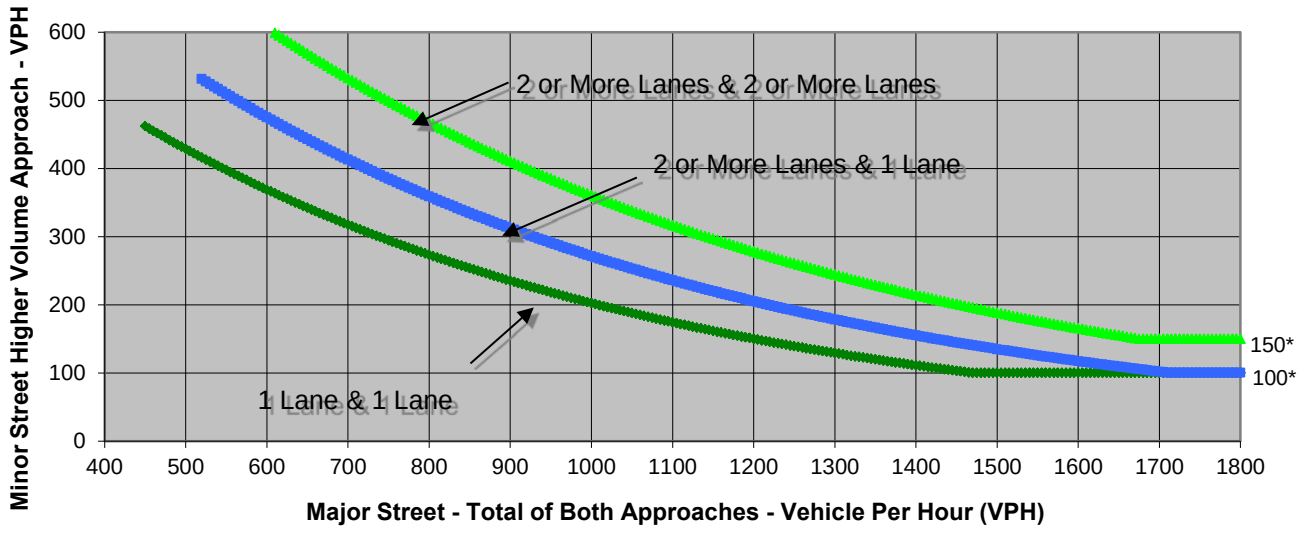
Turn Movement Volumes

	NB	SB	EB	WB
Left	4	0	62	0
Through	354	0	76	1
Right	27	0	0	0
Total	385	0	138	1

Major Street Direction

x North/South
East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street Mandela Parkway Northbound	Minor Street 20th Street	Warrant Met
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**385**	**138**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project Gateway Park Connection

Major Street W. Grand Ave
Minor Street Campbell St.

Scenario Cumulative Conditions
Peak Hour PM

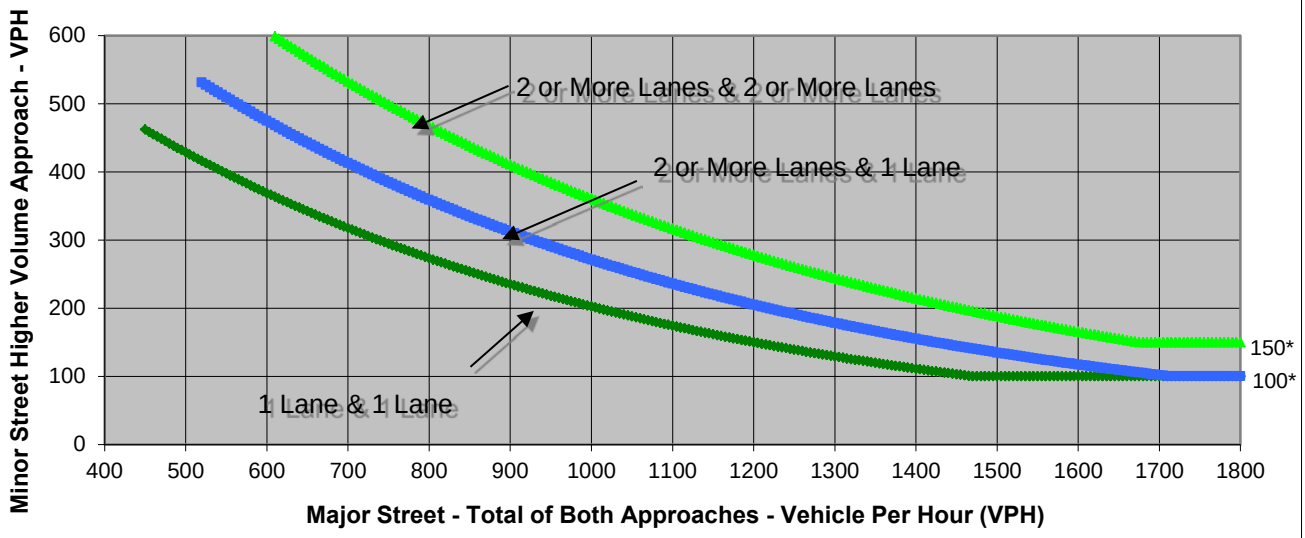
Turn Movement Volumes

	NB	SB	EB	WB
Left	54	3	128	30
Through	0	7	1,008	1,079
Right	22	232	67	17
Total	76	242	1,203	1,126

Major Street Direction

	North/South
x	East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	W. Grand Ave	Campbell St.	
Number of Approach Lanes	**2**	**1**	**YES**
Traffic Volume (VPH) *	**2,329**	**242**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project: Gateway Park Connection

Major Street: Mandela Parkway Southbound
Minor Street: 24th Street

Scenario: Cumulative Conditions
Peak Hour: PM

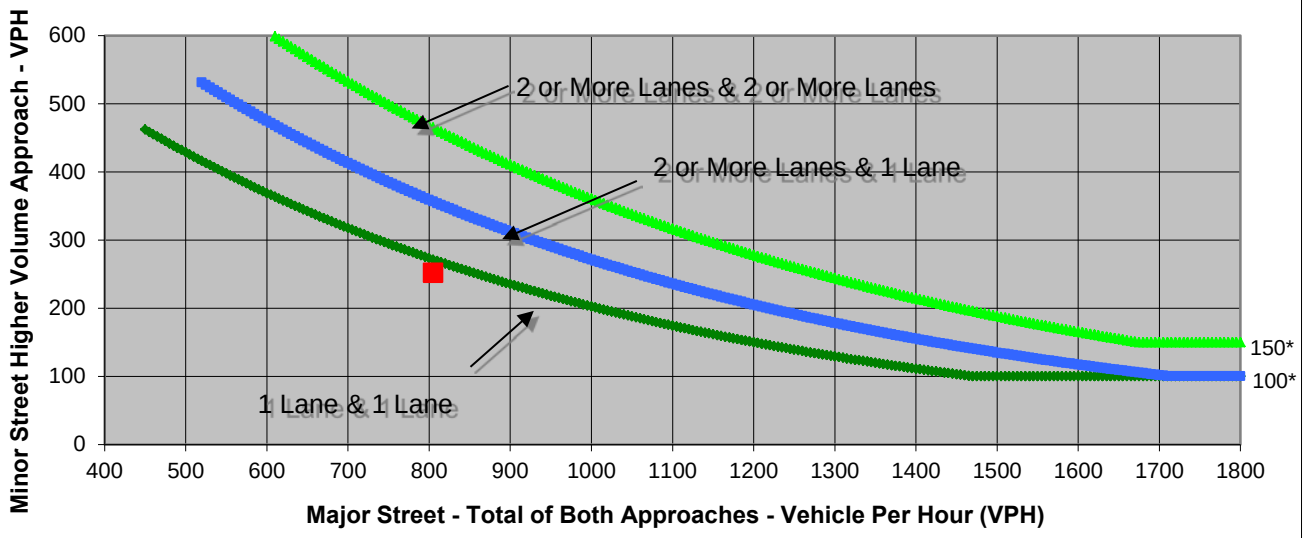
Turn Movement Volumes

	NB	SB	EB	WB
Left	0	0	252	0
Through	0	805	0	0
Right	0	0	0	0
Total	0	805	252	0

Major Street Direction

x North/South
East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	Mandela Parkway Southbound	24th Street	
Number of Approach Lanes	**2**	**2**	**NO**
Traffic Volume (VPH) *	**805**	**252**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project Gateway Park Connection
Scenario Cumulative Conditions
Peak Hour PM

Major Street Mandela Parkway Southbound
Minor Street 20th Street

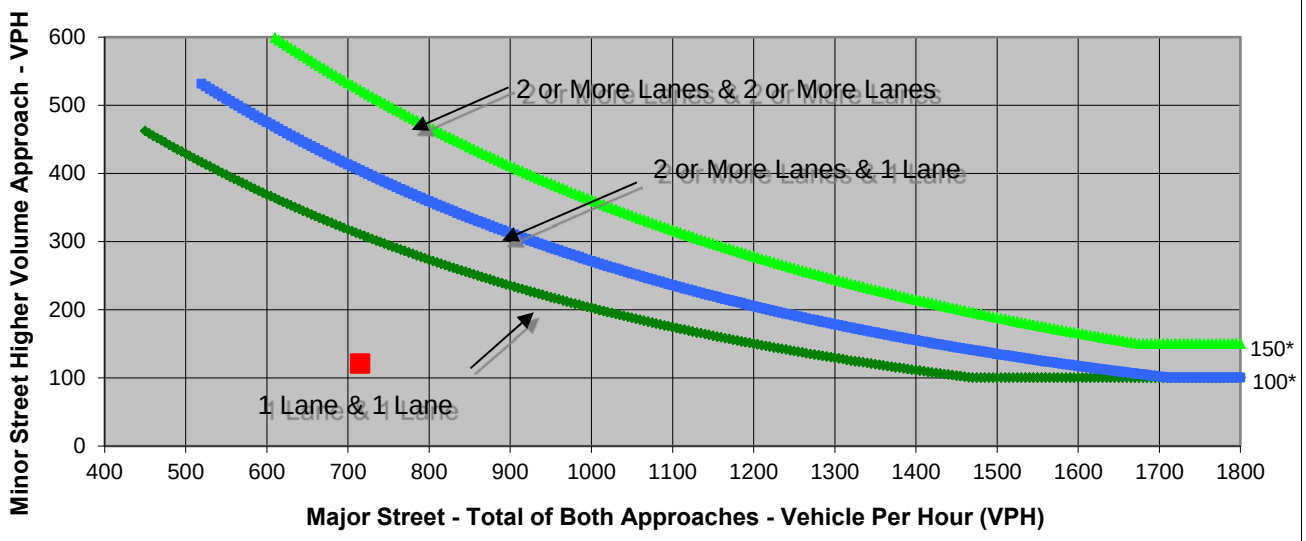
Turn Movement Volumes

	NB	SB	EB	WB
Left	0	10	0	7
Through	0	702	109	2
Right	0	3	12	0
Total	0	715	121	9

Major Street Direction

x North/South
East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	Mandela Parkway Southbound	20th Street	
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**715**	**121**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project Gateway Park Connection
Scenario Cumulative Conditions
Peak Hour PM

Major Street Mandela Parkway
Minor Street 24th Street

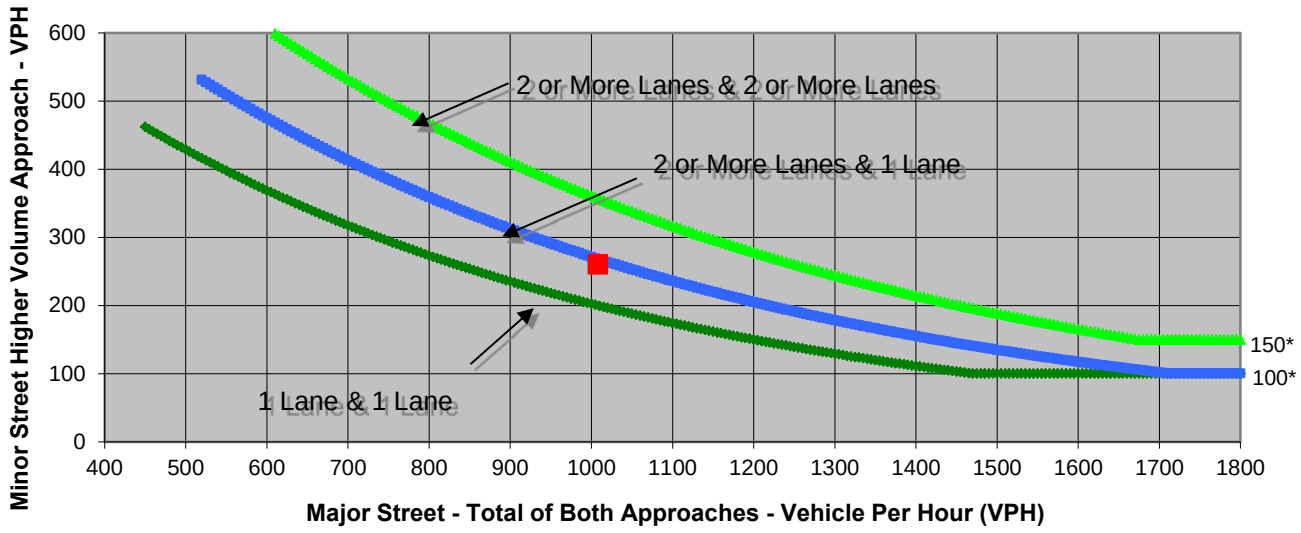
Turn Movement Volumes

	NB	SB	EB	WB
Left	7	0	0	0
Through	1,001	0	0	245
Right	0	0	0	15
Total	1,008	0	0	260

Major Street Direction

x North/South
East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	Mandela Parkway	24th Street	
Number of Approach Lanes	**2**	**2**	**NO**
Traffic Volume (VPH) *	**1,008**	**260**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project Gateway Park Connection
Scenario Cumulative Conditions
Peak Hour PM

Major Street Mandela Parkway Northbound
Minor Street 20th Street

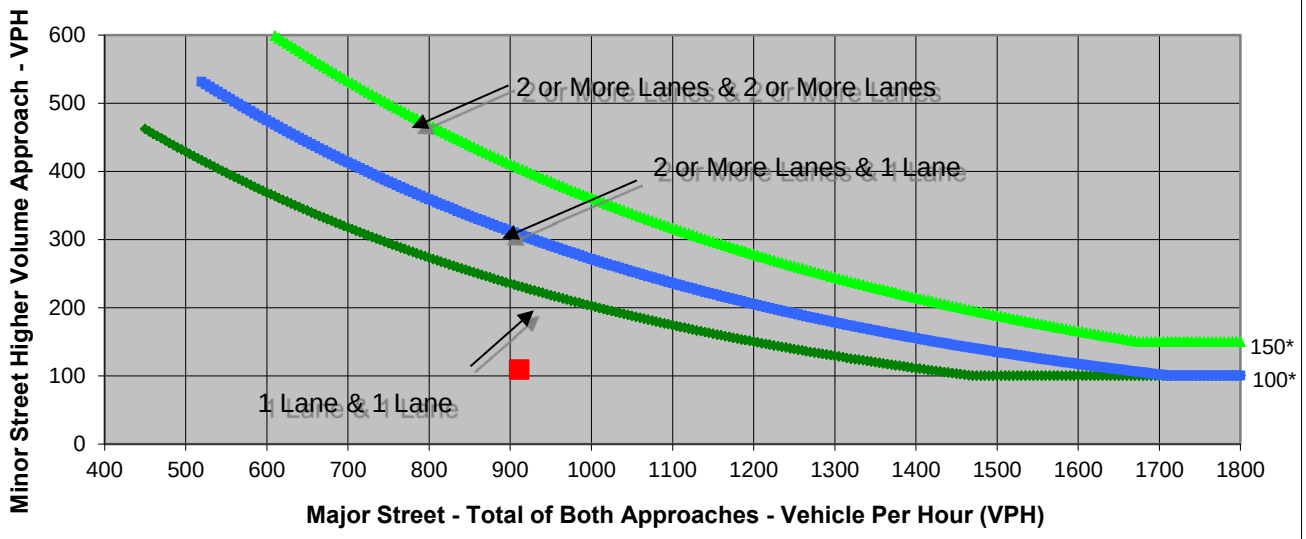
Turn Movement Volumes

	NB	SB	EB	WB
Left	8	0	109	0
Through	900	0	0	2
Right	3	0	0	7
Total	911	0	109	9

Major Street Direction

x North/South
East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	Mandela Parkway Northbound	20th Street	
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**911**	**109**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project Gateway Park Connection

Major Street W. Grand Ave
Minor Street Campbell St.

Scenario Cumulative Conditions
Peak Hour SAT

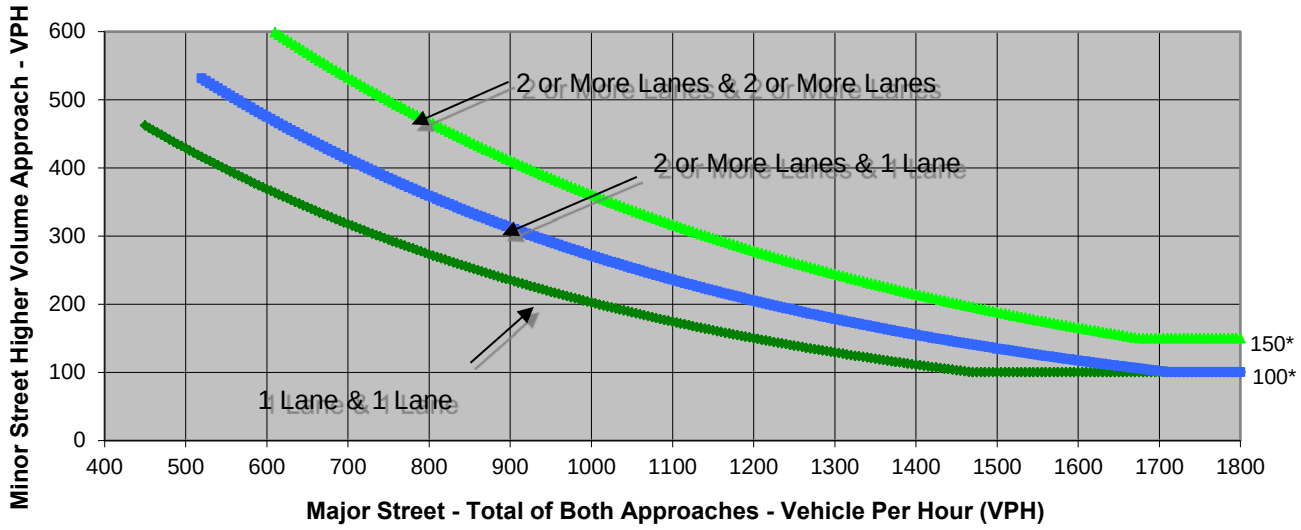
Turn Movement Volumes

	NB	SB	EB	WB
Left	72	5	55	30
Through	7	17	606	1,048
Right	39	151	55	8
Total	118	173	716	1,086

Major Street Direction

	North/South
x	East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	W. Grand Ave	Campbell St.	
Number of Approach Lanes	**2**	**1**	**YES**
Traffic Volume (VPH) *	**1,802**	**173**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project Gateway Park Connection

Major Street Mandela Parkway Southbound
Minor Street 24th Street

Scenario Cumulative Conditions
Peak Hour SAT

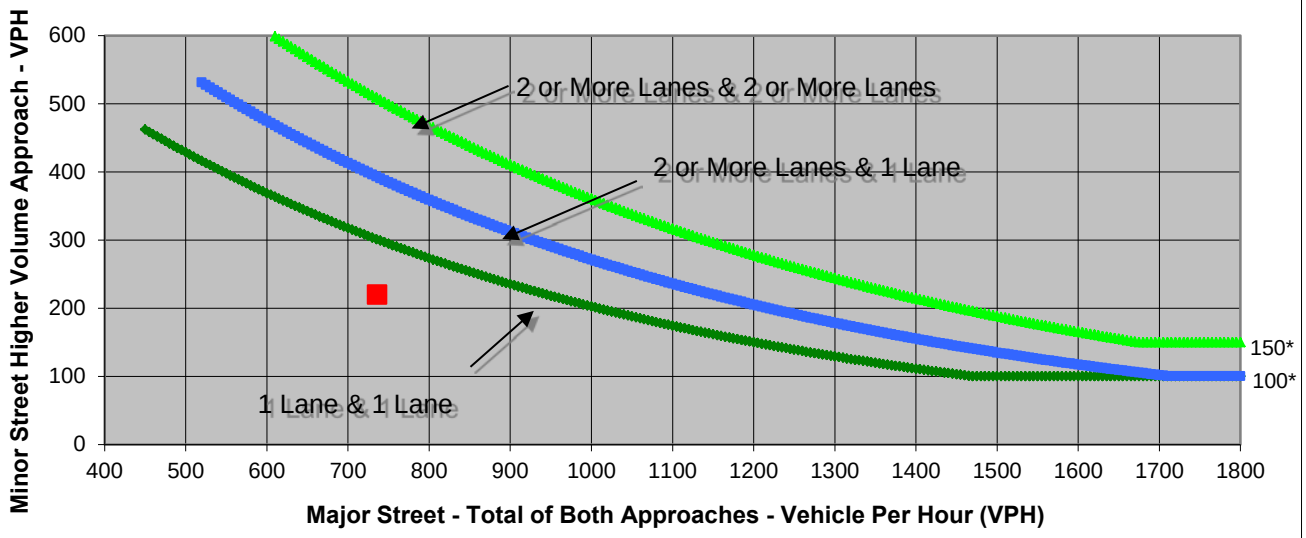
Turn Movement Volumes

	NB	SB	EB	WB
Left	0	0	220	0
Through	0	736	0	0
Right	0	0	0	0
Total	0	736	220	0

Major Street Direction

x North/South
East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	Mandela Parkway Southbound	24th Street	
Number of Approach Lanes	**2**	**2**	**NO**
Traffic Volume (VPH) *	**736**	**220**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project Gateway Park Connection
Scenario Cumulative Conditions
Peak Hour SAT

Major Street Mandela Parkway Southbound
Minor Street 20th Street

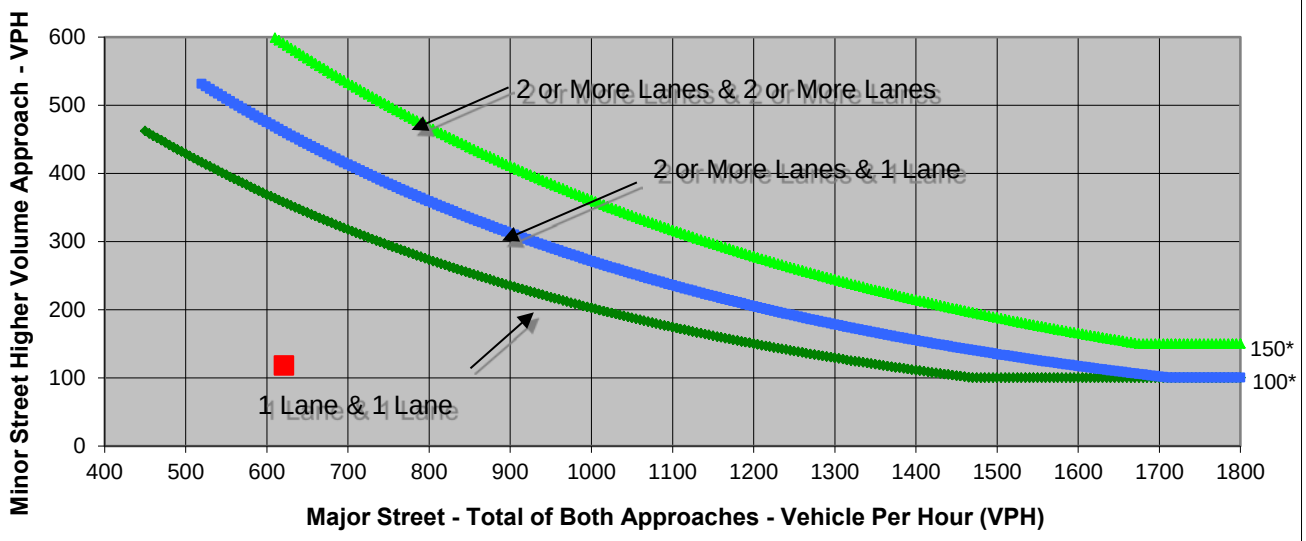
Turn Movement Volumes

	NB	SB	EB	WB
Left	0	42	92	0
Through	0	562	2	99
Right	0	17	24	0
Total	0	621	118	99

Major Street Direction

x North/South
East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	Mandela Parkway Southbound	20th Street	
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**621**	**118**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project Gateway Park Connection
Scenario Cumulative Conditions
Peak Hour SAT

Major Street Mandela Parkway
Minor Street 24th Street

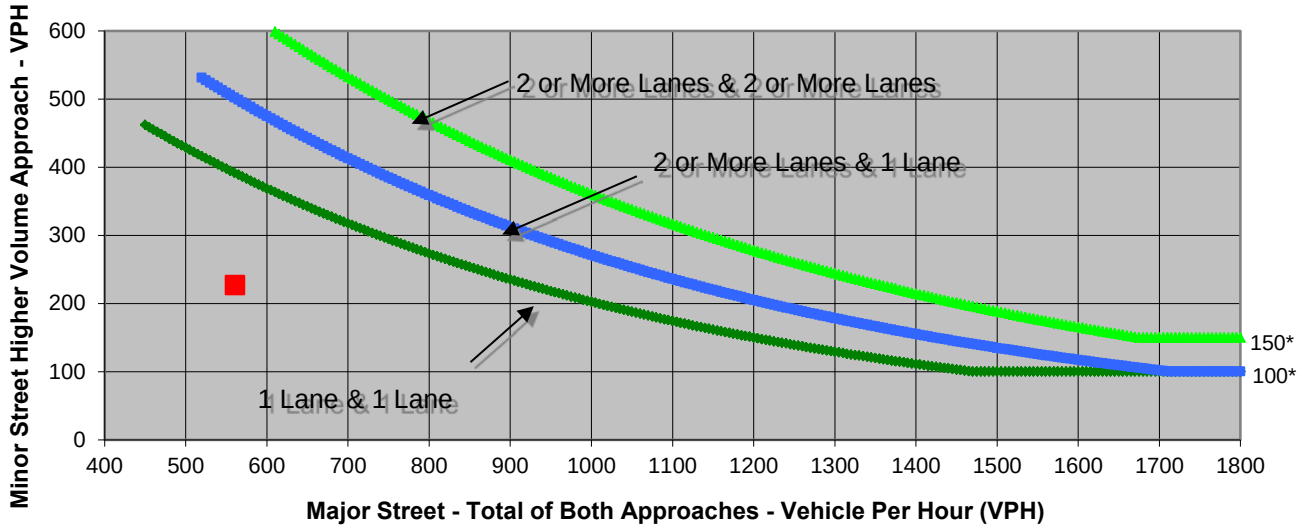
Turn Movement Volumes

	NB	SB	EB	WB
Left	5	0	0	0
Through	556	0	0	215
Right	0	0	0	12
Total	561	0	0	227

Major Street Direction

x North/South
East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street Mandela Parkway	Minor Street 24th Street	Warrant Met
Number of Approach Lanes	**2**	**2**	**NO**
Traffic Volume (VPH) *	**561**	**227**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project Gateway Park Connection
Scenario Cumulative Conditions
Peak Hour SAT

Major Street Mandela Parkway Northbound
Minor Street 20th Street

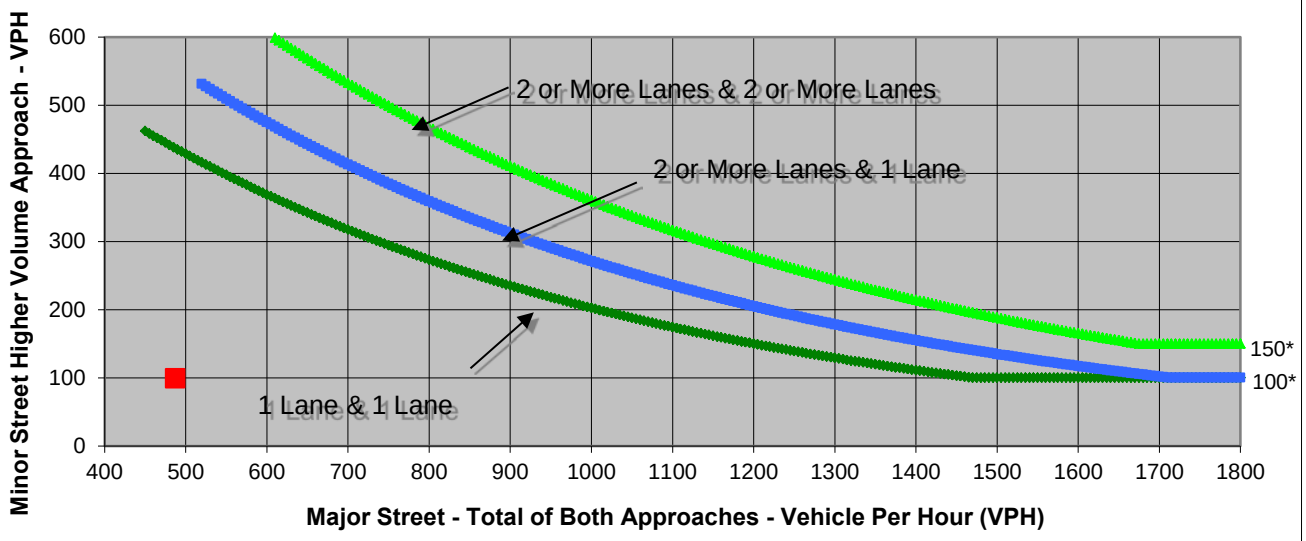
Turn Movement Volumes

	NB	SB	EB	WB
Left	5	0	0	0
Through	447	0	99	2
Right	35	0	0	0
Total	487	0	99	2

Major Street Direction

x North/South
East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	Mandela Parkway Northbound	20th Street	
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**487**	**99**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project: Gateway Park Connection

Major Street: W. Grand Ave
Minor Street: Campbell St.

Scenario: Cumulative with Park Conditions
Peak Hour: PM

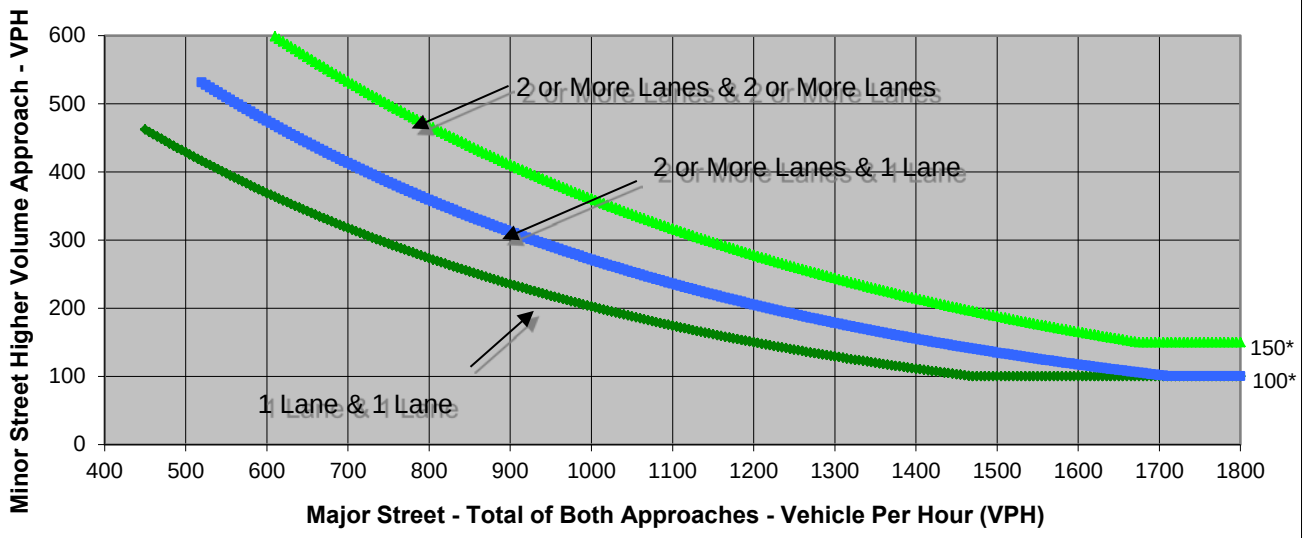
Turn Movement Volumes

	NB	SB	EB	WB
Left	54	3	128	30
Through	0	7	1,048	1,136
Right	22	232	67	17
Total	76	242	1,243	1,183

Major Street Direction

	North/South
x	East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	W. Grand Ave	Campbell St.	
Number of Approach Lanes	**2**	**1**	**YES**
Traffic Volume (VPH) *	**2,426**	**242**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project Gateway Park Connection

Major Street Mandela Parkway Southbound
Minor Street 24th Street

Scenario Cumulative with Park Conditions
Peak Hour PM

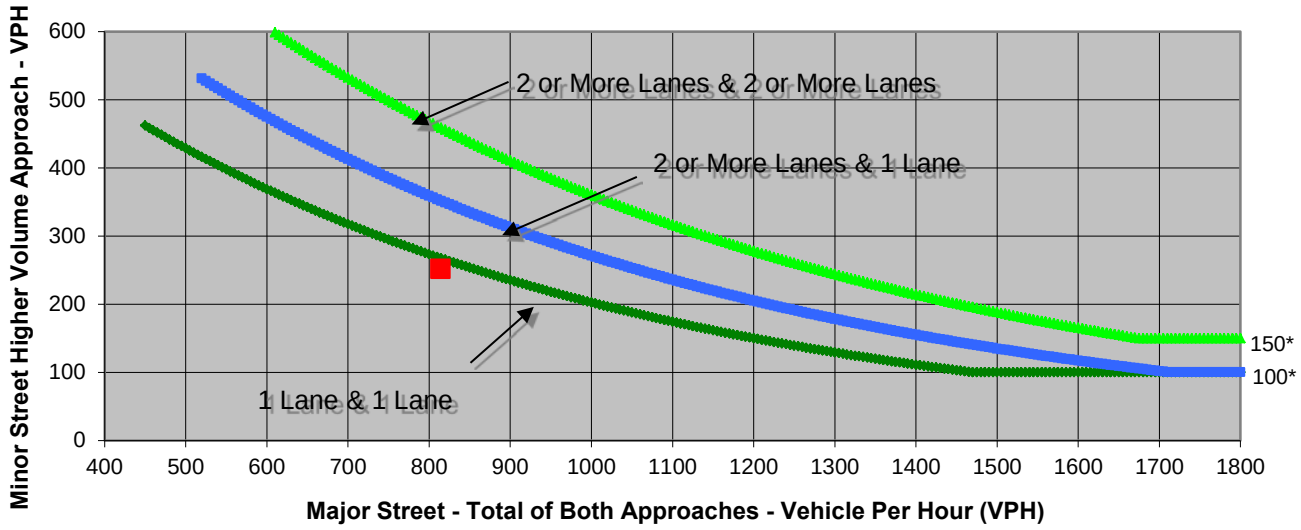
Turn Movement Volumes

	NB	SB	EB	WB
Left	0	0	252	0
Through	0	814	0	0
Right	0	0	0	0
Total	0	814	252	0

Major Street Direction

x North/South
East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	Mandela Parkway Southbound	24th Street	
Number of Approach Lanes	**2**	**2**	**NO**
Traffic Volume (VPH) *	**814**	**252**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project Gateway Park Connection
Scenario Cumulative with Park Conditions
Peak Hour PM

Major Street Mandela Parkway Southbound
Minor Street 20th Street

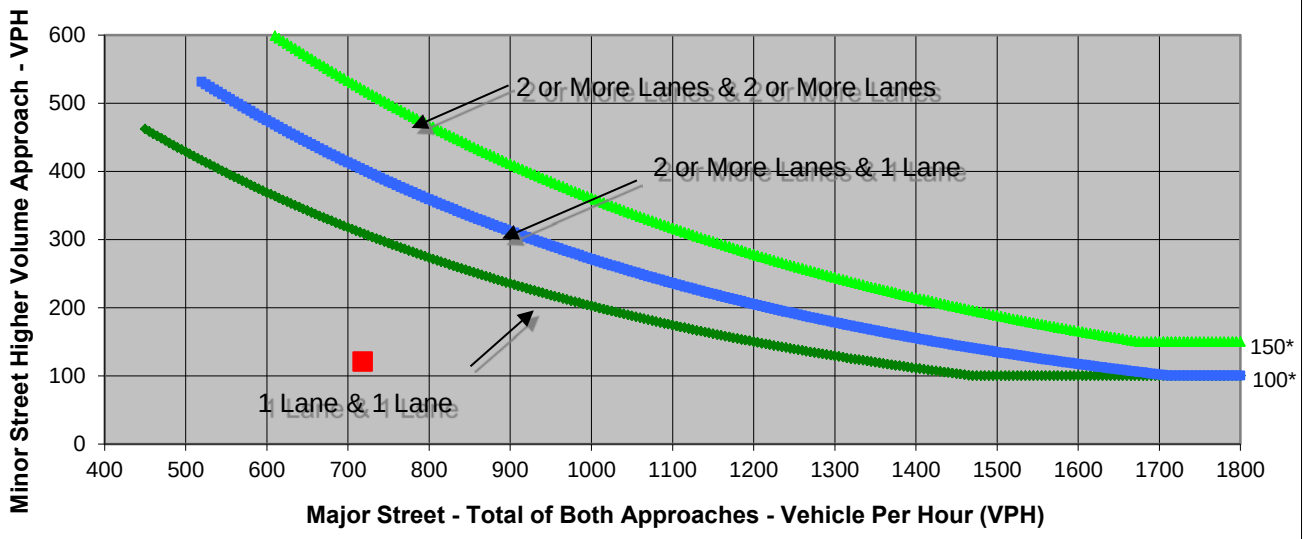
Turn Movement Volumes

	NB	SB	EB	WB
Left	0	10	0	7
Through	0	705	109	2
Right	0	3	12	0
Total	0	718	121	9

Major Street Direction

x North/South
East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	Mandela Parkway Southbound	20th Street	
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**718**	**121**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project Gateway Park Connection
Scenario Cumulative with Park Conditions
Peak Hour PM

Major Street Mandela Parkway
Minor Street 24th Street

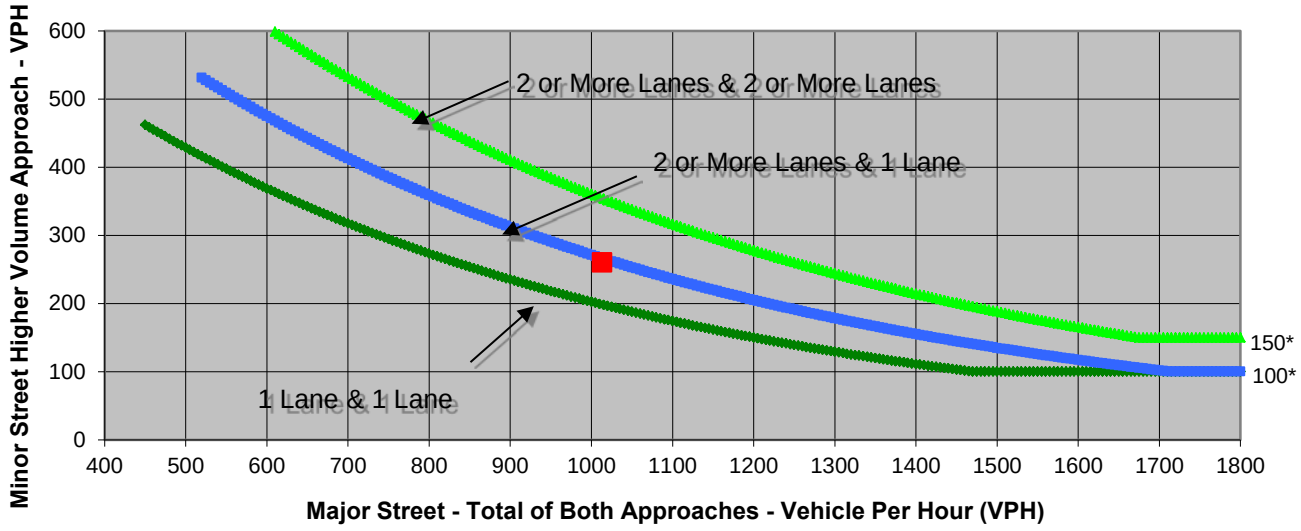
Turn Movement Volumes

	NB	SB	EB	WB
Left	7	0	0	0
Through	1,006	0	0	245
Right	0	0	0	15
Total	1,013	0	0	260

Major Street Direction

x North/South
East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	Mandela Parkway	24th Street	
Number of Approach Lanes	**2**	**2**	**NO**
Traffic Volume (VPH) *	**1,013**	**260**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project Gateway Park Connection
Scenario Cumulative Conditions
Peak Hour PM

Major Street Mandela Parkway Northbound
Minor Street 20th Street

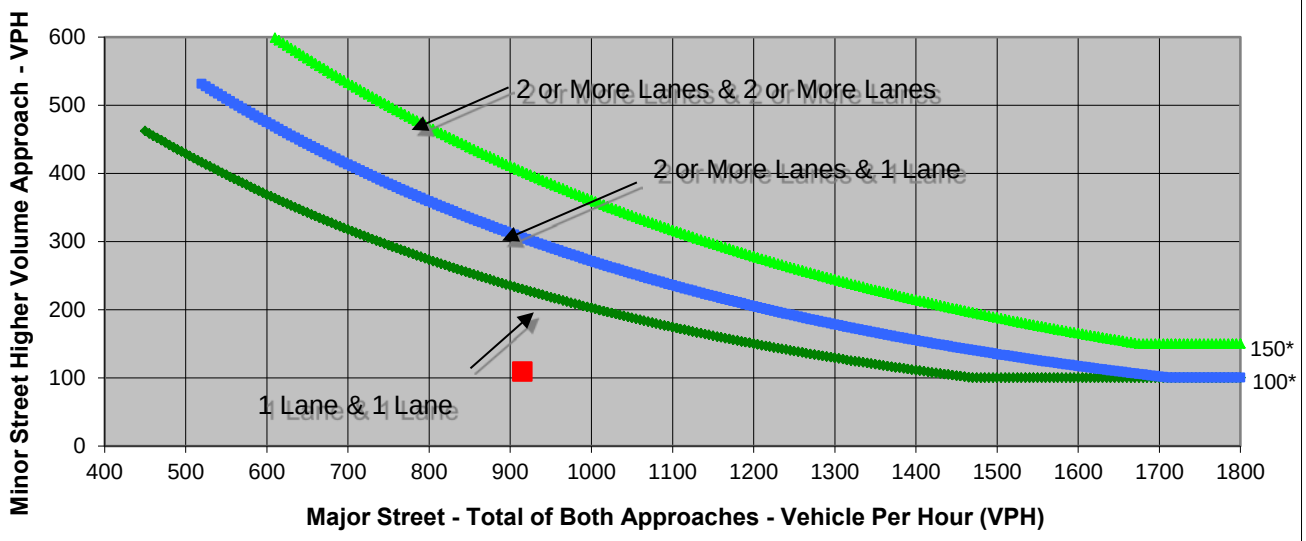
Turn Movement Volumes

	NB	SB	EB	WB
Left	8	0	109	0
Through	904	0	0	2
Right	3	0	0	7
Total	915	0	109	9

Major Street Direction

x North/South
East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	Mandela Parkway Northbound	20th Street	
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**915**	**109**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project: Gateway Park Connection

Major Street: W. Grand Ave
Minor Street: Campbell St.

Scenario: Cumulative with Park Conditions
Peak Hour: SAT

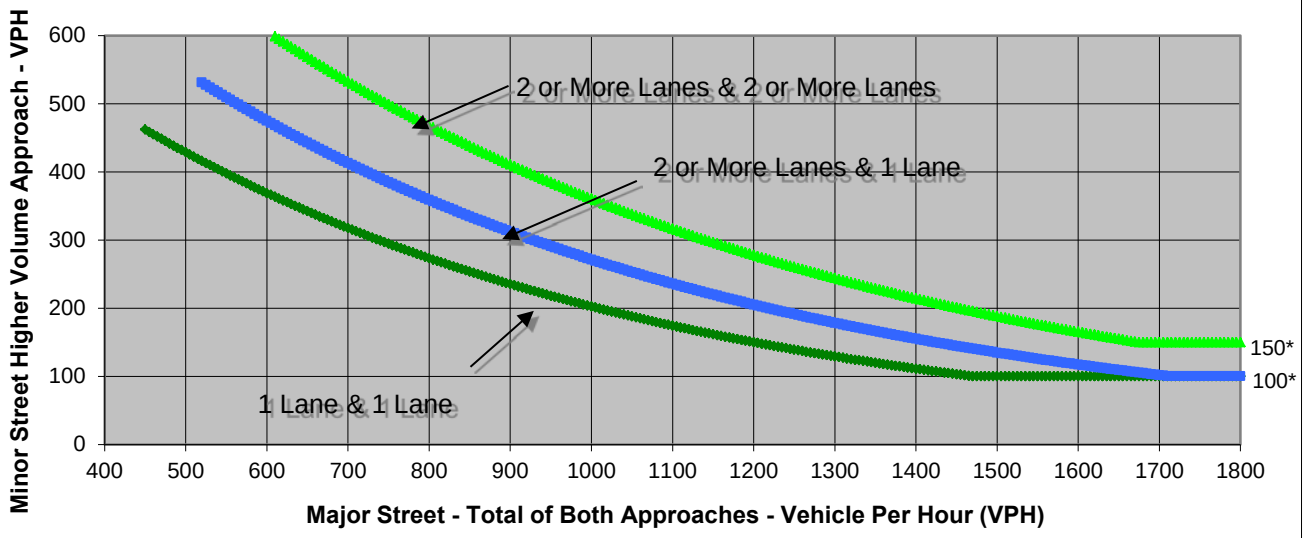
Turn Movement Volumes

	NB	SB	EB	WB
Left	72	5	55	30
Through	7	17	710	1,151
Right	39	151	55	8
Total	118	173	820	1,189

Major Street Direction

	North/South
x	East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	W. Grand Ave	Campbell St.	
Number of Approach Lanes	**2**	**1**	**YES**
Traffic Volume (VPH) *	**2,009**	**173**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project: Gateway Park Connection

Major Street: Mandela Parkway Southbound
Minor Street: 24th Street

Scenario: Cumulative with Park Conditions
Peak Hour: SAT

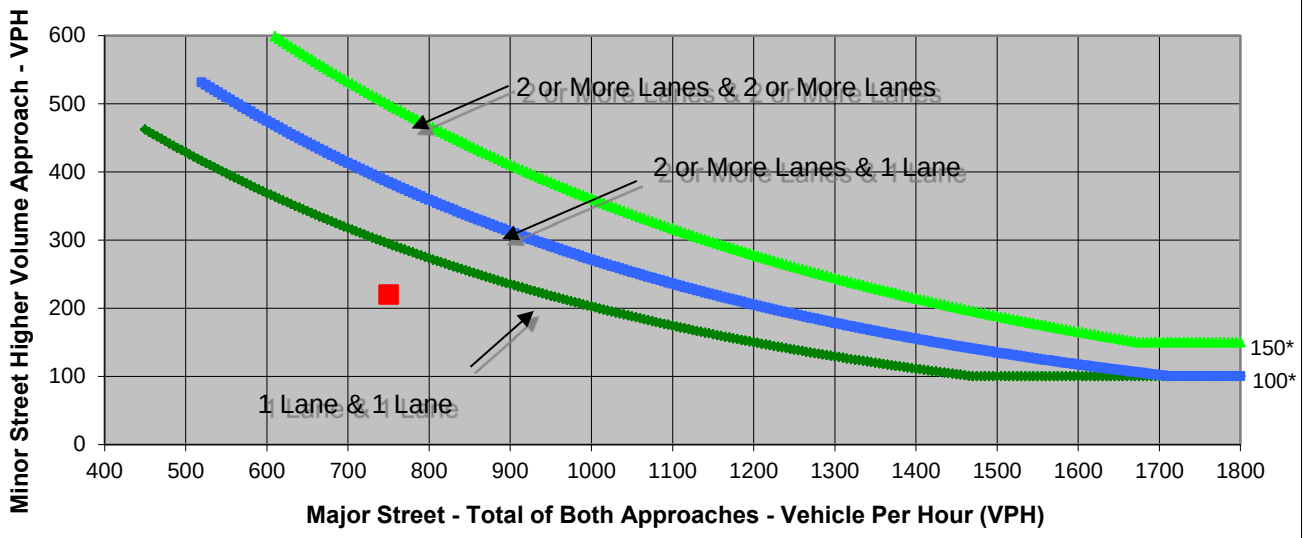
Turn Movement Volumes

	NB	SB	EB	WB
Left	0	0	220	0
Through	0	750	0	0
Right	0	0	0	0
Total	0	750	220	0

Major Street Direction

x North/South
East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	Mandela Parkway Southbound	24th Street	
Number of Approach Lanes	**2**	**2**	**NO**
Traffic Volume (VPH) *	**750**	**220**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project Gateway Park Connection
Scenario Cumulative with Park Conditions
Peak Hour SAT

Major Street Mandela Parkway Southbound
Minor Street 20th Street

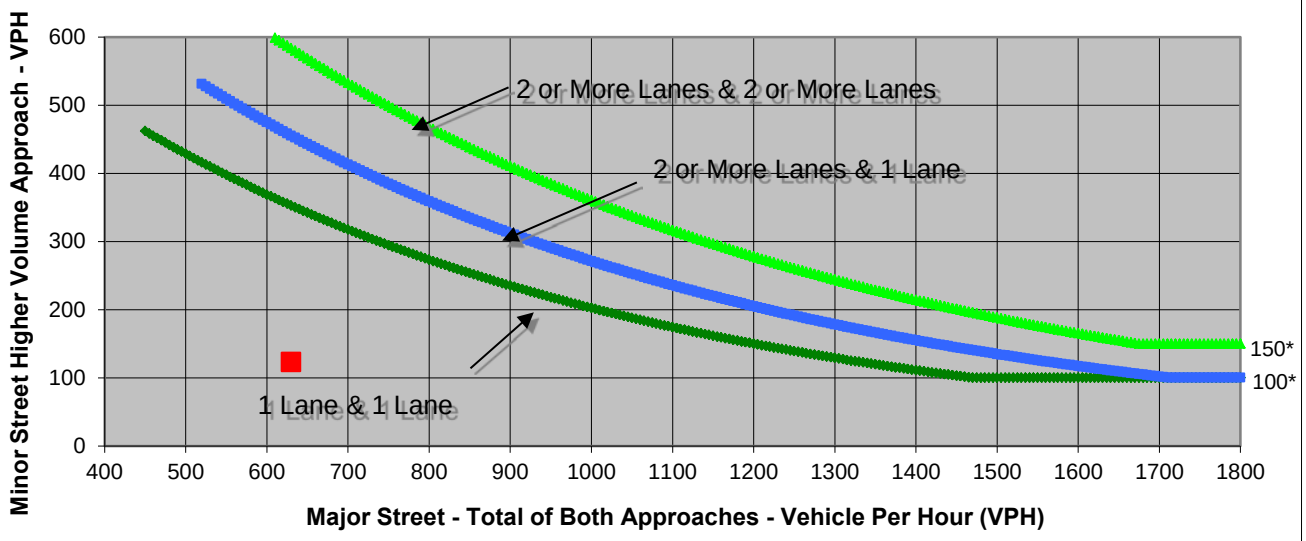
Turn Movement Volumes

	NB	SB	EB	WB
Left	0	42	97	8
Through	0	571	2	0
Right	0	17	24	15
Total	0	630	123	23

Major Street Direction

x North/South
East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	Mandela Parkway Southbound	20th Street	
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**630**	**123**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project Gateway Park Connection
Scenario Cumulative with Park Conditions
Peak Hour SAT

Major Street Mandela Parkway
Minor Street 24th Street

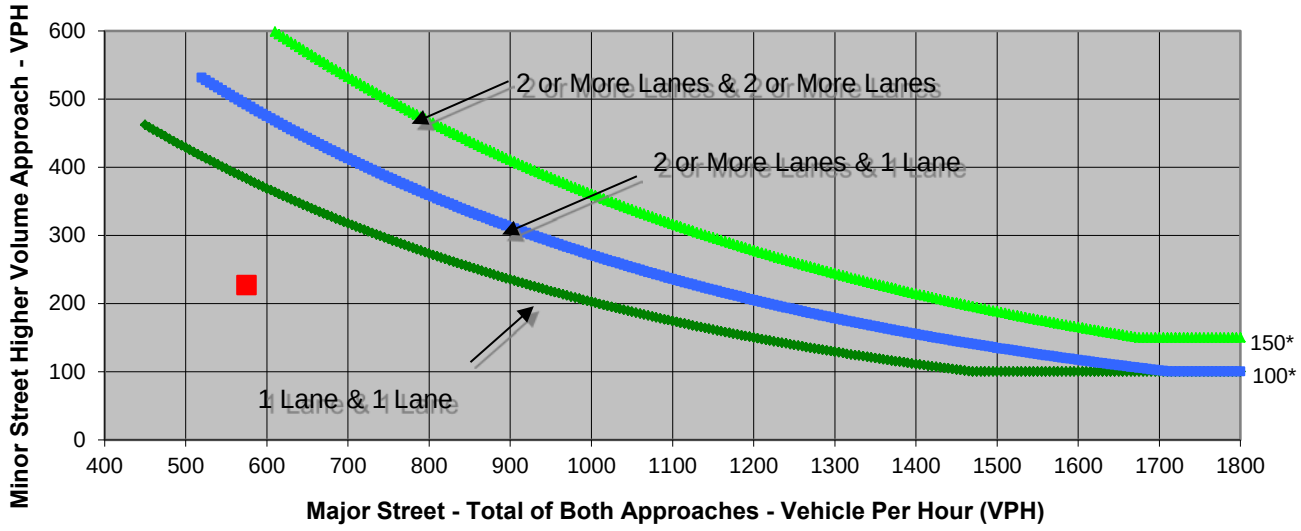
Turn Movement Volumes

	NB	SB	EB	WB
Left	5	0	0	0
Through	570	0	0	215
Right	0	0	0	12
Total	575	0	0	227

Major Street Direction

x North/South
East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	Mandela Parkway	24th Street	
Number of Approach Lanes	**2**	**2**	**NO**
Traffic Volume (VPH) *	**575**	**227**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project Gateway Park Connection
Scenario Cumulative Conditions
Peak Hour SAT

Major Street Mandela Parkway Northbound
Minor Street 20th Street

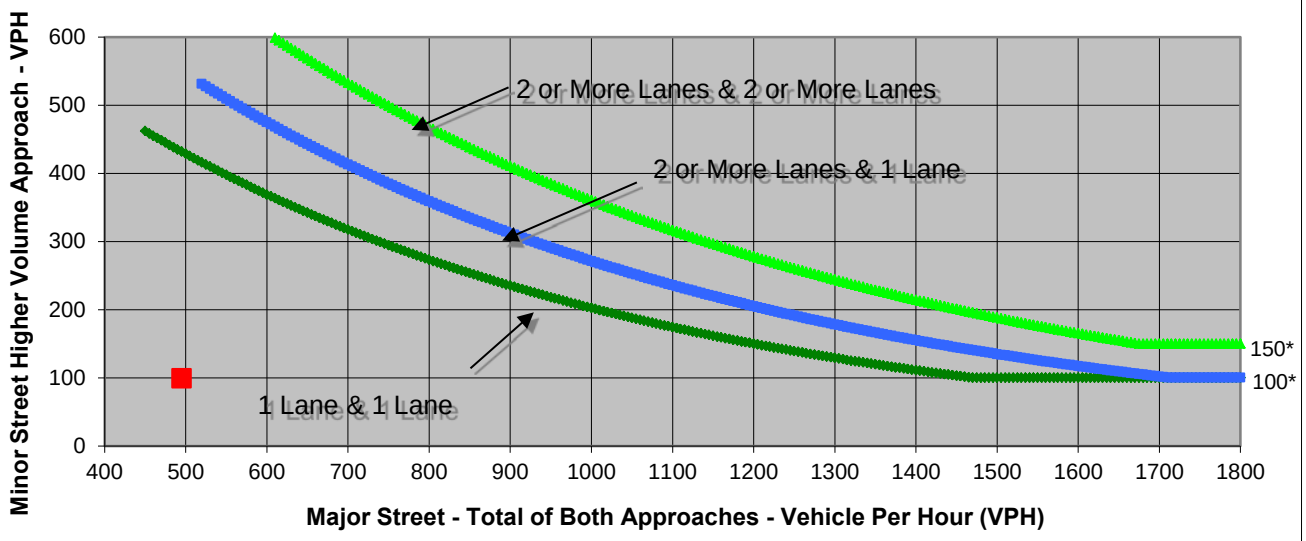
Turn Movement Volumes

	NB	SB	EB	WB
Left	5	0	99	0
Through	455	0	0	2
Right	35	0	0	0
Total	495	0	99	2

Major Street Direction

x North/South
East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	Mandela Parkway Northbound	20th Street	
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**495**	**99**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project: Gateway Park Connection

Major Street: W. Grand Ave
Minor Street: Campbell St.

Scenario: Cumulative with Connection Conditions
Peak Hour: PM

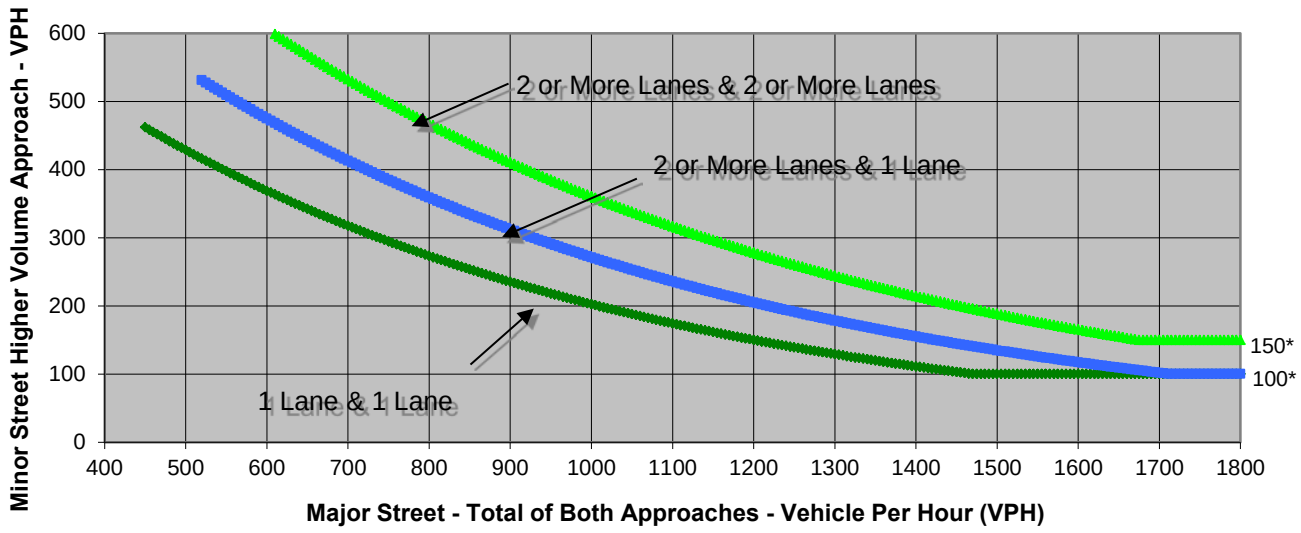
Turn Movement Volumes

	NB	SB	EB	WB
Left	0	3	135	0
Through	0	0	1,075	1,108
Right	0	265	0	43
Total	0	268	1,210	1,151

Major Street Direction

	North/South
x	East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street W. Grand Ave	Minor Street Campbell St.	Warrant Met
Number of Approach Lanes	**2**	**1**	**YES**
Traffic Volume (VPH) *	**2,361**	**268**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No	1	of	1
Project	Gateway Park Connection		
Scenario	Cumulative with Connection Conditions		
Peak Hour	PM		

Major Street	Mandela Parkway Southbound
Minor Street	24th Street

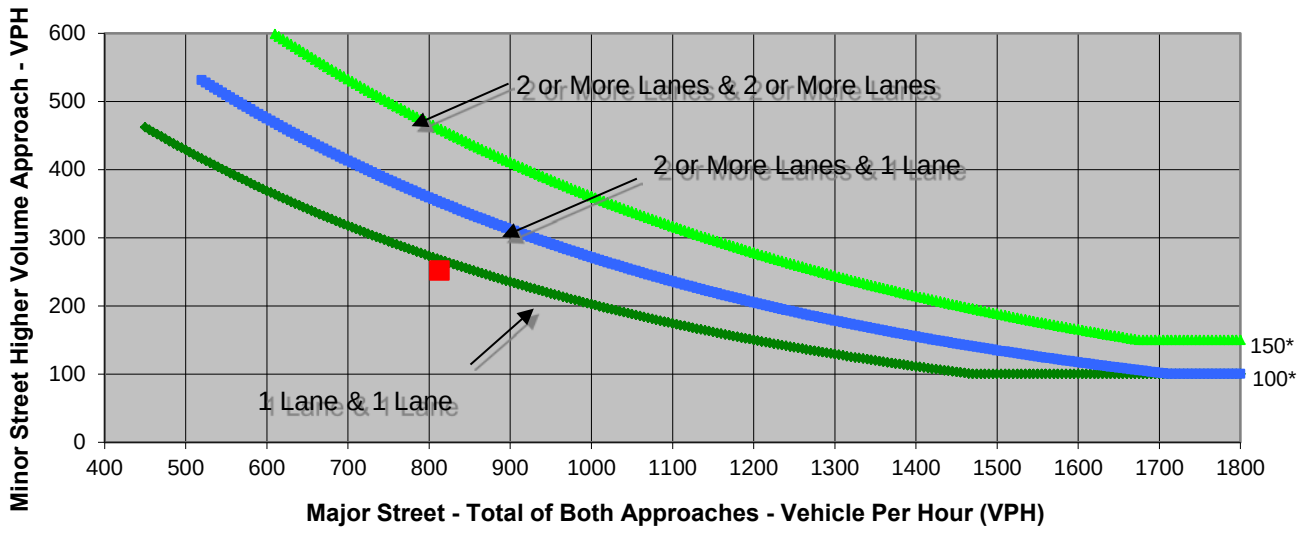
Turn Movement Volumes

	NB	SB	EB	WB
Left	0	0	252	0
Through	0	813	0	0
Right	0	0	0	0
Total	0	813	252	0

Major Street Direction

x	North/South
	East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	Mandela Parkway Southbound	24th Street	
Number of Approach Lanes	**2**	**2**	**NO**
Traffic Volume (VPH) *	**813**	**252**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No	1	of	1
Project	Gateway Park Connection		
Scenario	Cumulative with Connection Conditions		
Peak Hour	PM		
Major Street	Mandela Parkway Southbound		
Minor Street	20th Street		

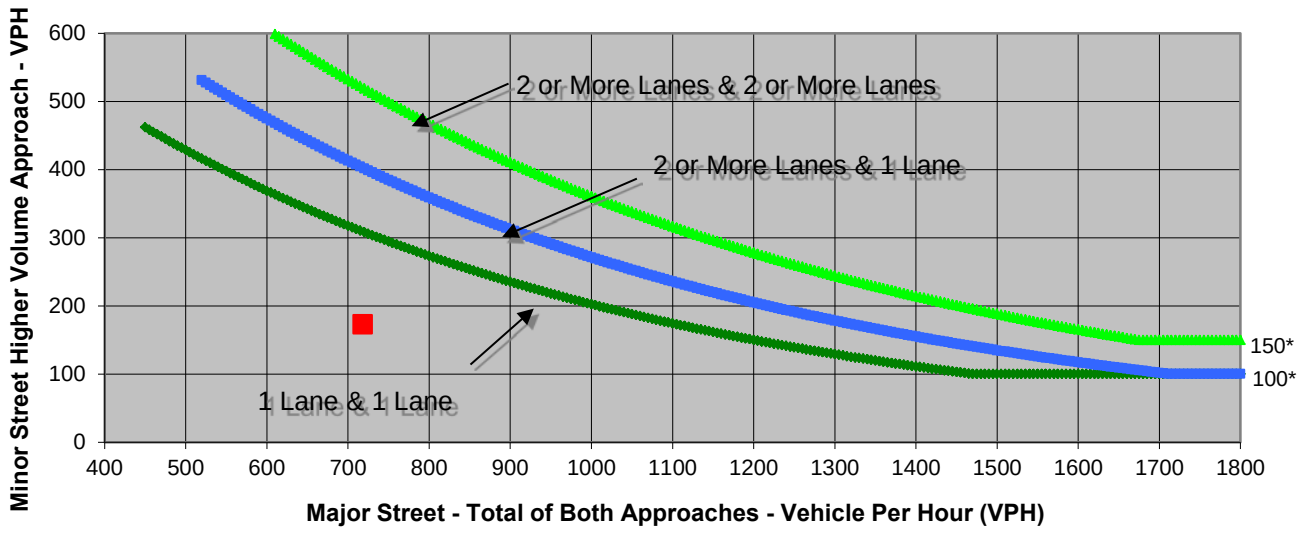
Turn Movement Volumes

	NB	SB	EB	WB
Left	0	10	0	7
Through	0	705	161	2
Right	0	3	12	0
Total	0	718	173	9

Major Street Direction

x	North/South
	East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	Mandela Parkway Southbound	20th Street	
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**718**	**173**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project: Gateway Park Connection

Major Street: Mandela Parkway
Minor Street: 24th Street

Scenario: Cumulative with Connection Conditions
Peak Hour: PM

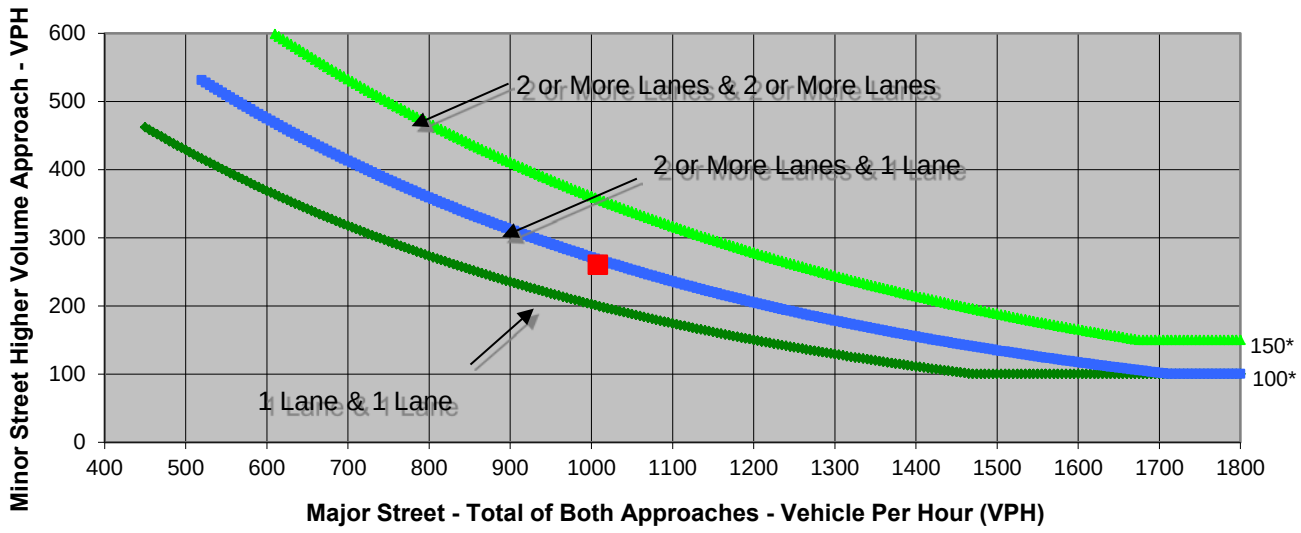
Turn Movement Volumes

	NB	SB	EB	WB
Left	7	0	0	0
Through	1,001	0	0	245
Right	0	0	0	15
Total	1,008	0	0	260

Major Street Direction

x	North/South
	East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street Mandela Parkway	Minor Street 24th Street	Warrant Met
Number of Approach Lanes	**2**	**2**	**NO**
Traffic Volume (VPH) *	**1,008**	**260**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project: Gateway Park Connection

Major Street: Mandela Parkway Northbound
Minor Street: 20th Street

Scenario: Cumulative with Connection Conditions
Peak Hour: PM

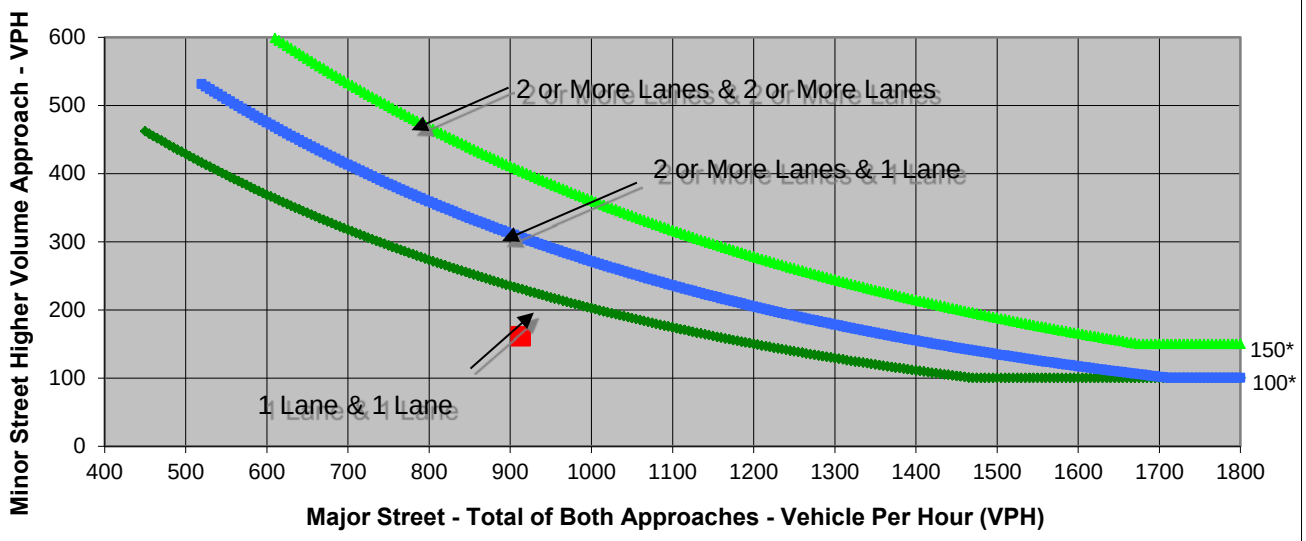
Turn Movement Volumes

	NB	SB	EB	WB
Left	8	0	161	0
Through	902	0	0	2
Right	3	0	0	7
Total	913	0	161	9

Major Street Direction

x North/South
East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street Mandela Parkway Northbound	Minor Street 20th Street	Warrant Met
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**913**	**161**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project: Gateway Park Connection

Major Street: W. Grand Ave
Minor Street: Campbell St.

Scenario: Cumulative with Connection Conditions
Peak Hour: SAT

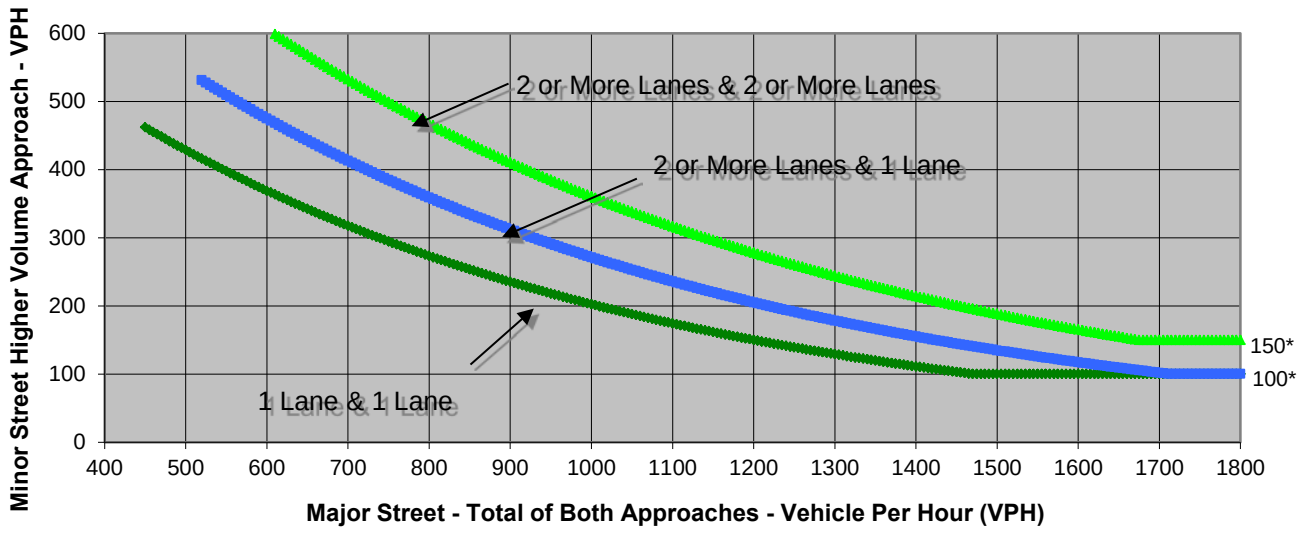
Turn Movement Volumes

	NB	SB	EB	WB
Left	0	5	77	0
Through	0	0	661	1,089
Right	0	205	0	57
Total	0	210	738	1,146

Major Street Direction

	North/South
x	East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street W. Grand Ave	Minor Street Campbell St.	Warrant Met
Number of Approach Lanes	**2**	**1**	**YES**
Traffic Volume (VPH) *	**1,884**	**210**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project: Gateway Park Connection

Major Street: Mandela Parkway Southbound
Minor Street: 24th Street

Scenario: Cumulative with Connection Conditions
Peak Hour: SAT

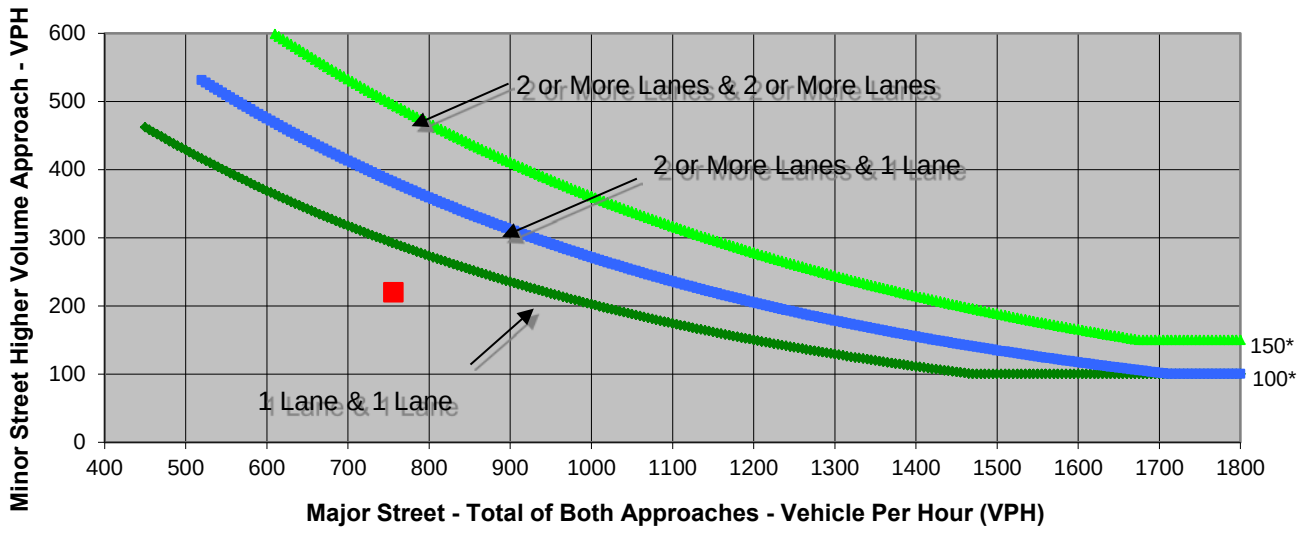
Turn Movement Volumes

	NB	SB	EB	WB
Left	0	0	220	0
Through	0	756	0	0
Right	0	0	0	0
Total	0	756	220	0

Major Street Direction

x North/South
East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street Mandela Parkway Southbound	Minor Street 24th Street	Warrant Met
Number of Approach Lanes	**2**	**2**	**NO**
Traffic Volume (VPH) *	**756**	**220**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project: Gateway Park Connection

Major Street: Mandela Parkway Southbound
Minor Street: 20th Street

Scenario: Cumulative with Connection Conditions
Peak Hour: SAT

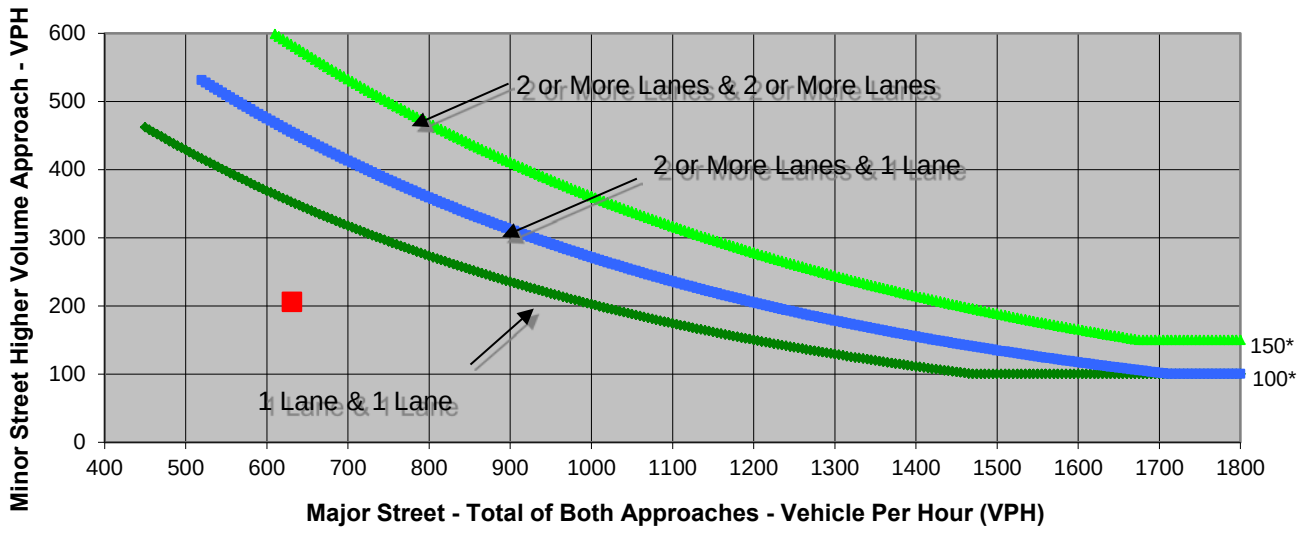
Turn Movement Volumes

	NB	SB	EB	WB
Left	0	17	0	8
Through	0	572	182	0
Right	0	42	24	0
Total	0	631	206	8

Major Street Direction

x North/South
East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street Mandela Parkway Southbound	Minor Street 20th Street	Warrant Met
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**631**	**206**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No	1	of	1
Project	Gateway Park Connection		
Scenario	Cumulative with Connection Conditions		
Peak Hour	SAT		

Major Street	Mandela Parkway
Minor Street	24th Street

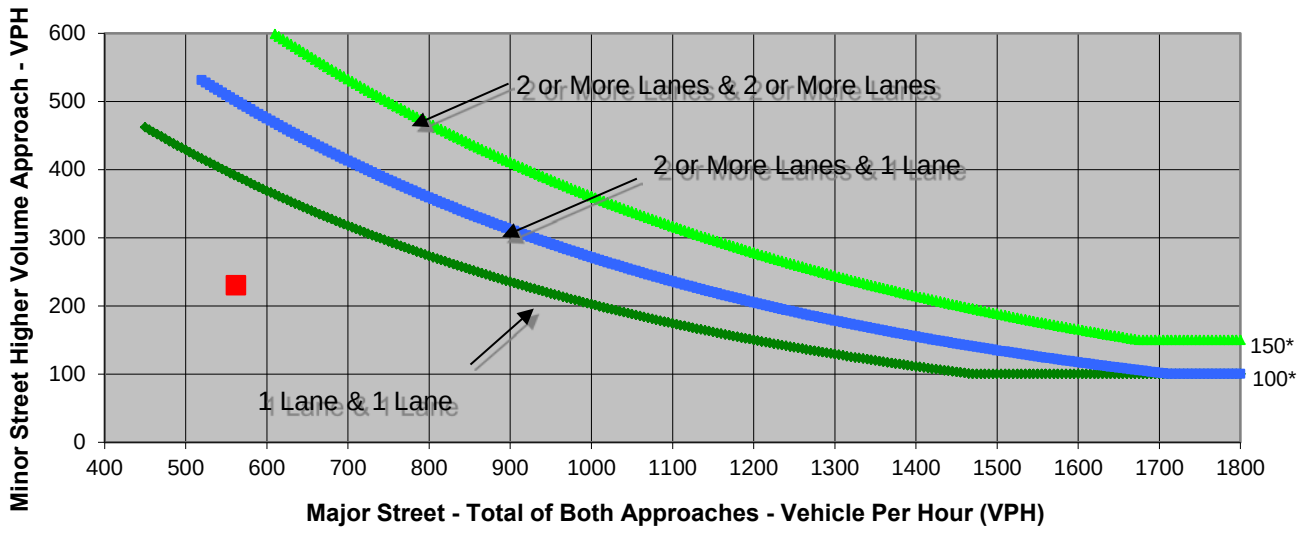
Turn Movement Volumes

	NB	SB	EB	WB
Left	5	0	0	0
Through	557	0	0	215
Right	0	0	0	15
Total	562	0	0	230

Major Street Direction

x	North/South
	East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street Mandela Parkway	Minor Street 24th Street	Warrant Met
Number of Approach Lanes	**2**	**2**	**NO**
Traffic Volume (VPH) *	**562**	**230**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project: Gateway Park Connection

Major Street: Mandela Parkway Northbound
Minor Street: 20th Street

Scenario: Cumulative with Connection Conditions
Peak Hour: SAT

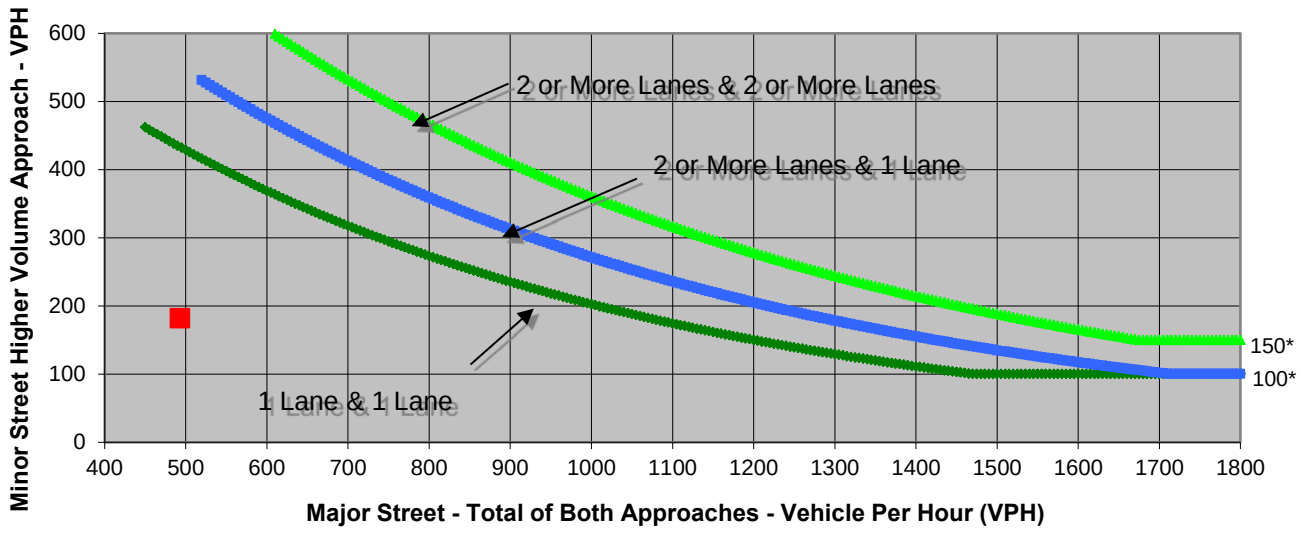
Turn Movement Volumes

	NB	SB	EB	WB
Left	5	0	182	0
Through	453	0	0	2
Right	35	0	0	0
Total	493	0	182	2

Major Street Direction

x North/South
East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street Mandela Parkway Northbound	Minor Street 20th Street	Warrant Met
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**493**	**182**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project: Gateway Park Connection

Major Street: W. Grand Ave
Minor Street: Campbell St.

