Route 262 Improvements Existing Conditions Traffic Operations Report

Prepared for

Alameda County Congestion Management Agency
and
HQE Incorporated

Draft Report

Prepared By

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1 INTRODUCTION

The Alameda County Congestion Management Agency (ACCMA), in partnership with the City of Fremont and Caltrans, has contracted with HQE, Inc. and DKS Associates to prepare a Project Study Report (PSR) for potential improvements to State Route 262 (Mission Boulevard) between I-880 and I-680 in the City of Fremont. The Route 262 Improvements PSR will address the need and purpose of the proposed project, identify the potential environmental impacts, and identify the estimated costs and timeline for delivery. The PSR will consist of evaluating the following project components:

- Widening of Route 262 (Mission Boulevard) from four to six lanes between Warm Springs Boulevard and I-680;
- Modification of the I-680/Route 262 interchange to improve operations; and
- Tight Diamond Interchange and/or intersection improvements at Route 262/Warm Springs Boulevard.

The purpose of this report is to describe the existing conditions within the study area with respect to key roadway infrastructure and traffic performance.

While the proposed project components focus on improvements to SR 262 and the I-680/SR 262 interchange, the traffic analysis network includes all ramps and mainlines at the I-680/SR 262 and I-880/SR 262 interchanges plus the arterial segment of SR 262 between these interchanges. This arterial segment includes the signalized intersections at Warm Springs Blvd and Mohave Drive. The study area and intersections are illustrated in Figure 1.

Section 2 of this report identifies the various data and information sources used in preparing this memorandum. The existing roadway infrastructure is described in Section 3. A summary of the traffic data is presented in Section 4. A summary of the congestion and queuing characteristics within the study area is presented in Section 5. The level-of-service (LOS) analysis results for the study intersections are provided in Section 6, while the freeway merge, diverge and weave analysis results are presented in Section 7.

