FEHR PEERS

Memorandum

Date: December 16, 2019

To: Alameda CTC

From: Robert Rees and Ronald Ramos, Fehr & Peers

Subject: SR-262 (Mission Boulevard) Cross Connector Project – Local Street Analysis

OK18-0250.00

This memorandum studies the existing traffic operations of the local street intersections on the Mission Blvd/SR-262 (SR-262) corridor and select locations on parallel corridors to SR-262. Additionally, this document identifies the travel patterns between the Interstate 880 (I-880) and Interstate 680 (I-680) as they pass through the cities of Fremont and Milpitas. A separate evaluation of existing freeway operating conditions along I-680 and I-880 is provided in the *State Route 262 (Mission Boulevard) Cross Connector Project Final Existing Conditions Operations Analysis Report* (September 2019). Both interstates are key regional corridors in the Bay Area with high volumes and heavy congestion. Typically, as a result of the high traffic volumes that access the freeway system, the ramp intersections with the local streets often have the poorest operating conditions.

The on-alignment (i.e. State Highway System or in Caltrans right of way) intersections analyzed in this memorandum are along the SR-262/Mission Boulevard and Warren Avenue corridors, and the off-alignment intersections (i.e. not in Caltrans right of way) are along Auto Mall Parkway, South Grimmer Boulevard, Kato-Scott Creek Road, and Dixon Landing Road.

SR-262 is one of several east-west connectors between I-680 and I-880 in the City of Fremont, and it serves as a major corridor to an employment and manufacturing dense area. The area is prone to high traffic volumes that include trucks from the manufacturing facilities and pedestrian/bicycle traffic due to the employment centers and residential areas. The area is also well connected to transit with the Warm Springs BART station located between SR-262 and South Grimmer Boulevard.

Most traffic concerns on SR-262 occur due to the high volumes of traffic exiting and entering I-680 and I-880. Fremont's Mobility Action Plan (March 2019) identified the SR-262/I-680 interchange as the worst traffic "hot spot" in District 5, which encompasses the project study area. A top traffic concern for the District was neighborhood traffic intrusion.

Memo Organization

Project Description

SR-262, is a conventional highway located in the City of Fremont and serves as major east-west connector between I-680 and I-880 serving freight traffic, regional, and local commutes. SR-262 is also proximate to major economic drivers in the Bay Area such as manufacturing, information technology, and Silicon Valley. Additionally, SR-262 serves as a primary route to the Warm Spring/South Fremont BART station and Tesla. The housing/work imbalance between jobs in the Silicon Valley and housing in the Tri-Valley, Contra Costa County, and Central Valley, as well as growth in Fremont causes pass-through traffic on the corridor and through the area.

The Project, currently in the Project Initiation Document (PID) Phase, will propose a range of alternatives, primarily focusing on improvements to SR-262 between I-880 and I-680, and the extents of related SR-262 ramp modifications to/from I-880 and I-680. The premise of these improvements aims to reduce congestion and improve traffic flow for the local and regional transportation networks in the vicinity of SR-262, improve east-west regional connectivity in southern Alameda County, and encourage mode shift from single-occupancy vehicles to increase vehicle occupancy and person through-put by promoting multimodal components within the corridor.

This report evaluates existing traffic operations at intersections for the weekday morning (8:00 AM to 9:00 AM) and afternoon (5:00 PM to 6:00 PM) peak hours.

Study Area

The project study area for the local street analysis focused on SR-262 between I-880 and I-680 and east of I-680 where it becomes Mission Boulevard through the Curtner Road and Paseo Padre Parkway intersections; Warren Avenue from Landing Parkway to Warm Springs Boulevard; and Kato Road at the SR-262 ramps. The local street study also considered traffic operations at six intersections off the SR-262 corridor alignment. The study intersections and intersection

geometry as well as the peak hour traffic volumes are shown on **Figure 1**. In addition, **Figure 2** provides the bike and pedestrian volumes. The study intersections include:

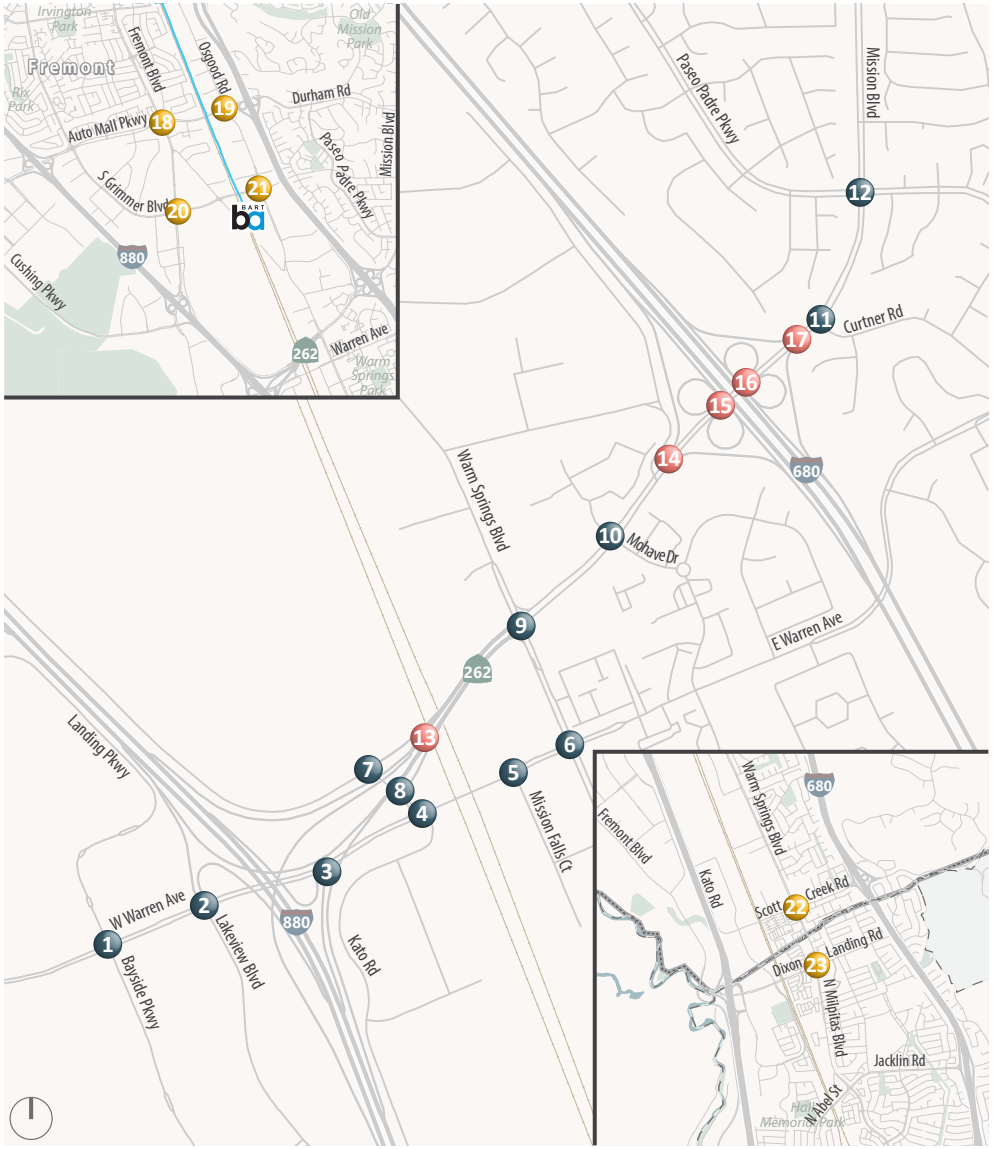
1. Warren Avenue at Landing Parkway/Bayside Parkway
2. Warren Avenue at Lakeview Boulevard/Southbound I-880 ramps
3. Warren Avenue at Northbound I-880 ramps
4. Warren Avenue at Kato Road
5. Warren Avenue at Mission Falls Court
6. Warren Avenue at Warm Springs Boulevard
7. Kato Road at SR-262 off-ramp
8. Kato Road at SR-262 on-ramp
9. SR-262 at Warm Springs Boulevard
10. SR-262 at Mohave Drive
11. Mission Boulevard at Curtner Road
12. Mission Boulevard at Paseo Padre Parkway
13. I-880 Ramps/ SR-262
14. Southbound I-680 Diagonal Ramps/ SR-262
15. Southbound I-680 Loop Ramps/ SR-262
16. Northbound I-680 Loop Ramps/ SR-262
17. Northbound I-680 Diagonal Ramps/ SR-262
18. Auto Mall Parkway at Fremont Boulevard
19. Auto Mall Parkway at Osgood Road
20. South Grimmer Boulevard at Fremont Boulevard
21. South Grimmer Boulevard at Osgood Road/Warm Springs Boulevard
22. Kato Road-Scott Creek Road at Warm Springs Boulevard
23. Dixon Landing Road at North Milpitas Boulevard

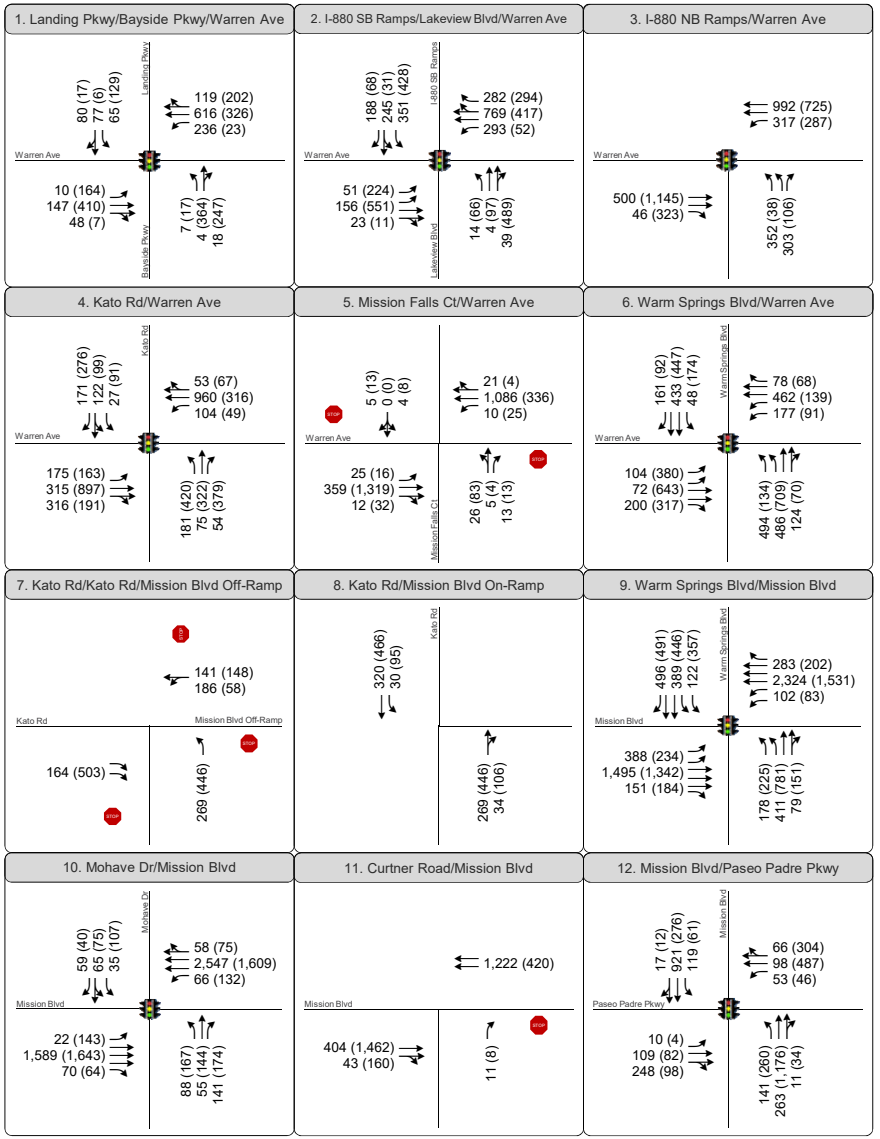
Existing Characteristics

Roadway System Descriptions

Intersections were selected for the local street study along SR-262 / Mission Boulevard as well as select intersections on parallel corridors to SR-262 including: Auto Mall Parkway, South Grimmer Boulevard, Warren Avenue, and Dixon Landing Road / Kato Road-Scott Creek Road.

SR-262 is an east-west Caltrans-designated conventional highway between I-680 and I-880 that serves regional, local, and freight traffic. The highway is divided by a raised median and provides three travel lanes for each direction with a posted speed of 45 miles per hour. Through the I-680/SR-262 interchange there are two travel lanes in each direction. East of I-680, Mission Boulevard continues north with the same cross section, intersecting I-680 at Interstate 238 (I-238). The local street study considers the Warm Springs and Mohave Drive intersections on SR-262 as well as Curtner Road and Paseo Parkway intersections on Mission Boulevard. These intersections were chosen for the local street study to understand how changes to the SR-262 corridor might influence changes in intersection operations as traffic transitions between the SR-262 and Mission Boulevard corridors.



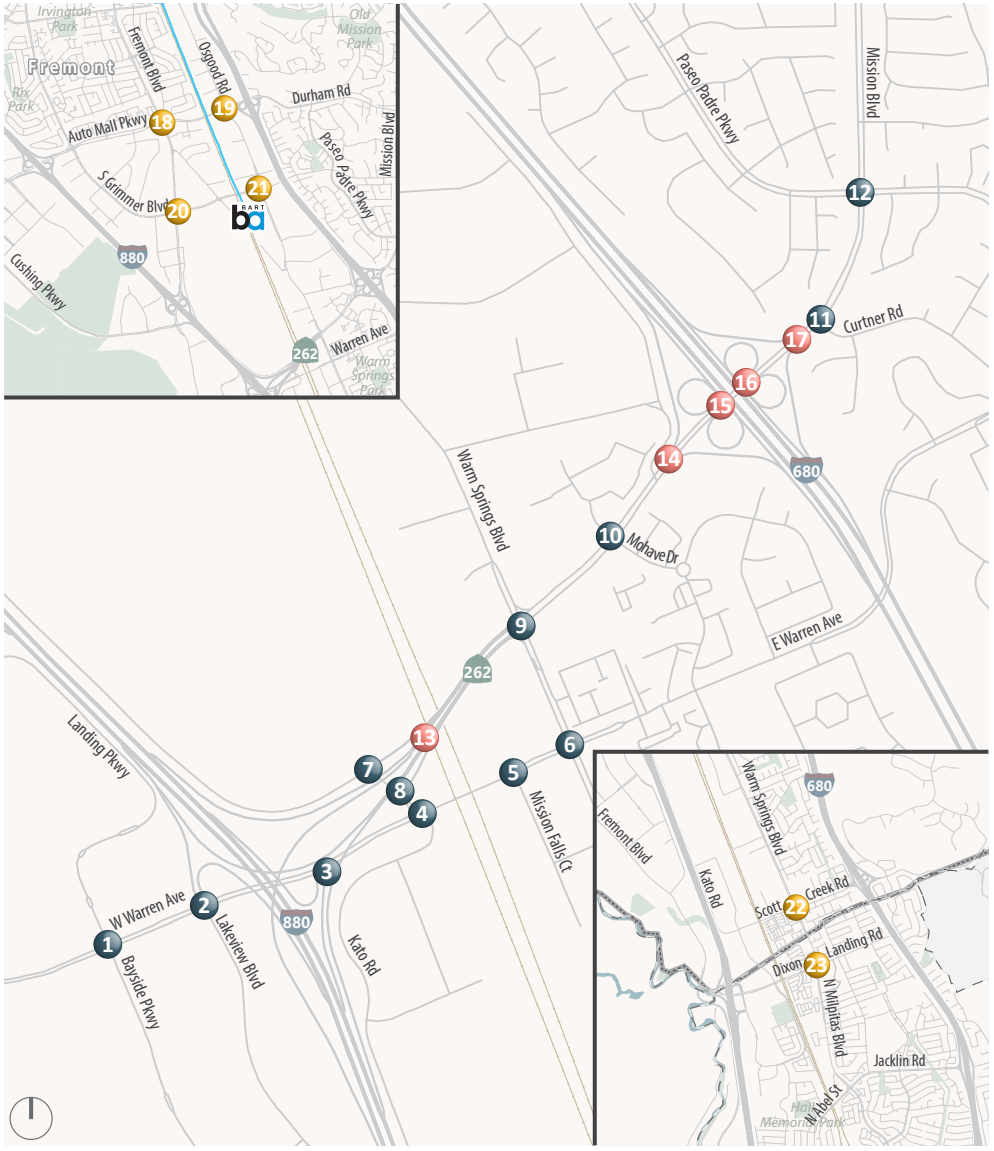


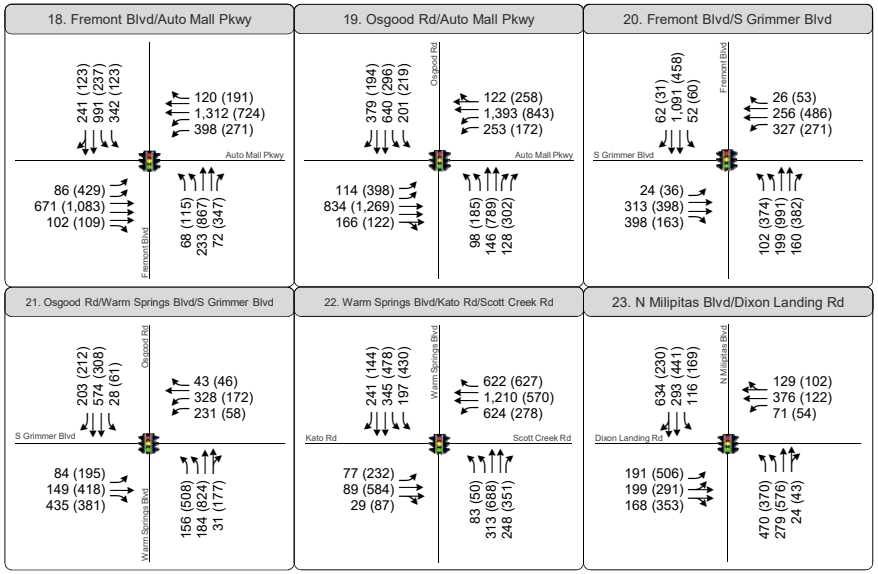
XX (YY) AM (PM) Peak Hour Traffic Volumes Signalized Intersection Stop Sign

On-Alignment Study Intersection # Ramp Intersection # Off-Alignment Study Intersection

Figure 1a

Existing Conditions Peak Hour Intersection Volumes, Lane Configurations and Traffic Controls





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

Signalized Intersection

Stop Sign

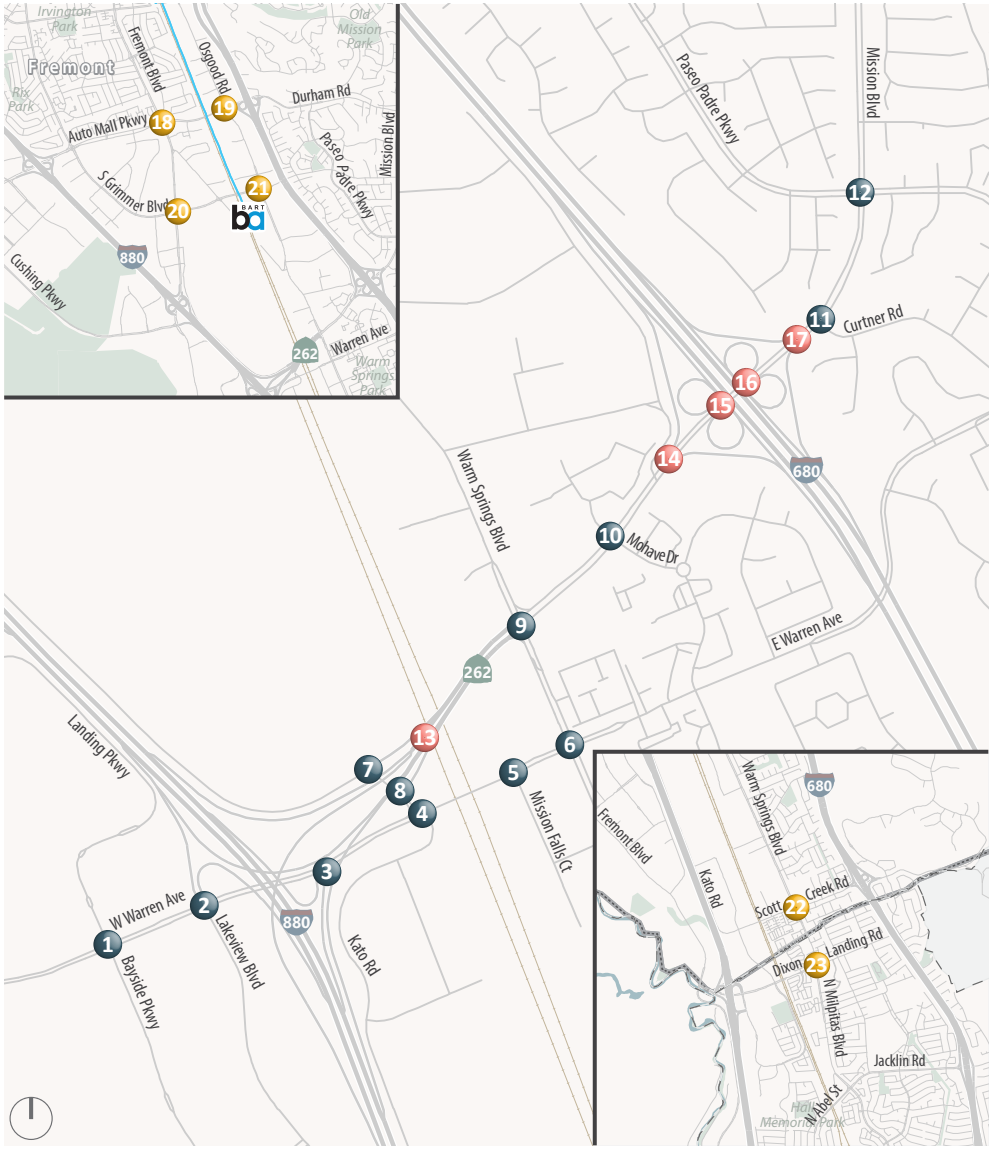
On-Alignment Study Intersection

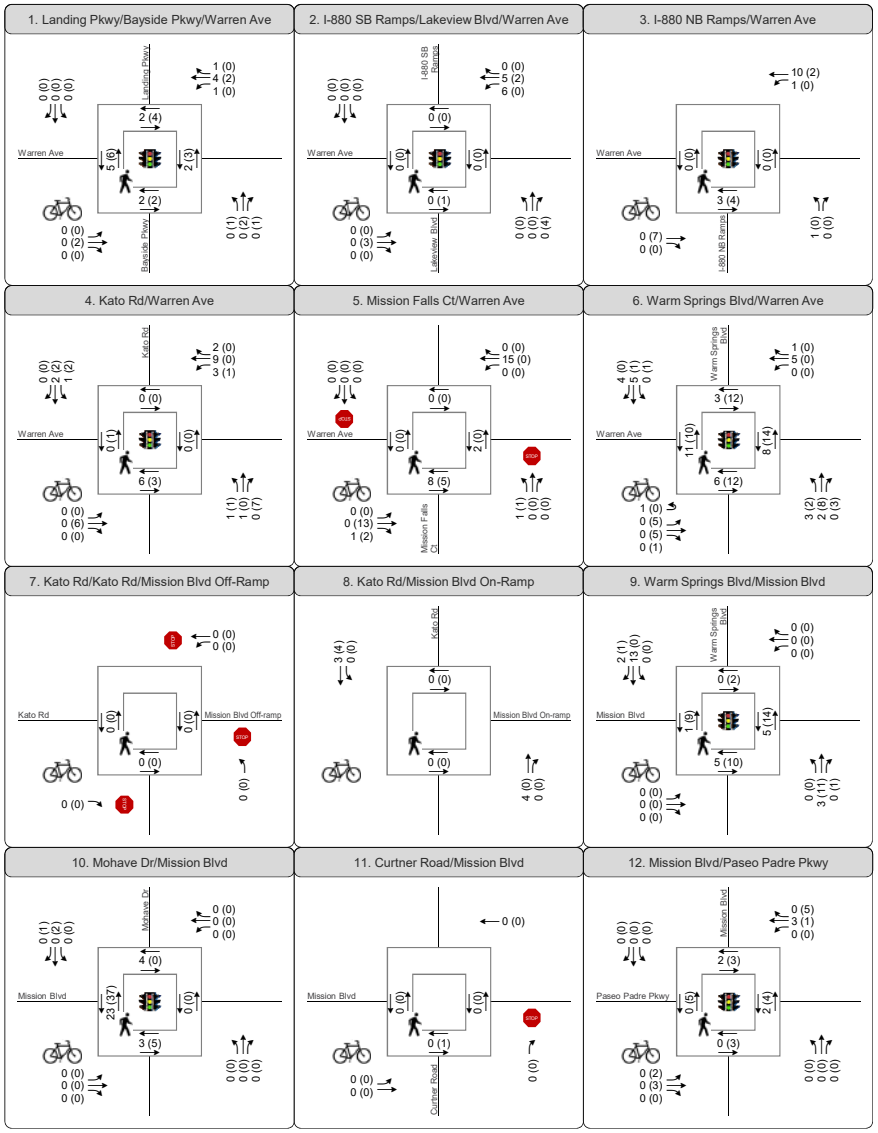
Ramp Intersection

Off-Alignment Study Intersection

Figure 1b

Existing Conditions Peak Hour Intersection Volumes, Lane Configurations and Traffic Controls