Scenario: Cumulative with Connection & Park Conditions
Peak Hour: PM

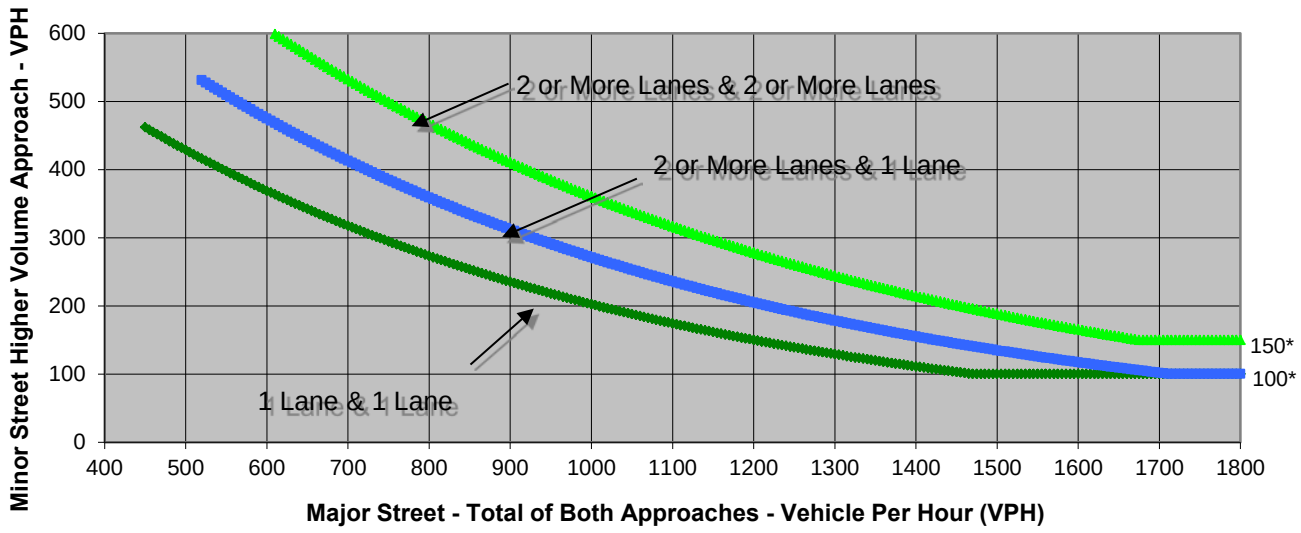
Turn Movement Volumes

	NB	SB	EB	WB
Left	0	3	135	0
Through	0	0	1,115	1,165
Right	0	265	0	43
Total	0	268	1,250	1,208

Major Street Direction

	North/South
x	East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street W. Grand Ave	Minor Street Campbell St.	Warrant Met
Number of Approach Lanes	**2**	**1**	**YES**
Traffic Volume (VPH) *	**2,458**	**268**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project: Gateway Park Connection

Major Street: Mandela Parkway Southbound
Minor Street: 24th Street

Scenario: Cumulative with Connection and Park Conditions
Peak Hour: PM

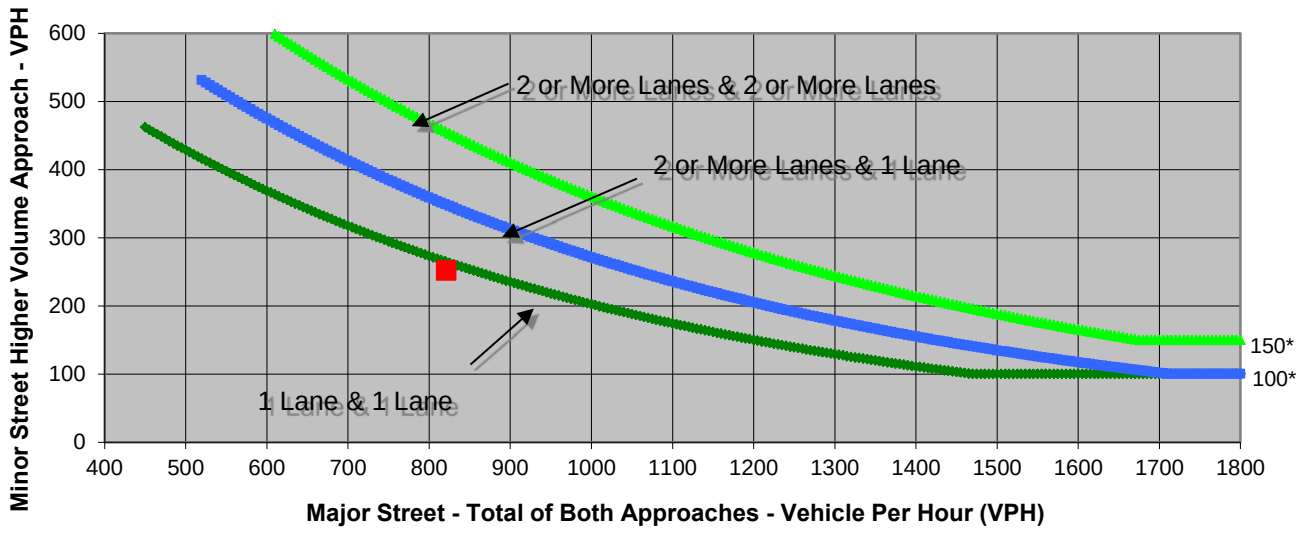
Turn Movement Volumes

	NB	SB	EB	WB
Left	0	0	252	0
Through	0	821	0	0
Right	0	0	0	0
Total	0	821	252	0

Major Street Direction

x North/South
East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	Mandela Parkway Southbound	24th Street	
Number of Approach Lanes	**2**	**2**	**NO**
Traffic Volume (VPH) *	**821**	**252**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No	1	of	1
Project	Gateway Park Connection		
Scenario	Cumulative with Connection and Park Conditions		
Peak Hour	PM		
Major Street	Mandela Parkway Southbound		
Minor Street	20th Street		

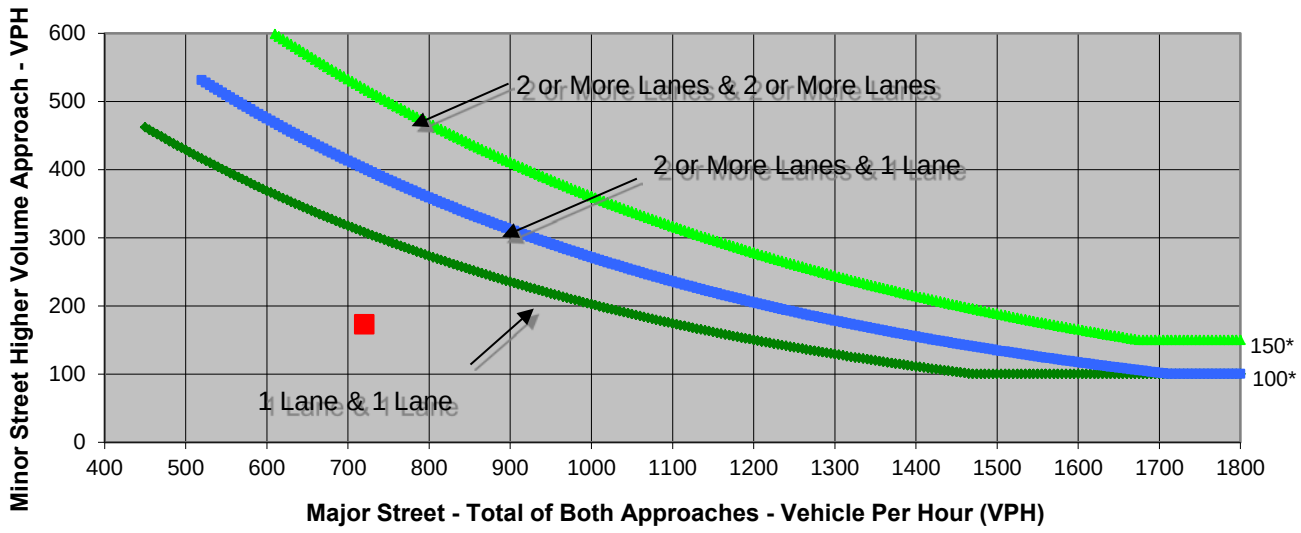
Turn Movement Volumes

	NB	SB	EB	WB
Left	0	10	0	7
Through	0	707	161	2
Right	0	3	12	0
Total	0	720	173	9

Major Street Direction

x	North/South
	East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	Mandela Parkway Southbound	20th Street	
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**720**	**173**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project: Gateway Park Connection

Major Street: Mandela Parkway
Minor Street: 24th Street

Scenario: Cumulative with Connection and Park Conditions
Peak Hour: PM

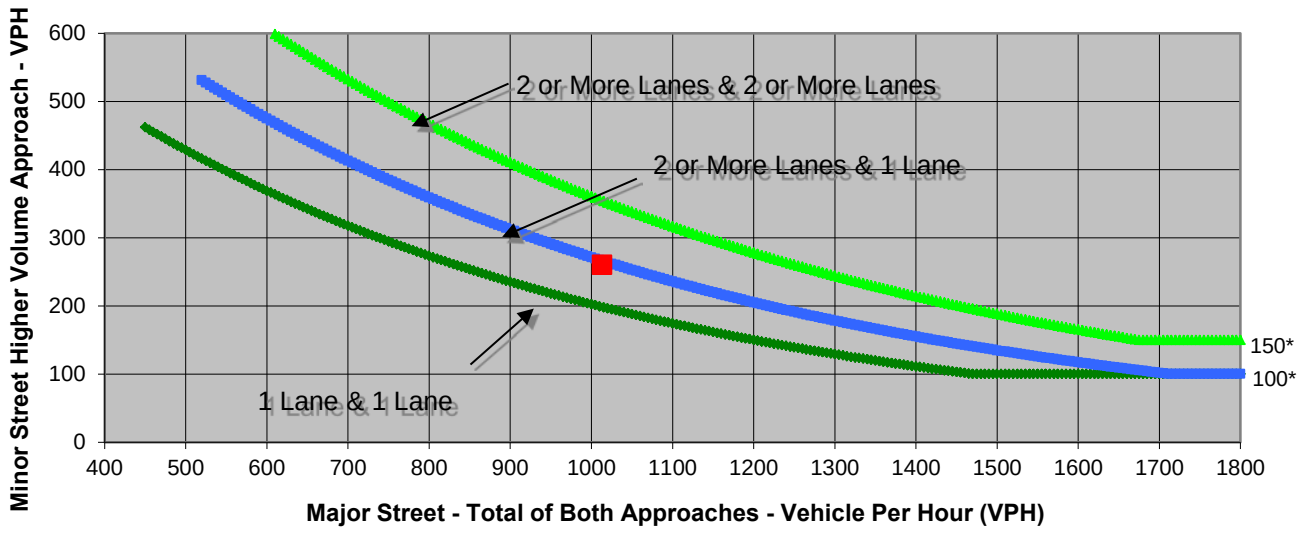
Turn Movement Volumes

	NB	SB	EB	WB
Left	7	0	0	0
Through	1,006	0	0	245
Right	0	0	0	15
Total	1,013	0	0	260

Major Street Direction

x	North/South
	East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street Mandela Parkway	Minor Street 24th Street	Warrant Met
Number of Approach Lanes	**2**	**2**	**NO**
Traffic Volume (VPH) *	**1,013**	**260**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No	1	of	1
Project	Gateway Park Connection		
Scenario	Cumulative with Connection and Park Conditions		
Peak Hour	PM		

Major Street	Mandela Parkway Northbound
Minor Street	20th Street

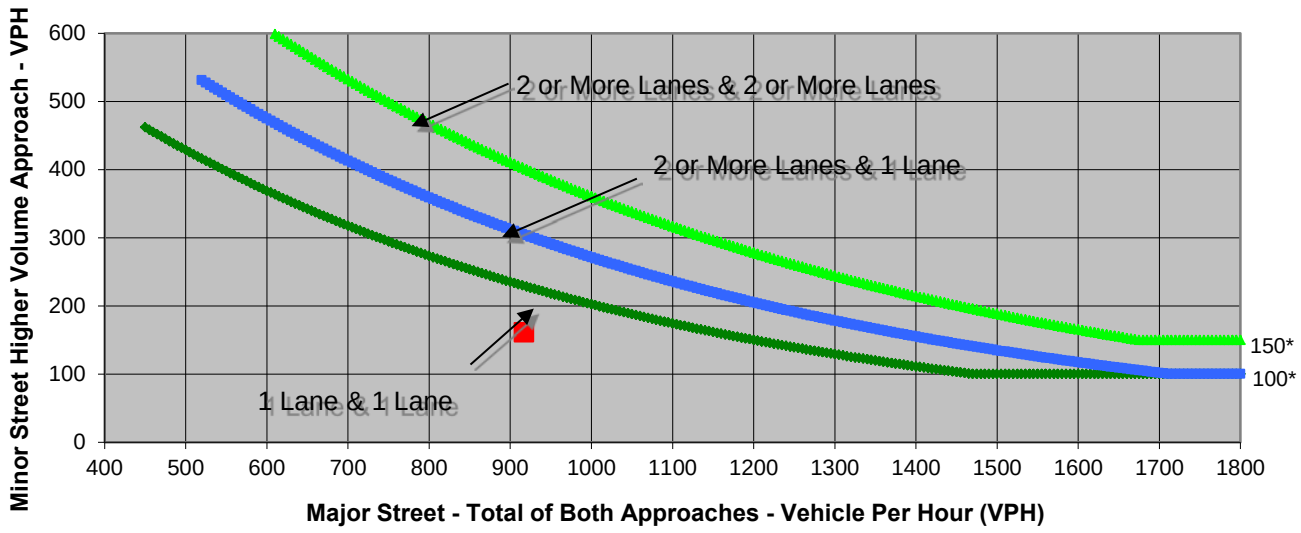
Turn Movement Volumes

	NB	SB	EB	WB
Left	8	0	161	0
Through	906	0	0	2
Right	3	0	0	7
Total	917	0	161	9

Major Street Direction

x	North/South
	East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	Mandela Parkway Northbound	20th Street	
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**917**	**161**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project: Gateway Park Connection

Major Street: W. Grand Ave
Minor Street: Campbell St.

Scenario: Cumulative with Connection & Park Conditions
Peak Hour: SAT

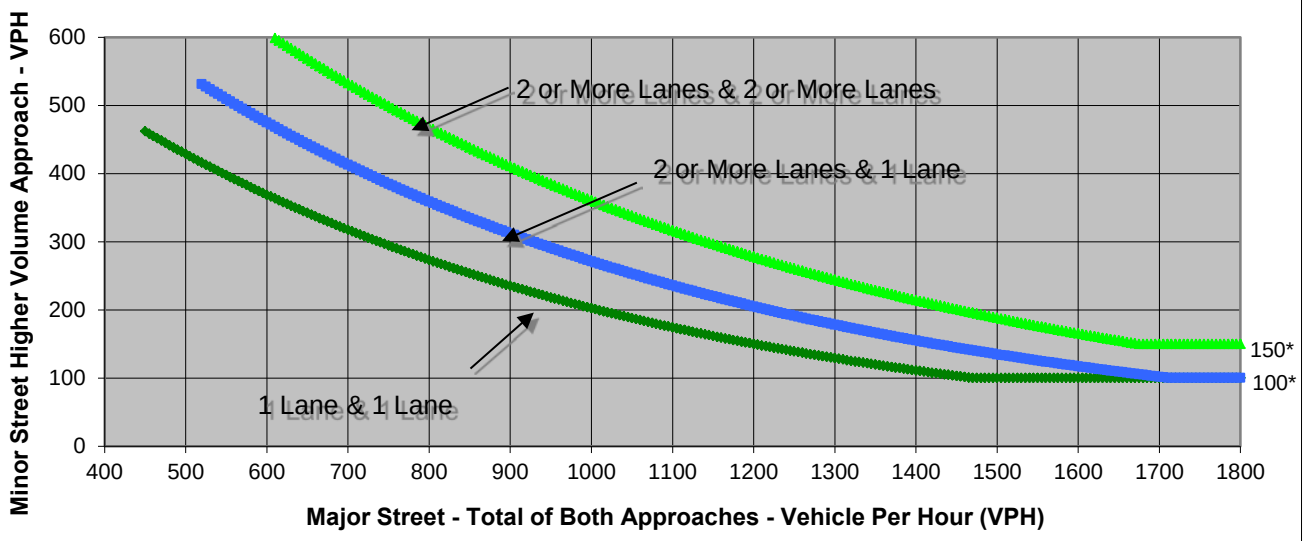
Turn Movement Volumes

	NB	SB	EB	WB
Left	0	5	77	0
Through	0	0	765	1,192
Right	0	205	0	57
Total	0	210	842	1,249

Major Street Direction

	North/South
x	East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street W. Grand Ave	Minor Street Campbell St.	Warrant Met
Number of Approach Lanes	**2**	**1**	**YES**
Traffic Volume (VPH) *	**2,091**	**210**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No	1	of	1
Project	Gateway Park Connection		
Scenario	Cumulative with Connection and Park Conditions		
Peak Hour	SAT		

Major Street	Mandela Parkway Southbound
Minor Street	24th Street

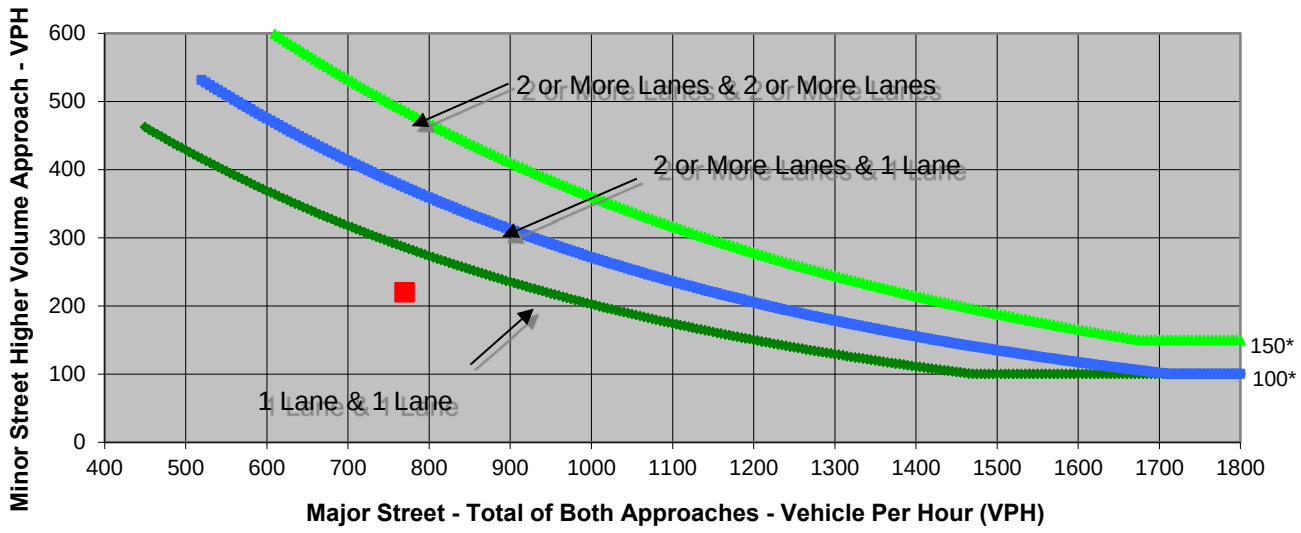
Turn Movement Volumes

	NB	SB	EB	WB
Left	0	0	220	0
Through	0	770	0	0
Right	0	0	0	0
Total	0	770	220	0

Major Street Direction

x	North/South
	East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	Mandela Parkway Southbound	24th Street	
Number of Approach Lanes	**2**	**2**	**NO**
Traffic Volume (VPH) *	**770**	**220**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project: Gateway Park Connection

Major Street: Mandela Parkway Southbound
Minor Street: 20th Street

Scenario: Cumulative with Connection and Park Conditions
Peak Hour: SAT

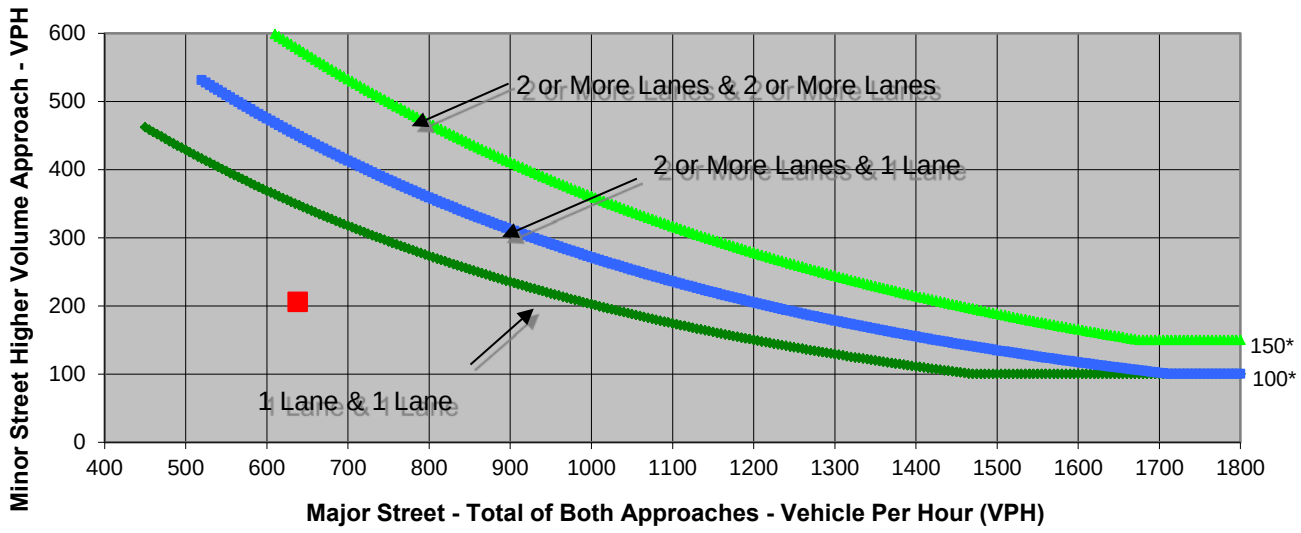
Turn Movement Volumes

	NB	SB	EB	WB
Left	0	42	0	8
Through	0	579	182	0
Right	0	17	24	0
Total	0	638	206	8

Major Street Direction

x	North/South
	East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	Mandela Parkway Southbound	20th Street	
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**638**	**206**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No 1 of 1

Project: Gateway Park Connection

Major Street: Mandela Parkway
Minor Street: 24th Street

Scenario: Cumulative with Connection and Park Conditions
Peak Hour: SAT

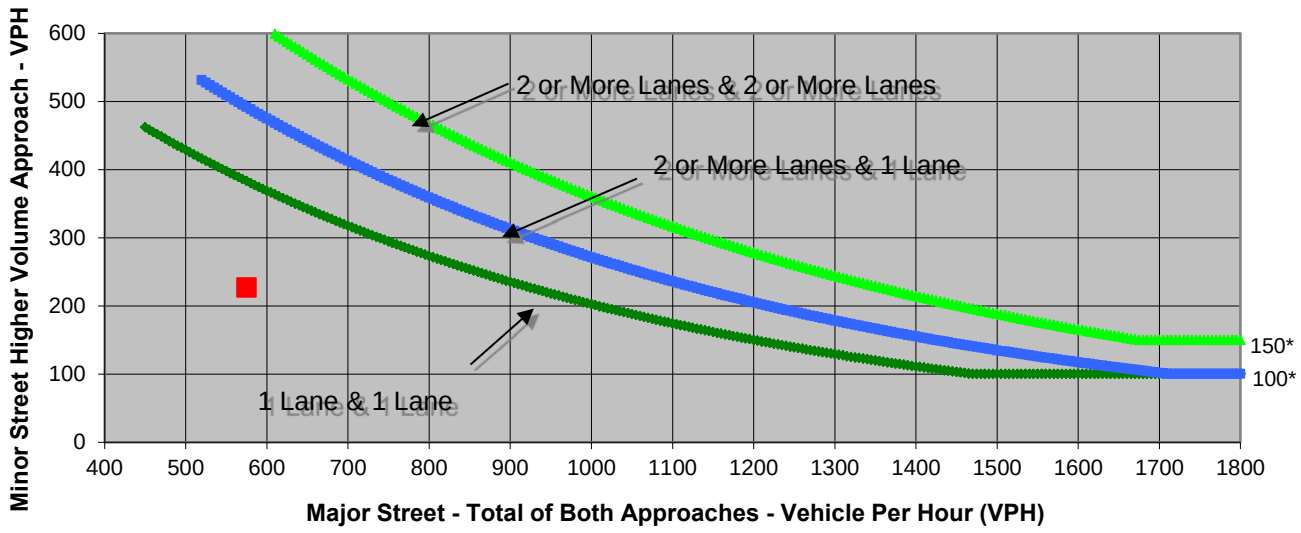
Turn Movement Volumes

	NB	SB	EB	WB
Left	5	0	0	0
Through	570	0	0	215
Right	0	0	0	12
Total	575	0	0	227

Major Street Direction

x	North/South
	East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street Mandela Parkway	Minor Street 24th Street	Warrant Met
Number of Approach Lanes	**2**	**2**	**NO**
Traffic Volume (VPH) *	**575**	**227**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

Sheet No	1	of	1
Project	Gateway Park Connection		
Scenario	Cumulative with Connection and Park Conditions		
Peak Hour	SAT		

Major Street	Mandela Parkway Northbound
Minor Street	20th Street

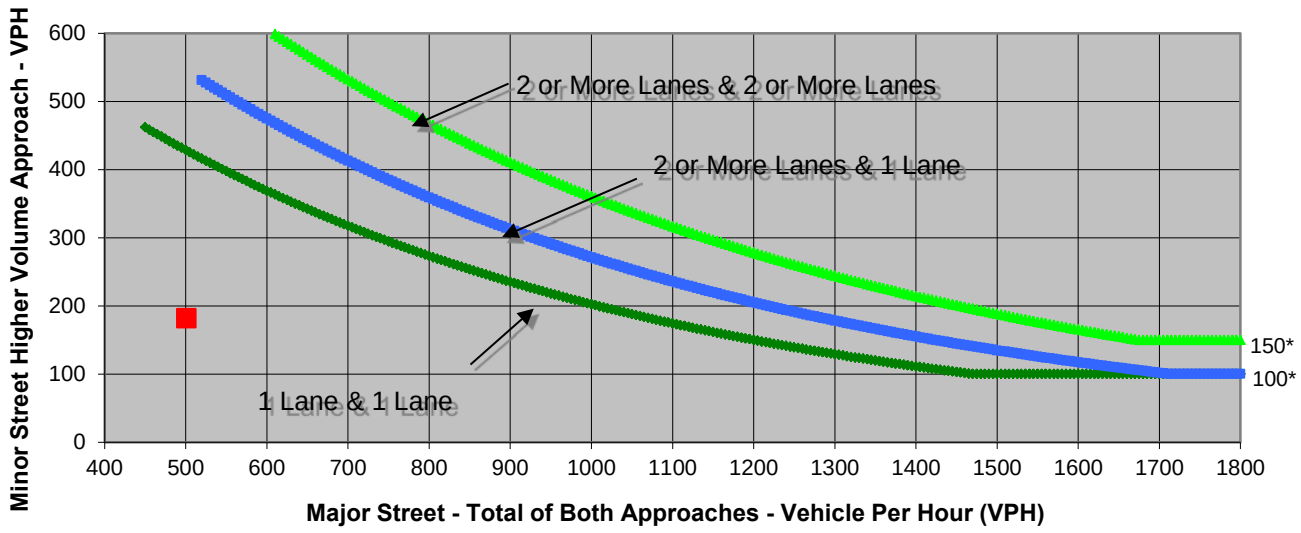
Turn Movement Volumes

	NB	SB	EB	WB
Left	5	0	182	0
Through	461	0	0	2
Right	35	0	0	0
Total	501	0	182	2

Major Street Direction

x	North/South
	East/West

Figure 4C-3. Warrant 3, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2012

	Major Street	Minor Street	Warrant Met
	Mandela Parkway Northbound	20th Street	
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**501**	**182**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approaches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

APPENDIX D: BICYCLE AND PEDESTRIAN FORECASTING METHOD

MEMORANDUM

Date: November 28, 2011

To: Blake Clark, PE and Francis Lo, PE; T.Y. Lin International

From: Brooke DuBose & Matt Goyne; Fehr & Peers

Subject: ***SFOBB West Span Bicycle/Pedestrian/Maintenance Path PSR Project – Forecasting and Traffic Analysis Methodology***

SF10-0477

This memorandum presents our proposed methodology for conducting pedestrian and bicycle forecasts and a traffic analysis for the San Francisco-Oakland Bay Bridge West Span Bicycle/Pedestrian/ Maintenance (BPM) Path.

The methodology for conducting pedestrian and bicycle forecasts for the BPM was previously documented in the memorandum *SFOBB West Span Bicycle/Pedestrian/Maintenance Path PSR Project – Forecasting Methodology*, dated April 12, 2010. **Attachment A** includes Fehr & Peers' responses to comments received from Caltrans. In addition, **Attachment A** includes responses to comments received from Caltrans regarding the October 31, 2011 "Forecasting and Traffic Analysis Methodology" memorandum.

This traffic analysis will include weekday AM and PM and weekend mid-day peak hour intersection analysis at up to five intersections for existing and future conditions. Forecasted traffic to the project staging area will be added to existing and future no project conditions intersection traffic volumes to determine the project's effects.

BICYCLE AND PEDESTRIAN TRAVEL DEMAND FORECASTING

Per our previous conversations, we understand that the team does not expect pedestrian and bicycle forecasts of the facility to substantially affect the proposed width of the path on the bridge. However, forecasts will be used to determine the scope and project elements for vertical circulation. Overall, we expect the product of this effort to be order-of-magnitude bicycle and pedestrian usage forecasts for the subject facility, for purposes of sizing and locating vertical circulation elements.

Bicycle and pedestrian demand forecasts will rely on existing data at other facilities and minimal collection of new data. Other bridges in the Bay Area allow bicycles and pedestrians (Antioch, Carquinez, Dumbarton, and Golden Gate). However, the only one of those bridges that experiences commuter, recreational, and tourism-related usage at relatively high levels is the Golden Gate Bridge. Although we do not expect that tourism-related use for the west span of the Bay Bridge will be as high as the Golden Gate Bridge, we do anticipate that pedestrian and

bicycle volumes near the San Francisco anchorage of the Bay Bridge will experience similar demand. Recreational use for the west span will likely be less on the Bay Bridge compared to the Golden Gate Bridge, while commuter use may be significant in the long-term once the proposed Treasure Island development and the eastern span of the Bay Bridge are complete.

To obtain an order-of-magnitude estimate of bicycle and pedestrian usage on the Bay Bridge, we will:

A. Collect bicycle and pedestrian counts from the "Bicycle Safety Study for the Golden Gate Bridge" report prepared by Alta Planning + Design (April 15, 2011).
B. Coordinate with Caltrans to obtain bicycle and pedestrian counts from other bridges in the Bay Area
C. Coordinate with AC Transit, BART, and Caltrans to obtain data on the use of bicycles on transit and bicycle shuttle service for transbay trips (if available)
D. Review forecasted bicycle demand prepared as a part of plans for proposed development on Treasure Island and in SoMa as well as the proposed expansion of ferry service by the Water Transit Authority (WTA).
E. Compare the data and determine an approximate forecast the Bay Bridge usage, likely within the range between the Golden Gate Bridge observations and counts provided by Caltrans from other sites.

A detailed approach for each task is described below.

Task A. Collect Data at the Golden Gate Bridge

Bicycle and pedestrian counts were collected in August 2010 as a part of the "Bicycle Safety Study for the Golden Gate Bridge" report prepared by Alta Planning + Design (April 15, 2011). These counts identify the weekday and weekend peak hours for pedestrian and bicycle use on the Golden Gate Bridge. These peak hour counts will be used for forecasting the pedestrian and bicycle volumes on the BPM Path. No new pedestrian and bicycle counts will be collected at the Golden Gate Bridge as a part of this study.

Task B. Collect Data from Caltrans

Fehr & Peers will review data collected by Caltrans for bicycle and pedestrian volumes on the other bridges in the Bay Area. It is our understanding that Caltrans has recent data from the Dumbarton Bridge that will assist in our forecasting for the Bay Bridge. We will evaluate Caltrans data and assume all trips are primarily recreational or commuter-related.

Task C. Collect Data from AC Transit, BART, and Caltrans for Transbay Bicycle Service

To evaluate existing transbay bicycle usage, we will collect available data from AC Transit for bus-mounted and under carriage bicycle racks as well as data from Caltrans on the use of transbay bicycle shuttles. We will review existing shuttle schedules and policies for bicycles on buses to assess the current capacity and operations of transbay service. In addition, we will collect available data regarding transbay peak hour bicycle demand on BART. This demand

estimate will include order of magnitude bicycle latent demand, and will be likely be much lower than the bicycle forecasts proposed in Task E.

Task D. Review Plans for Forecasted Future Transbay Bicycle Demand

Fehr & Peers will review plans prepared for proposed developments on Treasure Island and in SoMa (if available) and document bicycle forecast demand for transbay crossings presented in those plans. We will also review WTA plans for projected bicycle demand on future ferry service. We do not propose to do additional analysis regarding ferries or the proposed developments. As noted in Task C, the projected future bicycle demand included in these studies is likely to be much lower than the bicycle forecasts proposed in Task E.

Task E. Compare Data and Forecast Bay Bridge Use

We will compile the data collected on the Golden Gate Bridge, Dumbarton Bridge, and other bridges for which data is available from Caltrans and create a matrix to compare the results based on total volumes, type of use, adjacent land use and population density. We will incorporate relevant data from our work on the Treasure Island Redevelopment project to assist with our analysis.

Given the unique characteristics of the Golden Gate Bridge (GGB) and Bay Bridge (BB) compared to other bridges in the area, we will forecast the combined pedestrian and bicycle volumes on the Bay Bridge with the following approach:

- Volumes near the San Francisco anchorage of BB will be 90-100% of GGB volumes
- Volumes between 500-1000 feet (distance to be determined based on qualitative assessment conducted in Task A) of San Francisco end of BB will be 80-90% of GGB volumes
- Volumes near the Yerba Buena anchorage of BB will be between 60-80% of GGB volumes.

We will review these percentages with the project development team to ensure consensus in our approach. These percentages assume that bicycles on the west span of the Bay Bridge are likely to continue across the bridge to Yerba Buena while many pedestrians will only travel part of the way across before returning to San Francisco, similar to the existing patterns at the Golden Gate Bridge. The forecasts will be critical to appropriately size the proposed connections at each end of the bridge which include ramps to the Rincon Hill area, a path to the Transbay Terminal in San Francisco, as well as the elevators/stairs at Pier W-1 at the Embarcadero.

There will also be a qualitative discussion of the potential for modal shift for transbay travel.

We recognize that this is a relatively simplistic approach; however, based on the unique nature of the project, the variable nature of some of the forecasting assumptions, and the limited effects the forecasting may have on the design of the path width in general, we believe that this is an appropriate level of study for the current phase of project development. As the project is further developed and as it enters the environmental review and project approval phase, additional work may be required.

The forecasted volumes will provide a conservative assessment of the volumes at the landing areas to the bridge. They will not be used as a part of the purpose or need statement for the project.

VEHICULAR TRAFFIC ANALYSIS

Fehr & Peers proposes to study vehicle traffic at the following five intersections, as shown on **Figure 1**:

- Harrison Street / The Embarcadero
- Harrison Street / Spear Street
- Harrison Street / Fremont Street
- Folsom Street / Fremont Street
- Folsom Street / 1st Street

Vehicular access routes to and from the elevator staging area include Harrison Street, Folsom Street, Fremont Street, 1st Street, Bryant Street, and The Embarcadero. The above study intersections were chosen as they represent key gateways into the adjacent Rincon Hill neighborhood and will likely serve the highest amount of project-generated vehicle traffic on critical movements. The above intersections will be analyzed under existing, existing plus project, and cumulative plus project conditions to determine the potential effects of the proposed BPM. In addition, a qualitative discussion regarding the pedestrian and bicycle conditions at these intersections and on adjacent study area roadways will be included for existing and plus project conditions.

Task A. Existing Conditions

Fehr & Peers will collect existing weekday AM and PM peak period (7 to 9 AM and 4 to 6 PM) and Saturday peak period (1 to 3 PM) intersection vehicle turning movement volumes at the five study intersections. During the vehicle counts, we will also collect pedestrian and bicycle counts at the study intersections. We will use these volumes to evaluate existing peak hour intersection vehicle levels of service. We will also qualitatively describe existing pedestrian, bicycle, and transit circulation and amenities in the area. This will include observing and identifying existing amenities the intersection of Spear Street and The Embarcadero, which currently has low levels of pedestrian and bicycle activity but would likely be an important connection to the BPM in the future.

Task B. Forecast Vehicular Traffic Generation

As previously discussed, we will use the Golden Gate Bridge as a proxy for roughly approximating the potential usage of Bay Bridge bicycle and pedestrian facilities, as both bridges are likely to offer scenic views that attract relatively high levels of tourism, in addition to commuter traffic. Fehr & Peers will collect peak period vehicular traffic counts at the parking facilities adjacent to each end of the Golden Gate Bridge as shown in **Table 1**.

N

Not to Scale

FEHR & PEERS

Proposed Study Locations

Figure 1

TABLE 1
GOLDEN GATE BRIDGE TRAFFIC COUNTS

Location	Weekday AM Peak Period (7 to 9 AM)	Weekday PM Peak Period (4 to 6 PM)	Weekend Mid-Day (1 to 3PM)
South End of Golden Gate Bridge	New Counts	2010 Counts[1]	2010 Counts[1]
North End of Golden Gate Bridge	New Counts	New Counts	New Counts

Notes:

1. Existing weekday PM and weekend mid-day peak period traffic counts were collected at the southern parking lot for the *Doyle Drive Replacement Project Merchant Road & Toll Plaza East Study* (January 2011, ARUP) in August 2010.

Source: Fehr & Peers, October 2011

We recognize that some of the vehicular traffic using the Golden Gate Bridge parking areas is generated simply by the scenic views from the parking lot itself, making a direct comparison between parking areas adjacent to the Golden Gate Bridge and those proposed for staging at the Bay Bridge difficult. We will conduct site observations during the weekend mid-day peak period (the busiest time period) to determine the percent of vehicles that park in the parking lots and then walk or bicycle on the bridge. This portion of the vehicular traffic generated at the Golden Gate Bridge lots will be assumed to be the vehicular demand associated with the Bridge's bicycle and pedestrian facilities. We will make a similar assumption for the proposed Bay Bridge facility to determine weekday AM and PM peak hour and Saturday peak hour vehicle traffic generation, although we propose to work with T.Y. Lin and Caltrans to determine whether some adjustments may be warranted. We recognize that availability of convenient parking at the Bay Bridge and the Golden Gate Bridge may not be similar, but for conservative measure the parking supply at the Bay Bridge will not limit the trip generation to the site.

Task C. Vehicular Trip Distribution and Assignment

Based on the results of Tasks A and B and the proposed staging area layout, we will determine the directions of approach and departure for new vehicle traffic, specifically the changes to individual intersection turning movement volumes during the evaluation periods (weekday AM and PM peak hours, and Saturday peak hour).

Task D. Existing Plus Project Conditions

We will add the forecasted net increase in peak hour vehicle traffic to the existing conditions traffic volumes to forecast "existing plus project" intersection traffic volumes. We will calculate intersection vehicle levels of service for the weekday AM and PM peak hours and Saturday peak hour. We will assume that the near-term proposed bicycle infrastructure is in place as proposed in the San Francisco Bike Plan (2009). This includes Class II bicycle lanes on Fremont Street and on Beale Street south of Folsom Street. If the additional vehicle traffic (and modified roadway network) results in unacceptable traffic conditions, based on the City of San Francisco criteria for identifying traffic impacts, we will identify appropriate improvements, if feasible and consistent with the City's "transit first" policies. It should be noted that the traffic analysis and improvement recommendations are not intended for use in environmental clearance for the

proposed project, but are rather for preliminary planning purposes. Future environmental analysis, if required, may require substantially more analysis than included in this scope.

Task E. Future Conditions

A number of studies have been conducted in the area, including the Transit Center District Plan, have projected future conditions (year 2030) vehicle traffic volumes. We will use growth factors developed from these studies to forecast future conditions intersection vehicle traffic volumes for the weekday AM and PM peak hours. Saturday peak hour vehicle traffic forecasts will be determined by applying the existing ratio of Saturday peak hour vehicle traffic to weekday PM peak hour vehicle traffic to future weekday PM peak hour forecasts. Note that some intersections in this study may not have been previously analyzed, so this task may involve applying growth factors developed at other downtown intersections to the study intersections for this analysis. This is an adequate approach for this planning-level study; however, more detailed forecasts may be necessary later in the PSR process and future environmental analysis.

We will conduct future conditions intersection vehicle level of service analysis at the five study intersections and identify future operating conditions. We will recommend improvements to address long-term deficiencies, if any.

Appendix C-2

Errata for the West Oakland Link

FEHR PEERS

DRAFT MEMORANDUM

Date: November 30, 2020

To: Rich Walter and Diana Roberts, ICF

From: Kathrin Tellez and Rob Rees, Fehr & Peers

Subject: Errata for the West Oakland Link

WC12-2992

Fehr & Peers prepared a transportation impact assessment for the San Francisco–Oakland Bay Bridge Regional Bicycle/Pedestrian Connection (proposed project), now known as the West Oakland Link (Link), in October 2014 (2014 TIA). That document was incorporated into a draft Environmental Document that was approved by the California Department of Transportation (Caltrans), but never circulated for public review. Since the preparation of the 2014 TIA, the City of Oakland updated their Transportation Impact Review Guidelines, and the California Environmental Quality Act (CEQA) guidelines were updated to identify vehicle miles traveled (VMT) as the most appropriate metric to evaluate the environmental effects of a project from a transportation perspective and prohibited the use of delay-based metrics for the purposes of identifying transportation impacts under CEQA.

The purpose of this review is to identify changes to the proposed project that could result in changed analysis conclusions from those presented in the 2014 TIA and review the updated CEQA criteria to determine if new or changed impacts could result from the proposed project. Specifically, this memorandum focuses on VMT, plan consistency, and safety.

PROJECT DESCRIPTION

The proposed project includes developing new Class I facilities and connecting on-street facilities and a parking lot located in the City of Oakland, Alameda County, near the Interstate (I)-880 and I-80 interchange and the East Span of the Bay Bridge. The Class I facility would extend between Mandela Parkway to the east and the Bay Bridge Trail to the west and would be an elevated structure for most of this distance, providing access across existing freeways, railways, and industrial

areas. The proposed project is an independent structure, except over the railroad tracks, where it would be located on the existing West Grand Avenue overcrossing structure.

The proposed project also includes on-street bicycle facilities that would connect surrounding streets to the Class I facility and provide access to a 100-space parking lot on Wood Street. The proposed project description is generally unchanged from the proposed project as evaluated in 2014, except for creating a dead end at Campbell Street on the southern side of West Grand Alley.

SIGNIFICANCE CRITERIA

The determination of significance for project impacts is based on applicable policies, regulations, goals, and guidelines defined by the Lead Agency. Although the lead agency for this proposed project is Caltrans, City of Oakland criteria were used because the proposed project is largely within the City of Oakland. When the 2014 TIA was prepared, vehicle level of service (LOS), amongst other metrics, was used to identify potentially significant impacts. The purpose of this review is to determine if previously identified impacts and associated mitigation measures would no longer be necessary under the new criteria, and if new potential impacts could occur. Based on the updated CEQA criteria, and the City of Oakland Transportation Impact Review Guidelines, the Project would have a significant impact on the environment if it would:

1. Cause substantial additional VMT per capita, per service population, or other appropriate efficiency measure. Specifically,
    - For residential uses, a project would cause substantial additional VMT if it exceeds existing regional household VMT per capita minus 15 percent.
    - For office uses, a project would cause substantial additional VMT if it exceeds the existing regional VMT per worker minus 15 percent.
    - For retail uses, a project would cause substantial additional VMT if it exceeds the existing regional VMT per worker minus 15 percent.
    - For retail projects greater than 80,000 square feet, a project would cause substantial additional VMT if it results a net increase in citywide total VMT per service population.[1]

[1] Although this is not a stated significance criterion in the City of Oakland, it is used here because it is consistent with OPR guidance that recommends that "agencies should analyze the effects of a retail project by assessing the change in total VMT, because retail projects typically re-route travel from other destinations."

2. Conflict with a plan, ordinance, or policy addressing the safety or performance of the circulation system, including transit, roadways, bicycle lanes, and pedestrian paths (except for automobile LOS or other measures of vehicle delay).

3. Substantially induce additional automobile travel by increasing physical roadway capacity in congested areas; i.e., adding new mixed-flow lanes or adding new roadways to the network.

VEHICLE MILES TRAVELED

In response to Senate Bill 743 (SB 743), the Office of Planning and Research (OPR) updated CEQA guidelines to include new transportation-related evaluation metrics. Draft guidelines were developed in August 2014, and after several rounds of public review and feedback, final proposed Guidelines were published on November 27, 2017, with an associated *Technical Advisory Document on Evaluating Transportation Impacts in CEQA* dated December 2018. That process identified VMT as the most appropriate metric for evaluating the environmental effects of a project from a transportation perspective and prohibited the use of delay-based metrics for the purposes of identifying transportation impacts under CEQA.

The City of Oakland has established VMT thresholds for typical development projects, such as residential, office, or retail uses. Transportation projects are typically evaluated to determine if they could result in induced travel. For example, adding a lane to a congested portion of the highway could result in additional travel as time barriers to travel are reduced. Guidance from OPR, as documented in the December 2018 Technical Advisory[2], specifies "that the addition of new or enhanced bicycle bike or pedestrian facilities on existing streets/highways or within existing public rights-of-way and the addition of Class I bicycle paths, trails, multi-use paths, or other off-road facilities that serve non-motorized travel" is not likely to increase VMT and should not be required for conducting an induced travel analysis. Therefore, the Class I and Class II facility portions of the proposed project can be presumed to have a less-than-significant impact on VMT, and no further analysis is required.

The 100-space parking lot portion of the proposed project may not be exempt from VMT analysis. As there are no published guidelines or criteria to evaluate VMT for a parking lot that serves as a trailhead for a Class I facility, guidance presented in the City of Oakland Transportation Impact Review Guidelines and the concepts presented in the Technical Advisory were applied to the parking lot portion of the proposed project, considering the intent of SB 743 which is to "promote

[2] https://www.opr.ca.gov/docs/20190122-743_Technical_Advisory.pdf

the reduction of greenhouse gas emissions, the development of multimodal transportation networks, and a diversity of land uses."

The Guidelines suggest the use of "screening criteria" that can be applied to a project to determine whether that project can be presumed to cause a less-than-significant amount of VMT, in which case the proposed project could be screened out of doing further VMT analysis. The City of Oakland criteria includes the ability to screen out small projects, defined those that generate fewer than 100 vehicle trips per day. As detailed in the 2014 TIA, the parking lot portion of the proposed project could generate up to 400 vehicle trips per day. Many of those trips are likely already on the roadway system and not new vehicle trips. Many people who ride bicycles on the Bay Bridge Path have been observed to park in other locations in the vicinity, including the Ikea and Target parking lots and parking areas off Burma Road. However, the extent of this usage has not been quantified, and providing a trail facility parking facility in combination with the new bicycle facilities could generate new bicycle travel demand that could backfill parking demand shifts in the area.

Another screening method recommended by the City of Oakland and the OPR Technical Advisory is map-based screening, in which geographic areas that generate low levels of VMT are identified, because projects located in those areas are presumed to exhibit similarly low levels of VMT and thus can be screened out of doing further VMT analysis. This type of screening is recommended for residential and for office (i.e., employment) uses. The Metropolitan Transportation Commission (MTC) has prepared VMT maps that characterize the current (year 2020) VMT per Capita by Place of Residence[3] and VMT per Capita by Place of Work[4] for all areas of the nine-county San Francisco Bay Area region, summarized at the geographic level of the Transportation Analysis Zone (TAZ).

The parking lot portion of the proposed project is located in an area that experiences low levels of VMT per capita by place of residence, meaning that people who live in this area tend to travel shorter distances for their daily needs. Although employment uses in this area tend to have higher levels of VMT, this is largely a function of the primarily industrial jobs located in the area.

Although the parking lot portion of the proposed project is expected to generated some new VMT, it is expected to be at a low level on a per capita basis, as the people who live in the general vicinity tend to travel at levels at least 15 percent below existing regional averages per household. If the parking lot portion of the proposed project were not constructed, trail users that drive to the area

[3] https://mtc.maps.arcgis.com/apps/webappviewer/index.html?id=5dac76d69b3d41e583882e146491568b
[4] https://mtc.maps.arcgis.com/apps/webappviewer/index.html?id=98463b4f73ca43c5944a5c30648fd689

would likely still continue to drive and park in non-designated areas and use roadway facilities connecting to the trail that do not provide adequate bicycle facilities. Therefore, if the parking lot were not constructed, there would not likely be an appreciable change in overall VMT, and there could be worse safety outcomes.

Based on the review of VMT per capita levels in the area, and the types of trips that are expected to be generated by the proposed project—primarily residential based trips for recreational purposes—the parking lot portion of the project is expected to have a ***less-than-significant impact*** on VMT, and no mitigation measures are required.

PLAN CONSISTENCY

Since the preparation of the 2014 TIA, the City of Oakland and other agencies adopted several plans that influence the West Oakland Area, including *Let's Bike Oakland (*July 2019), *Oakland Walks!* (2017), *West Oakland Truck Management Plan* (April 2019), the *West Oakland Community Action Plan* (October 2019), and the *AC Transit Service Adjustment Plan*. Additionally, the West Oakland Specific Plan was reviewed.

Let's Bike Oakland

The City of Oakland bike plan identifies a new protected bicycle lane on West Grand Avenue from Maritime Street east through Downtown Oakland and beyond. Within the project area, Wood Street is designated as a future neighborhood bicycle route, and buffered bicycle lanes are proposed to be provided on 14th Street, 18th Street, and Mandela Parkway.

The proposed project would advance the provision of protected bicycle facilities on West Grand Avenue by completing the portion of the proposed project between Mandela Parkway and Maritime Street. The proposed project would also provide Class II bicycle lanes on the following roadways:

- Grand Avenue Alley (westbound), from Mandela Parkway to Wood Street
- 20th Street, from Mandela Parkway (one block south of West Grand Avenue) to Wood Street
- Wood Street, from 20th Street to 24th Street
- Willow Street, from 20th Street to West Grand Alley

- Campbell Street, from 20th Street to West Grand Alley
- Wood Street Parking Lot

These lanes would provide additional bicycle facilities beyond those identified in the City's Bike Plan and would not preclude the provision of additional bicycle facilities as identified in the Plan.

Oakland Walks!

The City of Oakland's 2017 Pedestrian Plan identifies the project area as car-dependent, with the worst sidewalks in the City and the second-highest transportation system injury rate. The proposed project does not propose any changes at high-injury intersections. There are numerous sidewalk gaps in the area, including on Wood Street and 20th Street. As part of roadway modifications to provide Class II bicycle facilities on these roadways, sidewalks and crosswalks would be constructed, helping to close gaps in the sidewalk network. Construction of the proposed project would not preclude the construction of additional pedestrian facilities by others.

West Oakland Truck Management Plan

The *West Oakland Truck Management Plan*, prepared by the City of Oakland and the Port of Oakland, is an action plan designed to reduce the effects of truck transportation on local streets in West Oakland. The plan identifies a number of improvements in the West Oakland area, including designating additional streets as Truck Prohibited Streets, improved truck routing and wayfinding to minimize the number of trucks driving on non-industrial streets, improved safety at intersections near the port, improved traffic enforcement, changed parking regulations, and improved parking enforcement. The proposed project would not preclude the implementation of any of the plans or strategies identified in the *West Oakland Truck Management Plan*, and although it would not construct any of the safety improvements identified, the proposed project would improve bicycle facilities along Grand Avenue (a truck route), improving bicyclist safety in West Oakland.

West Oakland Community Action Plan

The *West Oakland Community Action Plan*, prepared by the Bay Area Air Quality Management District, identifies specific strategies and goals to improve air quality and reduce pollution in West Oakland. Although most of the emissions in West Oakland originate from the Port and port-related functions, there are strategies in the plan related to improving the design and safety of local streets to encourage residents to walk or ride bicycles. Because the proposed project would provide improved bicycle infrastructure in the area, it helps to further the goals in the West Oakland

Community Action plan and would not preclude the implementation of other strategies identified in the plan.

AC Transit Service Adjustment Plan

The *AC Transit Service Adjustment Plan*, prepared by AC Transit, identifies changed routes in the project vicinity, mostly to increase the frequency of specific routes and eliminate some underperforming routes. Implementation of the proposed project would not preclude planned changes to AC Transit service in the area.

West Oakland Specific Plan

The *West Oakland Specific Plan*, prepared by the City of Oakland, provides comprehensive, multi-faceted strategies for facilitating the development of selected vacant and/or underutilized commercial and industrial properties within the West Oakland community. The Plan is a tool for supporting, attracting, and developing commercial and industrial enterprises to provide jobs and services needed by the West Oakland community and the City of Oakland at large. The plan identifies the provision of bicycle facilities in the area, including Class II bicycle facilities on West Grand Avenue. The proposed project advances planned improvements by constructing a Class I bicycle facility along the West Grand Avenue corridor between Mandela Parkway and Maritime Street.

The *West Oakland Specific Plan* also identifies Wood Street as a Neighborhood Route, and intersecting streets, such as 20th Street, as a minor priority pedestrian route. A neighborhood route is a local street that connects schools, parks, recreational centers, and libraries. As such, neighborhood routes are intended to be used for active transportation, as well as recreation, and provide safe walking at night. The proposed project would improve a portion of Wood Street and intersecting streets, helping to achieve *West Oakland Specific Plans* goals. Implementation of the proposed project would not preclude the implementation of other goals and policies articulated in the plan.

Based on our review of applicable Plans, the Link project would not conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities. This is a ***less-than-significant*** impact, and no mitigation measures are required.

SAFETY

The following traffic safety thresholds were reviewed:

1. Directly or indirectly cause or expose roadway users (e.g., motorists, pedestrians, bus riders, bicyclists) to a permanent and substantial transportation hazard due to a new or existing physical design feature or incompatible uses
2. Directly or indirectly result in a permanent substantial decrease in pedestrian safety
3. Directly or indirectly result in a permanent substantial decrease in bicyclist safety
4. Directly or indirectly result in a permanent substantial decrease in bus rider safety
5. Generate substantial multi-modal traffic traveling across at-grade railroad crossings that cause or expose roadway users (e.g., motorists, pedestrians, bus riders, bicyclists) to a permanent and substantial transportation hazard

The proposed project would increase motor vehicle traffic and pedestrian and bicycle activity in the West Oakland area, also increasing the potential for conflicts between motor vehicles and vulnerable roadway users at intersections. The Link project is not expected to attract new bus riders to the transit system in the area.

Transportation Hazards

The Link project is intended to separate bicycle and pedestrian travel from motor vehicle travel, reducing potential conflicts between different roadway users. Access to the Link from the east would be from West Grand Avenue at Mandela Parkway. Access to the Link from users that park within the Wood Street parking lot would be from new Class 2 bicycle lanes marked on Wood Street, 20th Street, Willow Street, and Campbell Street, connecting to the at-grade section of the path between Mandela Parkway and Campbell Street. The Link would provide a physical separation between path users (i.e., pedestrians and bicyclists) and motor vehicle traffic for most of its length, reducing hazards; however, at two intersections there could be increased bicycle and pedestrian exposure:

- West Grand Avenue/Frontage Road/I-80 Ramps
- West Grand Avenue/Mandela Parkway (Northbound)

Impact TR-1: West Grand Avenue/Frontage Road/I-80 Ramps: The proposed project would increase bicycle and pedestrian exposure to vehicles at the intersection with an increase in bicycle

and pedestrian traffic crossing the west leg of the intersection, resulting in a potentially significant impact based on the Significance Criteria.

> Mitigation Measure TR-1: Upgrade the traffic signal equipment at the intersection to provide video detection for vehicles and bicycles and provide a leading pedestrian interval. Also, consider converting the eastbound through-right shared lane to a right-turn only lane and prohibiting the eastbound right-turn movement when the pedestrian phase is activated. As part of the upgrade, Caltrans and City of Oakland should explore if providing protected left-turn movements, as compared to the 2014 spilt phase operation, would provide better operations for all users. Installing upgraded traffic signal equipment (i.e., video detection for vehicles and bicycles) and providing a leading pedestrian interval would improve operations for all roadway users, reducing the impact to a ***less-than-significant*** level.

Impact TR-2: West Grand Avenue/Mandela Parkway (Northbound): The proposed project would increase bicycle and pedestrian exposure to vehicles at the intersection, resulting in a potentially significant impact based on City of Oakland Significance Criteria.

> Mitigation Measure TR-2: Modify the eastbound approach to convert the shared left-through lane to a left-turn only lane. Install protected phasing for the eastbound and westbound left-turn movements, and upgrade the traffic signal equipment as necessary to provide bicycle video detection. With this improvement, bicycle and pedestrian travel through the intersection would be improved, reducing the project impact to a ***less-than-significant*** level.

Link Design

The Link can be divided into five sections with varying widths reflective of right-of-way constraints. Because the proposed project is intended to accommodate both bicycle and pedestrian travel, there could be some conflicts between bicyclists and pedestrians. Generally, the path is being designed to provide 10 feet for bicyclists (i.e., five-foot lanes in each direction), a five-foot area for pedestrians, and a two-foot shy area for fencing within a 17-foot cross section. Segments 2 and 3 would be 14 feet wide (i.e., a 10-foot clear area and 4 feet for shoulders to accommodate fencing). The Caltrans *Highway Design Manual* (Chapter 1000) specifies a minimum width of 8 feet for a two-way bike path, with 10 feet preferred. Where a path is on a structure, the minimum width of the path is 14 feet, to provide 10 feet for travel and a 4-foot-wide shoulder area.

The project as currently proposed would meet or exceed Caltrans standards for Class I path design. The volume of pedestrian and bicycle travel expected along the Link is expected to be less than 10 percent of the total pedestrian and bicycle traffic that is expected through the Park area and the East Span of the Bay Bridge, as presented in the 2016 TIA, with higher levels of bicycle activity than pedestrian activity. This level of activity would result in 140 to 450 Link users on a typical weekday and 430 to 830 Link users on a weekend day, with less activity during an individual hour.

A Trail Level of Service Calculator as developed by North Carolina State University and Toole Design Group, based on the Federal Highway Administration *Shared-Use Path Level of Service Calculator—A User's Guide,* July 2006, was used to assess the Pedestrian/Bicycle LOS on the Link, which considers factors such as bicyclist passing, desired buffer space between path users, and the mix of bicyclists, pedestrians, runners and child bicyclists. Based on the weekend peak hour pedestrian/bicycle volume estimate (between 60 and 120 trail users in a peak hour) on the Link, the Trail LOS is B for the segments with a 17-foot cross section and LOS C for segments with a 14-foot cross section, meaning that pedestrians and bicyclists can generally travel fairly unimpeded along the Link, although some bicyclists may have to wait to pass a slower-moving bicyclist. Trail operations would be better during other times of day and week.

Approximately 500 users per hour could be accommodated on the Path at LOS D condition, which is considered the functional capacity of a trail. When these conditions are experienced, bicyclists are likely to avoid peak periods or adjust expectations of path operations. Segment 3 of the Link constrains the volume of pedestrian and bicycle travel that could be accommodated along the entire Link corridor.

Bicycle/pedestrian conflicts could exist where the Path would connect to the existing Bay Bridge Trail, below the I-880/I-80 connection.

Impact TR-3: Pedestrian/Bicycle Conflicts – Connection of Link to Existing Bay Bridge Trail: The Link project will add a connection to the existing Bay Bridge Trail, resulting in bicycle/pedestrian conflicts at the intersection. As this could create a hazard for pedestrians and bicyclists, this is a potentially ***significant impact*** based on City of Oakland Significance Criteria.

> Mitigation Measure TR-3: Provide additional path width in the vicinity of the Bay Bridge Trail intersection, directional signage and striping, and potentially a bicycle stop sign on the Path at the Bay Trail connection. Implementation of this measure would reduce the Pedestrian Safety impact to a ***less-than-significant*** level.

Pedestrian Safety

The proposed project would add a separated bicycle and pedestrian path connecting West Oakland to the Bay Bridge Trail that would be open at all times. Sidewalks and paths are provided in the project vicinity along Grand Avenue and Mandela Parkway, connecting to the Link, as well as crosswalks and pedestrian signals. Some Link pedestrians could use the Wood Street parking lot. Although sidewalks are provided on some of the streets around the parking lot, they are discontinuous in the area.

Impact TR-4: Pedestrian Safety: The Link project could add pedestrian demand between the Wood Street parking lot and the start of the Path at Mandela Parkway, approximately 0.25 mile. Because sidewalks are discontinuous in this area, this is a potentially ***significant impact*** based on City of Oakland Significance Criteria.

> Mitigation Measure TR-4: Identify the pedestrian path of travel between the Wood Street parking lot and the Path. Install sidewalks, crosswalks (if these are not installed by other projects), lighting elements (if needed), and way-finding elements, as necessary, along the pedestrian path of travel. Implementation of this measure would reduce the Pedestrian Safety impact to a ***less-than-significant*** level.

Bicycle Safety

The proposed project would add a separated bicycle and pedestrian path connecting West Oakland to the Bay Bridge Trail, which would enhance bicycle safety by adding a separated bicycle facility where there currently is none. The Link would have lighting and access provided 24 hours a day. Some bicyclists could use the Wood Street parking lot and access the Link from the Class 2 bicycle facilities proposed on the streets connecting the Wood Street parking lot and the Link. The Class 2 bicycle facilities would be constructed, in addition to crossing treatments, including lighting elements if needed, and wayfinding elements, concurrent with or prior to the construction of the Wood Street parking lot, ensuring that bicycle facilities would be available to meet demand.

Segment 4 of the Path contains a 180-degree curve on a 2 percent grade to transition from the elevated structure to grade level. Based on guidance provided in the Caltrans *Highway Design Manual*, a 5 percent grade is the maximum allowed for short segments, and 2 percent is recommended for sustained grades. The minimum design speed for a bicycle path is 20 miles per hour, with the minimum radius of curvature at that design speed of 90 feet.

Impact TR-5: Bicycle Safety: Based on information contained in Chapter 1000 of the Caltrans *Highway Design Manual*, the minimum design speed for a bicycle path is 20 miles per hour, with the minimum radius of curvature at that design speed of 90 feet, which may not be met with the current design.

> Mitigation Measure TR-5: Warning signs should be installed at the curve approaches for Segment 4 and clear lines of sight maintained between path sections. Deviations from the *Highway Design Manual* will require a design exception to document the engineering constraints, design options considered, and elements of the final plan. Implementation of this measure would reduce this Bicycle Safety impact to a ***less-than-significant*** level.

Bus Rider Safety

The proposed project is not expected to have a significant demand for public transit, nor would it change any existing transit facility. Therefore, the impact to bus rider safety is considered ***less than significant.***

INDUCED AUTOMOBILE TRAVEL

The proposed project would not increase the physical roadway capacity for vehicles., and, therefore, would not induce additional automobile travel. Because the proposed project would construct bicycle facilities, it is expected to induce bicycle travel in the area, which could reduce overall vehicle travel. Therefore, the proposed project is expected to have a positive impact. No impact is identified under this criteria, and no mitigation is required.

CONCLUSION

Based on our review of the West Oakland Link project, in combination with updated CEQA Criteria, we conclude that the proposed project would have a less-than-significant impact on VMT and plan consistency. Potential impacts related to transportation hazards and bicycle and pedestrian safety were identified, and mitigation measures were proposed to reduce those impacts to a less-than-significant level.

Please contact Kathrin Tellez (k.tellez@fehrandpeers.com) or Rob Rees (r.rees@fehrandpeers.com) with questions.

Appendix D

California Native Plant Society's Inventory of Rare and Endangered Plants of California

CNPS California Native Plant Society

*The database used to provide updates to the Online Inventory is under construction. View updates and changes made since May 2019 here.

Plant List

1 matches found. *Click on scientific name for details*

Search Criteria

California Rare Plant Rank is one of [1A, 1B, 2A, 2B, 3, 4], FESA is one of [Endangered, Threatened, Candidate], CESA is one of [Endangered, Threatened, Rare], Found in Quad 3712273

Modify Search Criteria | Export to Excel | Modify Columns | Modify Sort | Display Photos

Scientific Name	Common Name	Family	Lifeform	Blooming Period	CA Rare Plant Rank	State Rank	Global Rank
Holocarpha macradenia	Santa Cruz tarplant	Asteraceae	annual herb	Jun-Oct	1B.1	S1	G1

Suggested Citation

California Native Plant Society, Rare Plant Program. 2021. Inventory of Rare and Endangered Plants of California (online edition, v8-03 0.39). Website http://www.rareplants.cnps.org [accessed 01 February 2021].

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The California Lichen Society
California Natural Diversity Database
The Jepson Flora Project
The Consortium of California Herbaria
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Questions and Comments
rareplants@cnps.org

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Appendix E

California Natural Diversity Database List of Sensitive Species

Summary Table Report

California Department of Fish and Wildlife

California Natural Diversity Database

Query Criteria: Quad IS (Oakland West (3712273))

Name (Scientific/Common)	CNDDB Ranks	Listing Status (Fed/State)	Other Lists	Elev. Range (ft.)	Total EO's	Element Occ. Ranks						Population Status		Presence		
						A	B	C	D	X	U	Historic > 20 yr	Recent <= 20 yr	Extant	Poss. Extirp.	Extirp.
Accipiter cooperii Cooper's hawk	G5 S4	None None	CDFW_WL-Watch List IUCN_LC-Least Concern	30 30	118 S:1	0	0	0	0	0	1	0	1	1	0	0
Ambystoma californiense California tiger salamander	G2G3 S2S3	Threatened Threatened	CDFW_WL-Watch List IUCN_VU-Vulnerable	20 20	1336 S:1	0	0	0	0	1	0	1	0	0	0	1
Amsinckia lunaris bent-flowered fiddleneck	G3 S3	None None	Rare Plant Rank - 1B.2 BLM_S-Sensitive SB_UCBG-UC Botanical Garden at Berkeley SB_UCSC-UC Santa Cruz		93 S:1	0	0	0	0	0	1	1	0	1	0	0
Antrozous pallidus pallid bat	G4 S3	None None	BLM_S-Sensitive CDFW_SSC-Species of Special Concern IUCN_LC-Least Concern USFS_S-Sensitive WBWG_H-High Priority	210 210	420 S:1	0	0	0	0	0	1	1	0	1	0	0
Astragalus tener var. tener alkali milk-vetch	G2T1 S1	None None	Rare Plant Rank - 1B.2	20 30	65 S:2	0	0	0	0	2	0	2	0	0	1	1
Bombus caliginosus obscure bumble bee	G4? S1S2	None None	IUCN_VU-Vulnerable	10 700	181 S:2	0	0	0	0	0	2	2	0	2	0	0
Bombus crotchii Crotch bumble bee	G3G4 S1S2	None Candidate Endangered		175 175	437 S:1	0	0	0	0	0	1	0	1	1	0	0
Bombus occidentalis western bumble bee	G2G3 S1	None Candidate Endangered	USFS_S-Sensitive	10 500	306 S:2	0	0	0	0	0	2	2	0	2	0	0
Carex comosa bristly sedge	G5 S2	None None	Rare Plant Rank - 2B.1	0 0	32 S:1	0	0	0	0	1	0	1	0	0	0	1
Chloropyron maritimum ssp. palustre Point Reyes salty bird's-beak	G4?T2 S2	None None	Rare Plant Rank - 1B.2 BLM_S-Sensitive	5 5	76 S:2	0	0	0	0	2	0	2	0	0	2	0

Summary Table Report

California Department of Fish and Wildlife

California Natural Diversity Database

Name (Scientific/Common)	CNDDB Ranks	Listing Status (Fed/State)	Other Lists	Elev. Range (ft.)	Total EO's	Element Occ. Ranks						Population Status		Presence		
						A	B	C	D	X	U	Historic > 20 yr	Recent <= 20 yr	Extant	Poss. Extirp.	Extirp.
Chorizanthe cuspidata var. cuspidata San Francisco Bay spineflower	G2T1 S1	None None	Rare Plant Rank - 1B.2	20 20	17 S:1	0	0	0	0	1	0	1	0	0	0	1
Chorizanthe robusta var. robusta robust spineflower	G2T1 S1	Endangered None	Rare Plant Rank - 1B.1	30 30	20 S:1	0	0	0	0	1	0	1	0	0	1	0
Cicindela hirticollis gravida sandy beach tiger beetle	G5T2 S2	None None		10 10	34 S:1	0	0	0	0	1	0	1	0	0	0	1
Circus hudsonius northern harrier	G5 S3	None None	CDFW_SSC-Species of Special Concern IUCN_LC-Least Concern	5 5	53 S:1	0	0	0	0	0	1	0	1	1	0	0
Corynorhinus townsendii Townsend's big-eared bat	G4 S2	None None	BLM_S-Sensitive CDFW_SSC-Species of Special Concern IUCN_LC-Least Concern USFS_S-Sensitive WBWG_H-High Priority	710 710	635 S:1	0	0	0	0	1	0	1	0	0	1	0
Coturnicops noveboracensis yellow rail	G4 S1S2	None None	CDFW_SSC-Species of Special Concern IUCN_LC-Least Concern NABCI_RWL-Red Watch List USFS_S-Sensitive USFWS_BCC-Birds of Conservation Concern	20 20	45 S:1	0	0	0	0	0	1	1	0	1	0	0
Danaus plexippus pop. 1 monarch - California overwintering population	G4T2T3 S2S3	None None	USFS_S-Sensitive	10 200	383 S:3	0	0	0	0	0	3	0	3	3	0	0
Elanus leucurus white-tailed kite	G5 S3S4	None None	BLM_S-Sensitive CDFW_FP-Fully Protected IUCN_LC-Least Concern	5 5	180 S:1	0	1	0	0	0	0	1	0	1	0	0
Eucyclogobius newberryi tidewater goby	G3 S3	Endangered None	AFS_EN-Endangered IUCN_VU-Vulnerable	5 10	127 S:2	0	0	0	0	1	1	2	0	1	0	1

Summary Table Report

California Department of Fish and Wildlife

California Natural Diversity Database

Name (Scientific/Common)	CNDDB Ranks	Listing Status (Fed/State)	Other Lists	Elev. Range (ft.)	Total EO's	Element Occ. Ranks						Population Status		Presence		
						A	B	C	D	X	U	Historic > 20 yr	Recent <= 20 yr	Extant	Poss. Extirp.	Extirp.
Extriplex joaquinana San Joaquin spearscale	G2 S2	None None	Rare Plant Rank - 1B.2 BLM_S-Sensitive SB_CalBG/RSABG-California/Rancho Santa Ana Botanic Garden		127 S:1	0	0	0	0	1	0	1	0	0	1	0
Geothlypis trichas sinuosa saltmarsh common yellowthroat	G5T3 S3	None None	CDFW_SSC-Species of Special Concern USFWS_BCC-Birds of Conservation Concern	7 7	112 S:1	0	0	1	0	0	0	1	0	1	0	0
Gilia capitata ssp. chamissonis blue coast gilia	G5T2 S2	None None	Rare Plant Rank - 1B.1 SB_UCBG-UC Botanical Garden at Berkeley	100 100	37 S:1	0	0	0	1	0	0	1	0	1	0	0
Gilia millefoliata dark-eyed gilia	G2 S2	None None	Rare Plant Rank - 1B.2 BLM_S-Sensitive		54 S:1	0	0	0	0	1	0	1	0	0	0	1
Hemizonia congesta ssp. congesta congested-headed hayfield tarplant	G5T2 S2	None None	Rare Plant Rank - 1B.2 SB_UCBG-UC Botanical Garden at Berkeley		52 S:1	0	0	0	0	0	1	1	0	1	0	0
Heteranthera dubia water star-grass	G5 S2	None None	Rare Plant Rank - 2B.2		9 S:1	0	0	0	0	0	1	1	0	1	0	0
Holocarpha macradenia Santa Cruz tarplant	G1 S1	Threatened Endangered	Rare Plant Rank - 1B.1 SB_CalBG/RSABG-California/Rancho Santa Ana Botanic Garden SB_UCBG-UC Botanical Garden at Berkeley	100 100	37 S:2	0	0	0	0	2	0	2	0	0	0	2
Horkelia cuneata var. sericea Kellogg's horkelia	G4T1? S1?	None None	Rare Plant Rank - 1B.1 SB_UCSC-UC Santa Cruz USFS_S-Sensitive	20 20	58 S:2	0	0	0	0	2	0	2	0	0	2	0
Lasiurus cinereus hoary bat	G3G4 S4	None None	IUCN_LC-Least Concern WBWG_M-Medium Priority	325 325	238 S:2	0	0	0	0	0	2	2	0	2	0	0

Summary Table Report

California Department of Fish and Wildlife

California Natural Diversity Database

Name (Scientific/Common)	CNDDB Ranks	Listing Status (Fed/State)	Other Lists	Elev. Range (ft.)	Total EO's	Element Occ. Ranks						Population Status		Presence		
						A	B	C	D	X	U	Historic > 20 yr	Recent <= 20 yr	Extant	Poss. Extirp.	Extirp.
Laterallus jamaicensis coturniculus California black rail	G3G4T1 S1	None Threatened	BLM_S-Sensitive CDFW_FP-Fully Protected IUCN_NT-Near Threatened NABCI_RWL-Red Watch List USFWS_BCC-Birds of Conservation Concern	6 19	303 S:2	0	0	1	0	1	0	2	0	1	1	0
Layia carnosa beach layia	G2 S2	Endangered Endangered	Rare Plant Rank - 1B.1 SB_CalBG/RSABG-California/Rancho Santa Ana Botanic Garden SB_SBBG-Santa Barbara Botanic Garden	40 40	25 S:1	0	0	0	0	1	0	1	0	0	0	1
Leptosiphon rosaceus rose leptosiphon	G1 S1	None None	Rare Plant Rank - 1B.1		31 S:1	0	0	0	0	1	0	1	0	0	1	0
Melospiza melodia pusillula Alameda song sparrow	G5T2? S2S3	None None	CDFW_SSC-Species of Special Concern USFWS_BCC-Birds of Conservation Concern	5 20	38 S:5	0	2	0	0	0	3	3	2	5	0	0
Northern Coastal Salt Marsh Northern Coastal Salt Marsh	G3 S3.2	None None			53 S:1	0	0	0	0	0	1	1	0	1	0	0
Nyctinomops macrotis big free-tailed bat	G5 S3	None None	CDFW_SSC-Species of Special Concern IUCN_LC-Least Concern WBWG_MH-Medium-High Priority	175 175	32 S:1	0	0	0	0	0	1	1	0	1	0	0
Phalacrocorax auritus double-crested cormorant	G5 S4	None None	CDFW_WL-Watch List IUCN_LC-Least Concern	30 30	39 S:1	0	0	0	0	0	1	1	0	1	0	0
Plagiobothrys chorisianus var. chorisianus Choris' popcornflower	G3T1Q S1	None None	Rare Plant Rank - 1B.2 BLM_S-Sensitive SB_UCSC-UC Santa Cruz	20 20	42 S:1	0	0	0	0	1	0	1	0	0	0	1
Polygonum marinense Marin knotweed	G2Q S2	None None	Rare Plant Rank - 3.1		32 S:1	0	0	0	0	0	1	1	0	1	0	0

Summary Table Report

California Department of Fish and Wildlife

California Natural Diversity Database

Name (Scientific/Common)	CNDDB Ranks	Listing Status (Fed/State)	Other Lists	Elev. Range (ft.)	Total EO's	Element Occ. Ranks						Population Status		Presence		
						A	B	C	D	X	U	Historic > 20 yr	Recent <= 20 yr	Extant	Poss. Extirp.	Extirp.
Rallus obsoletus obsoletus California Ridgway's rail	G3T1 S1	Endangered Endangered	CDFW_FP-Fully Protected NABCI_RWL-Red Watch List	0 1	99 S:2	0	1	1	0	0	0	0	2	2	0	0
Reithrodontomys raviventris salt-marsh harvest mouse	G1G2 S1S2	Endangered Endangered	CDFW_FP-Fully Protected IUCN_EN-Endangered	3 3	144 S:1	0	0	0	0	0	1	1	0	1	0	0
Sanicula maritima adobe sanicle	G2 S2	None Rare	Rare Plant Rank - 1B.1 SB_SBBG-Santa Barbara Botanic Garden USFS_S-Sensitive		17 S:1	0	0	0	0	1	0	1	0	0	0	1
Scapanus latimanus parvus Alameda Island mole	G5T1Q SH	None None	CDFW_SSC-Species of Special Concern	10 30	8 S:7	0	0	0	0	0	7	7	0	7	0	0
Spirinchus thaleichthys longfin smelt	G5 S1	Candidate Threatened		0 0	46 S:2	0	0	0	0	0	2	1	1	2	0	0
Sternula antillarum browni California least tern	G4T2T3Q S2	Endangered Endangered	CDFW_FP-Fully Protected NABCI_RWL-Red Watch List	10 10	75 S:1	0	1	0	0	0	0	1	0	1	0	0
Suaeda californica California seablite	G1 S1	Endangered None	Rare Plant Rank - 1B.1		18 S:1	0	0	0	0	0	1	0	1	1	0	0
Trifolium hydrophilum saline clover	G2 S2	None None	Rare Plant Rank - 1B.2		56 S:3	0	0	0	0	3	0	3	0	0	0	3
Tryonia imitator mimic tryonia (=California brackishwater snail)	G2 S2	None None	IUCN_DD-Data Deficient	0 0	39 S:1	0	0	0	0	1	0	1	0	0	0	1
Viburnum ellipticum oval-leaved viburnum	G4G5 S3?	None None	Rare Plant Rank - 2B.3		39 S:1	0	0	0	0	0	1	1	0	1	0	0

Appendix F

U.S. Fish and Wildlife Service List of Threatened and Endangered Species

United States Department of the Interior

FISH AND WILDLIFE SERVICE
San Francisco Bay-Delta Fish And Wildlife
650 Capitol Mall
Suite 8-300
Sacramento, CA 95814
Phone: (916) 930-5603 Fax: (916) 930-5654
http://kim_squires@fws.gov

In Reply Refer To: February 01, 2021
Consultation Code: 08FBDT00-2021-SLI-0084
Event Code: 08FBDT00-2021-E-00208
Project Name: West Oakland Link

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

San Francisco Bay-Delta Fish And Wildlife
650 Capitol Mall
Suite 8-300
Sacramento, CA 95814
(916) 930-5603

This project's location is within the jurisdiction of multiple offices. Expect additional species list documents from the following office, and expect that the species and critical habitats in each document reflect only those that fall in the office's jurisdiction:

Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
(916) 414-6600

Project Summary

Consultation Code: 08FBDT00-2021-SLI-0084
Event Code: 08FBDT00-2021-E-00208
Project Name: West Oakland Link
Project Type: ** OTHER **
Project Description: The proposed project is the West Oakland Link (Project or Link). It is a new bicycle/pedestrian path connection between West Oakland and the bike path leading to the East Span of the San Francisco Oakland Bay Bridge (Bay Bridge) in Oakland, California. The Link would provide safe access to the newly constructed bicycle/ pedestrian path connecting to and on the Bay Bridge (Bay Bridge Trail), as well as access to existing and planned segments of the regional San Francisco Bay Trail and a connection between West Oakland and the Port via the Class I trail along the east side of Maritime Street.

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@37.8204801,-122.29326774642007,14z

Counties: Alameda County, California

Endangered Species Act Species

There is a total of 12 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
Salt Marsh Harvest Mouse *Reithrodontomys raviventris* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/613	Endangered

Birds

NAME	STATUS
California Clapper Rail *Rallus longirostris obsoletus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/4240	Endangered
California Least Tern *Sterna antillarum browni* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8104	Endangered
Western Snowy Plover *Charadrius nivosus nivosus* Population: Pacific Coast population DPS-U.S.A. (CA, OR, WA), Mexico (within 50 miles of Pacific coast) There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/8035	Threatened

Reptiles

NAME	STATUS
Alameda Whipsnake (=striped Racer) *Masticophis lateralis euryxanthus* There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/5524	Threatened
Green Sea Turtle *Chelonia mydas* Population: East Pacific DPS No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/6199	Threatened

Amphibians

NAME	STATUS
California Red-legged Frog *Rana draytonii* There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/2891	Threatened

Fishes

NAME	STATUS
Delta Smelt *Hypomesus transpacificus* There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/321	Threatened
Tidewater Goby *Eucyclogobius newberryi* There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/57	Endangered

Insects

NAME	STATUS
San Bruno Elfin Butterfly *Callophrys mossii bayensis* There is **proposed** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/3394	Endangered

Flowering Plants

NAME	STATUS
California Seablite *Suaeda californica* Population: No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/6310	Endangered
Santa Cruz Tarplant *Holocarpha macradenia* There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/6832	Threatened

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

NMFS Species List[1]

Quad Name Oakland West
Quad Number 37122-G3

ESA Anadromous Fish

SONCC Coho ESU (T) -
CCC Coho ESU (E) -
CC Chinook Salmon ESU (T) -
CVSR Chinook Salmon ESU (T) - X
SRWR Chinook Salmon ESU (E) - X
NC Steelhead DPS (T) -
CCC Steelhead DPS (T) - X
SCCC Steelhead DPS (T) -
SC Steelhead DPS (E) -
CCV Steelhead DPS (T) - X
Eulachon (T) -
sDPS Green Sturgeon (T) - X

ESA Anadromous Fish Critical Habitat

SONCC Coho Critical Habitat -
CCC Coho Critical Habitat -
CC Chinook Salmon Critical Habitat -
CVSR Chinook Salmon Critical Habitat -
SRWR Chinook Salmon Critical Habitat - X
NC Steelhead Critical Habitat -
CCC Steelhead Critical Habitat - X
SCCC Steelhead Critical Habitat -
SC Steelhead Critical Habitat -
CCV Steelhead Critical Habitat -
Eulachon Critical Habitat -
sDPS Green Sturgeon Critical Habitat - X

ESA Marine Invertebrates

[1] Species or critical habitat designations marked with an "X" marked may occur within the Oakland West quadrant. Species or critical habitat designations that are not marked with an "X" do not occur within the Oakland West quadrant.

Range Black Abalone (E) -
Range White Abalone (E) -

ESA Marine Invertebrates Critical Habitat

Black Abalone Critical Habitat -

ESA Sea Turtles

East Pacific Green Sea Turtle (T) -
Olive Ridley Sea Turtle (T/E) -
Leatherback Sea Turtle (E) -
North Pacific Loggerhead Sea Turtle (E) -

ESA Whales

Blue Whale (E) -
Fin Whale (E) -
Humpback Whale (E) -
Southern Resident Killer Whale (E) -
North Pacific Right Whale (E) -
Sei Whale (E) -
Sperm Whale (E) -

ESA Pinnipeds

Guadalupe Fur Seal (T) -

Steller Sea Lion Critical Habitat -

Essential Fish Habitat

Coho EFH -	X
Chinook Salmon EFH -	X
Groundfish EFH -	X
Coastal Pelagics EFH -	X
Highly Migratory Species EFH -	

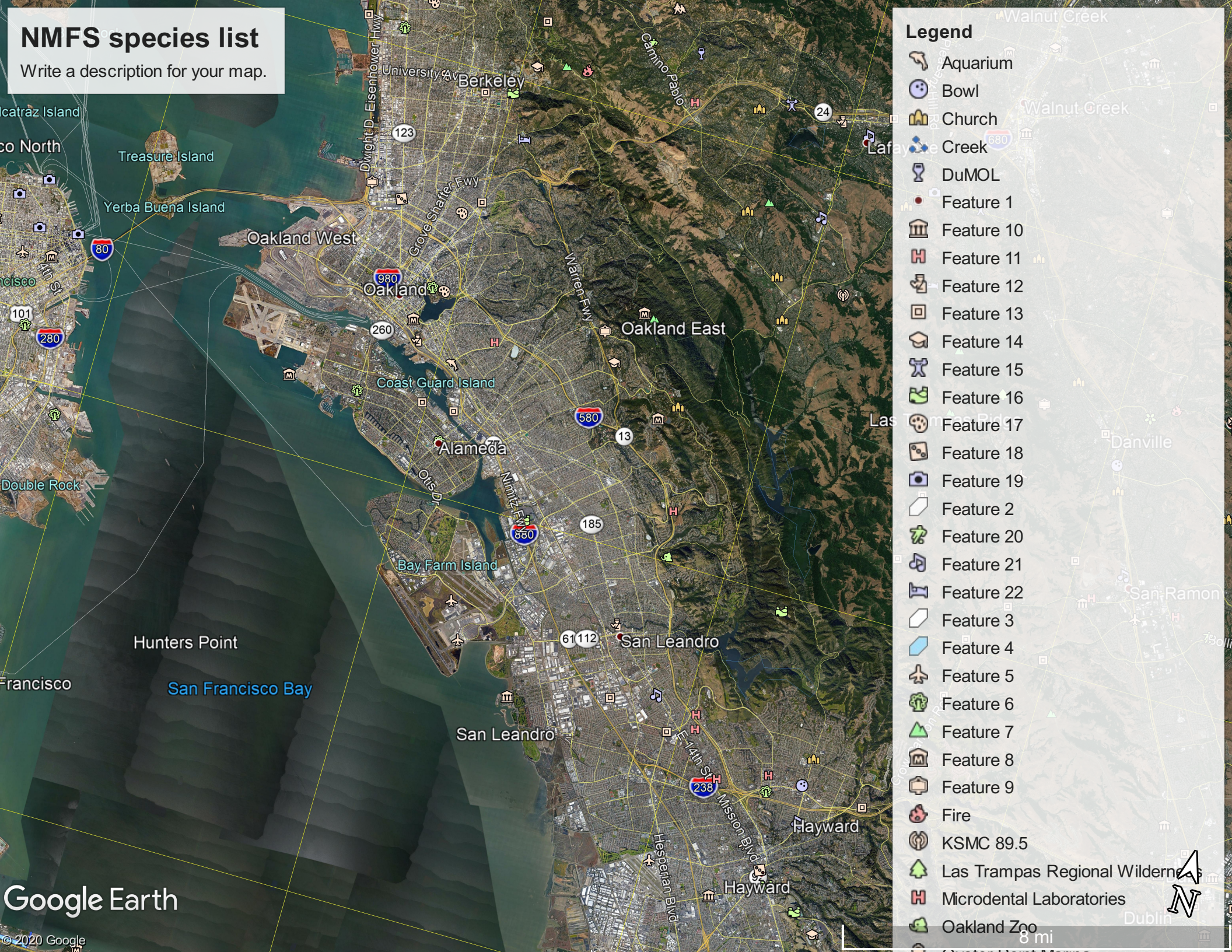
MMPA Species

ESA and MMPA Cetaceans/Pinnipeds

MMPA Cetaceans -
MMPA Pinnipeds - X

NMFS species list

Write a description for your map.



Legend

- Aquarium
- Bowl
- Church
- Creek
- DuMOL
- Feature 1
- Feature 10
- Feature 11
- Feature 12
- Feature 13
- Feature 14
- Feature 15
- Feature 16
- Feature 17
- Feature 18
- Feature 19
- Feature 2
- Feature 20
- Feature 21
- Feature 22
- Feature 3
- Feature 4
- Feature 5
- Feature 6
- Feature 7
- Feature 8
- Feature 9
- Fire
- KSMC 89.5
- Las Trampas Regional Wilderness
- Microdental Laboratories
- Oakland Zoo

Appendix G-1

Cultural Resources Background Information

Cultural Resources Background Information

This information was compiled by ICF cultural resources specialists to provide additional background information to supplement the information contained in Section 2.5, Cultural Resources, of the Initial Study prepared for the San Francisco-Oakland Bay Bridge Regional Bicycle/Pedestrian Connection Project. Additionally, ICF prepared the Historic Resources Evaluation Report and the Archaeological Survey Report, which are separately bound documents (2014).

G.1. Ethnography

At the time of European contact, the Bay Area was occupied by a group of Native Americans whom ethnographers refer to as the Ohlone or Costanoan. The Ohlone are a linguistically defined group composed of several autonomous tribelets that spoke eight different but related languages. The Ohlone languages, together with Miwok, comprise the Utian language family of the Penutian stock. The territory of the Ohlone people extended along the coast from the Golden Gate in the north to just below Carmel to the south, and as far as 60 miles inland (Levy 1978:485–486).

The Project area lies within the tribal group known as the Huchiun. The Huchiun appear to have had extensive land along the East Bay shore, from Temescal Creek opposite the Golden Gate north at least to the lower San Pablo and Wildcat Creek drainages in the present area of Richmond. The first large groups of Huchiuns came to Mission San Francisco in the fall of 1794, where they were identified as "Jutchiunes-All from the northeast of the mission". Somewhere before 1820, the Mission founded a cattle ranch in the Richmond, San Pablo area, which they called "San Ysidro of the Juchiunes". That mission ranch, taken over during the 1820s by the Castro family, became the Mexican rancho called "San Pablo, alias Los Cuchiyunes" (Milliken 1995:243).

Seven Spanish missions were founded in Ohlone territory between 1776 and 1797. While living within the mission system, the Ohlone commingled with other groups, including the Esselen, Yokuts, Miwok, and Patwin. Mission life was devastating to the Ohlone population. It has been estimated that in 1776, when the first mission was established in Ohlone territory, the Ohlone population numbered around 10,000. By

1832, the Ohlones numbered less than 2,000 as a result of introduced disease, harsh living conditions, and reduced birth rates (Cook 1943a, 1943b in Levy 1978:486).

Under the Mexican government, secularization of the mission lands began in earnest in 1834. The indigenous population scattered away from the mission centers, and the few that were given rancherias from the mission lands were ill-equipped to maintain or work their land. Most of the former mission land was divided among loyal Mexican subjects, and the Ohlone who chose to remain in their ancestral territory usually became squatters. Some were given jobs as manual laborers or domestic servants on Mexican ranchos or, later, American cattle ranches. During the next few decades, there was a partial return to aboriginal religious practices, particularly shamanism, and some return to food collection as a means of subsistence (Levy 1978:486–487).

Although they have yet to receive formal recognition from the federal government, the Ohlone are becoming increasingly organized as a political unit and have developed an active interest in preserving their ancestral heritage. In the later part of the twentieth century, the Galvan family of Mission San José worked closely with the American Indian Historical Society and "successfully prevented destruction of a mission cemetery that lay in the path of a proposed freeway. These descendants incorporated as the Ohlone Indian Tribe, and now hold title to the Ohlone Indian Cemetery in Fremont" (Yamane 1994 in Bean 1994:xxiv). Many Ohlone are active in maintaining their traditions and advocating for Native American issues.