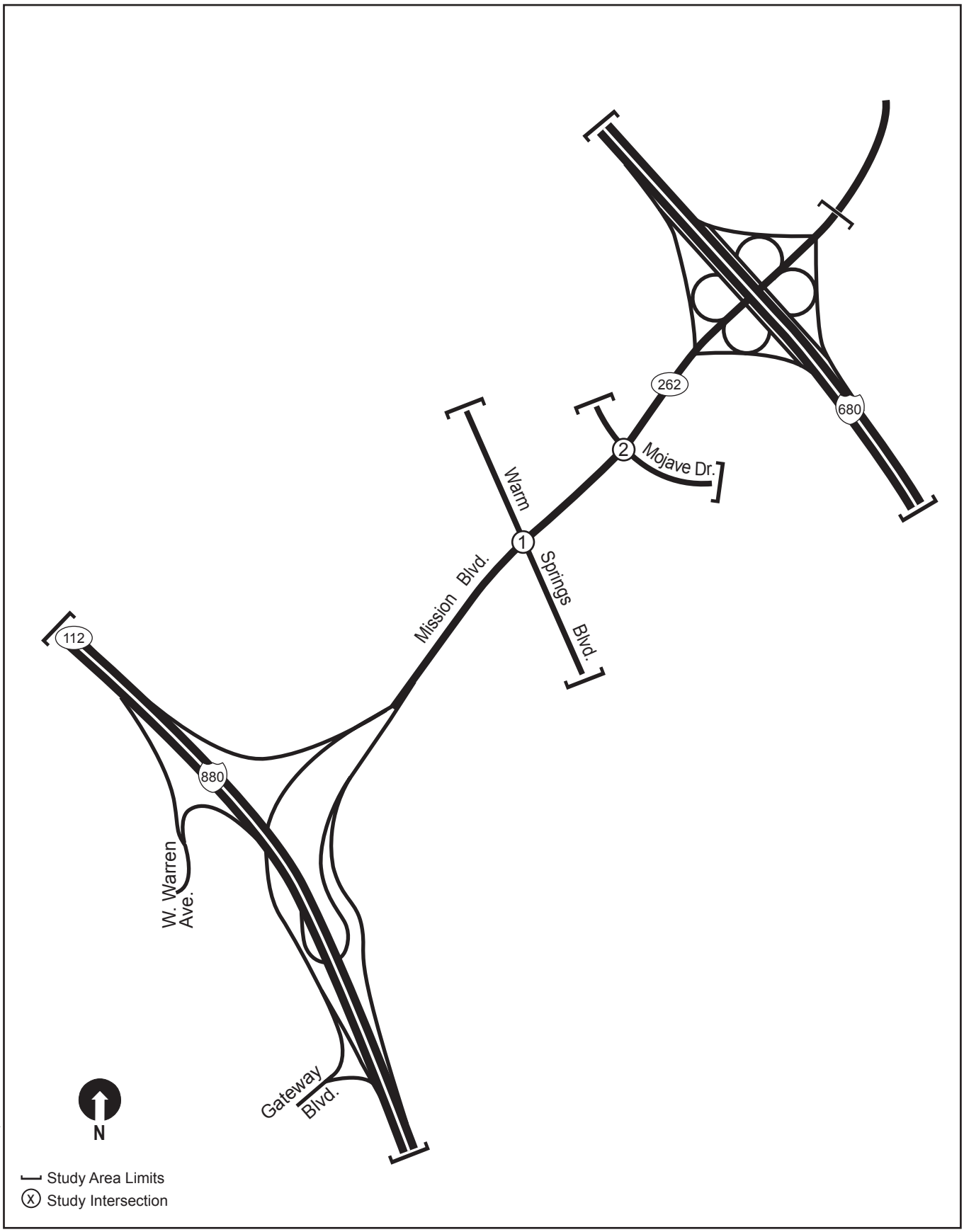

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Figure 1
Roadway Network and Study Intersections

2 DATA SOURCES

This study includes the analysis of operating conditions during both the weekday AM peak period (6:00 AM to 10:00 AM) and PM peak period (3:00 PM to 7:00 PM). To support this analysis, extensive field observations, data compilation, and data collection were conducted. The types of data relevant to this effort and the sources for these data are presented in Table 1.

Table 1 Relevant Data Sources

Data Type	Source (s)	Dates	Comments
Freeway and arterial geometry	Aerial photographs	June-08	
	DKS field review	June - 08	
Intersection signal timing	Caltrans		
Freeway mainline traffic volumes	PeMS	Real-time data	Multiple locations within study area, however reliability varies
Freeway ramps and connectors traffic volumes	DKS 4-hour manual counts during AM/PM peak	June - 08	Counts performed: NB I-880 off to Mission SB I-880 overpass to Mission SB I-880 to West Warren Ave WB Mission to NB I-880 WB Mission to SB I-880 WB Mission to Gateway EB Gateway to SB I-880
	Prior Study (Fremont Bayside EIR)	Feb - 08	2-hour manual counts
	Caltrans Census	2004 and 2006	
Freeway truck volumes/percentages	PeMS database	June - 07	
Arterial segment traffic volumes	DKS 1-week tube counts	June - 08	Count performed: Segment of Mission Blvd East of I-680
Intersection traffic volumes	DKS 4-hour manual traffic counts	June - 08	Counts performed: Mission Blvd at Warm Springs Blvd Mission Blvd at Mohave Drive
	Prior Study (Fremont Bayside EIR)	Feb - 08	2-hour manual counts
Source: DKS Associates, 2008			

3 EXISTING ROADWAY INFRASTRUCTURE

The study network is comprised of two interchanges and two intersections. The design characteristics of each interchange and each intersection are described below.

3.1 I-680/SR-262 Interchange

The interchange at I-680 and SR-262 is a cloverleaf interchange as illustrated in Figure 2. With this design, there are collector/distributor roads to provide a buffer between weaving vehicles using the interchange and mainline traffic on I-680. Within the study area, I-680 has three mixed lanes in the northbound direction. In the southbound direction, the mainline includes three mixed lanes and one HOV lane. There is also a southbound auxiliary lane between the Auto Mall/Durham Road on-ramp and the SR 262 off-ramp. SR-262 (Mission Boulevard) is an east-west highway and it has two lanes on each direction. Within the interchange there are auxiliary lanes between the loop ramps on SR 262.