XX (YY) AM (PM) Peak Hour Bicycle Volumes

XX (YY) AM (PM) Peak Hour Pedestrian Volumes

Signalized Intersection

Stop Sign

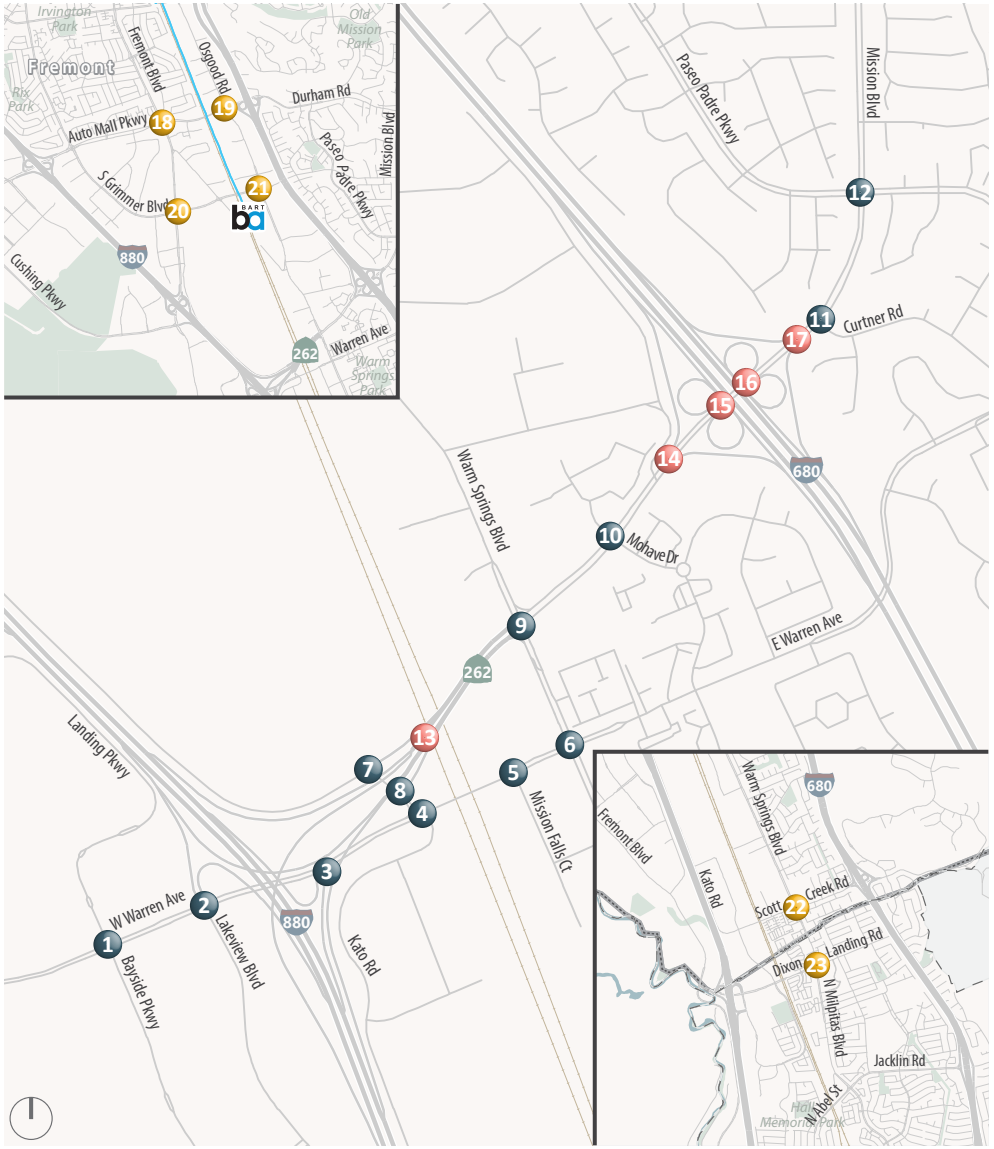
On-Alignment Study Intersection

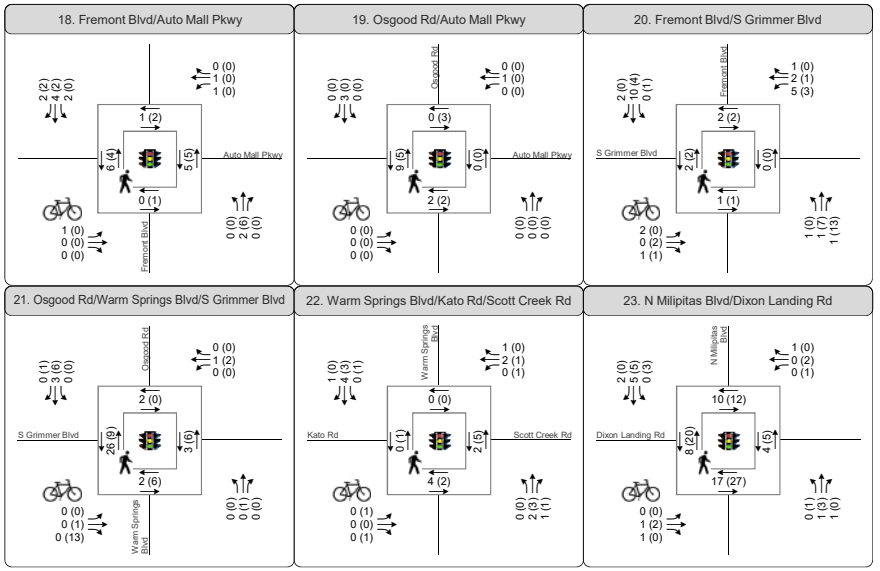
Ramp Intersection

Off-Alignment Study Intersection

Figure 2a

Existing Conditions
Peak Hour Bicycle and Pedestrian Volumes





XX (YY) AM (PM) Peak Hour Bicycle Volumes

XX (YY) AM (PM) Peak Hour Pedestrian Volumes

Signalized Intersection

Stop Sign

On-Alignment Study Intersection

Ramp Intersection

Off-Alignment Study Intersection

Figure 2b

Existing Conditions
Peak Hour Bicycle and Pedestrian Volumes

Auto Mall Parkway is an east-west city arterial that intersects I-680 and I-880 north of the SR-262 corridor. The arterial is divided by a raised median and provides two travel lanes for each direction with a posted speed of 45 miles per hour. This corridor provides an alternative connection to SR-262 between the two interstate freeways. Studying traffic operations at Osgood Road and Fremont Boulevard intersections on this corridor would help to understand how changes to the SR-262 corridor might influence changes in operations along Auto Mall Parkway.

South Grimmer Boulevard is an east-west city arterial that connects to I-880 in the west via Fremont Boulevard and extends east intersecting at Osgood Boulevard before crossing I-680 intersecting Paseo Parkway and Mission Boulevard. The arterial is divided by a raised median and provides two travel lanes for each direction with a posted speed of 40 miles per hour. Studying traffic operations at Osgood Road and Fremont Boulevard intersection on this corridor would help to understand whether local circulation patterns might change around the Warm Springs BART station as a result of changes to the SR-262 corridor.

Dixon Landing Road and Kato Road-Scott Creek Road these east-west city arterials combined connect the I-680 and I-880 freeways south of the SR-262 corridor. The arterials are divided by center lanes and provides two travel lanes for each direction with a posted speed of 40 miles per hour. This corridor provides an alternative connection to SR-262 between the two interstate freeways. Studying traffic operations on these two east-west corridors at North Milpitas Boulevard and Warm Springs Boulevard would help to understand how changes to the SR-262 corridor might influence changes in operations along east-west corridors south of SR-262.

North Milpitas Boulevard, Warm Spring Boulevard, Osgood Boulevard is a north-south city arterial that runs perpendicular to SR-262 and parallel to I-680 and I-880 through Milpitas and Fremont. The arterials are divided by raised medians and provides two travel lanes for each direction with a posted speed of 35 miles per hour. Several study intersections were identified along this corridor to understand how changes to SR-262 might influence changes in intersection traffic operations along parallel corridors north and south of SR-262 including Auto Mall Parkway, South Grimmer Road, Warren Avenue, Kato Road, and Dixon Landing Road.

Truck Route System

I-680 and I-880 are interstate freeways and designated truck routes while SR-262, a Caltrans-designated conventional highway, is a designated truck route in Fremont. While not part of the local street analysis Auto Mall Parkway, west of I-880, is also designated as a truck route by Fremont. It should also be noted that a portion of Dixon Landing Road, between I-880 and Milmont Road, while it is outside the local street study intersections, is a designated truck route in the City of Milpitas.[1]

[1] https://www.fremont.gov/DocumentCenter/View/691/Map---Truck-Routes?bidId= http://www.ci.milpitas.ca.gov/_pdfs/trans_truck_routes_map.pdf

Because of its location and connection between I-680 and I-880 the SR-262 corridor is a logical freight connector, connecting to major industrial centers such as the Tesla manufacturing plant, and the general connections to other major freight generators between San Jose / Santa Clara and areas such as Tracy, Stockton, and Modesto via the interstate freeways. Truck traffic was observed at all study intersections, even though some intersections are not on truck routes, because the study intersections provide connections to adjacent commercial uses. The section titled, Origin and Destination Data, shows figures with pass through and local truck volumes. The truck volumes are highest on the SR-262 corridor with about 550 and 280 trucks using the westbound corridor during the AM (6 AM to 10 AM) and PM (2 PM to 8 PM) study periods, respectively. Trucks using eastbound SR-262 range from about 440 during the AM period to 310 during the pm period.

Transit System

The following discussion focuses on the transit system that intersects with the SR-262 corridor. The primary transit service providers in the study area are the Alameda County Transit (AC Transit), Santa Clara Valley Transportation Authority (VTA), and Bay Area Regional Transit (BART). AC Transit provides local bus service and VTA provides express commute bus service. BART is a regional rail connecting the Bay Area. Each service is described below.

AC Transit

AC transit provides local bus service within the study area. There are three bus routes that utilize the SR-262 corridor. The 215-bus route provides service from Fremont BART to Warm Springs BART and ultimately the industrial cluster west of I-880 and SR-262, via Warm Springs Boulevard and Warren Avenue. The 239-bus line provides service from Fremont BART to Dixon Landing Road via Grimmer Boulevard, Mission Boulevard, and Warm Springs Boulevard. The 217-bus service provides connection from the California School for the Blind, Deaf, and Multi-handicapped, near Fremont BART, to the Great Mall/Main Station, via Mission Boulevard and Warm Springs Boulevard.[2]

VTA / Express Bus Routes

VTA provides express bus service from Warm Springs BART and Fremont BART to employment centers in San Jose. These are commute peak period buses, meaning that in the mornings they only run southbound and in the evenings they run northbound.[3] They use I-880, and have no stops on the SR-262 corridor. There are 4 express bus lines, which are as follows:

- 180 – express from Warm Springs BART station to East San Jose
- 181 – express from Warm Springs BART station to Downtown San Jose

[2] http://www.actransit.org/pdf/maps/version_21/city_map.pdf
[3] http://www.vta.org/sfc/servlet.shepherd/document/download/069A0000001cwcWIAQ

- 140 – express from Fremont BART station to Mission College Santa Clara
- 120 – express from Fremont BART station to Mountain View

BART

BART is a regional rail service that connects the Bay Area, including San Francisco, Richmond, Berkeley, Oakland, Walnut Creek, Pleasanton, and South Fremont.[4] Warm Springs/South Fremont BART Station is currently an end of line station found less than 1 mile north of SR-262. The BART extension to the Berryessa area of San Jose is under construction and the continuation of BART to downtown San Jose is under preliminary engineering analysis and design. Two lines start and end at the station, the Daly City Line and the Richmond Line. BART fares are dependent on trip length. Parking is available at the station for $3 per day or with a permit. There is a designated parking area for electric vehicle with charging stations. There are 56 on-demand bike lockers.[5]

Bicycle and Pedestrian System

Bicycle and pedestrian volumes are significant in the vicinity of the SR-262 corridor, reflecting the residential and employment dense nature of the area. The following discussion focuses on the bicycle and pedestrian system that intersects with the SR-262 corridor.

Bicycle System Definitions

Typical bicycle facilities include the following:

- **Bike paths (Class I)** – Paved trails that are separated from roadways.
- **Bike lanes (Class II)** – Lanes on roadways designated for use by bicycles through striping, pavement legends, and signs.
- **Bike routes (Class III)** – Designated roadways for bicycle use by signs only; may or may not include additional pavement width for cyclists.
- **Cycle Tracks/Separated Bikeways (Class IV) –** Bicycle facilities located on roadways that are separated through physical dividers.

Bicycle Facilities

The bicycle facilities that intersect the local street study intersections in the immediate vicinity of SR-262 include: [6]

- There are Class II bike lanes along SR-262 between Brown Road and Warm Springs Boulevard. East of I-680 Class II bike lanes begin on Mission Boulevard at Paseo Padre Parkway and continue north along Mission Boulevard.

[4] https://www.bart.gov/system-map
[5] https://www.bart.gov/stations/warm
[6] https://www.fremont.gov/DocumentCenter/View/2913/Map---Fremont-Bikeway-Map-12_09?bidId=

- There are Class II bike lanes along Warren Avenue, except over I-880, where bikes share the road, and this is difficult to transverse due to high traffic volumes. This corridor serves as the east-west bike connection rather than SR-262.
- There are Class II bike lanes on Warm Springs Boulevard south of Warren Avenue to the Milpitas border while bikes share the road with high volumes of motor vehicle traffic north of Warren Avenue up beyond Auto Mall Parkway.

While there are no bike connections on SR-262 and Mission Boulevard, west of Paseo Padre Parkway, bike riders who do use the corridor must traverse uncontrolled on- and off-ramp merges at the I-680 interchange.

Existing Pedestrian System

Pedestrian facilities, crosswalk and signal phasing, are summarized **Table 1**. The existing pedestrian infrastructure at each study intersection is listed in Table 1 because the pedestrian features influence the intersection operations evaluated in this memorandum. The signalized intersections have crosswalks on at least one leg and provide signal phasing and crosswalk ramps wherever crosswalks exist. The all-way stop and side-street stop intersections mostly do not have designated crosswalks, but they have crosswalk ramps. The I-680 freeway on- and off-ramps have crosswalk ramps at the local street interface but generally do not have striped crosswalks. The pedestrian facilities, independent of interstate ramps, are more accessible than the pedestrian facilities around the interstate interchanges.

Along the SR-262 and Mission Boulevard corridor there are sidewalks east of Warm Springs Boulevard and there are no pedestrian facilities west of the intersection as it serves as on- and off-ramps to Kato Road and I-880. The sidewalks are generally 10 feet wide with accompanying landscape except through the I-680 interchange area where the sidewalk widths reduce to 6 feet and there are minimal landscape treatments. North of I-680 the sidewalk widths narrow to 4- to 5-feet but the corridors are heavily landscaped. Sidewalks on Warm Springs Boulevard approaching SR-262 are generally 10 feet except the southbound approach which has a 6-foot sidewalk. Sidewalks on Mohave Drive approaching SR-262 are generally 8- to 10-feet wide. There are sidewalks on one side of Brown Road approaching SR-262 and its width varies from 4- to 10-feet.

Table 1: Intersection Pedestrian Facilities

Intersection		Control	# of Marked Crosswalks
1	Landing Parkway/Bayside Parkway/West Warren Avenue	Signal	4
2	Lakeview Boulevard/southbound I-880 ramps/Warren Avenue	Signal	2 *west, south legs*
3	Northbound I-880 ramps/Warren Avenue	Signal	1 *south leg*
4	Kato Road/Warren Avenue	Signal	2 *south, west legs*
5	Mission Falls Court/Warren Avenue	All-way Stop	0
6	Warm Springs Boulevard/Warren Avenue	Signal	4
7	Kato Road/Mission Boulevard off-ramp	All-way Stop	0
8	Kato Road/Mission Boulevard On-ramp	Uncontrolled	0
9	Warm Springs Boulevard/Mission Boulevard	Signal	4
10	Mohave Drive/Mission Boulevard	Signal	3 *south, north, west leg*
11	Mission Boulevard/Curtner Road	Side-street Stop	0
12	Mission Boulevard/Paseo Padre Parkway	Signal	4
14	Southbound I-680 Diagonal Off-Ramp	Uncontrolled	1
	Southbound I-680 Diagonal On-Ramp	Uncontrolled	0
15	Southbound I-680 Loop On-Ramp	Uncontrolled	0
	Southbound I-680 Loop Off-Ramp	Uncontrolled	0
16	Northbound I-680 Loop Off-Ramp	Uncontrolled	0
	Northbound I-680 Loop On-Ramp	Uncontrolled	1
17	Northbound I-680 Diagonal On-Ramp	Uncontrolled	0
	Northbound I-680 Diagonal Off-Ramp	Uncontrolled	1
18	Auto Mall Parkway at Fremont Boulevard	Signal	4
19	Auto Mall Parkway at Osgood Rd	Signal	3
20	South Grimmer Boulevard at Fremont Boulevard	Signal	4
21	South Grimmer Boulevard at Warm Springs Boulevard	Signal	4
22	Kato Road-Scott Creek Road at Warm Springs Boulevard	Signal	3
23	Dixon Landing Road at North Milpitas Boulevard	Signal	4

Source: Fehr & Peers, 2019

Origin and Destination Data

This section presents origin-destination (O-D) studies for the I-680 and I-880 corridors with the overall intent to identify how automobile and truck drivers are traveling between the two corridors. StreetLight Data was purchased and forms the basis for the study presented in this section. When a smartphone with location-based services enabled runs an app that utilizes those services (such as Google Maps), the phone transmits the user's location along with a unique user ID number. This information provides location information to within 60 feet and is used by StreetLight Data along with GPS devices, connected vehicles and more to determine the routes of individual person trips by linking the travel paths of these users to the roadway network. The data was pulled for the months of September and October of 2017 and the first half of 2018. The study focused on eight east-west corridors between I-880 and I-680 including:

1. Auto Mall Parkway
2. South Grimmer Boulevard
3. SR-262
4. Warren Avenue
5. Dixon Landing Road
6. Jacklin Road
7. East Calaveras Boulevard
8. Montague Expressway

The data analysis considered the following gateway locations as well as the local area:

1. I-680 between Vargas Road and SR-238 Mission Boulevard Interchanges
2. I-880 between Auto Mall Parkway and Stevenson Boulevard Interchanges
3. SR-237 between McCarthy and Zanker Interchanges
4. Great Mall Parkway west of I-880
5. Montague Expressway west of I-880
6. I-880 between Montague Expressway and Brokaw Road Interchanges
7. South I-880 between Montague Expressway and Capitol Avenue Interchanges
8. Local Area are all the trips that do not have an origin and destination within the seven gateways above. Most of the trips are covered as described in the figures below.

The study periods included the weekday AM (6 to 10 AM) and PM (2 to 8 PM) periods when congestion in the study area is greatest and focused on the origins and destinations for the I-680 corridor between Vargas Road and SR-238 Mission Boulevard interchanges and I-880 between Auto Mall Parkway and Stevenson Boulevard Interchanges.