G.2. Prehistory

Milliken et al. (2007) present a series of culture changes in the Bay Area. The period of occupation during the cal 11,500 to 8000 B.C., when Clovis big-game hunters, then initial Holocene gatherers, presumably lived in the area, lacks evidence, because such evidence has likely been washed away by stream action, buried under more recent alluvium, or submerged on the continental shelf (Rosenthal and Meyer 2004:1). There is evidence, however, that an in-place forager economic pattern began around cal 8000 B.C., and was followed by five cycles of change that began at approximately cal 3500 B.C.

G.2.1. Early Holocene (Lower Archaic), cal 8000–3500 B.C.

During this time period, the archaeological record displays artifacts such as wide-stemmed point types that are typified by the relatively well-represented Borax Lake Wide Stem. Milling implements such as handstones and milling slabs were more prevalent, signifying the increased use of, and reliance on, plant resources. Small, far-ranging groups represented a mobile forager settlement pattern (Fredrickson 1989); however, their activities are more visible in the archaeological record. Furthermore, social systems appeared to develop and be more elaborate (Milliken et al. 2007:114).

G.2.2. Early Period (Middle Archaic), cal 3500–500 B.C.

Several technological and social developments characterize this period in the Bay Area. Rectangular *Haliotis* and *Olivella* shell beads, the markers of the Early Period bead horizon, continued in use until at least 2,800 years ago (Ingram 1998; Wallace and Lathrop 1975:19). The mortar and pestle were first documented in the Bay Area shortly after 4000 B.C., and by 1500 cal B.C., cobble mortars and pestles, and not millingslabs and handstones, were used at sites throughout the Bay Area, including ALA-307 (West Berkeley) and ALA-483 (Livermore Valley) (Wiberg 1996:373).

G.2.3. Lower Middle Period (Initial Upper Archaic), cal 500 B.C.–cal A.D. 430

Although it is unclear when the "major disruption in symbolic integration systems" originated, it is clear in the record around 500 B.C. and may have begun several hundred years earlier (Milliken et al. 2007:115). Rectangular shell beads disappeared from the Bay Area, Central Valley, and portions of Southern California during this time; and a whole new suite of decorative and presumed religious objects appeared during the Early Period-Middle Period Transition (EMT) (Elsasser 1978), which corresponds to the beginning of this period. Net sinkers, a typical early period marker throughout the Bay, disappeared from most sites, with the exception of SFR-112, where they continued in use well into the Middle Period (Pastron and Walsh 1988:90).

G.2.4. Upper Middle Period (Late Upper Archaic), A.D. cal 430–1050

Around 430 A.D., the *Olivella* saucer bead trade network collapsed, and over half of known bead horizon M1 sites were abandoned, while the remaining sites saw a large increase in sea otter bones. Additionally, the Meganos extended burial mortuary pattern began to spread in the interior East Bay (Bennyhoff 1994a, 1994c). At the

same time that these changes were happening, a series of *Olivella* saddle bead horizons that would come to be known as M2, M3, and M4 were developing (Milliken et al. 2007:116).

G.2.5. Initial Late Period (Lower Emergent), A.D. CAL 1050–1550

Fredrickson (1973) coined the term "Emergent" to describe this period, in recognition of the appearance of a new level of sedentism, status ascription, and ceremonial integration in lowland central California. The Middle/Late Transition (MLT) bead horizon, previously thought to have occurred around A.D. 300, is now largely believed to have occurred around cal A.D. 1000 (Milliken et al. 2007:116). During the MLT, burial objects became much more elaborate, and initial markers of the Augustine Pattern appeared in the form of multiperforated and bar-scored *Haliotis* ornaments, fully shaped show mortars, and new *Olivella* bead types. Classic Augustine Pattern markers, which appeared in Bead Horizon L1 (after cal A.D. 1250), include the arrow, flanged pipe, *Olivella* callus cup bead, and the banjo effigy ornament (Bennyhoff 1994b). The Stockton serrated series, the first arrow-sized projectile point in the Bay Area, also appeared after A.D. 1250 (Milliken et al. 2007:116-117).

G.2.6. Terminal Late Period: Protohistoric Ambiguities

Changes in artifact types and mortuary objects characterized A.D. cal 1500–1650. The signature Olivella sequin and cup beads of the central California L1 Bead Horizon abruptly disappeared, and clamshell disk beads, markers of the L2 Bead Horizon, spread across the North Bay (Milliken et al. 2007:117). Toggle harpoons, hopper mortars, plain corner-notched arrow-sized projectile points, clamshell disk beads, magnesite tube beads, and secondary cremation all also appeared in the North Bay first during this period (Milliken et al. 2007:117).

Another upward cycle of regional integration was commencing when it was interrupted by Spanish settlement in the Bay Area beginning in 1776. Such regional integration was a continuing characteristic of the Augustine Pattern, most likely brought to the Bay Area by Patwin speakers from Oregon, who introduced new tools (such as the bow) and traits (such as pre-internment grave pit burning) into central California. Perhaps the Augustine Pattern, with its inferred shared regional religious and ceremonial organization, was developed as a means of overcoming insularity, not in the core area of one language group but in an area where many neighboring language groups were in contact (Milliken et al. 2007:118).

G.3. History

G.3.1. Early Occupation and Development in Oakland

The land that is now Oakland was part of the Mexican land grant given to Luis Maria Peralta in 1820. The Rancho San Antonio encompassed approximately 44,800 acres of land, covering virtually all of today's Oakland, San Leandro, Alameda, Piedmont, Emeryville, Berkeley, and Albany. In 1842, Peralta divided his rancho among his four sons (Marschner 2001:149-153).

Oakland was incorporated by the state legislature in May of 1852. Commercial and industrial development concentrated around and near the wharves as early as 1854, when the ferryboat service to San Francisco was established. In 1863, the San Francisco and Oakland Railroad was completed and began operation along Railroad Avenue (now 7th Street), extending from Oakland Point (now West Oakland) to Broadway. However, the population as well as businesses in Oakland saw its first major boom when the transcontinental railroad terminus was completed in Oakland in 1869. Transportation developments, such as the Caldecott Tunnel and the Bay Bridge, connected the City of Oakland to the surrounding communities. World War I (1914–1918) and World War (1939–1945) brought heavy maritime industry to the area of Oakland known as West Oakland.

G.3.2. Development in West Oakland

For much of its history, West Oakland, also called Oakland Point, was a peninsula surrounded by the San Antonio Estuary, Lake Merritt tidal slough, and marshy shores at the Bay west of Pine and Cedar Street. It extended from 16th Street on the south to 28th Street on the north, coming inland as far as Adeline Street.

Development in West Oakland has been closely tied to its railroad, military and maritime industries. In 1869, the transcontinental railroad terminus created the wharf extension 2 miles inland to accommodate hefty ships carrying cargo. The railroad lines along 1st and 7th Streets brought residential, commercial and industrial development to West Oakland. As early as the 1870s, with the help of the transcontinental railroad, West Oakland would become a railroad town which gradually expanded over parts of the marshlands. The headquarters for the railroad's Northern California maintenance, construction, and shipbuilding operations were located in West Oakland, which employed about half of the local residents.

In 1909, Western Pacific Railroad added railroad tracks and a freight depot in West Oakland, about 2 miles south of the Project area. A lesser known industrial district developed in the Project area, but more slowly due to the obstacles created by the natural landscape (marshlands).

The Outer Harbor and area east of the railroad tracks did not see development until well into the 1920s, when automobile and truck transportation became more prevalent; and the Bay Bridge was constructed, enabling industrial and warehouse development away from the railroad lines. By 1920, there were some scattered strips of industrial development along Peralta Street and 22nd Street east of the tracks.

By 1935, this area was zoned for heavy industry, and several prominent industries were located west of Peralta Street. These include Pacific Coast Aggregates and Merco Nordstrom Valve Company at 24th and Peralta Streets, and the brick warehouse at 18th and Campbell Streets. However, complete industrial development of the Project area in West Oakland would not occur until the purchase of the Outer Harbor by the U.S. Army during World War II and the later boom of the post war years. The Army took control of the entire Outer Harbor by 1941 and developed the areas between Maritime Street and the railroad tracks. They filled marshlands, opening the area east of the tracks for further development.

In 1943, the port was completed and comprised of 13 deep draft ship berths, approximately 175 buildings and structures, 27 miles of rail tracks, and millions of square feet of open and covered storage. A majority of these facilities and structures were dedicated to operational aspects of the World War II mission. Military activities in the area continued with the Korean War in 1950, the Viet Nam war in the 1960s and 1970s, and Desert Storm in the early 1990s.

In 1995, the Defense Base Realignment and Closure Commission recommended the Oakland Army Base be closed. As a result, the Oakland Base Reuse Authority was created to oversee the closure and transfer to the Oakland Redevelopment Agency and the Port of Oakland. Military activity on the base officially ceased in 1999. The former base property was to be shared by the City and the Port, and the title was transferred on August 7, 2006 (Minor 2006: 3).

Currently, demolition of much of the Oakland Army Base is underway and is being redeveloped by the City of Oakland and the Port of Oakland.

G.4. Section 106 of the National Historic Preservation Act and National Register of Historic Places

Section 106 of the National Historic Preservation Act (NHPA) requires that, before beginning any undertaking, a federal agency must take into account the effects of the undertaking on historic properties and offer the Advisory Council on Historic Preservation (ACHP) and other interested parties an opportunity to comment on these actions. Specific regulations regarding compliance with Section 106 state that, although the tasks necessary to comply with Section 106 may be delegated to others, the federal agency is ultimately responsible for ensuring that the Section 106 process is completed.

The Section 106 review process involves a five-step procedure.

1. Initiate the Section 106 process (assess the ability of the undertaking to affect historic properties, identify consulting parties, and plan to involve interested parties).
2. Identify historic properties in the Area of Potential Effect (APE).
3. Assess adverse effects.
4. Resolve adverse effects.
5. Implement the project according to the memorandum of agreement (MOA), or implement project without an MOA if no agreement is necessary.

Section 106 requires federal agencies or those they fund or permit to consider the effects of their actions on properties that are determined eligible for listing or are listed in the NRHP. To determine whether an undertaking could affect NRHP-eligible properties, cultural resources (including archaeological, historical, architectural, and traditional cultural properties) must be inventoried and evaluated for the NRHP. To be listed in the NRHP, a property must be at least 50 years old (or be of exceptional historic significance if less than 50 years old) and meet one or more of the NRHP criteria. To qualify for listing, a *historic property* must represent a significant theme or pattern in history, architecture, archaeology, engineering, or culture at the local, state, or national level. It must meet one or more of the four criteria listed below and have sufficient integrity to convey its historic significance. The criteria for evaluating the eligibility of a historic property for listing in the NRHP are defined in 36 CFR Section 60.4 as follows.

- Criterion A – Association with events that have made a significant contribution to the broad patterns of our history.

- Criterion B – Association with the lives of persons significant to our past.
- Criterion C – Resources that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction.
- Criterion D – Resources that have yielded, or may be likely to yield, information important to history or prehistory.

In addition to meeting the significance criteria, a significant historic property must possess integrity to be considered eligible for listing in the NRHP. *Integrity* refers to a property's ability to convey its historic significance (U.S. Department of Interior 1991:44). Integrity is a quality that applies to historical resources in seven specific ways: location, design, setting, materials, workmanship, feeling, and association. To be considered a significant historic property, a resource must possess two, and usually has more, of these kinds of integrity, depending on the context and the reasons why the property is significant. National Park Service (NPS) Bulletin 15, *How to Apply the National Register Criteria for Evaluation* (National Park Service 2002), discusses the types of integrity:

- *Location* – the place where the historic property was constructed or the place where the historic event took place.
- *Design* – the combination of elements that create the form, plan, space, structure, and style of a property.
- *Setting* – the physical environment of a historic property.
- *Materials* – the physical environments where combined or deposited during a particular period of time and in a particular pattern or configuration to form a historic property.
- *Workmanship* – the physical evidence of the crafts of a particular culture or people during any given period in history or prehistory.
- *Feeling* – a property's expression of the aesthetic or historic sense of a particular period of time.
- *Association* – the direct link between an important historic event or person and a historic property. (National Park Service 2002)

The NRHP criteria also limit the consideration of moved properties because significance is embodied in locations and settings. Under NRHP, moving a building destroys the integrity of location and setting. A moved property can be eligible for listing if it is significant primarily for architectural value or if it is the surviving

property most importantly associated with a historic person or event (National Park Service 2002).

Section 106 regulations define an adverse effect as an effect that alters, directly or indirectly, the qualities that make a resource eligible for listing in the NRHP (36 CFR Part 800.5[a][1]). Consideration must be given to the property's location, design, setting, materials, workmanship, feeling, and association, to the extent that these qualities contribute to the integrity and significance of the resource. Adverse effects may be direct and reasonably foreseeable, or may be more remote in time or distance (36 CFR Part 8010.5[a][1]). Examples of adverse effects are listed below.

- Physical destruction of or damage to all or part of the property.
- Alteration of a property, including restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation, and provision of handicapped access, that is not consistent with the *Secretary's Standards for the Treatment of Historic Properties* (Weeks and Grimmer 1995) and applicable guidelines.
- Removal of the property from its historic location.
- Change of the character of the property's use or of physical features within the property's setting that contribute to its historic significance.
- Introduction of visual, atmospheric, or audible elements that diminish the integrity of the property's significant historic features.
- Neglect of a property that causes its deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance to a Native American tribe or Native Hawaiian organization.
- Transfer, lease, or sale of property out of federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of the property's historic significance.

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Appendix G-2

Cultural Resources (APE, HPSR, HRER, ASR) Technical Errata

Memorandum

To:	John Kenyon and Snehalatha Pavuluri, TYLin
From:	Lily Arias, ICF Archaeologist David Lemon, ICF Senior Architectural Historian Diana Roberts, ICF Project Manager,
Date:	May 11, 2022
Re:	**Cultural Resources (APE, HPSR, HRER, ASR) Technical Errata**

Dear Mr. Kenyon and Ms. Pavuluri,

The below documentation serves as an update to the existing regulatory and environmental conditions at the project site regarding cultural resources as of 2020. As needed, effect conclusions are updated as well. This errata memorandum was prepared by ICF staff member Lily Arias, archaeologist, and David Lemon, senior architectural historian. This memorandum includes the following sections:

- Project Description
- Setting
- Effects Analysis
- Conclusion

Project Description

The footprint for the project has not changed since the San Francisco-Oakland Bay Bridge Regional Bicycle/Pedestrian Connection Initial Study/Mitigated Negative Declaration (IS/MND) was drafted in 2014. However, the project proponent has introduced three phasing options to guide construction.

The Link may be implemented in more than one phase to respond to timing considerations and the availability of funds as well as the schedule for related projects. The sections that follow discuss the possible phasing options. All Class II bicycle lanes and bicycle boxes would be installed as part of the initial period of construction, regardless of phasing option.

Phasing Option 1

Phasing Option 1 would construct approximately 2,900 feet of Class I path structure, beginning approximately 600 feet east of Maritime Street and continuing to the Bay Bridge Trail. Starting from the east, the structure would begin approximately 600 feet east of Maritime Street with an interim connection to the multi-use path, which was installed as part of the high-occupancy vehicle/bus extension project. Under Phasing Option 1, the West Oakland Link profile would be lowered to tie in to West Grand Avenue. The structure would continue west, parallel to West Grand Avenue. The elevated Link structure would span Maritime Street and the existing at-grade railroad crossings near Burma Road. The structure would then continue under the Interstate 80 ramps and tie in at the connection to the Bay Bridge Trail. Construction under the initial build portion of Phasing Option 1 would correspond to a portion of Segment 4 and all of Segment 5.

When additional funding for construction is available, the Link would be extended to Mandela Parkway. The interim connection to West Grand Avenue could either be demolished or retained as an emergency access point. The remaining easterly portion of Segment 4 would be constructed with a slightly revised vertical profile. Segments 1 through 3 as well as the ramps to Maritime Street and Oakland Maritime Support Services (OMSS) (the remainder of Segment 4) would also be constructed.

Phasing Option 2

Phasing Option 2 would be similar to Phasing Option 1. However, a 600-foot segment on the east side of Maritime Street would be designed and constructed so that the bridge deck could be raised during a future phase of the project, providing a smooth profile and minimizing elevation changes for the Link under the full build condition. Construction under the initial build portion of Phasing Option 2 would correspond to a portion of Segment 4 and all of Segment 5.

When additional funding for construction becomes available, the Link would be extended to Mandela Parkway. The above-mentioned 600 feet of the bridge deck could be raised to its final elevation by extending the bridge columns. Segments 1 through 3, the remaining easterly portion of Segment 4, and the ramps to Maritime Street and OMSS would also be constructed.

Phasing Option 3

Phasing Option 3 would construct Segment 4, except for the ramps to Maritime Street, OMSS, and Segment 5 of the Link project.

When additional funding for construction is available, Segments 1 through 3 and the ramps to Maritime Street and OMSS could be constructed.

Area of Potential Effects

The changes in the project have not resulted in changes to either the horizontal or vertical Area of Potential Effects (APE).

Setting

Changes in the Setting

Archaeological Resources

A records search was conducted at the Northwest Information Center of the California Historical Resources Information System in April 2014. An updated records search was not performed as part of this errata. The project site remains within a developed area; since the original analysis was conducted, new buildings have been constructed on the former Oakland Army Base.

Built-Environment Resources

Eight buildings in the APE have been completely or partially demolished during and since preparation of the 2015 Historical Resources Evaluation Report (HRER). These buildings were once part of the northeast section of the former Oakland Army Base Historic District. As indicated in the 2015 HRER, because of demolition activities at the time of preparation of the HRER, ICF—with California Department of Transportation Professionally Qualified Staff approval—excluded the former historic district from the architectural APE. Outright and partial demolition of the eight buildings represents the only change in setting for built-environment resources.

Changes in Regulatory Setting

Archaeological Resources

Assembly Bill 52 – Tribal Cultural Resources

Since preparation of the Archaeological Survey Report (ASR) in 2015, Assembly Bill 52 (AB 52) has been passed into law. It applies to all California Environmental Quality Act (CEQA) projects with a Notice to Proceed dated after July 15, 2015. AB 52, which amended the Public Resources Code, requires lead agencies to participate in formal consultations with California Native American tribes during the CEQA process, if requested by any tribe, to identify tribal cultural resources that may be subject to significant impacts by a project. Where a project may have a significant impact on a tribal cultural resource, the lead agency's environmental document must discuss the impact and whether feasible alternatives or mitigation measures could avoid or substantially lessen the impact. Consultation is required until the parties agree to measures to mitigate or avoid a significant effect on a tribal cultural resource or it is concluded that mutual agreement cannot be reached.

A tribal cultural resource can be 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. It must be either on or eligible for the California Register of

Historical Resources or a local historic register; otherwise, the lead agency, at its discretion and supported by substantial evidence, may choose to treat the resource as a significant tribal cultural resource.

Formal notification letters were sent out pursuant to AB 52 on October 19, 2020.

Built-Environment Resources

There are no changes in the regulatory setting for built-environment resources.

Effects Analysis

Changes in Methods

Archaeological Resources

To assess the potential to affect as-yet undocumented tribal cultural resources, which are often also archaeological resources, the Native American Heritage Commission (NAHC) was requested to conduct a search. The request was submitted on September 29, 2020. The NAHC responded on October 5, 2020, providing a list of 10 California Native American tribal representatives. A formal notification, pursuant to AB 52, was sent to the three individuals as well as the seven additional California Native American tribal representatives on October 19, 2020. No responses were received from California Native American Tribes within the requested time for responses between October 19 and November 30, 2020. One Tribal representative requested a copy of the cultural resources Initial Study section in April 2021 but otherwise raised no concerns or identified any issues. No formal consultation was requested.

Built-Environment Resources

There are no changes in the methods for analyzing potential effects on built-environment resources.

Changes in Effects

Archaeological Resources

No changes in effects are anticipated.

Built-Environment Resources

No changes in effects on built-environment resources are anticipated as a result of project phasing.

Conclusion

Archaeological Resources

Despite the age of the records search, neither the horizontal nor vertical APE has changed. One tribal representative requested a copy of the cultural resources Initial Study section in April 2021 but otherwise raised no concerns or identified any issues and did not request consultation. Therefore, the conclusions in the 2015 ASR have not changed.

Built-Environment Resources

Given that neither the horizontal nor vertical APE has changed since approved by the California Department of Transportation Professionally Qualified Staff in 2015 and the changes in the affected environment would not result in adverse effects, it is likely that the conclusions in the 2015 HRER have not changed.

As noted above, eight buildings that were previously part of the northeast section of the *former* Oakland Army Base Historic District in the APE have been completely or partially demolished since preparation of the 2015 HRER. The 2015 HRER acknowledged that these district contributors were undergoing demolition at the time the report was prepared and concluded that the project would not result in an adverse effect on the former historic property. The 2015 HRER also identified four historic properties in the APE. These properties were in the West Oakland warehouse district north and south of West Grand Avenue. All four were determined eligible for listing in the National Register of Historic Places (NRHP) as part of the 2015 study. The HRER concluded that the project would not result in direct or indirect adverse effects on the four historic properties because the elevated portion of the proposed Link structure would travel along the south side of West Grand Avenue, with an elevated ascent similar to that of West Grand Avenue. As such, the proposed elevated Link structure would not have an indirect visual effect on the NRHP-eligible properties on the south side of West Grand Avenue.

Appendix H

Preliminary Foundation Report

FUGRO CONSULTANTS, INC.

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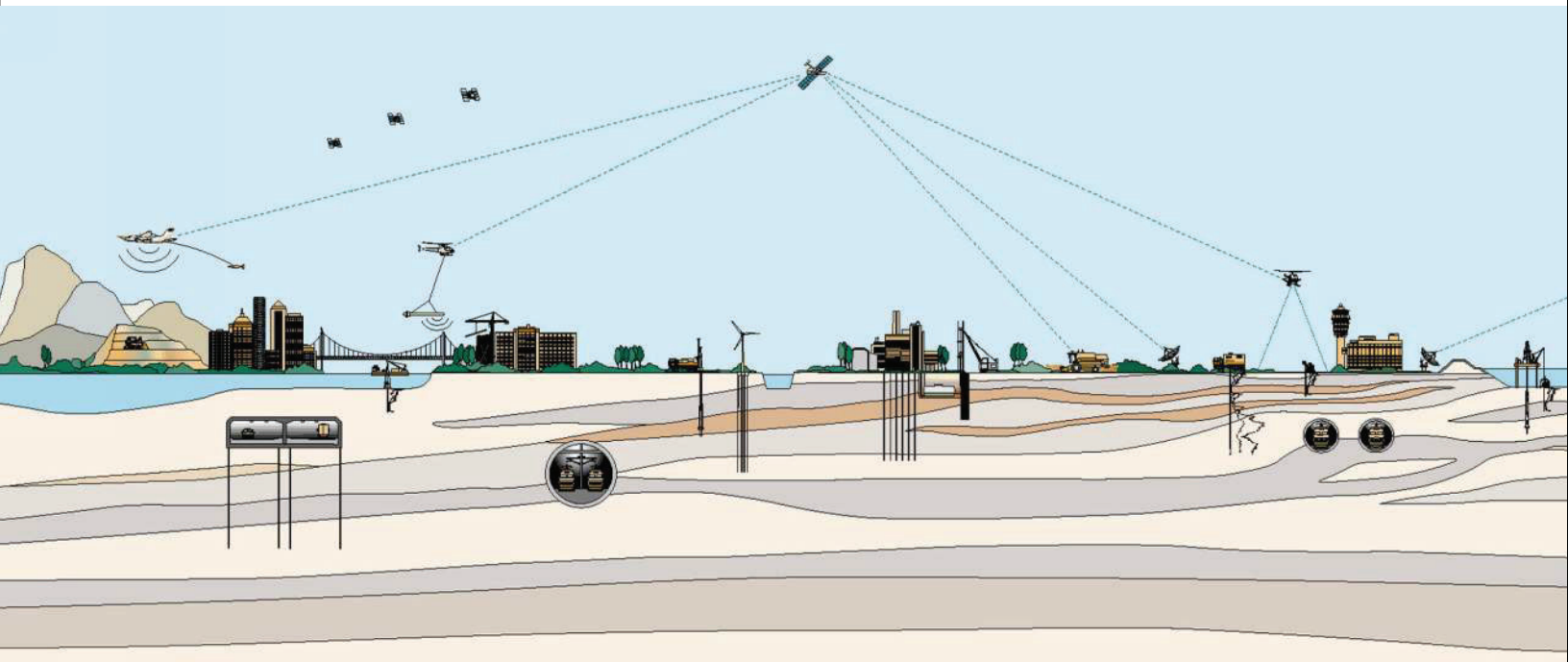
PRELIMINARY FOUNDATION REPORT
SAN FRANCISCO OAKLAND BAY BRIDGE
BICYCLE/PEDESTRIAN CONNECTION
OAKLAND, CALIFORNIA

Prepared for:
TY Lin International

November 2014
Fugro Project No. 04.72130012



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November 14, 2014
Project No. 04.72130012

TY Lin International
1111 Broadway, Suite 2150
Oakland, California 94607

Attention: Ms. Eva Lillie

Subject: Preliminary Foundation Report, San Francisco Oakland Bay Bridge Bicycle /Pedestrian Connection
Oakland, California

Dear Ms. Lillie:

Fugro Consultants, Inc. is pleased to present this revised Preliminary Foundation Report (PFR) for the proposed San Francisco Oakland Bay Bridge Bicycle / Pedestrian Connection (Path) Project in Oakland, California. We have updated our report in accordance with the Caltrans reviewer's comments dated October 8, 2014. Our findings, opinions, conclusions and recommendations are based on applicable standards of our profession at the time this report was prepared.

We thank you for the opportunity to be of service to TY Lin International. If you should have any questions or require additional information on this PFR, please call the undersigned at (510) 267-4422.

Sincerely,

FUGRO CONSULTANTS, INC.

Timothy Chi-To Wong, P.E., G.E.
Associate Engineer

W. Andrew Herlache, P.E., G.E.
Senior Principal Engineer

CTW/WAH:afp

Copies Submitted: (3) Addressee and pdf file on CD

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1.0 INTRODUCTION

This report presents the results of a preliminary geotechnical study prepared by Fugro for the San Francisco Oakland Bay Bridge Bicycle /Pedestrian Connection (Path) Project in Oakland, California (Vicinity Map, Figure 1). Fugro completed this Preliminary Foundation Report (PFR) on behalf of TY Lin International (TY Lin) and the Gateway Park Working Group, which is composed of nine local, regional, and state agencies including Bay Area Transit Authority (BATA), Caltrans, San Francisco Bay Conservation and Development Commission (BCDC), Alameda County Transportation Commission (CTC), East Bay Regional Park District (EBRPD), City of Oakland, Port of Oakland, East Bay Municipal District (EBMUD) and Association of Bay Area Governments' (ABAG) Bay Trail Project.

The Connection is part of the larger Gateway Park Project (Site Plan, Plate 1a) which encompasses five development areas located near the Oakland-touchdown of the new eastern span of the Bay Bridge. The five development areas are known as Key Point, Port Playground, Windbreak, Bridgeyard, and Radio Beach. These areas along with a sixth area known as Landscaping are presented in a separate report. The Connection project includes of a bicycle /pedestrian path (Class I[1]) divided into five segments. The five segments include an at-grade connection to Mandela Parkway, a separate elevated structure to the east, a West Grand Avenue overcrossing (including a Class III[3] section), a separate elevated structure to the west, and an at-grade connection to the Bay Bridge Trail. Future improvements could include: 1) a gravel parking lot (about 100 parking spaces) west of Wood Street (between 24th Street and West Grand Avenue), 2) landscaping areas, 3) an art statue by Mandela Parkway, and 4) a bike path (Class II[2]) at-grade near the eastern end of the project. These other improvements (including the at-grade connection to Mandela Parkway) will be discussed in the preliminary Geotechnical Design Report (GDR).

2.0 PURPOSE AND SCOPE OF USE

The purpose of this PFR is to summarize previous field investigations and subsurface conditions in the project vicinity, evaluate the seismic hazard conditions, make preliminary foundation recommendations, and identify the need for additional geotechnical investigations or studies for the proposed project.

3.0 PROPOSED STRUCTURE

Based on the layout plan dated June 5, 2014 (Appendix A), the proposed multi-span bicycle/pedestrian path structures are about 1.14 mile long in total length including the at grade segment which is about 450 feet long. According to TY Lin, the elevated structures (except part of Segment 3) are planned to be supported by Cast-In-Drilled Hole (CIDH) piles that are approximately 6 to 7 feet in diameter. The bicycle/pedestrian path has been divided into the five segments described below from east to west.

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[1] Class I bikeways (bike paths) are separate paths with exclusive right of way for bicycles and pedestrians, with minimal vehicular crossings.

[2] Class II bikeways (bike lanes) are striped lanes on streets, separating bicycles from vehicles, within the road right-of-way.

[3] Class III bikeways (bike routes) are lanes shared with motor vehicles

3.1 SEGMENT 1 - AT-GRADE CONNECTION TO MANDELA PARKWAY

Between Mandela Parkway and Campbell Street at West Grand Avenue, the new bicycle/pedestrian path would be a 15-foot wide Class I at-grade path along the south side of West Grand Avenue for approximately 450 feet. A landscape medium will be on the north side of the path to separate the path from vehicular traffic. A Cul-de-sac will be created at Willow Street to prevent vehicular traffic from crossing the new Class I bike path. An emergency vehicle access will be located at the intersection of Campbell Street and West Grand Avenue.

From Mandela Parkway at 20th Street (one block south of West Grand Avenue), there would be Class II bicycle lanes along 20th Street to Wood Street and along Wood Street to 24th Street and the proposed 100-space parking lot on the west side of Wood Street.

3.2 SEGMENT 2 - SEPARATE ELEVATED STRUCTURE EAST

From Campbell Street, the Class I path would be continue for approximately 1050 feet as a separate structure along the south side of West Grand Avenue and would begin an elevated ascent similar to West Grand Avenue, crossing at Wood Street. After the Wood Street crossing, the new path would continue on the West Grand Avenue bridge structure (refer to Segment 3 below).

The existing Grand Avenue Alley would be required to be permanently closed to traffic. A pedestrian sidewalk would remain along with the landscaping under the structure. The Grand Avenue Alley is the narrow, one-way street on the south side of Grand Avenue between Mandela Parkway and Wood Street.

3.3 SEGMENT 3 - WEST GRAND AVENUE OVERCROSSING

After the Wood Street overcrossing, the Class I path would continue for approximately 780 feet on the West Grand Avenue overcrossing over the frontage road and spur line railroad tracks, under the I-880 freeway structures, and over the Burlington Northern & Santa Fe Railroad (BNSF) and Union Pacific Railroad (UPRR) tracks. The width of the travel lanes and striped medium would be reduced to provide enough width for the bike path, now Class III, using the existing West Grand Avenue roadway structure. After the railroad crossing, the new path continues as a separate structure on the south side of West Grand Avenue (refer to Segment 4).

3.4 SEGMENT 4 - SEPARATE ELEVATED STRUCTURE WEST

After the railroad crossing, the Class I path would continue for approximately 3,400 feet as a separate structure on the south side of West Grand Avenue. The bike path would cross over Maritime Street and continue to the touchdown near the Caltrans maintenance facility. The path would descend with a switchback curve to the east of the Caltrans maintenance facility.

Two ramps could also be included with this section after the Class I path is construction, if funding is available. On the east side of Maritime Street, there could be an approximately 700-foot-long ramp extending to Burma Road. On the west side of Maritime Street, there would be an approximately 250-foot-long ramp extending to a roof-top landing and rest stop on the planned Oakland Maritime Support Services building.

3.5 SEGMENT 5 - AT-GRADE CONNECTION TO BAY BRIDGE TRAIL

From Segment 4, the Class I path would continue another 350 feet at grade level below the I-880/80 connection lanes and connect to the existing Bay Bridge Trail.

3.6 CLASS II BIKE LANES

The project could also include Class II bike paths along surface streets near the east touchdown of the Class I bike path, providing connections to Mandela Parkway and the proposed Wood Street parking lot. The Class II bike lanes would have a width of approximately 5 feet extending along each side of the street and cover approximately 4650 linear feet. The Class II bike paths would be constructed after the Class I bike path if funding is available.

4.0 PERTINENT REPORTS

The following reports and drawings prepared by Fugro and other consulting firms are pertinent to this study. No new investigation was performed for this PFR:

- Fugro – Earth Mechanics, 2013, Foundation Report for IERBY Temporary Improvements on Oakland Mole Touchdown, San Francisco-Oakland Bay Bridge East Span Seismic Safety Project, Oakland, California, March 19.
- Berlogar Stevens & Associates, 2012, Updated Master Plan Level Geotechnical Investigation Report, Oakland Army Base, Oakland, California, March 7.
- Fugro – Earth Mechanics, 2003, Final Geotechnical Foundation Report, Oakland Shore Approach Structures, SFOBB East Span Seismic Safety Project, Oakland, California, May 19.
- Earth Tech, 2001, Final Report: Oakland Army Base Utility Study Geotechnical Review, Oakland, California, April.
- Subsurface Consultants, Inc., 1999, Geotechnical Investigation Oakland Harbor Navigation Improvement (-50 Foot) Project, Port of Oakland, Oakland and Alameda, California, February 12.
- Caltrans, 1994, Project Plans for Construction of State Highway in Alameda County in Oakland on Route 880 at West Grand Avenue and on Route 80 from 0.7 Mile West to 1.0 Mile East of San Francisco-Oakland Bay Bridge Toll Plaza (Parts 1 and 2), Contract No. 04-192231.
- Sloan, Doris, 1992, The Yerba Buena Mud: Record of the Last Interglacial Predecessor of San Francisco Bay, California, Geological Society of America Bulletin, vol. 104.
- Rogers/Pacific, Inc., 1991, Final Report to National Science Foundation, Engineering Geologic Site Characterization of the Greater Oakland – Alameda Area, Alameda and San Francisco Counties, California, December 30.

The borings as shown on Plates 1a and 1b are based on the above reference reports and project plans. Plate 1a and 1b present the existing boring and/or Cone Penetration Tests (CPTs) approximate locations for the Gateway Park project and the Connection project, respectively. The boring logs used for the Connection Project are included in Appendix B.

5.0 GEOLOGIC AND SEISMOTECTONIC SETTING

5.1 REGIONAL GEOLOGY

The site is located in the Coast Ranges geomorphic province, which is characterized by northwest-southeast trending valleys and ridges. These are controlled by folds and faults that resulted from the collision of the Pacific and North American plates and subsequent strike-slip faulting along the San Andreas fault zone. The Bay Area also experienced uplift and faulting in several episodes during late Tertiary time (about 25 to 2 million years ago). This produced a series of northwest-trending valleys and mountain ranges, including the Berkeley Hills, the San Francisco Peninsula, and the intervening San Francisco Bay.

5.2 LOCAL GEOLOGY

The Coast Ranges consist of northwest-trending mountain ranges, basins, and narrow valleys generally paralleling major geologic structures and the coastline of California. The San Andreas fault system and the Hayward fault zone, contain active, northwest-trending, strike-slip faults, and to a lesser degree thrust faults which bound the study area.

Bedrock in the project vicinity consists of the late Jurassic and Cretaceous age Franciscan Complex and it is time contemporaneous Great Valley Sequence. The Franciscan Complex is a tectonic mixture of intensely deformed sedimentary, volcanic, and metamorphic rocks including serpentinite, which generally are in faulted contact with the overlying Great Valley Sequence. The San Francisco Bay sits within a broad depression in the Franciscan bedrock resulting from an east-west extension between the San Andreas and the Hayward fault systems. The bedrock surface is estimated to lie at Elevations -400 to -600 feet3 in the study area. The bedrock surface becomes deeper towards the south-southeast and shallower in other directions.

The unconsolidated geologic formations central to this study were deposited on top of the dissected Franciscan bedrock surface during several episodes of significant sea level rise and fall associated with past glaciations. These formations were grouped by Rogers and Figures, (1991), into the following major geologic units (from deepest to shallowest): the Alameda Formation, Old Bay Clay, the San Antonio Formation, Young Bay Mud, and Fill.

The lower Alameda Formation, consisting of continental sediments, was deposited on top of the bedrock surface between 500,000 and 1,000,000 years ago. Depositional environments likely included alluvial fans, lakes, flood plains, streams, and swamps (Rogers and Figures, 1991). Boring logs indicate a mixture of clay, silt, sand, and gravel, with predominantly fine-grained sediments and discontinuous layers of sand and gravel. These sediments are typically oxidized and therefore brown to yellow in color.

Between 400,000 to 500,000 years ago the sea entered the bay and deposition of the upper Alameda Formation began. These sediments were deposited in alluvial, estuarine, and marine environments (Rogers and Figuers,1991). Alameda Formation consists of a mixture of clay, silt, sand, and gravel, with a greater proportion of fine-grained sediments. Sand and gravel units are relatively thin and discontinuous. Sediments include both oxidized alluvial (brown/yellow) and unoxidized (blue/gray/green) marine layers, resulting from a depositional

[3] Elevations referenced to North American Vertical Datum 1988 (NAVD88)

environment that changed with the rise and fall of the sea level and basin subsidence. Deposition and subsequent erosion of the upper Alameda Formation ceased approximately 125,000 years ago when Old Bay Clay deposition began (Sloan, 1992).

The Old Bay Clay is an unoxidized marine/estuarine unit consisting primarily of gray silty clay with occasional thin, discontinuous sand lenses. It was deposited beginning 115,000 to 125,000 years ago and ending 40,000 to 100,000 years ago during a time when sea level was as high as 20 feet higher than today (Rogers/Pacific, Inc., 1991; Sloan, 1992). The Old Bay Clay forms a relatively continuous layer extending a considerable distance inland from the present shoreline. Erosion of the top of this unit occurred during the Wisconsin glacial period between 90,000 and 11,000 years ago when sea level was considerably lower than at present (Rogers and Figures, 1991).

The San Antonio Formation consists of continental deposits, including the Aeolian Merritt sands and alluvial Posey sands. Deposition of these units occurred in late Wisconsin time when sea level was lower than at present. The top of the San Antonio Formation was subsequently eroded in very late Wisconsin time.

Deposition of the Young Bay Mud has been occurring over the last 10,000 years and continues today. The Young Bay Mud consists of estuarine/marine gray silty clay with minor discontinuous sand lenses.

The Young Bay Mud is overlain by undifferentiated fill that was placed in the late 1800s and throughout the 1900s.

A local geology map is shown on Figure 2.

5.3 SEISMOTECTONIC SETTING

The project site is located in the San Francisco Bay Area, which is considered one of the most seismically active regions in the United States. Significant earthquakes have occurred in the Bay Area and are associated with crustal movements along a system of subparallel fault zones that generally trend in a northwesterly direction.

The Coast Ranges tectonic province is bounded on the west by the northwest-trending San Andreas fault system, the primary boundary between the Pacific and North American Plates. The system boundary is represented as a broad region, 100 to 200 km wide, centered on the plate boundary, including much of the Coast Ranges, and is tectonically dominated at present by the dextral horizontal shear caused by the relative motion of the two plates. In the San Francisco Bay region, the plate boundary is a 100-km-wide zone of deformation consisting of several major strike-slip fault zones as shown in Figure 3 including the San Gregorio, San Andreas, Hayward-Rodgers Creek, Calaveras, and Concord-Green Valley faults (USGS, 2006). Table 1 outlines the distance from the site to nearby major faults, their segment length, slip rate, and magnitude.

The last major earthquake on the Hayward fault occurred in 1868 and caused widespread damage throughout much of the East Bay region. This earthquake caused surface rupture from Fremont to as far north as Berkeley. Although the fault rupture was poorly documented, modeling of survey data suggest that the fault moved as far north as Berkeley, and from these data the average amount of horizontal movement along the fault is inferred to be

about 1.9 meters (Stover and Coffman, 1993). Small vertical displacements (0.1–0.2 m) have also been estimated (Lienkemper and others, 2002). Based on empirical relationships among earthquake magnitude, fault rupture length, and displacement (Wells and Coppersmith, 1994), a large event on the Hayward fault is capable of generating displacements of at least 10 feet. In addition to coseismic rupture, the Hayward fault is undergoing creep, i.e., it is undergoing continuous aseismic slip. This amounts to about 4 to 6 mm/yr on the Hayward fault in Fremont (Lienkaemper and others, 1997).

Table 1. Major Active Faults in the Project Vicinity

Fault	Distance to Project Site (km)	Slip Rate (mm/yr)	M_{max}	Fault Type
North Hayward	6	9	7.3	bi-lateral
South Hayward	17	9	7.3	bi-lateral
San Andreas - Peninsula	24	17	8	bi-lateral

In 2008, the Working Group on California Earthquake Probabilities (WGCEP 2007), in conjunction with the United States Geological Survey (USGS), the California Geological Survey (CGS), and the Southern California Earthquake Center (SCEC) published an updated report evaluating the probabilities of significant earthquakes occurring in the Bay Area over the next three decades. The report finds that there is a 63 percent probability that at least one magnitude 6.7 or greater earthquake will occur in the San Francisco Bay region over a 30-year period. This probability is an aggregate value that considers principal Bay Area fault systems and unknown faults (background values).

6.0 SITE AND SUBSURFACE CONDITION

6.1 SITE CONDITIONS

This linear project area is bound by retail/commercial and industrial properties along Wood Street and West Grand Avenue in its eastern portion and current and former industrial properties of the Oakland Army Base (OAB) and EBMUD wastewater treatment system in its western portion. The site is located in a mixed commercial/industrial and residential areas.

The far eastern limit of the Connection is Mandela Parkway, southwest of the MacArthur Maze. Mandela Parkway is the former location of the Cypress Freeway Structure which collapsed during the 1989 Loma Prieta Earthquake.

West Grand Avenue connects surface streets, such as Mandela Parkway, in Oakland to on and off ramps from the Nimitz Freeway and Interstate-80. West of Campbell Street, West Grand Avenue consists of an elevated roadway that crosses over industrial land occupied by existing Union Pacific Railroad (UPRR) and Burlington Northern Santa Fe (BNSF) Right-of-Ways (ROWs), the former OAB, and Port of Oakland property.

6.2 SUBSURFACE CONDITIONS

As previously discussed, the six main geologic units underlying the proposed project area are Fill, Young Bay Mud, the San Antonio Formation, Old Bay Clay, the Alameda Formation, and Franciscan Complex (bedrock). Old borings and wells explored previously encountered the upper five units except the Franciscan bedrock. At some locations, not all of the geologic units are present. The reasons certain units are missing include natural geologic depositional processes, past dredging, and the absence of fill placed offshore.

Based on the review of the available borings from previous investigation, we generated Idealized Soil Profiles F-F' and G-G' which are presented on Plates 2a and 2b respectively. It depicts our understanding of the ground surface conditions and the underlying soil types along the Connection alignment. The idealized soil profile represents our interpretation of how the soil (lithological) contacts vary between boring and well locations. Because of the wide spacing of the data points and the natural variations during soil deposition, the actual contact locations may vary. The approximate locations of the borings and wells from previous investigations are shown on the Site and Boring Location Plans (Plates 1a and 1b) and the boring logs are included in Appendix B.

6.2.1 Fill (Elevations 10 to -10 feet)

Beginning in the mid-1800s, progressive filling of the natural bay margins occurred in the Port area. The fill was placed at various times and using various filling techniques, including hydraulic filling and end-dumping techniques. The materials used as fill also vary significantly across the project area. The fill materials encountered by the recent borings and wells included various combinations of clay, silt, sand, gravel, and cobbles. The borings indicated the fill ranges from loose to dense. In several areas, loose to medium dense and some occasional dense, fine- to medium-grained sands were encountered below the water table. These loose to medium dense sands are likely hydraulically placed fill with relatively high potential to liquefy in a major earthquake event. The thickness of the fill varies from 5 to 20 feet across the project area.

6.2.2 Young Bay Mud (Elevations +5 to -60 feet)

The formation referred to as Young Bay Mud (YBM) consists predominantly of a soft to medium stiff fat clay. The material typically has a high moisture content and a low dry density, and is soft, highly plasticity, and highly compressible. The thickness of the YBM encountered in the boring logs varies from 10 to 60 feet across the project site. There are occasional sand lenses embedded within the Bay Mud but they are discontinuous across the proposed structure alignment.

6.2.3 San Antonio Formation (Elevation -10 to -40 feet)

The San Antonio Formation includes fine- to medium-grained estuarine, alluvial, and aeolian sands that contain a varying amount of silt and clay. The Merritt sand is an aeolian deposit that is generally brown or yellow in color, dense to very dense, and ranges from being clean to containing silt and clay. The Posey sand is reworked Merritt sand that tends to be gray/green in color, medium dense, and clayey. The majority of the San Antonio Formation is relatively dense to very dense sand with Standard Penetration Test (SPT) blow counts ranging from 30 to 70. There are a few layers encountered described as medium dense but it is mixed with varying amount of clay. The thickness of the San Antonio Formation encountered in the borings varies from 0 to 20 feet across the project site.

6.2.4 Old Bay Clay (Elevations -25' to maximum depth explored)

The Old Bay Clay typically consists of a stiff to hard fat clay that occasionally contains thin lenses of fine-grained sand. The material typically has a lower moisture content, higher density, higher strength, and lower compressibility than the Young Bay Mud. Several historical borings encountered sandy layers within the Old Bay Clay, referred to as Old Bay Deposits. These sandy layers are typically 10 to 15 feet thick and dense to very dense. The bottom of the Old Bay Clay was not encountered in the borings reviewed for this study; however, we estimated the bottom of the Old Bay Clay is at approximate Elevations -75 feet to -100 feet based on the contour map generated from previous investigation by others4.

The Alameda Formation and the bedrock were not encountered in previous borings in the project vicinity.

6.2.5 Groundwater Conditions:

Existing data indicate that shallow groundwater in the project area typically varies from Elevation 0 to 3 feet. Based on information provided in the report "Matrix Environmental Services, LLC, Final, Upland Areas of Concern, Feasibility Study, BRAC Parcel 1, Oakland Army Base, dated March 2006", the tidal influence on the groundwater gradient extends approximately 600 feet inland from the Oakland Harbor; in this area, groundwater flow is expected to be highly variable due to tidal forces. However, the distance of the proposed structure to the Bay is at least 1,000 feet so the tidal force should not significantly impact the groundwater level of the site.

[4] Information based on report titled "Geotechnical Investigation -50 foot Navigational Improvement Project Port of Oakland, Oakland and Alameda, California", February 1999.

7.0 GEOLOGIC AND SEISMIC HAZARDS

The followings discuss the potential geologic and seismic hazards at the project site:

7.1 FAULT RUPTURE

The majority of earthquakes in the Bay Area are associated with the San Andreas Fault and Hayward Fault system. The San Andreas Fault system is a 100-km-wide zone of deformation, which includes multiple northwest-southeast trending strike-slip faults that control the formation of the mountains and valleys of the Coast Ranges Geomorphic Province. As discussed previously, the nearest active fault is the Hayward fault located approximately 6.2 km to the northeast of the site. The structure does not fall within a CGS Fault-Rupture Hazard Zone (Alquist-Priolo Earthquake Fault Zone), as shown on Figure 4. Caltrans (2009) considers a distance of 50 horizontal feet on either side of a field evaluated active fault trace to have a potential for surface fault rupture displacement hazard (SFRDH). Therefore the potential for ground surface rupture is not a design consideration for the proposed structure.

7.2 STRONG GROUND SHAKING

Due to the close proximity of the Hayward fault, the project site will be subject to strong ground shaking during future large earthquakes originating on this fault, as well as from other regional faults.

The WGCEP (USGS, 2007) considers the Hayward-Rodgers Creek fault system the most likely source of the next M 6.7 or larger earthquake in the Bay Area, with a 31 percent probability of occurring in the time period 2007 to 2037. Their model also incorporates a scenario where the Hayward fault ruptures along with the Rodgers Creek fault. Rupture of the entire length of both faults would generate a mean maximum earthquake of M 7.3 (USGS, 2007). Rupture of the Rodgers Creek fault and the northern segment of the Hayward fault would generate a maximum event of M 7.1.

7.3 LIQUEFACTION

Strong ground shaking caused by large earthquakes can induce ground displacement and/or failure, such as liquefaction, compaction settlement, and slope movement. A site's susceptibility to these hazards relates to the site topography, soil conditions, and depth to groundwater.

Liquefaction is a soil behavior phenomenon whereby sediments temporarily lose shear strength and collapse. This condition is caused by cyclic loading during earthquake shaking that generates high pore-water pressures within the sediments. The soil most susceptible to liquefaction is loose, cohesionless, granular soil below the water table and within about 50 feet of the ground surface. Liquefaction can result in loss of foundation support and settlement of overlying structures, ground subsidence and translation due to lateral spreading, and differential settlement of affected deposits.

The liquefaction susceptibility of the sediments at the project site and its vicinity is mapped by the USGS as "very high" in the vicinity of project site, as shown in Figure 5. Based on our review of the field investigation and laboratory test data, the site is generally underlain by fill consisting of loose to medium dense cohesionless sand (with occasional dense sand) of

approximately 5 to 15 feet thick and the depth to groundwater is approximately 2 to 6 feet. Where these deposits are below the water table, there is a high potential for them to liquefy during a major seismic event. There are also some deeper sand layers; there are some thin layers of 1 to 2 feet of medium dense sand layer but the majority of this sand layers tend to be dense and/or cohesive and we judge that they have a relatively low potential to liquefy during a major seismic event.

We used the available information from previous investigations obtained to evaluate the potential for seismically-induced ground surface settlement in the area of the proposed improvements. In accordance with the procedures developed by Tokimatsu and Seed (1987) for estimating volumetric strain of saturated clean sand based on the energy corrected SPT blow count $(N_1)_{60}$ and the cyclic stress ratio (CSR), the settlement at each boring location was estimated. The calculation indicated that the accumulative settlement is on the order of 6 to 10.2 inches based on a moment magnitude Mw of 7.3 and a PGA of 0.62g. The medium dense to dense lower sand layer may be subject to less than 1-inch of settlement. These calculations are provided in the table in Appendix C.

The liquefaction-induced settlements within the surficial fill may induce downdrag loads on deep foundations. Downdrag load on piles should be re-evaluated after completion of future investigations and final design of the Path structure is completed.

Lateral spreading occurs when a layer liquefies at depth and causes horizontal movement or displacement of the overburden mass on sloping ground or toward a free face, such as a stream bank or excavation, or towards an open body of water. Given that the site is generally flat and it is about 1,000 feet from the shoreline of the Bay, we conclude that the potential for lateral spreading is low; however, due to the large lateral extent and depth of liquefiable fill, limited permanent lateral soil displacements may occur. The impact of soil displacements on structures should be evaluated as part of detailed design at a later phase.

7.4 LANDSLIDE AND SLOPE FAILURE

Due to the relatively flat topography at the site, landsliding is not considered a hazard.

7.5 FLOOD

FEMA flood zone maps (http://www.fema.com) indicate that the project area is located outside the 100-year flood plain. Tsunami, or seismically induced large waves, may be generated by rapid movements on earthquake faults. Studies[5] have been conducted on wave attenuation within San Francisco Bay in the event of a large tsunami, and the project site is within the tsunami inundation line.

Sea level rise issues are addressed in a separate technical memorandum titled “Sea Level Rise Adaptation Revision 3” prepared by CH2M Hill dated February 17, 2014.

7.6 SCOUR

Because the existing and proposed structure supports are located outside waterways, scour is not an issue for the proposed structure.

[5] Information is based on Tsunami Inundation Map for Emergency Planning, Oakland West Quadrangle by California Geological Survey, dated July 31, 2009.

7.7 CORROSION

The 2012 Berlogar Stevens & Associates report tested 17 soil samples around the Oakland Army Base for corrosivity testing (Appendix C), and 6 soil samples (H-9, H-16, H-28, H-30, H-56, and T-5) are located near this project location (approximately 260 to 1000 feet away). The classification of these samples, as documented in the report, ranged from "moderately corrosive" to "severely corrosive". The pH of the soils ranged from 7.4 to 8.2, which does not present corrosion problems for buried iron, steel, mortar-coated steel and reinforced concrete structures. The sulfide ion concentrations reflect none detected with a detected limit of 50 mg/kg. One sample (T-5) was tested to contain chloride ion concentrations more than 300mg/kg, which is sufficient to attack steel embedded in a concrete mortar coating. In addition, an elevated level of sulfate ion concentrations was detected and was determined to be sufficient to damage reinforced concrete structures and cement mortar-coated steel. Therefore, concrete that comes into contact with this soil should use sulfate resistant cement such as Type II, with a maximum water-to-cement ratio of 0.55.

We recommend the corrosion potential of subsurface soils in the vicinity of the proposed improvements be evaluated in accordance with the requirements of Caltrans Memo to Designers 3-1 (July 2008) and ASTM standards during preparation of the future Foundation Report. Specifically, the redox potential, pH, resistivity, chloride, and sulfate will be tested for corrosivity potential to evaluate the effect of corrosion on the proposed improvements.

8.0 SEISMIC DESIGN CRITERIA

8.1 SEISMIC DESIGN METHODOLOGY

The seismic design methodology adopted for this project is based on the following current Caltrans standards:

1. Seismic Design Criteria (SDC), v 1.7, April 2013;
2. Guidelines for Structures Foundation Reports, v 2.0, updated March 2009;
3. California Seismic Hazard Map (2007); and
4. Caltrans ARS online (v2.3.06).

The new Caltrans procedures for developing the design acceleration response spectrum (ARS) use the envelope of the deterministic and probabilistic spectra, in contrast to the old procedure that used only the deterministic spectrum. The new deterministic spectrum is now adopting two next generation attenuation (NGA) models: an average of Campbell and Bozorgnia (CB) and Chiou and Youngs (CY) attenuation models. The deterministic spectrum is based on the envelope of median spectra corresponding to characteristic earthquakes occurring on all seismic sources in the vicinity of the site. The probabilistic spectrum is defined as the uniform hazard spectrum corresponding to a probability of exceedance of 5% in 50 years (975-year return period) per 2008 USGS hazard maps. In addition, the new procedure also updated the site factor, updated the near fault factor, and includes deep basin effect.

8.2 SITE SOIL PROFILE

Boring logs from the field explorations at the project site were reviewed. Shear wave velocity measurements were not made for the previous projects. The representative blow counts and undrained shear strength were used to estimate shear wave velocity based on empirical correlation recommended in Geotechnical Services Design Manual (Caltrans, 2009). The weighted average of the shear wave velocity over the depth of 100 feet was used to determine $V_{s,30}$, which were found in a range of 139 to 248 m/s (Caltrans 2012). However, the site is underlain by more than 10 feet of soft soil (Bay Mud) and is therefore classified as Soil Profile Type E[6] based on the guidelines given in SDC Table B.1.

While some of the surficial fill is potentially liquefiable (Soil Type F), at this preliminary design phase the seismic design spectrum was developed under the simplifying assumption of non-liquefiable material. Additional geotechnical investigations and engineering analyses (e.g. site-specific ground response analyses) should be performed during the preparation for the Foundation Report. However, if the final design of the bridge foundation is relatively deep and the surficial liquefiable fill is confined to be within shallow depth (confirmed by new explorations) such that the site response would not be affected by this liquefiable material, then a code based spectrum may be used instead.

8.3 FAULT TYPE AND NEAR-FIELD SPECTRAL ACCELERATIONS

The technical report that accompanies the California Seismic Hazard Map (2007) indicates that the controlling fault is the Hayward fault, which is 6.2 km away from the site. Since the project site is less than 15 km from the nearest active fault, design spectral accelerations should be modified to account for near-fault effects as follows:

Period (sec)	Increase in Spectral Acceleration (%)
<0.5	0
0.5 to 1.0	0-20 (determined by linear interpolation)
>1.0	20

This does not include adjustments for bridges with fundamental periods of vibration greater than 1.5 seconds. As the design proceeds, the fundamental period of vibration of the planned structures for this project should be verified with the structural engineer.

6 A soil profile with shear wave velocity vs < 600 ft/s (180 m/s) or any profile with more than 10 ft (3 m) of soft clay, defined as soil with plasticity index PI > 20, water content w ≥ _40 percent, and undrained shear strength su < 500 psf (25 kPa)

8.4 DESIGN ACCELERATION RESPONSE SPECTRUM

The Design Acceleration Response Spectrum (ARS) corresponding to Vs,30 = 180 m/s, magnitude of controlling event 7.3, was obtained from ARS online and modified to account for near field effects, as described above. The Design Acceleration Response Spectra is attached as Figure 6, and the spectral values are provided in Table 2. The design ARS curve is the envelope of the deterministic spectrum (Mw = 7.3, R = 6.2 km) and probabilistic spectrum (975-year return period). For the project location, the design spectrum is controlled by the probabilistic spectrum at all structural periods.

Table 2. Spectral Acceleration Values

T (s)	Sa (g)
0.01	0.621
0.05	0.866
0.10	1.000
0.15	1.166
0.20	1.300
0.25	1.332
0.30	1.359
0.40	1.328
0.50	1.305
0.60	1.287
0.70	1.278
0.85	1.257
1.00	1.238
1.20	1.120
1.50	0.991
2.00	0.847
3.00	0.544
4.00	0.390
5.00	0.314

9.0 GEOTECHNICAL RECOMMENDATIONS

On the basis of the results of our preliminary geotechnical study, we conclude that the proposed project is feasible from a geotechnical standpoint. The following sections provide preliminary foundation recommendations for the proposed elevated bike/pedestrian structure.

9.1 FOUNDATION ALTERNATIVES

Various foundation alternatives, including isolated shallow foundations as well as deep foundations such as drilled piers and driven piles, were considered to support the proposed structure. The foundation type should be chosen based on structure loading, allowable settlement and economics.

Spread footing foundations are not generally viable unless ground improvement is conducted because of the presence of Bay Mud and potentially liquefiable fill which would lead to total and differential settlements that would exceed the design tolerance. In addition, uplift requirements would likely require very large footings and/or permanent ground anchors. If ground improvement (jet grouting, compaction grouting or cement deep soil mixing) were implemented, shallow foundations could be designed; however, the overall costs would likely be excessive. Therefore, spread footing foundations are not recommended.

Driven precast prestressed concrete piles (PCPS) were also considered for foundation support of the structure. The use of driven piles is sometimes limited due to constructability disadvantages, such as noise and vibration impacts to adjacent structures during installation, as well as difficult driving conditions in dense sands or gravels. Based on the results of the existing subsurface data, the soil layers encountered at the site consists primarily of stiff to very stiff cohesive soils which are not likely to cause any drivability problem for driven piles. Driven piles can be battered at an angle to increase the lateral capacity. In addition, PCPS offer advantages in shallow groundwater and caving soil conditions and also do not produce drill spoils. Based on discussions with TY Lin, PCPS was not selected for this preliminary study; however, this option should be included as a possibility in the environmental documents and should be re-evaluated during final design.

Cast-in-drilled-hole (CIDH) piles have the advantages of easy penetration into dense/hard soil zones, the availability of larger diameters for increased lateral capacity, and adaptability of length to variable subsurface conditions. The presence of shallow groundwater or caving soils can complicate the use of CIDH piles. From the constructability standpoint, CIDH piling rigs are more economical to mobilize than pile driving rigs, can work in limited access conditions, and have significantly lower noise and vibration impacts during pile installation than driving operations. Based on discussions with TY Lin, 6 and 7 feet diameter CIDH piles are currently proposed for support of the Connection structure.

9.2 DESIGN SOIL PARAMETERS

Idealized soil profiles with soil stratigraphy and generalized soil engineering parameters are presented in Table 3. This idealized soil profile forms the basis for developing preliminary foundation recommendations for the proposed elevated structure. The proposed CIDH piles will gain primary vertical support through skin friction in the Old Bay Clay. For evaluating axial pile capacity, the skin friction developed within the undocumented fill and Bay Mud was ignored because of the potential for liquefaction of the sands and settlement in the Young Bay Mud. However, these units can be included to resist in short-term lateral loads. While thicker fill exists at some locations along the Connection alignment, thinner fills were used in the idealized profiles because they represent a majority of the alignment and this is considered conservative assuming the piles gain support through the Old Bay Clay. Due to the variability of the location and thickness of the sand, the sand lenses below the Bay Mud and interbedded within Old Bay Clay were conservatively considered assigned Old Bay Clay properties for computing vertical support. The lower sand layer can be included in the detailed design phase when new borings are performed at each foundation location to obtain site-specific information.

Furthermore, to account for the variation of the Bay Mud thickness, two idealized soil profiles were used to bracket the range of subsurface conditions. For other thickness of Bay Mud, the pile capacity can be interpolated linearly. In determining lateral capacity in the event of liquefaction, the fill layer properties were ignored to account for the loss of strength.

Table 3. Generalized Soil Design Parameters

Profile No.	Soil Type	Depth (feet)	Unit Weight (pcf)	Friction Angle (deg)	Shear Strength (psf)
1	Fill	0-8	120	28	350 (residual, liquefied)
	Young Bay Mud	8-28	98	-	*100 + 10z
	Old Bay Clay	28-110[1]	115	-	1,500
2	Fill	0-6	120	28	-
	Young Bay Mud	6-60	98	-	*100 + 10z
	Old Bay Clay	60 -110[1]	115	-	1,500

Note 1: The thickness of Old Bay Clay is estimated based on the deepest boring explored. The actual depth could be deeper.

9.3 CAST-IN-DRILLED HOLE PILES

As discussed above for this preliminary study, 6 to 7 feet diameter CIDH piles have been selected as the Connector foundation support type. At the time this report was prepared, the design loads were not yet available. Therefore, the proposed pile lengths verses capacities are provided in Figure 7. The final pile data table including design loads and design tip elevations will need to be updated for the Foundation Report once the loading conditions are available and additional geotechnical investigations and analyses are performed. The axial (compression) pile capacities shown in Figure 7 are ultimate values. For preliminary design, the residual strength of the liquefied material is estimated using $N_{160,cs}$ correlations (Seed and Harder 1990). The skin friction due to the non-liquefiable crust using static strength and the liquefied layer using residual strength are used to estimate the downdrag load. The downdrag load is estimated to be about 60 to 70 kips applied to the pile length above the Bay Mud. The downdrag load should disappear once the seismic settlement of this sand layer is complete. This should be re-evaluated when additional boring information is obtained in future design phase to confirm the thickness of the fill and liquefaction potential.

We recommend using a resistance factor of 0.7 and 1.0 for the strength limit state and the extreme limit state, respectively, to calculate the factored nominal resistance in accordance with the Load and Resistance Factor Design (LRFD) methods.

Resistance to lateral loads can be developed by bending of the pile and by soil-pile interaction. The magnitude of the lateral load resistance that can develop depends upon several factors such as the pile size, the physical properties of the surrounding soils, and the structural design of the pile. We used the computer program LPILE plus 5.0 to analyze the individual pile response to the lateral and axial loads with a series of nonlinear springs that are internally generated by the program as a function of user-specified soil properties. In addition, the piles were modeled as free head condition with respect to the two soil profiles including both liquefaction and non-liquefaction conditions. The required depth to provide sufficient lateral capacities is determined by the location of the second zero moment. The lateral loads required producing 1/4 -inch and 1-inch movement at the top of pile are summarized in Table 4. The design tip elevations shown below were estimated only based on the lateral load requirement as information regarding nominal resistance (both compression and tension) are not available at this time.

Table 4. Proposed CIDH Pile Data Tables

For Non-Liquefaction Case:

Pile Type	Soil Profile	Nominal Resistance	1 Inch Deflection		¼ Inch Deflection	
			Minimum Design Tip Elevation (feet)	Lateral Capacity (kips)	Minimum Design Tip Elevation (feet)	Lateral Capacity (kips)
6-ft CIDH	1	N/A	-79	178	-75	69
7-ft CIDH	1	N/A	-90	225	-83	91
6-ft CIDH	2	N/A	-98	172	-93	54
7-ft CIDH	2	N/A	-99	220	-96	75

For Liquefaction Case:

Pile Type	Soil Profile	Nominal Resistance	1 Inch Deflection		¼ Inch Deflection	
			Minimum Design Tip Elevation (feet)	Lateral Capacity (kips)	Minimum Design Tip Elevation (feet)	Lateral Capacity (kips)
6-ft CIDH	1	N/A	-92	69	-78	37
7-ft CIDH	1	N/A	-97	108	-88	55
6-ft CIDH	2	N/A	-96	61	-83	27
7-ft CIDH	2	N/A	-99	93	-93	38

Notes: 1) Assume pile cut off elevation at 0 feet (NAVD 88).

9.4 CONSTRUCTION CONSIDERATIONS

Potential construction considerations include:

- The loose cohessionless fill may cave in during installation of the CIDH piles, drilling slurry and/or casing will likely be required.
- Based on the previous investigations, we expect the CIDH piles will encounter groundwater between approximately the Elevations 3 and 0 feet.
- Limited access: the project site is located within urban area and local streets that may require lane closure during construction for the operation of the crane, removing spoil, delivering and installing reinforcing cages, and tremie concrete placement.
- Physical conflicts: potential conflicts with locations of new bridge supports and all existing facilities, such as utilities and adjacent overcrossing foundations.
- Disposal of soil cuttings/excavated materials: in-situ fill material may be contaminated and the handling and disposal should be performed with a Site Mitigation Plan (SMP) that includes health and safety criteria.

10.0 ADDITIONAL FIELD INVESTIGATION AND LABORATORY TESTING

As the project advances, we recommend additional geotechnical investigations be performed to characterize the subsurface conditions at the proposed locations of the foundations and verify our preliminary foundation recommendations for the proposed elevated structure. The following additional field investigations are recommended:

- Perform a boring and/or Cone Penetration Test (CPT) advancing 100 feet below the design pile cut-off elevation at each structure support location.
- Perform laboratory tests on recovered soil samples to determine engineering properties, including strength tests, Atterberg limits, sieve analysis, R-value test and corrosivity tests.

At new boring locations, samples should be taken at least at 5-foot depth intervals or at changes in strata. The final sample interval should be based on the materials encountered during drilling and sampling. Drive samples in the alluvium should be taken with either a SPT or Modified California (MC) sampler. Shelby Tubes and Pitcher Barrel samples should be used to collect Bay Mud and Old Bay Clay, respectively. In addition, suspension logging should be performed in selected borings to measure shear wave velocity for seismic design analysis.

At new CPT locations, the CPT probe was advanced using a hydraulic push system mounted in a mobile truck to collect information electronically such as tip resistance, sleeve friction, pore pressure and inclination data at 0.05 m intervals as the sounding was advanced. In addition, the CPT soundings can also include 1) Seismic Cone Penetration Tests (SCPTs) which collect compression and shear wave velocity for evaluation of the Vs30 and 2) Pore Pressure Dissipation Tests (PPDTs) which measure hydrostatic pressure for evaluation of the static groundwater table. The SCPT uses a modified CPT cone that contains a built-in seismometer.

These additional investigations will also allow a confirmation of liquefaction susceptibility and triggering potential, analyses of potential ground deformations and effects on foundation capacity, and design recommendations to accommodate any anticipated consequences of liquefaction.

11.0 LIMITATIONS

The opinions, conclusions and recommendations presented herein are based on subsurface information developed by others. The recommendations presented in this report are based on the assumption that the soil and geologic conditions do not deviate substantially from those anticipated by the information contained in the existing logs of test borings. If any variations are encountered during construction, the Geotechnical Professional should be contacted so that supplemental recommendations can be made.

If existing facilities, utilities, soils/bedrock conditions, road/structure distress, slope distress or groundwater/seepage conditions other than those noted in this report are present on the site, then their presence was not known, or was not considered in the preparation of this report. Locating utilities and evaluating potential utility interference is outside the scope of this report. Individuals utilizing this report shall inform Fugro if they are aware of any additional facilities or site conditions so that their presence and impact upon the project (or vice-versa) can be properly evaluated and recommendations modified to address geotechnical issues as necessary.

Specific review and investigation for environmental issues and subsurface environmental contamination will be investigated by Fugro and presented in a separate report if requested.

The opinions and recommendations presented in this report were developed with the standard of care commonly used by other geotechnical professionals practicing at the same time, within the same locality and under the same limitations. No other warranties are included, either expressed or implied, as to the professional advice included in this report.

This report has been prepared for the benefit of TY Lin International and the Gateway Park Working Group. The information contained in this report, including all exhibits and attachments, may not be used by any party other than TY Lin International and the Gateway Park Working Group, without the express written consent of Fugro Consultants Inc.

12.0 REFERENCES

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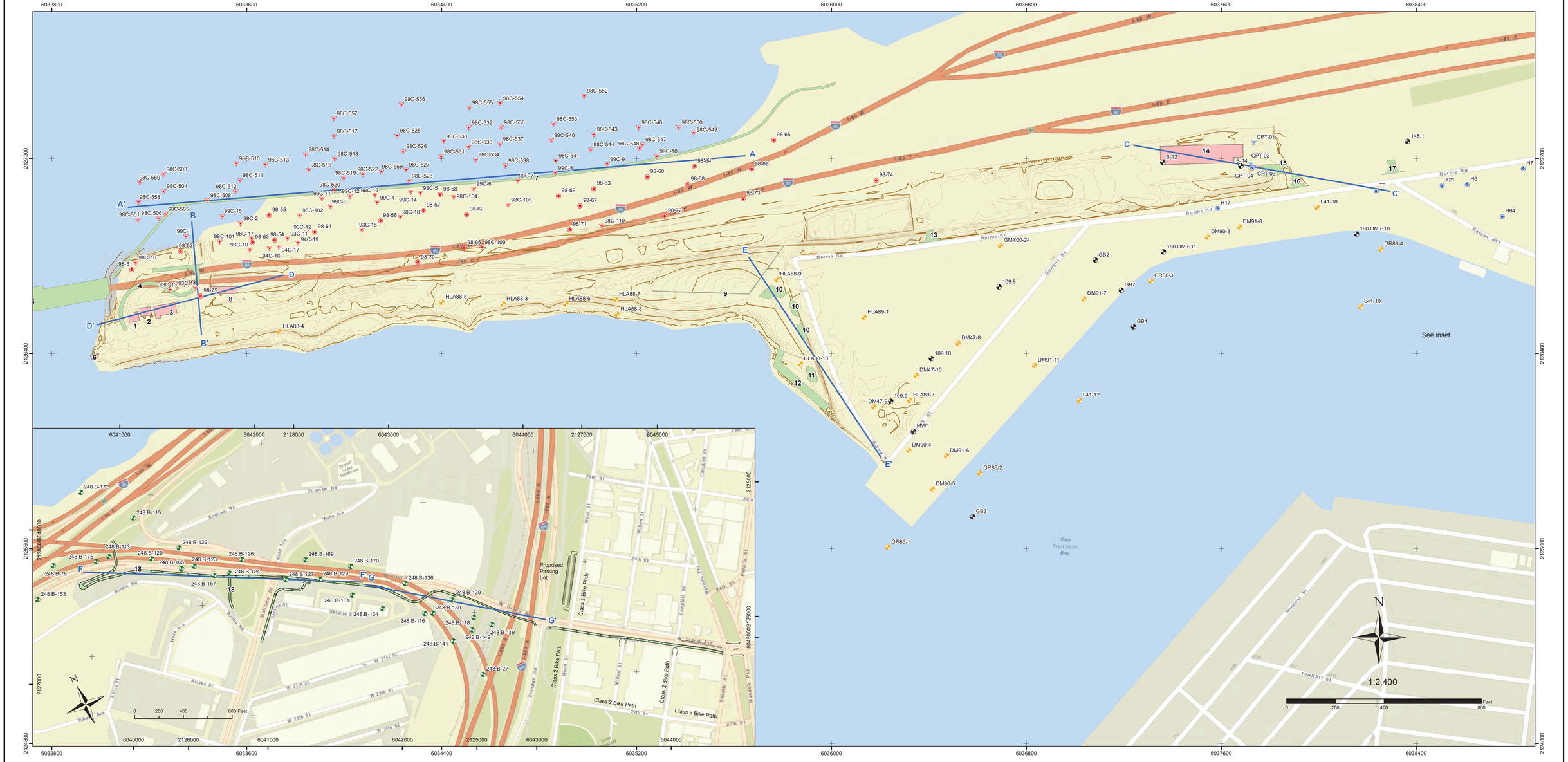
PLATES



Legend

- Fugro 2014 CPT
- Fugro 2011 Boring
- SFOBB CPT
- SFOBB Boring
- Historical Borings (1946 - 2007)
- Army Base Borings
- Caltrans Borings
- Cross Section Line

Structures

- Existing
- Proposed

Building Index

Building No.	Name
1	PG&E Substation
2	Historical Key Building
3	Historical Mole Substation
4	Bay Bridge Elevated Bike Path Structure Connection to Park
5	2-288 Span Structure
6	EBMUD Building @ "The Point"
7	North Shore Elevated Bike Path on Structure
8	Mole Substation (PG&E)
9	Retaining Wall

Building No.	Name
10	Visitor Center
11	Climbing Wall
12	Shoreline Protection
13	EBMUD Crossing Location 1
14	IERBYS/Historical Warehouse
15	Auditorium
16	EBMUD Crossing Location 2
17	EBMUD Crossing Location 3
18	Burma Road Elevated Bike Path Structure

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SITE AND BORING LOCATION PLANS
GATEWAY PARK
San Francisco Oakland Bay Bridge Bicycle / Pedestrian Connection, Oakland, California

NO:	DATE:	DESCRIPTION:	DRAWN:	CHKD:	APPR:
1	Jun 2014	Exploration and Cross section Location Map	CBD	HS	TW

JOB NUMBER: 04.72130012

PLATE.: 1a

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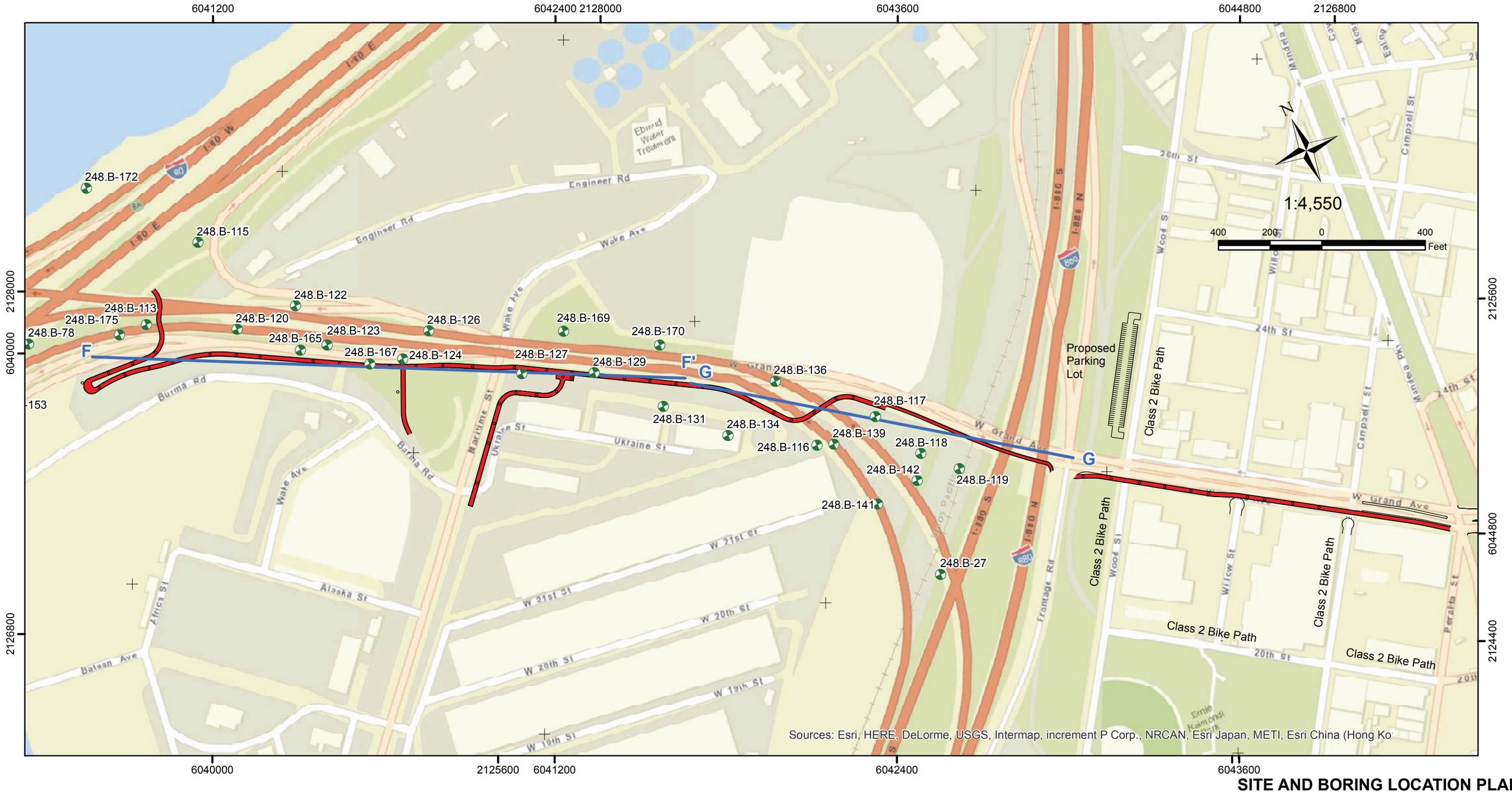

Legend

- Caltrans Borings
- Cross Section Line
- Burma Road Elevated Bike Path Structure

SITE AND BORING LOCATION PLAN
THE CONNECTION
San Francisco Oakland Bay Bridge
Bicycle / Pedestrian Connection
Oakland, California

PLATE 1b

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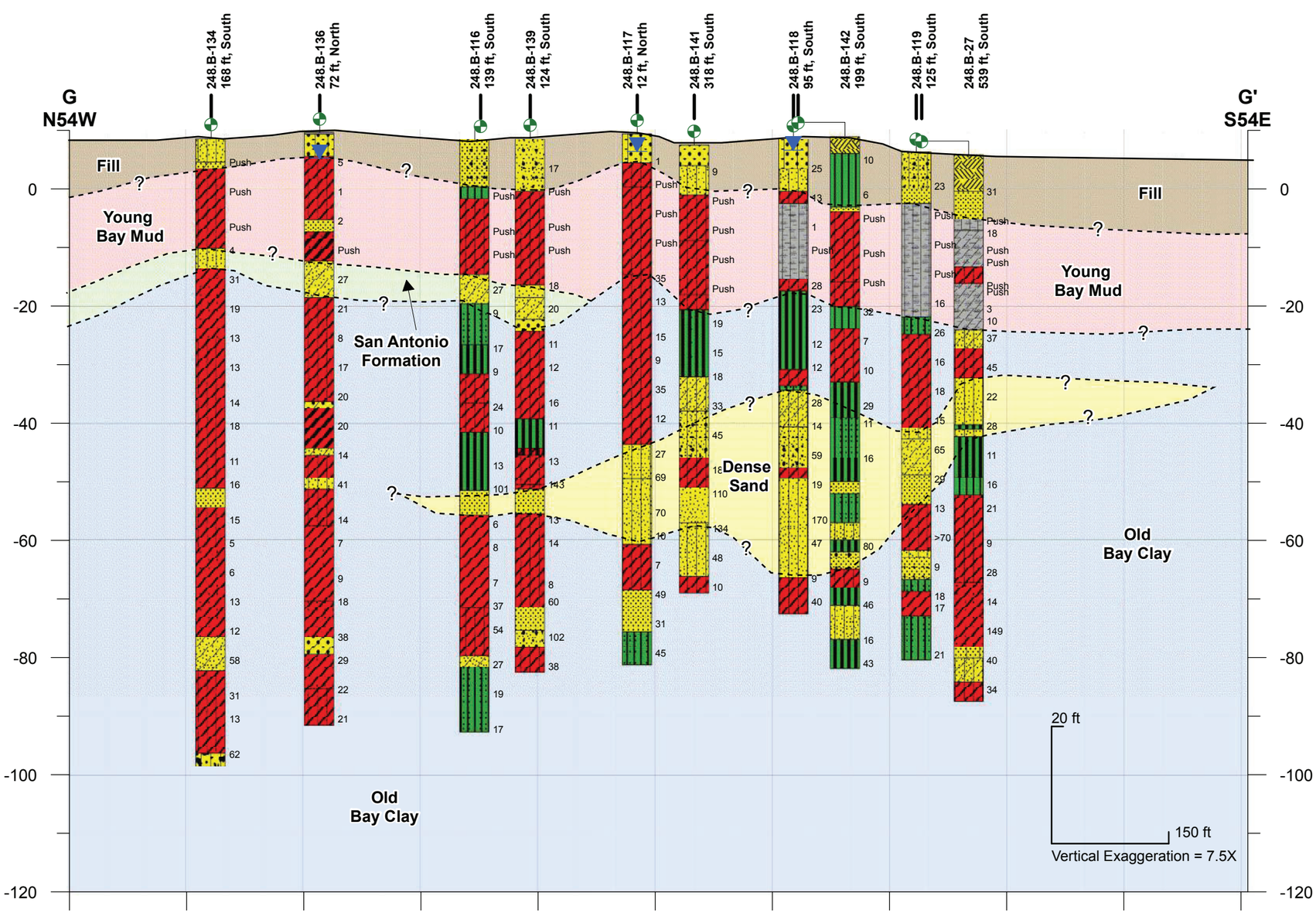

Legend

- Lean CLAY (CL)
- Silty CLAY (CL-ML)
- Lean CLAY with Sand (CL)
- Sandy Lean Clay (CL)
- Fat CLAY (CH)
- Fat CLAY with SAND (CH)
- Silt (ML)
- Sandy SILT (ML)
- Elastic Silt (MH)
- Poorly-Graded SAND (SP)
- Poorly-Graded SAND with Clay (SP-SC)
- Poorly-Graded SAND with Silt (SP-SM)
- Gravelly Poorly-Graded SAND (SP)
- Well-Graded SAND (SW)
- Gravelly Well-Graded SAND (SW)
- Clayey SAND (SC)
- Clayey to Silty SAND (SC-SM)
- Silty SAND (SM)
- Gravelly Silty SAND (SM)
- Fill
- Poorly-Graded GRAVEL (GP)
- Poorly-Graded GRAVEL with Clay (GP-GC)
- Poorly-Graded GRAVEL with Silt (GP-GM)
- Well-Graded GRAVEL (GW)
- Silty Gravel (GM)
- Low-Plasticity Organic (OL)
- High-Plasticity Organic (OH)
- Asphaltic Concrete

6 SPT Blow Count

IDEALIZED SUBSURFACE PROFILE
San Francisco Oakland Bay Bridge
Bicycle / Pedestrian Connection
Oakland, California

PLATE 2b

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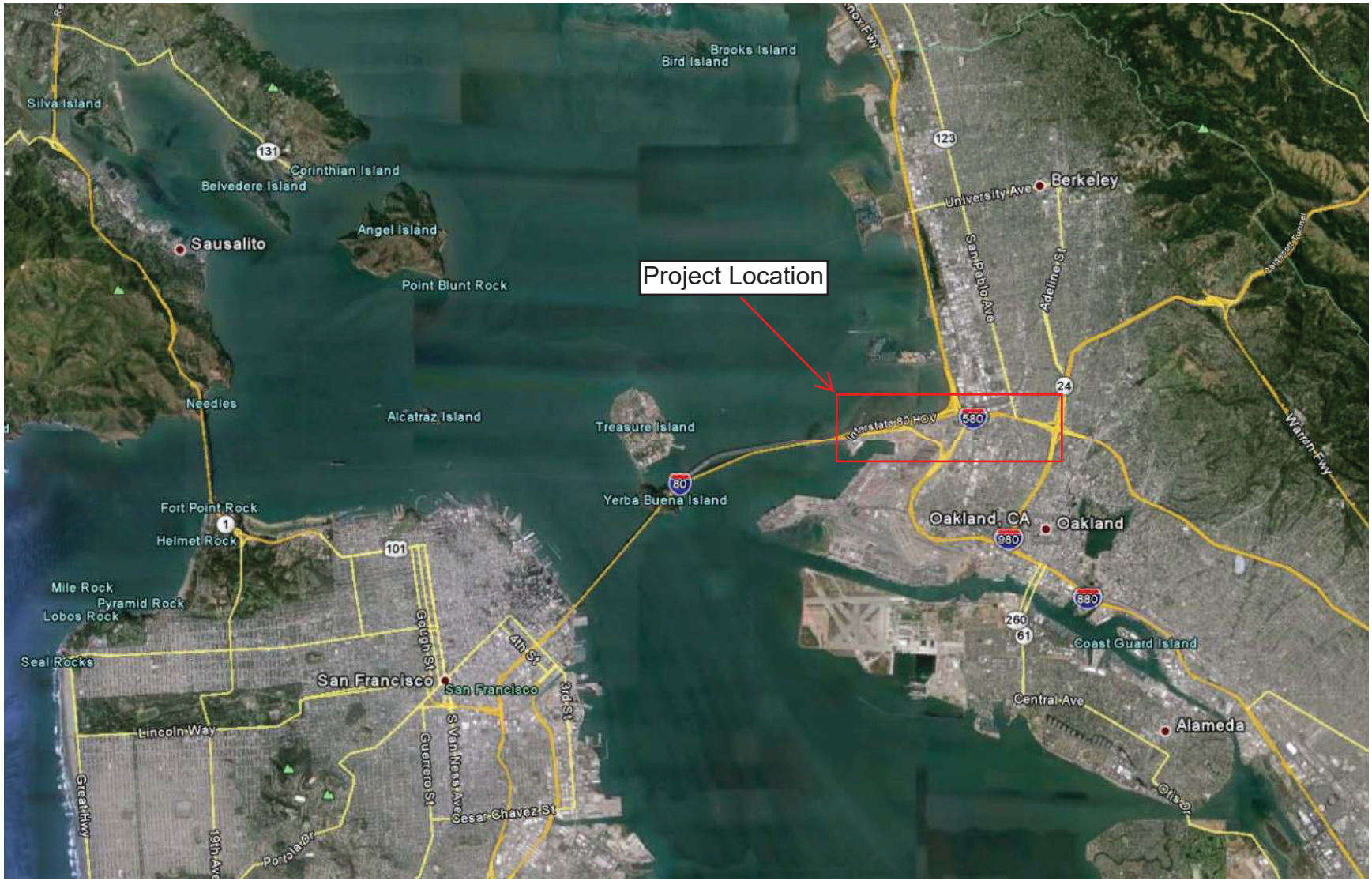
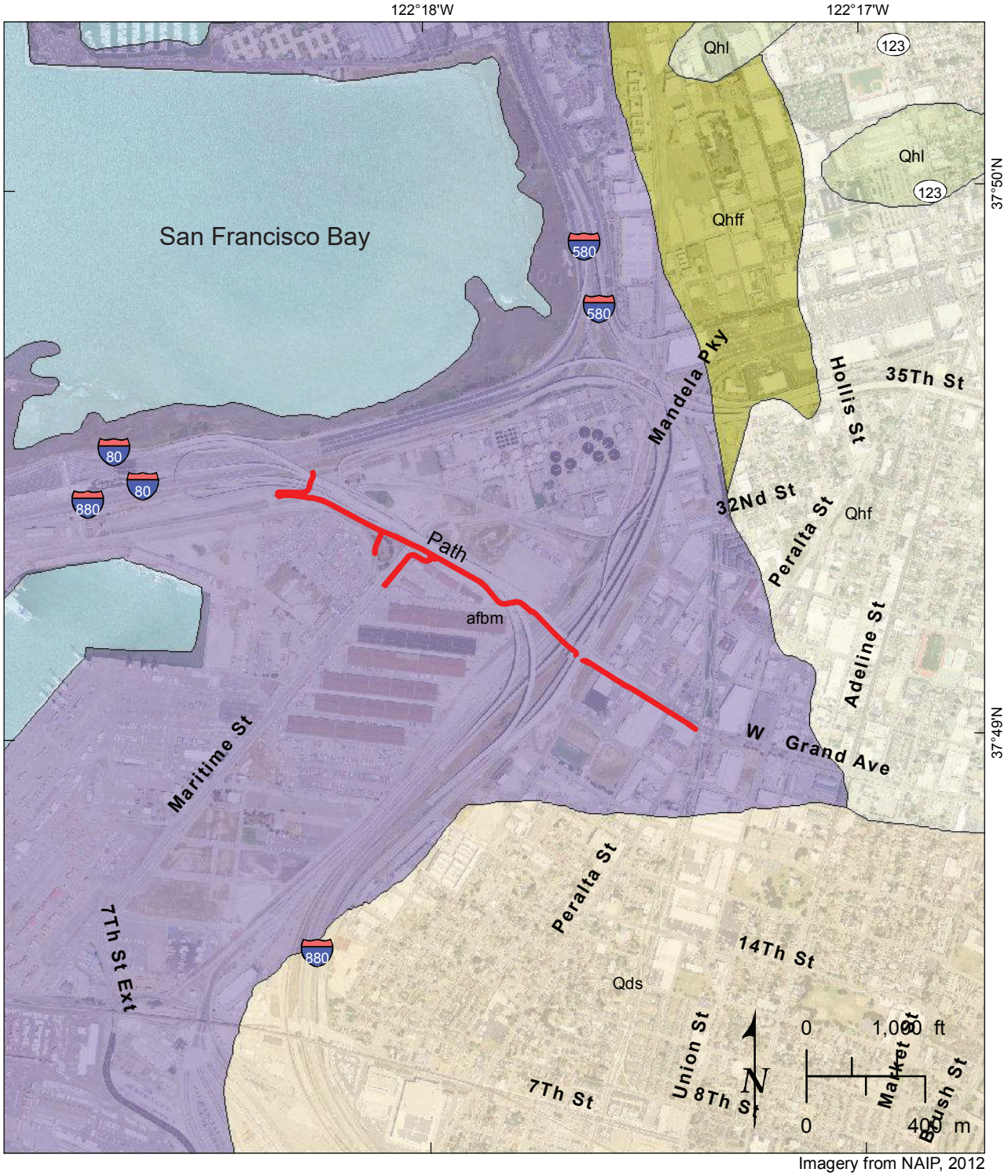
FIGURES