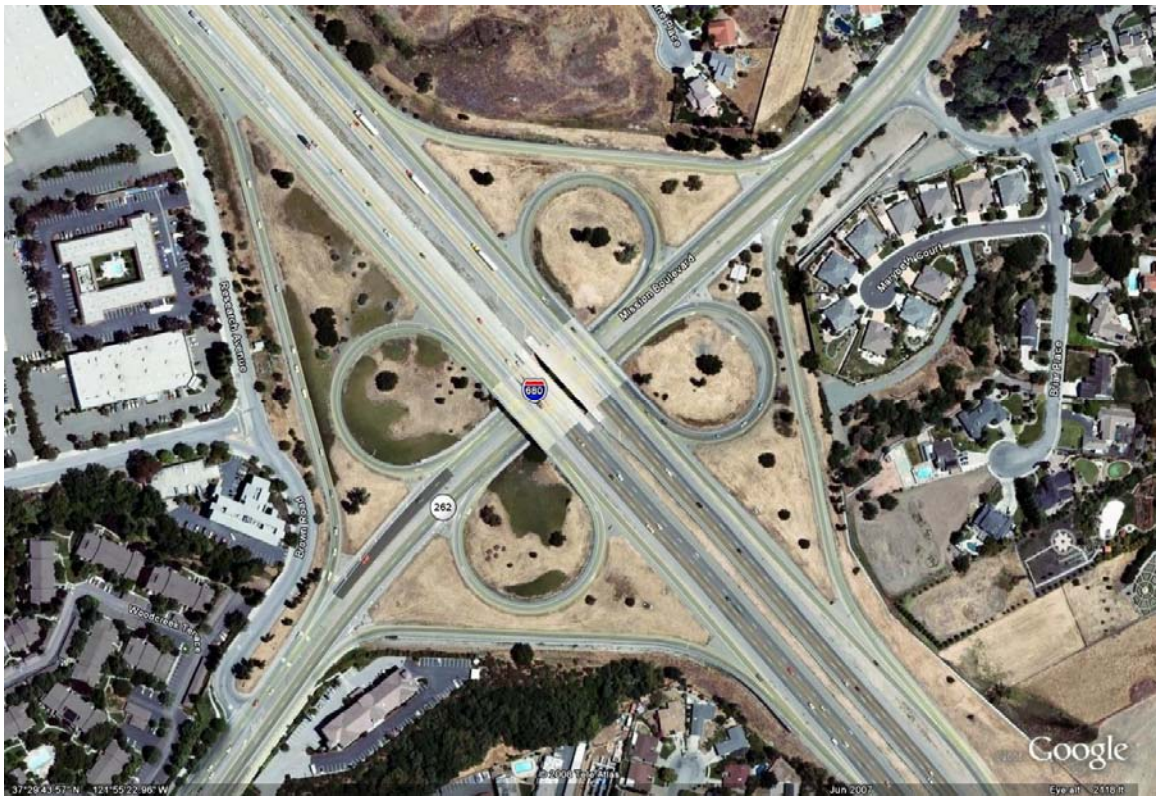

Figure 2 I-680/SR 262 Interchange

3.2 I-880/SR-262 Interchange

Unlike the I-680/SR-262 Interchange, the I-880/SR-262 Interchange is not a standard interchange as illustrated in Figure 3. Currently, there are three lanes on each direction of I-880 through the interchange and two lanes on each direction of SR-262 to the east of the interchange. However, improvements to this interchange and segment of I-880 are currently under construction. These improvements will include new connectors and extension of the HOV lanes in both direction through the interchange.

Figure 3 I-880/SR 262 Interchange

3.3 Warm Springs Blvd/SR-262 Intersection

The intersection of Warm Springs Boulevard and SR-262 (Mission Boulevard) is shown in Figure 4. Warm Springs Boulevard is a major north/south arterial with two lanes in each direction, widening to five or six lanes at the intersection. To the west of Warm Springs, SR 262 is two lanes in each direction but widens to three continuous lanes between Warm Springs and Mohave in both directions. SR 262 also widens to five or six lanes at the intersection. There are striped bike lanes on Warm Springs Blvd south of SR 262, and on SR 262 east of Warm Springs Blvd.

The intersection geometry is summarized below:

- Northbound (Warm Springs Blvd): 2 left-turn lanes + 2 through lanes + 1 right-turn lane
- Southbound (Warm Springs Blvd): 2 left-turn lanes + 1 through lanes + 1 shared lane (through and right-turn) + 1 right-turn lane
- Eastbound (SR 262): 2 left-turn lanes + 3 through lanes + 1 right-turn lanes
- Westbound (SR 262): 2 left-turn lanes + 3 through lanes + 1 right-turn lane

Figure 4 Warm Springs Blvd/ SR 262 Intersection

3.4 Mohave Dr/SR-262 Intersection

The intersection at Mohave Drive and SR-262 (Mission Boulevard) is shown in Figure 5. Mohave Drive is a local collector with one lane in each direction. The intersection geometry is:

- Northbound (Mohave Drive): 1 left-turn lane + 1 through lane + 1 right-turn lane
- Southbound (Mohave Drive Blvd): 1 left-turn lane + 1 shared lane (through and left –turn) + 1 right-turn lane
- Eastbound (SR 262): 1 left-turn lane + 3 through lanes + 1 right-turn lane
- Westbound (SR 262): 1 left-turn lane + 2 through lanes + 1 shared lane (through and right-turn lane)

Figure 5 Mohave Dr/ SR 262 Intersection

4 TRAFFIC DATA SUMMARIES

4.1 Freeway Mainline Traffic Volumes

Mainline traffic volumes were obtained from PeMS for selected locations on both I-880 and I-680 on a typical weekday in April of 2008. Table 2 summarizes the observed freeway mainline volumes during AM and PM peak periods.

Table 2 Observed Freeway Mainline Volumes

Location	Date	Median Volume (vph)							
		AM				PM			
		6-7	7-8	8-9	9-10	3-4	4-5	5-6	6-7
I-680N before Mission Blvd On-ramp (VDS 400376)	Apr-08	3742	4793	4677	3703	5491	4837	5036	5154
I-680S after Mission Blvd Off-ramp (VDS 400566)	Apr-08	3423	5004	5546	3964	2889	3240	3574	2781
I-880N after Mission Blvd On-ramp (VDS 400189)	Apr-08	3311	4158	3769	3549	5449	5884	6119	5986
I-880S before Lakeview Blvd/West Warren Ave Off-ramp (VDS 400409)	Apr-08	6214	5982	5250	5229	5321	5352	5315	4776

Source: PeMS

Exact locations of the first three detector stations were verified from a field observation. The location of the last detector station is approximated from the PeMS graphical user interface. These four detector stations provide freeway mainline volumes for this study.

4.2 Ramp and Intersection Traffic Volumes

Traffic volumes for the ramps and intersections within the study area were derived from numerous sources including the Caltrans Traffic Volume Census, recent counts conducted for the Fremont Bayside EIR, and new data collected in May/June of 2008. Caltrans Census data included 2004 and 2006 counts for the I-880/SR 262 and I-680/SR 262 interchanges respectively. Manual ramp and intersection counts for the Fremont Bayside EIR were conducted in February 2008. New counts specifically for this study were conducted for all ramps at the I-880/SR 262 interchange, two ramps at I-680/SR 262 interchange. Copies of the data sheets for these new counts are contained in Appendix A.

As would be expected, the counts from the different sources vary, sometimes substantially. Also, the counts for adjacent facilities (i.e. the departure of one intersection and approach for the downstream intersection) do not always match. To support the traffic modeling and analysis activities, the counts compiled from all of the sources mentioned above were used to develop a set of balanced AM and PM peak hour traffic volumes. These values, shown in Figure 6, are the basis for the existing conditions operational analysis presented in Sections 5 and 6 of this report.