Figure 3a shows the AM and PM period vehicles traveling from southbound I-680 between Vargas Road and SR-238 Mission Boulevard interchanges through the study area to the other gateways as well as the vehicles with local destinations within the study area. **Figure 3b** shows similar information for vehicles traveling to northbound I-680 between Vargas Road and SR-238 Mission Boulevard interchanges.

Figure 4a shows the AM and PM period vehicles traveling from southbound I-880 between Auto Mall Parkway and Stevenson Boulevard Interchanges through the study area to the other gateways as well as the vehicles with local destinations within the study area. **Figure 4b** shows similar information for vehicles traveling to northbound I-880 between Auto Mall Parkway and Stevenson Boulevard Interchanges.

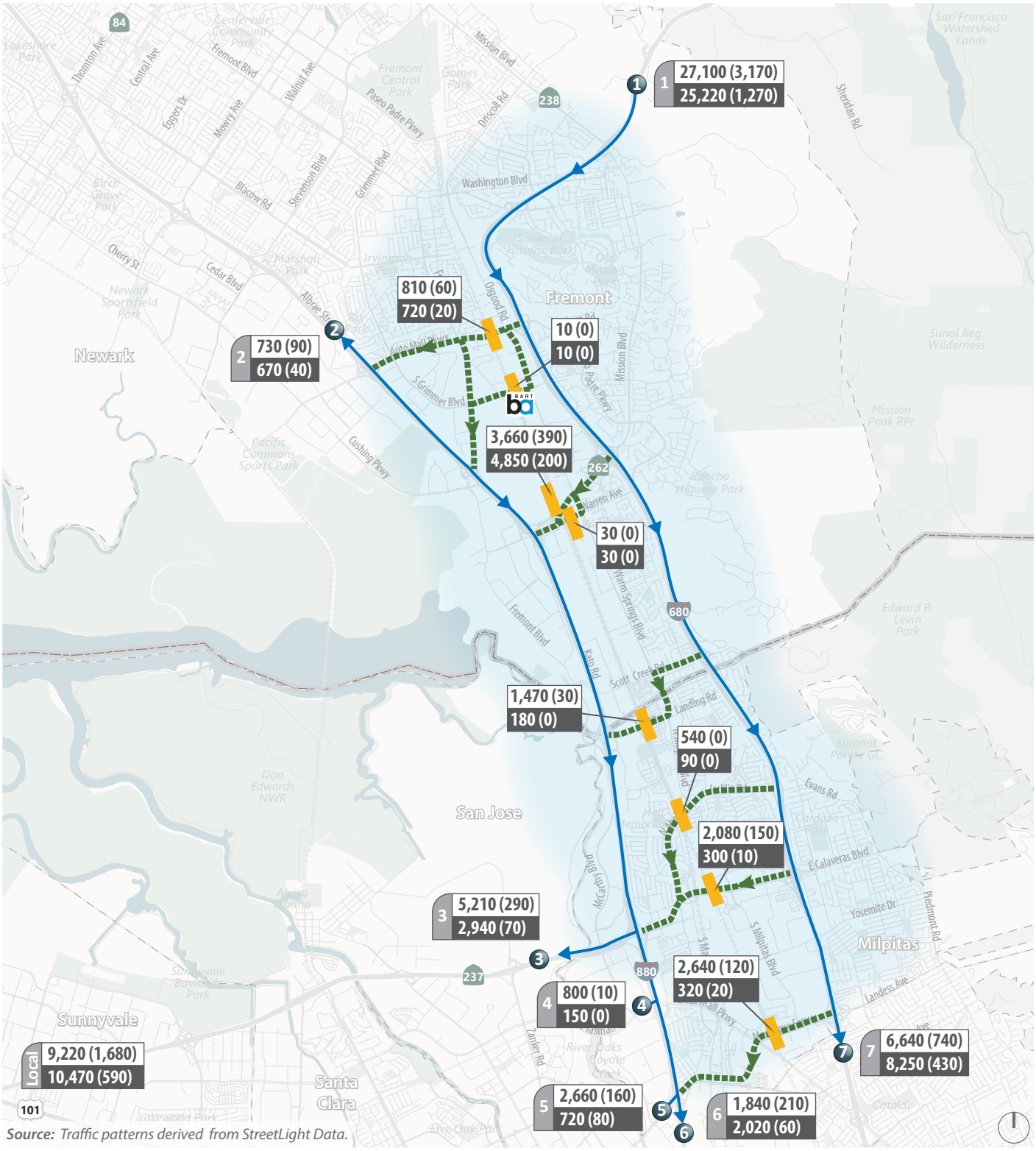
AM Peak Period (6 AM to 10 AM)

As shown in **Figure 3a**, there are about 27,100 vehicles traveling southbound on I-680 between Vargas Road and SR-238 Mission Boulevard interchanges to the other gateways including local traffic destinations. About 6,640 vehicles (25%) remain on I-680 through the study area, 9,220 vehicles (34%) travel to destinations within the local area, and 11,240 vehicles (41%) use one of the east-west streets to travel from I-680 to I-880 in the morning peak period. Most of these vehicles use SR-262 (3,660 total vehicles/14%) followed by Montague Expressway (2,640 total vehicles/10%), and East Calaveras Road (2,080 total vehicles/8%).

As shown in **Figure 3b**, there are about19,030 vehicles traveling northbound on I-680 between SR-238 Mission Boulevard and Vargas Road interchanges from the other gateways including local traffic origins. About 6,340 vehicles (33%) travel only on I-680 through the study area, 8,240 vehicles (43%) travel from destinations within the local area, and 4,450 vehicles (24%) use one of the east-west streets to travel from I-880 to I-680 in the morning peak period between. The heavily used east-west street is SR-262 (3,600 total vehicles/19%).

As shown in **Figure 4a**, there are about 28,450 vehicles traveling southbound on I-880 between Stevenson Boulevard and Auto Mall Parkway interchanges to the other gateways including local traffic destinations. About 16,950 vehicles (60%) remain on I-880 through the study area, 10,100 vehicles (35%) travel to destinations within the local area, and 1,400 vehicles (5%) use one of the east-west streets to travel from I-880 to I-680 in the morning peak period. Most of these vehicles use SR-262 (790 total vehicles/3%) followed by Auto Mall Parkway (550 total vehicles/2%).

As shown in **Figure 4b**, there are about 21,080 vehicles traveling northbound on I-880 between Auto Mall Parkway and Stevenson Boulevard interchanges from the other gateways including local traffic origins. About 10,180 vehicles (48%) travel only on I-880 through the study area 7,480 vehicles (35%) travel from destinations within the local area, and 3,420 vehicles (16%) use one of the east-west streets to travel from I-680 to I-880 in the morning peak period. Most of these vehicles use SR-262 (1,840 total vehicles/9%) followed by Auto Mall Parkway (1,380 total vehicles/7%).



Source: Traffic patterns derived from StreetLight Data.

I-680 / I-880 Connection | # O-D Location | Middle Filter | Travel Direction | Local Area

AM All Vehicles (AM Trucks)
PM All Vehicles (PM Trucks)

Middle Filter Volumes

AM All Vehicles (AM Trucks)
PM All Vehicles (PM Trucks)

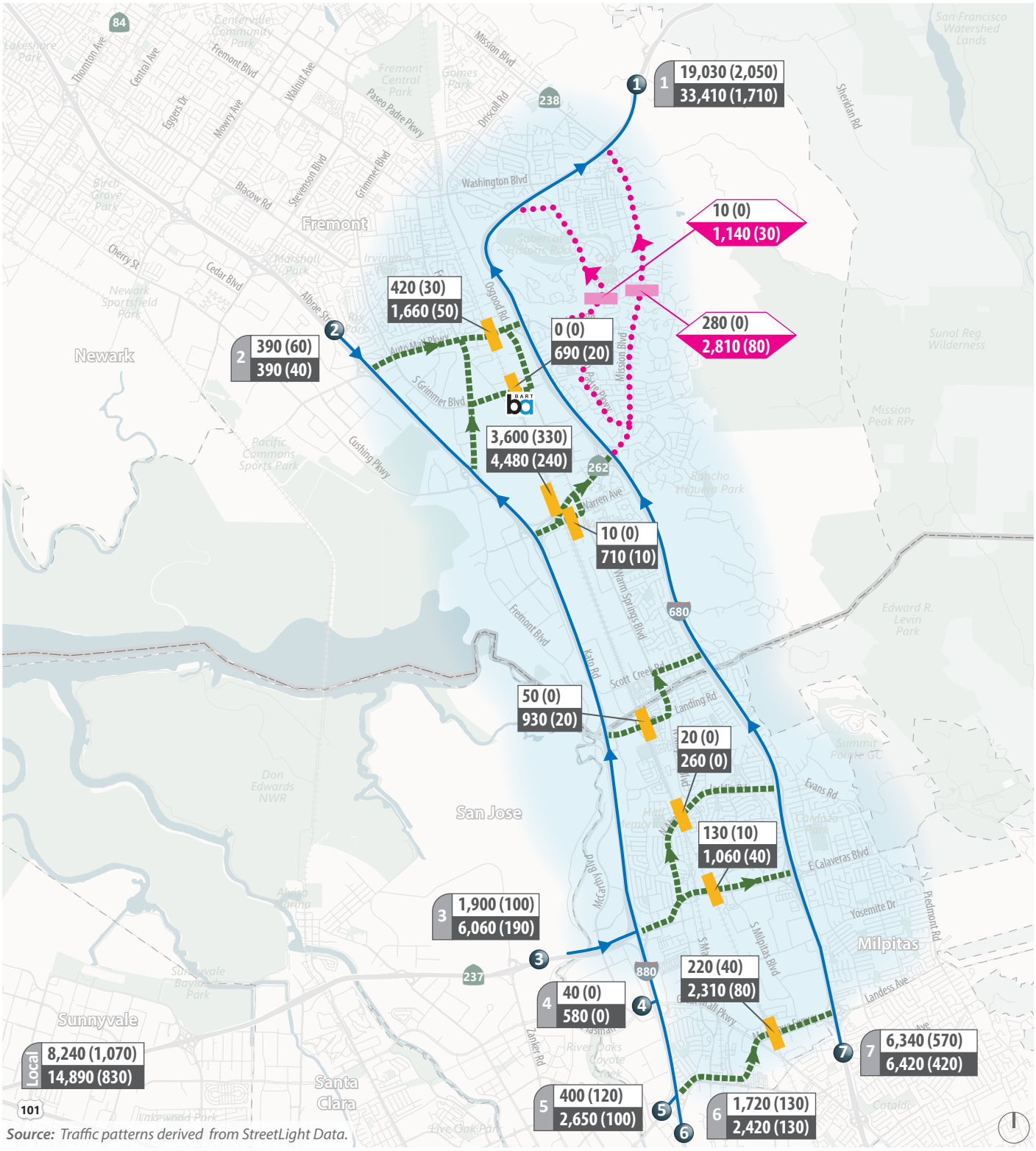
O-D Volumes

AM = 6 - 10 AM
PM = 2 - 8 PM

AM = 6 - 10 AM
PM = 2 - 8 PM

Figure 3a

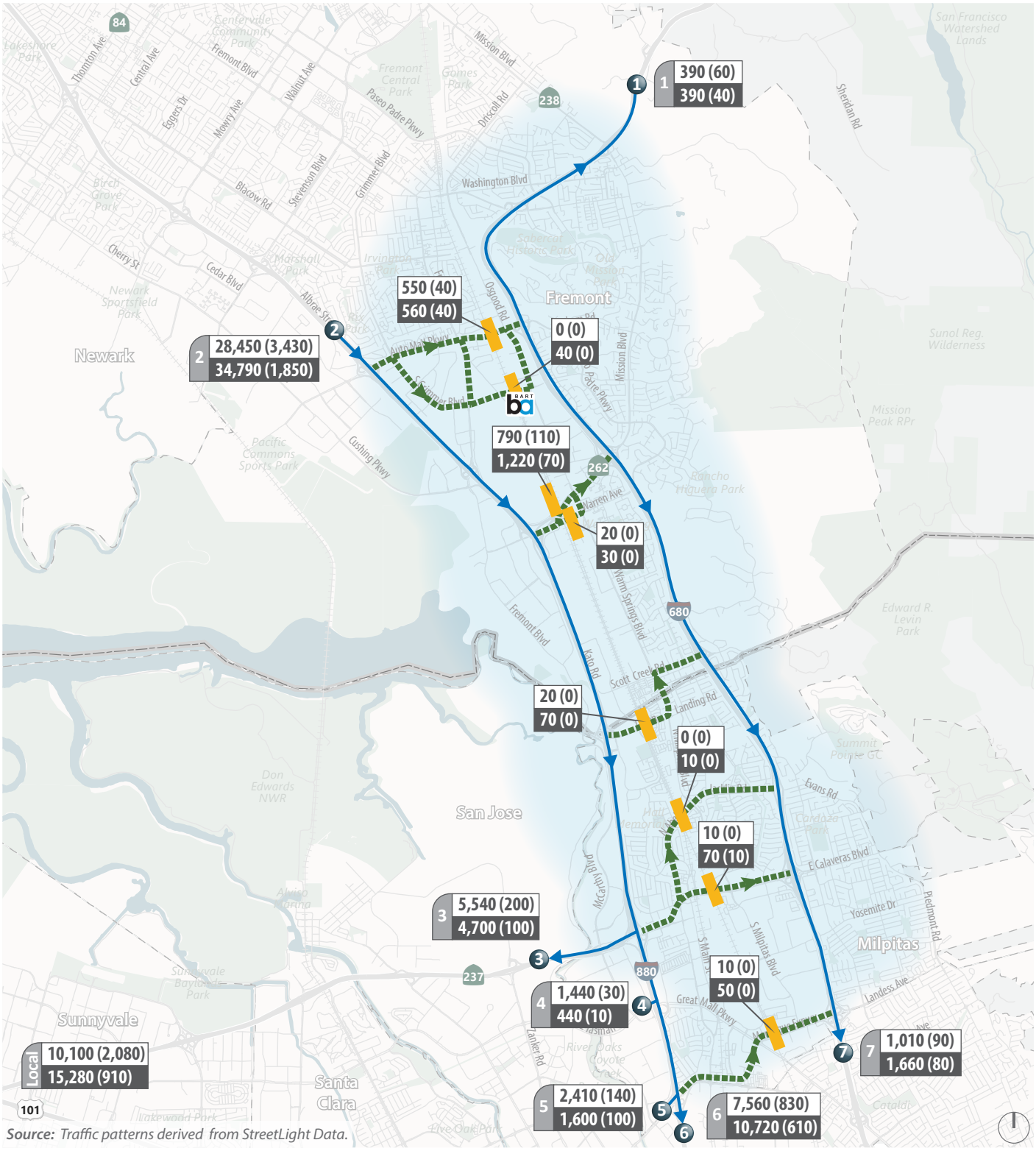
Vehicular Traffic Patterns
Southbound I-680 between Vargas and SR 238 Interchanges



Source: Traffic patterns derived from StreetLight Data.

Figure 3b

Vehicular Traffic Patterns
Northbound I-680 between SR 238 and Vargas Interchanges



Source: Traffic patterns derived from StreetLight Data.

I-680 / I-880 Connection | # O-D Location | Middle Filter | Travel Direction | Local Area

AM All Vehicles (AM Trucks)
PM All Vehicles (PM Trucks)
Middle Filter Volumes

AM = 6 - 10 AM
PM = 2 - 8 PM

AM All Vehicles (AM Trucks)
PM All Vehicles (PM Trucks)
O-D Volumes

AM = 6 - 10 AM
PM = 2 - 8 PM

Figure 4a

Vehicular Traffic Patterns
Southbound I-880 between Stevenson and Auto Mall Interchanges

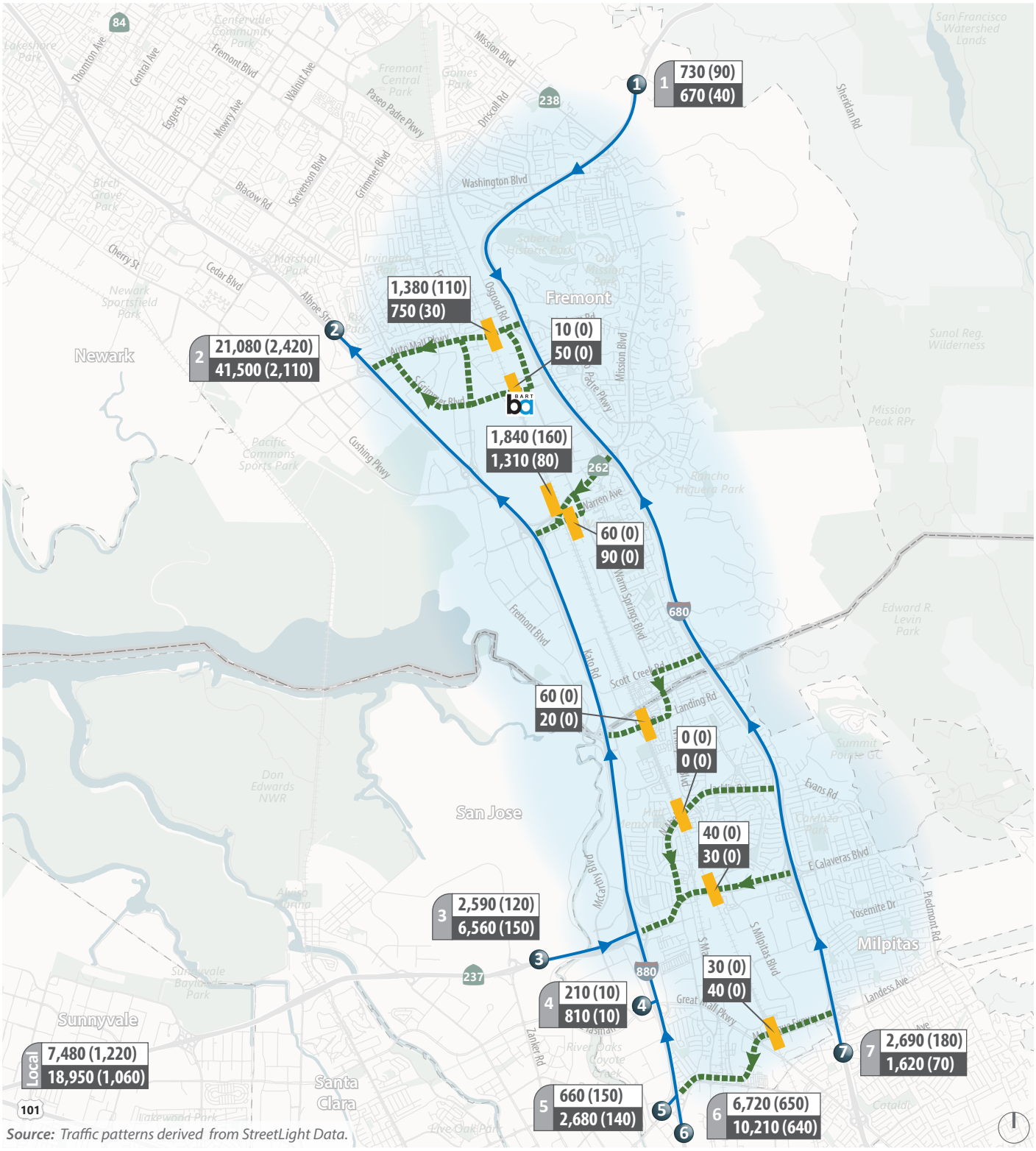


Figure 4b

Vehicular Traffic Patterns
Northbound I-880 between Auto Mall and Stevenson Interchanges

PM Peak Period (2 PM to 8 PM)

As shown in **Figure 3a**, there are about 25,220 vehicles traveling southbound on I-680 between Vargas Road and SR-238 Mission Boulevard interchanges to the other gateways including local traffic destinations. About 8,250 vehicles (33%) remain on I-680 through the study area, 10,470 vehicles (41%) travel to destinations within the local area, and 6,500 vehicles (26%) use one of the east-west streets to travel from I-680 to I-880 in the afternoon period. Most of these vehicles use SR-262 (4,850 total vehicles/19%).

As shown in **Figure 3b**, there are about 33,410 vehicles traveling northbound on I-680 between SR-238 Mission Boulevard and Vargas Road interchanges from the other gateways including local traffic origins. About 6,420 vehicles (19%) travel only on I-680 through the study area, 14,890 vehicles (45%) travel from destinations within the local area, and 12,100 vehicles (36%) use one of the east-west streets to travel from I-880 to I-680 in the afternoon period. Most of these vehicles use SR-262 (4,480 total vehicles/13%) followed by Montague Expressway (2,310 total vehicles/7%) and then Auto Mall Parkway (1,660 total vehicles/5%).