Vicinity Map

FIGURE 1



Imagery from NAIP, 2012

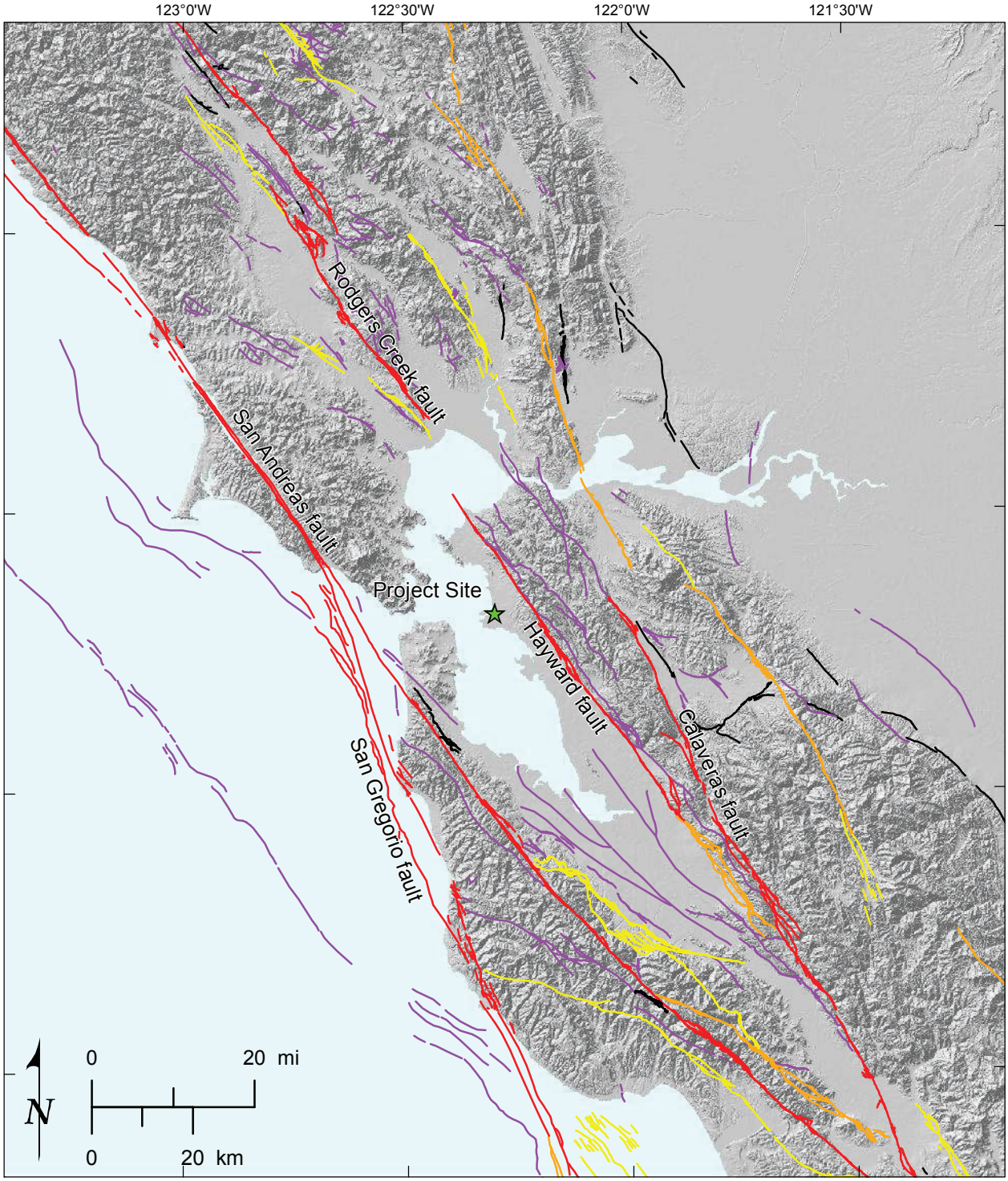
Quaternary Deposits
(Knudsen et al., 2000; USGS OFR 00-444)

afbm	Artificial fill over San Francisco Bay mud
Qhff	Fine-grained Holocene alluvial fan deposits
Qhf	Holocene alluvial fan deposits
Qhl	Holocene alluvial fan levee deposits
Qds	Latest Pleistocene to Holocene dune sand

Quaternary Geologic Map

San Francisco Oakland Bay Bridge
Bicycle / Pedestrian Connection

FIGURE 2



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Quaternary Faults (slip rate mm/year)

- >5
- 1-5
- 0.2-1
- <0.2
- Unknown

Major Active Fault Map

San Francisco Oakland Bay Bridge
Bicycle / Pedestrian Connection

FIGURE 3

Imagery from NAIP, 2012

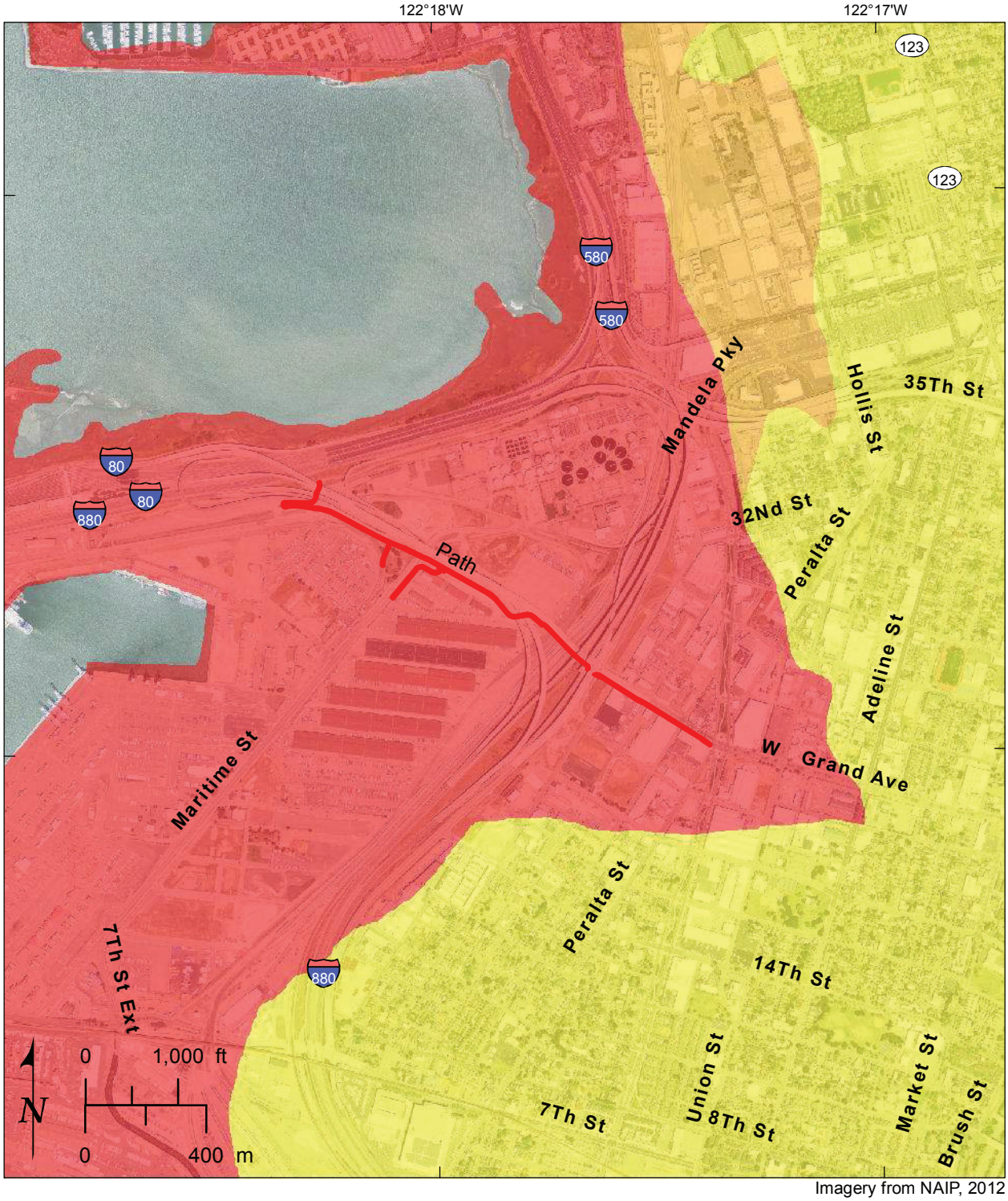
AP fault zone

Alquist-Priolo Earthquake Fault Zone

San Francisco Oakland Bay Bridge

Bicycle / Pedestrian Connection

FIGURE 4



Imagery from NAIP, 2012

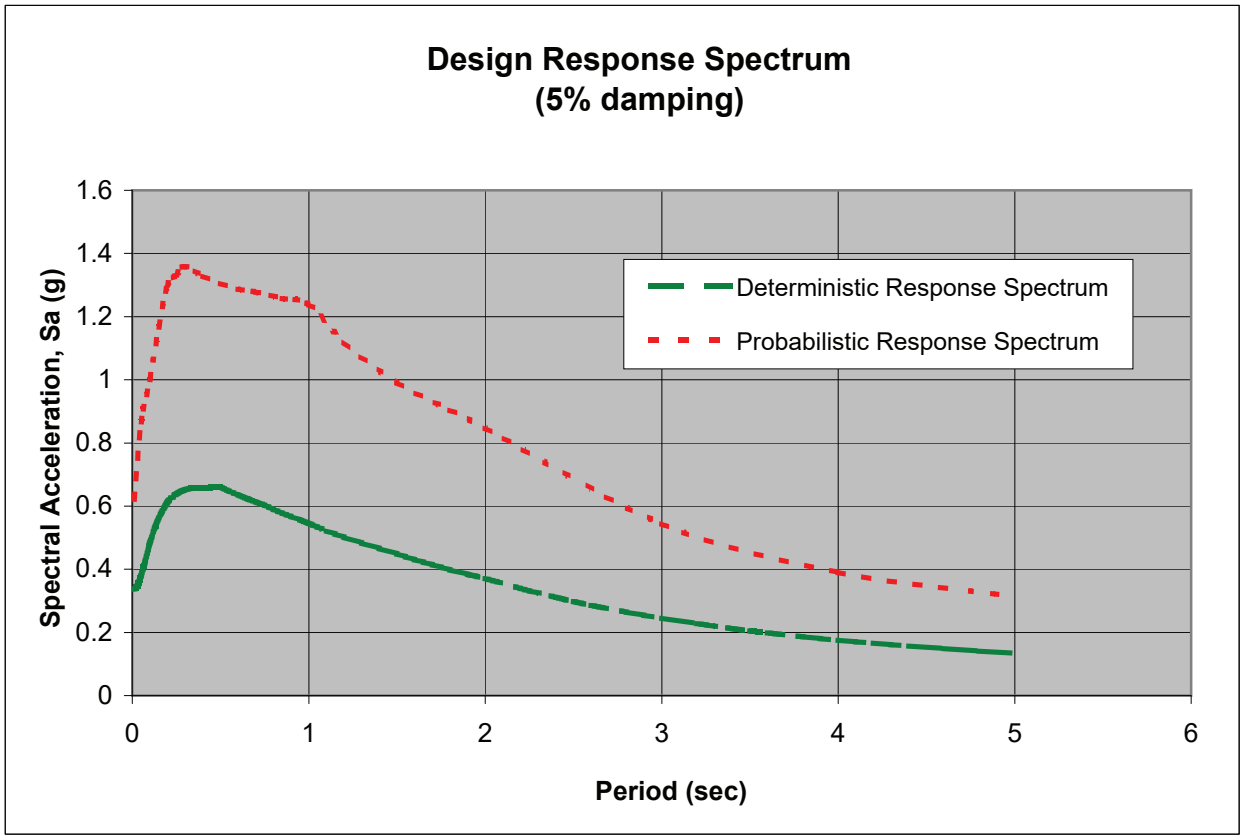
Liquefaction Susceptibility
(Knudsen et al., 2000; USGS OFR 00-444)

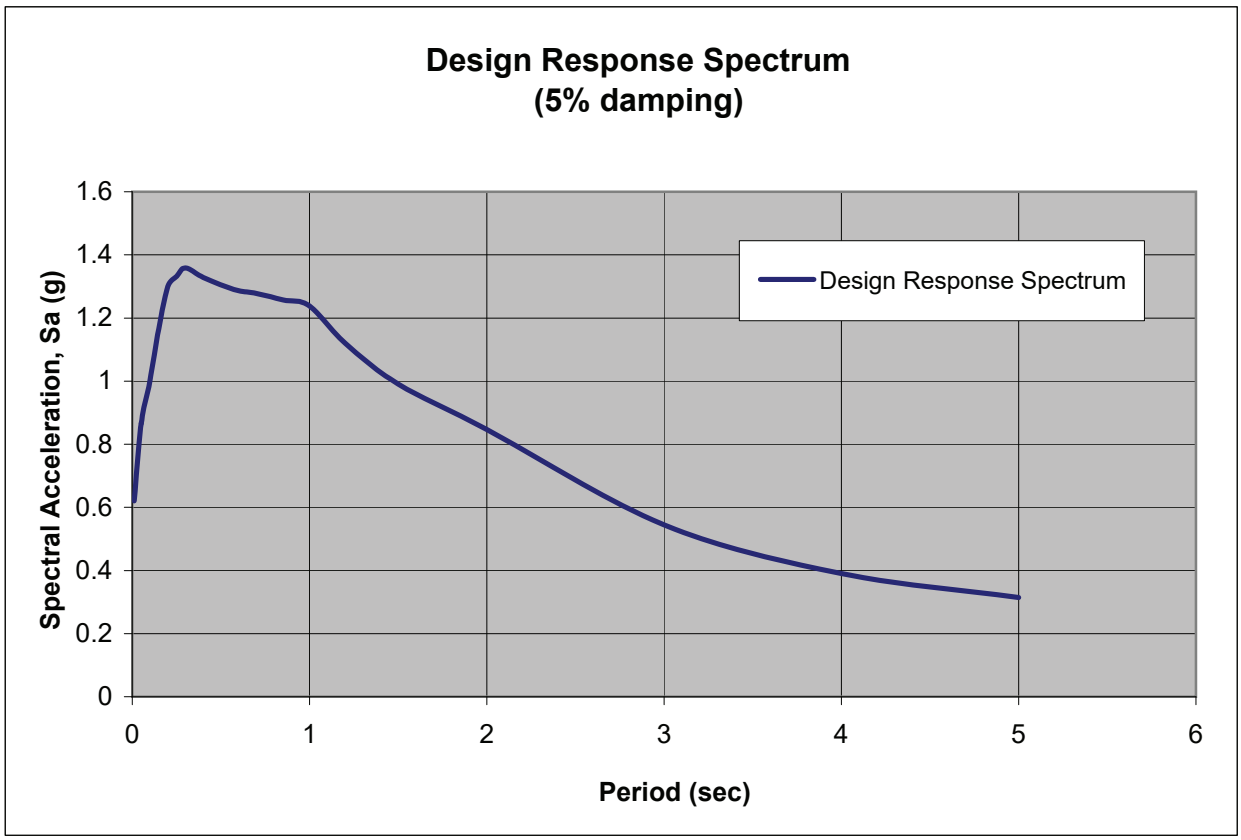
- Very High
- High
- Moderate
- Low (not within map extent)
- Very Low (not within map extent)

Liquefaction Susceptibility in the Project Vicinity

San Francisco Oakland Bay Bridge
Bicycle / Pedestrian Connection

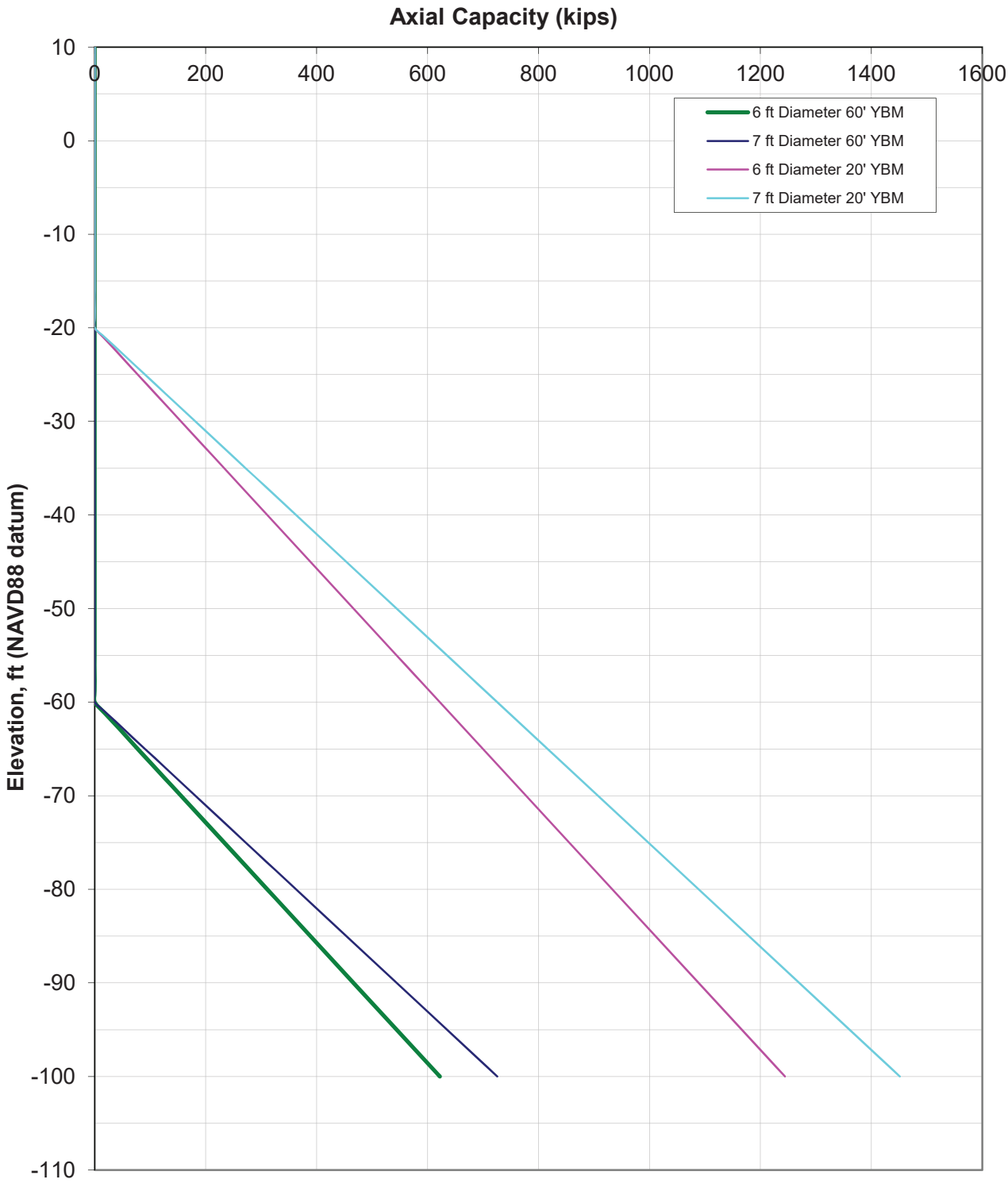
FIGURE 5





Recommended Acceleration Response Spectrum

Figure 6



Gateway Park - The Connection
Cast-In-Drilled Holes (CIDH) Piles Ultimate Capacity

FIGURE 7

APPENDIX A
PROJECT LAYOUT PLANS

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS

UNDERGROUND SERVICE ALERT

CALL BEFORE YOU DIG
1-800-227-2600

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No. _____
Exp. _____
CIVIL
STATE OF CALIFORNIA

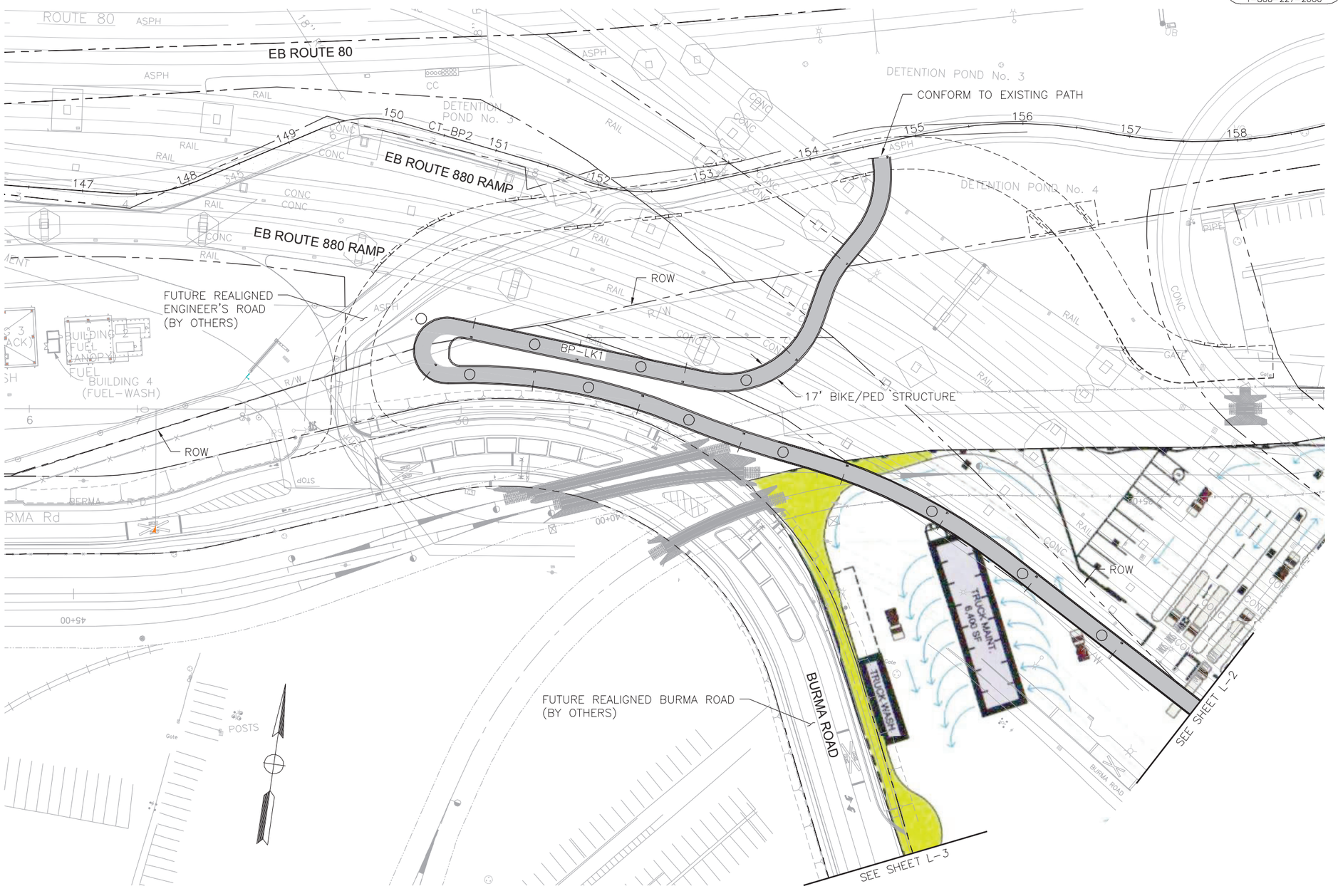
THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

BAY AREA TOLL AUTHORITY
101 EIGHT STREET
OAKLAND, CALIFORNIA 94607

T.Y. LIN INTERNATIONAL
1111 BROADWAY, SUITE 2150
OAKLAND, CALIFORNIA 94607

NOTES:

1. XXXXXXXXXXXXXXX
2. XXXXXXXXXXXXXXX



LAYOUT

Scale: 1"=50'

PRELIMINARY PLAN

L-1

LAST REVISION 06-05-14

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

EA XX-XXXXX

REVISED BY | CALCULATED-DESIGNED BY | CHECKED BY | SUPERVISOR

CONSULTANT FUNCTIONAL SUPERVISOR

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

Drawing: P:\320142.00 Gateway Park\CADD\00 Shts\S-LINK-XXX-C-L001-50sc.dwg

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS

UNDERGROUND SERVICE ALERT

CALL BEFORE YOU DIG
1-800-227-2600

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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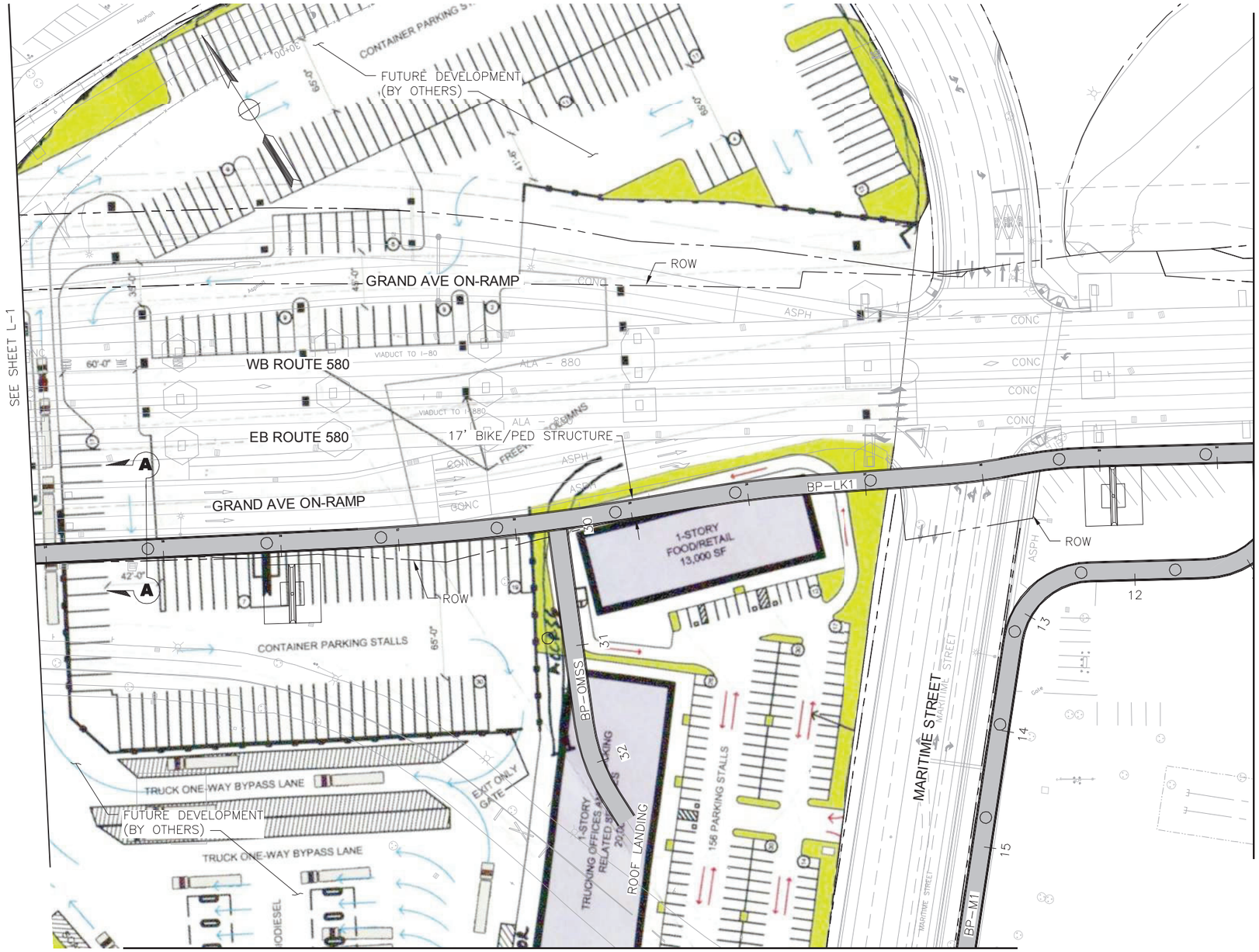
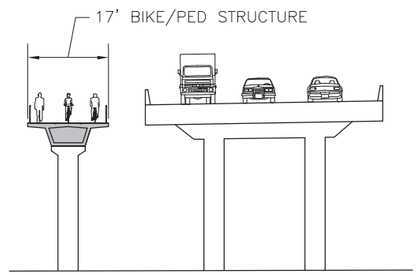
OAKLAND, CALIFORNIA 94607

T.Y. LIN INTERNATIONAL
1111 BROADWAY, SUITE 2150
OAKLAND, CALIFORNIA 94607

NOTES:

1. XXXXXXXXXXXXXXX
2. XXXXXXXXXXXXXXX





PROPOSED SECTION A-A
NTS

50' 0' 100' 150'
SCALE: 1" = 50'

LAYOUT
Scale: 1"=50'

PRELIMINARY PLAN

L-2

LAST REVISION 06-05-14

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

EA XX-XXXXX

REVISED BY | CALCULATED-DESIGNED BY | CHECKED BY | CONSULTANT FUNCTIONAL SUPERVISOR | STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION | Caltrans

Drawing: P:\320142.00 Gateway Park\CADD\00 Shts\S-LINK-XXX-C-L002-50sc.dwg

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS

UNDERGROUND SERVICE ALERT

CALL BEFORE YOU DIG
1-800-227-2600

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No. ____
Exp. ____
CIVIL
STATE OF CALIFORNIA

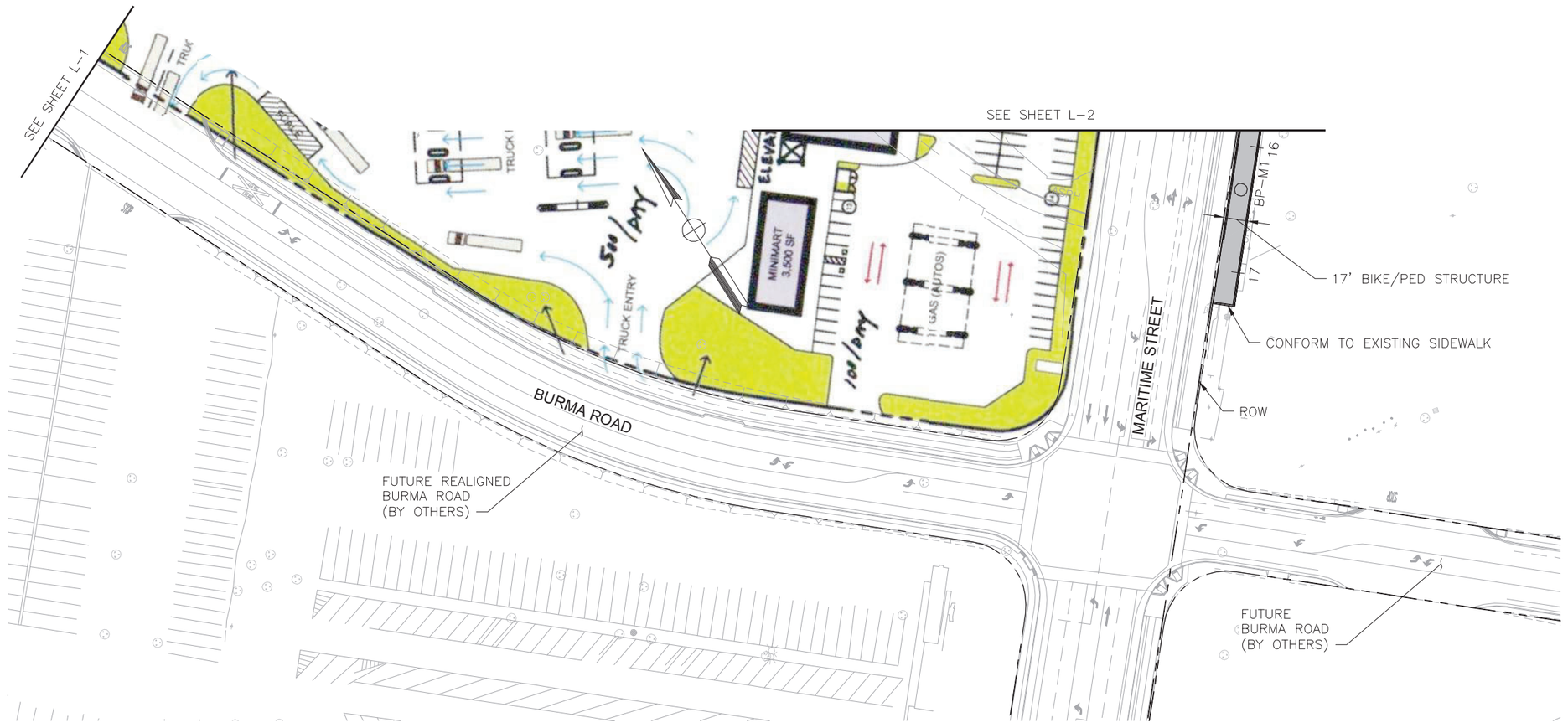
THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

BAY AREA TOLL AUTHORITY
101 EIGHT STREET
OAKLAND, CALIFORNIA 94607

T.Y. LIN INTERNATIONAL
1111 BROADWAY, SUITE 2150
OAKLAND, CALIFORNIA 94607

NOTES:

1. XXXXXXXXXXXXXXX
2. XXXXXXXXXXXXXXX



50' 0' 100' 150'
SCALE: 1" = 50'

LAYOUT
Scale: 1"=50'

PRELIMINARY PLAN

L-3

LAST REVISION 06-05-14

REVISED BY | CALCULATED-DESIGNED BY | CHECKED BY | CONSULTANT FUNCTIONAL SUPERVISOR

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Drawing: P:\320142.00 Gateway Park\CADD\00 Shts\S-LINK-XXX-C-L003-50sc.dwg

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

EA XX-XXXXX

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS

UNDERGROUND SERVICE ALERT

CALL BEFORE YOU DIG
1-800-227-2600

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No. ____
Exp. ____
CIVIL
STATE OF CALIFORNIA

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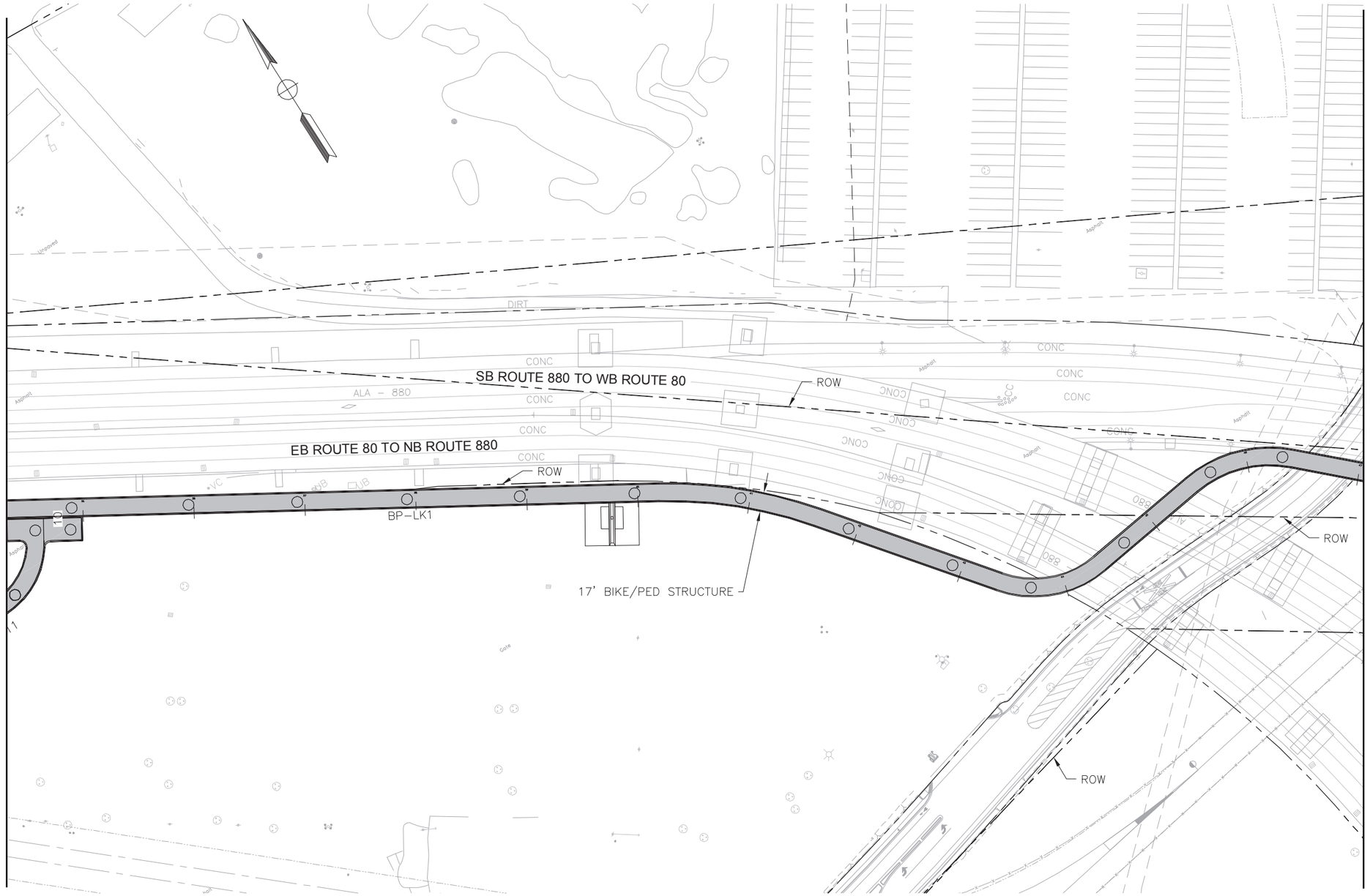
101 EIGHT STREET
OAKLAND, CALIFORNIA 94607

T.Y. LIN INTERNATIONAL
1111 BROADWAY, SUITE 2150
OAKLAND, CALIFORNIA 94607

NOTES:

1. XXXXXXXXXXXXXXX
2. XXXXXXXXXXXXXXX



50' 0' 100' 150'
SCALE: 1" = 50'

LAYOUT
Scale: 1"=50'

PRELIMINARY PLAN

L-4

LAST REVISION 06-05-14

REVISED BY | CALCULATED-DESIGNED BY | CHECKED BY | SUPERVISOR | CONSULTANT FUNCTIONAL | DEPARTMENT OF TRANSPORTATION | STATE OF CALIFORNIA

Drawing: P:\320142.00 Gateway Park\CADD\00 Shts\S-LINK-XXX-C-L004-50sc.dwg

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

EA XX-XXXXX

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS

UNDERGROUND SERVICE ALERT
CALL BEFORE YOU DIG
1-800-227-2600

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No. ____
Exp. ____
CIVIL
STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

BAY AREA TOLL AUTHORITY
101 EIGHT STREET
OAKLAND, CALIFORNIA 94607

T.Y. LIN INTERNATIONAL
1111 BROADWAY, SUITE 2150
OAKLAND, CALIFORNIA 94607

NOTES:

1. XXXXXXXXXXXXXXX
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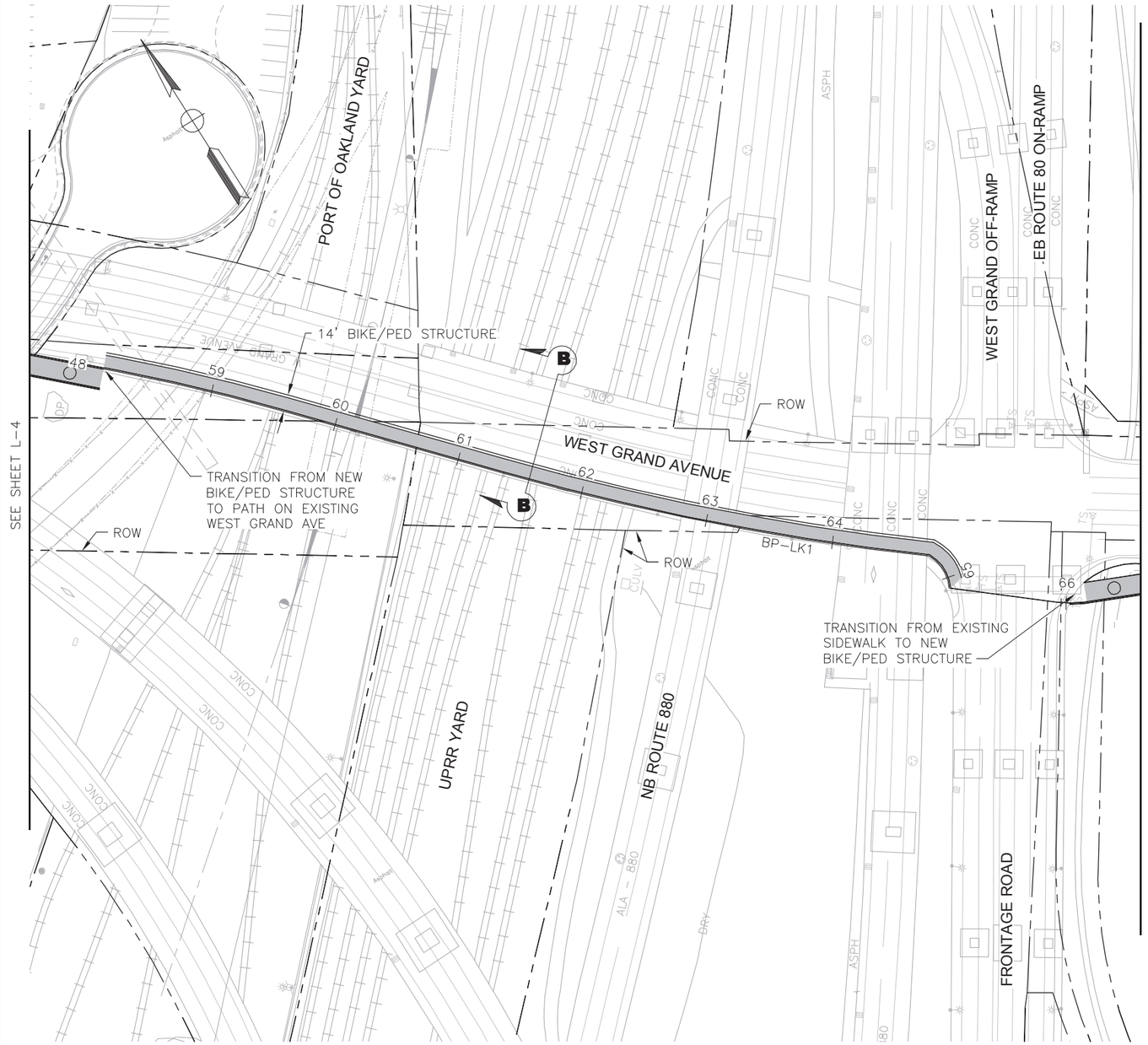

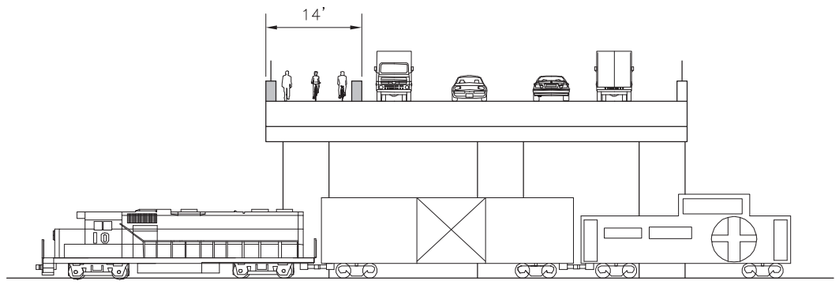

PROPOSED SECTION B-B
NTS

50' 0' 100' 150'
SCALE: 1" = 50'

LAYOUT
Scale: 1"=50'

PRELIMINARY PLAN

L-5

LAST REVISION 06-05-14

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

EA XX-XXXXX

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STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

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Drawing: P:\320142.00 Gateway Park\CADD\00 Shts\S-LINK-XXX-C-L005-50sc.dwg

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS

UNDERGROUND SERVICE ALERT

CALL BEFORE YOU DIG
1-800-227-2600

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No. _____
Exp. _____
CIVIL
STATE OF CALIFORNIA

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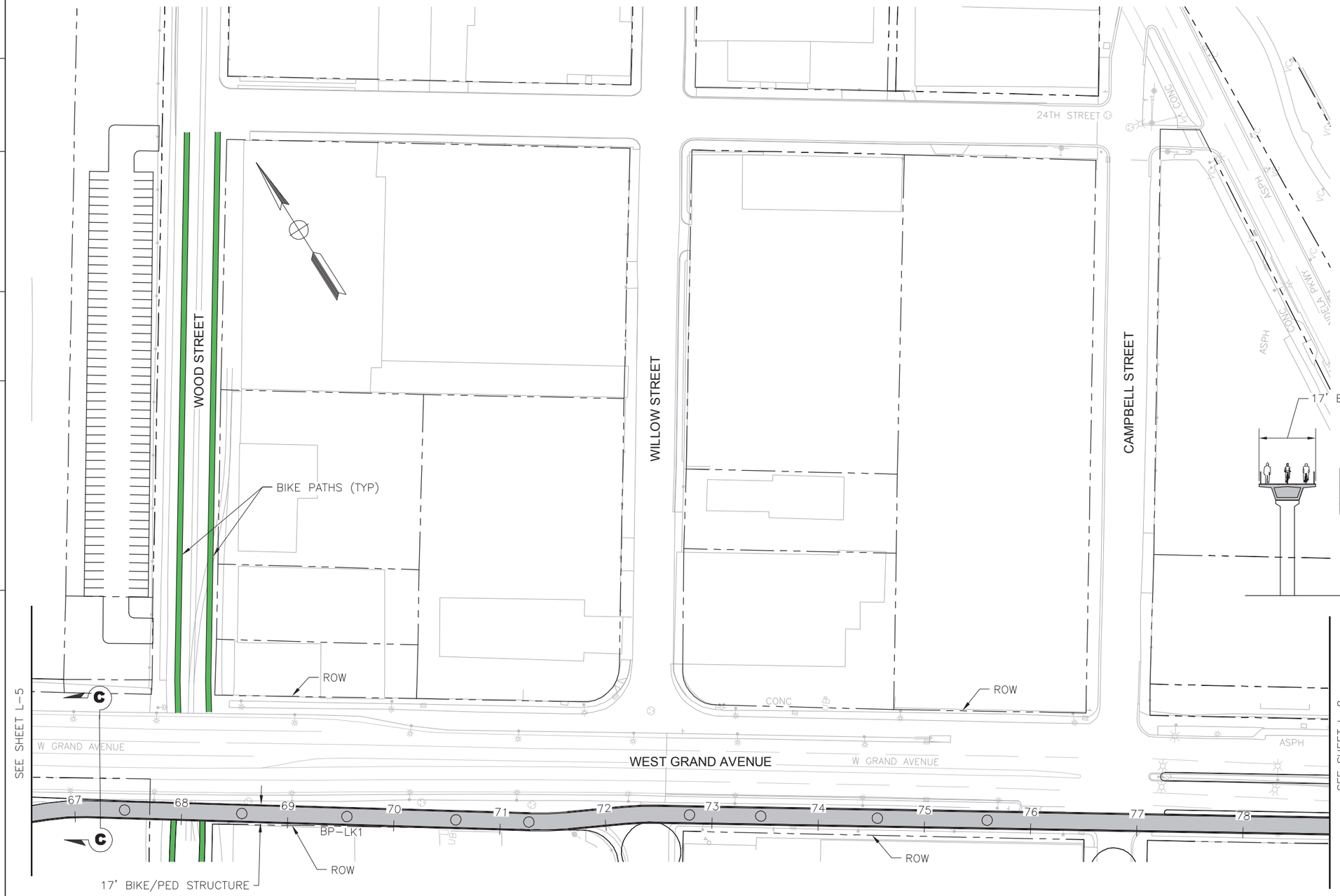
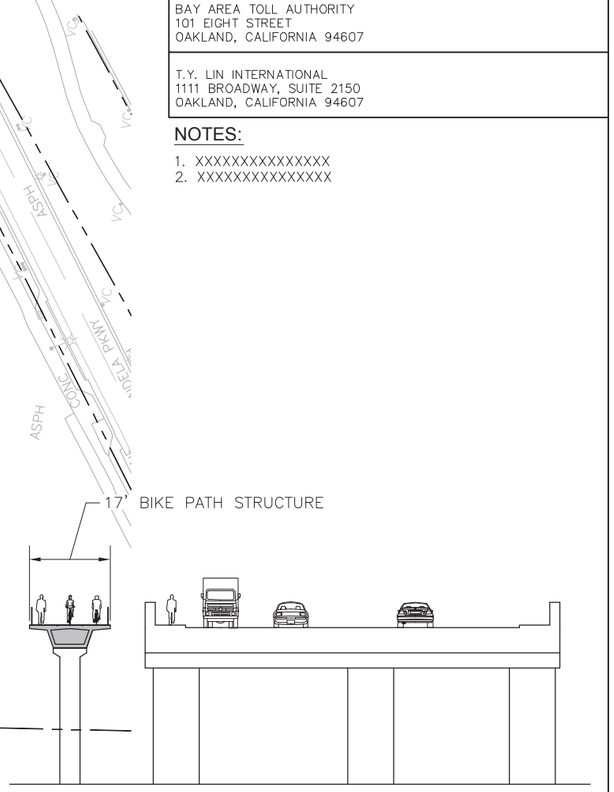
BAY AREA TOLL AUTHORITY
101 EIGHT STREET
OAKLAND, CALIFORNIA 94607

T.Y. LIN INTERNATIONAL
1111 BROADWAY, SUITE 2150
OAKLAND, CALIFORNIA 94607

NOTES:

1. XXXXXXXXXXXXXXX
2. XXXXXXXXXXXXXXX





PROPOSED SECTION C-C
NTS

50' 0' 100' 150'
SCALE: 1" = 50'

LAYOUT
Scale: 1"=50'

PRELIMINARY PLAN

L-6

LAST REVISION 06-05-14

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

EA XX-XXXXX

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STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Drawing: P:\320142.00 Gateway Park\CADD\00 Shts\S-LINK-XXX-C-L006-50sc.dwg

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS

UNDERGROUND SERVICE ALERT
CALL BEFORE YOU DIG
1-800-227-2600

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No. _____
Exp. _____
CIVIL
STATE OF CALIFORNIA

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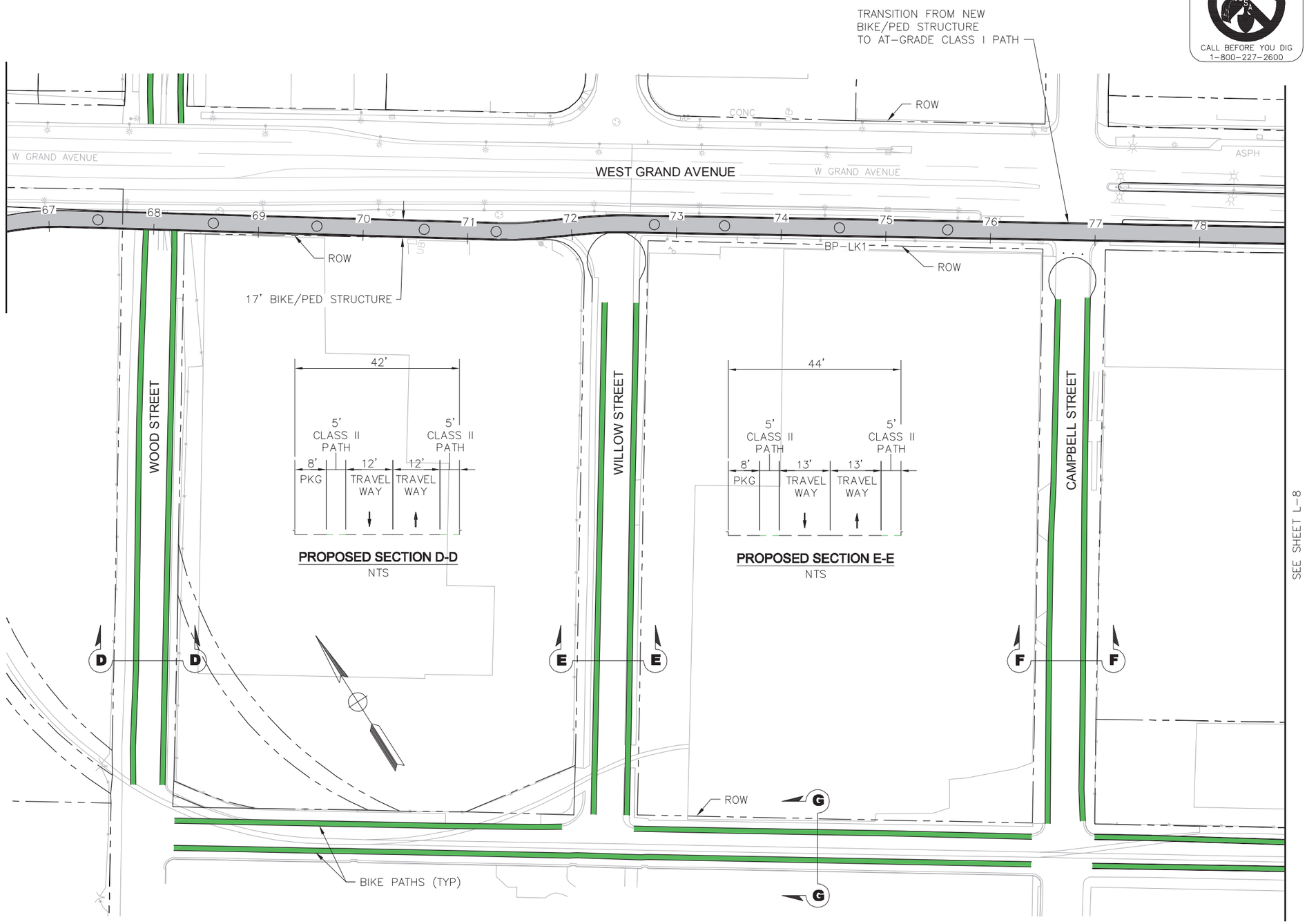
BAY AREA TOLL AUTHORITY
101 EIGHT STREET
OAKLAND, CALIFORNIA 94607

T.Y. LIN INTERNATIONAL
1111 BROADWAY, SUITE 2150
OAKLAND, CALIFORNIA 94607

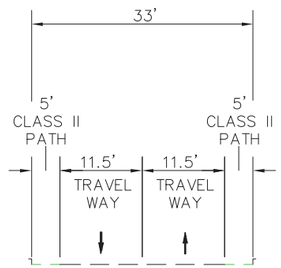
NOTES:

1. XXXXXXXXXXXXXXX
2. XXXXXXXXXXXXXXX

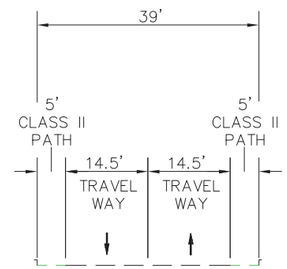


PROPOSED SECTION D-D
NTS

PROPOSED SECTION E-E
NTS



PROPOSED SECTION F-F
NTS



PROPOSED SECTION G-G
NTS

50' 0' 100' 150'
SCALE: 1" = 50'

LAYOUT
Scale: 1"=50'

PRELIMINARY PLAN

L-7

REVISED BY	CALCULATED-DESIGNED BY	CHECKED BY

SUPERVISOR
CONSULTANT FUNCTIONAL
STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans

Drawing: P:\320142.00 Gateway Park\CADD\00 Shts\S-LINK-XXX-C-L007-50sc.dwg

LAST REVISION 06-05-14

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

EA XX-XXXXX

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS

UNDERGROUND SERVICE ALERT

CALL BEFORE YOU DIG
1-800-227-2600

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No. _____
Exp. _____
CIVIL
STATE OF CALIFORNIA

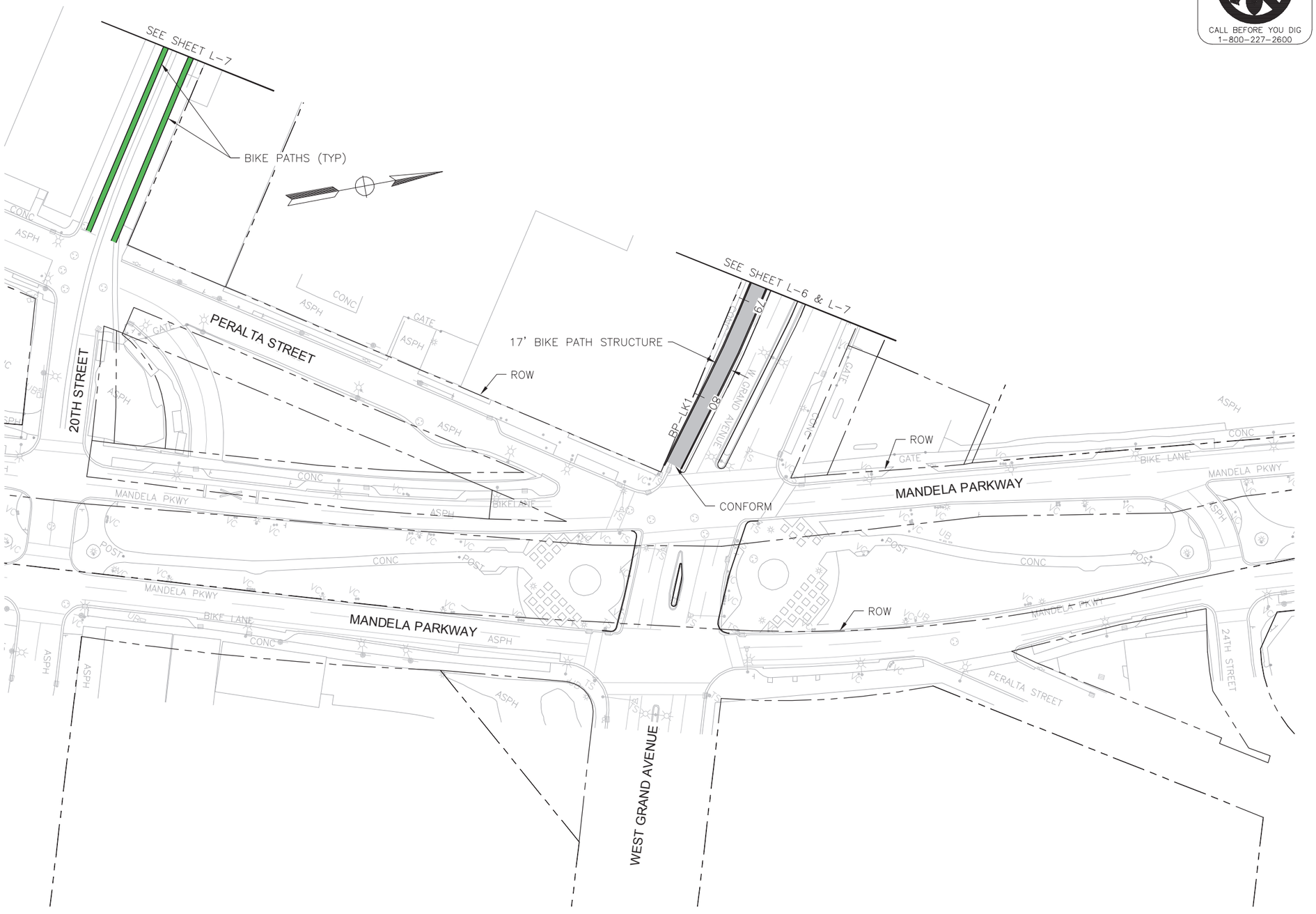
THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

BAY AREA TOLL AUTHORITY
101 EIGHT STREET
OAKLAND, CALIFORNIA 94607

T.Y. LIN INTERNATIONAL
1111 BROADWAY, SUITE 2150
OAKLAND, CALIFORNIA 94607

NOTES:

1. XXXXXXXXXXXXXXX
2. XXXXXXXXXXXXXXX



50' 0' 100' 150'
SCALE: 1" = 50'

LAYOUT
Scale: 1"=50'

PRELIMINARY PLAN

L-8

REVISED BY | CALCULATED-DESIGNED BY | CHECKED BY | CONSULTANT FUNCTIONAL SUPERVISOR

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

Drawing: P:\320142.00 Gateway Park\CADD\00 Shts\S-LINK-XXX-C-L008-50sc.dwg

LAST REVISION 06-05-14

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

EA XX-XXXXX

APPENDIX B

BORING LOGS FROM PREVIOUS INVESTIGATIONS

DIST.	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	Ala	880, 80	34.4, 1.3/3.0	557	1412

R.C. Wilhelms
CERTIFIED ENGINEERING GEOLOGIST

REGISTERED GEOLOGIST — R.C. WILHELMS — No. 560 — Exp. 6-30-94 — CERTIFIED ENGINEERING GEOLOGIST — STATE OF CALIFORNIA

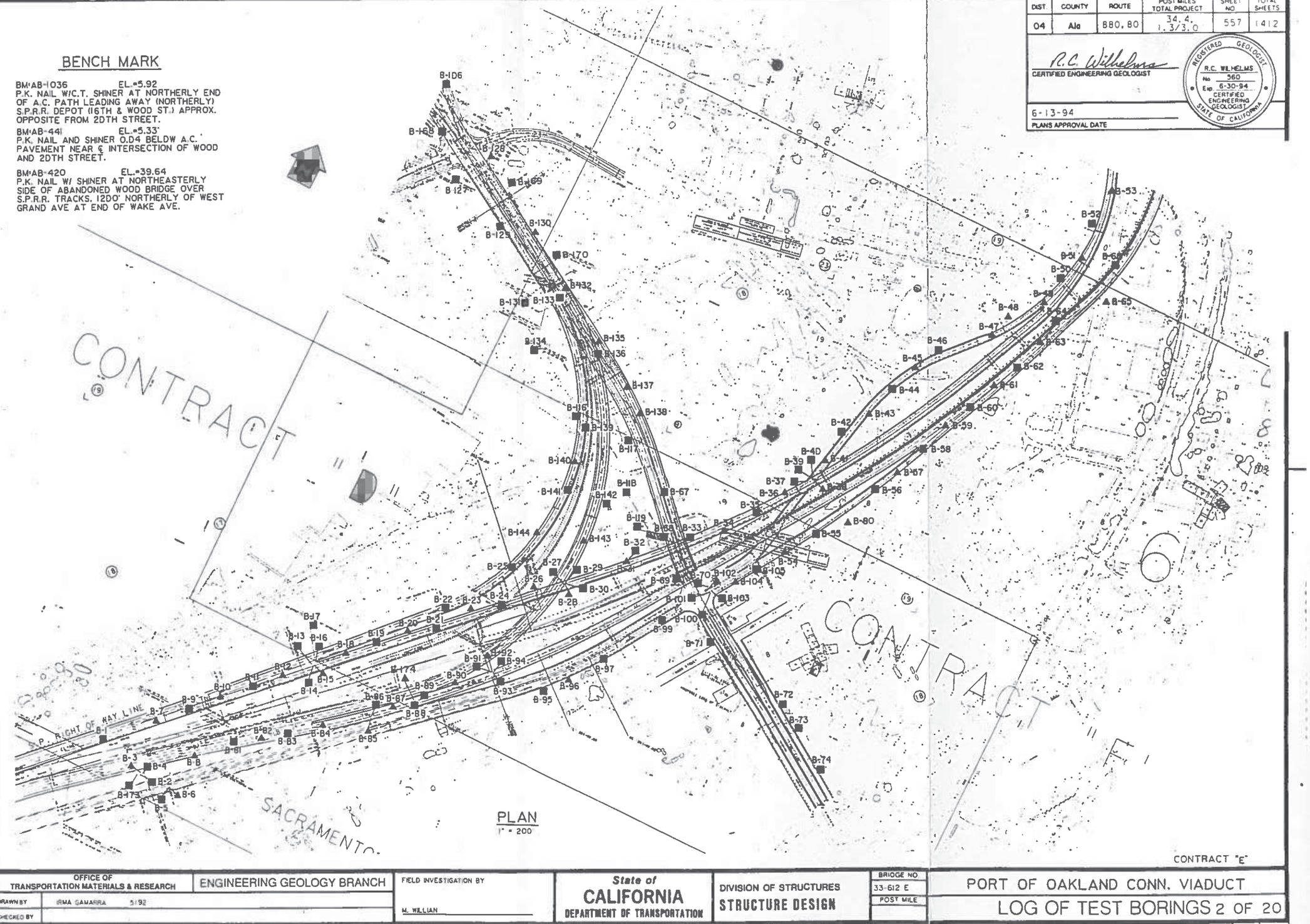
6-13-94
PLANS APPROVAL DATE

BENCH MARK

BM AB-1036 EL.=5.92
P.K. NAIL W/C.T. SHINER AT NORTHERLY END OF A.C. PATH LEADING AWAY (NORTHERLY) S.P.R.R. DEPOT (16TH & WOOD ST.) APPROX. OPPOSITE FROM 20TH STREET.

BM AB-441 EL.=5.33'
P.K. NAIL AND SHINER 0.04 BELOW A.C. PAVEMENT NEAR ℄ INTERSECTION OF WOOD AND 20TH STREET.

BM AB-420 EL.=39.64
P.K. NAIL W/ SHINER AT NORTHEASTERLY SIDE OF ABANDONED WOOD BRIDGE OVER S.P.R.R. TRACKS. 120' NORTHERLY OF WEST GRAND AVE AT END OF WAKE AVE.



PLAN
1" = 200

CONTRACT "E"

OFFICE OF TRANSPORTATION MATERIALS & RESEARCH	ENGINEERING GEOLOGY BRANCH	FIELD INVESTIGATION BY	State of CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF STRUCTURES STRUCTURE DESIGN	BRIDGE NO. 33-612 E	PORT OF OAKLAND CONN. VIADUCT	
DRAWN BY IRMA GAMARRA 5/92		M. WILLIAN			POST MILE	LOG OF TEST BORINGS 2 OF 20	
CHECKED BY							

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 04
EA 192231

DISREGARD PRINTS BEARING EARLIER REVISION DATES

SHEET 116 OF 148

240-B-11
B-78

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO
04	Ala	880, 80	34.4, 1.3/3.0	558

R.C. Wilhelms
CERTIFIED ENGINEERING GEOLOGIST

6-13-94
PLANS APPROVAL DATE

OFFICE OF TRANSPORTATION MATERIALS & RESEARCH	ENGINEERING GEOLOGY BRANCH	FIELD INVESTIGATION BY: M. WILLIAMS	State of CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF STRUCTURES STRUCTURE DESIGN

DRAWN BY
CHECKED BY

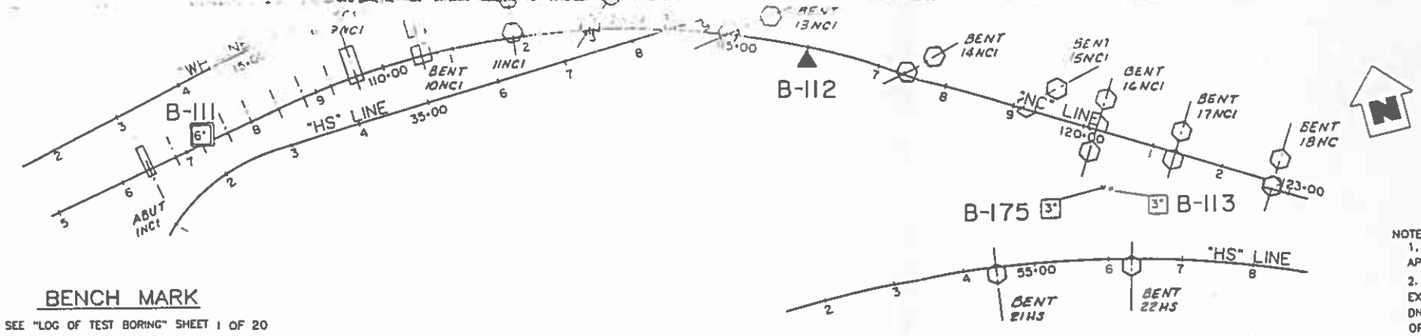
BRIDGE NO. 33-612 E
POST MILE

PORT OF OAKLAND CONN. VIAD
LOG OF TEST BORINGS 3

CU 04
EA 192231

DISREGARD PRINTS BEARING EARLIER REVISION DATES
REVISION DATES (PRELIMINARY STAGE ONLY)

248.B-113



PLAN
1" = 100'

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	Ala	880.80	34.4, 1.3/3.0	560	14

R.C. Wilhelms
CERTIFIED ENGINEERING GEOLOGIST

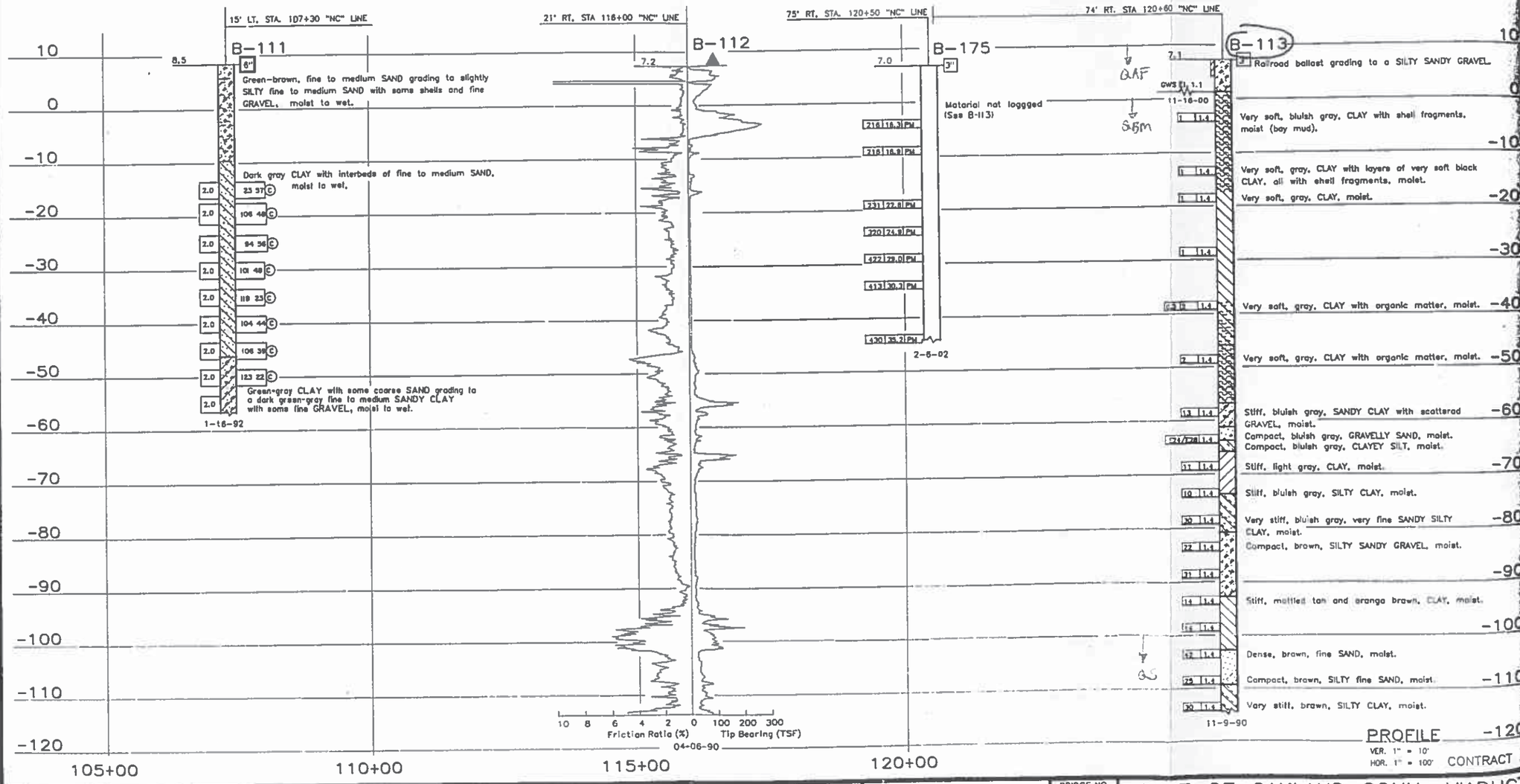
REGISTERED GEOLOGIST R.C. WILHELMS No. 380 Exp. 6-30-94 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

6-13-94
PLANS APPROVAL DATE

NOTE:
1. UNCONFINED COMPRESSIVE STRENGTH APPROXIMATED BY HAND PENETROMETER.
2. E = BLOW COUNT FOR ONE FOOT PENETRATION EXTRAPOLATED FROM BLOW COUNT FOR LESS THAN ONE FOOT (DUE TO CHANGE IN MATERIAL OR HARD DRIVING).

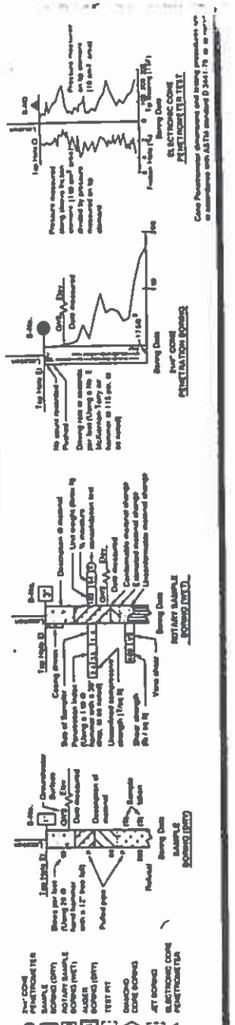
LEGEND
Menard's Modulus (psi) 765 | 27.9 PM
Net Limit Pressure (psi)
Pressure Meter

BENCH MARK
SEE "LOG OF TEST BORING" SHEET 1 OF 20

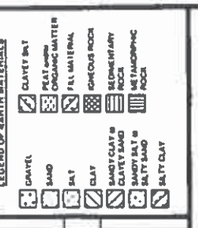


PROFILE
VER. 1" = 10'
HOR. 1" = 100'
CONTRACT

LEGEND OF BORING OPERATIONS



LEGEND OF EARTH MATERIALS



CONSISTENCY CLASSIFICATION FOR SOILS
According to the Standard Penetration Test

Penetration (Blows/ft)	Granular	Cohesive
0 - 4	Very loose	Very soft
5 - 9	Loose	Soft
10 - 19	Slightly compact	Medium stiff
20 - 39	Compact	Stiff
40 - 79	Dense	Very stiff
>79	Very dense	Very hard

NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analyses.