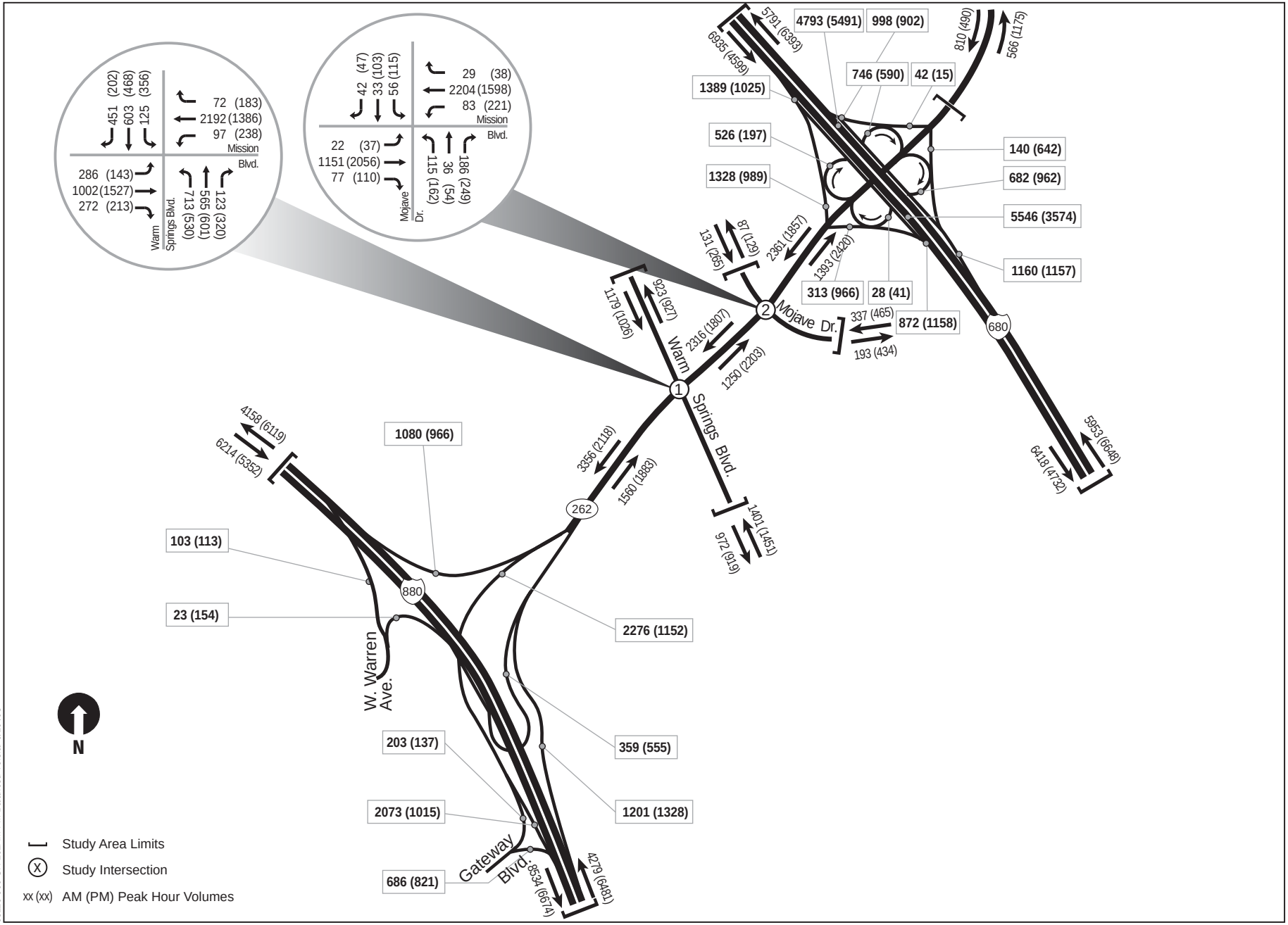

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Figure 6
AM and PM Peak Hour Balanced Volumes

4.3 Truck Volume and Percentage

Truck volume and percentage data within the study area were extracted from the PeMS database for freeways. Average peak periods and daily truck volumes and percentages for April of 2008 are presented in Table 3.

Table 3 Freeway Truck Percentages and Volumes

Location	AM Peak Period (6-10 am)		PM Peak Period (3-7 pm)		Average Daily Data	
	Truck Percentage	Truck Volume (veh)	Truck Percentage	Truck Volume (veh)	Truck Percentage	Truck Volume (veh)
I-680 Northbound						
I-680N south of the study area (VDS 400232)	4.9%	728	3.0%	523	4.8%	2,781
I-680N before Mission Blvd Offramp (VDS 401583)	0.7%	110	0.9%	148	0.5%	315
I-680N before Mission Blvd Onramp (VDS 400376)	15.5%	2,633	13.7%	2,812	17.0%	12,572
I-680 Southbound						
I-680S after Mission Blvd Off-ramp (VDS 400566)	1.3%	228	0.9%	110	1.0%	492
I-680S after Mission Blvd On-ramp (VDS 400633)	3.6%	523	3.6%	481	2.8%	1,345
I-880 Northbound						
I-880N before Dixon Landing Rd On-ramp (VDS 401643)	4.6%	744	1.4%	277	5.4%	4,022
I-880N after Mission Blvd On-ramp (VDS 400189)	7.4%	1,086	4.3%	1,007	6.0	4,639
I-880 Southbound						
I-880S before Lakeview Blvd/West Warren Ave Off-ramp (VDS 400409)	5.4%	1,213	2.9%	613	4.2%	3,805
I-880S after Dixon Landing Rd Off-ramp (VDS 401637)	2.0%	352	4.9%	713	4.2%	2,721
Source: PeMS						

For northbound I-680, PeMS Vehicle Detector Station (VDS) 400232, which is located south of the study area, was used to derive truck percentages instead of using VDS 401583 and VDS 400376. That is because data from these two detectors, which are close to each other, are not consistent with one another nor adjacent locations and PeMS detector diagnostics indicate hardware problems.