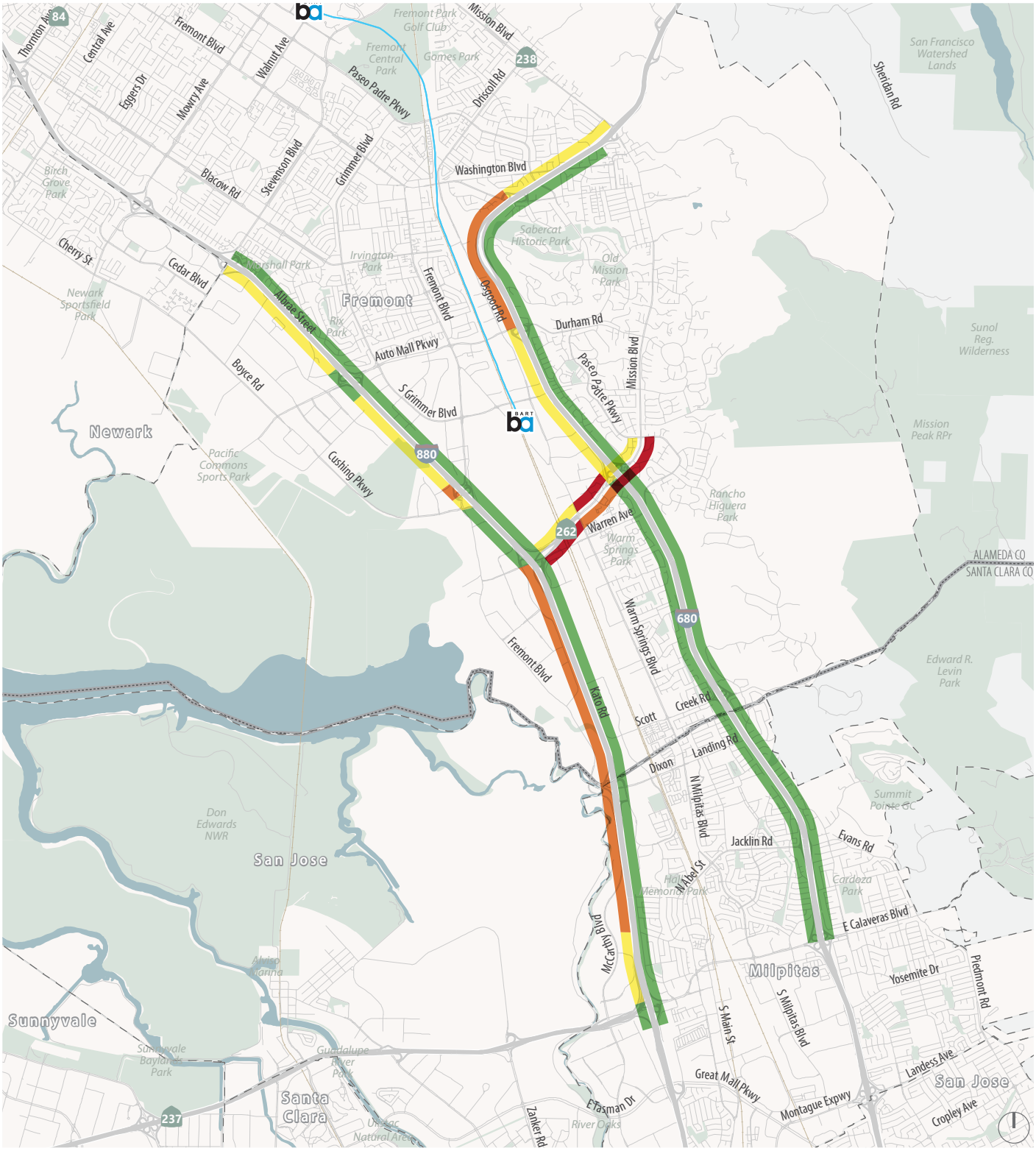
As shown in **Figure 4a**, there are about 34,790 vehicles traveling southbound on I-880 between Stevenson Boulevard and Auto Mall Parkway interchanges to the other gateways including local traffic destinations. About 17,460 vehicles (50%) remain on I-880 through the study area, 15,280 vehicles (44%) travel to destinations within the local area, and 2,050 vehicles (6%) use one of the east-west streets to travel from I-880 to I-680 in the afternoon period. Most of these vehicles use SR-262 (1,220 total vehicles/4%) followed by Auto Mall Parkway (560 total vehicles/2%).

As shown in **Figure 4b**, there are about 41,500 vehicles traveling northbound on I-880 between Auto Mall Parkway and Stevenson Boulevard interchanges from the other gateways including local traffic origins. About 20,260 vehicles (49%) remain on I-880 through the study area 18,950 vehicles (46%) travel from destinations within the local area, and 2,290 vehicles (5%) use one of the east-west streets to travel from I-680 to I-880 in the afternoon period. Most of these vehicles use SR-262 (1,310 total vehicles/3%) followed by Auto Mall Parkway (750 total vehicles/2%).

Field Visit Observations on State Route 262

Motor Vehicle Observations on SR-262

Figure 5a and **Figure 5b** present the existing AM and PM peak hour vehicular travel speeds on I-680, I-880, and SR-262. For I-680 and I-880 freeway segments, travel speeds under 35 mph indicate segments is in queue. For SR-262, travel speeds under 25 mph indicate segments is in queue. A more detailed queuing discussion is presented below.



< 25 mph
25-35 mph
35-55 mph
> 55 mph

Figure 5A

AM Peak Hour Vehicle Travel Speeds

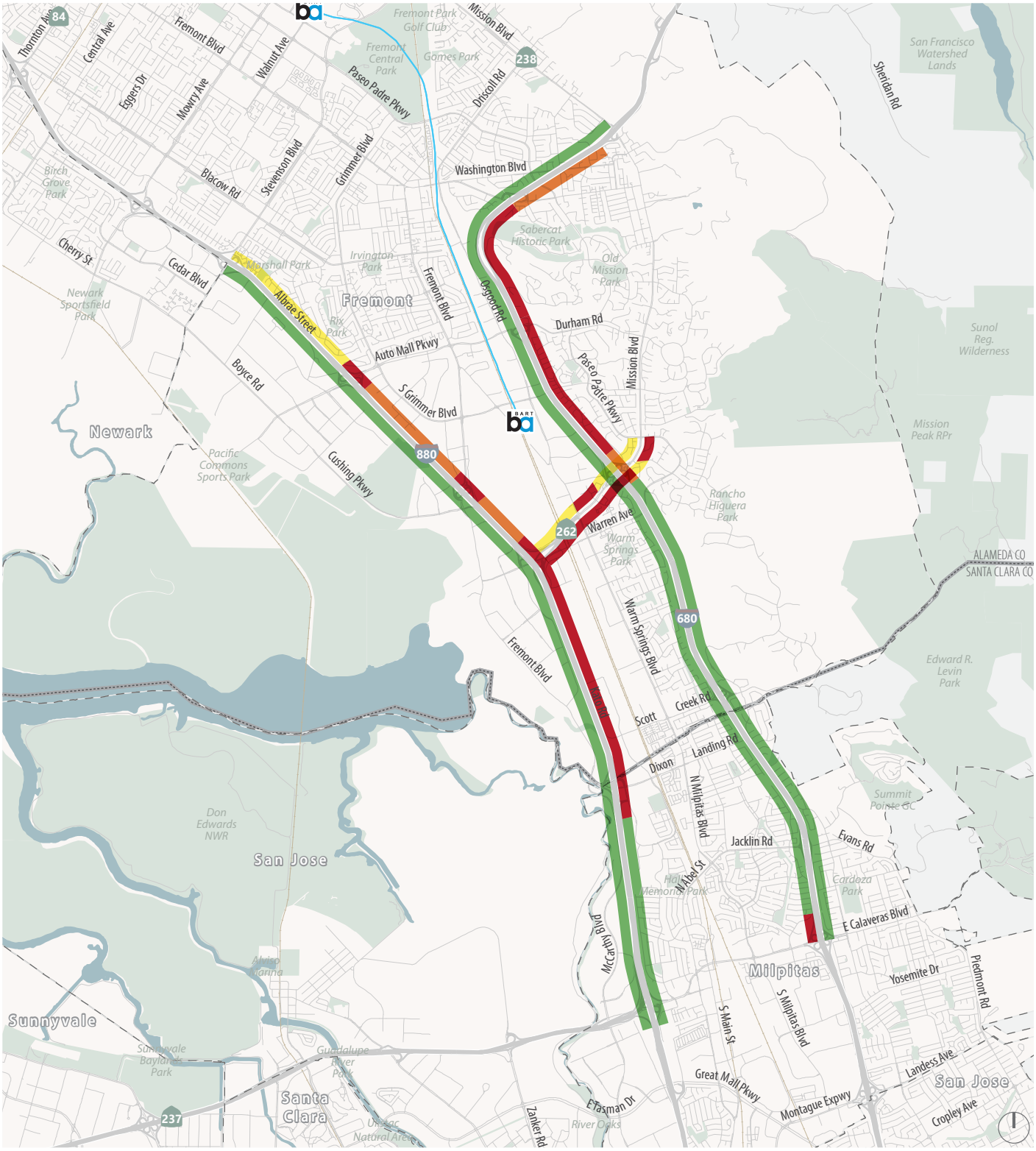


Figure 5B

PM Peak Hour Vehicle Travel Speeds

Westbound SR-262

AM Peak Period

Excessive queuing on the westbound approach to the SR-262 and Mohave Drive intersection begins around 7 AM and impacts traffic operations on westbound SR-262 and the I-680 southbound off-ramp to westbound SR-262. The I-680 southbound off-ramp to westbound SR-262 is effectively in queue from around 7 AM to 11 AM and impacts southbound I-680 mainline operations during this same period. The queue forms because the westbound demand is higher than the effective green capacity at the SR-262 and Mohave Drive intersection.

The westbound SR-262 loop on-ramp to southbound I-680 is metered during the AM peak period. Field observations indicate that the queues from the ramp meter are contained on the on-ramp, which includes a collector-distributor road, and does not impact traffic operations upstream of the on-ramp on westbound SR-262.

PM Peak Period

No major bottlenecks with excessive queueing were observed. Queuing occurs on the westbound approach to the SR-262/Mohave Drive intersection and impacts traffic operations on westbound SR-262 and the I-680 southbound off-ramp to westbound SR-262. However, the queues on the I-680 southbound off-ramp are contained within the ramp itself and do not impact operations on southbound I-680. Like the AM peak period, the queue forms because the westbound demand is higher than the effective green capacity at the SR-262 and Mohave Drive intersection.

Eastbound SR-262

AM Peak Period

No major bottlenecks with excessive queuing were observed on eastbound SR-262 during the AM peak period. Queueing was observed at the signalized intersections, but the queues were generally contained within the available storage.

PM Peak Period

During the PM period, there is a queue that forms at a bottleneck on northbound I-680 at the Washington Boulevard interchange that extends back onto SR-262 and I-880. In addition, the northbound I-680 collector-distributor road restricts the movement of traffic from eastbound SR-262 onto northbound I-680. This queue on I-680 is present between 2 PM and 7 PM.

Pedestrian and Bicycle Observations on SR-262

Given the size of the SR-262 intersections with Warm Springs Boulevard and Mohave Drive, and associated long pedestrian crossing times, one would expect minimal pedestrian and bicycle use in the area. However, pedestrians and bicyclists are present in the area because of the mix of local land uses which generate pedestrian and bicycle demands.

Pedestrians were observed to use SR-262 intersections with Warm Springs Boulevard and Mohave Drive. At Warm Springs Boulevard the highest pedestrian crossings occurred in early afternoon (between 3 and 5 PM) crossing the southern leg of the intersection. While at Mohave Drive higher pedestrian volumes occurred crossing the western leg of the intersection. No pedestrians were observed using the SR-262 corridor through the I-680 interchange area and a limited number of pedestrians were observed at the Curtner Road and Paseo Padre Parkway intersections.

Bicyclists were observed using the Warm Springs Boulevard corridor crossing SR-262. Higher use was noted southbound in the AM period and northbound in the PM period. North/south bicycle use on Mohave Drive was minimal and no bicyclists were observed using the SR-262 corridor in the east-west direction between Warm Springs Boulevard and Paseo Padre Parkway.

Intersection Traffic Operations

Intersection operations are described using the term "Level of Service[7]" (LOS). Level of Service is a qualitative description of traffic operations from the vehicle driver perspective and consists of the delay experienced by the driver at the intersection. It ranges from LOS A, with no congestion and little delay, to LOS F, with excessive congestion and delays. Different methodologies are used to assess signalized and unsignalized (stop-controlled) intersections.

Existing Traffic Conditions

Figure 1 and **Figure 2** present existing intersection lane configurations, traffic controls, and peak hour volumes at study intersections. Based on volumes and roadway configurations presented, Fehr & Peers calculated the LOS at the study intersections using the 2010 *Highway Capacity Manual* (HCM) methodologies. **Attachment A** provides the detailed LOS calculation sheets. **Table 2** summarizes the existing intersection analysis results for the on- and off-alignment intersections.

On-alignment intersections

During the AM peak hour and consistent with field observations, the Mohave Drive/ SR-262 intersection operates at LOS F. The queue at the intersection's westbound approach extends back to both the southbound I-680 diagonal off-ramp and the northbound I-680 loop off-ramp. In both instances the queue adversely impacts the freeway operations. Warm Spring Boulevard/SR-262 operates at LOS F due to long eastbound queues. The I-680 ramp merge/diverge points with SR-262, except the northbound diagonal ramp perform at LOS E and F during the AM Peak hour.

[7] Level of service is a qualitative description of traffic flow based on factors such as speed, travel time, delay, and freedom to maneuver. Six levels are defined from LOS A, which reflects free-flow conditions where there is very little interaction between vehicles, to LOS F, where the vehicle demand exceeds the capacity and high levels of vehicle delay result. LOS E represents "at-capacity" operations. When traffic volumes exceed the intersection capacity, stop-and-go conditions result, and a vehicle may wait through multiple signal cycles before passing through the intersection; these operations are designated as LOS F.

Table 2: Existing Intersection Operations Global Study Area AM/PM Peak Hour [1]

Intersection		Peak Period[1]	Control	Average Delay (seconds/veh) [2]	LOS
On-alignment Intersections Peak Hour Results[3]					
1	Landing Parkway/Bayside Parkway/Warren Avenue	AM	Signal	9	A
		PM		25	C
2	I-880 SB Ramps/Lakeview Boulevard/Warren Avenue	AM	Signal	19	B
		PM		31	C
3	I-880 NB Ramps/Warren Avenue	AM	Signal	16	B
		PM		13	B
4	Kato Road/Warren Avenue	AM	Signal	30	C
		PM		42	D
5	Mission Falls Ct/Warren Avenue	AM	Side-street Stop	1 (10)	A (B)
		PM		4 (11)	A (B)
6	Warm Springs Boulevard/Warren Avenue	AM	Signal	35.0	D
		PM		39	D
7	Kato Road/ SR-262 Off-Ramp	AM	All-way Stop	13	B
		PM		1	A
8	Kato Road/ SR-262 On-Ramp	AM	Uncontrolled	1 (1)	A (A)
		PM		1 (1)	A (A)
9	Warm Springs Boulevard/ SR-262	AM	Signal	**>120**	**F**
		PM		**>120**	**F**
10	Mohave Drive/ SR-262	AM	Signal	**>120**	**F**
		PM		53	D
11	Curtner Road/Mission Boulevard	AM	Side-street Stop	18 **(75)**	C **(F)**
		PM		3 (4)	A (A)
12	Mission Boulevard/Paseo Padre Parkway	AM	Signal	38	D
		PM		38	D
13	I-880 Ramps/ SR-262	AM	Uncontrolled	21 **(43)**	C **(E)**
		PM		**>120 (>120)**	**F (F)**
14	Southbound I-680 Diagonal Ramps/ SR-262	AM	Uncontrolled	**75 (>120)**	**F (F)**
		PM		15 (28)	B (D)
15	Southbound I-680 Loop Ramps/ SR-262	AM	Uncontrolled	**49 (52)**	**E (F)**
		PM		**44 (96)**	**E (F)**
16	Northbound I-680 Loop Ramps/ SR-262	AM	Uncontrolled	**62 (93)**	**F (F)**
		PM		**78 (>120)**	**F (F)**

Table 2: Existing Intersection Operations Global Study Area AM/PM Peak Hour [1]

Intersection		Peak Period[1]	Control	Average Delay (seconds/veh) [2]	LOS
17	Northbound I-680 Diagonal Ramps/ SR-262	AM	Uncontrolled	9 (**81**)	A **(F)**
		PM		2 (3)	A (A)
Off-alignment Intersections Peak Hour Results[4]					
18	Auto Mall Parkway at Fremont Boulevard	AM	Signal	52	D
		PM		50	D
19	Auto Mall Parkway at Osgood Rd	AM	Signal	53	D
		PM		54	D
20	South Grimmer Boulevard at Fremont Boulevard	AM	Signal	**66**	**E**
		PM		**63**	**E**
21	South Grimmer Boulevard at Osgood Rd/Warm Springs Boulevard	AM	Signal	43	D
		PM		50	D
22	Kato Road-Scott Creek Road at Warm Springs Boulevard	AM	Signal	**77**	**E**
		PM		**84**	**F**
23	Dixon Landing Road at North Milpitas Boulevard	AM	Signal	48	D
		PM		41	D

Notes: **Bold** indicates unacceptable intersection operations
1. AM 1-hour peak period is 8:00 AM to 9:00 AM. PM 1-hour peak period is 5:00 PM to 6:00 PM.
2. Weighted average control delay presented for signalized intersections. Delay for side-street stop-controlled intersections presented as Whole-Intersection Average Delay (Worst Approach Delay)
3. On-alignment intersection analysis was performed in Vissim.
4. Off-alignment intersection analysis was performed in Synchro.
Source: Fehr & Peers, April 2019

During the PM peak hour, the I-680 northbound collector-distributor road at the SR-262 interchange causes traffic to queue back onto the northbound I-680 loop on-ramp and then onto the SR-262 corridor where the queue extends back through the Mohave Drive and the Warm Springs Boulevard signalized intersections and ultimately back to northbound I-880 and the associated ramp connectors to eastbound SR-262. Note that the Mohave Drive/ SR-262 intersection operates at LOS D even with long eastbound queues/delays. This is because the westbound, northbound, and southbound approaches operate with small queues/delay. The I-880 ramps at SR-262 perform at LOS of F during the PM Peak. The I-680 southbound and northbound loop ramps at SR-262 perform at LOS E and F respectively.

Off-alignment intersections

Two off-alignment intersections operate below LOS D during the AM and PM peak hours. During the AM peak hour, the South Grimmer Boulevard / Fremont Boulevard intersection and the Kato

Road-Scott Creek Road / Warm Springs Boulevard intersection operate at LOS of E. During the PM peak hour, the South Grimmer Boulevard / Fremont Boulevard operates at LOS E while the Kato Road-Scott Creek Road / Warm Springs Boulevard intersection operates at LOS F.

Collision Data

Collision data was prepared by CHS Consulting and their documentation is in **Attachment B**. This section summarizes the data. Collision data was obtained from the Traffic Analysis Surveillance and Analysis System (TASAS), which is the collision database maintained by Caltrans. The study area roadways for which the collision data was obtained included SR-262 (Mission Boulevard) between I-880 and I-680. Caltrans staff provided the collision data in the study area between January 1, 2014 and December 31, 2018. The data was summarized and is presented in **Table 3**.

Table 3: Collision Summary of Study Area

Freeway	Location	Number of Accidents			Actual Accident Rate[2]			Average Accident Rate (State)[2]		
		Total	Fatal	Fatal + Injury	Total	Fatal	Fatal + Injury	Total	Fatal	Fatal + Injury
SR-262[1]	Between I-880 and I-680	135	1	59	1.00	.007	0.44	1.39	0.011	0.61

Notes:
1. Collisions on SR-262 include both intersections and roadways.
2. Actual and Average Accident Rates are measured in accidents per million vehicle miles.
Source: CHS, 2019

For SR-262 (between I-880 and I-680) a total of 135 collisions with one fatality were reported over the five-year period. The collision rates for SR-262 are lower than the Statewide average for total accidents, fatal accidents, and for "fatal + injury" accidents.

Policy Context

Several policies and projects are applicable to the Mission Boulevard (SR 262) Cross-Connector Project and these policies and projects will be used to assess the Project. The City of Fremont's various adopted plans and policies provide a strong foundation for complete streets improvements on SR 262. Related policies and goals supporting complete streets improvements are summarized in **Table 4**, and recommended projects are summarized in **Table 5**. This generally include significant complete streets redesigns to Mission and Warm Springs Boulevards' cross-section as well as pedestrian safety improvements at interchanges and intersections.

Table 4: Summary of Goals

Agency	Plan	Year	Goals
City of Fremont	Complete Streets Policy	2013	Vision: "It is the vision of the City of Fremont that major streets will balance the needs of automobiles with the needs of pedestrians, bicyclists, and transit users. Over time, all of Fremont's corridors should evolve into multi-modal streets that offer safe and attractive choices among different travel modes." Complete Streets Principles: 1. Complete Streets Serving All Users and Modes 2. Complete Streets Infrastructure 3. Context Sensitivity 4. Complete Streets Routinely Addressed by All Departments 5. All Projects and Phases
	General Plan	2011	Mobility Element Goals: 1. Creating "Complete" Streets 2. Reducing Vehicle Miles Traveled 3. Enhancing Accessibility, Efficiency and Connectivity 4. Balancing Mobility and Neighborhood Quality 5. Connecting to the Region 6. Moving Goods 7. Managing Parking
	Bicycle Master Plan	2018	Citywide Goals: 1. Implement a safe, convenient, connected, and comfortable citywide bicycling network for people of all ages and abilities who live, work, and visit Fremont. 2. Prioritize bicycle safety to achieve the City's Vision Zero Policy, maintaining zero fatalities and continuing to reduce severe injuries by 2020. 3. Use best practices and innovative but tested bicycle designs to implement a continuous, comprehensive low-stress bicycle network to serve all ages and abilities. 4. Attract new bicycling trips through education, encouragement, and enforcement activities. 5. Provide for regular maintenance of the bicycle network. 6. Facilitate coordination and cooperation in the development of the bicycle network.

Table 4: Summary of Goals

Agency	Plan	Year	Goals
	Pedestrian Master Plan	2016	Citywide Goals: 1. Activity – increase the percentage of all trips made on foot from 9% in 2007 to 15% by 2025. 2. Safety – reduce annual reported pedestrian-motor vehicle collisions from 44.4 (5- year average 2003-2007) to 22 by 2025. 3. Infrastructure and Design – establish a world class pedestrian environment in Fremont's City Center / Downtown and in Town Center Districts and improve the pedestrian experience throughout Fremont with additional infrastructure, thoughtful design and integration, and routine maintenance. 4. Connectivity and Accessibility – ensure safe, continuous, and convenient pedestrian access to essential pedestrian destinations and districts throughout Fremont for all residents, workers, and visitors. 5. Land Development – plan, design, and construct new development to celebrate and invite walking, particularly in the City's Downtown District, City Center and Town Centers.
City of Fremont	Warm Springs/South Fremont Community Plan	2014	Community Planning Principles are: 1. Innovation Hub 2. Focused Intensity 3. Diversity of Uses 4. Well-Loved Public Places 5. Health and Recreation 6. Ease of Movement 7. Visually Interesting Urban Fabric 8. Ecological Health and Sustainability
Alameda CTC	Countywide Active Transportation Plan	2019	Countywide Goals: 1. Safety – Increase the safety of people bicycling and walking in Alameda County 2. Multimodal connectivity – Create connected networks of streets and trails that enable people of all ages and abilities to walk and bike to meet their daily needs 3. Encouragement – Increase walking and biking in Alameda County 4. Impactful investment – Invest public monies in projects and programs that maximize benefits for Alameda County's transportation system
Caltrans	State Route 262 Transportation Concept Report	2011	SR 262 Corridor's issues are: 1. Consider intermodal. automobile and bicycle parking plus pedestrian and bicycle pathways. 2. Consider the deficiencies in bicycle and pedestrian access along SR 262

Source: Fehr & Peers.