OFFICE OF TRANSPORTATION MATERIALS & RESEARCH	ENGINEERING GEOLOGY BRANCH
DRAWN BY	K. WAHL 5-92
CHECKED BY	

FIELD INVESTIGATION BY: M. WILLIAMS

State of CALIFORNIA DEPARTMENT OF TRANSPORTATION

DIVISION OF STRUCTURES
STRUCTURE DESIGN

BRIDGE NO. 33-612 E
POST MILE

PORT OF OAKLAND CONN. VIADUCT
LOG OF TEST BORINGS 5 OF 20

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 04
EA 192231

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY)

SHEET 119 TOTAL SHEETS 140

LEGEND OF BORING OPERATIONS
LEGEND OF EARTH MATERIALS
CONSISTENCY CLASSIFICATION

DIST.	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	Ala	880, 80	34.4, 1.3/3.0	561	1412

R.C. Wilhelms
CERTIFIED ENGINEERING GEOLOGIST

REGISTERED GEOLOGIST R.C. WILHELMS No. 560 Exp. 8-30-94 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

6-13-94
PLANS APPROVAL DATE

248.B-115
·B-120

BENCH MARK

SEE "LOG OF TEST BORINGS 1 OF 20"

NOTES:

1. UNCONFINED COMPRESSIVE STRENGTH APPROXIMATED BY HAND PENETROMETER TEST
2. £ = BLOW COUNT FOR ONE FOOT PENETRATION EXTRAPOLATED FROM BLOW COUNT FOR LESS THAN ONE FOOT (DUE TO CHANGE IN MATERIAL OR HARD DRIVING)

PLAN

1" = 100'

PROFILE

Hor. 1" = 20'
Ver. 1" = 10'

CONTRACT "E"

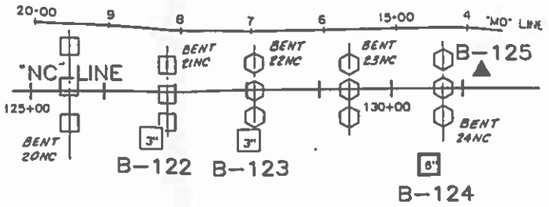
OFFICE OF TRANSPORTATION MATERIALS & RESEARCH	ENGINEERING GEOLOGY BRANCH	FIELD INVESTIGATION BY:	State of CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF STRUCTURES STRUCTURE DESIGN	BRIDGE NO. 33-612 E	PORT OF OAKLAND CONN. VIADUCT
DRAWN BY IRMA CAMARRA 5/92		M. WILLIAN		CU 04 EA 192231	POST MILE	LOG OF TEST BORINGS 6 OF 20
CHECKED BY		ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3			DISREGARD EARLIER	

248-B-122
B-123

DIST	COUNTY	ROUTE	POST MILE TOTAL PROJECT	SHEET NO.
04	Ala	880, 80	34.4, 1.3/3.0	562

R.C. Wilhelms
CERTIFIED ENGINEERING GEOLOGIST

6-13-94
PLANS APPROVAL DATE

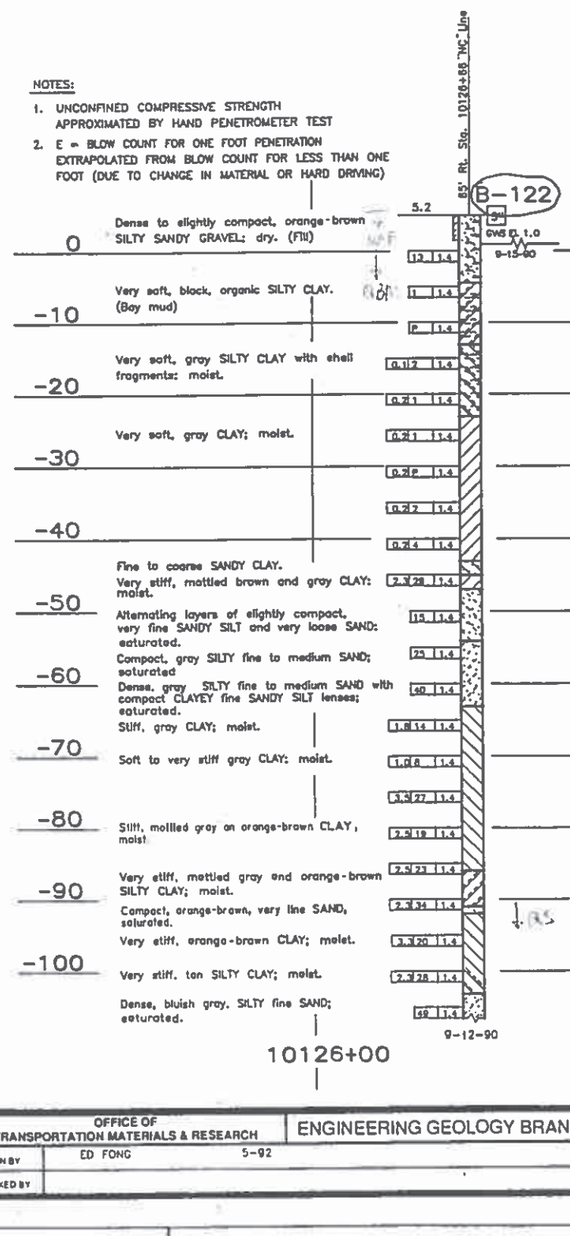


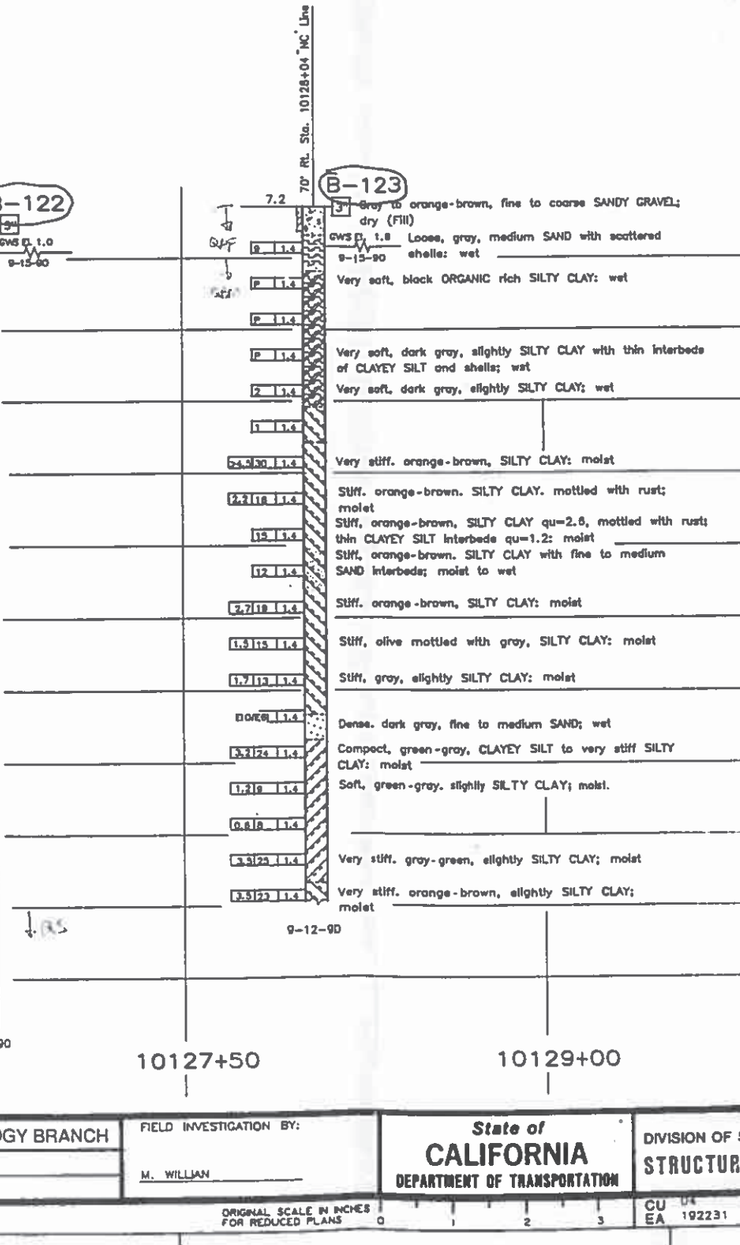
BENCH MARK

See "Log of Test Borings 1 of 20

NOTES:

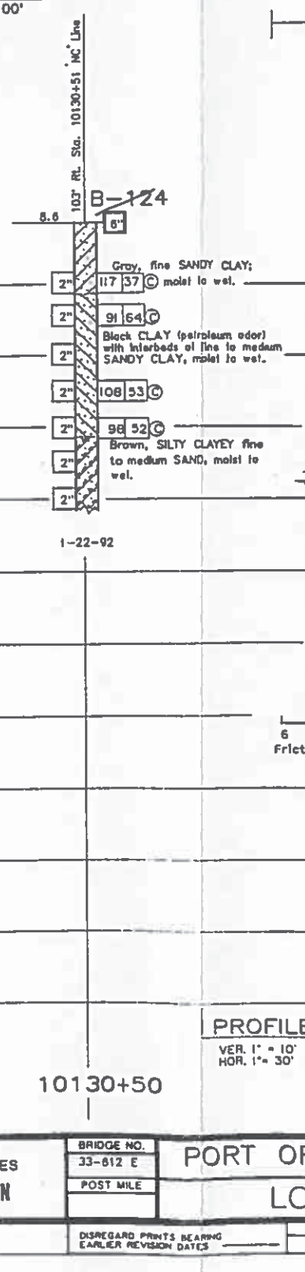
1. UNCONFINED COMPRESSIVE STRENGTH APPROXIMATED BY HAND PENETROMETER TEST
2. E = BLOW COUNT FOR ONE FOOT PENETRATION EXTRAPOLATED FROM BLOW COUNT FOR LESS THAN ONE FOOT (DUE TO CHANGE IN MATERIAL OR HARD DRIVING)

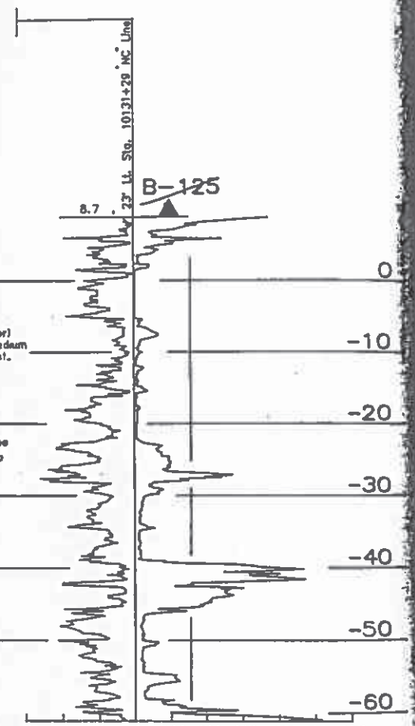




PLAN

1"=100'



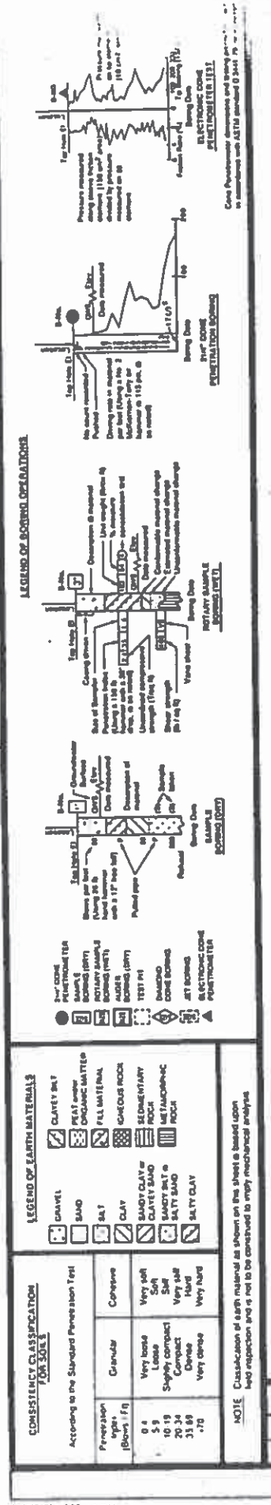


PROFILE

VER. 1" = 10'
HOR. 1" = 30'

0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100

10126+00 10127+50 10129+00 10130+50 10132+00



OFFICE OF TRANSPORTATION MATERIALS & RESEARCH	ENGINEERING GEOLOGY BRANCH	FIELD INVESTIGATION BY:	State of CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF STRUCTURES STRUCTURE DESIGN	BRIDGE NO. 33-812 E
DRAWN BY ED FONG 5-92		M. WILLIAN			POST MILE
CHECKED BY					

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 04
EA 192231

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY)

PORT OF OAKLAND CONN. VIADU

LOG OF TEST BORINGS 7 OF

CONTRACT

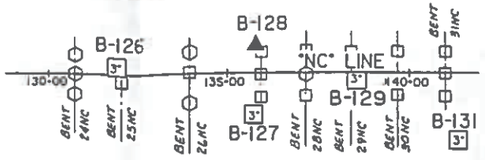
DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	Ala	880, 80	34.4, .1, 3/3.0	563	1412

248. B-126
· B-127
· B-128
· B-129
· B-131

R.C. Wilhelms
CERTIFIED ENGINEERING GEOLOGIST

REGISTERED GEOLOGIST R.C. WILHELMS No. 560 Exp. 8-30-94 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

6-13-92
PLANS APPROVAL DATE

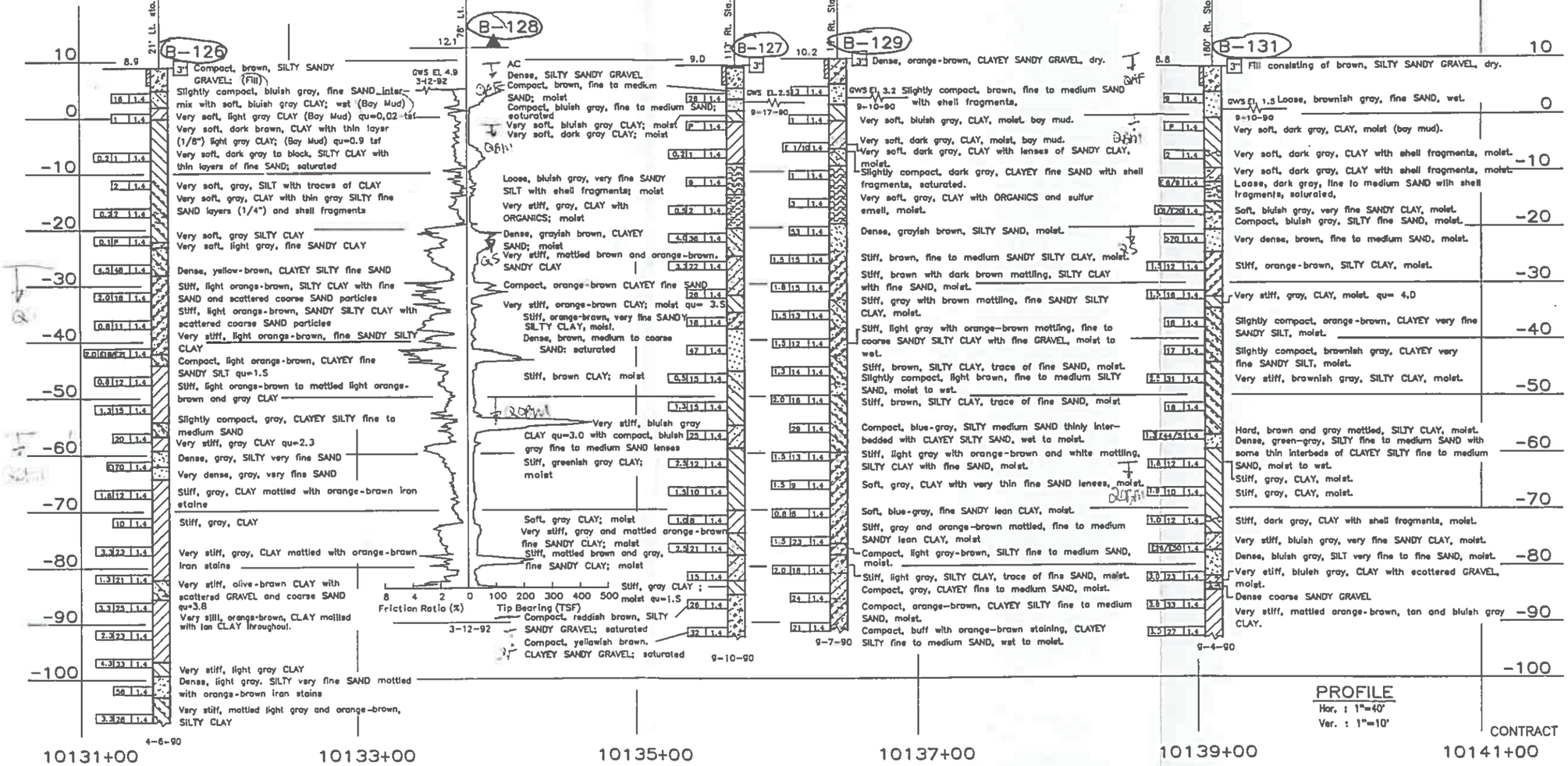


BENCH MARK

See * Log of Test Borings 1 of 20 *

PLAN
1"=200'

NOTES:
1. UNCONFINED COMPRESSIVE STRENGTH APPROXIMATED BY HAND PENETROMETER TEST
2. E = BLOW COUNT FOR ONE FOOT PENETRATION EXTRAPOLATED FROM BLOW COUNT FOR LESS THAN ONE FOOT (DUE TO CHANGE IN MATERIAL OR HARD DRIVING)



PROFILE
Hor. : 1"=40'
Ver. : 1"=10'

CONTRACT "E"

DIVISION OF NEW TECHNOLOGY, MATERIALS AND RESEARCH	OFFICE OF ENGINEERING GEOLOGY	FIELD INVESTIGATION BY	State of CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF STRUCTURES STRUCTURE DESIGN	BRIDGE NO. 33-612 E
DRAWN BY ED FONG 5-92		M. WILLIAN			POST MILE
CHECKED BY				CU 04 EA 192231	

PORT OF OAKLAND CONN. VIADUCT

LOG OF TEST BORINGS B OF 20

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY)

122 148

248.B-158
·B-159
·B-160

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	ALA	880.80	34.2, 1.3/3.0	569	1412

GEOTECHNICAL PROFESSIONAL

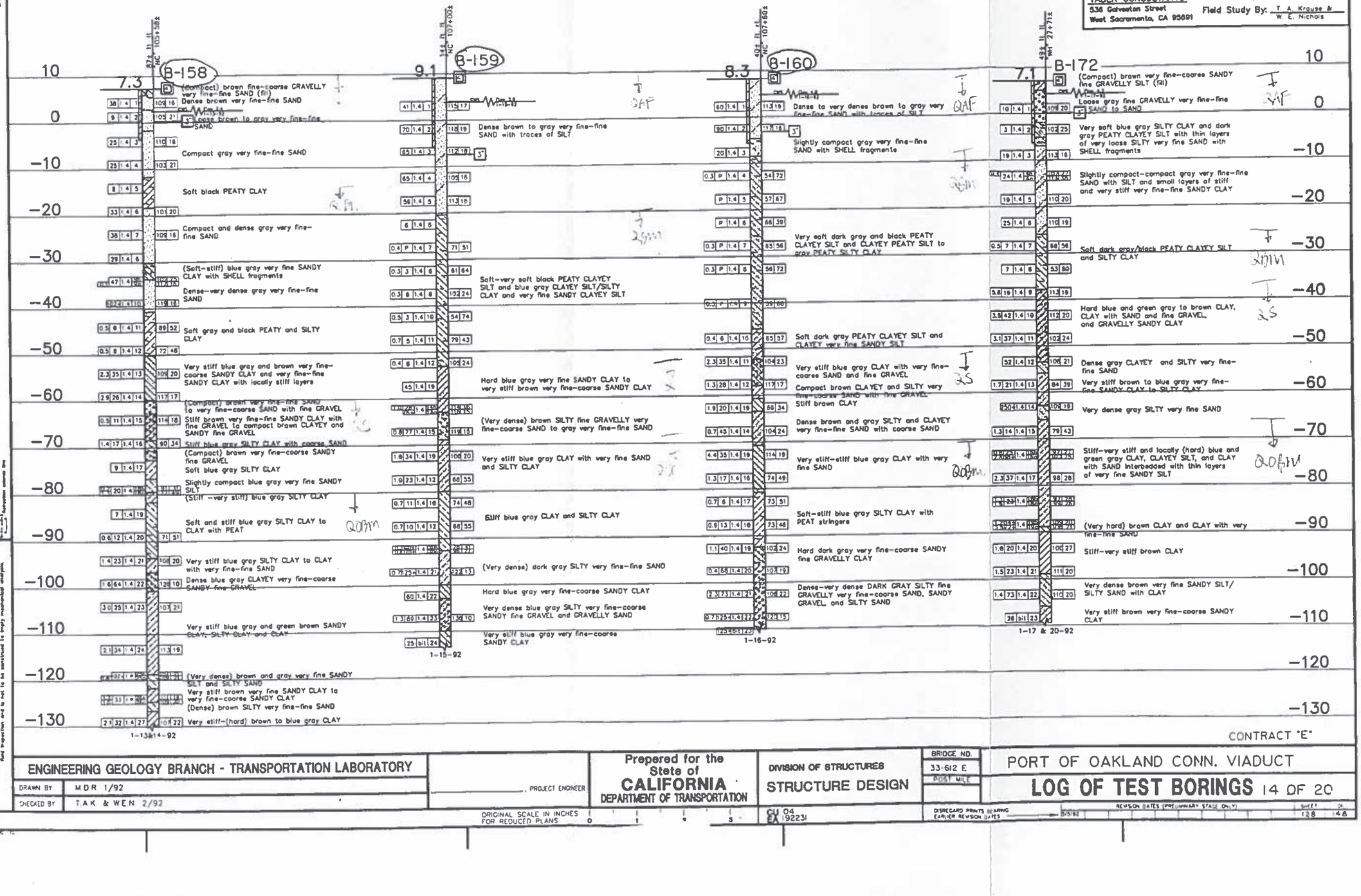
6-13-94
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER H. R. TABER No. 817 EXP. 12-31-92 GEOTECHNICAL STATE OF CALIFORNIA

TABER CONSULTANTS
536 Galveston Street
West Sacramento, CA 95691

JOB No. 1P1/388/72.019
Field Study By: T. A. Krouse & W. E. Nichols

FOR PLAN VIEW, SEE SHEET 1 OF 20



GRAVEL · SAND · SILT · CLAY · CLAYEY SILT · SILTY CLAY · SANDY CLAY or CLAYEY SAND · SANDY SILT or SILTY SAND · FILL MATERIAL · IGNEOUS ROCK · SEDIMENTARY ROCK · METAMORPHIC ROCK

According to the Standard Penetration Test

	Cohesive	Granular
Resistance (Blows/ Ft)	Very soft, Soft, Stiff, Very Stiff, Hard, Very Hard	Very loose, Loose, Slightly compact, Compact, Dense, Very dense
0-2		
3-4		
5-8		
9-15		
16-30		
31-50		
>50		

NOTE: Classification of earth material as shown on this sheet is based upon data from inspection and is not to be construed to imply homogeneous conditions.

ENGINEERING GEOLOGY BRANCH - TRANSPORTATION LABORATORY

DRAWN BY: M D R 1/92
CHECKED BY: T A K & W E N 2/92

PROJECT ENGINEER

Prepared for the State of CALIFORNIA DEPARTMENT OF TRANSPORTATION

DIVISION OF STRUCTURES
STRUCTURE DESIGN

CU 04
EA 192231

BRIDGE NO. 33-612 E
POST MILE

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 5/5/92

PORT OF OAKLAND CONN. VIADUCT

LOG OF TEST BORINGS 14 OF 20

CONTRACT "E"

SHEET 128 OF 148

APPENDIX C
LIQUEFACTION SETTLEMENT

Liquefaction Evaluation

Seed et al. (2003) Procedure

Earthquake Magnitude M = 7.50 (MCE)
Peak Ground Acceleration: 0.62 (g)
Vs,40 = 591 (fps)
MSF (Seed et, al., 2003) = 1.00

Boring ID	USCS class from boring log	Depth to Sample (ft)	Layer Thickness (ft)	GS Elev	γ_m (pcf)	Blows foot, N	Sampler code	% finer than No200	USCS class lab	PI	GWT Elev. Ft	Assigned Class.	Sample Elev. (ft)	σ_v, psf	σ_v', psf	Sampler Correction	Rod Length, m	CR	FC, %	C_N	ER	$N_{1,60}$	Capped FC	C_{Fines}	$(N_1)_{60cs}$	f	Kσ	CRR	Rd	CSR	CSR*	FS_L	FS_L < 1	P_L	Liquefaction Susceptibility	Below GWT	Assessment	FS_L	P_L	Lookup Num	Vol. Strain (%)	Settlement (inches)	PI	Final Enginering Judgment	Liquefied Layer Thickness (ft)
B-165	SP	10.0	5.00	5.4	120	1	SPT	10	SP		-0.6	SP	-5	1200	950	1.1	4.6	0.85	10	1.45	75	2	10	1.33	2	0.61	1.00	0.048	0.96	0.491	0.491	0.1	Yes	1.00	Yes	Yes	Yes	0.1	1.0	249	10.00	6.0		Yes	5
B-165	CL	15.0	5.00	5.4	98	1	SPT	40	CL		-0.6	CL	-10	1690	1128	1.1	6.1	0.95	40	1.33	75	2	35	2.15	4	0.62	1.00	0.051	0.93	0.562	0.562	0.1	Yes	1.00	No	Yes	No	-	-					No	0
B-165	CL	20.0	5.00	5.4	98	0	SPT	40	CL		-0.6	CL	-15	2180	1306	1.1	7.6	0.95	40	1.24	75	0	35	0.00	0	0.60	1.00	0.042	0.88	0.595	0.595	0.1	Yes	1.00	No	Yes	No	-	-					No	0
B-165	CL	25.0	5.00	5.4	98	0	SPT	40	CL		-0.6	CL	-20	2670	1484	1.1	9.1	0.95	40	1.16	75	0	35	0.00	0	0.60	1.00	0.041	0.83	0.600	0.600	0.1	Yes	1.00	No	Yes	No	-	-					No	0
B-165	CL	30.0	5.00	5.4	98	7	SPT	40	CL		-0.6	CL	-25	3160	1662	1.1	10.7	1.00	40	1.10	75	11	35	1.31	14	0.67	1.00	0.098	0.76	0.585	0.585	0.2	Yes	1.00	No	Yes	No	-	-					No	0
B-165	CL	35.0	5.00	5.4	98	0	SPT	40	CL		-0.6	CL	-30	3650	1840	1.1	12.2	1.00	40	1.04	75	0	35	0.00	0	0.60	1.00	0.038	0.70	0.560	0.560	0.1	Yes	1.00	No	Yes	No	-	-					No	0
B-165	CL	40.0	5.00	5.4	98	0	SPT	40	CL		-0.6	CL	-35	3920	1798	1.1	13.7	1.00	40	1.05	75	0	35	0.00	0	0.60	1.00	0.039	0.65	0.569	0.569	0.1	Yes	1.00	No	Yes	No	-	-					No	0
B-165	CL	45.0	4.50	5.4	98	0	SPT	40	CL		-0.6	CL	-40	4410	1976	1.1	15.2	1.00	40	1.01	75	0	35	0.00	0	0.60	1.00	0.038	0.61	0.545	0.545	0.1	Yes	1.00	No	Yes	No	-	-					No	0
B-165	CL	49.0	2.50	5.4	98	1	SPT	40	CL		-0.6	CL	-44	4802	2119	1.1	16.5	1.00	40	0.97	75	1	35	2.45	3	0.62	1.00	0.041	0.58	0.532	0.532	0.1	Yes	1.00	No	Yes	No	-	-					No	0
B-165	CL	50.0	3.00	5.4	115	18	SPT	40	CL		-0.6	CL	-45	5750	3004	1.1	16.8	1.00	40	0.82	76	20	35	1.23	25	0.73	0.91	0.193	0.58	0.446	0.490	0.4	Yes	1.00	No	Yes	No	-	-					No	0
B-165	CL	55.0	5.00	5.4	115	24	SPT	40	CL		-0.6	CL	-50	6325	3267	1.1	18.3	1.00	40	0.78	77	27	35	1.21	32	0.76	0.90	0.317	0.56	0.436	0.483	0.7	Yes	0.60	No	Yes	No	-	-					No	0
B-165	CL	60.0	5.00	5.4	115	29	SPT	40	CL		-0.6	CL	-55	6900	3530	1.1	19.8	1.00	40	0.75	78	31	35	1.20	37	0.79	0.90	0.464	0.55	0.430	0.480	1.1		0.04	No	Yes	No	-	-					No	0
B-165	CL	65.0	4.50	5.4	125	19	SPT	5	CL		-0.6	CL	-60	8125	4443	1.1	21.3	1.00	5	0.67	79	18	5	1.03	19	0.70	0.80	0.111	0.54	0.397	0.497	0.3	Yes	1.00	No	Yes	No	-	-					No	0
B-165	CL	69.0	2.50	5.4	115	8	SPT	40	CL		-0.6	CL	-64	7935	4004	1.1	22.6	1.00	40	0.71	80	8	35	1.35	11	0.66	0.80	0.063	0.54	0.430	0.536	0.1	Yes	1.00	No	Yes	No	-	-					No	0
B-165	CL	70.0	3.00	5.4	115	56	SPT	40	CL		-0.6	CL	-65	8050	4056	1.1	22.9	1.00	40	0.70	81	58	35	1.17	68	0.80	0.88	0.600	0.54	0.431	0.491	1.4		0.00	No	Yes	No	-	-					No	0
B-165	CL	75.0	5.00	5.4	115	53	SPT	40	CL		-0.6	CL	-70	8625	4319	1.1	24.4	1.00	40	0.68	82	54	35	1.17	64	0.80	0.87	0.600	0.54	0.433	0.500	1.4		0.00	No	Yes	No	-	-					No	0
B-165	CL	80.0	5.00	5.4	115	23	SPT	40	CL		-0.6	CL	-75	9200	4582	1.1	25.9	1.00	40	0.66	83	23	35	1.22	28	0.74	0.82	0.216	0.54	0.436	0.532	0.5	Yes	0.98	No	Yes	No	-	-					No	0
B-165	CL	85.0	5.00	5.4	115	35	SPT	40	CL		-0.6	CL	-80	9775	4845	1.1	27.4	1.00	40	0.64	84	35	35	1.19	41	0.80	0.85	0.570	0.54	0.438	0.517	1.3		0.00	No	Yes	No	-	-					No	0
B-165	CL	90.0	5.00	5.4	115	17	SPT	40	CL		-0.6	CL	-85	10350	5108	1.1	29.0	1.00	40	0.63	85	17	35	1.25	21	0.70	0.77	0.120	0.54	0.440	0.571	0.3	Yes	1.00	No	Yes	No	-	-					No	0
B-165	CL	95.0	5.00	5.4	115	29	SPT	40	CL		-0.6	CL	-90	10925	5371	1.1	30.5	1.00	40	0.61	86	28	35	1.20	34	0.77	0.81	0.311	0.54	0.441	0.548	0.7	Yes	0.65	No	Yes	No	-	-					No	0
B-165	CL	100.0	5.00	5.4	115	23	SPT	40	CL		-0.6	CL	-95	11500	5634	1.1	32.0	1.00	40	0.60	87	22	35	1.22	27	0.73	0.77	0.183	0.54	0.443	0.575	0.4	Yes	1.00	No	Yes	No	-	-					No	0
B-165	CL	105.0	5.00	5.4	115	23	SPT	40	CL		0.4	CL	-100	12075	5835	1.1	33.5	1.00	40	0.59	88	22	35	1.22	27	0.73	0.76	0.179	0.54	0.449	0.589	0.4	Yes	1.00	No	Yes	No	-	-					No	0
B-165	CL	110.0	5.00	5.4	115	22	SPT	40	CL		1.4	CL	-105	12650	6036	1.1	35.1	1.00	40	0.58	89	21	35	1.22	25	0.73	0.75	0.162	0.54	0.455	0.606	0.4	Yes	1.00	No	Yes	No	-	-					No	0
B-165	CL	115.0	3.00	5.4	115	46	SPT	40	CL		2.4	CL	-110	13225	6236	1.1	36.6	1.00	40	0.57	90	43	35	1.18	51	0.80	0.81	0.600	0.54	0.460	0.571	1.3		0.00	No	Yes	No	-	-					No	0
B-165	CL	116.0	0.75	5.4	115	20	SPT	40	CL		3.4	CL	-111	13340	6226	1.1	36.9	1.00	40	0.57	91	19	35	1.23	23	0.72	0.74	0.138	0.54	0.465	0.631	0.3	Yes	1.00	No	Yes	No	-	-					No	0
B-165	CL	116.5															37.0	1.00											0.54					Yes											

Estimated Settlement of Entire Boring Depth (inches) = 6.0 **Total= 5.0**

Final Enginering Judgment is based on:
1.N160cs: if N160cs>35, no liquification problem
2.Induced settlement: if induced settlement is limited and the liquefied layer is deep, no liquefication problem

Note:
The high groundwater table is assumed if there is any change of the groundwater due to the use of peremable paver, assume a 2 feet increase to be conservative

Liquefaction Evaluation

Seed et al. (2003) Procedure

Earthquake Magnitude M = 7.50 (MCE)
Peak Ground Acceleration: 0.62 (g)
Vs,40 = 591 (fps)
MSF (Seed et, al., 2003) = 1.00

Boring ID	USCS class from boring log	Depth to Sample (ft)	Layer Thickness (ft)	GS Elev	γ_m (pcf)	Blows foot, N	Sampler code	% finer than No200	USCS class lab	PI	GWT Elev. Ft	Assigned Class.	Sample Elev. (ft)	σ_v, psf	σ_v', psf	Sampler Correction	Rod Length, m	CR	FC, %	C_N	ER	$N_{1,60}$	Capped FC	C_{Fines}	$(N_1)_{60cs}$	f	Kσ	CRR	Rd	CSR	CSR*	FS_L	FS_L < 1	P_L	Liquefaction Susceptibility	Below GWT	Assessment	FS_L	P_L	Lookup Num	Vol. Strain (%)	Settlement (inches)	PI	Final Enginering Judgment	Liquefied Layer Thickness (ft)
B-167	SP-SM	7.0	9.50	8.8	120	19	SPT	10	SP-SM		2.6	SP-SM	2	840	790	1.1	3.7	0.80	10	1.59	75	33	10	1.06	35	0.78	1.00	0.594	0.98	0.420	0.419	1.4		0.00	Yes	Yes	No	-	-					No	0
B-167	ML	12.0	5.50	8.8	120	1	SPT	10	ML		2.6	ML	-3	1440	1078	1.1	5.2	0.85	10	1.36	75	2	10	1.35	2	0.61	1.00	0.046	0.95	0.513	0.513	0.1	Yes	1.00	Yes	Yes	Yes	0.1	1.0	251	10.00	6.6		Yes	5.5
B-167	SM	18.0	5.00	8.8	120	8	SPT	10	SM		2.6	SM	-9	2160	1424	1.1	7.0	0.95	10	1.19	75	12	10	1.08	13	0.67	1.00	0.099	0.90	0.553	0.553	0.2	Yes	1.00	Yes	Yes	Yes	0.2	1.0	1355	3.47	2.1		Yes	5
B-167	CL	22.0	5.00	8.8	98	1	SPT	40	CL		2.6	CL	-13	2552	1566	1.1	8.2	0.95	40	1.13	75	1	35	2.33	3	0.62	1.00	0.046	0.86	0.567	0.567	0.1	Yes	1.00	No	Yes	No	-	-					No	0
B-167	CL	28.0	5.00	8.8	98	1	SPT	40	CL		2.6	CL	-19	3140	1780	1.1	10.1	1.00	40	1.06	75	1	35	2.34	3	0.62	1.00	0.044	0.79	0.561	0.561	0.1	Yes	1.00	No	Yes	No	-	-					No	0
B-167	CL	32.0	5.00	8.8	98	0	SPT	40	CL		2.6	CL	-23	3532	1922	1.1	11.3	1.00	40	1.02	75	0	35	0.00	0	0.60	1.00	0.038	0.74	0.546	0.546	0.1	Yes	1.00	No	Yes	No	-	-					No	0
B-167	CL	38.0	5.00	8.8	115	35	SPT	40	CL		2.6	CL	-29	4370	2386	1.1	13.1	1.00	40	0.92	75	44	35	1.18	52	0.80	0.98	0.600	0.67	0.493	0.505	1.2		0.00	No	Yes	No	-	-					No	0
B-167	CL	42.0	5.00	8.8	115	14	SPT	40	CL		2.6	CL	-33	4830	2596	1.1	14.3	1.00	40	0.88	75	17	35	1.24	21	0.71	0.94	0.148	0.63	0.472	0.501	0.3	Yes	1.00	No	Yes	No	-	-					No	0
B-167	CL	48.0	5.00	8.8	115	16	SPT	40	CL		2.6	CL	-39	5520	2912	1.1	16.2	1.00	40	0.83	75	18	35	1.24	23	0.71	0.91	0.161	0.59	0.449	0.492	0.4	Yes	1.00	No	Yes	No	-	-					No	0
B-167	CL	52.0	5.00	8.8	115	9	SPT	40	CL		2.6	CL	-43	5980	3122	1.1	17.4	1.00	40	0.80	76	10	35	1.31	13	0.67	0.88	0.078	0.57	0.439	0.500	0.2	Yes	1.00	No	Yes	No	-	-					No	0
B-167	CL	58.0	5.00	8.8	115	24	SPT	40	CL		2.6	CL	-49	6670	3438	1.1	19.2	1.00	40	0.76	77	26	35	1.21	31	0.76	0.89	0.295	0.55	0.430	0.484	0.7	Yes	0.70	No	Yes	No	-	-					No	0
B-167	CL	62.0	4.00	8.8	115	11	SPT	40	CL		2.6	CL	-53	7130	3648	1.1	20.4	1.00	40	0.74	78	12	35	1.29	15	0.68	0.84	0.086	0.54	0.427	0.510	0.2	Yes	1.00	No	Yes	No	-	-					No	0
B-167	SP	66.0	5.00	8.8	125	60	SPT	5	SP		2.6	SP	-57	8250	4518	1.1	21.6	1.00	5	0.67	79	58	5	1.02	59	0.80	0.86	0.600	0.54	0.396	0.461	1.5		0.00	Yes	Yes	No	-	-					No	0
B-167	CL	72.0	5.50	8.8	115	100	SPT	40	CL		2.6	CL	-63	8280	4174	1.1	23.5	1.00	40	0.69	80	102	35	1.16	117	0.80	0.87	0.600	0.54	0.431	0.493	2.0		0.00	No	Yes	No	-	-					No	0
B-167	CL	77.0	5.00	8.8	115	12	SPT	40	CL		2.6	CL	-68	8855	4437	1.1	25.0	1.00	40	0.67	81	12	35	1.29	15	0.68	0.79	0.084	0.54	0.433	0.550	0.2	Yes	1.00	No	Yes	No	-	-					No	0
B-167	CL	82.0	7.50	8.8	115	11	SPT	40	CL		2.6	CL	-73	9430	4700	1.1	26.5	1.00	40	0.65	82	11	35	1.30	14	0.67	0.77	0.075	0.54	0.436	0.567	0.2	Yes	1.00	No	Yes	No	-	-					No	0
B-167	CL	92.0	7.50	8.8	115	17	SPT	40	CL		2.6	CL	-83	10580	5226	1.1	29.6	1.00	40	0.62	83	16	35	1.25	20	0.70	0.76	0.113	0.54	0.439	0.576	0.3	Yes	1.00	No	Yes	No	-	-					No	0
B-167	CL	97.0	5.00	8.8	115	130	SPT	40	CL		2.6	CL	-88	11155	5489	1.1	31.1	1.00	40	0.60	84	121	35	1.15	140	0.80	0.83	0.600	0.54	0.441	0.534	2.0		0.00	No	Yes	No	-	-					No	0
B-167	CL	102.0	5.50	8.8	115	20	SPT	40	CL		2.6	CL	-93	11730	5752	1.1	32.6	1.00	40	0.59	85	18	35	1.24	23	0.71	0.75	0.135	0.54	0.443	0.589	0.3	Yes	1.00	No	Yes	No	-	-					No	0
B-167	CL	108.0	5.00	8.8	115	31	SPT	40	CL		2.6	CL	-99	12420	6068	1.1	34.4	1.00	40	0.57	86	28	35	1.20	34	0.77	0.78	0.305	0.54	0.444	0.567	0.7	Yes	0.70	No	Yes	No	-	-					No	0
B-167	CL	112.0	2.40	8.8	115	31	SPT	40	CL		2.6	CL	-103	12880	6278	1.1	35.7	1.00	40	0.56	87	28	35	1.20	34	0.77	0.78	0.298	0.54	0.445	0.573	0.7	Yes	0.74	No	Yes	No	-	-					No	0
B-167	CL	112.8															35.9	1.00											0.54					Yes												

Estimated Settlement of Entire Boring Depth (inches) = 8.7

Total= 10.5

Final Enginering Judgment is based on:
1.N160cs: if N160cs>35, no liquification problem
2.Induced settlement: if induced settlement is limited and the liquefied layer is deep, no liquefication problem

Note:
The high groundwater table is assumed if there is any change of the groundwater due to the use of peremable paver, assume a 2 feet increase to be conservative

Liquefaction Evaluation

Seed et al. (2003) Procedure

Earthquake Magnitude M = 7.50 (MCE)
Peak Ground Acceleration: 0.62 (g)
Vs,40 = 591 (fps)
MSF (Seed et, al., 2003) = 1.00

Boring ID	USCS class from boring log	Depth to Sample (ft)	Layer Thickness (ft)	GS Elev	γ_m (pcf)	Blows foot, N	Sampler code	% finer than No200	USCS class lab	PI	GWT Elev. Ft	Assigned Class.	Sample Elev. (ft)	σ_v, psf	σ_v', psf	Sampler Correction	Rod Length, m	CR	FC, %	C_N	ER	$N_{1,60}$	Capped FC	C_{Fines}	$(N_1)_{60cs}$	f	Kσ	CRR	Rd	CSR	CSR*	FS_L	FS_L < 1	P_L	Liquefaction Susceptibility	Below GWT	Assessment	FS_L	P_L	Lookup Num	Vol. Strain (%)	Settlement (inches)	PI	Final Enginering Judgment	Liquefied Layer Thickness (ft)
B-127	SP	7.0	9.00	8.5	120	26	SPT	10	SP		2	SP	2	840	809	1.1	3.7	0.80	10	1.57	75	45	10	1.05	47	0.80	1.00	0.600	0.98	0.410	0.410	1.5		0.00	Yes	Yes	No	-	-					No	0
B-127	CL	11.0	6.00	8.5	98	0	SPT	40	CL		2	CL	-3	1232	951	1.1	4.9	0.85	40	1.45	75	0	35	0.00	0	0.60	1.00	0.046	0.96	0.500	0.500	0.1	Yes	1.00	No	Yes	No	-	-					No	0
B-127	CL	19.0	5.50	8.5	98	1	SPT	40	CL		2	CL	-11	2016	1236	1.1	7.3	0.95	40	1.27	75	2	35	2.19	4	0.62	1.00	0.050	0.89	0.588	0.588	0.1	Yes	1.00	No	Yes	No	-	-					No	0
B-127	CL	22.0	5.00	8.5	98	9	SPT	40	CL		2	CL	-14	2310	1343	1.1	8.2	0.95	40	1.22	75	14	35	1.26	18	0.69	1.00	0.143	0.86	0.598	0.598	0.2	Yes	1.00	No	Yes	No	-	-					No	0
B-127	CL	29.0	5.00	8.5	98	2	SPT	40	CL		2	CL	-21	2996	1592	1.1	10.4	1.00	40	1.12	75	3	35	1.71	5	0.63	1.00	0.052	0.78	0.589	0.589	0.1	Yes	1.00	No	Yes	No	-	-					No	0
B-127	SP-SM	32.0	3.50	8.5	120	36	SPT	10	SP-SM		2	SP-SM	-24	3356	1765	1.1	11.3	1.00	10	1.06	75	53	10	1.05	55	0.80	1.00	0.600	0.74	0.566	0.565	1.1		0.00	Yes	Yes	No	-	-					No	0
B-127	CL	36.0	5.00	8.5	120	22	SPT	10	CL		2	CL	-28	4320	2479	1.1	12.5	1.00	10	0.90	75	27	10	1.06	29	0.74	0.96	0.269	0.69	0.484	0.504	0.6	Yes	0.97	No	Yes	No	-	-					No	0
B-127	SP-SM	42.0	5.00	8.5	120	26	SPT	10	SP-SM		2	SP-SM	-34	5040	2825	1.1	14.3	1.00	10	0.84	75	30	10	1.06	32	0.76	0.93	0.326	0.63	0.453	0.485	0.7	Yes	0.72	Yes	Yes	Yes	0.7	0.7	3249	0.97	0.6		Yes	5
B-127	CL	46.0	5.00	8.5	115	18	SPT	40	CL		2	CL	-38	5290	2825	1.1	15.5	1.00	40	0.84	75	21	35	1.22	25	0.73	0.92	0.203	0.60	0.453	0.490	0.4	Yes	1.00	No	Yes	No	-	-					No	0
B-127	CL	52.0	6.00	8.5	115	47	SPT	40	CL		2	CL	-44	5980	3141	1.1	17.4	1.00	40	0.80	76	52	35	1.17	61	0.80	0.92	0.600	0.57	0.437	0.472	1.4		0.00	No	Yes	No	-	-					No	0
B-127	CL	58.0	5.00	8.5	125	15	SPT	5	CL		2	CL	-50	7250	4036	1.1	19.2	1.00	5	0.70	77	15	5	1.04	15	0.68	0.81	0.087	0.55	0.398	0.491	0.2	Yes	1.00	No	Yes	No	-	-					No	0
B-127	CL	62.0	5.00	8.5	125	15	SPT	5	CL		2	CL	-54	7750	4287	1.1	20.4	1.00	5	0.68	78	15	5	1.04	15	0.68	0.80	0.083	0.54	0.395	0.497	0.2	Yes	1.00	No	Yes	No	-	-					No	0
B-127	CL	68.0	5.00	8.5	115	25	SPT	40	CL		2	CL	-60	7820	3982	1.1	22.3	1.00	40	0.71	79	26	35	1.21	31	0.76	0.86	0.279	0.54	0.426	0.498	0.7	Yes	0.78	No	Yes	No	-	-					No	0
B-127	CL	72.0	5.00	8.5	115	12	SPT	40	CL		2	CL	-64	8280	4193	1.1	23.5	1.00	40	0.69	80	12	35	1.28	16	0.68	0.80	0.087	0.54	0.429	0.534	0.2	Yes	1.00	No	Yes	No	-	-					No	0
B-127	CL	78.0	5.00	8.5	115	10	SPT	40	CL		2	CL	-70	8970	4508	1.1	25.3	1.00	40	0.67	81	10	35	1.32	13	0.67	0.78	0.070	0.54	0.432	0.556	0.2	Yes	1.00	No	Yes	No	-	-					No	0
B-127	CL	82.0	5.00	8.5	115	8	SPT	40	CL		2	CL	-74	9430	4719	1.1	26.5	1.00	40	0.65	82	8	35	1.36	11	0.65	0.76	0.058	0.54	0.434	0.573	0.1	Yes	1.00	No	Yes	No	-	-					No	0
B-127	CL	88.0	5.00	8.5	115	21	SPT	40	CL		2	CL	-80	10120	5034	1.1	28.3	1.00	40	0.63	83	20	35	1.23	25	0.72	0.79	0.163	0.54	0.436	0.554	0.4	Yes	1.00	No	Yes	No	-	-					No	0
B-127	CL	92.0	4.50	8.5	115	15	SPT	40	CL		2	CL	-84	10580	5245	1.1	29.6	1.00	40	0.62	84	14	35	1.26	18	0.69	0.75	0.098	0.54	0.438	0.580	0.2	Yes	1.00	No	Yes	No	-	-					No	0
B-127	CL	97.0	4.50	8.5	115	26	SPT	40	CL		2	CL	-89	11155	5508	1.1	31.1	1.00	40	0.60	85	24	35	1.21	30	0.75	0.79	0.229	0.54	0.440	0.559	0.5	Yes	0.97	No	Yes	No	-	-					No	0
B-127	CL	101.0	2.20	8.5	115	32	SPT	40	CL		2	CL	-93	11615	5718	1.1	32.3	1.00	40	0.59	86	30	35	1.20	36	0.78	0.80	0.361	0.54	0.441	0.549	0.8	Yes	0.36	No	Yes	No	-	-					No	0
B-127	CL	101.4															32.4	1.00											0.54					Yes											**Total=**	**5.0**

Estimated Settlement of Entire Boring Depth (inches) = **0.6**

Final Enginering Judgment is based on:
1.N160cs: if N160cs>35, no liquification problem
2.Induced settlement: if induced settlement is limited and the liquefied layer is deep, no liquefaction problem

Note:
The high groundwater table is assumed if there is any change of the groundwater due to the use of peremable paver, assume a 2 feet increase to be conservative

APPENDIX D

CORROSION TEST RESULTS BY OTHERS

Job No. 3362.200
Oakland Army Base
Oakland, California

SUMMARY OF CORROSIVITY TEST RESULTS

Sample I.D.	Redox (mV)	pH	Resistivity (100% Saturation) (ohms-cm)		Sulfide (mg/kg)	Chloride (mg/kg)	Sulfate (mg/kg)
H-6 @ 1.5' - 2.0'	480	8.2	1,300	Corrosive	N.D.	91	77
H-9 @ 3.0' - 3.5'	470	8.1	5,900	Moderately Corrosive	N.D.	N.D.	N.D.
H-16 @ 6.0' - 6.5'	460	7.7	1,700	Corrosive	N.D.	58	71
H-17 @ 2.5' - 3.0'	460	8.2	2,500	Moderately Corrosive	N.D.	32	94
H-23 @ 3.5' - 4.0'	460	7.9	240	Severely Corrosive	N.D.	1,500	230
H-28 @ 2.0' - 2.5'	470	7.4	2,300	Moderately Corrosive	N.D.	96	44
H-30 @ 6.0' - 6.5'	460	8.1	1,900	Corrosive	N.D.	25	25
H-37 @ 4.5' - 5.0'	460	7.4	3,000	Moderately Corrosive	N.D.	N.D.	110
H-47 @ 2.5' - 3.0'	450	7.8	5,800	Moderately Corrosive	N.D.	24	43
H-49 @ 1.5' - 2.0'	450	7.5	4,300	Moderately Corrosive	N.D.	N.D.	17
H-55 @ 2.5' - 3.0'	450	7.4	5,000	Moderately Corrosive	N.D.	N.D.	48
H-56 @ 2.5' - 3.0'	440	7.6	7,000	Moderately Corrosive	N.D.	N.D.	23
H-63 @ 5.0' - 5.5'	450	7.9	17,000	Mildly Corrosive	N.D.	N.D.	N.D.
H-69 @ 4.0' - 4.5'	430	8.2	3,000	Moderately Corrosive	N.D.	33	44
T-5 @ 9.0' - 9.5'	270	8.2	220	Severely Corrosive	N.D.	2,800	210
T-11 @ 20.0' - 21.5'	440	8.2	290	Severely Corrosive	N.D.	1,600	230
T-15 @ 20.0 - 20.5'	400	8.4	160	Severely Corrosive	N.D.	2,100	77

N.D. = None Detected

California State Certified Laboratory No. 2153

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Concord, CA 94520-1006
925 462 2771 Fax. 925 462 2775
www.cercoanalytical.com

5 October 2011

Job No.1109179
Cust. No.10598

Mr. Steve Tsang
Berlogar Stevens & Associates
5587 Sunol Blvd.
Pleasanton, CA 94566

Subject: Project No.: 3362.200
Project Name: Oakland Army Base
Corrosivity Analysis – ASTM Test Methods with Brief Evaluation

Dear Mr. Tsang:

Pursuant to your request, CERCO Analytical has analyzed the soil samples submitted on September 26, 2011. Based on the analytical results, a brief corrosivity evaluation is enclosed for your consideration.

Based upon the resistivity measurements, Sample No.005 is classified as "severely corrosive", Samples No.001, No.003 and No.007 are classified as "corrosive" and Samples No.002, No.004 and No.006 are samples are classified as "moderately corrosive". All buried iron, steel, cast iron, ductile iron, galvanized steel and dielectric coated steel or iron should be properly protected against corrosion depending upon the critical nature of the structure. All buried metallic pressure piping such as ductile iron firewater pipelines should be protected against corrosion.

The chloride ion concentrations range from none detected to 1,500 mg/kg. Because the chloride ion concentrations are greater than 300 mg/kg, they are determined to be sufficient to attack steel embedded in a concrete mortar coating.

The sulfate ion concentrations ranged from none detected to 240 mg/kg and are determined to be sufficient to damage reinforced concrete structures and cement mortar-coated steel at these locations. Therefore, concrete that comes into contact with this soil should use sulfate resistant cement such as Type II, with a maximum water-to-cement ratio of 0.55.

The sulfide ion concentrations reflect none detected with a detected limit of 50 mg/kg.

The pH of the soils ranged from 7.4 to 8.2, which does not present corrosion problems for buried iron, steel, mortar-coated steel and reinforced concrete structures.

The redox potentials range from 460 to 480-mV, which are indicative of aerobic soil conditions.

This corrosivity evaluation is based on general corrosion engineering standards and is non-specific in nature. For specific long-term corrosion control design recommendations or consultation, please call *JDH Corrosion Consultants, Inc. at (925) 927-6630.*

We appreciate the opportunity of working with you on this project. If you have any questions, or if you require further information, please do not hesitate to contact us.

Very truly yours,
CERCO ANALYTICAL, INC.

J. Darby Howard, Jr., P.E.
President

JDH/jdl
Enclosure

California State Certified Laboratory No. 2153

CERCO analytical

1100 Willow Pass Court, Suite A
Concord, CA 94520-1006
925 462 2771 Fax: 925 462 2775
www.cercoanalytical.com

Client: Berlogar Stevens & Associates
Client's Project No.: 3362.200
Client's Project Name: Oakland Army Base
Date Sampled: Not Indicated
Date Received: 26-Sep-11
Matrix: Soil
Authorization: Signed Chain of Custody

Date of Report: 5-Oct-2011

Job/Sample No.	Sample I.D.	Redox (mV)	pH	Conductivity (umhos/cm)*	Resistivity (100% Saturation) (ohms-cm)	Sulfide (mg/kg)*	Chloride (mg/kg)*	Sulfate (mg/kg)*
1109179-001	H6 @ 1.5'-2.0'	480	8.2	-	1,300	N.D.	91	77
1109179-002	H9 @ 3.0'-3.5'	470	8.1	-	5,900	N.D.	N.D.	N.D.
1109179-003	H16 @ 6.0'-6.5'	460	7.7	-	1,700	N.D.	58	71
1109179-004	H17 @ 2.5'-3.0'	460	8.2	-	2,500	N.D.	32	94
1109179-005	H23 @ 3.5'-4.0'	460	7.9	-	240	N.D.	1,500	230
1109179-006	H28 @ 2.0'-2.5	470	7.4	-	2,300	N.D.	96	44
1109179-007	H30 @ 6.0'-6.5'	460	8.1	-	1,900	N.D.	25	25

Method:	ASTM D1498	ASTM D4972	ASTM D1125M	ASTM G57	ASTM D4658M	ASTM D4327	ASTM D4327
Detection Limit:	-	-	10	-	50	15	15
Date Analyzed:	4-Oct-2011	4-Oct-2011	-	29-Sep-2011	30-Sep-2011	3-Oct-2011	3-Oct-2011

Cheryl McMillen
Laboratory Director

* Results Reported on "As Received" Basis

N.D. - None Detected

Quality Control Summary - **All laboratory quality control parameters were found to be within established limits**

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20 October 2011

Job No.1110100
Cust. No.10598

Mr. Steve Tsang
Berlogar Stevens & Associates
5587 Sunol Blvd.
Pleasanton, CA 94566

Subject: Project No.: 3362.200
Project Name: Oakland Army Base
Corrosivity Analysis – ASTM Test Methods with Brief Evaluation

Dear Mr. Tsang:

Pursuant to your request, CERCO Analytical has analyzed the soil samples submitted on October 12, 2011. Based on the analytical results, a brief corrosivity evaluation is enclosed for your consideration.

The following classifications are based upon the resistivity measurement:

Severely Corrosive

Sample No.008	Sample No.009	Sample No.010

Moderately Corrosive

Sample No.001	Sample No.002	Sample No.003
Sample No.004	Sample No.005	Sample No.007

Mildly Corrosive

Sample No.006

All buried iron, steel, cast iron, ductile iron, galvanized steel and dielectric coated steel or iron should be properly protected against corrosion depending upon the critical nature of the structure. All buried metallic pressure piping such as ductile iron firewater pipelines should be protected against corrosion.

The chloride ion concentrations range from none detected to 2,800 mg/kg. Because the chloride ion concentrations are more than 300 mg/kg, they are determined to be sufficient to attack steel embedded in a concrete mortar coating.

The sulfate ion concentrations ranged from none detected to 230 mg/kg and are determined to be sufficient to damage reinforced concrete structures and cement mortar-coated steel at these locations. Therefore, concrete that comes into contact with this soil should use sulfate resistant cement such as Type II, with a maximum water-to-cement ratio of 0.55.

The sulfide ion concentrations reflect none detected with a detection limit of 50 mg/kg.

The pH of the soils ranged from 7.4 to 8.4, which does not present corrosion problems for buried iron, steel, mortar-coated steel and reinforced concrete structures.

The redox potentials ranged from 270 to 460-mV. Sample No.008 is indicative of potentially "slightly corrosive" soils resulting from anaerobic soil conditions, and the remaining samples are indicative of aerobic soil conditions.

This corrosivity evaluation is based on general corrosion engineering standards and is non-specific in nature. For specific long-term corrosion control design recommendations or consultation, please call *JDH Corrosion Consultants, Inc. at (925) 927-6630.*

We appreciate the opportunity of working with you on this project. If you have any questions, or if you require further information, please do not hesitate to contact us.

Very truly yours,
CERCO ANALYTICAL, INC.

J. Darby Howard, Jr., P.E.
President

JDH/jdl

Enclosure

California State Certified Laboratory No. 2153

CERCO analytical
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Client: Berlogar Stevens & Associates
Client's Project No.: 3362.200
Client's Project Name: Oakland Army Base
Date Sampled: Not Indicated
Date Received: 12-Oct-11
Matrix: Soil
Authorization: Signed Chain of Custody

Date of Report: 21-Oct-2011

Job/Sample No.	Sample I.D.	Redox (mV)	pH	Conductivity (umhos/cm)*	Resistivity (100% Saturation) (ohms-cm)	Sulfide (mg/kg)*	Chloride (mg/kg)*	Sulfate (mg/kg)*
1110100-001	H-37, 4.5-5.0'	460	7.4	-	3,000	N.D.	N.D.	110
1110100-002	H-47, 2.5-3.0'	450	7.8	-	5,800	N.D.	24	43
1110100-003	H-49, 1.5-2.0'	450	7.5	-	4,300	N.D.	N.D.	17
1110100-004	H-55, 2.5-3.0'	450	7.4	-	5,000	N.D.	N.D.	48
1110100-005	H-56, 2.5-3.0'	440	7.6	-	7,000	N.D.	N.D.	23
1110100-006	H-63, 5.0-5.5'	450	7.9	-	17,000	N.D.	N.D.	N.D.
1110100-007	H-69, 4.0-4.5'	430	8.2	-	3,000	N.D.	33	44
1110100-008	T-5, 9.0-9.5'	270	8.2	-	220	N.D.	2,800	210
1110100-009	T-11, 20.0-21.5'	440	8.2	-	290	N.D.	1,600	230
1110100-010	T-15, 20.0-20.5'	400	8.4	-	160	N.D.	2,100	77

Method:	ASTM D1498	ASTM D4972	ASTM D1125M	ASTM G57	ASTM D4658M	ASTM D4327	ASTM D4327
Detection Limit:	-	-	10	-	50	15	15
Date Analyzed:	18-Oct-2011	17-Oct-2011	-	14-Oct-2011	17-Oct-2011	17-Oct-2011 & 19-Oct-2011	17-Oct-2011

Cheryl McMillen
Laboratory Director

* Results Reported on "As Received" Basis

N.D. - None Detected

(1) Detection limit is elevated to 75 mg/kg due to dilution

Quality Control Summary - All laboratory quality control parameters were found to be within established limits

Appendix I-1

Water Quality Assessment Report

Draft Water Quality Assessment Report

San Francisco-Oakland Bay Bridge
Regional Bicycle/Pedestrian Connection Project
Alameda County, California

Prepared for:

BAY AREA TOLL AUTHORITY

Caltrans

Prepared by:

WRECO

July 2014

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San Francisco-Oakland Bay Bridge
Regional Bicycle/Pedestrian Connection Project
City of Oakland, Alameda County, California
04-ALA-80/580/880 *EA 04-3G230*

July 2014

STATE OF CALIFORNIA
Department of Transportation

Prepared By: _____ Date: _____
Erica Cruz, P.E.
(510) 836-5188
1814 Franklin Street, Suite 608, Oakland, CA 94612
WRECO

Approved By: _____ Date: _____
Professional Content Reviewer, Title
Phone Number
Office Name
Partner Agency Name

Approved By: _____ Date: _____
Management Content Reviewer, Title
Phone Number
Office Name
Partner Agency Name

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Executive Summary

The San-Francisco-Oakland Bay Bridge (SFOBB or Bay Bridge) Regional Bicycle/Pedestrian Connection (Path or Project) is located in the City of Oakland, Alameda County, near the Interstate 880 and Interstate 80 interchange and the new East Span of the Bay Bridge. The new Path would be approximately 6,030 linear feet (ft) and would connect the existing bicycle/pedestrian path on Mandela Parkway to the existing bicycle/pedestrian path near the California Department of Transportation (Caltrans) maintenance facility on the south side of the Bay Bridge. The Path will more-or-less parallel West Grand Avenue. The proposed improvements for the Project are limited to areas within Caltrans' right-of-way and the City of Oakland's right-of-way.

The construction of the Project would involve the installation of elevated platform structures. Temporary construction activities would take place including construction staging, storage, and parking for workers. The amount of permanent and temporary activity in the construction of the Project would be minimal.

The purpose of this Water Quality Assessment Report (WQAR) is to fulfill the requirements of the National Environmental Policy Act and the California Environmental Quality Act, and to provide information, to the extent possible, for National Pollutant Discharge Elimination System (NPDES) permitting.

Lower San Francisco Bay is the ultimate receiving water body and is listed on the 303 (d) list of impaired waters. The Gateway *Project Concept Report* (Perkins+Will 2012) did not list any wetlands along the Project. An updated biological report was not available at the time of this report. Once this report is available, the WQAR will be updated as needed.

The Project would disturb more than 9 acres of soil and would be subject to the requirements stated within the State Water Resources Control Board, NPDES General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities (Order No. 2009-0009-DWQ, NPDES No. CAS000002). A Storm Water Pollution Prevention Plan (SWPPP) would be required for the Project. A component of the SWPPP includes performing a risk level determination. The Construction General Permit separates projects into risk levels 1, 2, or 3. The Project would likely be classified as risk level 1 or 2.

The Project would be subject to the current Caltrans NPDES Permit (Order No. 99-06-DWQ). Based on the Caltrans *Project Planning and Design Guide* (2010), the Project is required to implement treatment best management practices (BMPs) because it would result in a net increase of more than 1 acre (ac) of new impervious surface. Treatment BMPs would be considered to avoid and minimize impacts to water resources to the maximum extent practicable.

Per the California Regional Water Quality Control Board's memorandum to Caltrans, dated July 21, 2008, hydromodification controls are required if a project submits a Report of Waste Discharge and lies within the political boundary of a municipality subject to

hydromodification requirements in an NPDES municipal permit. The segment of Alameda County within the Project site is a co-permittee under the "California Regional Water Quality Control Board San Francisco Bay Region Municipal Regional Stormwater NPDES Permit (MRP)" (Order R2-2009-0074, NPDES Permit No. CAS612008). However, per the Alameda Countywide Clean Water Program Hydromodification Management Plan Map, the Project is in an area that is tidally influenced and therefore exempt from hydromodification requirements.

The Project's overall design goal would be to avoid and minimize impacts to water resources to the maximum extent practicable, promote infiltration of stormwater runoff, maximize treatment of stormwater runoff, and reduce erosion by metering or detaining post-project runoff. The Project is expected to have a less-than-significant impact to water resources by meeting these goals and incorporating other applicable NPDES and Project-specific permit or agreement requirements.

Acronyms

ABAG	Association of Bay Area Governments
ACCWP	Alameda Countywide Clean Water Program
BCDC	Bay Conservation and Development Commission
bgs	below ground surface
BMP	best management practices
BSA	Biological Study Area
Caltrans	California Department of Transportation
CFR	Code of Federal Regulations
CGP	Construction General Permit
CEQA	California Environmental Quality Act
COC	Constituents of Concern
CTC	California Transportation Commission
CWA	Clean Water Act
DSA	disturbed soil area
EBRPD	East Bay Regional Park District
EPA	United States Environmental Protection Agency
ESA	Environmentally Sensitive Area
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
I-	Interstate
IS/NMD	initial study/mitigated negative declaration
MRP	Municipal Regional Permit
MS4	Municipal Separate Storm Sewer System
MSL	mean sea level
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NWI	National Wetland Inventory
OARB	Oakland Army Base
OC	Overcrossing
PAH	polyaromatic hydrocarbons
Path	SFOBB Regional Bicycle/Pedestrian Connection
PCB	polychlorinated biphenyls
PCR	Project Concept Report
PM	Post Mile
PS&E	Plans, Specifications, and Estimates
REC	Recognized Environmental Condition
RWQCB	Regional Water Quality Control Board
SFOBB	San Francisco-Oakland Bay Bridge
SFBRWQCB	San Francisco Bay Regional Water Quality Control Board
SWMP	Storm Water Management Plan
SWPPP	Storm Water Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TMDL	total maximum daily load

UC	Undercrossing
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
VOH	Volatile Organic Hydrocarbons
WDR	Waste Discharge Requirement
WPCP	Water Pollution Control Plan
WQAR	Water Quality Assessment Report

1 INTRODUCTION

The proposed project is a new bicycle/pedestrian connection (Path or Project) between West Oakland and the new East Span of the San Francisco-Oakland Bay Bridge (SFOBB or Bay Bridge) in Oakland, California (see Figure 1 and Figure 2). The new Path would provide safe access to the existing Bay Bridge Trail, as well as access to existing and planned segments of the regional San Francisco Bay Trail.

The Path would be approximately 6,030 linear feet (ft). On the west end, the Project would connect to the existing bicycle/pedestrian path near the California Department of Transportation (Caltrans) maintenance facility on the south side of the Bay Bridge toll plaza. This path continues westward and connects to the Bay Bridge Trail. On the east end, the new path would connect to the existing bicycle/pedestrian path on Mandela Parkway (see).

The Project is proposed by the Gateway Park Working Group. The Gateway Park Working Group includes the following nine local, regional, and state agencies: The Bay Area Toll Authority (BATA), Caltrans, San Francisco Bay Conservation and Development Commission (BCDC), California Transportation Commission (CTC), East Bay Regional Park District (EBRPD), City of Oakland, Port of Oakland, East Bay Municipal Utility District (EBMUD), and Association of Bay Area Governments (ABAG's) Bay Trail Project. The agency responsible for operation and maintenance of the new path is anticipated to be Caltrans but could also be EBRPD or City of Oakland.

Caltrans is the lead agency under the National Environmental Policy Act (NEPA). BATA is the lead agency under the California Environmental Quality Act (CEQA). The environmental documents are a CEQA initial study/mitigated negative declaration (IS/MND) and a NEPA categorical exclusion.

1.1 Project Purpose

The purpose of the Project is to provide a safe connection for bicyclists and pedestrians to travel between West Oakland and the Bay Bridge Trail. The area between is occupied by industry, railways and Interstate 880 (I-880). Current access for bicyclists and pedestrians is on roadways extending through the industrial area, which have heavy truck traffic and are not considered safe.

1.2 Project Description

The proposed project is a new bicycle/pedestrian connection (Path or Project) between West Oakland and the new East Span of the San Francisco-Oakland Bay Bridge (Bay Bridge) in Oakland, California (see Figure 1). The new Path would provide safe access to the existing bicycle/pedestrian path on the Bay Bridge (Bay Bridge Trail), as well as access to existing and planned segments of the regional San Francisco Bay Trail (Figure 3).

The Path would be approximately 6,030 linear feet (ft). On the west end, the Path would connect to the Bay Bridge Trail near the Caltrans maintenance facility on the south side of the Bay

Bridge toll plaza. On the east end, the Project would connect to the existing bicycle/pedestrian path on Mandela Parkway.

The Project is proposed by the Gateway Park Working Group. The Gateway Park Working Group includes the following nine local, regional, and state agencies: BATA, Caltrans, BCDC, CTC, EBRPD, City of Oakland, Port of Oakland, EBMUD, and ABAG. The agency responsible for operation and maintenance of the new path is anticipated to be Caltrans but could also be City of Oakland.

Caltrans is the lead agency under the NEPA. BATA is the lead agency under CEQA. The environmental documents are a CEQA IS/MND and a NEPA categorical exclusion.

The purpose of the Project is to provide a safe connection for bicyclists and pedestrians to travel between West Oakland and the Bay Bridge Trail. The area between is occupied by industry, railways, and Interstate 880 (I-880). Current access for bicyclists and pedestrians is on roadways extending through the industrial area, which have heavy truck traffic. The proposed Project is a new Class I bike path located in the City of Oakland, Alameda County, near the I-880 and I-80 interchange and the new East Span of the Bay Bridge (see Required Attachments).

The Class I bike path would extend 6,030 ft (1.14 mile) between Mandela Parkway on the east and the Bay Bridge Trail on the west. The bike path is an elevated structure for most of this distance to provide access across existing freeways, railwayss and industrial areas. It is an independent structure, except over the railroad tracks where it would be on the West Grand Avenue overcrossing structure. The elevated bike path reaches a maximum height of 37 ft where it is on the overcrossing structure.

The Class I bike path would be 17 ft wide (15 ft clear width and 2 ft for fencing), except on the overcrossing structure where it reduces to 14 ft wide (10 ft clear width and 4 ft for fencing). The bike path would have a maximum grade of 5 percent.

The Project could also include Class II bike lanes and a 100-space parking lot at the east end of the Class I bike path, if funding is available. The Class II bike lanes would extend along surface streets near the east touchdown of the bike path, providing connections to Mandela Parkway and to the proposed Wood Street parking lot.

Table 1 lists the estimated total disturbed soils areas (DSA) and added and reworked impervious area values by right-of-way. The total DSA was estimated from the existing pervious areas, plus the existing impervious to be converted to pervious areas, and reworked impervious areas. The impervious area and DSA values will be further refined during the Plans, Specifications & Estimates (PS&E) phase once the limits of grading, construction staging locations, and other areas of disturbance have been developed.

Table 1. Disturbed Soil, Added, and Reworked Areas

Right-of-Way	Disturbed Soil Area (acre)	Existing Impervious Area (acre)	Proposed Impervious Area (acre)	Added Impervious Area (acre)	Replaced Impervious Area (acre)	Added and Replaced Impervious Area (acre)
Caltrans	2.22	10.36	10.92	0.54	0.13	0.68
Oakland	6.82	20.53	20.85	1.14	1.17	2.31
Total	9.04	30.89	31.77	1.68	1.30	2.99

Source: TY Lin,2014

The portion of the Project within the City of Oakland is within the Alameda County Phase I Municipal Separate Storm Sewer System (MS4) under the "California Regional Water Quality Control Board San Francisco Bay Region Municipal Regional Stormwater NPDES Permit" (Order R2-2009-0074, NPDES Permit No. CAS612008) (MRP). In addition, the portion of the Project within Caltrans' right-of-way would be subject to the current Caltrans National Pollutant Discharge Elimination System (NPDES) Permit (Order No. 99-06-DWQ).

1.3 Approach to Water Quality Assessment

The purpose of the Water Quality Assessment Report (WQAR) is to fulfill the requirements of the NEPA and the CEQA, and to provide information for NPDES permitting. The document includes a discussion of the proposed Project, the physical setting of the Project area, and the regulatory framework with respect to water quality. It also provides data on surface water and groundwater resources within the Project area and the quality of these waters, describes water quality impairments and beneficial uses, identifies potential water quality impacts/benefits associated with the proposed Project, and recommends avoidance and/or minimization measures for potentially adverse impacts.

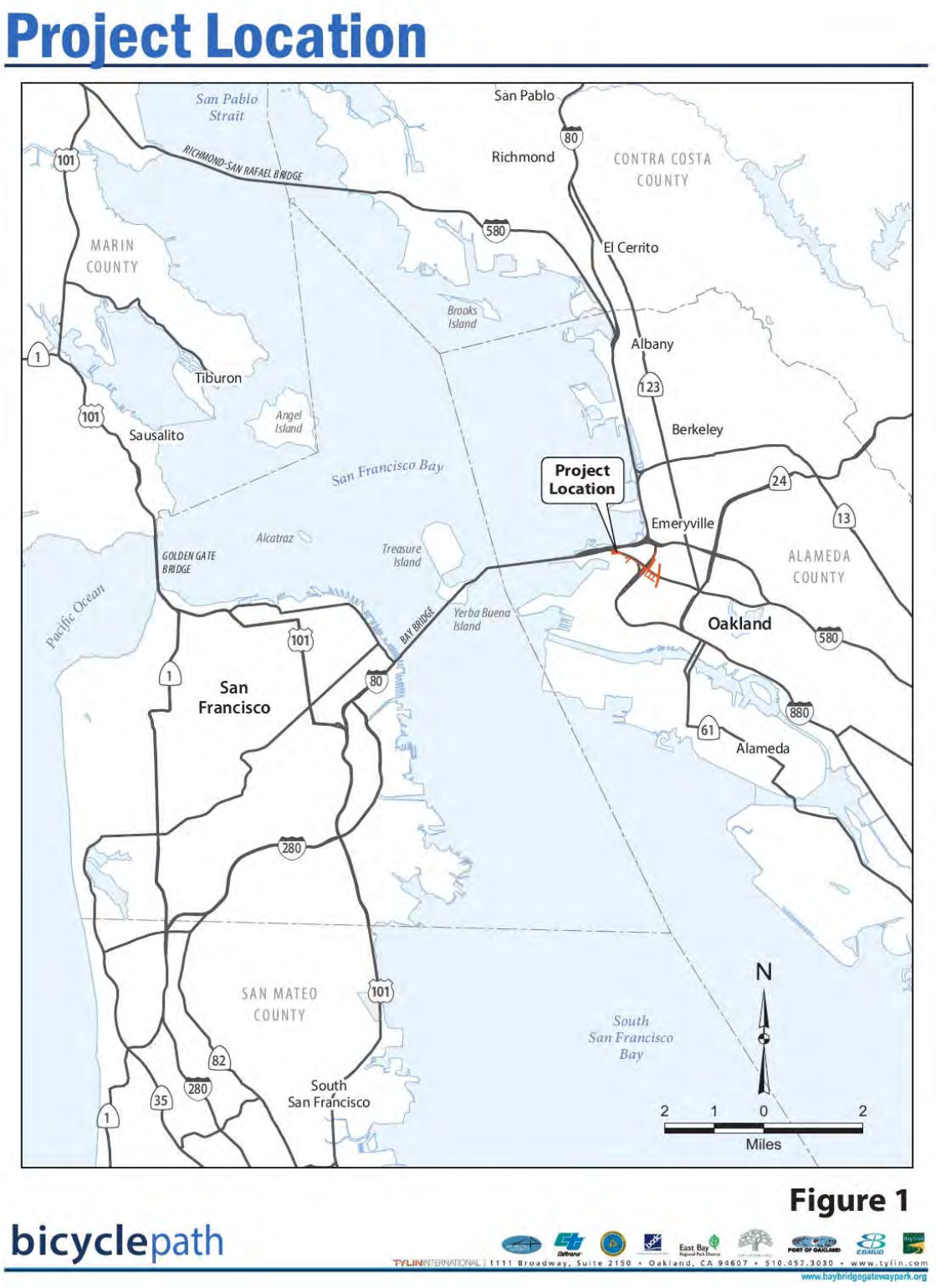

Figure 1. Project Location Map

Source: T.Y. Lin International, 2014

Figure 2. Vicinity Map

Source: T.Y. Lin International, 2014

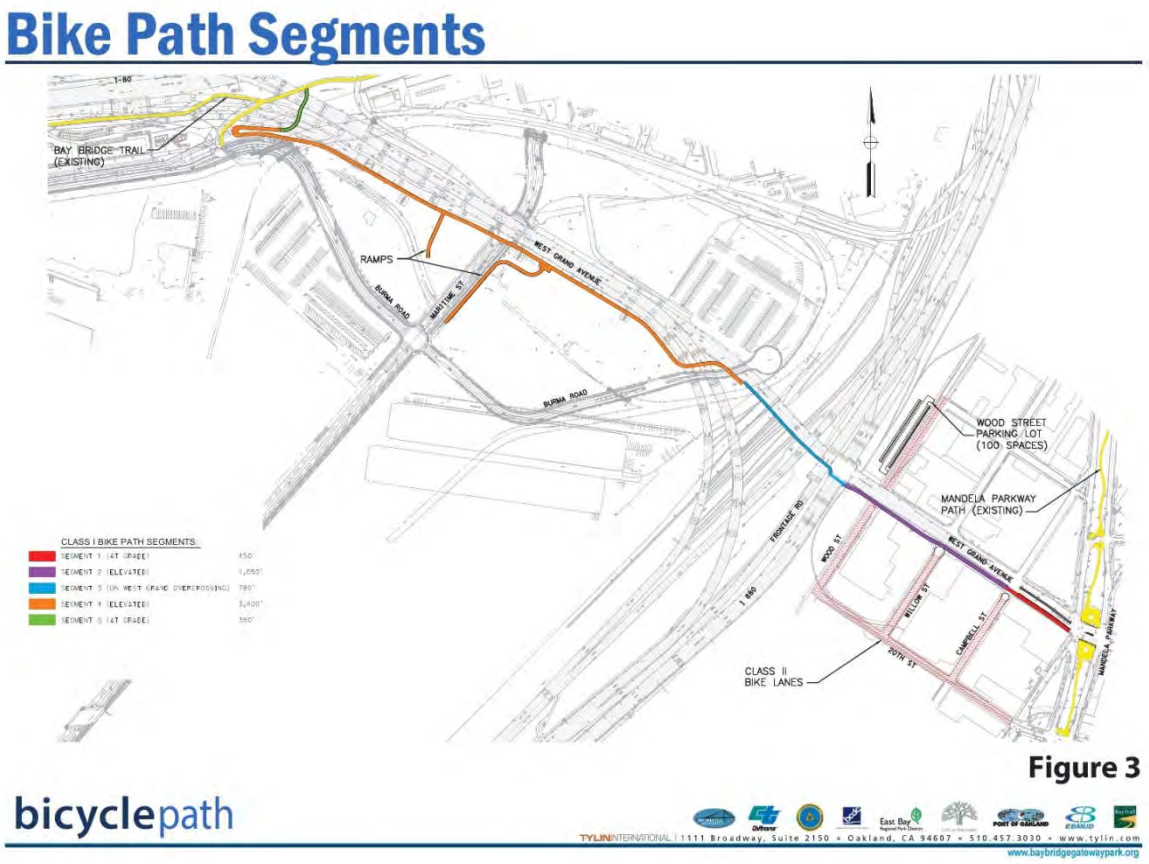

Figure 3. Bike Path Segments

Source: T.Y. Lin International, 2014

2 REGULATORY SECTION

2.1 Federal Laws and Requirements

2.1.1 Clean Water Act

In 1972 Congress amended the Federal Water Pollution Control Act, making the addition of pollutants to the waters of the U.S. from any point source unlawful unless the discharge is in compliance with an NPDES permit. Known today as the Clean Water Act (CWA), Congress has amended it several times. The objective of the CWA is "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters."

In the 1987 amendments, Congress directed dischargers of stormwater from municipal and industrial/construction point sources to comply with the NPDES permit scheme. Important CWA sections are:

- Sections 303 and 304 require states to promulgate water quality standards, criteria, and guidelines.
- Section 401 requires that an applicant for a federal license or permit for any activity potentially resulting in a discharge to waters of the United States (U.S.) must obtain certification from the State of California (State) that the discharge will comply with other provisions of the act. (Most frequently required in tandem with a Section 404 permit request. See below).
- Section 402 establishes the NPDES, a permitting system for the discharges (except for dredge or fill material) of any pollutant into waters of the U.S. The Regional Water Quality Control Boards (RWQCBs) administer this permitting program in California. Section 402(p) requires permits for discharges of stormwater from industrial/construction and MS4s.
- Section 404 establishes a permit program for the discharge of dredge or fill material into waters of the U.S. This permit program is administered by the U.S. Army Corps of Engineers (USACE).

USACE issues two types of 404 permits: general and standard permits. For general permits, there are two types: regional permits and nationwide permits. Regional permits are issued for a general category of activities when they are similar in nature and cause minimal environmental effect. Nationwide permits are issued to authorize a variety of minor project activities with no more than minimal effects.

There are also two types of standard permits: individual permits and Letters of Permission. Ordinarily, projects that do not meet the criteria for a nationwide permit may be permitted under one of USACE's standard permits. For standard permits, the USACE's decision to approve is based on compliance with the U.S. Environmental Protection Agency's (EPA's) Section 404 (b)(1) Guidelines (EPA Code of Federal Regulations [CFR] 40 Part 230) and whether permit approval is in the public interest. The 404(b)(1) guidelines were developed by the EPA in

conjunction with the USACE, and allow the discharge of dredged or fill material into the aquatic system (waters of the U.S.) only if there is no practicable alternative that would have less adverse effects. The 404(b)(1) guidelines state that USACE may not issue a permit if there is a least environmentally damaging practicable alternative to the proposed discharge that would have fewer effects on waters of the U.S. and not have any other significant adverse environmental consequences. Per the 404(b)(1) guidelines, documentation is needed that a sequence of avoidance, minimization, and compensation measures have been followed, in that order. The guidelines also restrict permitting activities that violate water quality or toxic effluent standards, jeopardize the continued existence of listed species, violate marine sanctuary protections, or cause "significant degradation" to waters of the U.S. In addition, every permit from the USACE, even if not subject to the 404(b)(1) guidelines, must meet general requirements (see 33 CFR 320.4).

2.2 State Laws and Requirements

2.2.1 Porter-Cologne Water Quality Control Act

California's Porter-Cologne Act, enacted in 1969, provides the legal basis for water quality regulation within California. This Act requires a "Report of Waste Discharge" for any discharge of waste (liquid, solid, or gaseous) to land or surface waters that may impair beneficial uses for surface and/or groundwater of the State. It predates the CWA and regulates discharges to waters of the State. Waters of the State include more than just waters of the U.S., such as groundwater and surface waters not considered waters of the U.S. Additionally, it prohibits discharges of "waste" as defined, which is broader than the CWA definition of "pollutant." Discharges under the Porter-Cologne Act are permitted by Waste Discharge Requirements (WDRs) and may be required even when the discharge is already permitted or exempt under the CWA.

The State Water Resources Control Board (SWRCB) and RWQCBs are responsible for establishing the water quality standards (objectives and beneficial uses) required by the CWA, and regulating discharges to ensure compliance with the water quality standards. Details regarding water quality standards in a project area are contained in the applicable RWQCB Basin Plan. In California, RWQCBs designate beneficial uses for all water body segments in their jurisdictions, and then set criteria necessary to protect these uses. Consequently, the water quality standards developed for particular water segments are based on the designated use and vary depending on such use. In addition, the SWRCB identifies waters failing to meet standards for specific pollutants, which are then state-listed in accordance with CWA Section 303(d). If a state determines that waters are impaired for one or more constituents, and the standards cannot be met through point source or non-point source controls (NPDES permits or WDRs), the CWA requires the establishment of total maximum daily loads (TMDLs). TMDLs specify allowable pollutant loads from all sources (point, non-point, and natural) for a given watershed.

2.2.2 State Water Resources Control Board and Regional Water Quality Control Boards

The SWRCB adjudicates water rights, sets water pollution control policy, issues water board orders on matters of statewide application, and oversees water quality functions throughout the

state by approving Basin Plans, TMDLs, and NPDES permits. RWCQBs are responsible for protecting beneficial uses of water resources within their regional jurisdiction using planning, permitting, and enforcement authorities.

2.2.3 National Pollutant Discharge Elimination System Program

Municipal Separate Storm Sewer Systems (MS4)

Section 402(p) of the CWA requires the issuance of NPDES permits for five categories of stormwater dischargers, including MS4s. The EPA defines an MS4 as "any conveyance or system of conveyances (roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, human-made channels, and storm drains) owned or operated by a state, city, town, county, or other public body having jurisdiction over stormwater, that are designed or used for collecting or conveying storm water." The portion of the Project within the City of Oakland is within the Alameda County Phase I Municipal Separate Storm Sewer System (MS4) under the "California Regional Water Quality Control Board San Francisco Bay Region Municipal Regional Stormwater NPDES Permit" (Order R2-2009-0074, NPDES Permit No. CAS612008) (MRP). In addition, the portion of the Project within Caltrans' right-of-way would be subject to the current Caltrans NPDES Permit (Order No. 99-06-DWQ)."

Construction General Permit

Construction General Permit (CGP) (Order No. 2009-009-DWQ, as amended by 2010-0014-DWG), adopted on November 16, 2010, became effective on February 14, 2011. The permit regulates stormwater discharges from construction sites that result in a DSA of one acre or greater, and/or are smaller sites that are part of a larger common plan of development. For all projects subject to the CGP, applicants are required to develop and implement an effective Storm Water Pollution Prevention Plan (SWPPP). In accordance with Caltrans' Standard Specifications, a Water Pollution Control Plan (WPCP) is necessary for projects with a DSA of less than 1 ac.

By law, all stormwater discharges associated with construction activity where clearing, grading, and excavation results in soil disturbance of at least 1 ac must comply with the provisions of the CGP. Construction activity that results in soil disturbances of less than 1 ac is subject to this CGP if there is potential for significant water quality impairment resulting from the activity as determined by the RWQCB. Operators of regulated construction sites are required to develop SWPPPs; implement sediment, erosion, and pollution prevention control measures; and obtain coverage under the CGP.

The CGP separates projects into risk levels 1, 2, or 3. Risk levels are determined during the planning and design phases and are based on potential erosion and transport to receiving waters. Requirements apply according to the risk level determined. For example, a Risk Level 3 (highest risk) project would require compulsory stormwater runoff pH and turbidity monitoring, and pre- and post-construction aquatic biological assessments during specified seasonal windows.

Section 401 Permitting

Under Section 401 of the CWA, any project requiring a federal license or permit that may result in a discharge to a water of the U.S. must obtain a 401 Certification, which certifies that the

project will be in compliance with State water quality standards. The most common federal permit triggering 401 Certification is a CWA Section 404 permit, issued by the USACE. The 401 permit certifications are obtained from the appropriate RWQCB, dependent on the project location, and are required before the USACE issues a 404 permit.

In some cases the RWQCB may have specific concerns with discharges associated with a project. As a result, the RWQCB may issue WDRs under the State Water Code (Porter-Cologne Act) that define activities, such as the inclusion of specific features, effluent limitations, monitoring, and plan submittals that are to be implemented for protecting or benefiting water quality. WDRs can be issued to address both permanent and temporary discharges of a project.

The Project is not anticipated to need a 401 permit.

2.3 Regional and Local Requirements

2.3.1 San Francisco Bay RWQCB Basin Plan

The San Francisco Bay Regional Water Quality Control Board (SFBRWQCB) established a General Basin Plan (2013) with goals and policies that apply to water bodies, if any, within the Project area, regarding beneficial uses and water quality objectives.

2.3.2 Local Agency NPDES Permit

The segment of Alameda County within the Project site is a co-permittee under the "California Regional Water Quality Control Board San Francisco Bay Region Municipal Regional Stormwater NPDES Permit" (Order R2-2009-0074, NPDES Permit No. CAS612008). This MRP presents the provision for permanent post-construction stormwater requirements. Within the Project limits, the Municipal Regional Permit (MRP) is administered regionally by the Alameda Countywide Clean Water Program (ACCWP) and locally by the City of Oakland. The ACCWP has developed a *C.3 Stormwater Technical Guidance* (Version 4.0, May 2013) to assist developers and engineers in complying with treatment and hydromodification requirements.

The MRP provides provisions and requirements for permanent stormwater treatment. Stormwater treatment measures are required to reduce the sediment and pollutant load resulting from the loss of pervious area and creation of impervious area. The permit sets impervious area thresholds for requiring projects to implement permanent stormwater treatment measures. The thresholds applicable for the Project include requiring permanent stormwater treatment measures when 10,000 square ft or more of impervious roadway area is created or replaced. If a project creates and/or replaces impervious area equal to more than 50 percent of the existing impervious area not previously requiring treatment, then the project must provide treatment for all existing and newly created impervious area.

In addition to permanent stormwater treatment requirements, the MRP provides provisions and requirements for hydromodification mitigation. Hydromodification is defined as the alteration of the hydrologic characteristics of coastal and non-coastal waters, which in turn could cause degradation of water resources. In the case of a stream channel, this is the process whereby a

stream bank is eroded by flowing water. This typically results in the suspension of sediment in the water course. Under the permit, projects that create or replace 1 ac or more of impervious area are required to evaluate hydromodification impacts to downstream water bodies and implement mitigation measures where appropriate.

3 AFFECTED ENVIRONMENT/EXISTING CONDITIONS

The Project proposes the construction of a new path connecting the existing bicycle/pedestrian path on Mandela Parkway to the existing bicycle/ pedestrian path near the Caltrans maintenance facility on the south side of the Bay Bridge. The Path will more-or-less parallel West Grand Avenue. The proposed improvements for the Project are limited to areas within Caltrans' right-of-way and the City of Oakland's right-of-way.

3.1 General Setting

3.1.1 Precipitation and Climate

Oakland has a moderate year-round climate. Humidity remains high while precipitation is low. The average temperatures vary between 49.9° F in January to 62.1° F in July, and the warmest months are September and October. The average annual precipitation is 23 inches. Almost all the City's rainfall occurs between October and January.

3.1.2 Population and Land Use

According to the Association of Bay Area Governments, the City of Oakland had a population of 390,724 as of 2010.

A majority of the Bay Bridge approach area consists of paved and/or developed freeway lanes and ramps and graded, paved, and/or landscaped shoulders and pullouts. Surrounding land use includes industrial and commercial developments in general. Most of the land areas adjacent to the I-80 corridor in the City of Oakland are zoned as resource conservation area to the north and general industrial/transportation to the south (City of Oakland 2013).

3.1.3 Topography

The topography along West Grand Avenue in the Project area is generally flat. Site elevations range between 8 ft above mean sea level (MSL) to approximately 17 ft above MSL.

3.1.4 Floodplains

There are no Federal Emergency Management Agency (FEMA) delineated 100-yr base floodplains within the Project limits (Appendix A).

3.1.5 Hydrology

3.1.5.1 Regional Hydrology

The Caltrans Water Quality Planning Tool identifies I-80 within the Project limits as crossing hydrologic sub-area number 204.20, and the Caltrans Stormwater Design Application website identifies the planning watersheds within these hydrologic sub-areas (see Table 2).

Table 2. Hydrologic Units within the Project Limits

I-80 PM	Hydrologic Unit	Hydrologic Area	Hydrologic Sub-area Number	Planning Watershed
Ala-80-1.04L/3.34 Ala-880-R34.0	South Bay	East Bay Cities	204.20	Undefined

Source: Caltrans Water Quality Planning Tool 2013

3.1.5.2 Local Hydrology

The receiving water body for the Project is the Lower San Francisco Bay. The receiving water body for the area north of I-80 discharges to Central San Francisco Bay and the area south of I-80 which includes the Project discharges to Lower San Francisco Bay.

3.1.5.3 Groundwater Hydrology

The Project area overlies East Bay Plain Subbasin within Santa Clara Valley Groundwater Basin. The East Bay Plain Subbasin (Basin Number 2-9.04) encompasses 122 square miles.

Figure 4. Groundwater Wells in the Project is a map obtained from the SWRCBs Groundwater Ambient Monitoring and Assessment database, which indicates the approximate locations and depth of groundwater wells within the Project limits on the figure, dots denote well locations, and colors indicate relative median depth-to-water (the darker the color, the larger the depth-to-water).

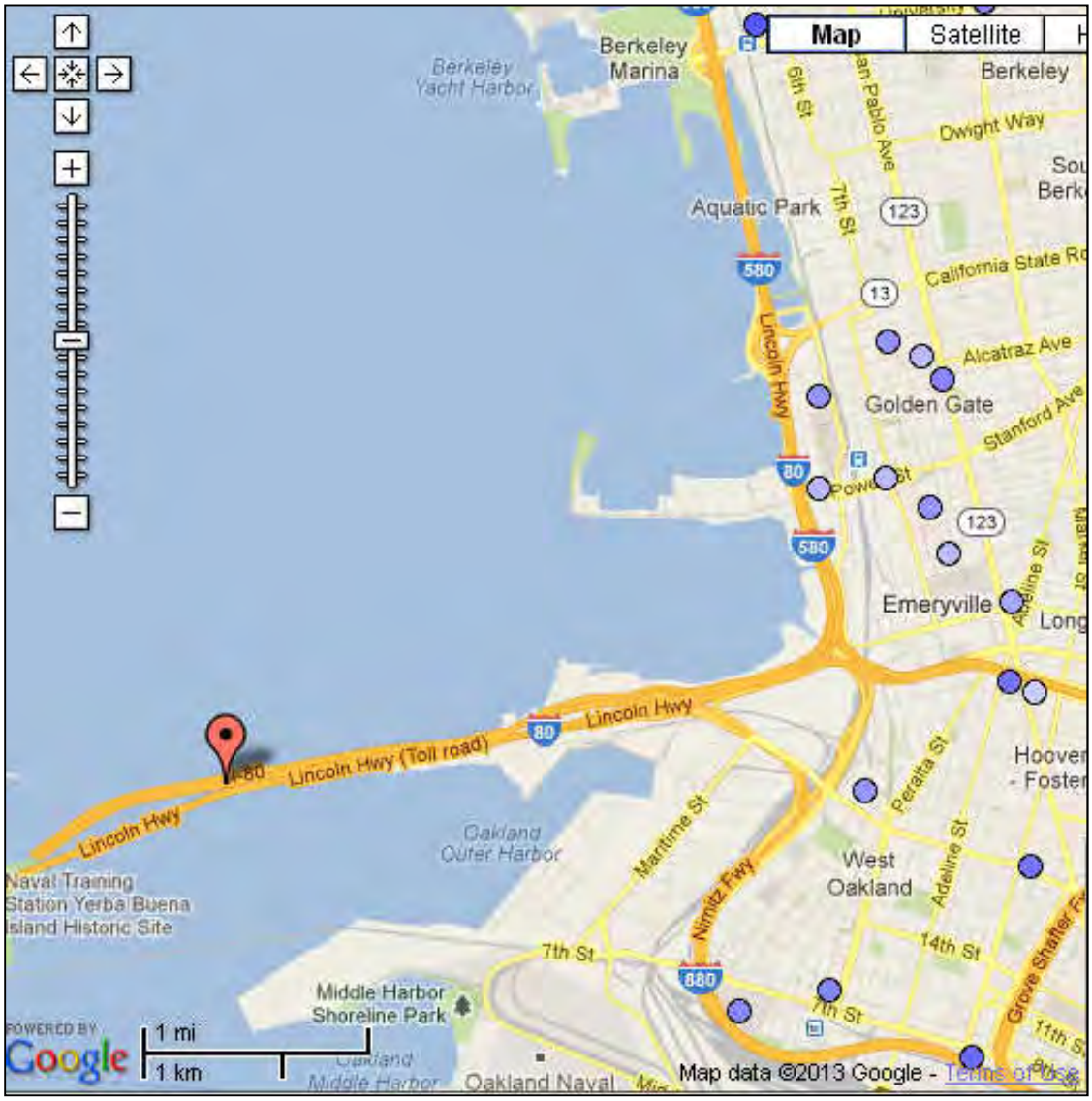

Figure 4. Groundwater Wells in the Project

Source: SWRCB, 2009

The groundwater depth varies from 3.1 ft to 16.8 ft below ground surface (bgs) within the Bay Bridge approach area (see Figure 4). The water table on the eastern end is higher than the western end, and is higher on the northern end than the southern end. The soil report for the Project is not available at this time. Project-specific groundwater information will be provided once the report is available.

Per the *Phase I Initial Site Assessment* (Fugro, 2014), groundwater is anticipated to occur at or slightly above mean sea level over the area of the Project. Accordingly, the depth to groundwater is expected to range from immediately bgs along and near the shoreline, up to a depth of 10 ft bgs at the farthest inland areas of the Site. Based on information provided in the report, [*Final, Upland Areas of Concern, Feasibility Study, BRAC Parcel 1, Oakland Army Base*, prepared by

Matrix Environmental Services, LLC (MES) and dated March 2006], the tidal influence on the groundwater gradient extends approximately 600 ft inland from the Oakland Harbor; in this area, groundwater flow is expected to be highly variable due to tidal forces. The groundwater gradient in areas beyond 600 ft from the harbor is anticipated to flow westward toward San Francisco Bay.

The groundwater level is anticipated to vary with the passage of time due to tidal influence, seasonal groundwater fluctuation, surface and subsurface flows into the bay, ground surface runoff, and other factors that may not have been present at the time of the previous investigation. Groundwater conditions within the Project limits should be verified during the PS&E phase.

3.1.6 Geology/Soils

The East Bay Plain Subbasin aquifer system consists of unconsolidated sediments of Quaternary age. Deposits include the early Pleistocene Santa Clara Formation, the late Pleistocene Alameda Formation, the early Holocene Temescal Formation, and artificial fill (see below for descriptions of the deposits). The cumulative thickness of the unconsolidated sediments is about 1,000 ft (CRWQCB 1999).

- The Santa Clara Formation consists of alluvial fan deposits inter-fingered with lake, swamp, river channel, and floodplain deposits. The formation ranges from 300 to 600 ft thick.

- The Alameda Formation includes a sequence of alluvial fan deposits bounded by mud deposits on top and bottom of the formation. The formation was deposited primarily in an estuarine environment and ranges from 26 to 245 ft thick.

- The Temescal Formation is an alluvial deposit consisting primarily of silts and clays with some gravel layers. The formation ranges from 1 to 50 ft thick. Artificial fill is found mostly along the bay front and wetlands areas and is derived primarily from dredging as well as quarrying, construction, demolition debris, and municipal waste. The fill ranges from 1 to 50 ft with the thickest deposits found nearer to the bay (California RWQCB 1999).