For SR 262, truck percentages were derived from the intersection counts at Warm Springs Boulevard and Mohave Drive (attached in Appendix C). Table 4 summarizes truck percentages on SR 262.

Table 4 SR-262 (Mission Boulevard) Truck Percentages

Location	AM Peak Hour	PM Peak Hour
SR-262 Eastbound	7.4%	2.6%
SR-262 Westbound	4.9%	3.7%

Source: DKS Associates, 2008

5 CONGESTION AND QUEUING OBSERVATIONS

In this section, the traffic data described in the prior section have been combined with direct observations of traffic operating conditions to develop a profile of the congestion and queuing characteristics within the study area. The field observations were conducted in June 2008. It should be noted that construction of the I-880/SR 262 improvements is underway at this time. These construction activities were observed to impact the travel speed on SR 262, especially eastbound SR 262 during the PM peak.

For each analysis period, the operating conditions and issues within the study area are summarized below and are illustrated in Figure 7.

5.1 Weekday AM Peak Period (6:00-10:00 AM)

During the AM peak period, varying levels of congestion were observed on I-680 southbound, I-880 southbound, and SR 262 westbound. A description of the weekday AM peak period congestion and queuing conditions, broken down by facility and direction, is provided below.

I-680 Northbound
No significant mainline congestion was observed during the AM peak period.

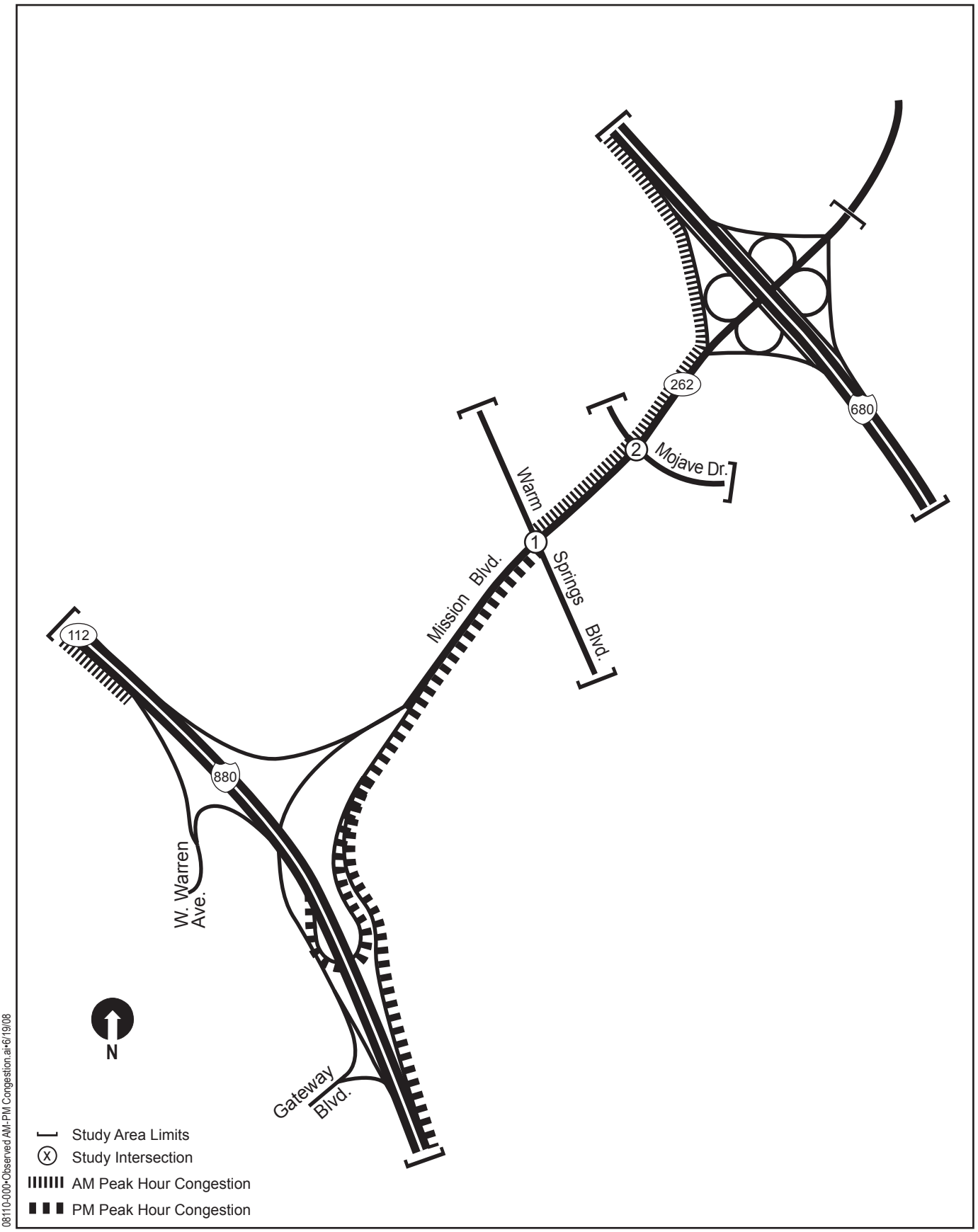
I-680 Southbound
Congestion on I-680 southbound was observed due to the queue spilling back from the downstream intersections on westbound SR-262 at Mohave Drive and at Warm Springs Boulevard. The queue from these intersections extends onto the southbound I-680 off-ramp and mainline I-680. The maximum observed queue extended 1000 ft north of the I-680 off-ramp. This condition was observed to start around 6:00 AM and continued beyond 10:00 AM.