Table 5: Summary of Related Recommendations and Policies

Corridor	Location	Recommendation or Policy	Reference
Corridors			
Mission Boulevard	East of Warm Springs Boulevard	-Class IV separated bikeways	Fremont Bicycle Master Plan, Alameda CTC Multimodal Arterial Plan
	Through study area	-Designated Multimodal Route (for auto, bus, bike, etc.) -Designated Truck Route	City of Fremont General Plan
		-High level of ITS infrastructure -Proposed curb lane widening to 12' -Proposed Tier 2 Goods Movement Route	Alameda CTC Multimodal Arterial Plan
		-Pedestrian improvements including safety improvements, audible pedestrian crossing signals, higher-visibility crosswalk markings, and curb extensions where feasible	City of Fremont General Plan
East Bay Greenway	UPRR Rail Alignment	-East Bay Greenway Class I Shared-Use Path	City of Fremont Bicycle Master Plan
Warm Springs Boulevard	Between Grimmer Boulevard and south city limit	-Class IV separated bikeways (7' bike lane with 4' buffer typical; 10-11' travel lanes) as part of the All Ages and Abilities Network -Consider delineators in existing buffered bike lanes in the near-term, and concrete medians to protect the bikeway as funding is available	City of Fremont Bicycle Master Plan; Alameda CTC Multimodal Arterial Plan
	North of Mission Boulevard (SR 262)	-Designated Urban Corridor typology with bikeways, two travel lanes in each direction, wide landscaped median, and wide sidewalks	Warm Springs/South Fremont Community Plan
	Through study area	-Planned shuttle route operated by TMA operating on Warm Springs Boulevard and Warren Avenue	Warm Springs/South Fremont Community Plan
	Through study area	-Pedestrian improvements including safety improvements, audible pedestrian crossing signals, higher-visibility crosswalk markings, and curb extensions where feasible	City of Fremont General Plan
	Through study area	-Warm Springs Boulevard is a designated Transit Route, which is also supportive of biking improvements	City of Fremont General Plan
Intersections			
Warm Springs Boulevard/Mission Boulevard (SR 262) Intersection		-Bicycle and pedestrian signal improvements -Green conflict zone striping at intersection	City of Fremont Bicycle Master Plan
		-Convert the at-grade intersection to grade-separated	City of Fremont General Plan

Table 5: Summary of Related Recommendations and Policies

Corridor	Location	Recommendation or Policy	Reference
I-680 / Mission Boulevard (SR 262)		Improvements for walking and biking, such as: -Fencing along overcrossings -high visibility ladder-style striping -Warning signage -Audible pedestrian signals -Tighter corner radii -Signal modifications -Striping and signing modifications	City of Fremont Pedestrian Master Plan
		-Marked crosswalk -Provide bicycle pockets -Widening sidewalks	Caltrans's State Route 262 Transportation Concept Report
All Intersections		-Pedestrian improvements including safety improvements, audible pedestrian crossing signals, higher-visibility crosswalk markings, and curb extensions where feasible	City of Fremont Pedestrian Master Plan

Source: Fehr & Peers, 2019.

Next Steps

The following tasks are the next steps to the project, primarily focusing on future conditions.

- The existing intersection volumes will be forecast to the Design Year under No-Build and Build conditions. Year 2045 was selected as the Design Year for analysis purposes. Separate forecasts will be prepared for the AM and PM peak periods.
- The Design Year traffic forecasts for the No Build and Build alternative will be evaluated for the study intersections. LOS and average delay will be derived from the models for the global peak hour – 8 to 9 AM and 5 to 6 PM. Differences in intersection operations will be noted to illustrate the project benefits to the on- and off-alignment intersections.
- A qualitative assessment of transit facilities will be performed to determine if the proposed build alternative would hinder or eliminate existing or proposed transit service or cause a substantial delay in transit service.
- Qualitative assessments of pedestrian and bicycle facilities to determine how the build alternative would likely perform in terms of pedestrian and bicycle desire lines, land use connectivity, and intersection and roadway features that enhance safety.
- Memorandum will be updated to discuss forecasting analysis and provided to Project Team for review. Following comments memorandum will be updated and submitted to Alameda CTC for review. Memorandum will be finalized upon one round of agency review. A comment resolution matrix or a document redline will be used to document each round of review and associated responses. Once all review comments have been resolved, the final document will be published.

FEHR PEERS

Attachment A:

Intersection Operation Results

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Intersection 1 **Landing Blvd./West Warren Avenue** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) LOS
NB	Left Turn	7	8	114.3%	18.5	B
	Through	4	4	100.0%	23.6	C
	Right Turn	18	16	88.9%	4.2	A
	Subtotal	29	28	96.6%	11.0	B
SB	Left Turn	65	54	83.1%	21.7	C
	Through	77	61	79.2%	21.9	C
	Right Turn	80	100	125.0%	10.0	A
	Subtotal	222	215	96.8%	16.3	B
EB	Left Turn	10	10	100.0%	23.0	C
	Through	147	164	111.6%	9.3	A
	Right Turn	48	41	85.4%	6.1	A
	Subtotal	205	215	104.9%	9.4	A
WB	Left Turn	236	215	91.1%	21.9	C
	Through	616	678	110.1%	3.6	A
	Right Turn	119	128	107.6%	3.7	A
	Subtotal	971	1,021	105.1%	7.5	A
Total		1,427	1,479	103.6%	9.1	A

Intersection 2 **Lakeview Blvd./SB I-880 ramps/Warren Avenue** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) LOS
NB	Left Turn	14	16	114.3%	30.7	C
	Through	4	7	175.0%	41.7	D
	Right Turn	39	34	87.2%	7.3	A
	Subtotal	57	57	100.0%	18.1	B
SB	Left Turn	351	335	95.4%	23.4	C
	Through	245	250	102.0%	25.2	C
	Right Turn	188	177	94.1%	13.8	B
	Subtotal	784	762	97.2%	21.8	C
EB	Left Turn	51	51	100.0%	31.8	C
	Through	156	159	101.9%	17.9	B
	Right Turn	23	25	108.7%	9.7	A
	Subtotal	230	235	102.2%	20.0	C
WB	Left Turn	293	261	89.1%	35.0	C
	Through	769	830	107.9%	15.5	B
	Right Turn	282	234	83.0%	7.8	A
	Subtotal	1,344	1,325	98.6%	18.0	B
Total		2,415	2,379	98.5%	19.4	B

Intersection 3 **NB I-880 ramps/Warren Avenue** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) LOS
NB	Left Turn	352	326	92.6%	23.8	C
	Through					
	Right Turn	303	319	105.3%	9.3	A
	Subtotal	655	645	98.5%	16.6	B
SB	Left Turn					
	Through					
	Right Turn					
	Subtotal					
EB	Left Turn					
	Through	500	495	99.0%	16.4	B
	Right Turn	46	36	78.3%	4.4	A
	Subtotal	546	531	97.3%	15.6	B
WB	Left Turn	317	274	86.4%	26.8	C
	Through	992	999	100.7%	12.0	B
	Right Turn					
	Subtotal	1,309	1,273	97.2%	15.2	B
Total		2,510	2,449	97.6%	15.6	B

Intersection 4 **Kato Road/Warren Avenue** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) LOS
NB	Left Turn	181	195	107.7%	38.5	D
	Through	75	60	80.0%	37.8	D
	Right Turn	54	57	105.6%	8.0	A
	Subtotal	310	312	100.6%	32.8	C
SB	Left Turn	27	18	66.7%	49.6	D
	Through	122	111	91.0%	42.6	D
	Right Turn	171	151	88.3%	0.7	A
	Subtotal	320	280	87.5%	20.4	C
EB	Left Turn	175	172	98.3%	46.3	D
	Through	315	323	102.5%	22.5	C
	Right Turn	316	316	100.0%	19.8	B
	Subtotal	806	811	100.6%	26.5	C
WB	Left Turn	104	115	110.6%	58.1	E
	Through	960	940	97.9%	29.8	C
	Right Turn	53	71	134.0%	23.3	C
	Subtotal	1,117	1,126	100.8%	32.2	C
Total		2,553	2,529	99.1%	29.2	C

Intersection 5 **Mission Falls Court/Warren Avenue** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) LOS
NB	Left Turn	26	18	69.2%	12.6	B
	Through	5	4	80.0%	13.6	B
	Right Turn	13	17	130.8%	6.9	A
	Subtotal	44	39	88.6%	10.2	B
SB	Left Turn	4	5	125.0%	0.0	A
	Through					
	Right Turn	5	3	60.0%	7.5	A
	Subtotal	9	8	88.9%	2.8	A
EB	Left Turn	25	26	104.0%	4.4	A
	Through	359	365	101.7%	0.6	A
	Right Turn	12	11	91.7%	1.1	A
	Subtotal	396	402	101.5%	0.9	A
WB	Left Turn	10	10	100.0%	2.0	A
	Through	1,086	1,104	101.7%	0.7	A
	Right Turn	21	20	95.2%	0.8	A
	Subtotal	1,117	1,134	101.5%	0.7	A
Total		1,566	1,583	101.1%	1.0	A

Intersection 6 **Warm Springs Blvd/Warren Avenue** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) LOS
NB	Left Turn	494	506	102.4%	53.9	D
	Through	486	429	88.3%	19.1	B
	Right Turn	124	121	97.6%	13.2	B
	Subtotal	1,104	1,056	95.7%	35.1	D
SB	Left Turn	48	39	81.3%	27.7	C
	Through	433	383	88.5%	10.6	B
	Right Turn	161	158	98.1%	7.2	A
	Subtotal	642	580	90.3%	10.8	B
EB	Left Turn	104	111	106.7%	36.6	D
	Through	72	80	111.1%	37.6	D
	Right Turn	200	190	95.0%	4.3	A
	Subtotal	376	381	101.3%	20.7	C
WB	Left Turn	177	164	92.7%	51.6	D
	Through	462	470	101.7%	73.3	E
	Right Turn	78	74	94.9%	18.2	B
	Subtotal	717	708	98.7%	62.5	E
Total		2,839	2,725	96.0%	35.0	D

Intersection 7 **Kato Road/Mission Blvd. off-ramp** **All-way Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) LOS
NB	Left Turn	269	277	103.0%	13.6	B
	Through					
	Right Turn					
	Subtotal	269	277	103.0%	13.6	B
SB	Left Turn					
	Through					
	Right Turn					
	Subtotal					
EB	Left Turn					
	Through					
	Right Turn	164	174	106.1%	6.5	A
	Subtotal	164	174	106.1%	6.5	A
WB	Left Turn	186	140	75.3%	15.5	C
	Through	141	123	87.2%	20.4	C
	Right Turn					
	Subtotal	327	263	80.4%	17.8	C
Total		760	714	93.9%	13.4	B

Intersection 8 **Kato Road/Mission Blvd. On-ramp** **Uncontrolled**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	l Delay (sec/veh) Average	l Delay (sec/veh) LOS
NB	Left Turn					
	Through	269	277	103.0%	0.7	A
	Right Turn	34	26	76.5%	0.4	A
	Subtotal	303	303	100.0%	0.7	A
SB	Left Turn	30	33	110.0%	3.4	A
	Through	320	282	88.1%	0.1	A
	Right Turn					
	Subtotal	350	315	90.0%	0.4	A
EB	Left Turn					
	Through					
	Second Right					
	Subtotal					
WB	Left Turn					
	Through					
	Second Right					
	Subtotal					
Total		653	618	94.6%	0.5	A

Intersection 9 **Warm Springs Blvd/Mission Blvd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) LOS
NB	Left Turn	178	182	102.2%	104.4	F
	Through	411	401	97.6%	77.4	E
	Right Turn	79	64	81.0%	29.1	C
	Subtotal	668	647	96.9%	80.2	F
SB	Left Turn	122	101	82.8%	140.5	F
	Through	389	341	87.7%	163.2	F
	Right Turn	496	450	90.7%	191.1	F
	Subtotal	1,007	892	88.6%	174.7	F
EB	Left Turn	388	370	95.4%	386.1	F
	Through	1,495	1,344	89.9%	242.6	F
	Right Turn	151	143	94.7%	177.0	F
	Subtotal	2,034	1,857	91.3%	266.2	F
WB	Left Turn	102	89	87.3%	66.4	E
	Through	2,324	2,199	94.6%	20.0	B
	Right Turn	283	269	95.1%	8.5	A
	Subtotal	2,709	2,557	94.4%	20.4	C
Total		6,418	5,953	92.8%	126.7	F

Intersection 10 **Mohave Drive/Mission Blvd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) LOS
NB	Left Turn	88	93	105.7%	119.5	F
	Through	55	50	90.9%	114.9	F
	Right Turn	141	148	105.0%	15.2	B
	Subtotal	284	291	102.5%	65.7	E
SB	Left Turn	35	27	77.1%	77.7	E
	Through	65	68	104.6%	85.6	F
	Right Turn	59	62	105.1%	11.9	B
	Subtotal	159	157	98.7%	55.1	E
EB	Left Turn	22	28	127.3%	99.3	F
	Through	1,589	1,368	86.1%	61.3	E
	Right Turn	70	61	87.1%	25.3	C
	Subtotal	1,681	1,457	86.7%	60.5	E
WB	Left Turn	66	61	92.4%	359.2	F
	Through	2,547	2,415	94.8%	265.0	F
	Right Turn	58	55	94.8%	261.9	F
	Subtotal	2,671	2,531	94.8%	267.2	F
Total		4,795	4,436	92.5%	178.6	F

Intersection 11 **Curtner Rd/Mission Blvd** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) LOS
NB	Left Turn					
	Through					
	Right Turn	11	8	72.7%	0.0	A
	Subtotal	11	8	72.7%	0.0	A
SB	Left Turn					
	Through					
	Right Turn					
	Subtotal					
EB	Left Turn					
	Through	404	359	88.9%	81.1	F
	Right Turn	43	29	67.4%	0.3	A
	Subtotal	447	388	86.8%	75.1	F
WB	Left Turn					
	Through	1,222	1,226	100.3%	0.4	A
	Right Turn					
	Subtotal	1,222	1,226	100.3%	0.4	A
Total		1,680	1,622	96.5%	18.3	C

Intersection 12 **Mission Blvd/Paseo Padre Pkwy** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) LOS
NB	Left Turn	141	121	85.8%	39.8	D
	Through	263	233	88.6%	13.5	B
	Right Turn	11	15	136.4%	5.9	A
	Subtotal	415	369	88.9%	21.8	C
SB	Left Turn	119	105	88.2%	34.9	C
	Through	921	924	100.3%	23.9	C
	Right Turn	17	16	94.1%	21.8	C
	Subtotal	1,057	1,045	98.9%	25.0	C
EB	Left Turn	10	5	50.0%	134.9	F
	Through	109	103	94.5%	111.7	F
	Right Turn	248	246	99.2%	92.2	F
	Subtotal	367	354	96.5%	98.5	F
WB	Left Turn	53	60	113.2%	41.2	D
	Through	98	86	87.8%	26.8	C
	Right Turn	66	58	87.9%	4.6	A
	Subtotal	217	204	94.0%	24.7	C
Total		2,056	1,972	95.9%	37.6	D

Intersection 13 **I-880 Ramps/Mission Blvd.** **Uncontrolled**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) LOS
NB	Left Turn					
	Through					
	Right Turn	1,600	1,582	98.9%	42.9	E
	Subtotal	1,600	1,582	98.9%	42.9	E
SB	Left Turn					
	Through					
	Right Turn					
	Subtotal					
EB	Left Turn					
	Through	370	358	96.8%	38.6	E
	Right Turn					
	Subtotal	370	358	96.8%	38.6	E
WB	Left Turn					
	Through	1,689	1,653	97.9%	6.1	A
	Right Turn	982	947	96.4%	3.7	A
	Subtotal	2,671	2,600	97.3%	5.2	A
Total		4,641	4,540	97.8%	21.0	C

Intersection 14 **SB I-680 Diagonal Ramps/Mission Blvd.** **Uncontrolled**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) LOS
NB	Left Turn					
	Through					
	Right Turn					
	Subtotal					
SB	Left Turn					
	Through					
	Right Turn	1,031	1,048	101.6%	157.3	F
	Subtotal	1,031	1,048	101.6%	157.3	F
EB	Left Turn					
	Through	1,347	1,196	88.8%	30.5	D
	Right Turn	436	362	83.0%	15.3	C
	Subtotal	1,783	1,558	87.4%	26.9	D
WB	Left Turn					
	Through	2,084	1,946	93.4%	69.6	F
	Right Turn					
	Subtotal	2,084	1,946	93.4%	69.6	F
Total		4,898	4,552	92.9%	75.2	F

Intersection 15 **SB I-680 Loop Ramps/Mission Blvd.** **Uncontrolled**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) LOS
NB	Left Turn					
	Through					
	Right Turn	14	10	71.4%	9.7	A
	Subtotal	14	10	71.4%	9.7	A
SB	Left Turn					
	Through					
	Right Turn					
	Subtotal					
EB	Left Turn					
	Through	1,347	1,190	88.3%	51.7	F
	Right Turn					
	Subtotal	1,347	1,190	88.3%	51.7	F
WB	Left Turn					
	Through	2,084	1,951	93.6%	48.7	E
	Right Turn	276	275	99.6%	34.0	D
	Subtotal	2,360	2,226	94.3%	46.9	E
Total		3,721	3,426	92.1%	48.5	E

Intersection 16 **NB I-680 Loop Ramps/Mission Blvd.** **Uncontrolled**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) LOS
NB	Left Turn					
	Through					
	Right Turn					
	Subtotal					
SB	Left Turn					
	Through					
	Right Turn	1,183	1,075	90.9%	83.9	F
	Subtotal	1,183	1,075	90.9%	83.9	F
EB	Left Turn					
	Through	233	205	88.0%	11.5	B
	Right Turn	1,128	973	86.3%	110.4	F
	Subtotal	1,361	1,178	86.6%	93.2	F
WB	Left Turn					
	Through	1,177	1,173	99.7%	9.6	A
	Right Turn					
	Subtotal	1,177	1,173	99.7%	9.6	A
Total		3,721	3,426	92.1%	61.7	F

Intersection 17 **NB I-680 Diagonal Ramps/Mission Blvd.** **Uncontrolled**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) LOS
NB	Left Turn					
	Through					
	Right Turn	214	184	86.0%	80.8	F
	Subtotal	214	184	86.0%	80.8	F
SB	Left Turn					
	Through					
	Right Turn					
	Subtotal					
EB	Left Turn					
	Through	233	204	87.6%	0.2	A
	Right Turn					
	Subtotal	233	204	87.6%	0.2	A
WB	Left Turn					
	Through	1,177	1,181	100.3%	0.2	A
	Right Turn	45	46	102.2%	0.2	A
	Subtotal	1,222	1,227	100.4%	0.2	A
Total		1,669	1,615	96.8%	9.4	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	86	671	102	398	1312	120	68	233	72	342	991	241
Future Volume (veh/h)	86	671	102	398	1312	120	68	233	72	342	991	241
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1827	1827	1827	1827	1827	1827	1827	1827	1827	1827	1827	1900
Adj Flow Rate, veh/h	91	714	0	423	1396	44	72	248	0	360	1054	0
Adj No. of Lanes	2	3	1	2	2	1	2	2	1	2	2	0
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.95	0.94	0.94
Percent Heavy Veh, %	4	4	4	4	4	4	4	4	4	4	4	4
Cap, veh/h	199	1695	528	481	1469	649	216	971	434	418	1178	0
Arrive On Green	0.06	0.34	0.00	0.14	0.42	0.42	0.06	0.28	0.00	0.12	0.34	0.00
Sat Flow, veh/h	3375	4988	1553	3375	3471	1532	3375	3471	1553	3375	3563	0
Grp Volume(v), veh/h	91	714	0	423	1396	44	72	248	0	360	1054	0
Grp Sat Flow(s),veh/h/ln	1688	1663	1553	1688	1736	1532	1688	1736	1553	1688	1736	0
Q Serve(g_s), s	3.6	15.4	0.0	17.2	54.3	2.4	2.9	7.8	0.0	14.6	40.3	0.0
Cycle Q Clear(g_c), s	3.6	15.4	0.0	17.2	54.3	2.4	2.9	7.8	0.0	14.6	40.3	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	199	1695	528	481	1469	649	216	971	434	418	1178	0
V/C Ratio(X)	0.46	0.42	0.00	0.88	0.95	0.07	0.33	0.26	0.00	0.86	0.89	0.00
Avail Cap(c_a), veh/h	265	1695	528	796	1469	649	289	971	434	579	1215	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	63.7	35.6	0.0	58.8	38.9	24.0	62.7	39.1	0.0	60.2	43.9	0.0
Incr Delay (d2), s/veh	0.6	0.8	0.0	3.5	14.3	0.2	0.3	0.2	0.0	7.3	8.9	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.7	7.2	0.0	8.3	28.9	1.0	1.3	3.7	0.0	7.3	20.8	0.0
LnGrp Delay(d),s/veh	64.3	36.4	0.0	62.4	53.2	24.2	63.0	39.3	0.0	67.5	52.8	0.0
LnGrp LOS	E	D		E	D	C	E	D		E	D	
Approach Vol, veh/h		805			1863			320			1414	
Approach Delay, s/veh		39.5			54.6			44.6			56.5	
Approach LOS		D			D			D			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	23.9	51.6	13.0	51.5	12.3	63.3	21.3	43.2
Change Period (Y+Rc), s	4.5	6.0	4.5	6.0	4.5	6.0	4.5	6.0
Max Green Setting (Gmax), s	32.5	28.0	11.5	47.0	10.5	50.0	23.5	35.0
Max Q Clear Time (g_c+I1), s	19.2	17.4	4.9	42.3	5.6	56.3	16.6	9.8
Green Ext Time (p_c), s	0.2	4.2	0.0	3.2	0.0	0.0	0.2	2.0