Per the Project *Initial Site Assessment* (Fugro, 2014), the geologic map titled: “Geologic Map of the San Francisco-San Jose Quadrangle, California” (California Division of Mines and Geology, dated 1991) shows that the majority of the Project (all areas west of the Nimitz Freeway) is mapped as artificial deposits. Based on the MES report, more than 6.5 million cubic yards of fill was placed to create the land surface that presently covers the area of the former Oakland Army Bases (OARB). The fill was placed by 1942, and rock fill for the seawall was imported from quarries located near Lake Temescal and Oak Knoll Naval Hospital. The remaining area is mapped as Pleistocene age alluvium (Older Alluvium) consisting of unconsolidated deposits of gravel, sand, silt, and clay. Clayey soils (known locally as “Bay Mud”) exist beneath the artificial fill and alluvial soils.

Soils data were reviewed from the USDA, Natural Resources Conservation Service (NRCS), to identify and evaluate existing soil conditions in the Project vicinity. Approximately three different soil units intersect in the Project (see Table 3). The major soil components mapped within the Project is primarily clay, loamy sand, and urban land complexes. Descriptions of all the soil features (e.g., setting, composition, and thickness) are included in Appendix B.

Table 3. Soil Information

Unit Name	Percentage of Area	Typical profile	Depth to Water (cm)
Urban land	97.4	N/A	>200
Urban land-Baywood complex	0.5	*0 to 16 inches:* Loamy sand *16 to 60 inches:* Loamy sand	>200
Urban land-Clear lake complex	2.1	*0 to 26 inches:* Clay *26 to 60 inches:* Clay	>200

Source: NRCS

3.1.6.1 Soil Erosion Potential

The NRCS provides information in their soil surveys regarding soil erodibility by providing a set of numerical indices for each soil type. The soil erodibility factor (K) is a measure of the susceptibility of a given soil type to erosion by water; it varies from 0.02 to 0.69, with soils having the highest K values as the most erodible. To estimate annual soil loss per acre, the K value of a soil is modified by factors representing plant cover, grade and length of slope, soil management practices, and climate. This value is used for the risk level determination associated with the CGP. See Appendix C for K factor maps in the Project area.

The Caltrans "CGP Info" GIS mapping system identifies the K factor for the Project area in the range of 0.24 to 0.37, which suggests moderate erosion susceptibility within the Project area.

3.1.7 Biological Communities

3.1.7.1 Aquatic Habitat

The National Wetland Inventory (NWI) database was referenced to determine if there were any previously documented aquatic features within the limit of the proposed Project. There are no aquatic features in the area of the proposed Project in the NWI. The *Gateway Park Draft Project Concept Report* (Gateway Report) (Perkins+Will 2011) does not mention any aquatic habitat in the Project.

3.1.7.2 Special-Status Species

The Gateway report lists special-status plants and wildlife species protected under the Federal and State endangered species acts with potential to occur in the vicinity. The current biological report was not available at the time of this report; information on special-status species will be updated once the report is available.

3.1.7.3 Stream/Riparian Habitats

The Gateway report did not list any stream/riparian habitats within the Project an updated biological report was not available at the time of this report. This information will be updated once the biological report is available.

3.1.7.4 Wetlands

Although there is a wetland under the elevated portion of the path near the railroad tracks have been identified by the Project biologist, no impact is anticipated to the wetland from the Project. Therefore, a 401 Certification from the SFBRWQCB is not expected to be required for this Project.

3.1.7.5 Fish Passage

There are no fish passages identified in the Project. However, the water bodies are identified as having the existing beneficial uses of fish migration see Section 3.2.1.

3.2 Water Quality Objectives/Standards and Beneficial Uses

3.2.1 Surface Water Quality Objectives/Standards and Beneficial Uses

The SFBRWQCB's Basin Plan (2013) lists the water quality objectives for the region in Chapter 3 of the Basin Plan (Appendix D). The surface water quality objectives consist of the following: bacteria, bioaccumulation, biostimulatory substances, color, dissolved oxygen, floating material, oil and grease, population and community ecology, pH, radioactivity, salinity, sediment, settleable material, suspended material, sulfide, taste and odors, temperature, toxicity, turbidity, and un-ionized ammonia.

Beneficial uses are critical to water quality management in California. According to State law, the beneficial uses of California's waters that may be protected against quality degradation include, but are not limited to, "domestic; municipal; agricultural and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves" (Water Code Section 13050). Beneficial uses for surface water and groundwater are divided into the 20 standard categories with definitions listed in Appendix E. Protection and enhancement of existing and potential beneficial uses are the primary goals of water quality planning. Runoff from the Project goes into storm drain systems for both Caltrans and City of Oakland, the runoff from Mandela Parkway and W Grand Avenue flow into Caltrans storm drain systems.

There are no surface streams within the Project limits. Lower San Francisco Bay is the direct receiving water body for the Project. The Basin Plan identifies beneficial uses for water bodies within its jurisdiction. The existing beneficial uses listed for Lower San Francisco Bay are as follows:

- Industrial Service Supply (IND)
- Ocean, Commercial, and Sport Fishing (COMM)
- Shellfish Harvesting (SHELL)

- Estuarine Habitat (EST)
- Fish Migration (MIGR)
- Preservation of Rare and Endangered Species (RARE)
- Fish Spawning (SPWN)
- Wildlife Habitat (WILD)
- Water Contact Recreation (REC-1)
- Non-Contact Water Recreation (REC-2)
- Navigation (NAV)

3.2.2 Groundwater Quality Objectives/Standards and Beneficial Uses

Per the Phase I *Initial Environmental Site Assessment* (Fugro, 2014), a portion of the Project lies within the limits of the OARB where soil, groundwater, and sediment impacts are known to be present, which is considered a recognized environmental condition (REC). Additionally, the planned Project crosses immediately adjacent to several sites listed in regulatory agency databases due to known or suspected soil and/or groundwater contamination that are considered RECs, these sites include the Heroic War Dead – EBMUD, the Southern Pacific Transportation Company and Port of Oakland.

For the portion of the Site within the boundaries of the former OARB known chemicals of concern (COCs) include heavy metals, volatile organic compounds (VOCs), poly-chlorinated biphenyls (PCBs), polyaromatic hydrocarbons (PAHs), and organochlorine pesticides. Based on the known soil, groundwater, and offshore sediment impacts associated with the OARB facility, it is considered a REC to the Project.

The Basin Plan (2013) sets general water quality objectives addressing bacteria, organic and non-organic chemical constituents, taste and odor, and radioactivity for all groundwater in the area. The Basin Plan states that: 1) groundwater shall be free of organic and inorganic chemical constituents in concentrations that adversely affect beneficial uses; 2) groundwater shall not contain taste or odor producing substances in concentrations that adversely affect beneficial uses; and 3) radionuclides shall not be present in concentrations deleterious to humans, plants, animals, or aquatic life. Appendix C summarizes water quality objectives based on beneficial uses established by the SFBRWQCB.

Groundwater subbasins identified as having the existing groundwater beneficial use of municipal and domestic water supply are subject to further narrative and numeric groundwater objectives for bacteria, organic and inorganic constituents, radioactivity, and taste and odor. These objectives are presented in Section 3.3 of the Basin Plan. Groundwater subbasins identified as having the beneficial use of agricultural water supply are subject to additional objectives for organic and inorganic chemical constituents stated in Section 3.4.2 of the Basin Plan.

Based on the examination of GIS information from the SWRCB, the Project area is located within the East Bay Basin Groundwater Subbasin (Basin identification number 2-9.04). The East Bay Basin Groundwater Subbasin's existing beneficial uses are municipal and domestic

water supply (MUN) and agricultural water supply (AGR), industrial process water supply (PROC), and industrial water supply (IND).

Table 4 lists contaminant groups most frequently found to exist in the groundwater resources in the San Francisco Bay Hydrologic Region.

Table 4. Most Frequently Occurring Contaminants by Contaminant Group in the San Francisco Bay Hydrologic Region

Contaminant Group	Contaminant - # of Wells	Contaminant - # of Wells	Contaminant - # of Wells
Inorganics	Iron – 57	Manganese – 57	Fluoride – 7
Radiological	Gross Alpha – 2	Radium 226 – 1	
Nitrates	Nitrates Nitrate (as NO_3) -27	Nitrate + Nitrite – 3	Nitrite (as N) – 1
Pesticides	Di(2-Ethylhexyl)phthalate – 4	Heptachlor – 1	
VOCs[1]/SVOCs[2]	PCE[3] – 4	Dichloromethane – 3	TCE[4]– 2
			Vinyl Chloride – 2

Source: Department of Water Resources 2003

Notes:
[1]VOC = Volatile Organic Compound
[2]SVOC = Semivolatile Organic Compound
[3]PCE = Tetrachloroethylene
[4]TCE = Trichloroethylene

3.3 Existing Water Quality

3.3.1 Regional Water Quality

Caltrans has performed many studies to monitor and characterize highway stormwater runoff throughout the State. Commonly found pollutants are total suspended solids, nitrate nitrogen, total nitrogen, phosphorous, orthophosphate, copper, lead, and zinc. Some sources of these pollutants are natural erosion, phosphorus from tree leaves, combustion products from fossil fuels, and the wearing of brake pads and tires (Caltrans 2003).

3.3.2 List of Impaired Waters

Lower San Francisco Bay is the Project receiving water body listed on the 2010 Integrated Report (Clean Water Act Section 303[d] List /305[b] Report); see Table 5 for the Pollutants in the Lower San Francisco Bay and the estimated EPA Total Maximum Daily Loads approval date.

Table 5. 303(d) Listed Water Body-Lower San Francisco Bay

Pollutant	Expected TMDL Completion Date	EPA TMDL Approved Date	Potential Sources
Chlordane	2013		Nonpoint Source
DDT	2013		Nonpoint Source
Dieldrin	2013		Nonpoint Source
Dioxin compounds (including 2,3,7,8-TCDD)	2019		Atmospheric Deposition
Furan Compounds	2019		Atmospheric Deposition
Invasive Species	2019		Ballast Water
Mercury		2/29/2008	Natural Sources
Mercury		2/29/2008	Atmospheric Deposition
Mercury		2/29/2008	Industrial Point Sources
Mercury		2/29/2008	Municipal Point Sources
Mercury		2/29/2008	Nonpoint Source
Mercury		2/29/2008	Resource Extraction
PCBs	2008		Unknown Nonpoint Source
PCBs (dioxin-like)	2008		Unknown Nonpoint Source
Trash	2021		Illegal dumping
Trash	2021		Urban Runoff/Storm Sewers

Notes: DDT=Dichlorodiphenyltrichloroethane
PCBs= Polychlorinated biphenyls

Source: SWRCB 2010

4 ENVIRONMENTAL IMPACTS

The following sections present the potential temporary and permanent water quality impacts from the proposed Project activities. The following discussions include Caltrans' procedures for identifying these potential impacts.

During construction, potential water quality impacts include sediment-laden discharge from disturbed soil areas and pollutant-laden discharge from storage or work areas. Temporary impacts can also result from construction near or within water resources.

The disturbed soil area, existing and proposed impervious areas, newly created added impervious, and reworked impervious areas are shown in Table 6 for the entire Project area, the Caltrans portion, and the non-Caltrans portion within the City of Oakland. Based on definitions in the Caltrans MS4 permit, the Project build alternative would create a total of 1.68 ac of new impervious surface.

Table 6. Total Disturbed Soil and Impervious Areas by Project Area

Right-of-Way	Disturbed Soil Area (acre)	Existing Impervious Area (acre)	Proposed Impervious Area (acre)	New Added Impervious Area (acre)	Reworked Impervious Area (acre)	New Added and Reworked Impervious Area (acre)
Caltrans	2.22	10.36	10.92	0.54	0.13	0.68
Oakland	6.82	20.53	20.85	1.14	1.17	2.31
Total	9.04	30.89	31.77	1.68	1.30	2.99

Source: TY Lin 2014

4.1 Potential Impacts to Water Quality

4.1.1 Anticipated Changes to the Physical/Chemical Characteristics of the Aquatic Environment

This Project would result in a minimal increase of impervious areas when compared with the overall watershed areas and, therefore, would minimally increase the volume and velocity of stormwater flow to downstream receiving water bodies. In addition, pollutant loading is not anticipated to increase significantly. The added impervious area is directly related to the potential permanent water quality impacts. Stormwater runoff from the Project area drains directly into the bay and to nearby storm drain systems, which ultimately discharge into lined and unlined channels.

4.1.1.1 Currents, Circulation, or Drainage Patterns

The goal of the Project drainage design would be to maintain existing drainage patterns. The added impervious area created by the Project may result in minimal impacts to the existing hydrograph, including minimal increases in low flow and peak flow velocity and volume to Lower San Francisco Bay. Existing drainage systems at the edge of shoulders or in the median may need to be relocated. New drainage systems may be required to capture the drainage from the Project.

4.1.1.2 Suspended Particulates (Turbidity)

During construction, potentially sediment-laden flow can result from runoff over DSAs that enter storm drainage facilities or directly discharge into Lower San Francisco Bay, increasing the turbidity, decreasing the clarity, and potentially impacting the beneficial uses of the bay. Additional sources of sediment that could result in increases in turbidity include uncovered or improperly covered active and non-active stockpiles, un stabilized slopes and construction staging areas, and improperly maintained or cleaned construction equipment.

The Project would result in a minimal increase of impervious area when compared with the overall watershed area, which would minimally increase the amount of runoff not infiltrated or dispersed over unpaved surfaces. This non-infiltrated and concentrated runoff could result in the direct discharge of sediment-laden flow from the roadway to the bay.

4.1.1.3 Oil, Grease, and Chemical Pollutants

Heavy metals associated with vehicle tire and brake wear, oil and grease, and exhaust emissions are the primary pollutants associated with transportation corridors. Generally, stormwater runoff has the following pollutants: total suspended solids, nitrate nitrogen, total nitrogen, phosphorous, ortho-phosphate, copper, lead, and zinc. The pollutants are dispersed from tree leaves, combustion products from fossil fuels, and the wearing of brake pads and tires. The build alternatives would also potentially result in increased deposition of particulates resulting from increased traffic loads throughout the Project segment.

4.1.1.4 Erosion and Accretion Patterns

The increase in impervious area could result in the modification of existing receiving water body hydrographs by increasing the flow volumes and rates and peak durations from the loss of unpaved overland flow and native infiltration (hydromodification). These hydromodification impacts could cause increased bed and bank erosion, loss of habitat, increased sediment transport and deposition, and increased flooding. Per the Alameda County HMP susceptibility map (2007), the entire Project area is tidally influenced /depositional – exempt from hydromodification and no hydromodification mitigation is required.

4.1.1.5 Aquifer Recharge/Groundwater

Dewatering would be needed at locations of excavation work with high groundwater. The proposed construction work required for the Project may have localized impacts to the flow of groundwater. Existing groundwater recharge areas within the Project limits would not be affected due to the minimal increase in impervious areas, which would insignificantly decreases the area available for infiltration. The impacts would be insignificant in comparison to the overall groundwater area and due to the highly variable nature of the existing groundwater flow paths. In addition, because groundwater resources in the area do not represent a sole source aquifer, no significant impacts to water quality in groundwater wells are anticipated.

4.1.1.6 Baseflow

The increase of impervious surfaces compared with the total watershed areas would be minimal. The amount of surface runoff that infiltrates into the groundwater system would be minimally affected; therefore, the amount of base flow to the Bay would be minimally affected. The impacts would be insignificant in comparison to the overall baseflow and due to the resilience in the natural hydrologic cycle.

4.1.2 Anticipated Changes to the Biological Characteristics of the Aquatic Environment

4.1.2.1 Special Aquatic Sites

The Gateway report does not list any special aquatic sites. The updated biological report was not available at the time of this report. Once this report is available, this section will be updated accordingly.

4.1.2.2 Habitat for Fish and Other Aquatic Organisms

There is no mention of habitat for fish or other aquatic organisms in the Project area in the Gateway report. This section will be updated as needed when the biological report is available.

4.1.2.3 Wildlife Habitat

In the Gateway report it states that “potential impact to wildlife species from the project could affect nesting birds using trees, shrubs and ground within the study area.” The Gateway report also lists wildlife species that have the potential to occur because of suitable or marginally suitable habitats. This section will be updated as needed when the biological report is available.

4.1.2.4 Endangered or Threatened Species

The Gateway report has a list of the potential special status plant and wildlife species that could be found in the Project area. The plant list contains more than 40 species; however, after the plant survey in December 2009 it was determined that the habitat is unsuitable or not present for nearly all special-status plant species. This section will be updated as needed when the biological report is available.

4.1.2.5 Invasive Species

The Gateway report states that there are many non-native species as well as a few native shrubs and sub-shrubs. There are no maps showing locations of the invasive species and therefore it is unknown if any of these invasive species occur within the Project area. This section will be updated as needed when the biological report is available.

4.1.3 Anticipated Changes to the Human Use Characteristics of the Aquatic Environment

4.1.3.1 Recreational or Commercial Fisheries

Lower San Francisco Bay has been identified as having the combined existing beneficial uses of ocean, commercial, and sport fishing and shellfish harvesting (see Section 3.2.1). The Project is expected to facilitate these beneficial uses. Per the Project *Existing and Future Conditions Study* (Perkins+Will 2010), the proposed Project location currently has no formal public access facilities to the shoreline, although the area is used informally for fishing and shoreline viewing. Proposed bike access, will bring activity.

4.1.3.2 Parks, National and Historic Monuments, National Seashores, Wild and Scenic Rivers, Wilderness Areas, etc.

The Project is not located in the vicinity of any rivers designated as part of the National Wild and Scenic Rivers System. As such, no wild or scenic rivers would be directly affected by the construction or operation of the Project.

4.1.3.3 Traffic/Transportation Patterns

As the gateway between San Francisco and Oakland (including the East Bay), commuters and recreational users will use the Project area to stage between auto, bicycle, pedestrian, and transit modes. Detailed information from traffic studies will be updated in the next submittal.

4.1.3.4 Safety

Project implementation is anticipated to facilitate access to the park for pedestrians and bicyclists and reduce congestion within the interchange area, thereby improving safety for motorists and maintenance workers.

4.1.4 Short-Term Impacts During Construction

4.1.4.1 Physical/Chemical Characteristics of the Aquatic Environment

Earth-moving and other construction activities could cause minor erosion and runoff of topsoils into the drainage systems along the Project corridor during construction, which could temporarily affect water quality in local waterways.

During construction, the build alternative for the Project would have the potential for temporary water quality impacts due to grading and excavation activities, which can cause increased erosion. Stormwater runoff from the Project site may transport pollutants to nearby receiving waters and storm drains if Best Management Practices (BMPs) are not properly implemented. Generally, as the DSAs increase, the potential for temporary water quality impacts also increases. The proposed Project has an estimated DSA of 3.1 ac for the build alternative. Based on the preliminary calculated area, the Project would have potential water quality impacts during construction.

Fueling or maintenance of construction vehicles would occur within the Project site during construction, so there is risk of accidental spills or releases of fuels, oils, or other potentially toxic materials. An accidental release of these materials may pose a threat to water quality if contaminants enter storm drains, open channels, or surface water receiving bodies. The magnitude of the impact from an accidental release depends on the amount and type of material spilled.

The proposed improvements for the Project do not involve substantial excavations that affect groundwater resources. As indicated in Section 3.1.5.3, the water table is relatively shallow, and the build alternative would involve excavation for the installation of the elevated bike structures; therefore, dewatering would be anticipated for the Project.

5 AVOIDANCE AND MINIMIZATION MEASURES

This Project would have minimal impacts to water quality if the following avoidance and minimization measures are incorporated.

5.1 Avoidance and/or Minimization Measures for Water Resources

Any potential avoidance measures for the Project would be evaluated through consultation with local and regulatory agencies.

To minimize potential impacts to waters of the U.S., construction activities will be limited to the smallest area possible to complete the proposed work. Construction will follow approved BMPs, including but not limited to erosion control, sediment control, spill prevention, and vehicle/equipment refueling measures to minimize any potential for impacting wetlands and waters onsite or downstream of the Project (Caltrans 2013).

A qualified biologist will clearly delineate the limited construction areas and environmentally sensitive areas (ESAs), if any, for incorporation into the Project plans and specifications. The construction crew will be alerted if a sensitive habitat exists adjacent to the construction zone. Before construction begins, the contractor would install ESA fencing to clearly delineate protected areas and would confine workers and equipment to the designated construction areas (Caltrans 2013).

5.2 Avoidance and/or Minimization Measures for Stormwater and Groundwater

The design features to address water quality impacts are a condition of Caltrans' NPDES permit, CGP, and other regulatory agency requirements. Implementation of details for these design features or BMPs would be developed and incorporated into the Project design and operations prior to the Project startup. With proper implementation of these design features or BMPs, short-term construction-related water quality impacts and permanent water quality impacts would be avoided or minimized.

5.2.1 Construction General Permit

In accordance with the CGP, the Project is required to perform a risk assessment and determine the project-level risk. There are three risk levels. The Project risk level is determined from the sediment risk and the receiving water risk. The sediment risk factor is determined from the product of the rainfall runoff erosivity factor (R), the soil erodibility factor (K), and the length-slope factor (LS). The R factor is determined from the U.S. EPA "Stormwater Phase II Final Rule Construction Rainfall Erosivity Waiver" Fact Sheet 3.1 (2012). The Project K and LS factors were determined from the Caltrans Stormwater Design Application website. Table 7 lists the sediment risk factors by planning watershed. To be conservative, the maximum K and LS values within the planning watershed are used to determine the sediment risk. The sediment risk is classified as low when the product of the R, K, and LS factors are less than 15, medium when the product is between 15 and 75, and high when the value is greater than 75.

For the R factor for the Project, the Erosivity Index (EI) Zone was found based on the Project geographic location. The annual isoerodent value for the Project area was interpolated on the California Isoerodent Map. The construction start date and construction end date are conservatively estimated to be 1/1/2017 and 12/31/2018 (per response to RFI sent 4/4/14), respectively. The total EI percent value is 200% for the Project duration, because the Project lasts for two years. The R factor is determined by multiplying the percent value obtained by the annual isoerodent value for each segment.

The receiving water risk can be classified as low or high depending on whether a project drains to a sediment-sensitive water body. A sediment-sensitive water body is either on the most recent 303(d) list for water bodies impaired for sediment; has an EPA approved TMDL plan for sediment; or has the beneficial uses of cold freshwater habitat (COLD), fish spawning (SPAWN), and fish migration (MIGRATORY). Lower San Francisco Bay, the Project receiving water body, is not sediment-sensitive water body. Table 7 summarizes the sediment and receiving water risks, plus presents the risk levels.

Table 7. Risk Level by Planning Watershed

Planning Watershed	PM limits	EI Zone	Annual Isoerodent Value	R	K	LS	Sediment Risk	Receiving Water Risk	Risk Level
Undefined	West of Willow Street	24	40	80	0.37	0.25	Low	Low	1
	East of Willow Street				0.24	0.26	Low		1

Source: Caltrans' Stormwater Design Application, 2012

All risk levels are subject to temporary construction site BMP implementation and visual monitoring requirements. The BMP implementation and sampling required under each risk level are measures that will minimize impacts to receiving water bodies and water resources.

Risk level 1 projects will be subject to minimum best management practice (BMP) implementation and visual monitoring requirements.

The risk levels presented in this section are based on planning level information available at the time of preparation of this report. The actual planning watershed or overall project risk level will be refined during the Project design phase.

5.2.2 Project Construction

The proposed Project has a proposed soil disturbance of more than 1 ac; therefore, it shall be regulated under the NPDES permit for Construction Activities (Order No. 2009-009-DWQ, as

amended by 2010-0014-DWQ and 2012-0006-DWQ; effective on July 17, 2012). Because the Project must comply with the CGP, a Notice of Intent will need to be filed with the SWRCB's Storm Water Multiple Application and Report Tracking System. Caltrans requires the Project's contractors to implement a SWPPP to comply with the conditions of the Caltrans MS4 permit and CGP to address the temporary water quality impacts resulting from the construction activities associated with the Project.

The SWPPP would be submitted by the contractor and approved by City of Oakland prior to the start of construction; its intent is to address construction-phase impacts. The SWPPP required for the Project will include the following elements:

- Project Description: the project description will include maps and other information related to construction activities and potential sources of pollutants.
- Minimum Construction Control Measures: these measures may include limiting construction access routes, stabilizing areas denuded by construction, and using sediment controls and filtration.
- Erosion and Sediment Control: the SWPPP is required to contain a description of soil stabilization practices, control measures to prevent a net increase in sediment load in stormwater, controls to reduce tracking sediment onto roads, and controls to reduce wind erosion.
- Non-Stormwater Management: the SWPPP will include provisions to reduce and control discharges other than stormwater.
- Post-Construction Stormwater Management: the SWPPP will include a list of stormwater control measures that will provide ongoing (permanent) protection for water resources.
- Waste Management and Disposal: the SWPPP will include a waste management section including equipment maintenance waste, used oil, batteries, etc. All waste must be disposed of as required by state and federal law.
- Maintenance, Inspection, and Repair: the SWPPP requires an ongoing program to ensure that all controls are in place and operating as designed.
- Monitoring: this provision requires documented inspections of the control measures.
- Reports: Caltrans will prepare an annual report on the construction of the Project and submit this report to the RWQCB, which must certify compliance with the SWPPP.
- Training: trained personnel must do inspections, maintenance, and repair of construction site BMPs.
- Construction Site Monitoring Program: The SWPPP includes a Construction Site Monitoring Program detailing the procedures and methods related to the visual monitoring and analysis plans for non-visible pollutants,

Caltrans is required to reduce pollutants in stormwater discharge levels to the maximum extent practicable. For the discharges coming from a construction site, pollutants must be reduced using the best available technology economically achievable, and conventional pollutants must be reduced using the best conventional technology.

5.2.3 List of Proposed Temporary Construction Site Best Management Practices (BMPs)

Potential temporary impacts to water quality can be prevented or minimized by implementing standard BMPs recommended for a particular construction activity. The selected temporary BMPs are intended to achieve compliance with the requirements of the permit and are consistent with the practices and recommendations required under the permit. Compliance with the requirements of the permit, and adherence to its conditions, would reduce or avoid potentially significant construction-related impacts.

Adverse impacts can occur during construction-related activities. Soil erosion, especially during heavy rainfall, can increase the suspended solids, dissolved solids, and organic pollutants in stormwater runoff generated within the Project area. These conditions would likely persist until the completion of construction activities and the implementation of long-term erosion control measures.

The installation of platform structures for the Project, may require the need for dewatering at locations with a high water table. Dewatering and associated permitting activities would be confirmed during the design phase, and a dewatering plan would be provided by the contractor. Contract documents would address any necessary permits for dewatering measures.

Scheduling is also a BMP that needs to be considered for the Project. All proposed construction work in jurisdictional areas would be scheduled per regulatory construction windows to minimize potential impacts to waters of the U.S.

Non-storm water waste management is also essential to minimizing the potential of water quality impacts on a project site. Accidental spills of petroleum hydrocarbons (such as fuels and lubricating oils), concrete wastewater, and possibly sanitary wastes, are also of concern during construction activities. An accidental release of these wastes can adversely affect surface water quality, vegetation, and wildlife habitat.

Erosion control measures could be applied to all exposed areas during construction, including the trapping of sediments within the construction area through the placement of barriers, such as silt fences, at the perimeter of the downstream drainage points or through the construction of temporary detention basins. Other methods of minimizing erosion impacts include the implementation of hydromulching and/or limiting the amount and length of exposure of the graded soil. The Alameda County MRP requires all construction sites to have BMPs in six categories; Erosion Control, Run-on and Run-off Control, Sediment Control, Active Treament Systems (as necessary), Good Site Management and Non Stormwater Managment. Site specific BMPs can be a combination of BMPs from the California BMP Handbook, the Caltrans Stormwater Quality Handbook, the California Regional Water Quality Control Board and new BMPs available since these Handbooks. Temporary erosion control and water quality measures would be defined in detail in the erosion control and water pollution control design sheets prepared for the Project, which would also include the specifications for the SWPPP. The suggested minimum temporary control BMPs that are necessary for the Project are included in Table 8.

Table 8. Temporary BMPs

Temporary BMP	Purpose
Soil Stabilization	
Move-In/Move-Out	Mobilization locations where permanent erosion control or revegetation to sustain slopes is required within the projects.
Temporary Cover	Plastic covers for stockpiles.
Sediment Control	
Temporary Fiber Rolls	Degradable fibers rolled tightly and placed on the toe and face of slopes to intercept runoff.
Temporary Silt Fence	Linear, permeable fabric barriers to intercept sediment-laden sheet flow. Placed downslope of exposed soil areas, along channels and project perimeter.
Temporary Gravel Bag Berm	Single row of gravel bags installed end to end to form a barrier across a slope to intercept runoff. Can be used to divert or detain moderately concentrated flows.
Temporary Drainage Inlet Protection	Runoff detainment devices used at storm drain inlets that is subject to runoff from construction activities.
Tracking Control	
Temporary Construction Entrances/Exits	Points of entrance/exit to a construction site that are stabilized to reduce the tracking of mud and dirt onto public roads.
Street Sweeping	Removal of tracked sediment to prevent them entering a storm drain or watercourse.
Non-Stormwater Management	
Dewatering Operations	Dewatering activities associated with stormwater and non-stormwater to prevent the discharge of pollutants from construction site.
All other anticipated non-stormwater management measures are covered under Job Site Management.	
Waste Management and Materials Pollution Control	
Temporary Concrete Washout Facilities	Specified vehicle washing areas to contain concrete waste materials.
All other anticipated waste management and materials pollution control measures are covered under Job Site Management.	
Job Site Management	
General measures covered under job site management includes • spill prevention and control • materials management • stockpile management • waste management • hazardous waste management • contaminated soil • concrete waste • sanitary and septic waste and liquid waste Miscellaneous job site management includes: • training of employees and subcontractors • proper selection, deployment and repair of construction site BMPs	Non-stormwater management consists of: • water control and conservation • illegal connection and discharge detection and reporting • vehicle and equipment cleaning • vehicle and equipment fueling and maintenance • paving, sealing, saw cutting, and grinding operations • thermoplastic striping and pavement markers • concrete curing and concrete finishing

Source: Caltrans 2012

5.2.4 Permanent Pollution Prevention Design Measures

In order to comply with the Caltrans' Statewide Permit (Order No. 2009-0009 DWQ), the MRP (Order No. R2-2009-0074) and the CGP, once construction is complete; Caltrans will take measures to reduce pollutant loadings from the facility to the MEP. This permit stipulates that permanent measures that control pollutant discharges must be considered and implemented for all new or reconstructed facilities. Permanent control measures located within Caltrans' right-of-way would reduce pollutants in the stormwater runoff from the roadway. These measures would reduce the suspended particulate loads, and thus prevent pollutants associated with the particulates from entering the waterways. These measures would be incorporated into the final engineering design or landscape design of the Project, and should take into account the expected runoff from the roadway. In addition, the NPDES permit stipulates that an operation and maintenance program be implemented for the permanent control measures. This category of water quality control measures could be identified to include both design pollution prevention BMPs and treatment BMPs.

Many design elements that are traditionally part of highway, drainage, and landscape design are considered beneficial to pollution prevention. In this particular discipline, designers must consider all of the items listed below for proper project design.

5.2.5 List of Proposed Design Pollution Prevention BMPs

Consideration of downstream effects related to potentially increased flow

The increase in impervious area can result in the modification of existing receiving water body's hydrographs by increasing the flow volumes and rates and peak durations from the loss of unpaved overland flow and native infiltration (hydromodification). These hydromodification impacts can cause increased bed and bank erosion, loss of habitat, increased sediment transport and deposition, and increased flooding.

Per the July 21, 2008 SWQCB's memorandum to Caltrans, the SWQCB does not require the Statewide permit (Order No. 99-06-DWQ) to implement hydromodification controls for its projects, unless the project submits a Report of Waste Discharge and lies within the political boundary of a municipality subject to hydromodification requirements in a NPDES municipal permit.

Accordingly, under the Alameda and Santa Clara County municipal agencies' Clean Water Programs (Alameda County Clean Water Program and Santa Clara Valley Urban Runoff Pollution Precipitation Plan), a project requires hydromodification management if the project creates and/or replaces one acre or more of impervious surface; increases impervious surface over pre-project conditions; and is located in a susceptible area as shown on the Hydromodification Management applicability maps, which are included in the Supplemental Attachments.

The Alameda County Clean Water Program Hydromodification Susceptibility map identifies the Project area as tidally influenced/depositional – exempt from hydromodification (Appendix F).

Concentrated flow conveyance systems
The Project will likely:

1. Have the potential to create water gullies
2. Create or modify existing slopes
3. Require the concentration of surface runoff
4. Require cross drains

Each of these conditions would require the proper design of these drainage facilities to handle the concentrated flows:

- Ditches, berms, dikes, and/or swales
- Overside drains
- Flared end sections
- Outlet protection/velocity dissipation devices

Slope/surface protection systems
The Project will create or modify existing slopes requiring the application of one or more of the following control measures:

- Vegetated surfaces
- Hard surfaces

Preservation of existing vegetation
Existing mature vegetation and landscaping would be protected in place where possible. Areas of clearing and grubbing would be limited to those areas impacted by new construction. Studies to determine environmentally sensitive areas are currently being conducted and will be discussed in PS&E phase Storm Water Data Report. Details of the areas to be preserved will be shown in the project plans to be developed during the PS&E phase.

Existing wetlands and other environmentally sensitive areas would be preserved during construction with the use of ESA fencing. Existing wetlands that cannot be preserved would be mitigated with appropriate measures to be developed during the PS&E phase.

The Project, including the elevated portions, could have plantings. The Project could include streetscape improvements, such as landscaping and art work, on Mandela Parkway within one block of West Grand Avenue.

5.2.6 List of Proposed Treatment BMPs

According to the Gateway report, the RWQCB encourages the use of rainwater harvesting and reuse, infiltration, evapotranspiration and bio-treatment as the preferred treatment options. Because of the high groundwater at the site, infiltration is not a viable option for stormwater quality. Rainwater harvesting may be used where feasible or non-potable uses; however, this may conflict with the East Bay Municipal Utilities District's (EBMUD's) desire to maximize the use of recycled water. It is

anticipated the biofiltration will be the primary treatment measure used to treat runoff from impervious surfaces.

Based on the site criteria, biofiltration strips and biofiltration swales are proposed as the preferred types of treatment BMPs for the Project.

5.2.7 Project Operation and Maintenance

Because the Caltrans Maintenance Unit is responsible for maintaining highway and BMP facilities once the Project is complete, the Maintenance Unit will be involved in the development process from conception through construction. The Maintenance Unit field representative has unique insight into local problems and maintenance and safety concerns. The Caltrans/Oakland Maintenance Unit typically comments on the following project-related issues:

- Drainage patterns (particularly known areas of flooding, debris, etc.)
- Stability of slopes and roadbed (help determine if the Project can be built and maintained economically)
- Possible material borrow or spoil sites
- Concerns of the local residents
- Existing and potential erosion problems
- Facilities within the right-of-way that will affect alternative designs
- Special problems such as deer crossings, endangered species, etc.
- Whether facilities are safe to maintain
- Known environmentally sensitive areas
- Frequency of traction sand use and estimate of sand quantity applied annually

The Maintenance Stormwater Coordinator for Caltrans and City of Oakland will be involved in the design review of any permanent stormwater treatment BMPs and will need to approve any such devices at the end of the PS&E phase.

5.3 Water Quality Assessment of Checklists

This Water Quality Assessment Checklist summarizes the stormwater quality evaluation process presented in the CEQA Environmental Checklist Form.

The following list of questions is from the Hydrology and Water Quality Checklist from Section 8 of the CEQA Environmental Checklist Form. The possible answers are: "Potentially Significant Impact," "Less than Significant with Mitigation Incorporated," "Less than Significant Impact," and "No Impact."

Would the Project:

a) *Violate any water quality standards or waste discharge requirements?*

Less than Significant Impact

The primary potential for impacts to water quality is soil erosion or suspended solids being introduced into the waterways. The proposed Project has a proposed soil disturbance of more than 1 ac; therefore, it shall be regulated under the NPDES permit for Construction Activities (Order No.

2009-009-DWQ, as amended by 2010-0014-DWQ and 2012-0006-DWQ; effective on July 17, 2012). This CGP is also referenced in Caltrans' and City of Oakland MRP. NPDES permit, from the SWRCB (Order No. 99-06-DWQ, National Pollutant Discharge Elimination System No. CAS000003). Stormwater discharges from Caltrans' transportation properties, facilities, and activities are regulated through this permit. Minimization measures that comply with this permit, such as requiring the contractor to submit a SWPPP prior to the start of construction and implementing permanent BMPs such as erosion control and treatment BMPs in the Project to address long-term impacts, would focus on the control of sediment and suspended solids from entering the waterways. Therefore, the proposed Project would comply with all water quality standards and waste discharge requirements, and the impact to water quality would be less than significant.

b) *Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of preexisting nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?*

Less than Significant Impact

Groundwater recharge is reduced when the ground is compacted or when it is covered completely (by development); this way, less water can seep into the soil. The added impervious areas are small in relation with the size of the groundwater basin located within the Project limits; therefore, groundwater recharge impacts would be less than significant.

c) *Substantially alter the existing drainage pattern of the site area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site?*

Less Than Significant Impact

There would not be any proposed changes to the existing drainage pattern due to the proposed improvements. No stream or river would be altered such that substantial erosion or siltation would result. The objective of the drainage design would be to limit the design water surface elevations and velocities to no greater than the existing conditions, or to what can be handled by the existing conditions, at the boundary of the proposed Project.

d) *Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?*

Less Than Significant Impact

Existing drainage patterns would be perpetuated. While the proposed Project would introduce added impervious surface area, the effect on the flow rate and amount of surface runoff would be negligible in comparison to the overall watershed of the receiving water body, Lower San Francisco Bay. Because drainage facilities within Caltrans' and City of Oakland right-of-way may discharge to local drainage facilities, the Project is expected to be required to comply with hydromodification management requirements stated within the California RWQCB San Francisco Bay Region Municipal Regional Stormwater NPDES Permit (Order R2-2009-0074, NPDES Permit No. CAS612008). Per the Alameda County HMP susceptibility map (2007), the entire Project area is

tidally influenced/depositional and is therefore exempt from hydromodification management requirements.

e) *Create or contribute runoff water which would exceed the capacity of existing or planned storm water drainage systems or provide substantial additional sources of polluted runoff?*

Less than Significant Impact

The proposed Project would increase the total impervious surface within the Project limits and, therefore, increase the volume of stormwater runoff. Potential sources of pollutants from the right-of-way include: total suspended solids, nutrients, pesticides, particulate metals, dissolved metals, pathogens, litter, biochemical oxygen demand, and total dissolved solids. Existing drainage facilities throughout the proposed Project limits, however, would be extended, replaced, repaired, and/or improved as necessary to provide proper off-site and highway drainage. In compliance with Caltrans' and City of Oakland NPDES requirements, water quality treatment BMPs would be included where practicable, which would include biofiltration swales and biofiltration strips at various locations throughout the Project area. Asphalt concrete dikes would not be used for areas with side slopes flatter than 4:1 (H:V). This may allow the pavement runoff to flow across the vegetated slopes, and flow in the vegetated swales along the highway. The impact to runoff, therefore, would be less than significant.

f) *Otherwise substantially degrade water quality?*

Less than Significant Impact

The primary potential impact to water quality is soil erosion or suspended solids being introduced into the waterways. The proposed Project has a soil disturbance of more than 1 ac, and therefore, shall be regulated under the CGP (Order No. 2009-009-DWQ, as amended by 2010-0014-DWQ and 2012-0006-DWQ; effective on July 17, 2012). This permit is also referenced in Caltrans' NPDES permit, from the SWRCB (Order No. 99-06-DWQ, National Pollutant Discharge Elimination System No. CAS000003). Stormwater discharges from Caltrans' and City of Oakland transportation properties, facilities, and activities are regulated through this permit. Minimization measures that comply with this permit, such as requiring the contractor to submit a SWPPP prior to start of construction and implementing permanent BMPs such as erosion control and treatment BMPs in the Project to address long-term impacts, would focus on the control of sediment and suspended solids from entering the waterways. Therefore, the proposed Project would comply with all water quality standards and waste discharge requirements, and the impact to water quality would be less than significant.

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Appendix A FEMA Flood Insurance Rate Maps

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JOINS PANEL 0054

ZONE X

ZONE VE
(EL 9)

San Francisco Bay

ZONE X

HT0858

80

ZONE X

W GRAND AVENUE

City Of
Oakland
065048

San Francisco Bay

ZONE VE
(EL 9)

MARITIME STREET

20TH ST

MAP SCALE 1" = 500'

250 0 500 1000

FEET

METER

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0058G

FIRM

FLOOD INSURANCE RATE MAP

ALAMEDA COUNTY, CALIFORNIA
AND INCORPORATED AREAS

PANEL 58 OF 725

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EMERYVILLE, CITY OF	060005	0058	G
OAKLAND, CITY OF	065048	0058	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
06001C0058G

EFFECTIVE DATE
AUGUST 3, 2009

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

Appendix B Web Soil Survey

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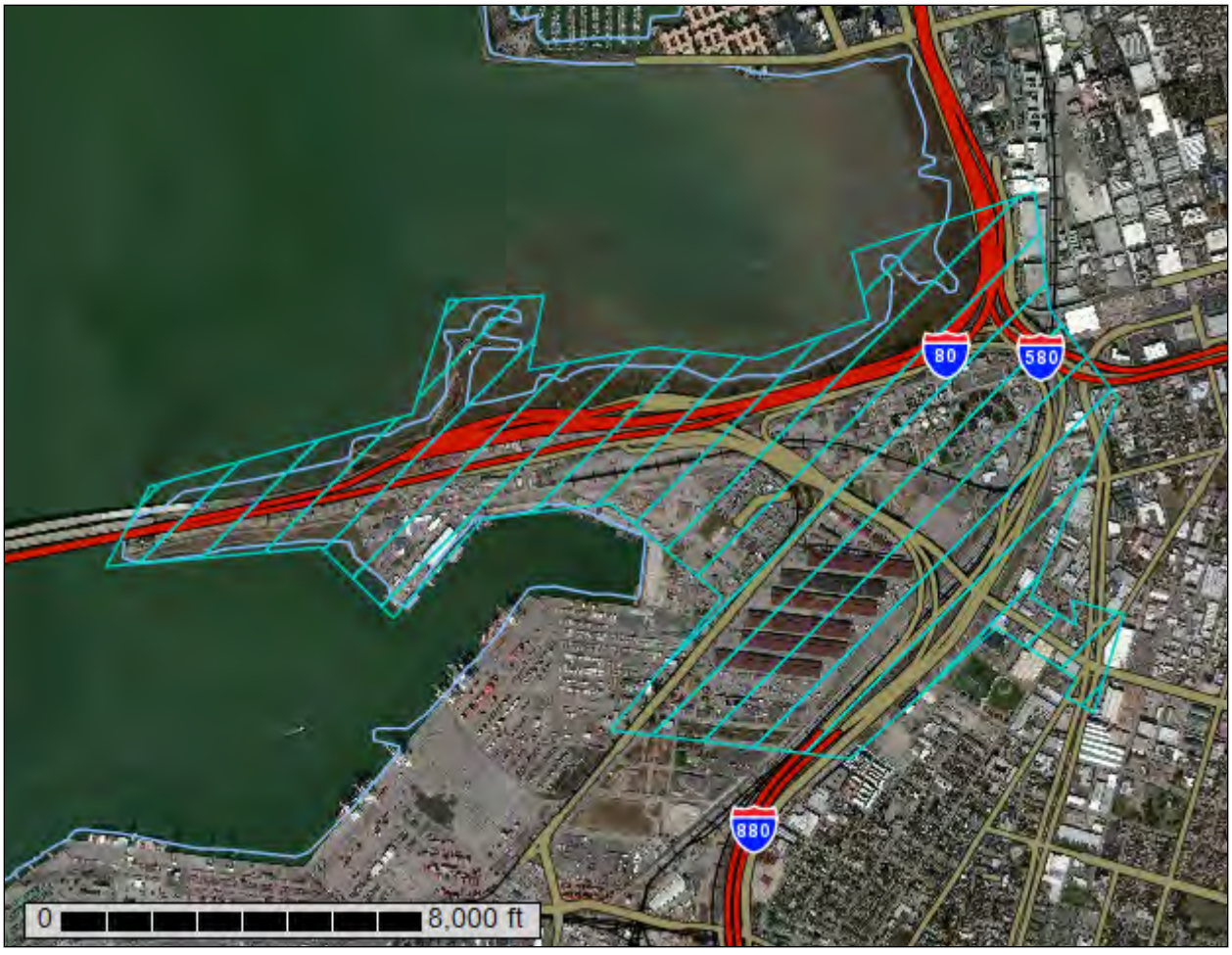
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Alameda County, California, Western Part



November 4, 2013

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://soils.usda.gov/sqi/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://soils.usda.gov/contact/state_offices/).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Soil Data Mart Web site or the NRCS Web Soil Survey. The Soil Data Mart is the data storage site for the official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the

individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:20,900 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 300 600 1200 1800

Feet: 0 1000 2000 4000 6000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Alameda County, California, Western Part
Survey Area Data: Version 7, Jul 27, 2010

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 26, 2010—Sep 17, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Alameda County, California, Western Part (CA610)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
146	Urban land	738.2	84.0%
147	Urban land-Baywood complex	3.1	0.4%
148	Urban land-Clear Lake complex	15.4	1.8%
162	Water	122.4	13.9%
Totals for Area of Interest		**879.1**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If

intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Alameda County, California, Western Part

146—Urban land

Map Unit Composition

Urban land: 95 percent
Minor components: 5 percent

Description of Urban Land

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 8

Minor Components

Unnamed soils in marshes

Percent of map unit: 5 percent
Landform: Basin floors
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear

147—Urban land-Baywood complex

Map Unit Setting

Elevation: 20 to 500 feet
Mean annual precipitation: 15 to 35 inches
Mean annual air temperature: 52 to 55 degrees F
Frost-free period: 300 days

Map Unit Composition

Urban land: 60 percent
Baywood and similar soils: 35 percent
Minor components: 5 percent

Description of Urban Land

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 8

Description of Baywood

Setting

Landform: Beach ridges
Landform position (three-dimensional): Riser
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Eolian deposits

Properties and qualities

Slope: 2 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water capacity: Low (about 4.9 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability classification (irrigated): 3s
Land capability (nonirrigated): 4e
Hydrologic Soil Group: A

Typical profile

0 to 16 inches: Loamy sand
16 to 60 inches: Loamy sand

Minor Components

Laugenour

Percent of map unit: 3 percent
Landform: Flood plains
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear

Omni

Percent of map unit: 2 percent
Landform: Flood plains
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear

148—Urban land-Clear Lake complex

Map Unit Setting

Elevation: 20 to 1,500 feet
Mean annual precipitation: 10 to 35 inches
Mean annual air temperature: 57 to 63 degrees F
Frost-free period: 225 to 300 days

Map Unit Composition

Urban land: 55 percent
Clear lake and similar soils: 35 percent

Minor components: 10 percent

Description of Urban Land

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 8

Description of Clear Lake

Setting

Landform: Basin floors
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from sedimentary rock

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 48 to 72 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 15.0
Available water capacity: Moderate (about 8.4 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability classification (irrigated): 2e
Land capability (nonirrigated): 4e
Hydrologic Soil Group: D

Typical profile

0 to 26 inches: Clay
26 to 60 inches: Clay

Minor Components

Omni

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear

Marvin

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear

162—Water

Map Unit Composition
Water: 100 percent

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Water Features

Water Features include ponding frequency, flooding frequency, and depth to water table.

Depth to Water Table

"Water table" refers to a saturated zone in the soil. It occurs during specified months. Estimates of the upper limit are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

This attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

122° 20' 8" W
122° 17' 1" W
37° 50' 11" N
37° 48' 35" N
558600
559000
559400
559800
560200
560600
561000
561400
561800
562200
562600
563000
4187800
4187400
4187000
4186600
4186200
4185800
4185400
4185000
162
162
80
880
80
580
580
148
32nd
Engineer Rd
146
Burma Rd
Peralta
146
Grand
148
19th St
147
Frontage
Ferry St
Maritime
880
14th
Map Scale: 1:20,900 if printed on A landscape (11" x 8.5") sheet.
N
Meters
0
300
600
1200
1800
Feet
0
1000
2000
4000
6000
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- 0 - 25
- 25 - 50
- 50 - 100
- 100 - 150
- 150 - 200
- > 200
- Not rated or not available

Soil Rating Lines
- 0 - 25
- 25 - 50
- 50 - 100
- 100 - 150
- 150 - 200
- > 200
- Not rated or not available

Soil Rating Points
- 0 - 25
- 25 - 50
- 50 - 100
- 100 - 150
- 150 - 200
- > 200
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Alameda County, California, Western Part
Survey Area Data: Version 7, Jul 27, 2010

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 26, 2010—Sep 17, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Depth to Water Table

Depth to Water Table— Summary by Map Unit — Alameda County, California, Western Part (CA610)				
Map unit symbol	**Map unit name**	**Rating (centimeters)**	**Acres in AOI**	**Percent of AOI**
146	Urban land	>200	738.2	84.0%
147	Urban land-Baywood complex	>200	3.1	0.4%
148	Urban land-Clear Lake complex	>200	15.4	1.8%
162	Water	>200	122.4	13.9%
Totals for Area of Interest			**879.1**	**100.0%**

Rating Options—Depth to Water Table

Units of Measure: centimeters

Aggregation Method: Dominant Component

Component Percent Cutoff: None Specified

Tie-break Rule: Lower

Interpret Nulls as Zero: No

Beginning Month: January

Ending Month: December

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Appendix C Construction General Permit Risk Assessment

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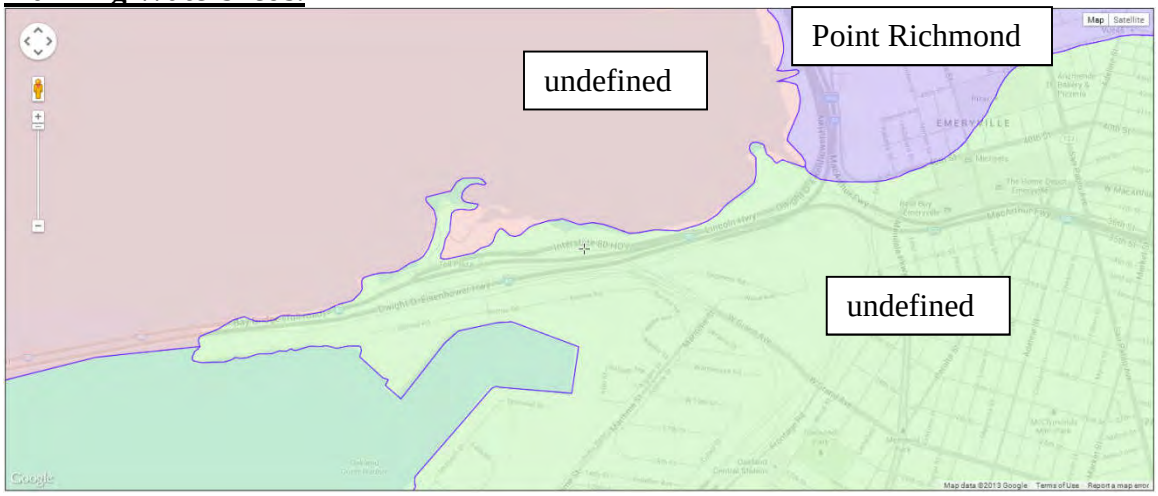
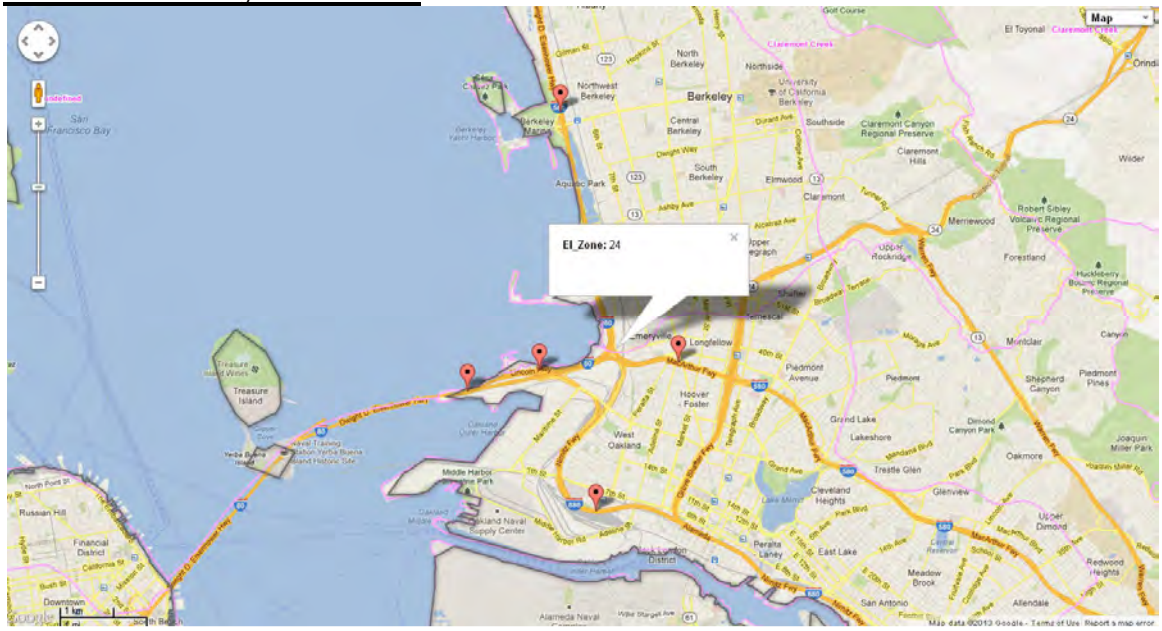
Planning Watersheds.



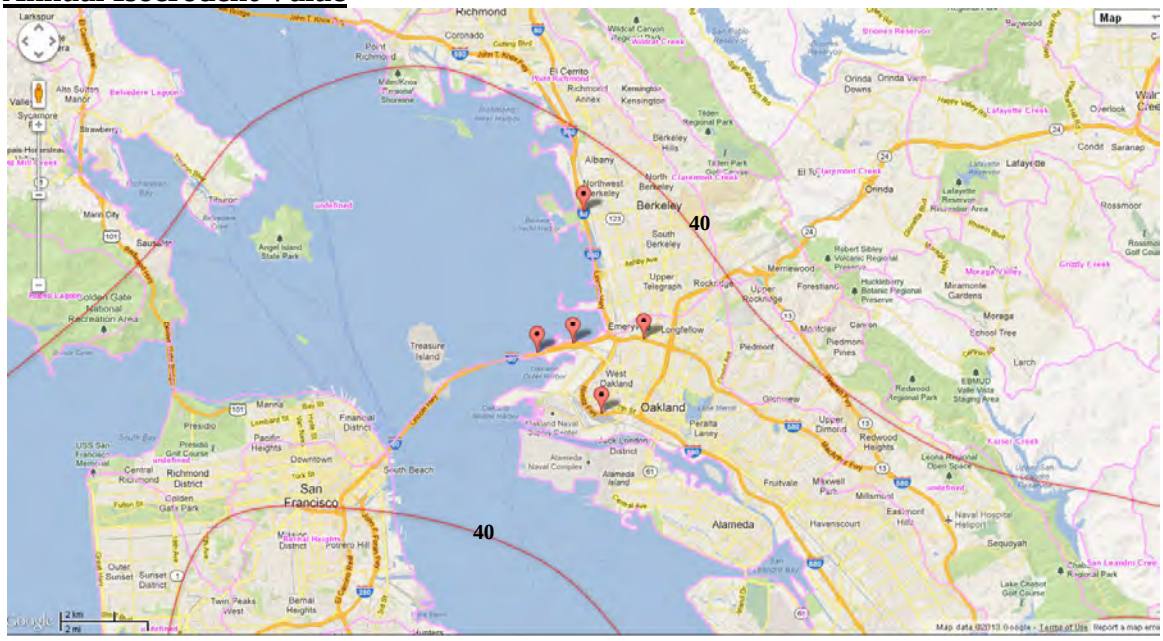
Source: Caltrans

R Factor Erosivity Index Zone



Source: Caltrans' Stormwater Design Application

Annual Isoerodent Value

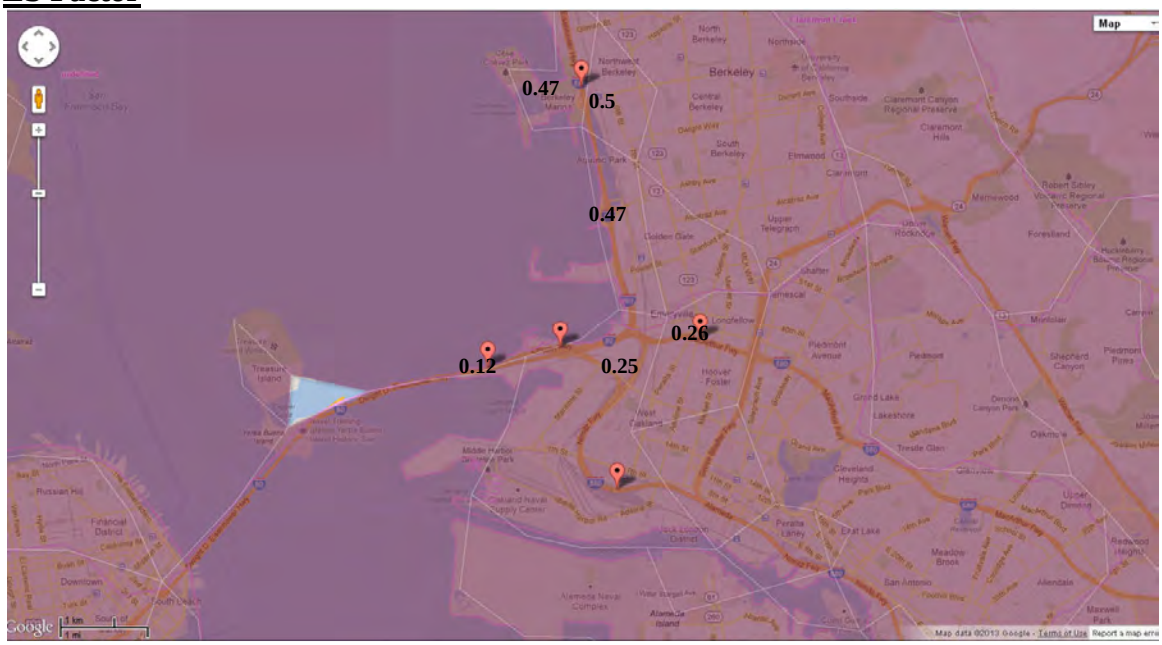


Source: Caltrans' Stormwater Design Application

K Factor

Source: Caltrans' Stormwater Design Application

LS Factor



Source: Caltrans' Stormwater Design Application

Receiving Water Risk

Note: Red areas = High receiving water risk

Source: Caltrans' Stormwater Design Application

Appendix D Water Quality Objectives

Appendix D.1 Objectives for Surface Waters

3.2 OBJECTIVES FOR OCEAN WATERS

The provisions of the State Board's "Water Quality Control Plan for Ocean Waters of California" (Ocean Plan) and "Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California" (Thermal Plan) and any revision to them will apply to ocean waters. These plans describe objectives and effluent limitations for ocean waters.

3.3 OBJECTIVES FOR SURFACE WATERS

The following objectives apply to all surface waters within the region, except the Pacific Ocean.

3.3.1 BACTERIA

Table 3-1 provides a summary of the bacterial water quality objectives and identifies the sources of those objectives. Table 3-2 summarizes U.S. EPA's water quality criteria for water contact recreation based on the frequency of use a particular area receives. These criteria will be used to differentiate between pollution sources or to supplement objectives for water contact recreation.

3.3.2 BIOACCUMULATION

Many pollutants can accumulate on particles, in sediment, or bioaccumulate in fish and other aquatic organisms. Controllable water quality factors shall not cause a detrimental increase in concentrations of toxic substances found in bottom sediments or aquatic life. Effects on aquatic organisms, wildlife, and human health will be considered.

3.3.3 BIOSTIMULATORY SUBSTANCES

Waters shall not contain biostimulatory substances in concentrations that promote aquatic growths to the extent that such growths cause nuisance or adversely affect beneficial uses. Changes in chlorophyll a and associated phytoplankton communities follow complex dynamics that are sometimes associated with a discharge of biostimulatory substances. Irregular and extreme levels of chlorophyll a or phytoplankton blooms may indicate exceedance of this objective and require investigation.

3.3.4 COLOR

Waters shall be free of coloration that causes nuisance or adversely affects beneficial uses.

3.3.5 DISSOLVED OXYGEN

For all tidal waters, the following objectives shall apply:

In the Bay:

Downstream of Carquinez Bridge	5.0 mg/l minimum
Upstream of Carquinez Bridge	7.0 mg/l minimum

For nontidal waters, the following objectives shall apply:

Waters designated as:

Cold water habitat	7.0 mg/l minimum
Warm water habitat	5.0 mg/l minimum

The median dissolved oxygen concentration for any three consecutive months shall not be less than 80 percent of the dissolved oxygen content at saturation.

Dissolved oxygen is a general index of the state of the health of receiving waters. Although minimum concentrations of 5 mg/l and 7 mg/l are frequently used as objectives to protect fish life, higher concentrations are generally desirable to protect sensitive aquatic forms. In areas unaffected by waste discharges, a level of about 85 percent of oxygen saturation exists. A three-month median objective of 80 percent of oxygen saturation allows for some degradation from this level, but still requires a consistently high oxygen content in the receiving water.

3.3.6 FLOATING MATERIAL

Waters shall not contain floating material, including solids, liquids, foams, and scum, in concentrations that cause nuisance or adversely affect beneficial uses.

3.3.7 OIL AND GREASE

Waters shall not contain oils, greases, waxes, or other materials in concentrations that result in a visible film or coating on the surface of the water or on objects in the water, that cause nuisance, or that otherwise adversely affect beneficial uses.

3.3.8 POPULATION AND COMMUNITY ECOLOGY

All waters shall be maintained free of toxic substances in concentrations that are lethal to or that produce significant alterations in population or community ecology or receiving water biota. In addition, the health and life history characteristics of aquatic organisms in waters affected by controllable water quality factors shall not differ significantly from those for the same waters in areas unaffected by controllable water quality factors.

3.3.9 pH

The pH shall not be depressed below 6.5 nor raised above 8.5. This encompasses the pH range usually found in waters within the basin. Controllable water quality factors shall not cause changes greater than 0.5 units in normal ambient pH levels.

3.3.10 RADIOACTIVITY

Radionuclides shall not be present in concentrations that result in the accumulation of radionuclides in the food web to an extent that presents a hazard to human, plant, animal, or aquatic life. Waters designated for use as domestic or municipal supply shall not contain concentrations of radionuclides in excess of the limits specified in Table 4 of Section 64443 (Radioactivity) of Title 22 of the California Code of Regulations (CCR), which is incorporated by reference into this Plan. This incorporation is prospective, including future changes to the incorporated provisions as the changes take effect (see Table 3-5).

3.3.11 SALINITY

Controllable water quality factors shall not increase the total dissolved solids or salinity of waters of the state so as to adversely affect beneficial uses, particularly fish migration and estuarine habitat.

3.3.12 SEDIMENT

The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses.

Controllable water quality factors shall not cause a detrimental increase in the concentrations of toxic pollutants in sediments or aquatic life.

3.3.13 SETTLEABLE MATERIAL

Waters shall not contain substances in concentrations that result in the deposition of material that cause nuisance or adversely affect beneficial uses.

3.3.14 SUSPENDED MATERIAL

Waters shall not contain suspended material in concentrations that cause nuisance or adversely affect beneficial uses.

3.3.15 SULFIDE

All water shall be free from dissolved sulfide concentrations above natural background levels. Sulfide occurs in Bay muds as a result of bacterial action on organic matter in an anaerobic environment.

Concentrations of only a few hundredths of a milligram per liter can cause a noticeable odor or be toxic to aquatic life. Violation of the sulfide objective will reflect violation of dissolved oxygen objectives as sulfides cannot exist to a significant degree in an oxygenated environment.

3.3.16 TASTES AND ODORS

Waters shall not contain taste- or odor-producing substances in concentrations that impart undesirable tastes or odors to fish flesh or other edible products of aquatic origin, that cause nuisance, or that adversely affect beneficial uses.

3.3.17 TEMPERATURE

Temperature objectives for enclosed bays and estuaries are as specified in the "Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays of California," including any revisions to the plan.

In addition, the following temperature objectives apply to surface waters:

- The natural receiving water temperature of inland surface waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Board that such alteration in temperature does not adversely affect beneficial uses.
- The temperature of any cold or warm freshwater habitat shall not be increased by more than 5°F (2.8°C) above natural receiving water temperature

3.3.18 TOXICITY

All waters shall be maintained free of toxic substances in concentrations that are lethal to or that produce other detrimental responses in aquatic organisms. Detrimental responses include, but are not limited to, decreased growth rate and decreased reproductive success of resident or indicator species. There shall be no acute toxicity in ambient waters. Acute toxicity is defined as a median of less than 90 percent survival, or less than 70 percent survival, 10 percent of the time, of test organisms in a 96-hour static or continuous flow test.

There shall be no chronic toxicity in ambient waters. Chronic toxicity is a detrimental biological effect on growth rate, reproduction, fertilization success, larval development, population abundance, community composition, or any other relevant measure of the health of an organism, population, or community.

Attainment of this objective will be determined by analyses of indicator organisms, species diversity, population density, growth anomalies, or toxicity tests (including those described in Chapter 4), or other methods selected by the Water Board. The Water Board will also consider other relevant information and numeric criteria and guidelines for toxic substances developed by other agencies as appropriate.

The health and life history characteristics of aquatic organisms in waters affected by controllable water quality factors shall not differ significantly from those for the same waters in areas unaffected by controllable water quality factors.

3.3.19 TURBIDITY

Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. Increases from normal background light penetration or turbidity relatable to waste discharge shall not be greater than 10 percent in areas where natural turbidity is greater than 50 NTU.

3.3.20 UN-IONIZED AMMONIA

The discharge of wastes shall not cause receiving waters to contain concentrations of un-ionized ammonia in excess of the following limits (in mg/l as N):

Annual Median	0.025
Maximum, Central Bay (as depicted in Figure 2-5) and upstream	0.16
Maximum, Lower Bay (as depicted in Figures 2-6 and 2-7):	0.4

The intent of this objective is to protect against the chronic toxic effects of ammonia in the receiving waters. An ammonia objective is needed for the following reasons:

- Ammonia (specifically un-ionized ammonia) is a demonstrated toxicant. Ammonia is generally accepted as one of the principle toxicants in municipal waste discharges. Some industries also discharge significant quantities of ammonia.
- Exceptions to the effluent toxicity limitations in Chapter 4 of the Plan allow for the discharge of ammonia in toxic amounts. In most instances, ammonia will be diluted or degraded to a nontoxic state fairly rapidly. However, this does not occur in all cases, the South Bay being a notable example. The ammonia limit is recommended in order to preclude any build up of ammonia in the receiving water.
- A more stringent maximum objective is desirable for the northern reach of the Bay for the protection of the migratory corridor running through Central Bay, San Pablo Bay, and upstream reaches.

3.3.21 OBJECTIVES FOR SPECIFIC CHEMICAL CONSTITUENTS

Surface waters shall not contain concentrations of chemical constituents in amounts that adversely affect any designated beneficial use. Water quality objectives for selected toxic pollutants for surface waters are given in Tables 3-3, 3-3A, 3-3B, 3-3C, 3-4 and 3-4A.

The Water Board intends to work towards the derivation of site-specific objectives for the Bay-Delta estuarine system. Site-specific objectives to be considered by the Water Board shall be developed in accordance with the provisions of the federal Clean Water Act, the State Water Code, State Board water quality control plans, and this Plan. These site-specific objectives will take into consideration factors such as all available scientific information and monitoring data and the latest U.S. EPA guidance, and local environmental conditions and impacts caused by bioaccumulation. The objectives in Tables 3-3 and 3-4 apply throughout the region except as otherwise indicated in the tables or when site-specific objectives for the pollutant parameter have been adopted. Site-specific objectives have been adopted for copper in segments of San Francisco Bay (see Figure 7.2-1-01), for nickel in South San Francisco Bay (Table 3-3A), and for cyanide in all

San Francisco Bay segments (Table 3-3C). Objectives for mercury that apply to San Francisco Bay are listed in Table 3-3B. Objectives for mercury that apply to Walker Creek, Soulajule Reservoir, and their tributaries, and to waters of the Guadalupe River watershed are listed in Table 3-4A.

South San Francisco Bay south of the Dumbarton Bridge is a unique, water-quality-limited, hydrodynamic and biological environment that merits continued special attention by the Water Board. Controlling urban and upland runoff sources is critical to the success of maintaining water quality in this portion of the Bay. Site-specific water quality objectives have been adopted for dissolved copper and nickel in this Bay segment. Site-specific objectives may be appropriate for other pollutants of concern, but this determination will be made on a case-by-case basis, and after it has been demonstrated that all other reasonable treatment, source control and pollution prevention measures have been exhausted. The Water Board will determine whether revised water quality objectives and/or effluent limitations are appropriate based on sound technical information and scientific studies, stakeholder input, and the need for flexibility to address priority problems in the watershed.

3.3.22 CONSTITUENTS OF CONCERN FOR MUNICIPAL AND AGRICULTURAL WATER SUPPLIES

At a minimum, surface waters designated for use as domestic or municipal supply (MUN) shall not contain concentrations of constituents in excess of the maximum (MCLs) or secondary maximum contaminant levels (SMCLs) specified in the following provisions of Title 22, which are incorporated by reference into this plan: Table 64431-A (Inorganic Chemicals) of Section 64431, and Table 64433.2-A (Fluoride) of Section 64433.2, Table 64444-A (Organic Chemicals) of Section 64444, and Table 64449-A (SMCLs-Consumer Acceptance Limits) and 64449-B (SMCLs-Ranges) of Section 64449. This incorporation-by-reference is prospective, including future changes to the incorporated provisions as the changes take effect. Table 3-5 contains water quality objectives for municipal supply, including the MCLs contained in various sections of Title 22 as of the adoption of this plan.

At a minimum, surface waters designated for use as agricultural supply (AGR) shall not contain concentrations of constituents in excess of the levels specified in Table 3-6.

3.4 OBJECTIVES FOR GROUNDWATER

Groundwater objectives consist primarily of narrative objectives combined with a limited number of numerical objectives. Additionally, the Water Board will establish basin- and/or site-specific numerical groundwater objectives as necessary. For example, the Water Board has groundwater basin-specific objectives for the Alameda Creek watershed above Niles to include the Livermore-Amador Valley as shown in Table 3-7.

The maintenance of existing high quality of groundwater (i.e., "background") is the primary groundwater objective.

In addition, at a minimum, groundwater shall not contain concentrations of bacteria, chemical constituents, radioactivity, or substances producing taste and odor in excess of the objectives described below unless naturally occurring background concentrations are greater. Under existing law, the Water Board regulates waste discharges to land that could affect water quality,

Appendix D.2 Objectives for Groundwater

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San Francisco Bay segments (Table 3-3C). Objectives for mercury that apply to San Francisco Bay are listed in Table 3-3B. Objectives for mercury that apply to Walker Creek, Soulajule Reservoir, and their tributaries, and to waters of the Guadalupe River watershed are listed in Table 3-4A.

South San Francisco Bay south of the Dumbarton Bridge is a unique, water-quality-limited, hydrodynamic and biological environment that merits continued special attention by the Water Board. Controlling urban and upland runoff sources is critical to the success of maintaining water quality in this portion of the Bay. Site-specific water quality objectives have been adopted for dissolved copper and nickel in this Bay segment. Site-specific objectives may be appropriate for other pollutants of concern, but this determination will be made on a case-by-case basis, and after it has been demonstrated that all other reasonable treatment, source control and pollution prevention measures have been exhausted. The Water Board will determine whether revised water quality objectives and/or effluent limitations are appropriate based on sound technical information and scientific studies, stakeholder input, and the need for flexibility to address priority problems in the watershed.

3.3.22 CONSTITUENTS OF CONCERN FOR MUNICIPAL AND AGRICULTURAL WATER SUPPLIES

At a minimum, surface waters designated for use as domestic or municipal supply (MUN) shall not contain concentrations of constituents in excess of the maximum (MCLs) or secondary maximum contaminant levels (SMCLs) specified in the following provisions of Title 22, which are incorporated by reference into this plan: Table 64431-A (Inorganic Chemicals) of Section 64431, and Table 64433.2-A (Fluoride) of Section 64433.2, Table 64444-A (Organic Chemicals) of Section 64444, and Table 64449-A (SMCLs-Consumer Acceptance Limits) and 64449-B (SMCLs-Ranges) of Section 64449. This incorporation-by-reference is prospective, including future changes to the incorporated provisions as the changes take effect. Table 3-5 contains water quality objectives for municipal supply, including the MCLs contained in various sections of Title 22 as of the adoption of this plan.

At a minimum, surface waters designated for use as agricultural supply (AGR) shall not contain concentrations of constituents in excess of the levels specified in Table 3-6.

3.4 OBJECTIVES FOR GROUNDWATER

Groundwater objectives consist primarily of narrative objectives combined with a limited number of numerical objectives. Additionally, the Water Board will establish basin- and/or site-specific numerical groundwater objectives as necessary. For example, the Water Board has groundwater basin-specific objectives for the Alameda Creek watershed above Niles to include the Livermore-Amador Valley as shown in Table 3-7.

The maintenance of existing high quality of groundwater (i.e., "background") is the primary groundwater objective.

In addition, at a minimum, groundwater shall not contain concentrations of bacteria, chemical constituents, radioactivity, or substances producing taste and odor in excess of the objectives described below unless naturally occurring background concentrations are greater. Under existing law, the Water Board regulates waste discharges to land that could affect water quality,

including both groundwater and surface water quality. Waste discharges that reach groundwater are regulated to protect both groundwater and any surface water in continuity with groundwater. Waste discharges that affect groundwater that is in continuity with surface water cannot cause violations of any applicable surface water standards.

3.4.1 BACTERIA

In groundwater with a beneficial use of municipal and domestic supply, the median of the most probable number of coliform organisms over any seven-day period shall be less than 1.1 most probable number per 100 milliliters (MPN/100 mL) (based on multiple tube fermentation technique; equivalent test results based on other analytical techniques as specified in the National Primary Drinking Water Regulation, 40 CFR, Part 141.21 (f), revised June 10, 1992, are acceptable).

3.4.2 ORGANIC AND INORGANIC CHEMICAL CONSTITUENTS

All groundwater shall be maintained free of organic and inorganic chemical constituents in concentrations that adversely affect beneficial uses. To evaluate compliance with water quality objectives, the Water Board will consider all relevant and scientifically valid evidence, including relevant and scientifically valid numerical criteria and guidelines developed and/or published by other agencies and organizations (e.g., U.S. Environmental Protection Agency (U.S. EPA), the State Water Board, California Department of Health Services (DHS), U.S. Food and Drug Administration, National Academy of Sciences, California Environmental Protection Agency's (Cal/EPA) Office of Environmental Health Hazard Assessment (OEHHA), U.S. Agency for Toxic Substances and Disease Registry, Cal/EPA Department of Toxic Substances Control (DTSC), and other appropriate organizations.)

At a minimum, groundwater designated for use as domestic or municipal supply (MUN) shall not contain concentrations of constituents in excess of the maximum (MCLs) or secondary maximum contaminant levels (SMCLs) specified in the following provisions of Title 22, which are incorporated by reference into this plan: Tables 64431-A (Inorganic Chemicals) of Section 64431, Table 64433.2-A (Fluoride) of Section 64433.2, and Table 64444-A (Organic Chemicals) of Section 64444. This incorporation-by-reference is prospective, including future changes to the incorporated provisions as the changes take effect. (See Table 3-5.)

Groundwater with a beneficial use of agricultural supply shall not contain concentrations of chemical constituents in amounts that adversely affect such beneficial use. In determining compliance with this objective, the Water Board will consider as evidence relevant and scientifically valid water quality goals from sources such as the Food and Agricultural Organizations of the United Nations; University of California Cooperative Extension, Committee of Experts; and McKee and Wolf's "Water Quality Criteria," as well as other relevant and scientifically valid evidence. At a minimum, groundwater designated for use as agricultural supply (AGR) shall not contain concentrations of constituents in excess of the levels specified in Table 3-6.

Groundwater with a beneficial use of freshwater replenishment shall not contain concentrations of chemicals in amounts that will adversely affect the beneficial use of the receiving surface water.

Groundwater with a beneficial use of industrial service supply or industrial process supply shall not contain pollutant levels that impair current or potential industrial uses.

3.4.3 RADIOACTIVITY

At a minimum, groundwater designated for use as domestic or municipal supply (MUN) shall not contain concentrations of radionuclides in excess of the MCLs specified in Table 4 (Radioactivity) of Section 64443 of Title 22, which is incorporated by reference into this plan. This incorporation-by-reference is prospective, including future changes to the incorporated provisions as the changes take effect. (See Table 3-5.)

3.4.4 TASTE AND ODOR

Groundwater designated for use as domestic or municipal supply (MUN) shall not contain taste- or odor-producing substances in concentrations that cause a nuisance or adversely affect beneficial uses. At a minimum, groundwater designated for use as domestic or municipal supply shall not contain concentrations in excess of the SMCLs specified in Tables 64449-A (Secondary MCLs-Consumer Acceptance Limits) and 64449-B (Secondary MCLs-Ranges) of Section 64449 of Title 22, which is incorporated by reference into this plan. This incorporation-by-reference is prospective, including future changes to the incorporated provisions as the changes take effect. (See Table 3-5.)

3.5 OBJECTIVES FOR THE DELTA

The objectives contained in the State Water Board's 1995 "Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary" and any revisions thereto shall apply to the waters of the Sacramento-San Joaquin Delta and adjacent waters as specified in that plan.

3.6 OBJECTIVES FOR ALAMEDA CREEK WATERSHED

The water quality objectives contained in Table 3-7 apply to the surface and groundwaters of the Alameda Creek watershed above Niles.

Wastewater discharges that cause the surface water limits in Table 3-7 to be exceeded may be allowed if they are part of an overall wastewater resource operational program developed by those agencies affected and approved by the Water Board.

TABLES

Table 3-1: Water Quality Objectives for Bacteria

Table 3-2: U.S. EPA Bacteriological Criteria for Water Contact Recreation

Table 3-3: Marine Water Quality Objectives for Toxic Pollutants for Surface Waters

Table 3-3A: Water Quality Objectives for Copper and Nickel in San Francisco Bay Segments

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Appendix D.3 Objectives for Marine Waters

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Table 3-3: Marine[a] Water Quality Objectives for Toxic Pollutants for Surface Waters (all values in ug/l)

Compound	4-day Average	1-hr Average	24-hr Average
Arsenic[b, c, d]	36	69	
Cadmium[b, c, d]	9.3	42	
Chromium VI[b, c, d, e]	50	1100	
Copper[c, d, f]			
Cyanide[g]			
Lead[b, c, d]	8.1	210	
Mercury[h]	0.025	2.1	
Nickel[b, c, d]	8.2	74	
Selenium[i]			
Silver[b, c, d]		1.9	
Tributyltin[j]			
Zinc[b, c, d]	81	90	
PAHs[k]			15

NOTES:

a. Marine waters are those in which the salinity is equal to or greater than 10 parts per thousand 95% of the time, as set forth in Chapter 4 of the Basin Plan. Unless a site-specific objective has been adopted, these objectives shall apply to all marine waters except for the South Bay south of Dumbarton Bridge (where the California Toxics Rule (CTR) applies) or as specified in note h (below). For waters in which the salinity is between 1 and 10 parts per thousand, the applicable objectives are the more stringent of the freshwater (Table 3-4) or marine objectives.

b. Source: 40 CFR Part 131.38 (California Toxics Rule or CTR), May 18, 2000.

c. These objectives for metals are expressed in terms of the dissolved fraction of the metal in the water column.

d. According to the CTR, these objectives are expressed as a function of the water-effect ratio (WER), which is a measure of the toxicity of a pollutant in site water divided by the same measure of the toxicity of the same pollutant in laboratory dilution water. The 1-hr. and 4-day objectives = table value X WER. The table values assume a WER equal to one.

e. This objective may be met as total chromium.

f. Water quality objectives for copper were promulgated by the CTR and may be updated by U.S. EPA without amending the Basin Plan. Note: at the time of writing, the values are 3.1 ug/l (4-day average) and 4.8 ug/l (1-hr. average). The most recent version of the CTR should be consulted before applying these values.

g. Cyanide criteria were promulgated in the National Toxics Rule (NTR) (Note: at the time of writing, the values are 1.0 µg/l (4-day average) and 1.0 µg/l (1-hr. average)) and apply, except that site-specific

Table 3-3A: Water Quality Objectives for Copper and Nickel in San Francisco Bay Segments (ug/L)

Compound	4-day Average (CCC)[1]	1-hr Average (CMC)[2]	Extent of Applicability
Copper	6.9	10.8	The portion of Lower San Francisco Bay south of the line representing the Hayward Shoals shown on Figure 7.1. and South San Francisco Bay
Copper	6.0	9.4	The portion of the delta located in the San Francisco Bay Region, Suisun Bay, Carquinez Strait, San Pablo Bay, Central San Francisco Bay, and the portion of Lower San Francisco Bay north of the line representing the Hayward Shoals on Figure 7.1.
Nickel	11.9	62.4*	South San Francisco Bay

[1]Criteria Continuous Concentration

[2]Criteria Maximum Concentration

*Handbook of Water Quality Standards, 2nd ed. 1994 in Section 3.7.6 states that the CMC = Final AcuteValue/2; 62.4 is the Final Acute Value (resident species database)/2; so the site-specific CMC is lower than the California Toxics Rule value because we are using the resident species database instead of the National Species Database.

Table 3-3B: Marine[a] Water Quality Objectives for Mercury in San Francisco Bay[b]		
Protection of Human Health	0.2 mg mercury per kg fish tissue	Average wet weight concentration measured in the edible portion of trophic level 3 and trophic level 4 fish[c]
Protection of Aquatic Organisms and Wildlife	0.03 mg mercury per kg fish	Average wet weight concentration measured in whole fish 3–5 cm in length

Notes:

a. Marine waters are those in which the salinity is equal to or greater than 10 parts per thousand 95% of the time, as set forth in Chapter 4 of the Basin Plan. For waters in which the salinity is between 1 and 10 parts per thousand, the applicable objectives are the more stringent of the freshwater or marine objectives.

b. Objectives apply to all segments of San Francisco Bay, including Sacramento/San Joaquin River Delta (within San Francisco Bay region), Suisun Bay, Carquinez Strait, San Pablo Bay, Richardson Bay, Central San Francisco Bay, Lower San Francisco Bay, and South San Francisco Bay (including the Lower South Bay).

c. Compliance shall be determined by analysis of fish tissue as described in Chapter 6, Surveillance and Monitoring.

Table 3-3C: Marine [a] Water Quality Objectives for Cyanide in San Francisco Bay [b] (values in ug/l)		
Cyanide	Chronic Objective (4-day Average)	2.9
Cyanide	Acute Objective (1-hour Average)	9.4

Notes:

a. Marine waters are those in which the salinity is equal to or greater than 10 parts per thousand 95% of the time, as set forth in Chapter 4 of the Basin Plan. For waters in which the salinity is between 1 and 10 parts per thousand, the applicable objectives are the more stringent of the freshwater or marine objectives.

b. Objectives apply to all segments of San Francisco Bay, including Sacramento/San Joaquin River Delta (within San Francisco Bay region), Suisun Bay, Carquinez Strait, San Pablo Bay, Central San Francisco Bay, Lower San Francisco Bay, and South San Francisco Bay.

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Appendix E Descriptions of Beneficial Uses

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CHAPTER 2: BENEFICIAL USES

State policy for water quality control in California is directed toward achieving the highest water quality consistent with maximum benefit to the people of the state. Aquatic ecosystems and underground aquifers provide many different benefits to the people of the state. The beneficial uses described in detail in this chapter define the resources, services, and qualities of these aquatic systems that are the ultimate goals of protecting and achieving high water quality. The Water Board is charged with protecting all these uses from pollution and nuisance that may occur as a result of waste discharges in the region. Beneficial uses of surface waters, groundwaters, marshes, and wetlands presented here serve as a basis for establishing water quality objectives and discharge prohibitions to attain these goals.

Beneficial use designations for any given water body do not rule out the possibility that other beneficial uses exist or have the potential to exist. Existing beneficial uses that have not been formally designated in this Basin Plan are protected whether or not they are identified. While the tables in this Chapter list a large, representative portion of the water bodies in our region, it is not practical to list each and every water body.

2.1 DEFINITIONS OF BENEFICIAL USES

The following definitions (in italic) for beneficial uses are applicable throughout the entire state. A brief description of the most important water quality requirements for each beneficial use follows each definition (in alphabetical order by abbreviation).

2.1.1 AGRICULTURAL SUPPLY (AGR)

Uses of water for farming, horticulture, or ranching, including, but not limited to, irrigation, stock watering, or support of vegetation for range grazing.

The criteria discussed under municipal and domestic water supply (MUN) also effectively protect farmstead uses. To establish water quality criteria for livestock water supply, the Water Board must consider the relationship of water to the total diet, including water freely drunk, moisture content of feed, and interactions between irrigation water quality and feed quality. The University of California Cooperative Extension has developed threshold and limiting concentrations for livestock and irrigation water. Continued irrigation often leads to one or more of four types of hazards related to water quality and the nature of soils and crops. These hazards are (1) soluble salt accumulations, (2) chemical changes in the soil, (3) toxicity to crops, and (4) potential disease transmission to humans through reclaimed water use. Irrigation water classification systems, arable soil classification systems, and public health criteria related to reuse of wastewater have been developed with consideration given to these hazards.

2.1.2 AREAS OF SPECIAL BIOLOGICAL SIGNIFICANCE (ASBS)

Areas designated by the State Water Board.

These include marine life refuges, ecological reserves, and designated areas where the preservation and enhancement of natural resources requires special protection. In these areas, alteration of natural water quality is undesirable. The areas that have been designated as ASBS in this Region are Bird Rock, Point Reyes Headland Reserve and Extension, Double Point, Duxbury Reef Reserve and Extension, Farallon Islands, and James V. Fitzgerald Marine Reserve, depicted in Figure 2-1. The California Ocean Plan prohibits waste discharges into, and requires wastes to be discharged at a sufficient distance from, these areas to assure maintenance of natural water quality conditions. These areas have been designated as a subset of State Water Quality Protection Areas as per the Public Resources Code.

2.1.3 COLD FRESHWATER HABITAT (COLD)

Uses of water that support cold water ecosystems, including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.

Cold freshwater habitats generally support trout and may support anadromous salmon and steelhead fisheries as well. Cold water habitats are commonly well-oxygenated. Life within these waters is relatively intolerant to environmental stresses. Often, soft waters feed cold water habitats. These waters render fish more susceptible to toxic metals, such as copper, because of their lower buffering capacity.

2.1.4 COMMERCIAL, AND SPORT FISHING (COMM)

Uses of water for commercial or recreational collection of fish, shellfish, or other organisms, including, but not limited to, uses involving organisms intended for human consumption or bait purposes.

To maintain fishing, the aquatic life habitats where fish reproduce and seek their food must be protected. Habitat protection is under descriptions of other beneficial uses.

2.1.5 ESTUARINE HABITAT (EST)

Uses of water that support estuarine ecosystems, including, but not limited to, preservation or enhancement of estuarine habitats, vegetation, fish, shellfish, or wildlife (e.g., estuarine mammals, waterfowl, shorebirds), and the propagation, sustenance, and migration of estuarine organisms.

Estuarine habitat provides an essential and unique habitat that serves to acclimate anadromous fishes (e.g., salmon, striped bass) migrating into fresh or marine water conditions. The protection of estuarine habitat is contingent upon (1) the maintenance of adequate Delta outflow to provide mixing and salinity control; and (2) provisions to protect wildlife habitat associated with marshlands and the Bay periphery (i.e., prevention of fill activities). Estuarine habitat is generally associated with moderate seasonal fluctuations in dissolved oxygen, pH, and temperature and with a wide range in turbidity.