I-880 Northbound
No significant mainline congestion was observed during the AM peak period.

I-880 Southbound
Congestion was observed on I-880 southbound due to the bottleneck between the off-ramp to W. Warren Avenue and the off-ramp to eastbound SR 262. The congestion started around 7:15 AM and continued beyond 10:00 AM. The queue extends beyond the Fremont Boulevard interchange.

SR 262 Eastbound
No significant congestion was observed during the AM peak period.

SR 262 Westbound
Congestion was observed on SR 262 westbound between Warm Springs Boulevard and I-680. It was caused by a high traffic demand from I-680 southbound heading to I-880 southbound. The queue started from the Warm Springs/SR 262 intersection and spills back through the Mohave/SR 262 intersection, onto the I-680 southbound off-ramp, and eventually onto I-680 southbound.



08110-000•Observed AM-PM Congestion.ai•6/19/08

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Figure 7
Observed AM and PM Network Congestion

5.2 Weekday PM Peak Period (3:00-7:00 PM)

During the PM peak period, varying levels of congestion were observed on I-880 northbound, I-880 southbound, and SR 262 eastbound. A description of the weekday PM peak period congestion and queuing conditions, broken down by facility and direction, is provided below.

I-680 Northbound
During the field investigations conducted for this study, no significant mainline congestion was observed during the PM peak period.

I-680 Southbound
No significant mainline congestion was observed during the PM peak period.

I-880 Northbound
Congestion was observed on I-880N, south of the off-ramp to SR 262 eastbound. This condition is the result of several factors including the existing bottleneck downstream of the off-ramp, current construction activities on both the I-880 mainline and the off-ramp, the turbulence caused by the northbound I-880 vehicles merging into the auxiliary lane to get off the freeway at Mission off-ramp, and congestion on the off-ramp itself. It started around 3:00 PM and continued beyond 7:00 PM. The queue extends beyond the Dixon Landing Road interchange.

I-880 Southbound
No significant mainline congestion was observed during the PM peak period. However, queuing was observed on the off-ramp to SR 262 eastbound due to the bottleneck at the downstream intersection at SR 262/Warm Springs. This queue was observed to extend the whole length of the off-ramp to SR 262 eastbound from 4:00 PM to 5:00 PM.

SR 262 Eastbound
Congestion was observed on SR 262 eastbound from Warm Springs Boulevard into the I-880 interchange. It was caused by a high traffic demand from I-880 northbound heading to I-680 northbound and slow travel speed in the construction zone. The demand exceeds Warm Springs/SR 262 intersection capacity causing queues that extend to the off-ramps from both I-880 northbound and I-880 southbound.

SR 262 Westbound
No significant congestion was observed during the PM peak period.

6 INTERSECTION LEVEL-OF-SERVICE

The AM and PM peak hour Level-of-Service (LOS) for each study intersection was determined using Synchro and the procedures from the 2000 Highway Capacity Manual (HCM) Operational methodology. As part of this methodology, the average delay per vehicle is used to determine the LOS. The results of this analysis are presented in Table 5. Synchro Level-of-Service calculations are attached in Appendix B.