Intersection Summary	
HCM 2010 Ctrl Delay	51.7
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	114	834	166	253	1393	122	98	146	128	201	640	379
Future Volume (veh/h)	114	834	166	253	1393	122	98	146	128	201	640	379
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		1.00	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1810	1810	1900	1810	1810	1900	1810	1810	1810	1810	1810	1810
Adj Flow Rate, veh/h	118	860	146	261	1436	122	101	151	61	207	660	205
Adj No. of Lanes	2	3	0	2	2	0	2	2	2	2	2	1
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
Percent Heavy Veh, %	5	5	5	5	5	5	5	5	5	5	5	5
Cap, veh/h	296	1202	203	923	1541	130	293	782	1343	298	787	343
Arrive On Green	0.09	0.28	0.27	0.28	0.48	0.47	0.09	0.23	0.22	0.09	0.23	0.23
Sat Flow, veh/h	3343	4256	719	3343	3206	271	3343	3438	2707	3343	3438	1497
Grp Volume(v), veh/h	118	665	341	261	766	792	101	151	61	207	660	205
Grp Sat Flow(s),veh/h/ln	1672	1647	1681	1672	1719	1758	1672	1719	1354	1672	1719	1497
Q Serve(g_s), s	4.7	25.4	25.7	8.6	58.5	59.6	4.0	5.0	0.4	8.4	25.6	17.1
Cycle Q Clear(g_c), s	4.7	25.4	25.7	8.6	58.5	59.6	4.0	5.0	0.4	8.4	25.6	17.1
Prop In Lane	1.00		0.43	1.00		0.15	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	296	930	475	923	826	845	293	782	1343	298	787	343
V/C Ratio(X)	0.40	0.71	0.72	0.28	0.93	0.94	0.34	0.19	0.05	0.69	0.84	0.60
Avail Cap(c_a), veh/h	334	1317	672	923	826	845	334	782	1343	573	835	364
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	60.3	45.2	45.7	39.8	34.1	34.5	60.1	43.7	7.7	61.9	51.5	48.2
Incr Delay (d2), s/veh	0.3	4.7	9.1	0.1	18.0	19.0	0.3	0.2	0.0	1.1	7.6	3.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.2	12.1	13.1	4.0	31.8	33.3	1.8	2.4	0.4	3.9	13.0	7.3
LnGrp Delay(d),s/veh	60.6	49.8	54.7	39.9	52.0	53.5	60.3	43.9	7.7	63.0	59.1	51.2
LnGrp LOS	E	D	D	D	D	D	E	D	A	E	E	D
Approach Vol, veh/h		1124			1819			313			1072	
Approach Delay, s/veh		52.5			50.9			42.1			58.3	
Approach LOS		D			D			D			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	16.4	71.3	16.3	36.1	44.1	43.5	16.5	35.8
Change Period (Y+Rc), s	4.5	6.0	4.5	5.5	6.0	* 6	4.5	5.5
Max Green Setting (Gmax), s	13.5	60.0	13.5	32.5	19.5	* 54	23.5	22.5
Max Q Clear Time (g_c+I1), s	6.7	61.6	6.0	27.6	10.6	27.7	10.4	7.0
Green Ext Time (p_c), s	0.0	0.0	0.0	2.6	0.1	9.6	0.1	1.2

Intersection Summary	
HCM 2010 Ctrl Delay	52.5
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	24	313	398	327	256	26	102	199	160	52	1091	62
Future Volume (veh/h)	24	313	398	327	256	26	102	199	160	52	1091	62
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1810	1810	1810	1810	1810	1810	1810	1810	1810	1810	1810	1810
Adj Flow Rate, veh/h	26	340	0	355	278	0	111	216	0	57	1186	0
Adj No. of Lanes	1	2	1	1	2	1	2	2	1	1	2	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	5	5	5	5	5	5	5	5	5	5	5	5
Cap, veh/h	222	442	198	379	757	339	482	1514	677	99	1179	527
Arrive On Green	0.13	0.13	0.00	0.22	0.22	0.00	0.14	0.44	0.00	0.06	0.34	0.00
Sat Flow, veh/h	1723	3438	1538	1723	3438	1538	3343	3438	1538	1723	3438	1538
Grp Volume(v), veh/h	26	340	0	355	278	0	111	216	0	57	1186	0
Grp Sat Flow(s),veh/h/ln	1723	1719	1538	1723	1719	1538	1672	1719	1538	1723	1719	1538
Q Serve(g_s), s	1.9	13.4	0.0	28.3	9.6	0.0	4.1	5.3	0.0	4.5	48.0	0.0
Cycle Q Clear(g_c), s	1.9	13.4	0.0	28.3	9.6	0.0	4.1	5.3	0.0	4.5	48.0	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	222	442	198	379	757	339	482	1514	677	99	1179	527
V/C Ratio(X)	0.12	0.77	0.00	0.94	0.37	0.00	0.23	0.14	0.00	0.58	1.01	0.00
Avail Cap(c_a), veh/h	363	724	324	388	774	346	482	1514	677	129	1179	527
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	54.0	59.0	0.0	53.6	46.3	0.0	53.0	23.4	0.0	64.3	46.0	0.0
Incr Delay (d2), s/veh	0.3	4.0	0.0	29.9	0.4	0.0	0.1	0.2	0.0	2.0	27.7	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.9	6.6	0.0	16.7	4.6	0.0	1.9	2.5	0.0	2.2	27.3	0.0
LnGrp Delay(d),s/veh	54.3	63.0	0.0	83.5	46.7	0.0	53.1	23.6	0.0	66.3	73.7	0.0
LnGrp LOS	D	E		F	D		D	C		E	F	
Approach Vol, veh/h		366			633			327			1243	
Approach Delay, s/veh		62.4			67.4			33.6			73.4	
Approach LOS		E			E			C			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	12.5	67.6		23.5	26.2	54.0		36.3
Change Period (Y+Rc), s	4.5	6.0		5.5	6.0	* 6		5.5
Max Green Setting (Gmax), s	10.5	47.0		29.5	9.5	* 48		31.5
Max Q Clear Time (g_c+I1), s	6.5	7.3		15.4	6.1	50.0		30.3
Green Ext Time (p_c), s	0.0	1.9		2.4	0.0	0.0		0.5

Intersection Summary	
HCM 2010 Ctrl Delay	65.3
HCM 2010 LOS	E

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	84	149	435	231	328	43	156	184	31	28	574	203
Future Volume (veh/h)	84	149	435	231	328	43	156	184	31	28	574	203
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		1.00	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1792	1792	1792	1792	1792	1792	1792	1792	1900	1792	1792	1792
Adj Flow Rate, veh/h	93	166	259	257	364	16	173	204	24	31	638	63
Adj No. of Lanes	1	1	1	2	1	1	2	2	0	1	2	1
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
Percent Heavy Veh, %	6	6	6	6	6	6	6	6	6	6	6	6
Cap, veh/h	137	562	477	314	589	493	272	1302	151	92	1345	582
Arrive On Green	0.08	0.31	0.31	0.09	0.33	0.33	0.08	0.42	0.41	0.05	0.40	0.40
Sat Flow, veh/h	1707	1792	1521	3312	1792	1502	3312	3073	357	1707	3406	1473
Grp Volume(v), veh/h	93	166	259	257	364	16	173	112	116	31	638	63
Grp Sat Flow(s),veh/h/ln	1707	1792	1521	1656	1792	1502	1656	1703	1728	1707	1703	1473
Q Serve(g_s), s	7.4	9.8	19.7	10.7	24.0	1.0	7.1	5.7	5.8	2.5	19.5	3.8
Cycle Q Clear(g_c), s	7.4	9.8	19.7	10.7	24.0	1.0	7.1	5.7	5.8	2.5	19.5	3.8
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.21	1.00		1.00
Lane Grp Cap(c), veh/h	137	562	477	314	589	493	272	721	732	92	1345	582
V/C Ratio(X)	0.68	0.30	0.54	0.82	0.62	0.03	0.64	0.16	0.16	0.34	0.47	0.11
Avail Cap(c_a), veh/h	171	562	477	497	589	493	473	721	732	244	1345	582
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	62.7	36.3	39.7	62.2	39.6	31.9	62.2	24.9	25.0	63.9	31.5	26.8
Incr Delay (d2), s/veh	4.4	0.4	1.6	2.8	4.8	0.1	0.9	0.5	0.5	0.8	1.2	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.7	4.9	8.5	5.0	12.6	0.4	3.3	2.8	2.9	1.2	9.4	1.6
LnGrp Delay(d),s/veh	67.1	36.7	41.4	65.0	44.4	32.0	63.2	25.4	25.5	64.7	32.7	27.1
LnGrp LOS	E	D	D	E	D	C	E	C	C	E	C	C
Approach Vol, veh/h		518			637			401			732	
Approach Delay, s/veh		44.5			52.4			41.7			33.6	
Approach LOS		D			D			D			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	11.5	63.3	17.3	47.9	15.5	59.3	15.2	50.0
Change Period (Y+Rc), s	4.5	5.5	4.5	5.5	4.5	5.5	4.5	5.5
Max Green Setting (Gmax), s	19.5	42.5	20.5	37.5	19.5	42.5	13.5	44.5
Max Q Clear Time (g_c+I1), s	4.5	7.8	12.7	21.7	9.1	21.5	9.4	26.0
Green Ext Time (p_c), s	0.0	1.9	0.1	2.3	0.1	6.0	0.0	2.8

Intersection Summary	
HCM 2010 Ctrl Delay	42.7
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	77	89	29	624	1210	622	83	313	248	197	345	241
Future Volume (veh/h)	77	89	29	624	1210	622	83	313	248	197	345	241
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		0.98	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	83	96	3	671	1301	407	89	337	29	212	371	42
Adj No. of Lanes	1	2	0	1	2	1	2	2	1	2	2	1
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	158	355	11	559	1188	524	282	485	214	883	1134	499
Arrive On Green	0.09	0.10	0.10	0.32	0.34	0.34	0.08	0.14	0.14	0.26	0.32	0.32
Sat Flow, veh/h	1774	3503	109	1774	3539	1562	3442	3539	1559	3442	3539	1557
Grp Volume(v), veh/h	83	48	51	671	1301	407	89	337	29	212	371	42
Grp Sat Flow(s),veh/h/ln	1774	1770	1842	1774	1770	1562	1721	1770	1559	1721	1770	1557
Q Serve(g_s), s	5.1	2.9	2.9	36.3	38.6	12.7	2.8	10.4	1.9	5.6	9.2	2.2
Cycle Q Clear(g_c), s	5.1	2.9	2.9	36.3	38.6	12.7	2.8	10.4	1.9	5.6	9.2	2.2
Prop In Lane	1.00		0.06	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	158	180	187	559	1188	524	282	485	214	883	1134	499
V/C Ratio(X)	0.53	0.27	0.27	1.20	1.10	0.78	0.32	0.69	0.14	0.24	0.33	0.08
Avail Cap(c_a), veh/h	193	332	346	559	1188	524	344	1000	441	883	1134	499
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	50.1	47.7	47.7	39.4	38.2	7.6	49.8	47.3	43.6	33.9	29.7	27.3
Incr Delay (d2), s/veh	1.0	1.1	1.1	106.2	56.1	7.6	0.2	8.0	1.3	0.1	0.8	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.6	1.5	1.6	34.2	28.1	6.5	1.3	5.6	0.9	2.7	4.6	1.0
LnGrp Delay(d),s/veh	51.1	48.9	48.8	145.6	94.3	15.3	50.0	55.3	44.9	33.9	30.4	27.6
LnGrp LOS	D	D	D	F	F	B	D	E	D	C	C	C
Approach Vol, veh/h		182			2379			455			625	
Approach Delay, s/veh		49.9			95.3			53.6			31.4	
Approach LOS		D			F			D			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	13.9	42.4	14.7	44.0	35.0	21.3	41.7	17.1
Change Period (Y+Rc), s	4.5	5.5	4.5	5.4	5.5	* 5.5	5.4	* 5.4
Max Green Setting (Gmax), s	11.5	32.5	12.5	38.6	11.5	* 33	29.5	* 22
Max Q Clear Time (g_c+I1), s	4.8	11.2	7.1	40.6	7.6	12.4	38.3	4.9
Green Ext Time (p_c), s	0.0	3.3	0.0	0.0	0.1	2.8	0.0	0.5

Intersection Summary	
HCM 2010 Ctrl Delay	76.8
HCM 2010 LOS	E

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	191	199	168	71	376	129	470	279	24	116	293	634
Future Volume (veh/h)	191	199	168	71	376	129	470	279	24	116	293	634
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.96	1.00		0.99	1.00		0.97	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	169	288	69	80	422	117	528	313	23	130	329	418
Adj No. of Lanes	1	2	0	1	2	0	2	2	0	1	2	0
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	309	504	118	369	570	156	587	1224	89	159	506	442
Arrive On Green	0.17	0.17	0.17	0.21	0.21	0.21	0.17	0.37	0.37	0.09	0.29	0.29
Sat Flow, veh/h	1774	2893	678	1774	2737	751	3442	3338	244	1774	1770	1544
Grp Volume(v), veh/h	169	183	174	80	271	268	528	165	171	130	329	418
Grp Sat Flow(s),veh/h/ln	1774	1863	1709	1774	1770	1719	1721	1770	1812	1774	1770	1544
Q Serve(g_s), s	9.7	10.1	10.4	4.2	16.0	16.3	16.8	7.3	7.4	8.0	18.2	29.6
Cycle Q Clear(g_c), s	9.7	10.1	10.4	4.2	16.0	16.3	16.8	7.3	7.4	8.0	18.2	29.6
Prop In Lane	1.00		0.40	1.00		0.44	1.00		0.13	1.00		1.00
Lane Grp Cap(c), veh/h	309	324	297	369	368	358	587	649	664	159	506	442
V/C Ratio(X)	0.55	0.57	0.58	0.22	0.74	0.75	0.90	0.25	0.26	0.82	0.65	0.95
Avail Cap(c_a), veh/h	556	584	536	556	555	539	610	649	664	289	510	445
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	42.1	42.2	42.4	36.6	41.3	41.4	45.4	24.7	24.7	49.9	34.9	39.0
Incr Delay (d2), s/veh	1.5	1.5	1.8	0.3	2.9	3.1	16.1	0.2	0.2	9.7	2.9	29.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.9	5.3	5.1	2.1	8.1	8.0	9.3	3.6	3.7	4.4	9.3	16.1
LnGrp Delay(d),s/veh	43.6	43.8	44.2	36.9	44.2	44.6	61.4	24.9	24.9	59.6	37.8	68.4
LnGrp LOS	D	D	D	D	D	D	E	C	C	E	D	E
Approach Vol, veh/h		526			619			864			877	
Approach Delay, s/veh		43.9			43.4			47.2			55.6	
Approach LOS		D			D			D			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	14.5	45.4		23.9	23.5	36.4		27.7
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	18.2	33.8		35.0	19.8	32.2		35.0
Max Q Clear Time (g_c+I1), s	10.0	9.4		12.4	18.8	31.6		18.3
Green Ext Time (p_c), s	0.2	1.8		2.5	0.2	0.3		3.1

Intersection Summary	
HCM 2010 Ctrl Delay	48.3
HCM 2010 LOS	D

Notes

Intersection 1 **Landing Blvd./West Warren Avenue** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) LOS
NB	Left Turn	17	23	135.3%	52.7	D
	Through	364	339	93.1%	44.6	D
	Right Turn	247	253	102.4%	38.2	D
	Subtotal	628	615	97.9%	42.3	D
SB	Left Turn	129	114	88.4%	14.6	B
	Through	6	11	183.3%	12.8	B
	Right Turn	17	19	111.8%	2.6	A
	Subtotal	152	144	94.7%	12.9	B
EB	Left Turn	164	143	87.2%	30.1	C
	Through	410	414	101.0%	14.2	B
	Right Turn	7	4	57.1%	7.9	A
	Subtotal	581	561	96.6%	18.2	B
WB	Left Turn	23	26	113.0%	28.9	C
	Through	326	295	90.5%	20.8	C
	Right Turn	202	197	97.5%	7.9	A
	Subtotal	551	518	94.0%	16.3	B
Total		1,912	1,838	96.1%	25.3	C

Intersection 2 **Lakeview Blvd./SB I-880 ramps/Warren Avenue** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) LOS
NB	Left Turn	66	66	100.0%	29.8	C
	Through	97	102	105.2%	29.9	C
	Right Turn	489	470	96.1%	16.8	B
	Subtotal	652	638	97.9%	20.2	C
SB	Left Turn	428	425	99.3%	77.6	E
	Through	31	47	151.6%	88.7	F
	Right Turn	68	77	113.2%	65.1	E
	Subtotal	527	549	104.2%	76.8	E
EB	Left Turn	224	230	102.7%	29.1	C
	Through	551	543	98.5%	19.7	B
	Right Turn	11	7	63.6%	18.3	B
	Subtotal	786	780	99.2%	22.4	C
WB	Left Turn	52	41	78.8%	33.2	C
	Through	417	378	90.6%	23.4	C
	Right Turn	294	279	94.9%	2.8	A
	Subtotal	763	698	91.5%	15.7	B
Total		2,728	2,665	97.7%	31.3	C

Intersection 3 **NB I-880 ramps/Warren Avenue** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) LOS
NB	Left Turn	38	40	105.3%	110.9	F
	Through					
	Right Turn	106	101	95.3%	90.3	F
	Subtotal	144	141	97.9%	96.1	F
SB	Left Turn					
	Through					
	Right Turn					
	Subtotal					
EB	Left Turn					
	Through	1,145	1,122	98.0%	9.2	A
	Right Turn	323	316	97.8%	3.6	A
	Subtotal	1,468	1,438	98.0%	7.9	A
WB	Left Turn	287	234	81.5%	25.2	C
	Through	725	669	92.3%	1.3	A
	Right Turn					
	Subtotal	1,012	903	89.2%	7.5	A
Total		2,624	2,482	94.6%	12.8	B

Intersection 4 **Kato Road/Warren Avenue** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) LOS
NB	Left Turn	420	327	77.9%	85.6	F
	Through	322	231	71.7%	85.7	F
	Right Turn	379	282	74.4%	51.2	D
	Subtotal	1,121	840	74.9%	74.1	E
SB	Left Turn	91	88	96.7%	40.2	D
	Through	99	86	86.9%	43.2	D
	Right Turn	276	275	99.6%	0.9	A
	Subtotal	466	449	96.4%	16.7	B
EB	Left Turn	163	153	93.9%	48.1	D
	Through	897	874	97.4%	31.4	C
	Right Turn	191	184	96.3%	27.5	C
	Subtotal	1,251	1,211	96.8%	32.9	C
WB	Left Turn	49	48	98.0%	53.1	D
	Through	316	299	94.6%	28.7	C
	Right Turn	67	69	103.0%	10.8	B
	Subtotal	432	416	96.3%	28.6	C
Total		3,270	2,916	89.2%	41.7	D

Intersection 5 **Mission Falls Court/Warren Avenue** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) LOS
NB	Left Turn	83	71	85.5%	11.7	B
	Through	4	1	25.0%	38.4	E
	Right Turn	13	16	123.1%	8.0	A
	Subtotal	100	88	88.0%	11.4	B
SB	Left Turn	8	5	62.5%	0.0	A
	Through					
	Right Turn	13	15	115.4%	0.0	A
	Subtotal	21	20	95.2%	0.0	A
EB	Left Turn	16	14	87.5%	1.8	A
	Through	1,319	1,205	91.4%	3.8	A
	Right Turn	32	26	81.3%	1.6	A
	Subtotal	1,367	1,245	91.1%	3.7	A
WB	Left Turn	25	25	100.0%	15.1	C
	Through	336	334	99.4%	0.0	A
	Right Turn	4	3	75.0%	0.8	A
	Subtotal	365	362	99.2%	1.0	A
Total		1,853	1,715	92.6%	3.5	A

Intersection 6 **Warm Springs Blvd/Warren Avenue** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) LOS
NB	Left Turn	134	120	89.6%	58.8	E
	Through	709	739	104.2%	33.0	C
	Right Turn	70	78	111.4%	27.1	C
	Subtotal	913	937	102.6%	35.8	D
SB	Left Turn	174	164	94.3%	67.0	E
	Through	447	391	87.5%	30.1	C
	Right Turn	92	133	144.6%	1.3	A
	Subtotal	713	688	96.5%	33.3	C
EB	Left Turn	380	322	84.7%	57.5	E
	Through	643	581	90.4%	59.6	E
	Right Turn	317	293	92.4%	6.4	A
	Subtotal	1,340	1,196	89.3%	46.0	D
WB	Left Turn	91	76	83.5%	44.6	D
	Through	139	124	89.2%	50.0	D
	Right Turn	68	77	113.2%	1.4	A
	Subtotal	298	277	93.0%	35.0	D
Total		3,264	3,098	94.9%	39.1	D

Intersection 7 **Kato Road/Mission Blvd. off-ramp** **All-way Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) LOS
NB	Left Turn	446	369	82.7%	1.4	A
	Through					
	Right Turn					
	Subtotal	446	369	82.7%	1.4	A
SB	Left Turn					
	Through					
	Right Turn					
	Subtotal					
EB	Left Turn					
	Through					
	Right Turn	503	484	96.2%	1.3	A
	Subtotal	503	484	96.2%	1.3	A
WB	Left Turn	58	54	93.1%	1.2	A
	Through	148	135	91.2%	1.7	A
	Right Turn					
	Subtotal	206	189	91.7%	1.6	A
Total		1,155	1,042	90.2%	1.4	A

Intersection 8 **Kato Road/Mission Blvd. On-ramp** **Uncontrolled**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	l Delay (sec/veh) Average	l Delay (sec/veh) LOS
NB	Left Turn					
	Through	446	369	82.7%	0.6	A
	Right Turn	106	83	78.3%	0.5	A
	Subtotal	552	452	81.9%	0.6	A
SB	Left Turn	95	87	91.6%	2.8	A
	Through	466	451	96.8%	0.1	A
	Right Turn					
	Subtotal	561	538	95.9%	0.5	A
EB	Left Turn					
	Through					
	Second Right					
	Subtotal					
WB	Left Turn					
	Through					
	Second Right					
	Subtotal					
Total		1,113	990	88.9%	0.6	A

Intersection 9 **Warm Springs Blvd/Mission Blvd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) LOS
NB	Left Turn	225	303	134.7%	73.7	E
	Through	781	800	102.4%	68.2	E
	Right Turn	151	129	85.4%	74.6	E
	Subtotal	1,157	1,232	106.5%	70.2	E
SB	Left Turn	357	353	98.9%	99.5	F
	Through	446	447	100.2%	54.8	D
	Right Turn	491	482	98.2%	14.4	B
	Subtotal	1,294	1,282	99.1%	51.9	D
EB	Left Turn	234	258	110.3%	2185.7	F
	Through	1,342	1,510	112.5%	2200.4	F
	Right Turn	184	172	93.5%	2147.4	F
	Subtotal	1,760	1,940	110.2%	2193.7	F
WB	Left Turn	83	86	103.6%	51.0	D
	Through	1,531	1,453	94.9%	18.7	B
	Right Turn	202	192	95.0%	9.6	A
	Subtotal	1,816	1,731	95.3%	19.3	B
Total		6,027	6,185	102.6%	718.2	F