2.1.6 FRESHWATER REPLENISHMENT (FRSH)

Uses of water for natural or artificial maintenance of surface water quantity or quality.

2.1.7 GROUNDWATER RECHARGE (GWR)

Uses of water for natural or artificial recharge of groundwater for purposes of future extraction, maintenance of water quality, or halting saltwater intrusion into freshwater aquifers.

The requirements for groundwater recharge operations generally reflect the future use to be made of the water stored underground. In some cases, recharge operations may be conducted to prevent seawater intrusion. In these cases, the quality of recharged waters may not directly affect quality at the wellfield being protected. Recharge operations are often limited by excessive suspended sediment or turbidity that can clog the surface of recharge pits, basins, or wells.

Under the state Antidegradation Policy, the quality of some of the waters of the state is higher than established by adopted policies. It is the intent of this policy to maintain that existing higher water quality to the maximum extent possible.

Requirements for groundwater recharge, therefore, shall impose the Best Available Technology (BAT) or Best Management Practices (BMPs) for control of the discharge as necessary to assure the highest quality consistent with maximum benefit to the people of the state. Additionally, it must be recognized that groundwater recharge occurs naturally in many areas from streams and reservoirs. This recharge may have little impact on the quality of groundwaters under normal circumstances, but it may act to transport pollutants from the recharging water body to the groundwater. Therefore, groundwater recharge must be considered when requirements are established.

2.1.8 INDUSTRIAL SERVICE SUPPLY (IND)

Uses of water for industrial activities that do not depend primarily on water quality,

including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, and oil well repressurization.

Most industrial service supplies have essentially no water quality limitations except for gross constraints, such as freedom from unusual debris.

2.1.9 MARINE HABITAT (MAR)

Uses of water that support marine ecosystems, including, but not limited to, preservation or enhancement of marine habitats, vegetation such as kelp, fish, shellfish, or wildlife (e.g., marine mammals, shorebirds).

In many cases, the protection of marine habitat will be accomplished by measures that protect wildlife habitat generally, but more stringent criteria may be necessary for waterfowl marshes and other habitats, such as those for shellfish and marine fishes. Some marine habitats, such as important intertidal zones and kelp beds, may require special protection.

2.1.10 FISH MIGRATION (MIGR)

Uses of water that support habitats necessary for migration, acclimatization between fresh water and salt water, and protection of aquatic organisms that are temporary inhabitants of waters within the region.

The water quality provisions acceptable to cold water fish generally protect anadromous fish as well. However, particular attention must be paid to maintaining zones of passage. Any barrier to migration or free movement of migratory fish is harmful. Natural tidal movement in estuaries and unimpeded river flows are necessary to sustain migratory fish and their offspring. A water quality barrier, whether thermal, physical, or chemical, can destroy the integrity of the migration route and lead to the rapid decline of dependent fisheries.

Water quality may vary through a zone of passage as a result of natural or human-induced activities. Fresh water entering estuaries may float on the surface of the denser salt water or hug one shore as a result of density differences related to water temperature, salinity, or suspended matter.

2.1.11 MUNICIPAL AND DOMESTIC SUPPLY (MUN)

Uses of water for community, military, or individual water supply systems, including, but not limited to, drinking water supply.

The principal issues involving municipal water supply quality are (1) protection of public health; (2) aesthetic acceptability of the water; and (3) the economic impacts associated with treatment- or quality-related damages.

The health aspects broadly relate to: direct disease transmission, such as the possibility of contracting typhoid fever or cholera from contaminated water; toxic effects, such as links between nitrate and methemoglobinemia (blue babies); and increased susceptibility to disease, such as links between halogenated organic compounds and cancer.

Aesthetic acceptance varies widely depending on the nature of the supply source to which people have become accustomed. However, the parameters of general concern are excessive hardness, unpleasant odor or taste, turbidity, and color. In each case, treatment can improve acceptability although its cost may not be economically justified when alternative water supply sources of suitable quality are available.

Published water quality objectives give limits for known health-related constituents and most properties affecting public acceptance. These objectives for drinking water include the U.S. Environmental Protection Agency Drinking Water Standards and the California State Department of Health Services criteria.

2.1.12 NAVIGATION (NAV)

Uses of water for shipping, travel, or other transportation by private, military, or commercial vessels.

2.1.13 INDUSTRIAL PROCESS SUPPLY (PRO)

Uses of water for industrial activities that depend primarily on water quality.

Water quality requirements differ widely for the many industrial processes in use today. So many specific industrial processes exist with differing water quality requirements that no meaningful criteria can be established generally for quality of raw water supplies. Fortunately, this is not a serious shortcoming, since current water treatment technology can create desired product waters tailored for specific uses.

2.1.14 PRESERVATION OF RARE AND ENDANGERED SPECIES (RARE)

Uses of waters that support habitats necessary for the survival and successful maintenance of plant or animal species established under state and/or federal law as rare, threatened, or endangered.

The water quality criteria to be achieved that would encourage development and protection of rare and endangered species should be the same as those for protection of fish and wildlife habitats generally. However, where rare or endangered species exist, special control requirements may be necessary to assure attainment and maintenance of particular quality criteria, which may vary slightly with the environmental needs of each particular species. Criteria for species using areas of

special biological significance should likewise be derived from the general criteria for the habitat types involved, with special management diligence given where required.

2.1.15 WATER CONTACT RECREATION (REC1)

Uses of water for recreational activities involving body contact with water where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, whitewater activities, fishing, and uses of natural hot springs.

Water contact implies a risk of waterborne disease transmission and involves human health; accordingly, criteria required to protect this use are more stringent than those for more casual water-oriented recreation.

Excessive algal growth has reduced the value of shoreline recreation areas in some cases, particularly for swimming. Where algal growths exist in nuisance proportions, particularly bluegreen algae, all recreational water uses, including fishing, tend to suffer.

One criterion to protect the aesthetic quality of waters used for recreation from excessive algal growth is based on chlorophyll a.

Public access to drinking water reservoirs is limited or prohibited by reservoir owner/operators for purposes of protecting drinking water quality and public health. In some cases, access to reservoir tributaries is also prohibited. For these water bodies, REC-1 is designated as E*, for the purpose of protecting water quality. No right to public access is intended by this designation.

2.1.16 NONCONTACT WATER RECREATION (REC2)

Uses of water for recreational activities involving proximity to water, but not normally involving contact with water where water ingestion is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tide pool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.

Water quality considerations relevant to noncontact water recreation, such as hiking, camping, or boating, and those activities related to tide pool or other nature studies require protection of habitats and aesthetic features. In some cases, preservation of a natural wilderness condition is justified, particularly when nature study is a major dedicated use.

One criterion to protect the aesthetic quality of waters used for recreation from excessive algal growth is based on chlorophyll a.

2.1.17 SHELLFISH HARVESTING (SHELL)

Uses of water that support habitats suitable for the collection of crustaceans and filter-feeding shellfish (e.g., clams, oysters, and mussels) for human consumption, commercial, or sport purposes.

Shellfish harvesting areas require protection and management to preserve the resource and protect public health. The potential for disease transmission and direct poisoning of humans is of considerable concern in shellfish regulation. The bacteriological criteria for the open ocean, bays, and estuarine waters where shellfish cultivation and harvesting occur should conform with the standards described in the National Shellfish Sanitation Program, Manual of Operation.

Toxic metals can accumulate in shellfish. Mercury and cadmium are two metals known to have caused extremely disabling effects in humans who consumed shellfish that concentrated these elements from industrial waste discharges. Other elements, radioactive isotopes, and certain toxins produced by particular plankton species also concentrate in shellfish tissue. Documented cases of paralytic shellfish poisoning are not uncommon in California.

2.1.18 FISH SPAWNING (SPWN)

Uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish.

Dissolved oxygen levels in spawning areas should ideally approach saturation levels. Free movement of water is essential to maintain well-oxygenated conditions around eggs deposited in sediments. Water temperature, size distribution and organic content of sediments, water depth, and current velocity are also important determinants of spawning area adequacy.

2.1.19 WARM FRESHWATER HABITAT (WARM)

Uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.

The warm freshwater habitats supporting bass, bluegill, perch, and other fish are generally lakes and reservoirs, although some minor streams will serve this purpose where stream flow is sufficient to sustain the fishery. The habitat is also important to a variety of nonfish species, such as frogs, crayfish, and insects, which provide food for fish and small mammals. This habitat is less sensitive to environmental changes, but more diverse than the cold freshwater habitat, and natural fluctuations in temperature, dissolved oxygen, pH, and turbidity are usually greater.

2.1.20 WILDLIFE HABITAT (WILD)

Uses of waters that support wildlife habitats, including, but not limited to, the preservation and enhancement of vegetation and prey species used by wildlife, such as waterfowl.

The two most important types of wildlife habitat are riparian and wetland habitats. These habitats can be threatened by development, erosion, andsedimentation, as well as by poor water quality.

The water quality requirements of wildlife pertain to the water directly ingested, the aquatic habitat itself, and the effect of water quality on the production of food materials. Waterfowl habitat is particularly sensitive to changes in water quality. Dissolved oxygen, pH, alkalinity, salinity, turbidity, settleable matter, oil, toxicants, and specific disease organisms are water quality characteristics particularly important to waterfowl habitat. Dissolved oxygen is needed in waterfowl habitats to suppress development of botulism organisms; botulism has killed millions of waterfowl. It is particularly important to maintain adequate circulation and aerobic conditions in shallow fringe areas of ponds or reservoirs where botulism has caused problems.

2.2 EXISTING AND POTENTIAL BENEFICIAL USES

2.2.1 SURFACE WATERS

Surface waters in the Region consist of non-tidal wetlands, rivers, streams, and lakes (collectively described as inland surface waters), estuarine wetlands known as baylands, estuarine waters, and coastal waters. In this Region, estuarine waters consist of the Bay system including intertidal, tidal, and subtidal habitats from the Golden Gate to the Region's boundary near Pittsburg and the lower portions of streams that are affected by tidal hydrology, such as the Napa and Petaluma rivers in the north and Coyote and San Francisquito creeks in the south.

Inland surface waters support or could support most of the beneficial uses described above. The specific beneficial uses for inland streams include municipal and domestic supply (MUN), agricultural supply (AGR),commercial and sport fishing (COMM), freshwater replenishment (FRESH), industrial process supply (PRO), groundwater recharge (GWR), preservation of rare and endangered species (RARE), water contact recreation (REC1), noncontact water recreation (REC2), wildlife habitat (WILD), cold freshwater habitat (COLD), warm freshwater habitat (WARM), fish migration (MIGR), and fish spawning (SPWN). The San Francisco Bay Estuary supports estuarine habitat (EST), industrial service supply (IND), and navigation (NAV) in addition to COMM, RARE, REC1, REC2, WILD, MIGR, and SPWN.

Coastal waters' beneficial uses include water contact recreation (REC1); noncontact water recreation (REC2); industrial service supply (IND); navigation (NAV); marine habitat (MAR); shellfish harvesting (SHELL); commercial and sport fishing (COMM); wildlife habitat (WILD), fish migration (MIGR), fish spawning (SPWN), and preservation of rare and endangered species (RARE). In addition, the California coastline within the Region is endowed with exceptional scenic beauty.

The beneficial uses of any specifically identified water body generally apply to all its tributaries. In some cases a beneficial use may not be applicable to the entire body of water, such as navigation in Richardson Bay or shellfish harvesting in the Pacific Ocean. In these cases, the Water Board's judgment regarding water quality control measures necessary to protect beneficial uses will be applied.

Beneficial uses of streams that have intermittent flows, as is typical of many streams in the region, must be protected throughout the year and are designated as "existing."

Beneficial uses of each significant water body have been identified and are organized according to the seven major Hydrologic Planning Areas within the Region (Figure 2-2). The maps locating each water body (Figures 2-3 through 2-9) were produced using a geographical information system (GIS) at the Water Board. The maps use the hydrologic basin information compiled by the California Interagency Watershed map, with supplemental information from the Oakland Museum of California Creek and Watershed Map series, the Contra Costa County Watershed Atlas, and the San Francisco Estuary Institute EcoAtlas. More detailed representations of each location can be created using this GIS version.

Table 2-1 contains the beneficial uses for many surface water bodies in the Region, organized geographically by the Region's seven Hydrologic Planning Areas. Within each Hydrologic Planning Area, water bodies are listed geographically, with tributaries indented below their receiving water body. In cases where a water body shares the same name with another water body (e.g., Redwood Creek), the location of the water body (county and/or other identifier) is given in parentheses. An alternative name for a water body, where known, is also shown in parentheses. In Table 2-1, beneficial uses are indicated as follows:

E – indicates the beneficial use exists in the water body.

E* – indicates public access to the water body is limited or prohibited for purposes of protecting drinking water quality and public health. REC-1 is designated as E* for the purpose of protecting water quality. No right to public access is intended by this designation.

P – indicates the water body could potentially support the beneficial use.

2.2.2 GROUNDWATER

Groundwater is defined as subsurface water that occurs beneath the water table in soils and geologic formations that are fully saturated. Where groundwater occurs in a saturated geologic unit that contains sufficient permeable thickness to yield significant quantities of water to wells and springs, it can be defined as an aquifer. A groundwater basin is defined as a hydrogeologic unit containing one large aquifer or several connected and interrelated aquifers.

Water-bearing geologic units occur within groundwater basins in the Region that do not meet the definition of an aquifer. For instance, there are shallow, low permeability zones throughout the Region that have extremely low water yields. Groundwater may also occur outside of currently identified basins. Therefore, for basin planning purposes, the term "groundwater" includes all subsurface waters, whether or not these waters meet the classic definition of an aquifer or occur within identified groundwater basins.

The California Department of Water Resources (DWR) evaluated the characteristics of groundwater basins in the Region and throughout the state and summarized the results in California's Groundwater, Bulletin 118 (2003). Of special importance to the Region are the 28 groundwater basins and seven sub-basins classified by DWR that produce, or potentially could produce, significant amounts of groundwater (Figures 2-10 and 2-10A-D). The Water Board maintains a GIS for all water bodies in the Region and has the capacity to present information on each basin at a much higher level of resolution than is depicted in Figures 2-10A-D.

Existing and potential beneficial uses applicable to groundwater in the Region include municipal and domestic water supply (MUN), industrial water supply (IND), industrial process supply (PRO), agricultural water supply (AGR), groundwater recharge (GWR), and freshwater replenishment to surface waters (FRESH). Table 2-2 lists the 28 identified groundwater basins and seven sub-basins located in the Region and their existing and potential beneficial uses.

Unless otherwise designated by the Water Board, all groundwater is considered suitable, or potentially suitable, for municipal or domestic water supply (MUN). In making any exceptions, the Water Board will consider the criteria referenced in State Water Board Resolution No. 88-63 and Water Board Resolution No. 89-39, "Sources of Drinking Water," where:

- The total dissolved solids exceed 3,000 milligrams per liter (mg/L) (5,000 microSiemens per centimeter, µS/cm, electrical conductivity), and it is not reasonably expected by the Water Board that the groundwater could supply a public water system; or
- There is contamination, either by natural processes or by human activity (unrelated to a specific pollution incident), that cannot reasonably be treated for domestic use using either Best Management Practices (BMPs) or best economically achievable treatment practices; or

- The water source does not provide sufficient water to supply a single well capable of producing an average, sustained yield of 200 gallons per day; or
- The aquifer is regulated as a geothermal energy-producing source or has been exempted administratively pursuant to 40 Code of Federal Regulations (CFR) Part 146.4 for the purpose of underground injection of fluids associated with the production of hydrocarbon or geothermal energy, provided that these fluids do not constitute a hazardous waste under 40 CFR Part 261.3.

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Appendix F Hydromodification Susceptibility Map

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Source: Alameda Countywide Clean Water Progra

Appendix I-2

Water Quality Technical Errata

Memorandum

To:	Mark Aikawa and Eva Pong
From:	Katrina Sukola Water Quality/Water Resources Specialist Diana Roberts Project Manager, ICF
Date:	November 30, 2020
Re:	**Water Quality Technical Errata**

Dear Mr. Aikawa and Ms. Pong,

The below documentation serves as an update to the existing regulatory setting and environmental conditions at the project site with respect to the Water Quality Technical Memorandum as of 2020. As needed, effect conclusions are updated as well. This errata memorandum was prepared by ICF staff Katrina Sukola, water quality/water resources specialist. This memorandum includes the following sections.

- Project Description
- Setting
- Effect Analysis

Project Description

The footprint for the project has not changed since the San Francisco-Oakland Bay Bridge Regional Bicycle/Pedestrian Connection Initial Study/Mitigated Negative Declaration (IS/MND) was drafted in 2014. However, the project proponent has introduced three phasing options to guide construction.

The Link may be implemented in more than one phase to respond to timing considerations and the availability of funds as well as the schedule for related projects. The sections that follow discuss the possible phasing options. All Class II bicycle lanes and bicycle boxes would be installed as part of the initial period of construction, regardless of phasing option.

Phasing Option 1

Phasing Option 1 would construct approximately 2,900 feet of Class I path structure, beginning approximately 600 feet east of Maritime Street and continuing to the Bay Bridge Trail. Starting from the east, the structure would begin approximately 600 feet east of Maritime Street with an interim connection to the multi-use path (MUP), which was installed as part of the high-occupancy vehicle/bus extension project. Under Phasing Option 1, the West Oakland Link profile would be lowered to tie in to West Grand Avenue. The structure would continue west, parallel to West Grand Avenue. The elevated Link structure would span Maritime Street and the existing at-grade railroad crossings near Burma Road. The structure would then continue under the Interstate 80 ramps and tie in at the connection to the Bay Bridge Trail. Construction under the initial build portion of Phasing Option 1 would correspond to a portion of Segment 4 and all of Segment 5.

When additional funding for construction is available, the Link would be extended to Mandela Parkway. The interim connection to West Grand Avenue could either be demolished or retained as an emergency access point. The remaining easterly portion of Segment 4 would be constructed with a slightly revised vertical profile. Segments 1 through 3 as well as the ramps to Maritime Street and Oakland Maritime Support Services (OMSS) (the remainder of Segment 4) would also be constructed.

Phasing Option 2

Phasing Option 2 would be similar to Phasing Option 1. However, a 600-foot segment on the east side of Maritime Street would be designed and constructed so that the bridge deck could be raised during a future phase of the project, providing a smooth profile and minimizing elevation changes for the Link under the full build condition. Construction under the initial build portion of Phasing Option 2 would correspond to a portion of Segment 4 and all of Segment 5.

When additional funding for construction becomes available, the Link would be extended to Mandela Parkway. The above-mentioned 600 feet of the bridge deck could be raised to its final elevation by extending the bridge columns. Segments 1 through 3, the remaining easterly portion of Segment 4, and the ramps to Maritime Street and OMSS would also be constructed.

Phasing Option 3

Phasing Option 3 would construct Segment 4, except for the ramps to Maritime Street, OMSS, and Segment 5 of the Link project.

When additional funding for construction is available, Segments 1 through 3 and the ramps to Maritime Street and OMSS could be constructed.

Setting

Changes in the Setting

The Federal Emergency Management Agency revised its regional Flood Insurance Rate Maps in December 21, 2018. As a result, flood zones have changed since the 2015 analysis. As discussed below, the State Water Resources Control Board (State Water Board) combined its 303(d) list and the 305(b) report into the 2014 and 2016 California Integrated Report. As a result, 303(d)-listed impairments for central San Francisco Bay have also changed since the 2015 analysis.

Changes in Regulatory Setting

Federal Laws and Requirements

The State of California adopts water quality standards to protect beneficial uses of state waters, as required by Section 303(d) of the Clean Water Act (CWA) as well as the Porter-Cologne Water Quality Control Act (Porter-Cologne Act). In addition to the impaired water body list required by CWA Section 303(d), CWA Section 305(b) requires states to develop a report that assesses statewide surface water quality. Both CWA requirements are being addressed through the development of a 303(d)/305(b) integrated report, which will be both an update to the 303(d) list and a 305(b) assessment of statewide water quality.

The 2015 analysis considered the State Water Board's 2010 California Integrated Report. However, as noted above, the State Water Board combined its 303(d) list and the 305(b) report into the 2014 and 2016 California Integrated Report. The complete 2014 and 2016 California Integrated Report was submitted to the U.S. Environmental Protection Agency (USEPA) for final approval of the California 303(d) list. The California 303(d) list was approved by USEPA on April 6, 2018.

State Laws and Requirements

California Department of Transportation National Pollutant Discharge Elimination System Permit Program

The California Department of Transportation (Caltrans) holds a general National Pollutant Discharge Elimination System (NPDES) permit that covers primarily municipal stormwater discharges. The Caltrans municipal separate storm sewer system (MS4) permit was amended in November 2017 (Order 2012-0011-DWQ [NPDES CAS000003, as amended by Order 2014-0006-EXEC, Order 2014-0077-DWQ, Order 2015-0036-EXEC, and ORDER WQ 2017-0026-EXEC], NPDES Statewide Stormwater Permit Waste Discharge Requirements for State of California Department of Transportation). However, the amendment is not certified. Per Section J of the "small" MS4 permit, the 2012 order expired on July 1, 2018. If the order is not reissued or replaced prior to the expiration date, it will be automatically continued in accordance with 40 Code of Federal Regulations 122.6 and remain in full force and effect. Therefore, all existing permit conditions and requirements will continue to be implemented until a new permit is adopted. In addition, Caltrans' Stormwater Management Plan (SWMP) describes the procedures and practices used to reduce or eliminate the discharge of pollutants to storm drainage systems and receiving waters. The last SWMP was adopted in July 2016, since completion of the 2014 Water Quality Technical Memorandum. The Project Planning and Design Guide was last updated in April 2019 in support of the SWMP.

Sustainable Groundwater Management Act

The Sustainable Groundwater Management Act of 2014 (SGMA) was not included in the 2014 Water Quality Technical Memorandum. The SGMA is a comprehensive three-bill package that Governor Jerry Brown signed into California state law in September 2014. The SGMA provides a framework for sustainable management of groundwater supplies by local authorities, with a limited role for state intervention only if necessary to protect the resource. The plan is intended to ensure a reliable groundwater water supply for California for years to come. The SGMA requires governments and water agencies with high- and medium-priority basins to end overdraft conditions and bring groundwater basins into balance with respect to pumping and recharge.

The project area is in the East Bay Plain subbasin of the larger Santa Clara Valley groundwater basin, which is designated as a medium-priority basin. The SGMA required local agencies to form groundwater sustainability agencies (GSAs) by June 30, 2017 and prepare groundwater sustainability plans (GSPs) by January 31, 2022, for medium-priority basins to manage the sustainability of groundwater basins. GSAs for all high- and medium-priority basins, as identified by the Department of Water Resources, must adopt a GSP or submit an alternative to a GSP. Groundwater in the basin is managed by the East Bay Municipal Utility District and the City of Hayward as the GSAs for the East Bay Plain subbasin. The GSP for the East Bay Plain subbasin, which will be used to manage groundwater in the basin, will include portions of Contra Costa County and Alameda County. Development of the East Bay Plain subbasin GSP is ongoing and estimated to be completed in 2022.

Regional and Local Requirements

San Francisco Bay Regional Water Quality Control Board

The San Francisco Bay Regional Water Quality Control Board regulates water quality in San Francisco Bay and is responsible for adopting, approving, and implementing the region's basin plan. The Water Quality Control Plan for the San Francisco Bay Basin (Basin Plan) is the board's master water quality control planning document.

The 2013 *San Francisco Bay Basin (Region 2) Water Quality Control Plan* was used to evaluate water quality in the 2015 San Francisco-Oakland Bay Bridge Regional Bicycle/Pedestrian Connection IS/MND. The document was updated to reflect Basin Plan amendments adopted up through May 4, 2017; it incorporates all amendments approved by the Office of Administrative Law as of November 5, 2019. Amendments include the selenium total maximum daily load (TMDL) for north San Francisco Bay and the bacteria TMDL for San Francisco Bay beaches. There were no changes to beneficial uses of in central San Francisco Bay.

Waste Discharge Requirements for Dewatering and Other Low-Threat Discharges to Surface Waters

The Porter-Cologne Act also includes a Waste Discharge Requirements Program to regulate point discharges. Although temporary construction-related dewatering of small volumes of water are typically covered under the General Construction Permit, the San Francisco Bay Regional Water Quality Control Board has regulations specific to dewatering activities. These typically involve

reporting and monitoring requirements. The following permits are required for specific types of dewatering:

- The 2015 analysis discussed the Volatile Organic Compound (VOC) and Fuel General Permit (Order No. R2-2012-0012), which covered dewatering discharges of groundwater contaminated with fuel or solvent. However, Order No. R2-2012-0012 has been rescinded. The current order is Order No. R2-2017-0048, NPDES Permit No. CAG912002, General Waste Discharge Requirements for Discharge or Reclamation of Extracted and Treated Groundwater Resulting from the Cleanup of Groundwater Polluted by VOCs, Fuel Leaks, Fuel Additives, and Other Related Wastes. Dischargers that enrolled under Order No. R2-2012-0012 and submitted an Notice of Intent (NOI) at the end of that order's term (March 15, 2017) are not required to submit a new NOI form to enroll under the 2017 order.
- The 2015 analysis also discussed the Discharge or Reuse of Extracted Brackish Groundwater, Reverse Osmosis Concentrate Resulting from Treated Brackish Groundwater, and Extracted Groundwater from Structural Dewatering Requiring Treatment (Groundwater General Permit Order No. 2012-0060). However, Order No. R2-2012-0060 was rescinded; the current Groundwater General Permit is Order No. 2018-0026. Dischargers that enrolled under Order No. R2-2012-0060 and submitted an NOI at the end of that order's term (August 9, 2017) are not required to submit a new NOI form to enroll under the 2018 order.

San Francisco Bay Municipal Regional Stormwater Permit

Stormwater discharges in the city of Oakland are permitted under the San Francisco Bay Municipal Regional Stormwater Permit (MRP). The Alameda County permittees of the MRP, including the City of Oakland, are subject to NPDES Permit No. CAS612008, issued by Order No. R2-2009-0074 on October 14, 2009, and amended by Order No. R2-2011-0083 on November 28, 2011, when discharging stormwater runoff from storm drains and watercourses within their jurisdictions.

The San Francisco Bay Region MRP was revised in 2015 (Order No. R2-2015-0049, NPDES Permit No. CAS612008). This order expires on December 31, 2020, five years from the effective date of the order. The MRP was amended by Order No. R2-2019-0004. The 2019 amendment included the addition of the Cities of Antioch, Brentwood, and Oakley; unincorporated Contra Costa County and the Contra Costa County Flood Control and Water Conservation District were incorporated into NPDES Permit No. CAS612008. The amendment included green infrastructure planning and implementation, trash load reductions, and other water quality pollutant controls for newly added permittees. The amendment also included revisions to Provisions C.1 and C.17 of Order No. R2-2015-0049 (e.g., compliance with discharge prohibitions and receiving water limitations for diazinon, chlorpyrifos, and methylmercury) as well as new annual report requirements. This permit continues in force and effect until a new permit is issued or the board rescinds the permit.

Alameda Countywide Clean Water Program

The Alameda Countywide Clean Water Program (ACCWP) maintains compliance with the NPDES permit requirements by requiring local agencies to address stormwater quality during development review, incorporate water quality best management practices during project construction, and reduce long-term water quality impacts through site design and source control measures.

The ACCWP developed its C.3 Stormwater Technical Guidance to assist developers and engineers in complying with treatment and hydromodification requirements. The technical guidance (version 6.0) was updated in October 2017.

City of Oakland Standard Conditions of Approval

The City of Oakland Standard Conditions of Approval (SCAs) includes conditions for projects. Since the 2015 analysis, the following City of Oakland SCAs, which are relevant to the project, were added:

49. State Construction General Permit. All projects that disturb one acre or more of surface area shall comply with the Construction General Permit issued by the State Water Resources Control Board prior to approval of a construction-related permit.

53. NPDES C.3 Stormwater Requirements for Regulated Projects. All regulated projects under the NPDES C.3 requirements would require a Post-Construction Stormwater Management Plan and Maintenance Agreement.

Revisions to the City of Oakland SCAs resulted in the removal of SCA 74, Stormwater Pollution Prevention Plan.

Effects Analysis

Changes in Methods

The 2015 analysis identified thresholds of significance for determining significant impacts on hydrology and water quality. However, the CEQA Guidelines Appendix G Checklist was revised in 2019. In accordance with revised Appendix G to the CEQA Guidelines, the project would consider new thresholds and whether the project would have a significant effect with respect to any of the conditions listed below.

- In flood hazard, tsunami, or seiche zones, risk release of pollutants due to project inundation.
- Conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan.

Furthermore, the revised method no longer considers whether the project would:

- Place housing within a 100-year flood hazard area, as mapped on a federal Flood Hazard Boundary Map or Flood Insurance Rate Map or other authoritative flood hazard delineation map.
- Place within a 100-year flood hazard area structures that would impede or redirect floodflows.
- Expose people or structures to a significant risk of loss, injury, or death involving inundation by seiche, tsunami, or mudflow.

- Expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam.
- Place housing within a 100-year flood hazard area.

The language for some of the thresholds of significance was also revised. The only substantial change is the language revision that states that the project would have a significant effect if it would result in any of the conditions listed below.

- Substantial decrease in groundwater supplies or substantial interference with groundwater recharge such that the project may impede sustainable groundwater management of the basin.

Changes in Effects

All construction and operational effects related to surface water, groundwater resources, water quality, and flooding are the same as documented in 2015. New or revised CEQA Appendix G criteria impacts related to hydrology and water quality are similar to impacts previously analyzed. Further, the same stormwater management requirements and best management practices (BMPs) would be implemented to reduce impacts to hydrology and water quality. The project would be required to obtain a NPDES Construction General Permit and prepare and implement a SWPPP. The SWPPP will include BMPs to manage stormwater runoff and protect water quality. Due to shallow groundwater in the project area, dewatering during construction is anticipated. If dewatering to surface waters is required, the contractor would either properly treat the water prior to discharge or dispose of the water at a hazardous waste facility to prevent any discharge of contaminated dewatered groundwater into the storm drain system that could contaminate surface waters. These activities would comply with applicable groundwater discharge requirements, such as the San Francisco Water Board dewatering requirements and the NPDES Construction General Permit.

The project would add 1.68 acres (73,180 square feet) of new impervious space. However, the project proposes approximately 0.93 acre of stormwater treatment, either vegetated flow-through treatment areas or bio-treatment basins. Any additional surface runoff volumes would be minor and would not exceed existing or planned stormwater drainage systems. Proposed stormwater treatment areas are expected to be sufficient in offsetting impacts of new impervious area resulting from the project.

Appendix J-1

Noise and Vibration Background

Background on Noise and Ground Vibration

This information was compiled by ICF acoustic analysts to support the Initial Study prepared for the San Francisco-Oakland Bay Bridge Regional Bicycle/Pedestrian Connection Project.

Noise is commonly defined as unwanted sound that annoys or disturbs people and potentially causes an adverse psychological or physiological effect on human health. Because noise is an environmental pollutant that can interfere with human activities, evaluation of noise is necessary when considering the environmental impacts of a Project.

Sound is mechanical energy (vibration) transmitted by pressure waves over a medium such as air or water. Sound is characterized by various parameters that include the rate of oscillation of sound waves (frequency), the speed of propagation, and the pressure level or energy content (amplitude). In particular, the sound pressure level is the most common descriptor used to characterize the loudness of an ambient (existing) sound level. Although the decibel (dB) scale, a logarithmic scale, is used to quantify sound intensity, it does not accurately describe how sound intensity is perceived by human hearing. The human ear is not equally sensitive to all frequencies in the entire spectrum, so noise measurements are weighted more heavily for frequencies to which humans are sensitive in a process called *A-weighting*, written as *dBA* and referred to as *A-weighted decibels*. **Table 1** defines sound measurements and other terminology used in this chapter, and **Table 2** summarizes typical A-weighted sound levels for different noise sources.

In general, human sound perception is such that a change in sound level of 1 dB cannot typically be perceived by the human ear. A change of 3 dB is barely noticeable. A change of 5 dB is clearly noticeable. A change of 10 dB is perceived as doubling or halving the sound level.

Different types of measurements are used to characterize the time-varying nature of sound. These measurements include the equivalent sound level (L_{eq}), the minimum and maximum sound levels (L_{min} and L_{max}), percentile-exceeded sound levels (such as L_{10}, L_{20}), the day-night sound level (L_{dn}), and the community noise equivalent level (CNEL). L_{dn} and CNEL values differ by less than 1 dB. As a matter of practice, L_{dn}

and CNEL values are considered to be equivalent and are treated as such in this assessment.

For a point source such as a stationary compressor or construction equipment, sound attenuates based on geometry at rate of 6 dB per doubling of distance. For a line source such as free flowing traffic on a freeway, sound attenuates at a rate of 3 dB per doubling of distance (California Department of Transportation 2013). Atmospheric conditions including wind, temperature gradients, and humidity can change how sound propagates over distance and can affect the level of sound received at a given location. The degree to which the ground surface absorbs acoustical energy also affects sound propagation. Sound that travels over an acoustically absorptive surface such as grass attenuates at a greater rate than sound that travels over a hard surface such as pavement. The increased attenuation is typically in the range of 1–2 dB per doubling of distance. Barriers such as buildings and topography that block the line of sight between a source and receiver also increase the attenuation of sound over distance.

Table 1. Definition of Sound Measurements

Sound Measurements	Definition
Decibel (dB)	A unitless measure of sound on a logarithmic scale, which indicates the squared ratio of sound pressure amplitude to a reference sound pressure amplitude. The reference pressure is 20 micro-pascals.
A-Weighted Decibel (dBA)	An overall frequency-weighted sound level in decibels that approximates the frequency response of the human ear.
C-Weighted Decibel (dBC)	The sound pressure level in decibels as measured using the C-weighting filter network. The C-weighting is very close to an unweighted or *flat* response. C-weighting is only used in special cases when low-frequency noise is of particular importance. A comparison of measured A- and C-weighted level gives an indication of low frequency content.
Maximum Sound Level (L_{max})	The maximum sound level measured during the measurement period.
Minimum Sound Level (L_{min})	The minimum sound level measured during the measurement period.
Equivalent Sound Level (L_{eq})	The equivalent steady state sound level that in a stated period of time would contain the same acoustical energy.
Percentile-Exceeded Sound Level (L_{xx})	The sound level exceeded *xx* % of a specific time period. L_{10} is the sound level exceeded 10% of the time. L_{90} is the sound level exceeded 90% of the time. L_{90} is often considered to be representative of the background noise level in a given area.
Day-Night Level (L_{dn})	The energy average of the A-weighted sound levels occurring during a 24-hour period, with 10 dB added to the A-weighted sound levels occurring during the period from 10:00 p.m. to 7:00 a.m.

Sound Measurements	Definition
Community Noise Equivalent Level (CNEL)	The energy average of the A-weighted sound levels occurring during a 24-hour period with 5 dB added to the A-weighted sound levels occurring during the period from 7:00 p.m. to 10:00 p.m. and 10 dB added to the A-weighted sound levels occurring during the period from 10:00 p.m. to 7:00 a.m.
Peak Particle Velocity (Peak Velocity or PPV)	A measurement of ground vibration defined as the maximum speed (measured in inches per second) at which a particle in the ground is moving relative to its inactive state. PPV is usually expressed in inches/second.
Frequency: Hertz (Hz)	The number of complete pressure fluctuations per second above and below atmospheric pressure.

Table 2. Typical A-weighted Sound Levels

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	110	Rock band
Jet flyover at 1,000 feet		
	100	
Gas lawnmower at 3 feet		
	90	
Diesel truck at 50 feet at 50 mph		Food blender at 3 feet
	80	Garbage disposal at 3 feet
Noisy urban area, daytime		
Gas lawnmower, 100 feet	70	Vacuum cleaner at 10 feet
Commercial area		Normal speech at 3 feet
Heavy traffic at 300 feet	60	
		Large business office
Quiet urban daytime	50	Dishwasher in next room
Quiet urban nighttime	40	Theater, large conference room (background)
Quiet suburban nighttime		
	30	Library
Quiet rural nighttime		Bedroom at night, concert hall (background)
	20	
		Broadcast/recording studio
	10	
	0	

Source: California Department of Transportation 2013.

J.1. Decibel Addition

Because decibels are logarithmic units, sound pressure levels cannot be added or subtracted through ordinary arithmetic. On the dB scale, a doubling of sound energy corresponds to a 3-dB increase. In other words, when two identical sources are each

producing sound of the same loudness, their combined sound level at a given distance would be 3 dB higher than one source under the same conditions. For example, if one source produces a sound pressure level of 70 dBA, two identical sources would not produce 140 dBA—rather, they would combine to produce 73 dBA. The cumulative sound level of any number of sources can be determined using decibel addition

J.2. Vibration

Operation of heavy construction equipment, particularly pile driving equipment and other impact devices such as pavement breakers, create seismic waves that radiate along the surface of and downward into the ground. These surface waves can be felt as ground vibration. Vibration from operation of this equipment can result in effects ranging from annoyance of people to damage of structures. Variations in geology and distance result in different vibration levels containing different frequencies and displacements. In all cases, vibration amplitudes decrease with increasing distance.

Perceptible groundborne vibration is generally limited to areas within a few hundred feet of construction activities. As seismic waves travel outward from a vibration source, they cause rock and soil particles to oscillate. The actual distance that these particles move is usually only a few ten-thousandths to a few thousandths of an inch. The rate or velocity (in inches per second) at which these particles move is the commonly accepted descriptor of the vibration amplitude, referred to as the peak particle velocity (PPV).

Vibration amplitude attenuates over distance and is a complex function of how energy is imparted into the ground and the soil or rock conditions through which the vibration is traveling. The following equation is used to estimate the vibration level at a given distance for typical soil conditions (Federal Transit Administration 2006). PPV_{ref} is the reference PPV at 25 feet from **Table 3**:

$$PPV = PPV_{ref} \times (25/Distance)^{1.5}$$

Table 3 summarizes typical vibration levels generated by construction equipment at the reference distance of 25 feet and other distances as determined using the attenuation equation above.

Table 3. Vibration Source Levels for Construction Equipment

Equipment	PPV at 25 Feet	PPV at 50 Feet	PPV at 75 Feet	PPV at 100 Feet	PPV at 175 Feet
Pile driver (sonic/vibratory)	0.734	0.2595	0.1413	0.0918	0.0396
Hoe ram or large bulldozer	0.089	0.0315	0.0171	0.0111	0.0048
Loaded trucks	0.076	0.0269	0.0146	0.0095	0.0041
Jackhammer	0.035	0.0124	0.0067	0.0044	0.0019
Small bulldozer	0.003	0.0011	0.0006	0.0004	0.0002

Source: Federal Transit Administration 2006.

Tables 4 and 5 summarize guidelines developed by Caltrans for damage and annoyance potential from transient and continuous vibration that is usually associated with construction activity. Pile driving, which would be required during Project construction, is considered a source of continuous vibration (California Department of Transportation 2004).

Table 4. Guideline Vibration Damage Potential Threshold Criteria

Structure and Condition	Maximum PPV (in/sec)	
	Transient Sources	Continuous/Frequent Intermittent Sources
Extremely fragile historic buildings, ruins, ancient monuments	0.12	0.08
Fragile buildings	0.2	0.1
Historic and some old buildings	0.5	0.25
Older residential structures	0.5	0.3
New residential structures	1.0	0.5
Modern industrial/commercial buildings	2.0	0.5

Source: California Department of Transportation 2004.

Note: Transient sources create a single isolated vibration event, such as blasting or drop balls. Continuous/frequent intermittent sources include impact pile drivers, pogo-stick compactors, crack-and-seat equipment, vibratory pile drivers, and vibratory compaction equipment.

Table 5. Guideline Vibration Annoyance Potential Criteria

Structure and Condition	Maximum PPV (in/sec) Transient Sources	Maximum PPV (in/sec) Continuous/Frequent Intermittent Sources
Barely perceptible	0.04	0.01
Distinctly perceptible	0.25	0.04
Strongly perceptible	0.9	0.10
Severe	2.0	0.4

Source: California Department of Transportation 2004.

Note: Transient sources create a single isolated vibration event, such as blasting or drop balls. Continuous/frequent intermittent sources include impact pile drivers, pogo-stick compactors, crack-and-seat equipment, vibratory pile drivers, and vibratory compaction equipment.

J.3. References

California Department of Transportation. 2004. *Transportation and Construction-Induced Vibration Guidance Manual*. June. Available: <http://www.dot.ca.gov/hq/env/noise/pub/vibrationmanFINAL.pdf>. Accessed: September 5, 2014.

California Department of Transportation. 2013. *Technical Noise Supplement to the Traffic Noise Analysis Protocol*. September. Available: < http://www.dot.ca.gov/hq/env/noise/pub/TeNS_Sept_2013B.pdf >. Accessed: December 10, 2013.

Federal Transit Administration. 2006. *Transit Noise and Vibration Impact Assessment*. Available: <http://www.fta.dot.gov/documents/ FTA_Noise_and_Vibration_Manual.pdf>. Accessed: September 5, 2014.

Appendix J-2

Noise and Vibration Technical Errata

Memorandum

To:	Mark Aikawa and Eva Pong, TY Lin
From:	Elizabeth Foley, ICF Senior Noise Technical Specialist Diana Roberts, ICF Project Manager
Date:	November 30, 2020
Re:	**Noise and Vibration Technical Errata**

Dear Mr. Aikawa and Ms. Pong,

The below documentation serves as an update to the existing regulatory and environmental conditions at the project site regarding noise as of 2020. As needed, effect conclusions are updated as well. This errata memorandum was prepared by ICF staff member Elizabeth Foley, senior noise technical specialist. It includes the following sections:

- Project Description
- Setting
- Effect Analysis

Project Description

The footprint for the project has not changed since the San Francisco-Oakland Bay Bridge Regional Bicycle/Pedestrian Connection Initial Study/Mitigated Negative Declaration (IS/MND) was drafted in 2014. However, the project proponent has introduced three phasing options to guide construction.

The Link may be implemented in more than one phase to respond to timing considerations and the availability of funds as well as the schedule for related projects. The sections that follow discuss the possible phasing options. All Class II bicycle lanes and bicycle boxes would be installed as part of the initial period of construction, regardless of phasing option.

Phasing Option 1

Phasing Option 1 would construct approximately 2,900 feet of Class I path structure, beginning approximately 600 feet east of Maritime Street and continuing to the Bay Bridge Trail. Starting from the east, the structure would begin approximately 600 feet east of Maritime Street with an interim connection to the multi-use path (MUP), which was installed as part of the high-occupancy vehicle/bus extension project. Under Phasing Option 1, the West Oakland Link profile would be lowered to tie in to West Grand Avenue. The structure would continue west, parallel to West Grand Avenue. The elevated Link structure would span Maritime Street and the existing at-grade railroad crossings near Burma Road. The structure would then continue under the Interstate 80 ramps and tie in at the connection to the Bay Bridge Trail. Construction under the initial build portion of Phasing Option 1 would correspond to a portion of Segment 4 and all of Segment 5.

When additional funding for construction is available, the Link would be extended to Mandela Parkway. The interim connection to West Grand Avenue could either be demolished or retained as an emergency access point. The remaining easterly portion of Segment 4 would be constructed with a slightly revised vertical profile. Segments 1 through 3 as well as the ramps to Maritime Street and Oakland Maritime Support Services (OMSS) (the remainder of Segment 4) would also be constructed.

Phasing Option 2

Phasing Option 2 would be similar to Phasing Option 1. However, a 600-foot segment on the east side of Maritime Street would be designed and constructed so that the bridge deck could be raised during a future phase of the project, providing a smooth profile and minimizing elevation changes for the Link under the full build condition. Construction under the initial build portion of Phasing Option 2 would correspond to a portion of Segment 4 and all of Segment 5.

When additional funding for construction becomes available, the Link would be extended to Mandela Parkway. The above-mentioned 600 feet of the bridge deck could be raised to its final elevation by extending the bridge columns. Segments 1 through 3, the remaining easterly portion of Segment 4, and the ramps to Maritime Street and OMSS would also be constructed.

Phasing Option 3

Phasing Option 3 would construct Segment 4, except for the ramps to Maritime Street, OMSS, and Segment 5 of the Link project.

When additional funding for construction is available, Segments 1 through 3 and the ramps to Maritime Street and OMSS could be constructed.

Setting

Changes in the Setting

The environmental setting of the project area is essentially the same as the setting discussed in the 2015 memorandum. With respect to sensitive receptors, the discussion in the 2015 memorandum correctly describes the types of receptors found in the project vicinity. The sensitive receptors in the vicinity are still recreational facilities (e.g., Raimondi Park) and residences. The only exception is a new project at 2011–2195 Wood Street that is approved but not yet built; it was not previously considered in the 2015 memorandum. Although the project is not built, it is an approved project and could be built and occupied prior to the completion of construction for the proposed project. Therefore, this approved residential land use project is considered to be a cumulative receptor for the purposes of this analysis.

Changes in Regulatory Setting

The regulatory setting applicable to the proposed project described in the 2015 memorandum is representative of the current regulatory environment. There are no changes to the setting.

Effects Analysis

Changes in Methods

A quantitative analysis of the project's impacts under each of the specific phasing options has not been conducted because the quantitative results in the 2015 memorandum represent a reasonable worst-case scenario. Other than phasing, the amount and type of construction activity previously analyzed are not expected to increase. Consequently, because the previous analysis is considered to be reasonably conservative, there are no changes to the methodology of the assessment of direct noise effects. However, there is a new approved project in the vicinity of the proposed project. Although this project, located at 2011–2195 Wood Street, has not yet been built and is not occupied, effects on this residential land use are assessed as part of the cumulative analysis.

Changes in Effects

As discussed previously, the quantitative results in the 2015 memorandum represent a worst-case scenario because the proposed project would generally be expected to require the same type and amount of construction activity analyzed under the previously analyzed project. Because the 2015 analysis is considered to be reasonably conservative, the direct effects presented in the 2015 noise analysis have not changed. However, as a result of the new cumulative project described above, a cumulative assessment of noise impacts on this residential land use has been added.

A new multi-family residential building will be constructed at 2011–2195 Wood Street; this was not previously considered in the 2015 memorandum. Although this project is not built, it is an approved project and therefore could be occupied while construction of the proposed project is under way. Therefore, it is considered to be a cumulative receptor for the purposes of this analysis. This project would be located along Wood Street, south of West Grand Avenue. The residential structure would be as close as approximately 50 feet from construction activities for the elevated path along West Grand Avenue and approximately 60 feet from in-road, at-grade construction activities along Wood Street. At a distance of 50 feet, pile driving can result in a noise level of approximately 94 A-weighted decibels (dBA), equivalent sound level (L_{eq}). As shown in Table 4 of the 2015 noise technical memo, combined noise from a concrete saw, pile driver, and sand blaster for construction of supporting columns for the elevated path section could result in a noise level of approximately 96 dBA L_{eq}. For construction of the at-grade portions of the project, a reasonable worst-case construction noise level was estimated in the 2015 analysis, assuming that the three loudest pieces of equipment would operate concurrently (i.e., concrete saw, jackhammer, and sand blaster). However, this estimate is conservative. There is very little chance of these loudest pieces of equipment being operated concurrently. The combined L_{eq} for these three pieces of equipment was estimated to be 91 dBA at 50 feet. Therefore, should the residences at the new 2011–2195 Wood Street project be occupied during project construction, residents may temporarily be exposed to elevated noise levels from construction.

Overall, construction would be short term, and noise effects would cease upon completion of the project. In addition, project construction activities would also be required to comply with Caltrans Standard Specifications Section 14-8.02, which would reduce the temporary noise effects from construction. Further, the project would comply with the City of Oakland's Standard Conditions of Approval (SCAs). Applicable SCAs include #61 (limits on days/hours of construction and operation), #62 (requirement to implement noise reduction measures to reduce construction noise), #63 (requirement of a construction noise management plan for extreme construction noise and requirement of notification for property owners within 300 feet of extreme noise-generating construction activities), #64 (requirement for project-specific construction noise reduction measures), and #65 (requirement to generate procedures for responding to and tracking construction noise complaints). Because the project would comply with the applicable restrictions related to construction noise and construction activities would follow the City of Oakland's SCAs, there would be no significant adverse noise impacts from project construction on this cumulative project.

Appendix K

Visual Impact Assessment

VISUAL IMPACT ASSESSMENT

West Oakland Link Project

June 2022

California Department of Transportation

EA 4H9710 EFIS 0413000324

4-ALA-80 PM 0.5/3.8

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District 4

Statement of Compliance: Produced in compliance with National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA) requirements, as appropriate, to meet the level of analysis and documentation that has been determined necessary for this project.

VISUAL IMPACT ASSESSMENT
West Oakland Link Project

I. PURPOSE OF STUDY AND ASSESSMENT METHOD

The purpose of this visual impact assessment (VIA) is to document potential visual impacts caused by the West Oakland Link Project (Project) and propose measures to lessen any detrimental impacts that are identified. Visual impacts are demonstrated by identifying visual resources in the Project area, measuring the amount of change that would occur as a result of the Project, and predicting how the affected public would respond to or perceive those changes. This visual impact assessment follows the guidance outlined in the publication *Visual Impact Assessment for Highway Projects* published by the Federal Highway Administration (FHWA) in March 1981. The *Questionnaire to Determine Visual Impact Assessment (VIA) Level* prepared for the Project is contained in Appendix A.

II. PROJECT DESCRIPTION

The Project proposes to construct a new bicycle/pedestrian path connection (Link) between West Oakland and the Bay Bridge Trail in Oakland, California (**Figure 1**). The Link would be approximately 6,030 linear feet. On the west end, the Link would connect to the existing bicycle/pedestrian path on the Bay Bridge (Bay Bridge Trail) on the south side of the Bay Bridge toll plaza. On the east end, the Link would connect to the existing bicycle/pedestrian path on Mandela Parkway. Refer to **Figure 2**.

The purpose of the Project is to provide a safe connection for bicyclists and pedestrians to travel between West Oakland and the Bay Bridge Trail and the Class I trail along the east side of Maritime Street. The area in between is occupied by industry, roadways, railways, and Interstate (I-) 880. Current access for bicyclists and pedestrians is on roadways extending through the industrial area that have heavy truck traffic, roadway intersections, and multiple at-grade rail crossings at Burma Road.

The Link was originally proposed by the Gateway Park Working Group as an element of Gateway Park, which is now named Judge John Sutter Regional Shoreline. The Gateway Park Working Group includes the following nine local, regional, and state agencies: The Bay Area Toll Authority (BATA), the California Department of Transportation (Caltrans), San Francisco Bay Conservation and Development Commission (BCDC), California Transportation Commission (CTC), East Bay Regional Park District (EBRPD), City of Oakland, Port of Oakland (Port), East Bay Municipal Utility District (EBMUD), and Association of Bay Area Governments (ABAG's). Subsequently, the Link, with its own independent utility and logical termini, was bifurcated from the Judge John Sutter Regional Shoreline Project to become a standalone project. The agency responsible for operation and maintenance of the bike path is anticipated to be Caltrans, with full financial contribution from BATA.

Caltrans is the lead agency under the National Environmental Policy Act (NEPA). BATA is the lead agency under the California Environmental Quality Act (CEQA). The environmental documents are a CEQA initial study/mitigated negative declaration (IS/MND) and a NEPA categorical exclusion.

The Project is a new Class I bike path[1] located in the City of Oakland, Alameda County, near the I-880 and I-80 interchange and the new East Span of the Bay Bridge (**Figures 1, 2, and 3**).

[1] Bicycle Path Classifications: **Class I bikeways (bike paths)** are separate paths with exclusive right of way for bicycles and pedestrians, with minimal vehicular crossings. **Class II bikeways (bike lanes)** are striped lanes on streets, separating bicycles from vehicles, within the road right-of-way. **Class III bikeways** are lanes shared with

Project Location

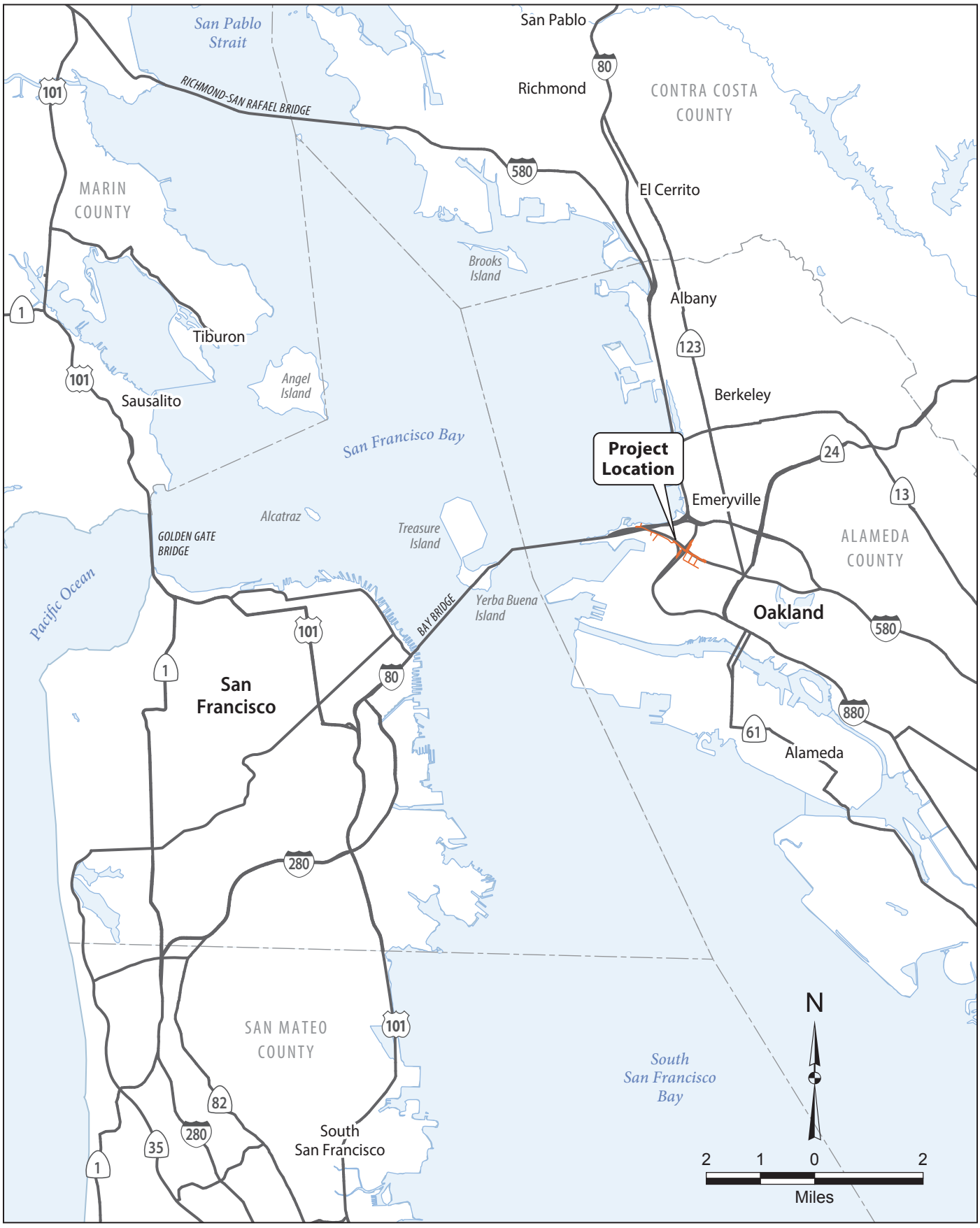

Figure 1

West Oakland Link

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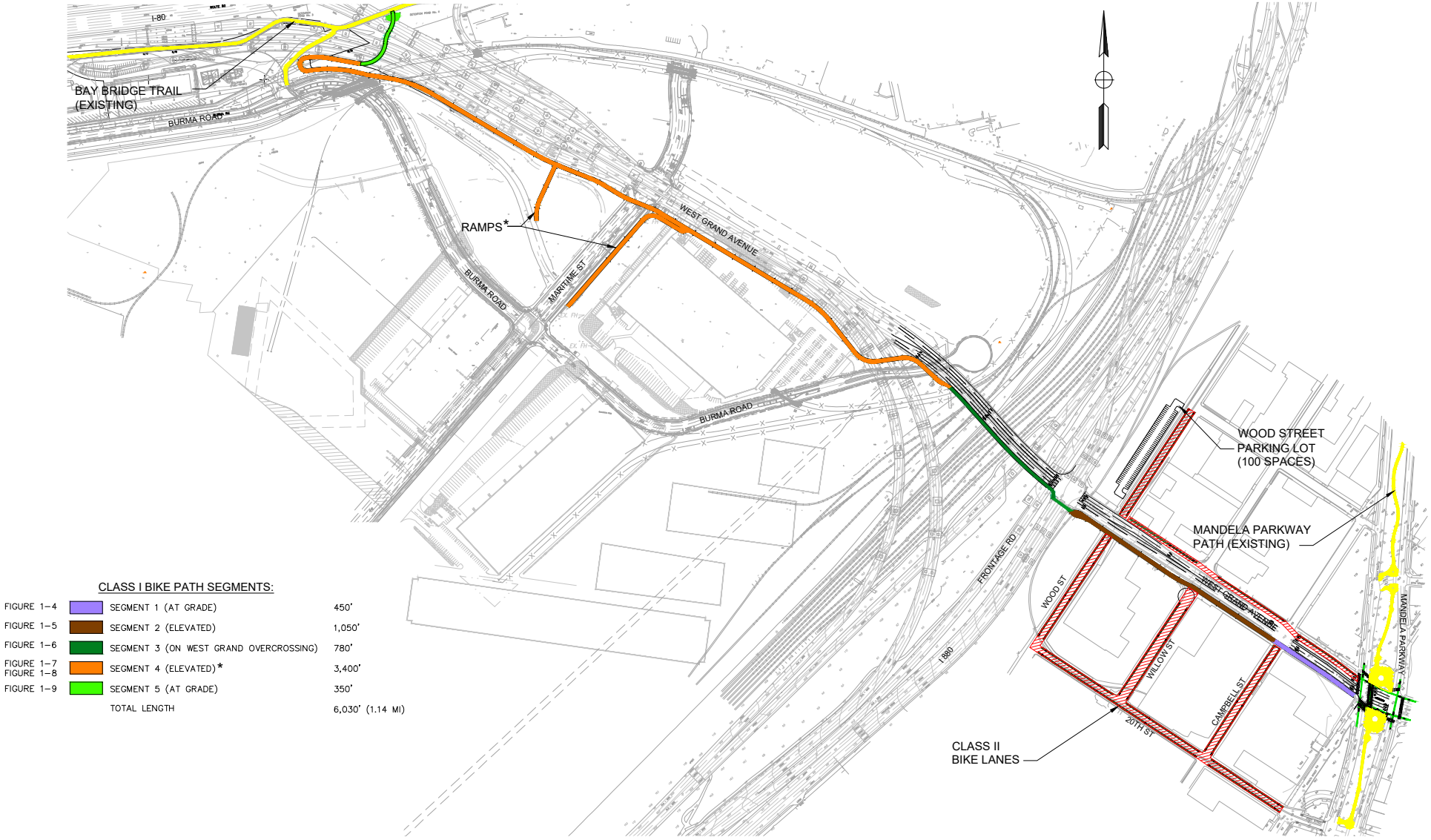
Project Area

Figure 2

West Oakland Link

Bike Path Segments



CLASS I BIKE PATH SEGMENTS:

FIGURE 1–4	SEGMENT 1 (AT GRADE)	450'
FIGURE 1–5	SEGMENT 2 (ELEVATED)	1,050'
FIGURE 1–6	SEGMENT 3 (ON WEST GRAND OVERCROSSING)	780'
FIGURE 1–7 FIGURE 1–8	SEGMENT 4 (ELEVATED)*	3,400'
FIGURE 1–9	SEGMENT 5 (AT GRADE)	350'
	TOTAL LENGTH	6,030' (1.14 MI)

Figure 3

Path

The Class I portion of the Link would extend 6,030 feet (1.14 miles) between Mandela Parkway on the east and the Bay Bridge Trail on the west. The Link is an elevated structure for most of this distance to provide access across existing freeways, railways, and industrial areas. It is an independent structure, except over the railroad tracks where it would be on the West Grand Avenue overcrossing structure. The elevated Link reaches a maximum height of 37 feet where it is on the overcrossing structure.

The Class I portion of the Link would be 17 feet wide (15 feet clear width and 2 feet for fencing), except on the West Grand Avenue overcrossing structure where it is 14 feet wide (10 feet clear width and 4 feet for barrier and fencing). The Link would have a maximum grade of 5 percent.

The Link would also include 8,170 feet of Class II bike lanes. A 100-space parking lot at the east end of the Class I bike path would also be included, if funding is available. The Class II bike lanes constructed for the Link would extend along surface streets near the east touchdown of the Link, providing connections to Mandela Parkway and to the proposed Wood Street parking lot.

The Project could also include an innovative spur connection to the proposed Oakland Maritime Support Services (OMSS) building; the connection would be designed to land on the roof of this building. This connection would provide lookout areas for path users and access for first responders when attempting to reach path users in the event of an emergency.

The Class I portion of the Link at the Maritime Street area could also include a ramp that would tie into the Class I path along the east side of Maritime Street and connect with the Port of Oakland.

The Project would require the conversion of roadway shoulders to a bicycle path for the Link and a lane reduction at the West Grand Avenue/Mandela Parkway intersection.

Class I Link Segments

The Link has been divided into five segments, described below from east to west (**Figure 3**).

Segment 1. At-Grade Connection to Mandela Parkway: The Class I portion of the Link would be at-grade along the south side of West Grand Avenue, between Mandela Parkway and Campbell Street (**Figure 4**). This segment would be approximately 450 feet long and 15-feet wide since no fencing is required. There would be a landscape island on the north side of the Link to separate the Link from vehicular traffic. Campbell Street and Willow Street would dead end or become a cul-de-sac where they intersect with the West Grand Avenue alley (the extension of West Grand Avenue that extends between Campbell and Wood Streets) on the south side of West Grand Avenue. This would prevent regular vehicular traffic from crossing the new Class I portion of the Link because there would not be sufficient vertical clearance under the Link structure for vehicles. The West Grand Avenue alley on the south side of the West Grand Avenue structure would be permanently closed to vehicle traffic or vacated. The north side of West Grand Avenue alley would remain open.

Segment 2. Separate Elevated Structure East: From Campbell Street, the Class I portion of the Link would continue for approximately 1,050 feet as a separate structure along the south side of West Grand Avenue (**Figure 5a**). The Link would increase in elevation with a gradient that would be Americans with Disability Act (ADA) compliant and cross over Willow Street and Wood Street (**Figure 5b**). After the Wood Street crossing, the Link would connect to the existing West Grand Avenue overcrossing (refer to Segment 3 below) just east of Frontage Road. The West Grand Avenue/Frontage Road crosswalk would

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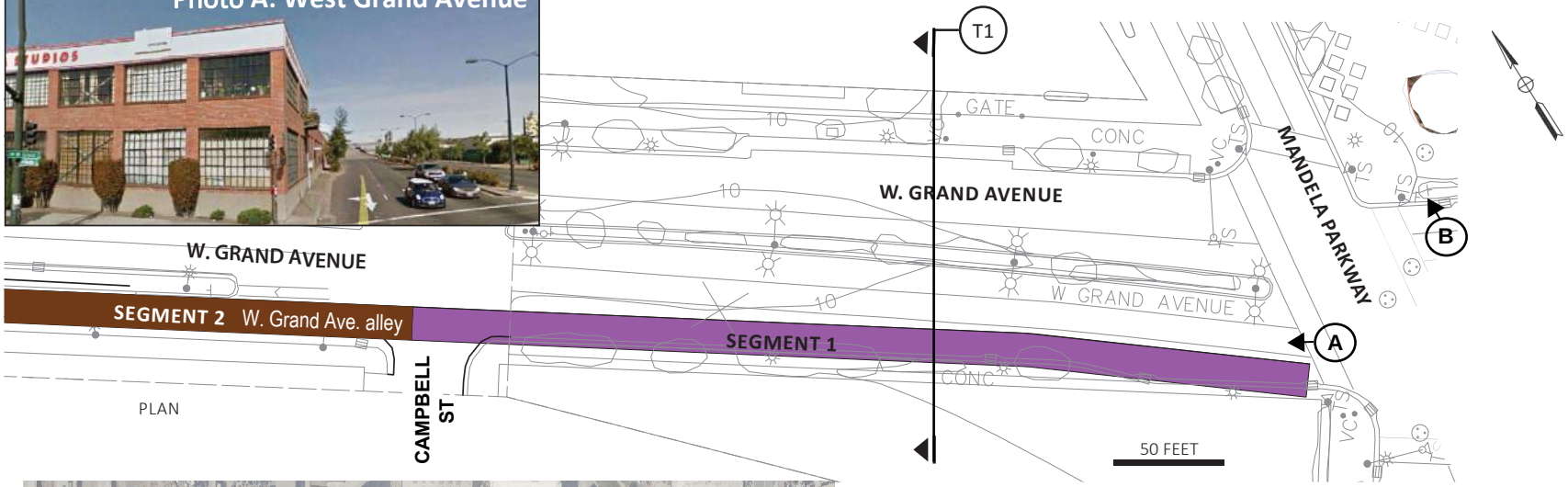
motor vehicles. **Class IV bikeways (separated bikeways)** are bikeway for the exclusive use of bicycles. Source: California Department of Transportation. *Highway Design Manual*. Chapter 1000, Bicycle Transportation Design. Last updated July 1, 2000. Available: dot.ca.gov/-/media/dot-media/programs/design/documents/chp1000-a11y.pdf.

Bike Path Segment 1



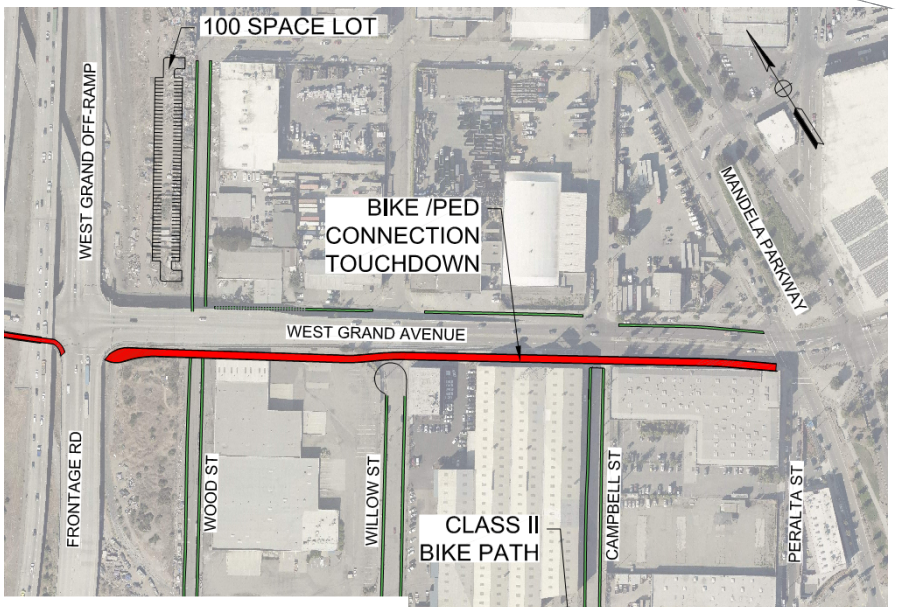


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Photo B: Mandela Parkway

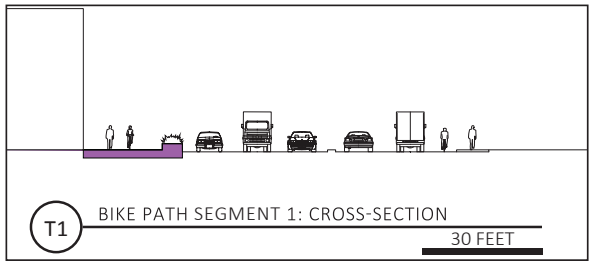
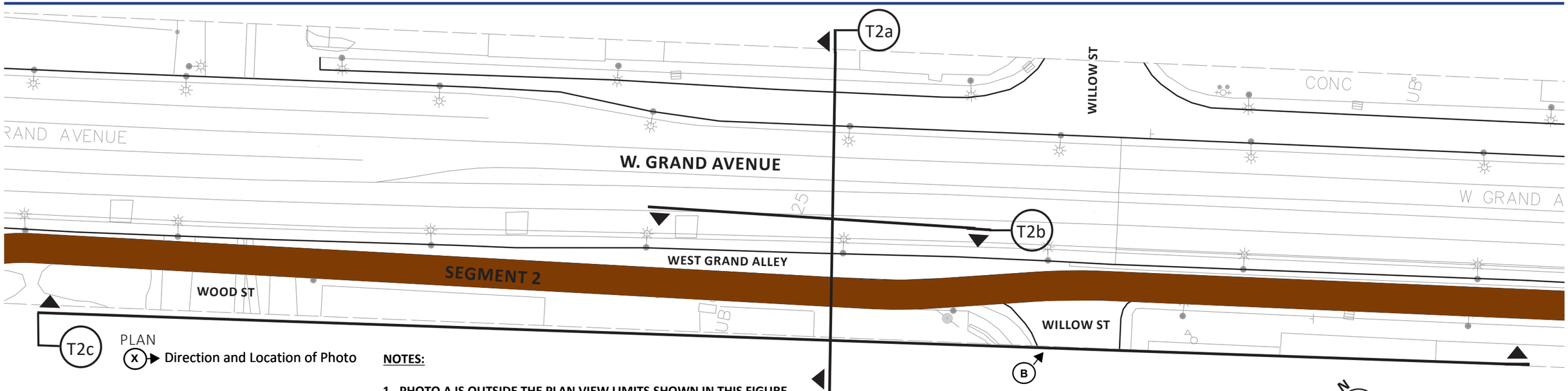


Figure 4

Bike Path Segment 2



NOTES:

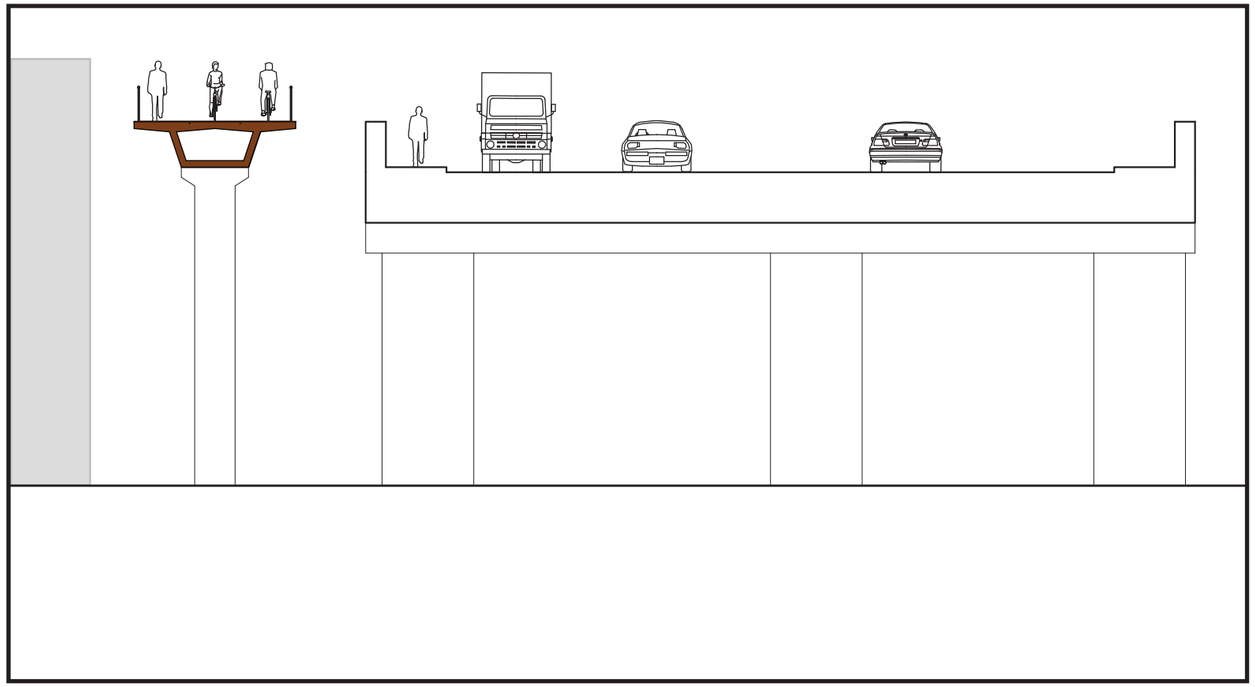
1. **PHOTO A IS OUTSIDE THE PLAN VIEW LIMITS SHOWN IN THIS FIGURE.**
2. **FOR LOCATION OF PHOTO A, SEE LOCATION OF SIMULATED KEY VIEW 4 IN FIGURE 10.**

Photo A: West Grand Avenue

Photo B: Willow Street

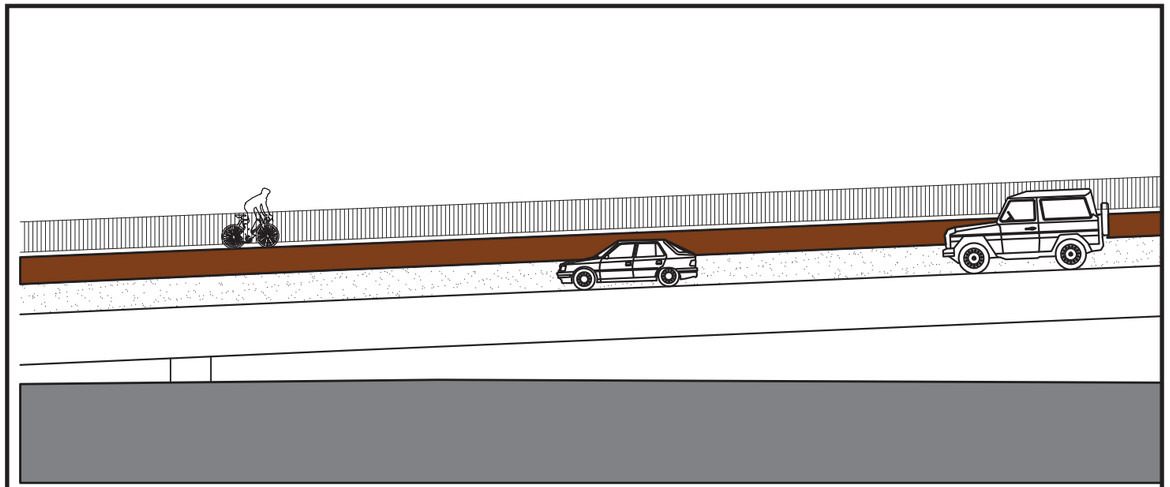
Figure 5a

Bike Path Segment 2



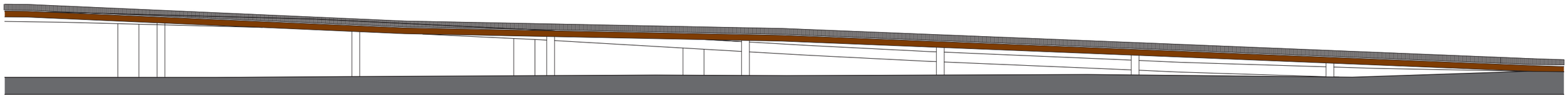
T2a SEGMENT 2: CROSS SECTION

SCALE: 1” = 15’



T2b SEGMENT 2: ELEVATION LOOKING SOUTH

SCALE: 1” = 15’



T2c BIKE PATH ELEVATION LOOKING NORTH

SCALE: 1” = 50’

Figure 5b

be improved. Construction of this segment would require permanently closing or vacating the existing West Grand Avenue alley. Where Campbell Street currently intersects with West Grand Avenue, bollards would be installed to allow emergency vehicles access to Campbell Street but prevent regular vehicular traffic from crossing the new Class I portion of the Link on the south side of West Grand Avenue. Where Willow Street currently intersects with West Grand Avenue, a cul-de-sac would be created on the south side of West Grand Avenue to prevent vehicular traffic, other than emergency vehicles, from crossing the new Class I portion of the Link.

Segment 3. West Grand Avenue Overcrossing: After the Wood Street overcrossing, the Class I portion of the Link would continue on the West Grand Avenue overcrossing for approximately 780 feet (**Figure 6a**). It would cross over Frontage Road and the railroad tracks (narrow gauge tracks or spur line), under the I-880 freeway structures, and over the Port of Oakland, Burlington Northern & Santa Fe Railroad and Union Pacific railroad tracks (**Figure 6b**). The width of the travel lanes and striped median would be reduced to provide enough width for Link using the existing West Grand Avenue structure. After crossing the railroad tracks, the Link would continue as a separate structure on the south side of West Grand Avenue (refer to Segment 4).

Segment 4. Separate Elevated Structure West: After crossing the railroad mainline and yard tracks, the Class I portion of the Link would continue for approximately 3,400 feet as a separate structure on the south side of West Grand Avenue and the I-880 outrigger structure. It would cross over Maritime Street, the four at-grade rail crossings on Burma Road and continue to the touchdown near the Caltrans maintenance facility (**Figures 7a, 7b, 8a, and 8b**). East of the Caltrans maintenance facility, the Link would descend with a switchback curve. This segment could also include two ramps, from the elevated structure to Maritime Street, which could be constructed if funding is available. On the east side of Maritime Street, there could be a 700-foot-long ramp extending toward Admiral Toney Way. On the west side of Maritime Street, there could be a 250-foot-long ramp extending to a roof-top landing and lookout area on the planned OMSS building. The maximum grade on the ramps would be 5 percent. The OMSS building completion date and operating hours are not yet known.

Segment 5. At-Grade Connection to Bay Bridge Trail: From the west touchdown, the Class I portion of the Link would continue another 350 feet at grade level under the I-880/I-80 connection lanes and connect to the existing Bay Bridge Trail (**Figures 8a and 8b**).

Ramp Connection to Class I Path Along East Side of Maritime Street

The Class I portion of the Link at the Maritime Street area could also include a ramp that would tie into the Class I path along the east side of Maritime Street to and from Admiral Toney Way. The tie-in at the Link segment would begin 600 feet east of Maritime Street, continue to the south, and touch down approximately 130 feet north of Admiral Toney Way. The tie-in would provide access to the Port of Oakland and additional access for first responders when attempting to reach path users in the event of an emergency

Ramp Connection to OMSS Building

The Project could also include an innovative spur connection to the OMSS building; the spur would be designed to land on the roof of this building. The OMSS building would provide lookout areas, restroom facilities, and concessions for path users and access for first responders when attempting to reach path users in the event of an emergency.

Class II Bike Lanes

The Project could also include Class II bike lanes along surface streets near the east touchdown of the Class I Link, providing connections to Mandela Parkway, the proposed Wood Street parking lot, and planned development along Wood Street (**Figure 3**). The width of the Class II bike lanes, extending along

each side of the street, would be 5 feet. The Class II bike lanes, which would cover approximately 8,170 linear feet, would be constructed after the Class I portion of the Link, if funding is available. Class II bike lanes would extend along the following surface streets:

- West Grand Avenue alley (westbound), from Peralta Street to Wood Street
- 20th Street, from Peralta Street to Wood Street
- Wood Street, from 20th Street to 24th Street
- Willow Street, from 20th Street to West Grand Avenue
- Campbell Street, from 20th Street to West Grand Avenue

The Project could include construction of a new 100-space parking lot on the west side of Wood Street, north of West Grand Avenue and beneath the east side of I-880 (**Figure 3**). The parking lot would cover 0.48 acre (21,217 square feet [sf]).

The parking lot would include lighting to achieve a minimum of 1 foot-candle[2] at primary circulation areas. The parking lot would include landscaping, which could include drought-tolerant trees, shrubs, and groundcover on an additional 6,000 sf. The purpose of the parking lot is (1) to provide a convenient way for some users of the Link to park and then walk/bicycle on the Link; and (2) to provide an alternative way for some users of Judge John Sutter Regional Park to reach the park by bicycling or walking rather than driving to the park itself. The parking lot would increase the range of users for the Link and park, including people who are unable to access the Link by walking or bicycling because of distance or other obstacles. Some users with mobility challenges may not be able to walk or bicycle the entire distance to reach the Link (or do it safely) but could use the Link if they were to drive to the parking lot and then walk or bicycle along the Link to reach the park or other destinations. The Wood Street parking lot would be constructed after the Link if funding is available.

Mandela Parkway Median

The Project could include streetscape improvements, such as landscaping and artwork, on the Mandela Parkway median within one block of West Grand Avenue. The landscaping would enhance the existing landscaping and would not involve any major changes.

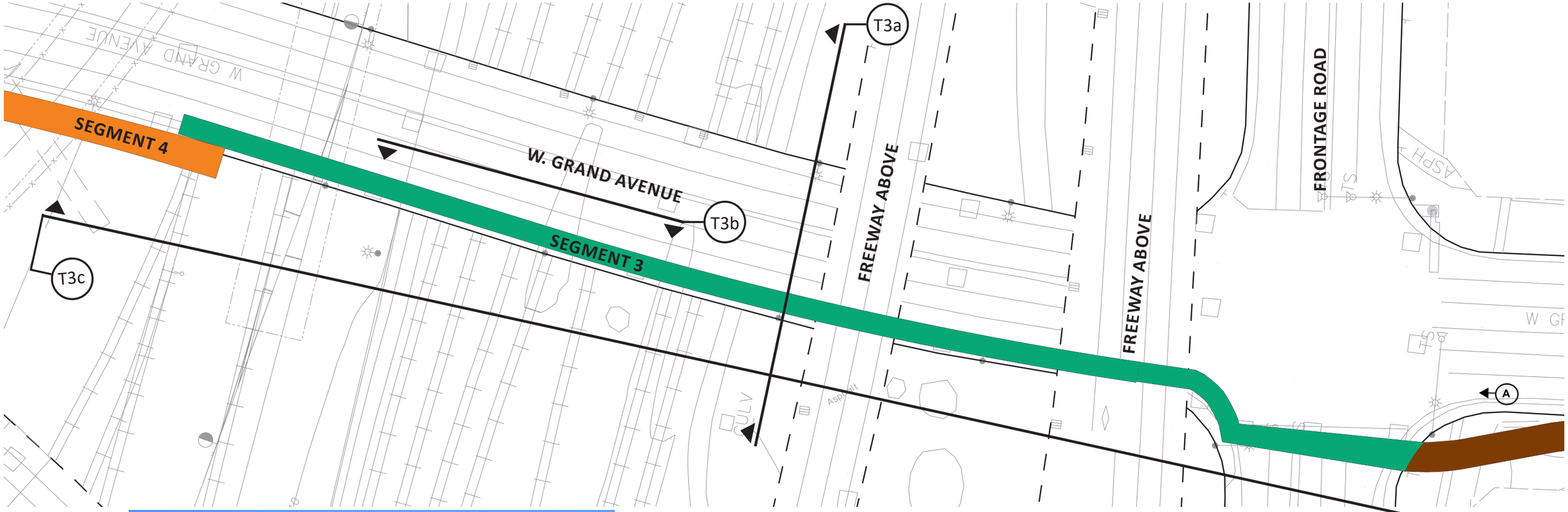
Project Features

Project features would include access points, fencing, lighting, lookout areas, way-finding and interpretive elements, landscaping, stormwater drainage infrastructure, safety measures, and operations and maintenance facilities. The final design process would include community workshops to solicit community input on Project aesthetics and landscaping, among other topics of interest to the community. The design would incorporate design elements desired by the community to instill a feeling of pride and Project ownership that reflects the values and character of the community.

Access Points: As described above for Segments 1 and 5, the Link would be accessible from Mandela Parkway at West Grand Avenue on the east end and from the Bay Bridge Trail on the west end (**Figure 3**). In addition, there could be access points on either side of Maritime Street, whereby the elevated portion of the Link could have ramps extending down to the east and/or west side of Maritime Street (**Figure 3**). On the west side of Maritime Street, the ramp would be approximately 250 linear feet and could include a landing on the roof top of the planned OMSS building. On the east side of Maritime Street, the ramp would be approximately 700 feet. Both ramps would have a maximum grade of 5

[2] The term foot-candle refers to a measurement of illumination. It is a unit of illumination equivalent to the illumination produced by one candle at a distance of one foot and equal to one lumen incident per square foot (http://en.wikipedia.org/wiki/foot-candle).

Bike Path Segment 3



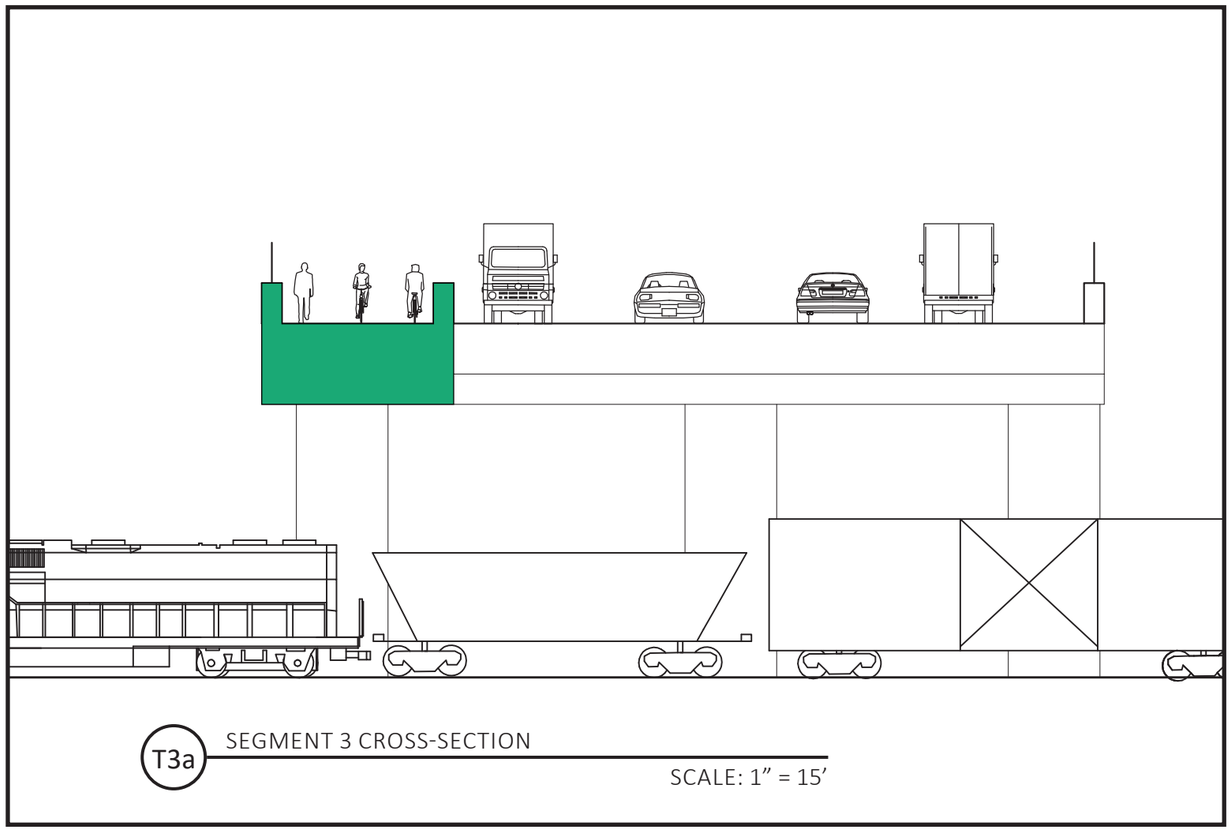
PLAN

Photo A: West Grand Avenue

X ▶ Direction and Location of Photo

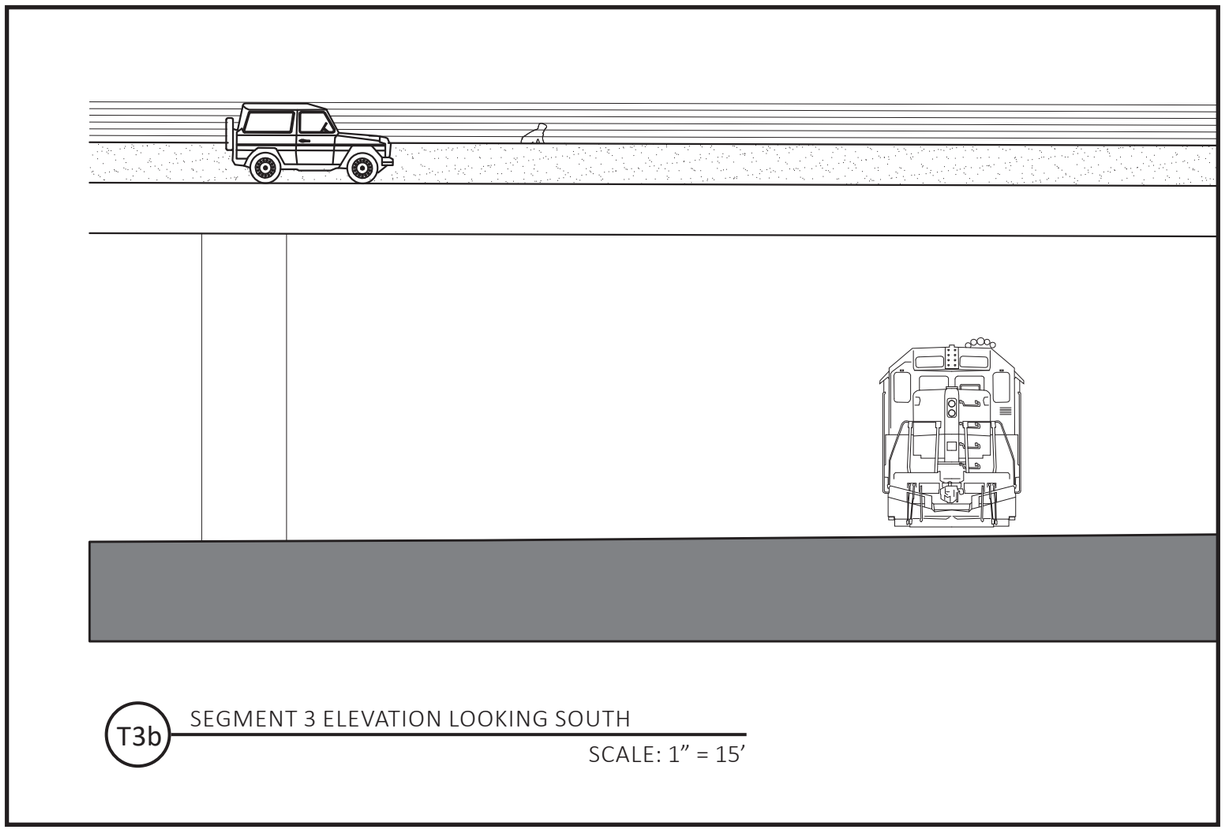
Figure 6a

Bike Path Segment 3



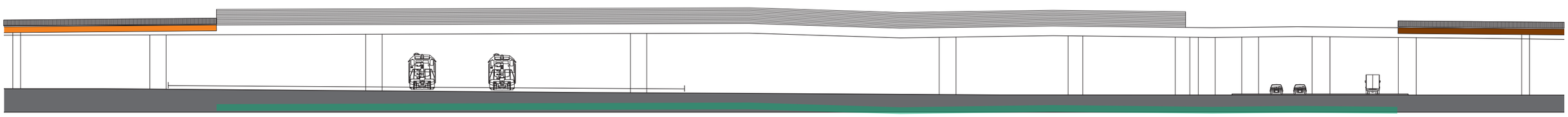
T3a SEGMENT 3 CROSS-SECTION

SCALE: 1” = 15’



T3b SEGMENT 3 ELEVATION LOOKING SOUTH

SCALE: 1” = 15’

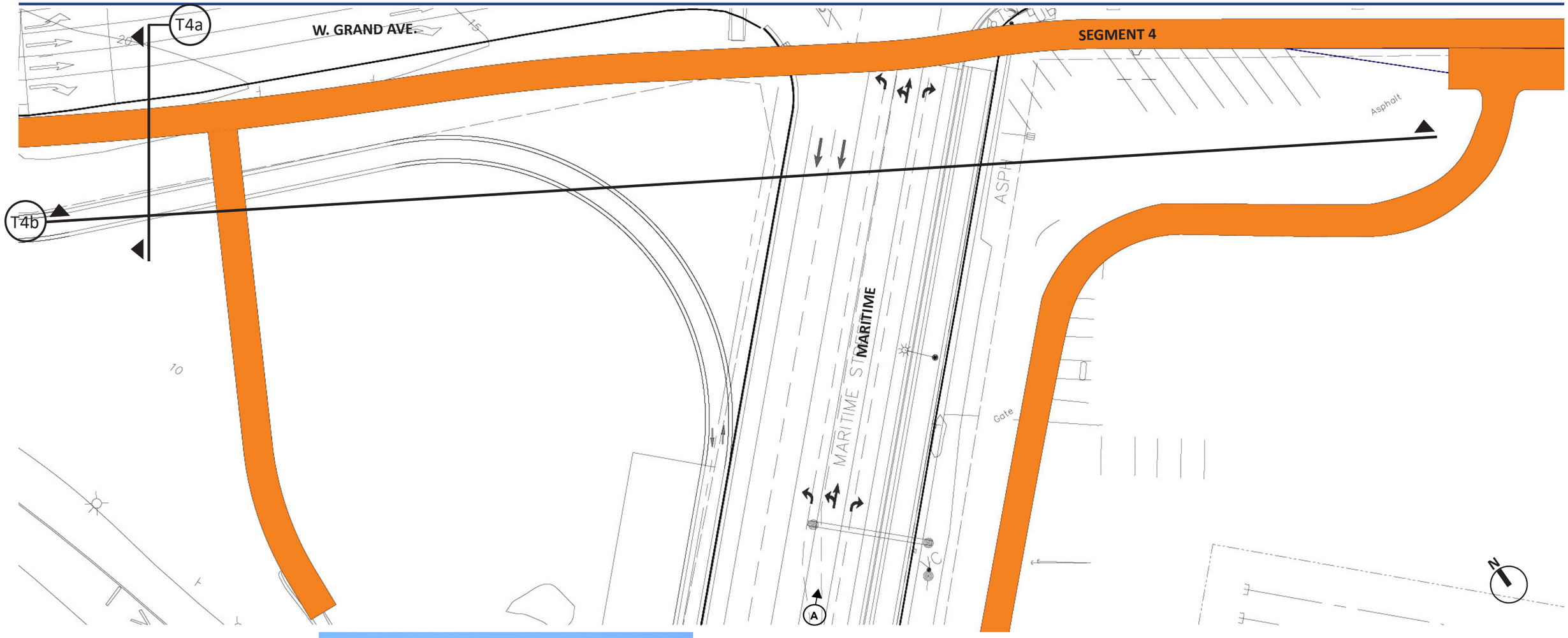


T3c BIKE PATH ELEVATION LOOKING NORTH

SCALE: 1” = 50’

Figure 6b

Bike Path Segment 4



PLAN

SCALE: 1" = 50'

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X Direction and Location of Photo

Figure 7a

West Oakland Link

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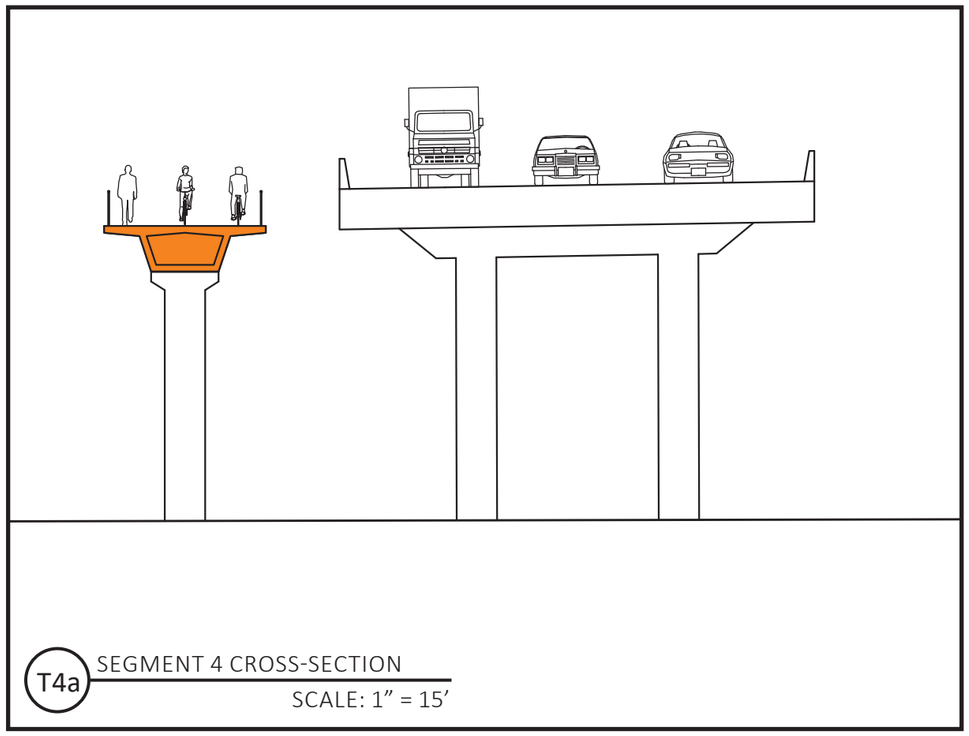
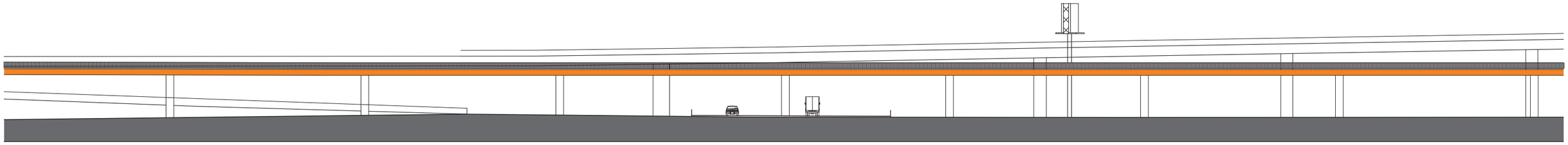
Bike Path Segment 4



T4a SEGMENT 4 CROSS-SECTION
SCALE: 1” = 15’



T4b BIKE PATH ELEVATION LOOKING NORTH
SCALE: 1” = 50’

Figure 7b

Bike Path Segment 5

Photo A: Bay Bridge Trail

Photo B: View from I-80

BAY BRIDGE TRAIL

SEGEMENT 5

W. GRAND AVE.

SEGEMENT 4

T5a

T5b

PLAN

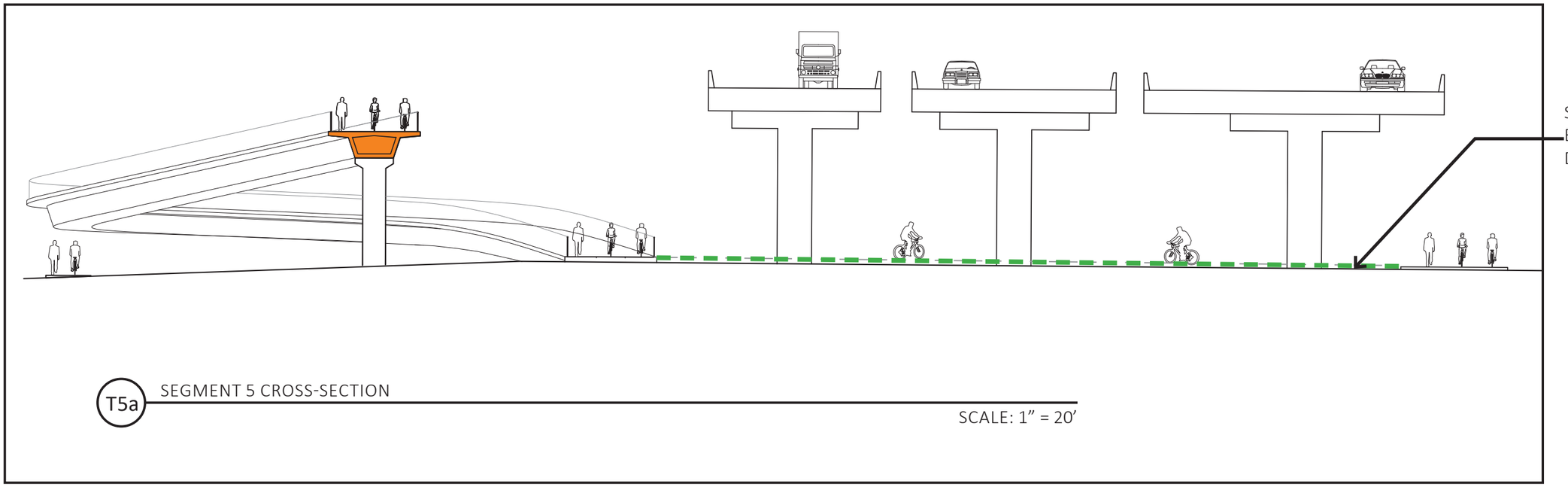
NOTES:

1. **PHOTOS A AND B ARE OUTSIDE THE PLAN VIEW LIMITS SHOWN IN THIS FIGURE.**
2. **FOR LOCATION OF PHOTO A, SEE LOCATION OF SIMULATED KEY VIEW 7 IN FIGURE 10.**
3. **FOR LOCATION OF PHOTO B, SEE LOCATION OF SIMULATED KEY VIEW 8 IN FIGURE 10.**

SCALE: 1" = 50'

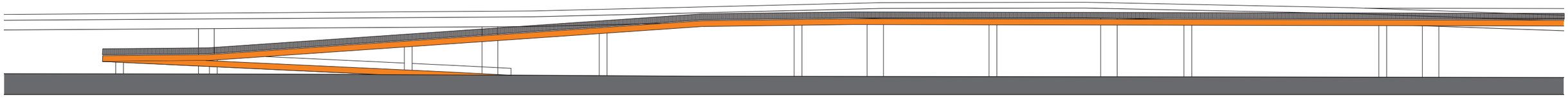
Figure 8a

Bike Path Segment 5



T5a SEGMENT 5 CROSS-SECTION

SCALE: 1” = 20’



T5b BIKE PATH ELEVATION LOOKING NORTH

SCALE: 1” = 50’

Figure 8b

percent. As mentioned previously, the Link and landing would be open at all times and would include low-level lighting. OMSS building hours are unknown at this time.

Design: The Class I portion of the Link would be a multipurpose facility and accessible to bicyclists and pedestrians. It would be designed to comply with the Caltrans *Highway Design Manual* standards for paths. The elevated structure would also be designed to comply with current Caltrans structural design requirements for pedestrian bridges, including Caltrans Standard Plans and 2018 Standard Specifications (or the most current). Ramps and curb cuts would comply with ADA requirements. In addition, the elevated portions of the Link and any retaining walls would have some texture on the columns and very likely on the outside edge of the bridge deck.

Fencing and Barriers: The elevated portion of the Link would include fencing that would be 8 feet in height above the finished surface. Fencing would be needed where the path crosses over a road or railroad; metal guardrail barriers would be used over other areas. The fencing and barriers would comply with all relevant building and safety codes. The specific types of fencing and metal guardrail barriers have not been determined; however, it is likely that chain-link fencing would be used for the path on West Grand Avenue over the railroad tracks (Segment 3). For Segment 3, there would be a concrete barrier with a minimum height of 42 inches between the Link and vehicular traffic. Designs and details regarding the fencing and metal guardrail barriers would meet the technical and safety requirements of the *Highway Design Manual* while following the Project aesthetic theme and language developed during the community design workshops.

Lighting: The Link would be open at all times. Therefore, low-level lighting would be installed along the Link. It is anticipated that 1-foot candle (minimum) light-emitting diode (LED) lights would be side mounted in the barrier along the elevated segments, although there could also be some overhead lights installed at the top of the fencing if deemed necessary for safety. Lighting along the at-grade segments would be provided by new or existing streetlights or pedestrian light standards and in conformance with the City of Oakland's Outdoor Lighting Standards and the Port of Oakland's Exterior Lighting Policy. The design of the lighting system would prioritize safety while preventing light pollution. The community can help develop creative design alternatives to the traditional cobra-head lighting option.

Lookout Areas: The elevated portion of the Link could have some wider areas that would serve as lookout areas, but the number and location have not been determined. It is anticipated that there would be up to three such lookout areas dispersed along the elevated segments.

Way-Finding and Interpretive Elements: The Link would include centerline striping and way-finding signage. There could also be safety signage, such as signs indicating the bicycle speed limit. In addition, the Link could include *way-finding and interpretive elements*, which may include topics of community interest such as old Bay Bridge artifacts, to help guide users to the existing paths and new East Span of the Bay Bridge. Proposed signage on West Grand Avenue would adhere to Caltrans's Gateway Monument Policy.

Landscaping: The elevated portion of the Link could include planters in the wider lookout areas or attached to the exterior sides of the structure. There could also be some landscaping under the structure at the west end touchdown (where path makes a switchback curve and descends) and at the east end (between Wood Street and Campbell Street).

Stormwater Drainage: Stormwater on the elevated structure would likely drain off at downspouts at the columns, and continue as surface flows or be conveyed to an existing drainage system, depending on the existing drainage patterns and facilities at each location. There would be no stormwater flowing directly into existing wetlands or drainages. The Project would include the provision of approximately 0.93 acre (40,510 sf) of stormwater treatment because the Project would add approximately 1.68 acres

(73,180 sf) of new impervious surfaces (WRECO 2014). This represents a treatment ratio of 1:1.8. Stormwater treatment options include vegetated flow-through treatment areas or bio-treatment basins beneath the elevated path and/or in vacant areas by freeways and the proposed Wood Street parking lot (**Figure 9**).

Safety: In addition to the fencing and lighting described above, the elevated portion of the Link would include solar call boxes and security cameras. It is anticipated that the Link would be patrolled periodically by California Highway Patrol (CHP) or City of Oakland officers on bicycles. Closed-circuit television would record and retain images for up to four weeks; this information would be available to law enforcement should a crime occur.

Project Phasing

The Project may be implemented in phases to respond to timing considerations and the availability of funds as well as the schedule for related projects. The sections that follow discuss the possible phasing options. All Class II bicycle lanes and bicycle boxes would be installed as part of the initial period of construction, regardless of phasing option.

Phasing Option 1

Phasing Option 1 would construct approximately 2,900 feet of Class I path structure, beginning approximately 600 feet east of Maritime Street and continuing to the Bay Bridge Trail. Starting from the east, the structure would begin approximately 600 feet east of Maritime Street with an interim connection to the multi-use path (MUP), which was installed as part of the high-occupancy vehicle/bus extension project. Under Phasing Option 1, the West Oakland Link profile would be lowered to tie into West Grand Avenue. The structure would continue west, parallel to West Grand Avenue. The elevated Link structure would span Maritime Street and the existing at-grade railroad crossings near Burma Road. The structure would then continue under the I-80 ramps and tie in at the connection to the Bay Bridge Trail. Construction under the initial build portion of Phasing Option 1 would correspond to a portion of Segment 4 and all of Segment 5.

When additional funding for construction is available, the Link would be extended to Mandela Parkway. The interim connection to West Grand Avenue could either be demolished or retained as an emergency access point. The remaining easterly portion of Segment 4 would be constructed with a slightly revised vertical profile. Segments 1 through 3 as well as the ramps to Maritime Street and the OMSS building (the remainder of Segment 4) would also be constructed.

Phasing Option 2

Phasing Option 2 would be similar to Phasing Option 1. However, a 600-foot segment on the east side of Maritime Street would be designed and constructed so that the bridge deck could be raised during a future phase of the Project, providing a smooth profile and minimizing elevation changes for the Link under the full-build condition. Construction under the initial build portion of Phasing Option 2 would correspond to a portion of Segment 4 and all of Segment 5.

When additional funding for construction becomes available, the Link would be extended to Mandela Parkway. The above-mentioned 600 feet of the bridge deck could be raised to its final elevation by extending the bridge columns. Segments 1 through 3, the remaining easterly portion of Segment 4, and the ramps to Maritime Street and the OMSS building would also be constructed.

Phasing Option 3

Phasing Option 3 would construct Segment 4, except for the ramps to Maritime Street, the OMSS building, and Segment 5 of the Link. When additional funding for construction is available, Segments 1 through 3 and the ramps to Maritime Street and the OMSS building could be constructed.

Potential Stormwater Treatment Areas

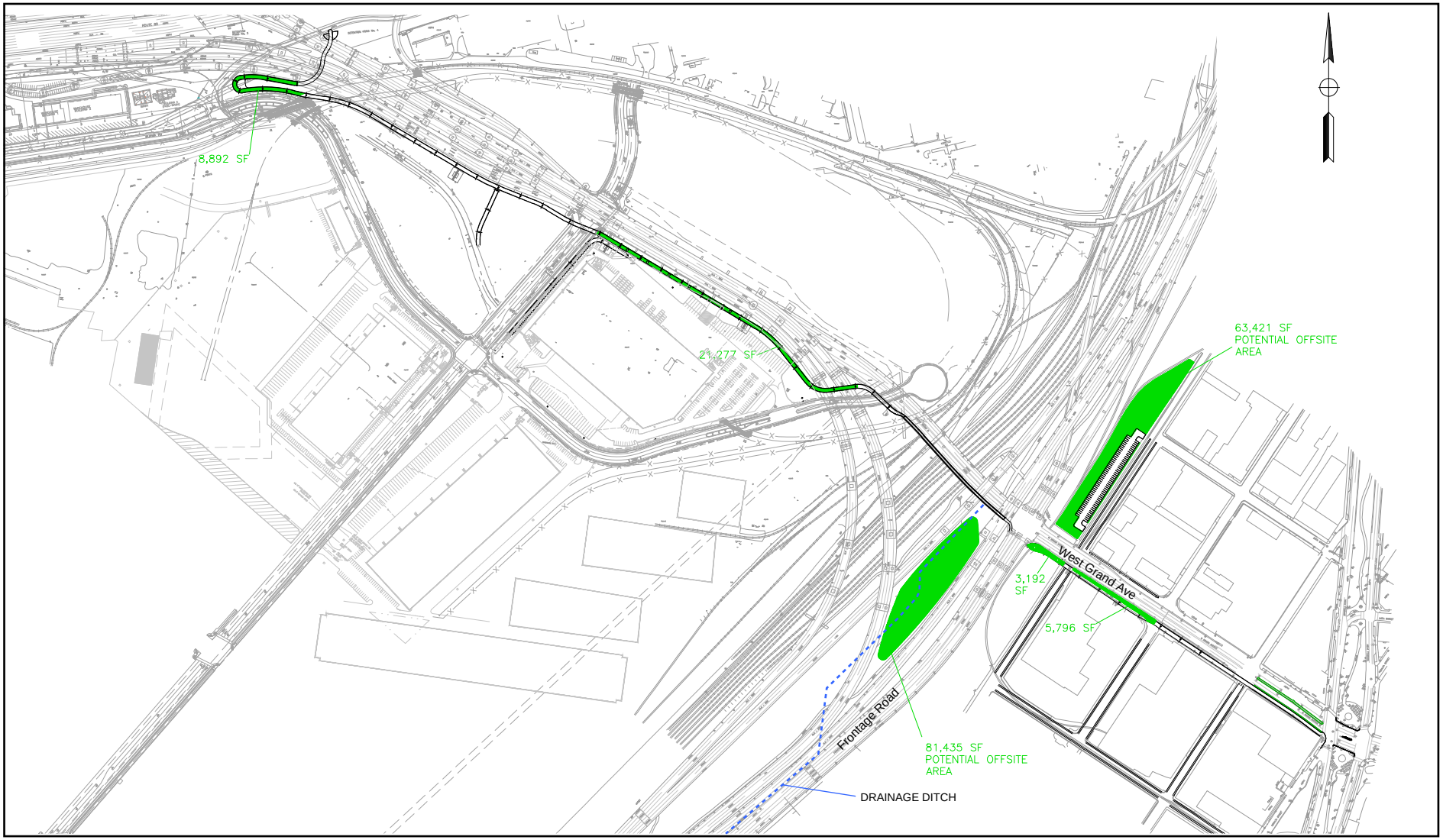


Figure 9

Project Construction

Excavation and Grading: Project construction would require excavation, grading and new pavement as follows:

- Excavation up to 5 feet deep for 45 column footings for the elevated portion of the Link (note that supporting piles would be driven 50-60 feet deep);
- Excavation up to 3 feet deep for at-grade modifications at the west end touch down near the Caltrans maintenance facility and the east touch down at Campbell Street and Willow Street, where there would be intersection modifications to create cul-de-sacs;
- Excavation up to 3 feet deep for at-grade modifications along City streets for new pavement sections, sidewalks, and driveways; and
- Excavation up to 3 feet deep and grading for gravel and asphalt pavement at the Wood Street parking lot.

It is estimated that the Project would result in up to approximately 2,600 cubic yards of cut material. During excavation, soils would be tested for contamination. Clean soils would be used or sold for reuse at nearby construction sites. Contaminated soils would be disposed of at an appropriate facility. It is estimated that approximately 44 trees could be removed, based on review of an aerial photo. Replacement planting would proceed consistent with City of Oakland Municipal Code.

Construction Hours and Duration: Construction is anticipated to occur between the hours of 7:00 a.m. and 6:00 p.m., Monday through Saturday. It is possible that evening work would be required for construction over Maritime Street and Burma Road. There would be no construction after 7:00 p.m. or on weekends or national holidays without special permission from the City of Oakland. If the Project is constructed as a single contract, construction is estimated to occur over 24 months, from October 2023 to October 2025. However, as discussed above, the Project may be constructed in phases:

- Phasing Option 1 would take 21 months for the initial build and the remaining construction would take an additional 18 months.
- Phasing Option 2 would take 21 months for the initial build and the remaining construction would take an additional 18 months.
- Phasing Option 3 would take 21 months for the initial build and the remaining construction would take an additional 15 months.

Vehicle Access: Construction truck activity and haul routes would be limited to key collector roads, including West Grand Avenue, Maritime Street, Frontage Parkway, and Wood Street. Construction vehicles may also use Burma Road, Mandela Parkway, Campbell Street, Willow Street, Peralta Street, and 20th Street. Construction activities are not anticipated to result in any long-term road closures, except for eastbound West Grand Avenue alley and its intersections with Willow Street and Campbell Street West. Temporary road closures could include Campbell Street for intersection modifications at West Grand Avenue, West Grand Avenue alley and its intersections with Willow Street and Campbell Street West, and Maritime Street to place falsework over Maritime Street for the new elevated structure. Temporary lane closures could occur on West Grand Avenue, Maritime Street, Wood Street, Willow Street, Engineers Road, Peralta Street, Campbell Street, and 20th Street. In those instances, detours would be provided.

Construction Equipment: Construction equipment and vehicles could include: backhoes, loaders, excavators, tractors, cranes, lifts, pile drivers, concrete trucks and pump, paving machine, compactors/rollers, and trucks for demolition, grading, and materials delivery. Construction equipment and power tools could include: jackhammers, air compressors, generators, concrete saws, power drills, welding equipment, sandblasting equipment, painting equipment, power and impact wrenches, and the like. Piles for the 45 footings (estimated amount to support the elevated portion of the Link) could be driven piles (precast concrete or steel) or cast-in-drilled-hole concrete piles, or a combination depending on the specific site conditions along the structure.

Staging: Construction staging would be on a disturbed or paved area, away from drainages. Options include using the Wood Street parking lot area before parking lot construction begins and/or renting a nearby parcel, possibly along Maritime Street or Burma Road.

Project Operations and Maintenance

The Link would be open 24 hours per day, seven days per week. Maintenance would include weekly trash removal, monthly sweeping, and bi-annual inspections for restriping, resurfacing, repairs, and bridge inspection and maintenance per state requirements. BATA would be financially responsible for maintenance of the completed Project, including any installed landscaping. BATA is currently in discussion with Caltrans regarding operations and maintenance responsibilities. An agreement is expected to be concluded before the start of construction.

III. PROJECT LOCATION AND SETTING

The Project location and setting provide the context for determining the type and severity of changes to the existing visual environment.

Regional Setting

The Project is located in the San Francisco Bay Area (Bay Area), approximately 1.3 miles northwest of downtown Oakland and approximately 5.5 miles east of the San Francisco shoreline, with views of both city skylines from the Project area.

The regional visual setting of the Bay Area is scenic and combines water, islands, bridges, mountains, and urban skylines. The Bay is a rich marine resource providing navigable waterways for commerce and recreation and habitat for numerous species. The Bay includes four major islands: Alcatraz, Angel Island, Treasure Island, and Yerba Buena Island. Seven bridges span the Bay, connecting communities and constituting significant scenic resources in their respective areas. The Golden Gate Bridge, Bay Bridge, Richmond-San Rafael Bridge, San Mateo Bridge, Dumbarton Bridge, Benicia Bridge, and Carquinez Bridge span significant stretches of open water and are highly visible from vantage points around the Bay and these bridges also provide views out and around to the scenic resources associated with the Bay Area landscape. Mount Tamalpais and the hills of the Marin headlands are to the northwest; the East Bay Hills of Oakland and Berkeley are located to the east; and the Santa Cruz Mountain Range along the Peninsula is located to the southwest. The city skylines of Oakland and San Francisco also complement the region's natural and urban setting. Regional urban development in the cities of Berkeley, Emeryville, Oakland, and Alameda are also visible and are largely concentrated between the East Bay Hills to the east (the dominant topographic feature in the area) and the Bay to the west.

The Bay Trail is an important recreational feature in the region that parallels a significant portion of the Bayshore in all nine Bay Area counties. The Bay Trail is a series of existing and planned regional hiking and bicycle trails that will eventually continuously connect around a 400-mile perimeter of the San Francisco and San Pablo Bays (ABAG 1989). On January 27, 2022, the San Francisco Bay Trail Project

approved the addition of the West Oakland Link to the spine alignment of the Bay Trail System (Lo pers. comm. 2022).

Transportation corridors are also a notable feature within the region and include six interstate freeways: I-80, I-280, I-380, I-580, I-880, and I-980; numerous state routes and local highways and surface streets; and several rail corridors.

Vicinity Setting

The Project vicinity largely composed of transportation facilities and industrial land uses associated with the Port of Oakland, East Bay Municipal Utility District wastewater treatment plant, and other industry. Representative areas within the Project vicinity are mapped on **Figure 10**. The Project is located 0.5 mile west of a major transportation hub created by the intersection of three interstate freeways: I-80, I-880, and I-580, known as the MacArthur Maze. Due to the large number of vehicles that travel on these freeways each day, the Project area is visible to motorists that pass quickly by the site. I-80 is an eight- to ten-lane freeway that serves San Francisco and the East Bay. North of Emeryville, I-80 runs in a north-south direction; but at the MacArthur Maze, I-80 turns and travels in an east-west direction between Oakland and San Francisco. This segment of I-80 is an eligible state scenic highway, but not officially designated (Caltrans 2013). This segment of I-80 is also a part of the MacArthur Freeway, which is a city designated scenic route from the San Leandro City limits to the San Francisco-Oakland Bay Bridge approach (City of Oakland 1974). I-880 is an eight-lane freeway that serves West Alameda County, the South Bay, and San Jose. I-580 is an eight-lane freeway that connects to Sacramento.

The Link would extend along the south side of West Grand Avenue, which generally runs in an east–west direction, extending beneath I-880 and connecting to westbound I-80. In addition, the path would provide be incorporated into the existing Bay Trail in proximity to Maritime Street, Burma Road, and Admiral Toney Way. In this area, the existing Bay Trail travels under the many elevated ramps and roadway structures that connect West Grand Avenue and Maritime Street to I-80; the trail has one connection to Burma Road. A large portion of the Bay Trail near the connection to Burma Road is shaded because of the extent of elevated roadway infrastructure that casts shadows on the trail. Burma Road starts at Maritime Street and extends west through the Project area, running parallel to I-80 and terminating at the Bay. Admiral Toney Way also starts at Maritime Street but extends eastward to the point where it terminates in a cul-de-sac just east of West Grand Avenue. The Port of Oakland, Bay Bridge Toll Plaza, and Caltrans' District 4 San Francisco-Oakland Bay Bridge (SFOBB) complex are south of the Link; the EBMUD wastewater treatment facility is to the north. From the toll plaza administration building site, the Link site is largely obscured by Caltrans' District 4 SFOBB complex and the elevated West Grand Avenue/Maritime Street exit ramp from westbound I-80 (**Figure 11a, Photo 1**). In this area, most of West Grand Avenue is grade separated and allows for views of the Port (**Figure 11a, Photo 2**). Views of the Port consist of a heavy-industrial, manmade environment that is mostly paved and has little to no vegetation. These views contain a number of warehouses, chain-link fencing surrounding facilities, streetlights, and utility poles and wires (similar to the ground-level views shown on **Figure 11b, Photo 3**). Most of the industrial facilities are older, except along Maritime Street, near its intersection with Admiral Toney Way, where long, linear distribution warehouses and older buildings have been removed. In their place, large-scale, modern distribution warehouse facilities have been constructed, retaining the industrial nature of the Project area. These views are typical of views from Maritime Street, Burma Road, and Admiral Toney Way, which provide access to the Port. West Grand Avenue does have an at-grade intersection and on-ramps at Maritime Street, which is used primarily by trucks for Port operations and activities. While portions of West Grand Avenue are elevated through the Port, vista views are very limited by adjacent elevated transportation structures. Most views are not scenic because they are largely comprised of the surrounding transportation infrastructure and industrial land

Locations of Project Areas and Photo Simulations

Figure 10

West Oakland Link

Project Area Photographs

Photo 1. Looking southeast toward the Link project area from the Bay Bridge Toll Plaza.
Source: Google Earth

Photo 2. Looking northwest from Burma Road toward Port storage yards and West Grand Avenue.

Figure 11a

Project Area Photographs

Photo 3. Looking east at the Maritime Street.
Source: Google Earth

Photo 4. Looking northwest toward Frontage Road and I-80 connection overpass from West Grand Avenue.

Figure 11b

Project Area Photographs

Photo 5. Looking northeast toward the rail line, elevated freeway connectors, and the Berkeley Hills from West Grand Avenue.

Photo 6. Looking north toward the EBMUD wastewater treatment facility at the Frontage Road and West Grand Avenue intersection.

Figure 11c

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Project Area Photographs

Photo 7. Looking northeast toward elevated freeway connectors, the rail line, western edge of Oakland, and Berkeley Hills from West Grand Avenue.

Photo 8. Looking northeast toward the rail line and elevated freeway connectors from Wood Street.

Figure 11d

Project Area Photographs

Photo 9. Looking northwest toward West Grand Avenue and elevated freeway connectors from Mandela Parkway.

Photo 10. Looking southwest toward the landscaped median of Mandela Parkway from the Bay Trail Bike Path.

Figure 11e

Project Area Photographs

Photo 11. Looking southwest toward the landscaped median of Mandela Parkway at the Bay Trail way-finding sign.

uses with very limited views of the Bay, East Bay Hills, and city skylines (**Figure 11b, Photo 4, and Figure 11c, Photo 5**). The primary location where scenic vista views are available are near the West Grand Avenue intersection with I-80, which is located closer to the Bay. The EBMUD wastewater treatment facility is somewhat visible (**Figure 11c, Photo 6**). The only notable change in the Project vicinity.

The Union Pacific Railroad right-of-way, Frontage Road, and I-880 separate Port land uses from other industrial/warehouse land uses east of these transportation facilities (**Figure 11d, Photo 7**). The Link crosses over the Union Pacific Railroad right-of-way and Frontage Road, which extend parallel to each other in a generally north-south direction. I-880 travels between the rail right-of-way and Frontage Road. The rail right-of-way and I-880 are currently surrounded by a chain-link fence and are inaccessible to the public (**Figure 11d, Photo 8**). The area is flat with a combination of paved surfaces and ruderal vegetation growing in small unpaved areas. Massive concrete pillars (some with graffiti) are evenly spaced throughout this area, supporting the I-880 aerial structure. The freeway overcrossing creates a visual barrier and separates the Port from the western edge of Oakland.

The eastern terminus of the Link is one block west of Mandela Parkway, at Campbell Street, where the aerial structure touches down and continues to the southeast at-grade to Mandela Parkway (**Figure 11e, Photo 9**). East of the rail right-of-way and I-880, the local surface streets form a grid-like pattern and include light industrial warehouses, storage facilities, expansive paved areas, and a neighborhood park (Raimondi Park) on large parcels of land. All buildings are one or two stories in height and feature little to no exterior articulation. The exception is the Peralta building, between Mandela Parkway and Campbell Street. The building is made of brick and has windows along West Grand Avenue. Although the Peralta building has great visual appeal compared to other buildings in the area, it does not stand out as overly unique. In addition, there is little separation between busy West Grand Avenue and the building, and the existing landscaping along the roadway is very sparse and does little to improve the aesthetics associated with the building.

East of Campbell Street, the elevated West Grand Avenue acts to segment this area and create a distinct separation between the buildings north and south of the roadway. Businesses north of West Grand Avenue do not have views toward the West Grand Avenue alley, which is where Segment 2 would be located, either because the elevated West Grand Avenue acts as a physical barrier to views to the south or the businesses do not have windows facing West Grand Avenue. Near the West Grand Avenue touchdown at Campbell Street, the building north of West Grand Avenue could have views toward the Project corridor. However, this building does not have south-facing windows, and privacy fencing drastically limits views toward the Project from within the property bounds. Buildings located immediately next to Segment 2, south of West Grand Avenue, include large warehouse structures that do not have windows facing the Project. However, the Lyft Oakland Hub building does have a windowed corner that is largely screened by security fencing with wide vertical rails. Therefore, there may be partial views toward the Project from this portion of the building. In addition, the Lyft Oakland Hub parking lot and adjacent sidewalks and roadways have fairly open views toward the Project. In the morning, West Grand Avenue casts a slight shadow on the West Grand Avenue alley because the roadway elevates westward from its touchdown at Campbell Street. Although the alley is not shaded when the sun is at solar noon, buildings along the West Grand Avenue alley cast shadows in the afternoon, leaving the alley mostly shaded. Although Lyft has invested in improving the visual quality of the buildings associated with its facility (e.g., by painting the warehouses and operations building and planting trees along the sidewalk), this portion of the Project remains visually degraded. This is because of a lack of maintenance for the remaining sidewalks and roadsides; tall weeds, trash, and graffiti are common. However, the elevated portion of West Grand Avenue offers highly channelized views of the East Bay Hills to the east.

Mandela Parkway extends in a north-south direction with a wide median in the middle. Although not a designated park, the Mandela Parkway median is designated open space extending 1.25 miles, between 32nd Street on the north to 8th Street on the south. Mandela Parkway provides an attractive parkscape in highly industrialized setting. It features a wide bicycle/pedestrian path, manicured lawns, maintained shrubs and trees, ornamental light fixtures, benches, and drinking fountains (**Figure 11e, Photo 10**). As shown on **Figure 11f, Photo 11**, Mandela Parkway also serves as a spur of the Bay Trail. Mandela Parkway is owned and operated by the City of Oakland Parks and Recreation Department.

The sidewalks and center median of West Grand Avenue, between Campbell Street and Mandela Parkway, are landscaped with street trees and ornamental grasses, as shown in Photo 9. Views toward the Project area are available from Mandela Parkway, as viewers briefly pass by the West Grand Avenue roadway corridor. However, trees along Mandela Parkway and West Grand Avenue would allow for only partial views of the Link as it descends along West Grand Avenue and touches down at Campbell Street. Views of the elevated structures west of this point are associated with West Grand Avenue and I-880.

Lastly, although not currently built, the 2011–2195 Wood Street project would construct a multi-level, mixed-use development with 235 residential units, if the project moves forward. That project would be constructed between Frontage Road, West Grand Avenue, and Wood Street where West Grand Avenue is elevated and introduce additional residential and commercial viewers (City of Oakland 2021a; Japlot 2020).

Overall, the Project vicinity is highly industrialized and composed of large parcels of land with substantial paved surfaces, aerial transportation structures and concrete pillars with graffiti, utility poles and lights, and ruderal vegetation (with the exception of Mandela Parkway and the landscaped block of West Grand Avenue). The vividness is of the Project vicinity is low, intactness is moderate, and unity is low to moderate. The resulting visual quality is moderately low.

Regulatory Setting

The California Environmental Quality Act (CEQA) Guidelines currently require a project in an urbanized area to analyze whether it would conflict with applicable zoning and other regulations governing scenic quality or, if located in a non-urbanized area, substantially degrade the existing visual character or quality of public views of the site and its surroundings. The Project would be located entirely within an urbanized area. Therefore, a regulatory setting has been added to this VIA. No rural areas would be affected by the Project.

Federal and State

There are no roadways within or near the Project area that are designated in federal or state plans as a scenic highway or route worthy of protection for maintaining and enhancing scenic viewsheds. The segment of I-80 passing near the Project area is an eligible state scenic highway but is not officially designated (Caltrans 2019). No other state regulations apply to visual resources within the Project area.

Regional and Local

City of Oakland General Plan

Land Use and Transportation Element

The City of Oakland (City) General Plan, Land Use and Transportation Element (City of Oakland 1998), contains the following policies relevant to the Project and aesthetics:

Policy I/C4.1 Protecting Existing Activities. Existing industrial, residential, and commercial activities and areas that are consistent with long-term land use plans for the City should be protected from the intrusion of potentially incompatible land uses.

Policy T3.5 Including Bikeways and Pedestrian Walks. The City should include bikeways and pedestrian walks in the planning of new, reconstructed, or realized streets, wherever possible.

Policy T6.2 Improving Streetscapes. The City should make major efforts to improve the visual quality of streetscapes. Design of the streetscape, particularly in neighborhoods and commercial centers, should be pedestrian oriented and include lighting, directional signs, trees, benches, and other support facilities.

Policy T6.3 Making the Waterfront Accessible. The waterfront should be made accessible to pedestrians and bicyclists throughout Oakland.

Policy T6.5 Protecting Scenic Routes. The City should protect and encourage enhancement of the distinctive character of scenic routes within the city through prohibition of billboards, design review, and other means.

Policy N9.5 Marking Significant Sites. Identify locations of interest and historic significance by markers, signs, public art, landscape, installations, or by other means.

Policy N10.1 Identifying Neighborhood "Activity Centers." Neighborhood Activity Centers should become identifiable commercial, activity, and communication centers for the surrounding neighborhood. The physical design of neighborhood activity centers should support social interaction and attract persons to the area. Some of the attributes that may facilitate this interaction include plazas, pocket parks, outdoor seating on public and private property, ample sidewalk width, street amenities such as trash cans and benches, and attractive landscaping.

Policy N12.4 Undergrounding Utility Lines. Electrical, telephone, and related distribution lines should be undergrounded in commercial and residential areas, except where special local conditions such as limited visibility of the poles and wires make this unneeded. They should also be underground in appropriate institutional, industrial, and other areas and generally along freeways, scenic routes, and heavily traveled streets. Programs should lead systematically toward the eventual undergrounding of all existing lines in such places. Where significant utility extensions are taking place in these areas, such as in new subdivisions, utilities should be installed underground from the start.

Open Space, Conservation, and Recreation Element

The City of Oakland General Plan, Open Space, Conservation, and Recreation Element (OSCAR) (City of Oakland 1996), contains the following policies relevant to the Project and aesthetics:

Policy OS-2.1: Protection of Park Open Space. Manage Oakland's urban parks to protect and enhance their open space character while accommodating a wide range of outdoor recreational activities.

Policy OS-2.6: Street Closures for Parks, Plazas, and Gardens. Where there is broad community and local support and where legally permissible, allow local street closures as a way of creating new parks, plazas, and garden sites in urban neighborhoods.

Policy OS-3.6: Open Space Buffers along Freeways. Maintain existing open space buffers along Oakland's freeways to absorb noise and emissions and enhance the scenic quality of the roadways. Manage steeply sloping or wooded parcels adjacent to highways owned by the State of California (Caltrans) to conserve natural resources and protect open space. Where compatible with adjacent land uses, support the use of land along, under, or over freeways in urban settings for greenbelts, recreation, public art, or other activities that enhance the usefulness and appearance of such land.

Policy OS-5.1: Priorities for Trail Improvement. Improve trail connections within Oakland, emphasizing connections between the flatlands and the hill and shoreline parks, lateral trail connections between the hill-area parks, and trails along the waterfront.

Policy OS-5.2: Joint Use of Rights-of-Way. Promote the development of linear parks or trails within utility or transportation corridors, including transmission line rights-of-way, abandoned railroad rights-of-way, and areas under the elevated BART [Bay Area Rapid Transit] tracks.

Policy OS-5.3: Trail Design Principles. Plan and design all new trails in a manner that (a) minimizes environmental impacts, (b) fully considers neighbor privacy and security issues, (c) involves the local community in alignment and design, and (d) considers the needs of multiple users, including pedestrians, bicyclists, and those in wheelchairs.

Policy OS-7.5: Lateral Access and Links to the Flatlands. Improve lateral access along the Oakland shoreline and linkages between the shoreline and nearby neighborhoods by creating a "Bay Trail" along the length of the Oakland waterfront. Where an alignment immediately along the waterfront is not possible, site the trail as close to the water as possible, with spur trails leading to the water's edge. In the transitional areas between Jack London Square and High Street, interim alignments may be designated along local streets, but the ultimate goal should be an unbroken trail along the water's edge between Jack London Square and Martin Luther King, Jr. Regional Shoreline.

Policy OS-9.2: Use of Natural Features to Define Communities. Use open space and natural features to define city and neighborhood edges and give communities within Oakland a stronger sense of identity. Maintain and enhance city edges, including the greenbelt on the eastern edge of the city, the shoreline, and San Leandro Creek. Use creeks, parks, and topographical features to help define neighborhood edges and create neighborhood focal points.

Policy OS-9.3: Gateway Improvements. Enhance neighborhood and city identity by maintaining or creating gateways. Maintain view corridors and enhance the sense of arrival at the major entrances to the city, including freeways, BART lines, and the airport entry. Use public art, landscaping, and signage to create stronger city and neighborhood gateways.

Policy OS-10.1: View Protection. Protect the character of existing scenic views in Oakland, paying particular attention to (a) views of the Oakland Hills from the flatlands, (b) views of downtown and Lake Merritt, (c) views of the shoreline, and (d) panoramic views from Skyline Boulevard, Grizzly Peak Road, and other hillside locations.

Policy OS-10.2: Minimizing Adverse Visual Impacts. Encourage site planning for new development that minimizes adverse visual impacts and takes advantage of opportunities for new vistas and scenic enhancement.

Policy OS-10.3: Underutilized Visual Resources. Enhance Oakland's underutilized visual resources, including the waterfront, creeks, San Leandro Bay, architecturally significant buildings or landmarks, and major thoroughfares.

Policy OS-10.4: Retention of City-Owned Open Space in Scenic Corridors. Retain City-owned parcels adjacent to Skyline Boulevard, Shepherd Canyon Road, and other scenic roadways to preserve panoramic views, vegetation, and natural character.

Policy OS-11.3: Public Art Requirements. Continue to require public art as a part of new public buildings or facilities. Consider expanding the requirement or creating voluntary incentives to private buildings with substantial public spaces.

Policy OS-11.4: Siting Public Art. Site public art with sensitivity to its surroundings. Locate public art in a manner that does not reduce useable open space in City parks or impede recreational activities.

Policy OS-12.1: Street Tree Selection. Incorporate a broad and varied range of tree species, which are reflected on a City-maintained list of approved trees. Street tree selection should respond to the general

environmental conditions at the planting site, including climate and micro-climate, soil types, topography, existing tree planting, maintenance of adequate distance between street trees and other features, the character of existing development, and the size and context of the tree planting area.

Policy OS-12.3: Street Tree Removal. Remove street trees only if they are hazardous, severely and incurably infested with insects or blight, or are severely and irreversibly damaged and deformed. Provide replacement trees in all cases where the site is suitable for street trees.

Policy CO-4.2: Landscaping with Drought-Tolerant Plants. Require use of drought-tolerant plants to the greatest extent possible and encourage the use of irrigation systems that minimize water consumption.

Policy CO-7.4: Tree Removal. Discourage the removal of large trees on already-developed sites unless removal is required for biological, public safety, or public works reasons.

Policy REC-3.3: Park Location Factors. Consider a range of factors when locating new parks or recreational facilities, including local recreational needs, projected operating and maintenance costs, budgetary constraints, surrounding land uses, citizen wishes, accessibility, the need to protect or enhance a historic resource, and site visibility.

Policy REC-6.3: Use of Surplus or Underutilized Properties. In areas where park deficiencies exist, pursue recreational use of open space at surplus schools, military bases, utility and watershed properties, and transmission and transportation corridors. Recreational uses in such locations should not conflict with the functional use of the property and should be compatible with prevailing environmental conditions.

Policy REC-7.6: Recognition of Local History. Promote programs, events, and markers at local parks that increase public awareness of local history and provide a sense of continuity with the past.

West Oakland Planning Area Strategy

The West Oakland Planning Area Strategy within the OSCAR recommends the following that can improve visual access:

- Improve access to the shoreline. This should include construction of the Bay Trail, along with spur trails along Maritime and Seventh Street/Middle Harbor Road.
- Where feasible, incorporate connections (arcades, landscaped easements, etc.) to parks in West Oakland (DeFremery, Lowell, Raimondi) as old industrial sites along Mandela Parkway are redeveloped.
- Continue street tree planting efforts and other programs to “green” West Oakland.

Scenic Highways Element

As described in the Scenic Highways Element (City of Oakland 1974), the MacArthur Freeway scenic corridor is a City-designated scenic route from the San Leandro city limits to the San Francisco-Oakland Bay Bridge approach. Although I-580 is also known as the MacArthur Freeway, the City-designated scenic route includes a segment of I-80 from its intersection with I-580 to the San Francisco-Oakland Bay Bridge approach (refer to Map 2 in the Scenic Highways Element). The Scenic Highways Element contains the following policies pertaining to aesthetic resources:

General Policy 2. All or portions of visually significant trafficways are eligible for future designation as scenic routes and for the protective restrictions that may be appropriate thereto.

General Policy 3. Urban development should be related sensitively to the natural setting.

General Policy 4. High standards for preserving and enhancing natural landforms and vegetation should be established and maintained to regulate all activities related to earthwork and the removal of trees, shrubs, or ground cover.

General Policy 5. Budgets for street improvements will, as a matter of course, include items for landscaping and tree planting, and the City budget should reflect the need for continued maintenance.

General Policy 6. Overhead utilities should be undergrounded along all freeways, scenic routes, and major streets. Programs should be developed to increase the present rate of undergrounding for existing overhead utilities.

General Policy 7. Billboards should be prohibited, and other signs should be controlled along freeways and parkways.

MacArthur Freeway Policy 1. The signs within the scenic corridor that are visible from the freeway should be for identification purposes only; no advertising should be permitted.

MacArthur Freeway Policy 2. Visual intrusions within the scenic corridor should be removed, converted, buffered, or screened from the motorist's view.

MacArthur Freeway Policy 3. Panoramic vistas and interesting views now available to the motorist should not be obliterated by new structures.

MacArthur Freeway Policy 4. New construction within the scenic corridor should demonstrate architectural merit and a harmonious relationship with the surrounding landscape.

City of Oakland Standard Conditions of Approval

The City of Oakland's adopted *Conditions of Approval and Uniformly Applied Development Standards Imposed as Standard Conditions of Approval* (SCA) includes general conditions of approval for all projects, general conditions for major permits, and uniformly applied development standards, which are imposed as standard conditions of approval (City of Oakland 2020). The SCA below may be considered relevant because the Project would be subject to trash and blight removal and graffiti control. In addition, the Project includes landscaping and new exterior lighting along the Link and in the Wood Street parking lot.

16. Trash and Blight Removal. The project applicant and their successors shall maintain the property free of blight, as defined in chapter 8.24 of the Oakland Municipal Code. For nonresidential and multifamily residential projects, the project applicant shall install and maintain trash receptacles near public entryways as needed to provide sufficient capacity for building users.

17. Graffiti Control.

a. During construction and operation of the project, the project applicant shall incorporate best management practices reasonably related to the control of graffiti and/or the mitigation of the impacts of graffiti. Such best management practices may include, without limitation:

    i. Installation and maintenance of landscaping to discourage defacement of and/or protect likely graffiti-attracting surfaces.

    ii. Installation and maintenance of lighting to protect likely graffiti-attracting surfaces.

    iii. Use of paint with anti-graffiti coating.

    iv. Incorporation of architectural or design elements or features to discourage graffiti defacement in accordance with the principles of Crime Prevention Through Environmental Design (CPTED).

v. Other practices approved by the City to deter, protect, or reduce the potential for graffiti defacement.

b. The project applicant shall remove graffiti by appropriate means within seventy-two (72) hours. Appropriate means include the following:

i. Removal through scrubbing, washing, sanding, and/or scraping (or similar method) without damaging the surface and without discharging wash water or cleaning detergents into the City storm drain system.

ii. Covering with new paint to match the color of the surrounding surface.

iii. Replacing with new surfacing (with City permits if required).

18. Landscape Plan.

a. *Landscape Plan Required.* The project applicant shall submit a final Landscape Plan for City review and approval that is consistent with the approved Landscape Plan. The Landscape Plan shall be included with the set of drawings submitted for the construction-related permit and shall comply with the landscape requirements of chapter 17.124 of the Planning Code. Proposed plants shall be predominantly drought-tolerant species. Specification of any street trees shall comply with the Master Street Tree List and Tree Planting Guidelines, which can be viewed at http://www2.oaklandnet.com/oakca1/groups/pwa/documents/report/oak042662.pdf and http://www2.oaklandnet.com/oakca1/groups/pwa/documents/form/oak025595.pdf, respectively, and with any applicable streetscape plan.

b. *Landscape Installation.* The project applicant shall implement the approved Landscape Plan unless a bond, cash deposit, letter of credit, or other equivalent instrument acceptable to the Director of City Planning, is provided. The financial instrument shall equal the greater of $2,500 or the estimated cost of implementing the Landscape Plan, based on a licensed contractor's bid.

c. *Landscape Maintenance.* All required planting shall be permanently maintained in good growing condition and, whenever necessary, replaced with new plant materials to ensure continued compliance with applicable landscaping requirements. The property owner shall be responsible for maintaining planting in adjacent public rights-of-way. All required fences, walls, and irrigation systems shall be permanently maintained in good condition and, whenever necessary, repaired or replaced.

19. Lighting Plan. Proposed new exterior lighting fixtures shall be adequately shielded to a point below the light bulb and reflector to prevent unnecessary glare onto adjacent properties.

City of Oakland Outdoor Lighting Standards

The City of Oakland's adopted *Outdoor Lighting Standards* provides lighting design and specification standards for private development projects on public right of ways or City properties. The standards direct that "all lighting equipment used in the City of Oakland will be standardized for energy efficiency, low glare and light pollution features, and the effective operation and maintenance of the lighting system City-wide" (Section D, *Lighting Equipment Guide*). In addition, Section C of the standards, Reduce Glare and Light Pollution, includes the following measures, which prevent light pollution from up-lighting (City of Oakland 2021b):

1. Forbid the installation of luminaries with open bulbs.
2. Use up-light limiting shields to minimize up-light components. The shields will direct the lights to the roadways.

3. Use Light Emitting Diode (LED) up-light because it is not as powerful as other sources of light.
4. Use full-cut-off luminaries wherever such equipment is available. Use semi-cut-off luminaries if the full-cut-off luminaries are not available.
5. Forbid the lighting of building facade.
6. Forbid the use of decorating lighting, and lighting for signs, billboards, etc.

Port of Oakland Exterior Lighting Policy

The Port of Oakland's *Exterior Lighting Policy* prescribes measures to prevent light pollution from development and operations in all areas under the jurisdiction of the Port. The General Mitigation Measures and Practices of the policy identify that the "Design of exterior lighting shall generally follow Illuminating Engineering Society of North America (IESNA)- *Recommended Lighting Levels for Exterior Lighting*. The *Dark-Sky Association* further recommends that lighting designers minimize illumination levels, pole height and spacing, glare, lighting system depreciation and life-cycle cost. Additionally, lighting pollution mitigation measures include specifying full cutoff light fixtures, horizontally oriented lamps (bulb), and low-reflectivity architectural surfaces.

IV. VISUAL RESOURCES AND RESOURCE CHANGE

Visual resources of the Project setting are defined and identified below by assessing *visual character* and *visual quality* in the Project corridor. *Resource change* is assessed by evaluating the visual character and the visual quality of the visual resources that comprise the Project corridor before and after the construction of the proposed Project.

The visual character of the proposed Project would be compatible with the existing visual character of the corridor. The Link structure would be of similar height and made of similar materials to the many elevated roadways in the vicinity but would be narrower with less substantial support columns. Because of the predominance of similar transportation structures and materials, it is anticipated that the Link would blend very well with the existing visual landscape in terms of form, line, color, texture.

The proposed Project would not alter the visual quality of the existing corridor. The Project vicinity is highly industrialized and composed of large parcels of land with substantial paved surfaces, aerial transportation structures and concrete pillars with graffiti, utility poles and lights, and ruderal vegetation (with the exception of Mandela Parkway and the landscaped block of West Grand Avenue). The vividness is of the Project vicinity is low, intactness is moderate, and unity is low to moderate. The resulting visual quality is moderately low. After the proposed Project is built, the existing visual quality of the Project area would remain the same if not improved by Project features that would beautify West Grand Avenue and provide access to views for recreationists.

Therefore, Resource Change (changes to visual resources as measured by changes in visual character and visual quality) would be low.

V. VIEWERS AND VIEWER RESPONSE

Neighbors (people with views *to* the road) and *highway and roadway users* (people with views *from* the road) would not be affected by the proposed Project. Neighbors include workers and visitors of the Port and other businesses in the vicinity and recreationists (pedestrians/joggers/bicyclists) using Mandela Parkway and other local surface streets and sidewalks. A virtual public meeting was conducted on December 17, 2020, for the Project; email comment-card submissions received from the public during this process express positive support for the Project (BATA 2020). Therefore, it is determined that

neighbors would have low sensitivity due to focus on work activities and limited availability of extended views of the Project site. Recreationists would have moderate-low sensitivity to changes resulting from the Project because while Mandela Parkway offers a pleasant viewer experience, recreational viewers are transient through the parkway, do not spend extended times there, and pass by the Project area fairly quickly. Recreational viewers on local roadways are also transient. Highway and roadway users include travelers on freeways and local roadways in the vicinity that would have low sensitivity to changes resulting from the proposed Project due to the focus on driving in an area with complex driving patterns, at higher rates of speed and with limited availability of extended views of the Project site. It is anticipated that the average response of all viewer groups would be low.

VI. VISUAL IMPACT

Visual impacts are determined by assessing changes to the visual resources and predicting viewer response to those changes. There are no officially designated state scenic routes in or around the Project area that would be affected by the Project, and thus there would be no impact. However, I-80 west of the MacArthur Maze is an eligible state scenic highway.

Construction

Construction of the Project would occur in an industrial area that lacks highly sensitive viewers. It would occur between 7:00 a.m. and 6:00 p.m., Monday through Saturday, over a 2-year period of time. Therefore, construction would occur during daylight hours, would not require disruptive high intensity lighting for nighttime construction, would be short-term and temporary in nature, and would not affect sensitive viewers. Temporary construction impacts would also be experienced by recreational viewers who use the Bay Trail connection to Burma Road during construction of the Segment 4 switchback and Segment 5 connection to the Bay Trail (see **Figure 8a**). Viewers would see heavy equipment, the erection of falsework, and construction of the switchback and touchdown. No closures would be anticipated to construct the Link connection and touchdown to the Bay Trail. However, recreational viewers would either be restricted from using the Bay Trail connection to Burma Road for a short period of time or, to avoid trail closures, be rerouted to the adjacent paved roadway with a temporary trail realignment during construction of the temporary falsework for the switchback. Trail closures, if needed, would be minimized and all efforts would be made to keep the trail operationally safe at all times. Visual impacts resulting from Project construction would be low.

Visual Character

The existing visual character of the Project vicinity would not be degraded or substantially altered by the Project. As noted in the project description, the final design process would include community workshops to solicit community input on Project aesthetics and landscaping, ensuring that the Project would incorporate design elements desired by the community. This would instill a feeling of pride and Project ownership and ensure that the Project would reflect the values and character of the community. The Project would introduce an elevated structure adjacent to West Grand Avenue, as shown on **Figures 4 through 8**. This structure would be made of similar materials to the many elevated roadways in the vicinity, but would be narrower with less substantial support columns, as seen on **Figure 12**, **Simulation 1**. Because of the predominance of similar transportation structures and materials, it is anticipated that the Link would blend very well with the existing visual landscape in an area lacking highly sensitive viewers. The Project would also include 8-feet high fencing. The type of fencing has not been determined, but it is likely to be chain-link fencing along West Grand Avenue crossing over the railroad tracks. Fencing along other segments may be white, if community input is favorable, to create a sense of connectivity and tie into the theme of the fencing along the Bay Trail. Although fencing may vary slightly

Simulation 1

Existing Conditions. View of West Grand Avenue from Maritime Street.

Simulated Conditions.

Figure 12

in type, fencing along roadways, as well as the Bay Trail, is a common visual feature in the vicinity, including West Grand Avenue and elevated transportation structures. Therefore, fencing is a pre-existing visual condition, and the proposed fencing would not be different enough to standout, visually, and contrast with the existing visual environment.

Link Segment 1, between Mandela Parkway and the West Grand Avenue overcrossing, may result in the removal of some of the existing landscaping associated with the sidewalks, as seen on **Figure 13**, **Simulation 2**. However, this would be minimized to the degree possible. As seen on **Figure 14**, **Simulation 3**, which is from the same vantage point as Simulation 2, a seat wall may be constructed as a design alternative. As seen in Simulations 2 and 3, the final design of the landscaping, seat wall, and signage may vary; however, the proposed landscaping would help retain the existing visual character, regardless of the variance. In addition, landscaping would help improve views from within the Peralta building by softening the visible landscape outside. Landscaping would also help improve views of the building by providing aesthetic appeal through a unified design, with greater separation between the building and the busy roadway. The City would review the final landscaping plans for compliance with City permit requirements with respect to tree type, spacing, setback, and required maintenance. It may also be perceived as an improvement to visual conditions for recreationists, nearby businesses, roadway travelers, and businesses and residents inside the Peralta building because signage at the Link entry, the Link itself, and new landscaping would contribute to a sense of place and destination in an area that is not currently very pedestrian friendly. New signage and striping for wayfinding would be similar to existing signage in the Project area, including Bay Trail Signage associated with Mandela Parkway. The Link may be painted green for safety; and although the green markings on the roadway would slightly stand out, it would not reduce the existing visual character of the industrial and commercial environment but would make the area more pedestrian friendly. Lookout areas along the elevated portions of the Link would not stand out as a visually separate structure from the Link segments, and associated landscaping would soften the visual appearance of an area that is dominated by hardscape and large, elevated transportation structures.

Views of the Link Segment 1 from Mandela Parkway are the most sensitive and would be minimally affected by the Project, as illustrated in Simulations 2 and 3 and described above. Link Segment 1 would be the most visible and result in limited visual changes. The primary changes that would be visible would be the at-grade portions of the Link, new landscaping in the medians, and minimal removal of existing sidewalk streetscape (i.e., existing trees that might be removed because of the Project). This portion of roadway is already paved so that the Link would not greatly alter the appearance of the view or increase the amount of pavement. The landscape median associated with Segment 1 would provide a visual separation between the roadway and Link and would reduce the available roadway width for vehicular traffic, as shown in the simulations. However, it would aid in further softening and improving the visual appearance of this portion of West Grand Avenue, in combination with the existing streetscape, and reduce the appearance of any streetscape removed as a result of the Project at this location. Overall, the changes at the point of connection to Mandela Parkway, an area where there is a higher concentration of residential, recreational, and commercial viewers, are likely to be viewed positively by the community and adjacent neighbors, especially because the final design process would include community workshops to solicit community input on Project aesthetics and landscaping. This would ensure that the Project would incorporate design elements that reflect the values and character desired by the community, which would instill a feeling of pride and Project ownership.

Views of the Link Segments 2 through 5 from Mandela Parkway would be limited and obscured by the existing streetscape and proposed median associated with Segment 1. Only glimpses of the elevated Link structure would be available as recreational viewers pass through Mandela Parkway because the

Simulation 2

Existing Conditions. View westward of West Grand Avenue from Mandela Parkway.

Simulated Conditions.
Note: Figures 13 and 14 show the types of landscaping and signage under consideration.

Figure 13

Simulation 3

Existing Conditions. View westward of West Grand Avenue from Mandela Parkway.

Simulated Conditions.
Note: Figures 13 and 14 show the types of landscaping and signage under consideration.

Figure 14

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structure would blend with the existing visual environment. Therefore, viewers most likely would not focus on the structure in passing.

Views of Segment 2, in the area where the elevated structure starts to ramp up from the end of Segment 1, would not greatly affect neighboring viewers. As seen on **Figure 15**, **Simulation 4**, buildings located immediately next to Segment 2, south of West Grand Avenue, include large warehouse structures that do not have windows that face the Project. Businesses north of West Grand Avenue also do not have windows that face the Project. Furthermore, these businesses have privacy fencing that limits views to the Project or limited ground-level views because of the elevated West Grand Avenue. Therefore, businesses to the north would have limited or no views of the Link. The primary viewers who would see the new elevated Link would be those in the Lyft Oakland Hub parking lot along West Grand Avenue, pedestrians on adjacent sidewalks, and roadway users. As seen on **Figure 15**, **Simulation 4**, the Link would not detract from views and would appear to be a visual extension of West Grand Avenue. The Link would result in closure of the West Grand Avenue alley; Willow Street would dead-end into the structure, although sidewalk access would be retained for pedestrians. However, as seen on **Figure 15**, **Simulation 4, and Figure 16**, **Simulation 5**, the new structure would be in keeping with the existing structure that elevates West Grand Avenue, cover up the existing graffiti, and remove a section of the alley between Willow Street and Wood Street where illegal dumping occurs. As described above, viewers would not be negatively affected by the Project because community design input would ensure that the Project would incorporate design elements that reflect the values and character desired by the community, which would instill a feeling of pride and Project ownership. In addition, although not currently built, the 2011–2195 Wood Street project would construct a multi-level, mixed-use development with 235 residential units, if the project moves forward. That project would introduce additional residential and commercial viewers. This has the potential to affect future residences. However, residents would be aware of the Link and West Grand Avenue, which is already an elevated transportation structure, lit with overhead streetlights, and adjacent to the future development site. Therefore, it is not anticipated that residents would be negatively affected. Supplemental landscaping and artwork within Mandela Parkway would be beneficial, providing visual interest and enhancing the existing visual landscape at this location.

Link Segment 3 would travel over tracks (**Figure 6**). As seen on **Figure 17**, **Simulation 6**, the Link would not detract from views and would appear to be a visual extension of West Grand Avenue from most locations, as seen on **Figure 15, Simulation 4**. The pathway would blend very well with the existing environment, even with white fencing, which tends to attract views. Furthermore, the pathway would not detract from the existing visual character and quality of views along the roadways. Travelers and pedestrians on Frontage Road and West Grand Avenue would not experience a notable difference in views. In addition, pedestrians along West Grand Avenue would be able to use the pathway, which would be a safer travel route and most likely perceived to be beneficial.

Link Segment 4 could include access ramps on the east and/or west side of Maritime Street (**Figures 3 and 7**). As seen on **Figure 12**, **Simulation 1**, the ramp on the east side of Maritime Street would introduce a new structure into the viewshed, but views from this vantage point would not be greatly affected because trees along Maritime Street block much of the view of the ramp. Therefore, the ramp would not stand out in this view. In addition, this area is already dominated by transportation structures and industrial uses. The new ramp would add a similar visual element to this view and would not greatly alter or degrade existing views. The same would be true of a ramp on the west side of Maritime Street. Link Segment 4 would also include a switchback ramp that would connect to the touchdown at Segment 5, which ends at the Bay Trail. As seen on **Figure 18**, **Simulation 7**, the Link switchback and touchdown would not detract from views because this area is already dominated by transportation

Simulation 4

Existing Conditions. View of warehouse on West Grand Avenue alley.

Simulated Conditions.

Figure 15

Simulation 5

Existing Conditions. View of West Grand Avenue alley from Willow Street.

Simulated Conditions.

Figure 16

Simulation 6

Existing Conditions. View of West Grand Avenue from Frontage Road.

Simulated Conditions.

Figure 17

Simulation 7

Existing Conditions. View northward from Burma Road.

Simulated Conditions.

Figure 18

structures and industrial uses. The scale of the Link structure would be smaller than that of the surrounding freeway infrastructure. However, the new structure would be similar in form and color and therefore in keeping with existing elevated transportation structures in the area. The addition of this new structure would not detract from views seen by recreationists, roadway travelers, or people within businesses in the area. Lastly, as seen on **Figure 19, Simulation 8**, the Link switchback and touchdown would not greatly alter views from I-80. Although the structure would be visible, it would be part of a view that is dominated by freeway infrastructure and industrial land uses in an area that is undergoing extensive redevelopment, which travelers along I-80 are accustomed to seeing. In addition, travelers along I-80 would pass by the Link at a high rate of speed. This segment of the freeway requires considerable attention because of merging traffic patterns. Therefore, views would be fleeting

The Class II bike lanes on local surface streets would not greatly affect the visual environment because they would blend and appear as a visual extension of the roadways on which they are constructed. The cul-de-sac at Willow Street and bollards at Campbell Street would limit vehicular access but would not greatly alter the visual environment because dead-ends are common in the Project vicinity and because of the availability of alternate routes.

The Wood Street parking lot would also not greatly affect the visual environment. This area is covered with ruderal vegetation and surrounded by elevated transportation structures, paved roadways, utility infrastructure, warehouses, and lacking sensitive viewers (refer to Photo 7). Landscaping would be beneficial because trees would provide visual interest and shade in an area that is currently very exposed, improving aesthetics in this industrial location.

Therefore, overall visual impacts of the Project on the existing visual character and quality of the Project area would be low, if not beneficial.

Consistency with Regulations Governing Scenic Quality in an Urbanized Area

As described above, the existing visual character of the Project vicinity would not be degraded or substantially altered by the Project. The Project would introduce an elevated structure adjacent to West Grand Avenue. The structure would be made of materials similar to those used on the many elevated roadways in the vicinity and would blend well with the existing visual landscape in an area, which lacks highly sensitive viewers. Class II bike lanes on local surface streets would not greatly affect the visual environment because they would appear as a visual extension of the roadways on which they are constructed. Some existing landscaping in the Project area may be removed, but removals would be minimized to the degree possible. In addition, proposed landscaping would aid in retaining the existing visual character, even though the final design of the landscaping (e.g., inclusion of a seat wall and signage options) may change. Supplemental landscaping and landscape features (e.g., signage, seat wall, artwork) would improve the visual appearance of the Project area, in combination with the existing streetscape, and reduce the appearance of any streetscape removed as a result of the Project. Supplemental landscaping and landscape features may also be perceived as beneficial because signage at the Link entry, the Link itself, and new landscaping would provide visual interest, contribute to a creating a sense of place and destination, and enhance the existing visual landscape of the Project area. Green pavement markings, delineating the pathway, would not reduce the existing visual character of the industrial and commercial environment but instead make the area more pedestrian friendly. Lookout areas along the elevated portions of the Link would not stand out as visually separate structures from the Link segments, and associated landscaping would soften the visual appearance of areas that are dominated by hardscape and elevated transportation structures.

The proposed ramp on the east side of Maritime Street would introduce a new structure into the viewshed, but views from this area are already dominated by transportation structures and industrial

Simulation 8

Existing Conditions. View eastward from I-80.

Simulated Conditions.

Figure 19

uses. The proposed fencing would not be different enough to stand out visually and contrast with the existing visual environment (fencing is a pre-existing visual condition). Operation and maintenance would preserve the visual quality of the Link and would not introduce discordant visual elements. The Link would not result in notable changes in views from local scenic roadways. Trash removal would aid in improving portions of the Project area. Therefore, overall visual changes to the existing visual character and quality of the Project area would be low, if not beneficial, and would provide a linkage to the Bay Trail, Bay Bridge, and shoreline areas. As a result, the proposed Project is highly compatible with local regulations governing scenic quality set forth in the City's General Plan.

The proposed Project includes bikeways and pedestrian walks (Policy T3.5). Existing utilities are already underground (Policy N12.4) in much of this area, and the proposed Project does not propose aboveground utilities. The design of the proposed Project and effects on the existing visual character and quality of the site, summarized above from the 2015 VIA, ensure that the proposed Project would protect existing activities (City of Oakland General Plan Policy l/C4.1), improve streetscapes (Policy T6.2), make the waterfront accessible (Policy T6.3), protect scenic routes (Policy T6.5), mark significant sites (Policy N9.5), and support neighborhood "activity centers" (Policy N10.1). Therefore, the proposed Project would not conflict with the Land Use and Transportation Element of the City's General Plan.

The proposed Project would protect park open space (City of Oakland General Plan Policy OS-2.1), and local street closures would aid in creating a linear parkway (Policy OS-2.6). Furthermore, the Project would maintain open space buffers along freeways (Policy OS-3.6), improve trail connections within Oakland (Policy OS-5.1), use joint rights-of-way (Policy OS-5.2), follow the City's trail design principles (Policy OS-5.3), improve lateral access and linkages to the Oakland shoreline (Policy OS-7.5), maintain and enhance the city's edge (Policy OS-9.2), improve city gateways (Policy OS-9.3), protect the character of existing scenic views in Oakland (Policy OS-10.1), minimize adverse visual impacts (Policy OS-10.2), enhance Oakland's visual resources (Policy OS-10.3), retain City-owned open space in scenic corridors (Policy OS-10.4), include public art that would be sited appropriately (Policies OS-11.3 and OS-11.4), locate the Link in an appropriate area (Policy REC-3.3), make use of underutilized areas (Policy REC-6.3), and be respectful of local history (Policy REC-7.6). In addition, the City would review the proposed Project's final landscaping plans for compliance with City permit requirements with respect to tree type, spacing, setback, and required maintenance. This would ensure compliance with Policies OS-12.1, OS-12.3, CO-4.2, and CO-7.4. Therefore, the proposed Project would not conflict with the OSCAR Element of the City's General Plan. It would also be consistent with the West Oakland Planning Area Strategy within the OSCAR because the proposed Project would improve shoreline access, create connections to parks in West Oakland, and include street tree planting to help "green" the city.

Because the Link would be mostly obscured from view and would blend with views, where available, impacts on scenic highways would be low. Therefore, the proposed Project would not conflict with the Scenic Highways Element of the City's General Plan.

As with the original project evaluated in the 2015 VIA, the proposed Project is not anticipated to result in any impacts that would result in a substantial, adverse change in light and glare. In addition, the proposed Project would be required to comply with the City's and Port's lighting standards and policies. Therefore, the proposed Project would be consistent with standards and policies contained in the City of Oakland's adopted *Outdoor Lighting Standards* and the Port of Oakland's *Exterior Lighting Policy.*

Overall, the proposed Project would be compatible with applicable zoning and other regulations governing scenic quality and would not conflict with such zoning and regulations.

Scenic Vistas

Elevated vista views from West Grand Avenue are very limited, and most are industrial in nature and not considered scenic. There are scenic vista views near the West Grand Avenue intersection with I-80, which is located closer to the Bay, because there are views of the Bay and surrounding hills and city skylines. The Project would not impede vista views because the elevated segments of the Link are even with or slightly lower than West Grand Avenue (refer to the cross sections shown on **Figures 4, 6b, 7b, and 8b**. While Segment 2 is slightly higher than West Grand Avenue, as shown on **Figure 5b**, this portion of the roadway does not have scenic vista views. Where visible, the Link would blend with vista views available from roadways.

The Project would provide an elevated vantage where viewers can have vista views from the elevated portions of the Link, in safety, and pause to take in views. This experience is not currently provided along West Grand Avenue in the Project area because it is a very busy roadway. Therefore, overall visual impacts to the existing scenic vista views would also be low, if not beneficial.

Scenic Highways

In the Project area, I-80 is an eligible state scenic highway but is not officially designated. Therefore, there would be no impact to state scenic highways. Views of the Link from much of I-80 (eligible city scenic highway) would be obscured by elevated transportation structures and industrial uses. In particular, views of the Link from the eastbound lanes, which face the Link, are obscured by the West Grand Avenue/Maritime Street flyover, which is the horseshoe-shaped elevated structure extending from westbound I-80 to eastbound West Grand Avenue and Maritime Street. The Link would not be visible on approach from westbound lanes because West Grand Avenue would block views of the Link, which is located on the other side of the roadway. The Link could be somewhat visible from this flyover and from the eastbound I-80 connector ramp to I-880 southbound, but the views would be fleeting and somewhat obstructed. As seen on **Figure 19, Simulation 8**, the Link switchback and touchdown would not greatly alter views from I-80. Although the structure would be visible, it would be part of a view that is dominated by freeway infrastructure and industrial land uses in an area that is undergoing extensive redevelopment, which travelers along I-80 are accustomed to seeing. In addition, travelers along I-80 would pass by the Link at a high rate of speed. This segment of the freeway requires considerable attention because of merging traffic patterns. Therefore, views would be fleeting. An example of how the elevated Link would blend with existing roadways is shown in **Figure 12, Simulation 1** (View of West Grand Avenue from Maritime Street). Because the Link would be mostly obscured from view and blend with views, where available, impacts on scenic highways would be low.

sun is at solar noon, buildings along the West Grand Avenue alley cast shadows in the afternoon, leaving the alley mostly shaded.

Light and Glare

The Project would increase shade incrementally. As seen on **Figure 12**, **Simulation 1**, shade cast by the Link structure would not be discernable from existing shade cast by West Grand Avenue; this would be true along much of the Link. In the morning, West Grand Avenue casts a slight shadow on the West Grand Avenue alley as the roadway elevates westward from its touchdown at Campbell Street. As seen on **Figure 16**, **Simulation 5**, the Link structure would cast a slight shadow. However, although the alley is not shaded when the sun is at solar noon, buildings along the south side of the West Grand Avenue alley cast shadows in the afternoon, leaving the alley mostly shaded. As seen on **Figure 15**, **Simulations 4** and **5**, this would result in a situation where the Link would be shaded, just like the alley. Near its connection to the Bay Trail, the Link would cause shading because of the switchback structure. However, a large portion of the Bay Trail near the connection to Burma Road is already shaded because of elevated

roadway infrastructure that casts shadows on the trail. As seen on **Figure 18**, **Simulation 7**, the Link switchback would not be as tall as surrounding infrastructure and would cast a shadow on only a small area where it crosses the Bay Trail. Recreationists on the trail are accustomed to such shading; the trail is already shaded quite a bit in this area. Therefore, shading caused by the Link is considered to be negligible because of the shading caused by other transportation infrastructure and buildings in the area, as well as the nominal amount of shading caused by Link structures.

The Project would include low-level lighting along the Link that would be designed to prevent light pollution. West Grand Avenue currently has street lighting along much of its length in the Project area, and vehicle headlights also increase the amount of nighttime lighting. New low-level lighting associated with the Link would be negligible compared to existing conditions because it would be side mounted in the barrier along the elevated segments. The 1- to 2-foot-candles would light a 1- to 2-foot area, which would not be very noticeable to passing drivers.

The Project could also include some overhead lights at the top of the fencing along the elevated portions of the Link if deemed necessary for safety. Lighting along the at-grade portions of the Link and at the Wood Street parking lot would be provided by new or existing streetlights or pedestrian light standards. There is existing lighting along Wood Street and security lighting at nearby warehouses. Proposed overhead lighting and pedestrian light standards would constitute a minimal change in the amount of lighting introduced to the area, given the existing sources of light in the area. Proposed lighting at the parking lot would constitute a minimal change in the amount of lighting introduced to the area. Furthermore, the Project would be required to comply with the City of Oakland's adopted Outdoor Lighting Standards and the Port of Oakland's Exterior Lighting Policy, ensuring that impacts from lighting would be minimized. With these measures in place, it is not anticipated that future residents at 2011–2195 Wood Street would be negatively affected by lighting associated with the Project. The elevated transportation structure is lit with overhead LED streetlights that provide amply roadway lighting, which would be seen at the future development site. Project lighting would not substantially increase lighting beyond that created by the streetlights on West Grand Avenue. In addition, once trees mature, lighting would be screened and filtered by the trees' foliage.

Glare resulting from the Project would be negligible, as seen in all eight simulations, due to the predominance of pavement and hardscape features present in the Project vicinity. Similarly, shading introduced by the structure would be consistent with existing transportation structures and would result in a negligible increase is shading. The proposed vegetation would reduce glare. Therefore, impacts resulting from light and glare would be low.

VII. AVOIDANCE AND MINIMIZATION MEASURES

Avoidance or minimization measures have been identified and can lessen visual impacts caused by the Project. Also, the inclusion of aesthetic features in the Project design previously discussed can help generate public acceptance.

This section describes additional avoidance and/or minimization measures to address specific visual impacts. These will be designed and implemented with concurrence of the District Landscape Architect. No mitigation measures have been identified for the Project. The following avoidance or minimization measures, to minimize visual impacts, will be incorporated into the Project:

1. Community input will ultimately drive the design on aesthetics and finishes used for support columns, elevated structures, and retaining walls so that they incorporate design elements desired

by the community. However, at a minimum, Aa roughened, textured surface shall be used for support columns, elevated structures, and retaining walls. This will soften the verticality of surfaces by providing visual texture and will reduce the amount of smooth surfaces that can reflect light, reducing glare, and be attractive for graffiti. A different texture than the minimum requirement may be used if community input favors such a change.

2. Vegetation that is destroyed, damaged, or removed by the Project or through incidental construction activities will be replaced, irrigated, and maintained during a plant establishment period. The plant establishment period for plants installed as part of the Project will be 3 years (5 years for plants installed through mitigation). In addition, all disturbed areas shall be restored to their previous condition or better. Disturbed areas will be hydroseeded to blend the area into the surrounding context. In addition, tree and shrub planting may be feasible in disturbed areas, where necessary.

VIII. SOURCES

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Appendix A. Questionnaire to Determine Visual Impact Assessment Level

Questionnaire to Determine Visual Impact Assessment (VIA) Level

Use the following questions and subsequent score as a guide to help determine the appropriate level of VIA documentation. This questionnaire assists the VIA preparer (i.e. Landscape Architect) in estimating the probable visual impacts of a proposed project on the environment and in understanding the degree and breadth of the possible visual issues. The goal is to develop a suitable document strategy that is thorough, concise and defensible.

Enter the project name and consider each of the ten questions below. Select the response that most closely applies to the proposed project and corresponding number on the right side of the table. Points are automatically computed at the bottom of the table and the total score should be matched to one of the five groups of scores at the end of the questionnaire that include recommended levels of VIA study and associated annotated outlines (i.e., minor, moderate, advanced/complex).

This scoring system should be used as a preliminary guide and should not be used as a substitute for objective analysis on the part of the preparer. Although the total score may recommend a certain level of VIA document, circumstances associated with any one of the ten question-areas may indicate the need to elevate the VIA to a greater level of detail. For projects done by others on the State Highway System, the District Landscape Architect should be consulted when scoping the VIA level and provide concurrence on the level of analysis used.

Calculate VIA Level Score

PROJECT NAME: Gateway Bike Path	
CHANGE TO VISUAL ENVIRONMENT	
1. Will the project result in a noticeable change in the physical characteristics of the existing environment? *Consider all project components and construction impacts - both permanent and temporary, including landform changes, structures, noise barriers, vegetation removal, railing, signage, and contractor activities.*	Low Level of Change (1 point) ▼
2. Will the project complement or contrast with the visual character desired by the community? Evaluate the scale and extent of the project features compared to the surrounding scale of the community. Is the project likely to give an urban appearance to an existing rural or suburban community? Do you anticipate that the change will be viewed by the public as positive or negative? Research planning documents, or talk with local planners and community representatives to understand the type of visual environment local residents envision for their community.	High Compatibility (1 point) ▼
3. What level of local concern is there for the types of project features (e.g., bridge structures, large excavations, sound barriers, or median planting removal) and construction impacts that are proposed?	Moderate Concern (2 points) ▼

Certain project improvements can be of special interest to local citizens, causing a heightened level of public concern, and requiring a more focused visual analysis.	
4. Will the project require redesign or realignment to minimize adverse change or will mitigation, such as landscape or architectural treatment, likely be necessary? Consider the type of changes caused by the project, i.e., can undesirable views be screened or will desirable views be permanently obscured so a redesign should be considered?	No Mitigation Likely (0 points) ▼
5. Will this project, when seen collectively with other projects, result in an aggregate adverse change (cumulative impacts) in overall visual quality or character? Identify any projects (both Caltrans and local) in the area that have been constructed in recent years and those currently planned for future construction. The window of time and the extent of area applicable to possible cumulative impacts should be based on a reasonable anticipation of the viewing public's perception.	Cumulative Impacts Unlikely to Occur (1 point) ▼
VIEWER SENSITIVITY	
1. What is the potential that the project proposal will be controversial within the community, or opposed by any organized group? This can be researched initially by talking with Caltrans and local agency management and staff familiar with the affected community's sentiments as evidenced by past projects and/or current information.	Low Potential (1 point) ▼
2. How sensitive are potential viewer-groups likely to be regarding visible changes proposed by the project? Consider among other factors the number of viewers within the group, probable viewer expectations, activities, viewing duration, and orientation. The expected viewer sensitivity level may be scoped by applying professional judgment, and by soliciting information from other Caltrans staff, local agencies and community representatives familiar with the affected community's sentiments and demonstrated concerns.	Moderate Sensitivity (2 points) ▼
3. To what degree does the project's aesthetic approach appear to be consistent with applicable laws, ordinances, regulations, policies or standards? Although the State is not always required to comply	

with local planning ordinances, these documents are critical in understanding the importance that communities place on aesthetic issues. The Caltrans Environmental Planning branch may have copies of the planning documents that pertain to the project. If not, this information can be obtained by contacting the local planning department. Also, many local and state planning documents can be found online at the California Land Use Planning Network.	High Compatibility (1 point) ▼
4. Are permits going to be required by outside regulatory agencies (i.e., Federal, State, or local)? Permit requirements can have an unintended consequence on the visual environment. Anticipated permits, as well as specific permit requirements - which are defined by the permitter, may be determined by talking with the project Environmental Planner and Project Engineer. Note: coordinate with the Caltrans representative responsible for obtaining the permit prior to communicating directly with any permitting agency.	Yes (3 points) ▼
5. Will the project sponsor or public benefit from a more detailed visual analysis in order to help reach consensus on a course of action to address potential visual impacts? Consider the proposed project features, possible visual impacts, and probable mitigation recommendations.	Yes (3 points) ▼

Calculate Total

It is recommended that you print a copy of these calculations for the project file.

PROJECT SCORE: 15

Select An Outline Based Upon Project Score

The total score will indicate the recommended VIA level for the project. In addition to considering circumstances relating to any one of the ten questions-areas that would justify elevating the VIA level, also consider any other project factors that would have an affect on level selection.

SCORE 6-9

No noticeable physical changes to the environment are proposed and no further analysis is required. Print out a copy of this completed questionnaire for your project file or Preliminary Environmental Study (PES).

SCORE 10-14

A brief **Memorandum** (see sample) addressing visual issues and providing a rationale for why no formal analysis is required.

SCORE 15-19

An abbreviated VIA is appropriate in this case. The assessment would briefly describe project features, impacts and any avoidance and minimization measures. Visual simulations would be optional. Go to the **Directions** for using and accessing the VIA Annotated Outlines.

SCORE 20-24

A fully developed VIA is appropriate. This technical study will likely receive public review. Go to the **Directions** for using and accessing the VIA Annotated Outlines.

SCORE 25-30

A fully developed VIA is appropriate that includes photo simulations. It is appropriate to alert the Project Development Team to the potential for highly adverse impacts and to consider project alternatives to avoid those impacts. Go to the **Directions** for using and accessing the VIA Annotated Outlines.