Intersection 10 **Mohave Drive/Mission Blvd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) LOS
NB	Left Turn	167	145	86.8%	87.8	F
	Through	144	134	93.1%	78.2	E
	Right Turn	174	191	109.8%	22.2	C
	Subtotal	485	470	96.9%	58.4	E
SB	Left Turn	107	106	99.1%	25.2	C
	Through	75	67	89.3%	17.8	B
	Right Turn	40	41	102.5%	0.0	A
	Subtotal	222	214	96.4%	18.0	B
EB	Left Turn	143	117	81.8%	57.8	E
	Through	1,643	1,847	112.4%	71.7	E
	Right Turn	64	61	95.3%	30.3	C
	Subtotal	1,850	2,025	109.5%	69.7	E
WB	Left Turn	132	118	89.4%	84.8	F
	Through	1,609	1,545	96.0%	33.8	C
	Right Turn	75	67	89.3%	24.5	C
	Subtotal	1,816	1,730	95.3%	36.9	D
Total		4,373	4,439	101.5%	53.2	D

Intersection 11 **Curtner Rd/Mission Blvd** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) LOS
NB	Left Turn					
	Through					
	Right Turn	8	8	100.0%	0.0	A
	Subtotal	8	8	100.0%	0.0	A
SB	Left Turn					
	Through					
	Right Turn					
	Subtotal					
EB	Left Turn					
	Through	1,462	1,420	97.1%	3.9	A
	Right Turn	160	159	99.4%	1.0	A
	Subtotal	1,622	1,579	97.3%	3.6	A
WB	Left Turn					
	Through	420	400	95.2%	0.1	A
	Right Turn					
	Subtotal	420	400	95.2%	0.1	A
Total		2,050	1,987	96.9%	2.9	A

Intersection 12 **Mission Blvd/Paseo Padre Pkwy** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) LOS
NB	Left Turn	260	240	92.3%	51.7	D
	Through	1,176	1,180	100.3%	29.7	C
	Right Turn	34	25	73.5%	19.4	B
	Subtotal	1,470	1,445	98.3%	33.1	C
SB	Left Turn	61	57	93.4%	55.6	E
	Through	276	270	97.8%	23.8	C
	Right Turn	12	12	100.0%	11.6	B
	Subtotal	349	339	97.1%	28.7	C
EB	Left Turn	4	7	175.0%	67.1	E
	Through	82	78	95.1%	46.6	D
	Right Turn	98	93	94.9%	6.9	A
	Subtotal	184	178	96.7%	26.7	C
WB	Left Turn	46	37	80.4%	80.9	F
	Through	487	482	99.0%	72.9	E
	Right Turn	304	294	96.7%	19.3	B
	Subtotal	837	813	97.1%	53.9	D
Total		2,840	2,775	97.7%	38.3	D

Intersection 13 **I-880 Ramps/Mission Blvd.** **Uncontrolled**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) LOS
NB	Left Turn					
	Through					
	Right Turn	1,559	1,175	75.4%	483.7	F
	Subtotal	1,559	1,175	75.4%	483.7	F
SB	Left Turn					
	Through					
	Right Turn					
	Subtotal					
EB	Left Turn					
	Through	515	546	106.0%	1442.4	F
	Right Turn					
	Subtotal	515	546	106.0%	1442.4	F
WB	Left Turn					
	Through	1,184	1,146	96.8%	1.9	A
	Right Turn	857	890	103.9%	1.3	A
	Subtotal	2,041	2,036	99.8%	1.6	A
Total		4,115	3,757	91.3%	361.8	F

Intersection 14 **SB I-680 Diagonal Ramps/Mission Blvd.** **Uncontrolled**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) LOS
NB	Left Turn					
	Through					
	Right Turn					
	Subtotal					
SB	Left Turn					
	Through					
	Right Turn	983	944	96.0%	2.2	A
	Subtotal	983	944	96.0%	2.2	A
EB	Left Turn					
	Through	985	1,117	113.4%	49.6	E
	Right Turn	912	957	104.9%	3.1	A
	Subtotal	1,897	2,074	109.3%	28.1	D
WB	Left Turn					
	Through	1,224	1,154	94.3%	1.2	A
	Right Turn					
	Subtotal	1,224	1,154	94.3%	1.2	A
Total		4,104	4,172	101.7%	14.8	B

Intersection 15 **SB I-680 Loop Ramps/Mission Blvd.** **Uncontrolled**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) LOS
NB	Left Turn					
	Through					
	Right Turn	25	20	80.0%	21.1	C
	Subtotal	25	20	80.0%	21.1	C
SB	Left Turn					
	Through					
	Right Turn					
	Subtotal					
EB	Left Turn					
	Through	985	1,105	112.2%	96.1	F
	Right Turn					
	Subtotal	985	1,105	112.2%	96.1	F
WB	Left Turn					
	Through	1,224	1,153	94.2%	0.8	A
	Right Turn	172	165	95.9%	3.6	A
	Subtotal	1,396	1,318	94.4%	1.2	A
Total		2,406	2,443	101.5%	44.3	E

Intersection 16 **NB I-680 Loop Ramps/Mission Blvd.** **Uncontrolled**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) LOS
NB	Left Turn					
	Through					
	Right Turn					
	Subtotal					
SB	Left Turn					
	Through					
	Right Turn	992	934	94.2%	39.1	E
	Subtotal	992	934	94.2%	39.1	E
EB	Left Turn					
	Through	537	507	94.4%	6.8	A
	Right Turn	473	632	133.6%	238.3	F
	Subtotal	1,010	1,139	112.8%	135.2	F
WB	Left Turn					
	Through	404	384	95.0%	0.1	A
	Right Turn					
	Subtotal	404	384	95.0%	0.1	A
Total		2,406	2,457	102.1%	77.6	F

Intersection 17 **NB I-680 Diagonal Ramps/Mission Blvd.** **Uncontrolled**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) LOS
NB	Left Turn					
	Through					
	Right Turn	1,085	1,076	99.2%	3.0	A
	Subtotal	1,085	1,076	99.2%	3.0	A
SB	Left Turn					
	Through					
	Right Turn					
	Subtotal					
EB	Left Turn					
	Through	537	506	94.2%	0.3	A
	Right Turn					
	Subtotal	537	506	94.2%	0.3	A
WB	Left Turn					
	Through	404	384	95.0%	0.0	A
	Right Turn	16	16	100.0%	0.0	A
	Subtotal	420	400	95.2%	0.0	A
Total		2,042	1,982	97.1%	1.7	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	429	1083	109	271	724	191	115	867	347	123	237	123
Future Volume (veh/h)	429	1083	109	271	724	191	115	867	347	123	237	123
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1900
Adj Flow Rate, veh/h	442	1116	0	279	746	103	119	894	0	127	244	0
Adj No. of Lanes	2	3	1	2	2	1	2	2	1	2	2	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	487	2073	646	327	1278	563	228	944	422	255	971	0
Arrive On Green	0.14	0.41	0.00	0.09	0.36	0.36	0.07	0.27	0.00	0.07	0.27	0.00
Sat Flow, veh/h	3442	5085	1583	3442	3539	1561	3442	3539	1583	3442	3632	0
Grp Volume(v), veh/h	442	1116	0	279	746	103	119	894	0	127	244	0
Grp Sat Flow(s),veh/h/ln	1721	1695	1583	1721	1770	1561	1721	1770	1583	1721	1770	0
Q Serve(g_s), s	16.9	22.3	0.0	10.7	22.9	6.1	4.5	33.2	0.0	4.8	7.2	0.0
Cycle Q Clear(g_c), s	16.9	22.3	0.0	10.7	22.9	6.1	4.5	33.2	0.0	4.8	7.2	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	487	2073	646	327	1278	563	228	944	422	255	971	0
V/C Ratio(X)	0.91	0.54	0.00	0.85	0.58	0.18	0.52	0.95	0.00	0.50	0.25	0.00
Avail Cap(c_a), veh/h	501	2073	646	347	1278	563	347	951	425	347	971	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	56.6	30.1	0.0	59.7	34.7	29.3	60.5	48.2	0.0	59.7	37.9	0.0
Incr Delay (d2), s/veh	19.3	1.0	0.0	16.5	2.0	0.7	0.7	17.9	0.0	0.6	0.2	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	9.3	10.6	0.0	5.8	11.5	2.7	2.2	18.6	0.0	2.3	3.6	0.0
LnGrp Delay(d),s/veh	75.9	31.1	0.0	76.2	36.6	30.0	61.2	66.1	0.0	60.2	38.1	0.0
LnGrp LOS	E	C		E	D	C	E	E		E	D	
Approach Vol, veh/h		1558			1128			1013			371	
Approach Delay, s/veh		43.8			45.8			65.5			45.7	
Approach LOS		D			D			E			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	17.2	60.6	13.4	42.8	23.5	54.4	14.4	41.7
Change Period (Y+Rc), s	4.5	6.0	4.5	6.0	4.5	6.0	4.5	6.0
Max Green Setting (Gmax), s	13.5	50.0	13.5	36.0	19.5	44.0	13.5	36.0
Max Q Clear Time (g_c+I1), s	12.7	24.3	6.5	9.2	18.9	24.9	6.8	35.2
Green Ext Time (p_c), s	0.0	11.1	0.0	2.0	0.0	6.8	0.0	0.5

Intersection Summary	
HCM 2010 Ctrl Delay	49.9
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	398	1269	122	172	843	258	185	789	302	219	296	194
Future Volume (veh/h)	398	1269	122	172	843	258	185	789	302	219	296	194
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		0.97	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1900	1845	1845	1900	1845	1845	1845	1845	1845	1845
Adj Flow Rate, veh/h	419	1336	120	181	887	250	195	831	249	231	312	44
Adj No. of Lanes	2	3	0	2	2	0	2	2	2	2	2	1
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
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	466	2139	192	254	1059	298	305	798	814	305	798	349
Arrive On Green	0.14	0.46	0.46	0.07	0.39	0.39	0.09	0.23	0.23	0.09	0.23	0.23
Sat Flow, veh/h	3408	4698	422	3408	2692	758	3408	3505	2673	3408	3505	1533
Grp Volume(v), veh/h	419	955	501	181	577	560	195	831	249	231	312	44
Grp Sat Flow(s),veh/h/ln	1704	1679	1763	1704	1752	1698	1704	1752	1336	1704	1752	1533
Q Serve(g_s), s	16.2	29.0	29.0	7.0	39.9	40.0	7.4	30.5	9.6	8.9	10.1	3.1
Cycle Q Clear(g_c), s	16.2	29.0	29.0	7.0	39.9	40.0	7.4	30.5	9.6	8.9	10.1	3.1
Prop In Lane	1.00		0.24	1.00		0.45	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	466	1529	803	254	689	667	305	798	814	305	798	349
V/C Ratio(X)	0.90	0.62	0.62	0.71	0.84	0.84	0.64	1.04	0.31	0.76	0.39	0.13
Avail Cap(c_a), veh/h	521	1529	803	292	689	667	369	798	814	420	850	372
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	56.9	27.8	27.8	60.6	36.8	36.8	58.9	51.7	36.0	59.6	43.9	41.1
Incr Delay (d2), s/veh	16.2	1.9	3.7	5.0	11.6	12.1	1.4	43.2	0.3	3.1	0.4	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.7	13.8	14.9	3.5	21.5	20.9	3.6	19.5	3.6	4.3	4.9	1.3
LnGrp Delay(d),s/veh	73.2	29.7	31.4	65.6	48.4	48.9	60.3	95.0	36.3	62.7	44.3	41.4
LnGrp LOS	E	C	C	E	D	D	E	F	D	E	D	D
Approach Vol, veh/h		1875			1318			1275			587	
Approach Delay, s/veh		39.9			51.0			78.2			51.3	
Approach LOS		D			D			E			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	22.8	58.7	16.5	36.0	14.5	67.0	16.5	36.0
Change Period (Y+Rc), s	4.5	6.0	4.5	5.5	4.5	6.0	4.5	5.5
Max Green Setting (Gmax), s	20.5	46.0	14.5	32.5	11.5	55.0	16.5	30.5
Max Q Clear Time (g_c+I1), s	18.2	42.0	9.4	12.1	9.0	31.0	10.9	32.5
Green Ext Time (p_c), s	0.1	2.8	0.1	2.7	0.0	13.9	0.1	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	53.8
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	36	398	163	271	486	53	374	991	382	60	458	31
Future Volume (veh/h)	36	398	163	271	486	53	374	991	382	60	458	31
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1845	1845	1845	1845	1845	1845	1845	1845	1845	1845
Adj Flow Rate, veh/h	39	428	0	291	523	0	402	1066	0	65	492	0
Adj No. of Lanes	1	2	1	1	2	1	2	2	1	1	2	1
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
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	272	543	243	357	712	318	448	1046	468	302	1228	549
Arrive On Green	0.15	0.15	0.00	0.20	0.20	0.00	0.13	0.30	0.00	0.17	0.35	0.00
Sat Flow, veh/h	1757	3505	1568	1757	3505	1568	3408	3505	1568	1757	3505	1568
Grp Volume(v), veh/h	39	428	0	291	523	0	402	1066	0	65	492	0
Grp Sat Flow(s),veh/h/ln	1757	1752	1568	1757	1752	1568	1704	1752	1568	1757	1752	1568
Q Serve(g_s), s	2.6	15.8	0.0	21.2	18.7	0.0	15.6	40.0	0.0	4.3	14.2	0.0
Cycle Q Clear(g_c), s	2.6	15.8	0.0	21.2	18.7	0.0	15.6	40.0	0.0	4.3	14.2	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	272	543	243	357	712	318	448	1046	468	302	1228	549
V/C Ratio(X)	0.14	0.79	0.00	0.82	0.73	0.00	0.90	1.02	0.00	0.22	0.40	0.00
Avail Cap(c_a), veh/h	387	772	345	426	850	380	471	1046	468	302	1228	549
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	48.9	54.5	0.0	51.0	50.0	0.0	57.3	47.0	0.0	47.7	32.9	0.0
Incr Delay (d2), s/veh	0.3	4.5	0.0	11.1	3.2	0.0	18.4	32.7	0.0	0.1	1.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.3	8.0	0.0	11.4	9.4	0.0	8.5	24.1	0.0	2.1	7.1	0.0
LnGrp Delay(d),s/veh	49.3	59.1	0.0	62.0	53.2	0.0	75.7	79.7	0.0	47.8	33.9	0.0
LnGrp LOS	D	E		E	D		E	F		D	C	
Approach Vol, veh/h		467			814			1468			557	
Approach Delay, s/veh		58.2			56.4			78.6			35.5	
Approach LOS		E			E			E			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	29.0	46.0		26.2	22.1	52.9		32.7
Change Period (Y+Rc), s	6.0	* 6		5.5	4.5	6.0		5.5
Max Green Setting (Gmax), s	10.5	* 40		29.5	18.5	32.0		32.5
Max Q Clear Time (g_c+I1), s	6.3	42.0		17.8	17.6	16.2		23.2
Green Ext Time (p_c), s	0.0	0.0		2.8	0.0	3.6		3.9

Intersection Summary	
HCM 2010 Ctrl Delay	63.0
HCM 2010 LOS	E

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	195	418	381	58	172	46	508	824	177	61	308	212
Future Volume (veh/h)	195	418	381	58	172	46	508	824	177	61	308	212
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		0.97	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1845	1845	1845	1845	1845	1845	1900	1845	1845	1845
Adj Flow Rate, veh/h	207	445	105	62	183	9	540	877	175	65	328	60
Adj No. of Lanes	1	1	1	2	1	1	2	2	0	1	2	1
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	230	499	421	252	393	329	585	1271	253	119	1173	512
Arrive On Green	0.13	0.27	0.27	0.07	0.21	0.21	0.17	0.44	0.44	0.07	0.33	0.33
Sat Flow, veh/h	1757	1845	1558	3408	1845	1546	3408	2898	578	1757	3505	1531
Grp Volume(v), veh/h	207	445	105	62	183	9	540	530	522	65	328	60
Grp Sat Flow(s),veh/h/ln	1757	1845	1558	1704	1845	1546	1704	1752	1723	1757	1752	1531
Q Serve(g_s), s	15.5	31.1	7.1	2.3	11.6	0.6	20.9	32.6	32.7	4.8	9.2	3.6
Cycle Q Clear(g_c), s	15.5	31.1	7.1	2.3	11.6	0.6	20.9	32.6	32.7	4.8	9.2	3.6
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.34	1.00		1.00
Lane Grp Cap(c), veh/h	230	499	421	252	393	329	585	768	756	119	1173	512
V/C Ratio(X)	0.90	0.89	0.25	0.25	0.47	0.03	0.92	0.69	0.69	0.54	0.28	0.12
Avail Cap(c_a), veh/h	282	613	517	343	502	421	623	768	756	138	1173	512
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	57.3	47.0	38.3	58.5	46.1	41.7	54.6	30.3	30.3	60.4	32.7	30.9
Incr Delay (d2), s/veh	23.3	14.3	0.4	0.2	1.2	0.0	18.2	5.0	5.1	1.4	0.6	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	9.0	17.8	3.1	1.1	6.1	0.3	11.3	16.8	16.6	2.4	4.6	1.6
LnGrp Delay(d),s/veh	80.7	61.4	38.7	58.7	47.3	41.8	72.8	35.3	35.4	61.9	33.3	31.3
LnGrp LOS	F	E	D	E	D	D	E	D	D	E	C	C
Approach Vol, veh/h		757			254			1592			453	
Approach Delay, s/veh		63.5			49.9			48.1			37.1	
Approach LOS		E			D			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	13.6	64.3	14.4	41.7	27.5	50.4	22.1	34.1
Change Period (Y+Rc), s	4.5	5.5	4.5	5.5	4.5	5.5	4.5	5.5
Max Green Setting (Gmax), s	10.5	45.5	13.5	44.5	24.5	31.5	21.5	36.5
Max Q Clear Time (g_c+I1), s	6.8	34.7	4.3	33.1	22.9	11.2	17.5	13.6
Green Ext Time (p_c), s	0.0	6.3	0.0	3.1	0.1	2.9	0.0	1.3

Intersection Summary	
HCM 2010 Ctrl Delay	50.4
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	232	584	87	278	570	627	50	688	351	430	478	144
Future Volume (veh/h)	232	584	87	278	570	627	50	688	351	430	478	144
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		0.99	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	249	628	84	299	613	394	54	740	92	462	514	56
Adj No. of Lanes	1	2	0	1	2	1	2	2	1	2	2	1
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	341	700	93	266	615	272	227	937	413	693	1443	635
Arrive On Green	0.19	0.22	0.22	0.15	0.17	0.17	0.07	0.26	0.26	0.20	0.41	0.41
Sat Flow, veh/h	1774	3138	419	1774	3539	1562	3442	3539	1560	3442	3539	1556
Grp Volume(v), veh/h	249	354	358	299	613	394	54	740	92	462	514	56
Grp Sat Flow(s),veh/h/ln	1774	1770	1787	1774	1770	1562	1721	1770	1560	1721	1770	1556
Q Serve(g_s), s	17.1	25.2	25.3	19.5	22.5	22.6	1.9	25.3	4.1	16.1	13.1	1.5
Cycle Q Clear(g_c), s	17.1	25.2	25.3	19.5	22.5	22.6	1.9	25.3	4.1	16.1	13.1	1.5
Prop In Lane	1.00		0.23	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	341	395	399	266	615	272	227	937	413	693	1443	635
V/C Ratio(X)	0.73	0.90	0.90	1.12	1.00	1.45	0.24	0.79	0.22	0.67	0.36	0.09
Avail Cap(c_a), veh/h	375	417	421	266	615	272	490	1320	582	693	1443	635
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	49.3	49.0	49.1	55.3	53.7	53.7	57.6	44.4	17.8	47.9	26.7	6.7
Incr Delay (d2), s/veh	5.2	21.3	21.6	92.6	35.3	222.3	0.2	6.7	1.2	2.0	0.7	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.9	14.6	14.9	16.4	14.0	26.5	0.9	13.2	1.9	7.8	6.5	0.7
LnGrp Delay(d),s/veh	54.5	70.4	70.6	147.8	89.0	276.0	57.8	51.1	19.1	49.9	27.4	7.0
LnGrp LOS	D	E	E	F	F	F	E	D	B	D	C	A
Approach Vol, veh/h		961			1306			886			1032	
Approach Delay, s/veh		66.4			158.8			48.2			36.3	
Approach LOS		E			F			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	13.1	58.5	30.4	28.0	31.7	39.9	24.0	34.4
Change Period (Y+Rc), s	4.5	5.5	5.4	* 5.4	5.5	* 5.5	4.5	5.4
Max Green Setting (Gmax), s	18.5	41.5	27.5	* 23	11.5	* 49	19.5	30.6
Max Q Clear Time (g_c+I1), s	3.9	15.1	19.1	24.6	18.1	27.3	21.5	27.3
Green Ext Time (p_c), s	0.0	5.1	0.1	0.0	0.0	7.2	0.0	1.6

Intersection Summary	
HCM 2010 Ctrl Delay	84.0
HCM 2010 LOS	F

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	506	291	353	54	122	102	370	576	43	169	441	230
Future Volume (veh/h)	506	291	353	54	122	102	370	576	43	169	441	230
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.96	1.00		0.94	1.00		0.96	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	380	554	273	59	133	1	402	626	43	184	479	199
Adj No. of Lanes	1	2	0	1	2	0	2	2	0	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	554	725	356	211	428	3	473	916	63	216	625	258
Arrive On Green	0.31	0.31	0.31	0.12	0.12	0.12	0.14	0.27	0.27	0.12	0.26	0.26
Sat Flow, veh/h	1774	2321	1141	1774	3599	27	3442	3352	230	1774	2428	1002
Grp Volume(v), veh/h	380	444	383	59	65	69	402	330	339	184	348	330
Grp Sat Flow(s),veh/h/ln	1774	1863	1599	1774	1770	1856	1721	1770	1812	1774	1770	1660
Q Serve(g_s), s	19.4	22.3	22.4	3.1	3.5	3.5	11.8	17.3	17.3	10.5	18.8	19.1
Cycle Q Clear(g_c), s	19.4	22.3	22.4	3.1	3.5	3.5	11.8	17.3	17.3	10.5	18.8	19.1
Prop In Lane	1.00		0.71	1.00		0.01	1.00		0.13	1.00		0.60
Lane Grp Cap(c), veh/h	554	582	499	211	211	221	473	484	495	216	456	428
V/C Ratio(X)	0.69	0.76	0.77	0.28	0.31	0.31	0.85	0.68	0.68	0.85	0.76	0.77
Avail Cap(c_a), veh/h	642	674	579	599	598	627	551	577	591	269	562	527
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	31.2	32.2	32.2	41.6	41.8	41.8	43.7	33.6	33.7	44.6	35.6	35.7
Incr Delay (d2), s/veh	2.5	4.5	5.3	0.7	0.8	0.8	10.7	2.6	2.6	19.0	4.9	5.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	9.9	12.2	10.6	1.6	1.8	1.8	6.3	8.8	9.0	6.3	9.8	9.4
LnGrp Delay(d),s/veh	33.7	36.7	37.5	42.3	42.6	42.6	54.4	36.2	36.2	63.6	40.5	41.2
LnGrp LOS	C	D	D	D	D	D	D	D	D	E	D	D
Approach Vol, veh/h		1207			193			1071			862	
Approach Delay, s/veh		36.0			42.5			43.0			45.7	
Approach LOS		D			D			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	17.1	32.8		36.9	18.7	31.2		16.8
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	15.7	33.8		37.5	16.6	32.9		35.0
Max Q Clear Time (g_c+I1), s	12.5	19.3		24.4	13.8	21.1		5.5
Green Ext Time (p_c), s	0.1	3.3		5.4	0.4	3.1		0.9

Intersection Summary	
HCM 2010 Ctrl Delay	41.1
HCM 2010 LOS	D

Notes

FEHR PEERS

Attachment B:

Collision Analysis

2201 Broadway | Suite 602 | Oakland, CA 94612 | (510) 834-3200 | Fax (510) 253-0059
www.fehrandpeers.com

2150 Trade Zone Boulevard
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Memorandum

Date: June 25, 2019

To: Sissel Berntsen-Heber, HNTB
Kim Franchi, HNTB

From: Jill Hough and Siqing Yi, CHS Consulting Group

Re: State Route 262 (Mission Boulevard) Cross Connector Project - Collision Analysis

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The purpose of this memo is to provide a summary of collisions for the State Route 262 (Mission Boulevard) Cross Connector Project. CHS obtained collision data from the Traffic Analysis Surveillance and Analysis System (TASAS), which is the collision database maintained by Caltrans. The study area roadways for which the collision data was obtained included the following:

- I-680 between Scott Creek Road and Auto Mall Parkway;
- I-880 between Dixon Landing Road and Fremont Boulevard; and
- State Route 262 (Mission Boulevard) between I-880 and I-680.

Caltrans staff provided the collision data in the study area between January 1, 2013 and December 31, 2017 (for I-680) and between January 1, 2014 and December 31, 2018 (for I-880 and SR-262). The data was summarized and is presented in Table 1.

Table 1
Collision Summary for Study Area

Freeway	Location	Number of Accidents			Actual Accident Rate[3]			Average Accident Rate (State)[3]		
		Total	Fatal	Fatal + Injury	Total	Fatal	Fatal + Injury	Total	Fatal	Fatal + Injury
SR-262[1]	Between I-880 and I-680	135	1	59	1.00	0.007	0.44	1.39	0.011	0.61
I-880[2]	Between Dixon Landing Road and Fremont Boulevard	1,025	4	277	0.89	0.003	0.24	0.89	0.003	0.27
I-680[2]	Between Scott Creek Road and Auto Mall Parkway	919	3	313	0.89	0.003	0.30	0.79	0.003	0.25

Notes:
1. Collisions on SR-262 include both intersections and roadways.
2. Collisions on I-680 and I-880 include both ramps and mainline.
3. Actual and Average Accident Rates are measured in accidents per million vehicle miles.

SR-262 (Mission Boulevard)

For SR-262 (Mission Boulevard), as shown in Table 1, a total of 135 collisions with one fatality were reported over the five-year period. The actual collision rates for SR-262 (Mission Boulevard) are lower than the Statewide average for total accidents, fatal accidents, and for "fatal + injury" accidents. Approximately 45% of the accidents were classified as "rear-end" collisions, and 33% were classified as "sideswipe" collisions. The majority of primary collision factors were speeding (40%) and improper turns (14%). Fewer collisions were categorized as "failure to yield" (11%) as the primary collision factor. The majority of collisions occurred in the left lanes (36%) and right lanes (43%). Fewer collisions occurred in the interior lanes (28%). In 81 percent of the collisions, the vehicle in the accident was proceeding straight. Of the 135 collisions, 24 occurred at intersections on Mission Boulevard: The remaining 111 accidents occurred on the Mission Boulevard roadway segments between I-880 and I-680. The detailed collision summary for the mainline and each intersection is shown in Table 2.

Table 2
Collision Summary for SR-262 (Mission Boulevard)

Location	Number of Accidents			Actual Accident Rate[1]			Average Accident Rate (State)[1]		
	Total	Fatal	Fatal + Injury	Total	Fatal	Fatal + Injury	Total	Fatal	Fatal + Injury
Mainline Between I-880 and I-680	111	1	41	0.82	0.007	0.30	1.39	0.011	0.61
Intersection at Warm Springs Blvd	9	0	5	0.06	0.00	0.03	0.24	0.001	0.11
Intersection at Mohave Dr	5	0	5	0.04	0.00	0.04	0.08	0.001	0.04
Intersection at Brown Rd	10	0	8	0.07	0.00	**0.06**	0.08	0.001	0.04

Notes: Actual accident rates shown in **bold** text exceed the statewide average for similar facilities.

1. Actual and Average Accident Rates are measured in accidents per million vehicle miles for mainline, and accidents per million vehicles for ramps.

The actual collision rates for the SR-262 mainline are lower than the SR-262 State average, with respect to total accidents, fatal accidents, and "fatal + injury" accidents. Review of detailed accident records associated with SR-262 shows that the majority of collisions are generally concentrated at the following two locations:

- Near the intersection of SR-262 and Warm Springs Boulevard: A total of 23.4% of the total SR-262 mainline collisions occurred within 300 feet west or east of the intersection; and

- At the SR-262 merging/diverging locations to I-880 and Kato Road ramps: A total of 42% of the total mainline collisions occurred from 300 feet west of the northbound and southbound I-880 on-ramp termini to eastbound Mission Boulevard; to 300 feet east of the Westbound Mission Boulevard off-ramp diverge point to Kato Road. Among the 74 collisions that occurred within these two segments, 62% were classified as "rear-end" collisions, and 38% were classified as "sideswipe" collisions. The primary collision factor for the majority of the collisions (54%) was speeding. Rear-end collisions, which make up the majority of accidents within this section, are generally associated with driver inattention, unsafe speeds, and/or lane changing in the presence of traffic congestion.

The actual collision rates for the intersections of SR-262 (Mission Boulevard) at Warm Springs Boulevard and Mohave Drive are lower than or the same as the Statewide average for total accidents, fatal accidents, and for "fatal + injury" accidents. At the intersection of SR-262 (Mission Boulevard) at Brown Road, the actual "fatal + injury" collision rate is slightly higher than the State average. A total of ten collisions occurred at this intersection, with eight collisions involving injuries. The primary collision factors were "failure to yield" for 40% of the collisions, and "improper turn" for 30% of the collisions. Seven of the ten collisions were classified as broadside collisions. The majority of the collisions related to left-turning vehicles from eastbound Mission Boulevard to northbound Brown Road. The types of collisions where the primary factors were either "failure to yield" or "improper turns" are generally associated with driver inattention.

I-880

As shown previously in Table 1, for I-880 overall, there were 1,025 collisions with four fatalities reported. The actual collision rates for mainline and ramps combined are lower than the State average for I-880 with respect to total accidents, fatal accidents, and "fatal + injury" accidents. The detailed collision summary for the mainline and for individual I-880 ramps is presented in Table 3.

The actual collision rates for the I-880 mainline are lower than the State average for I-880 with respect to total accidents, fatal accidents, and "fatal + injury" accidents. An analysis of individual collision records shows that a significant number of collisions occurred within the segment near Southbound I-880, north of the Mission Boulevard on-ramp and Northbound I -880, south of the Mission Boulevard off-ramp. There were 146 collisions reported within this segment (16% of the total collisions occurred within 3% of the total study area on I-880). Of the 146 collisions on this segment, 82% occurred in the northbound direction (NB I-880, south of the Mission Boulevard off-ramp).

Table 3
Collision Summary for I-880

Location	Number of Accidents			Actual Accident Rate[1]			Average Accident Rate (State)[1]		
	Total	Fatal	Fatal + Injury	Total	Fatal	Fatal + Injury	Total	Fatal	Fatal + Injury
Mainline Between Dixon Landing Road and Fremont Boulevard	898	3	233	0.75	0.003	0.20	0.90	0.003	0.27
I-880 SB On-ramp from WB Dixon Landing Rd	3	0	0	1.64	0	0	0.71	0.003	0.23
I-880 NB On-ramp from Dixon Landing Rd	10	0	6	**5.47**	0	**3.28**	0.6	0.002	0.21
I-880 SB Off-ramp to Dixon Landing Rd	4	0	1	**2.19**	0	**0.55**	0.2	0.001	0.06
I-880 SB On-ramp from EB Dixon Landing Rd	2	0	0	1.09	0	0	0.56	0.003	0.19
I-880 NB Off-ramp to Dixon Landing Rd	8	0	4	**4.38**	0	**2.19**	0.92	0.002	0.31
I-880 SB On-ramp from Warren Ave	1	0	1	0.55	0	**0.55**	0.67	0.001	0.23
I-880 NB On-ramp from Warren Ave	1	0	0	0.55	0	0	0.67	0.001	0.23
I-880 SB Off-ramp to Warren Ave	5	0	2	**2.74**	0	**1.09**	0.92	0.004	0.32
I-880 NB Off-ramp to Warren Ave	1	0	0	0.55	0	0	0.92	0.004	0.32
I-880 SB On-ramp from Mission Blvd	14	0	5	**7.66**	0	**2.74**	0.39	0.002	0.13
I-880 NB On-ramp from Mission Blvd	8	0	0	4.38	0	0	0.32	0.002	0.11
I-880 SB Off-ramp to Mission Blvd	6	0	2	**3.28**	0	**1.09**	0.45	0.003	0.15
I-880 NB Off-ramp to Mission Blvd	23	0	5	**12.58**	0	**2.74**	0.37	0.003	0.12
I-880 SB On-ramp from SB Fremont Blvd	8	0	6	**4.38**	0	**3.28**	0.6	0.002	0.21
I-880 NB Off-ramp to Fremont Blvd	28	1	10	**15.32**	0.547	**5.47**	0.92	0.004	0.32
I-880 NB On-ramp from SB Fremont Blvd	5	0	2	**1.03**	0	**0.41**	0.71	0.003	0.23

Notes: Actual accident rates shown in **bold** text exceed the statewide average for similar facilities.

1. Actual and Average Accident Rates are measured in accidents per million vehicle miles for the mainline, and accidents per million vehicles for ramps.

A total of 90 (or 62%) of the 146 collisions were classified as "rear-end" collisions, and the majority of collisions had "speeding" (53% of the total collisions) as the associate primary collision factor. This type of collision is generally associated with driver inattention, unsafe speeds, and or lane changing in congested traffic conditions.

For I-880 ramps, the actual total accident rates for most of the ramps are higher than the State average. Overall, 47% of the total 127 collisions on the I-880 ramps were classified as "rear-end" collisions, and 18% involved "hit object", such as guardrail and "dike or curb". The primary collision factor associated with the most collisions was "speeding" (39% of collisions), followed by the primary collision factor, "improper turns" which was associated with 17 percent of the collisions. Collisions in which the primary factor in the majority of cases is either speeding or improper turns are generally associated with driver inattention and unsafe speeds, as well as lane-changing in congested traffic conditions.

Review of detailed accident records associated with the I-880 ramps revealed three "hot spot" locations at which the total accident rates were highest, compared to the State averages for similar facilities:

- I-880 SB On-ramp from Mission Boulevard –A total of 14 accidents occurred at this location, seven of which involved injury or fatality. Of these collisions, eight (57%) were "sideswipe" collisions, and six (43%) were "rear-end" collisions. With respect to the primary collision factor, four (29%) of them were due to improper turns, and another four (29%) were because of speeding, making up the majority of these accidents. These types of collisions are generally associated with driver inattention, unsafe speeds and/or lane changing in congested traffic conditions.

- I-880 NB Off-ramp to Mission Boulevard –A total of 23 accidents occurred at this location, nine of which involved injury or fatality. Of these collisions, ten (44%) were "rear-end" collisions, and nine (39%) involved "hit object", such as guardrail. With respect to the primary collision factor, six (26%) were due to improper turns, and six (26%) were because of speeding, making up the majority of these accidents. These types of collisions are generally associated with driver inattention, unsafe speeds and/or lane changing in congested traffic conditions.

- I-880 NB Off-ramp to Fremont Boulevard – A total of 28 accidents occurred at this location, ten of which involved injury or fatality. The majority (68%) of the collisions were classified as "rear-end" collisions, and 16 of the total collisions (57%) indicated "speeding" as the primary collision factor. One fatality-collision occurred on this ramp and involved "hit object", in which the hit object was "dike or curb". Rear-end collisions were the majority of collisions and this type of

collision is generally associated with driver inattention, unsafe speeds, and lane changing in congested traffic conditions.

I-680

As shown previously in Table 1, there were 919 collisions reported on I-680 (freeway and ramps combined) with three fatalities: Two of the fatality collisions occurred in the northbound direction, and one fatality collision occurred in the southbound direction. The actual fatal collision rate for I-680 in the study area was the same as the average statewide collision rate. The actual "fatal + injury" collision rate was slightly higher than the State average; and the actual total collision rate was also slightly higher than the average. Additional analysis of I-680 collision mainline and ramp data was performed based on the fact that accident rates for I-680 within the study area were higher than the State average for total collision and "fatal + injury" collisions.

Regarding the types of collisions and primary collision factors associated with I-680, a total of 574 (or 63%) of the 919 total collisions were "rear-end" collisions, and 180 (20%) were "sideswipe" collisions. The majority of collisions (569 or 62%) had "speeding" as the associated primary collision factor.

A total of 313 (34%) of the total collisions involved injuries or fatalities. Approximately 68% of the parties involved in the 313 collisions with injury or fatality were classified as "rear-end" collisions. The "rear-end" type of collision was associated with the majority of both total collisions as well as collision with injury or fatality, along the I-680 corridor, in the study area.

Of the 919 total collisions, 807 (88%) involved hitting other vehicles, 22 (2%) involved hitting the median barrier, 14 (2%) involved hitting the "dike or curb", seven (1%) involved hitting traffic signs, and seven (1%) involved falling over an embankment. A total of 226 collisions (25%) of the 919 total collisions occurred in dusk/dawn or under dark lighting conditions.

The accident rates associated with the I-680 ramps in the study area are presented in Table 4. The types of collisions as well as the primary collision factors for the I-680 ramps are summarized as follows: A total of 108 collisions were reported over the five year period for the I-680 ramps in the study area. The actual collision rates for I-680 ramps are lower than the Statewide average for total accidents, fatal accidents, and for "fatal + injury" accidents. Approximately 53% of the accidents were classified as "rear-end" collisions, and 18% were classified as "hit object" collisions. The majority of primary collision factors were "speeding" (57%), followed by "improper turns" (19%). Of the 108 total collisions, 76 (73%)

Table 4

Collision Summary for I-680 Ramps

Location	Number of Accidents			Actual Accident Rate[1]			Average Accident Rate (State)[1]		
	Total	Fatal	Fatal + Injury	Total	Fatal	Fatal + Injury	Total	Fatal	Fatal + Injury
I-680 SB Off-Ramp to Scott Creek Rd	7	0	5	0.7	0	**0.5**	0.92	0.004	0.32
I-680 SB On-Ramp from Scott Creek Rd	6	0	2	0.58	0	0.19	0.6	0.002	0.21
I-680 NB On-Ramp from Scott Creek Rd	2	0	0	0.25	0	0	0.6	0.002	0.21
I-680 NB Off-Ramp to Scott Creek Rd	2	0	1	0.21	0	**0.1**	0.25	0.002	0.08
I-680 NB Off-Ramp Segment to WB Scott Creek Rd	4	0	1	0.47	0	0.12	0.93	0.004	0.3
I-680 NB Off-Ramp Segment to EB Scott Creek Rd	1	0	0	0.83	0	0	0.69	0.003	0.24
I-680 SB Off-Ramp to Mission Blvd	7	0	5	0.16	0	**0.11**	0.25	0.002	0.08
I-680 SB Off-Ramp Segment to WB Mission Blvd	14	0	4	0.33	0	0.09	0.37	0.003	0.12
I-680 SB Off-Ramp Segment to EB Mission Blvd	1	0	0	1.27	0	0	0.7	0.004	0.21
I-680 NB On-Ramp from Mission Blvd	2	0	1	0.06	0	0.03	0.2	0.001	0.06
I-680 NB On-Ramp Segment from WB Mission Blvd	2	0	0	3.43	0	0	0.56	0.003	0.19
I-680 NB On-Ramp Segment from EB Mission Blvd	10	0	3	0.3	0	0.09	0.71	0.003	0.23
I-680 SB On-Ramp from Mission Blvd	0	0	0	0	0	0	0.2	0.001	0.06
I-680 SB On-Ramp Segment from WB Mission Blvd	4	0	3	**1.07**	0	**0.8**	0.61	0.003	0.18
I-680 SB On-Ramp Segment from EB Mission Blvd	3	0	0	0.23	0	0	0.32	0.002	0.11
I-680 NB Off-Ramp to Mission Blvd	4	0	2	0.2	0	**0.1**	0.25	0.002	0.08
I-680 NB Off-Ramp Segment to WB Mission Blvd	4	0	2	0.28	0	0.14	0.93	0.004	0.3
I-680 NB Off-Ramp Segment to EB Mission Blvd	5	0	4	**0.82**	0	**0.65**	0.69	0.003	0.24
I-680 SB Off-Ramp to Auto Mall Pkwy	17	0	7	**0.99**	0	**0.41**	0.92	0.002	0.31

(Table 4, Continued)

Location	Number of Accidents			Actual Accident Rate[1]			Average Accident Rate (State)[1]		
	Total	Fatal	Fatal + Injury		Total	Fatal	Fatal + Injury		Total
I-680 SB On-Ramp from Auto Mall Pkwy	5	0	2	0.34	0	0.14	0.6	0.002	0.21
I-680 NB On-Ramp from Auto Mall Pkwy	2	0	2	0.13	0	0.13	0.6	0.003	0.21
I-680 NB Off-Ramp to Auto Mall Pkwy	6	0	0	0.48	0	0	0.92	0.004	0.32

Notes: Actual accident rates shown in **bold** text exceed the statewide average for similar facilities.

1. Actual and Average Accident Rates are measured in accidents per million vehicle miles for the mainline, and accidents per million vehicles for ramps.

involved hitting other vehicles, and 19 (18%) involved hitting objects such as "dikes and curbs", and traffic signs.

As mentioned, rear-end collisions made up the majority of accidents (and speeding made up the majority of primary collision factors). This type of collision is generally associated with driver inattention, unsafe speeds, and/or lane changing in congested traffic conditions.

Review of detailed accident records associated with the I-680 ramps revealed two "hot spot" locations, in the area within which improvements will be evaluated as part of the overall study; at which the fatal- or injury-accident rate was higher than the State average, as follows:

- I-680 Southbound On-Ramp Segment from Westbound Mission Blvd. – A total of four accidents occurred at this location, three of which involved injuries. 50 percent of the accident types were "overturn", 25% of the accident types were "rear-end", and 25% of the accident types were "hit object" (where the hit object was a guardrail).

- I-680 Northbound Off-Ramp Segment to Eastbound Mission Blvd – A total of five accidents occurred at this location, four of which involved injury or fatality. The majority of accidents (60%) were "hit object" collisions (where hit objects included guardrail, and dike or curb). The other two accidents were "overturn" collisions.

For the I-680 Southbound On-Ramp from Westbound Mission Blvd, 50% of accidents were "overturn" collisions, and suggest a possibility that the existing turning radii are challenging to drivers.

For the I-680 Northbound Off-Ramp Segment to Eastbound Mission Blvd, where the majority of accidents were "hit object" collisions (and struck objects were either dikes and curbs or guardrail); and the majority of collisions indicated "improper turns" as the primary collision factor. This type of collision is generally associated with driver inattention and/or lane changing in congested conditions. However, the SR-262 (Mission Boulevard) improvements could possibly address design issues (such as severe curves) that may be a factor with these accidents.

In conclusion, the review of both summary and detailed accident data results in the following key points:

- The actual collision rates on I-880 were lower than the State average for I-880 with respect to total accidents, fatal accidents, and "fatal + injury" accidents;

- The actual collision rates on SR-262 (Mission Boulevard) were lower than the State average for SR-262 (Mission Boulevard) with respect to total accidents, fatal accidents, and "fatal + injury" accidents;

- Detailed analysis of individual accidents on SR-262 (Mission Boulevard) indicates that the majority of accidents occurred on the roadway segments, as opposed to intersections. Most of the SR-262 (Mission Boulevard) accidents occurred in either the left lanes or right lanes and "speeding" was reported as a primary collision factor for the majority of accidents. Also, the majority of accidents at the intersections were also associated with speeding. These types of collisions are generally associated with driver inattention, unsafe speeding, and /or lane changing in congested traffic conditions.

- The actual "fatal + injury" collision rate for I-680 (combined freeway and ramp sections) was slightly higher than the State average; and the actual total collision rate was also slightly higher than the State average;

- Detailed analysis of the I-680 individual ramps, in the area in which improvements will be made in the study area, showed higher than average rates of accidents at the I-680 southbound on-ramp from Westbound Mission Boulevard as well as the I-680 northbound off-ramp segment to Eastbound Mission Boulevard.

- Half of accidents at the I-680 southbound on-ramp from Westbound Mission Boulevard involved "overturns"; and re-designing the ramp configuration for southbound I-680 could potentially

incorporate better turning radii (to the extent that the existing turning radii are challenging to drivers).

- The majority of accidents on the I-680 Northbound Off-ramp Segment to Eastbound Mission Boulevard was "hit object" collisions; and indicated "improper turn" as the primary collision factor. This type of collision ("hit object") is generally associated with driver inattention and/or lane changing in congested traffic congestions.