Table 5 Existing Intersection Level-of-Service

ID	Study Intersection	AM Peak		PM Peak	
		Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
1	Mission Blvd/SR 262 at Warm Springs Blvd	82.2	F	42.0	D
2	Mission Blvd/SR 262 at Mohave Dr	17.2	B	32.0	C

During the AM peak hour, the SR 262/Warm Springs intersection operates at LOS F. although the analysis results suggest that the SR 262/Mohave intersection operates at LOS B, the queue from Warm Springs spills back through this intersection. Consistent with the field observations, the Simtraffic simulation showed the westbound queue from SR 262/Warm Springs extending back through the SR 262/ Mohave Dr intersection and back to southbound I-680 off-ramp and I-680 mainlines during the AM peak hour. Similarly, the Simtraffic simulation also showed the queue formed on the eastbound Mission Blvd/SR 262 from Mission Blvd/ Warm Springs Blvd intersection and spilled back to northbound I-880 off-ramp to eastbound SR 262 during the PM peak hour.

7 FREEWAY MERGE, DIVERGE, AND WEAVING ANALYSIS

7.1 Methodology

The analysis of merge, diverge and weaving sections was undertaken using the Highway Capacity Software (HCS), which implements the HCM 2000 methodology. The sections that required additional analysis using HCS are listed in the following tables. Some difficulty comes from the presence of the weaving section in the non-freeway lane (SR 262), which is not specifically accommodated in the weaving section analysis in the HCM. Because the minimum free-flow-speed is required to be 55 mph for a weaving segment analysis in the HCM, the free-flow-speed on SR 262 is assumed to be 55 mph even though the posted speed limit in this section is 45 mph. The analysis results will be carefully reviewed to identify any impacts caused by this assumption.

It is noted that when a single-lane off-ramp results in a lane drop, the capacity of the ramp is governed by its geometry, and it is analyzed as a ramp roadway. When a lane drop occurs 2,500 ft or less downstream from a merge point at which a lane was added, a weaving configuration is created and should be analyzed using the weaving analysis procedure. In other cases, the entering and departing freeway segments are analyzed as basic freeway segments having different number of lanes. This will be applied to the following sections: northbound I-680 off-ramp to SR 262, southbound I-680 off-ramp to SR 262, northbound I-880 off-ramp to SR 262, and eastbound SR 262 on-ramp to southbound I-680.

When the number of lanes leaving the diverge area is more than the number entering the segment, it is considered as a major weave.

On-ramps are sometimes associated with the addition of a lane at the merge point. Similar to the lane drop of the diverge area, the analysis of single-lane additions is relatively straightforward. The downstream segment of the merge area is simply considered to be a basic freeway segment with an additional lane.

The analysis is applicable for a single one hour period. In general, data from the peak hour of the peak period was used for the merge, diverge and weaving analysis.

7.2 Input Assumptions

The assumptions made when coding the software are summarized in Table 6.

Table 6 Input Assumptions

Parameter	Assumption
Terrain	Level, with a heavy vehicle factor of 1.5. Rolling (with a heavy vehicle factor of 2.5) was considered, but the observed behavior of trucks in the vicinity of ramps is closer to Level than Rolling
Percentage of trucks	The percentage of trucks varies during both the AM and PM peaks. Data described in Section 4 was used to determine the percentage of trucks in the mainline flows for 7-8 am in the morning peak, and 4-5 pm in the evening peak. The numbers used in the analysis are: • AM – 5% • PM – 4%
Ramp free-flow speeds	There is a wide variety of geometric standards for both on- and off-ramps. In general, the free-flow speed on WB 262 to SB I-880 overpass was assumed 45 mph. In other cases, the default speed of 35 mph was used.
Adjacent ramp	The HCM defines the area of influence of a ramp as being within 1,500 feet of the ramp. It also defines an adjacent ramp as an upstream or downstream ramp (either on or off) that is within the effective influence distance, which is a function of ramp type and traffic volumes. However, the analysis procedure only allows consideration of one adjacent ramp at a time. In several locations, there are two ramps (one upstream, the other downstream) that are within 1,500 ft of another ramp. In these cases, the analysis was repeated for both the upstream and downstream ramps, and the worst case LOS reported in the tables.
Peak hour factor	Based on the 15-min counts at two intersections on SR 262/Mission Blvd, the peak hour factor of 0.92 was used in this section for both AM and PM peaks.

7.3 Results

The results of the merge, diverge, and weaving analyses are illustrated in Table 7 and Table 8 for the AM and PM peak hour, respectively. HCS outputs are attached in Appendix C.

Table 7 Existing AM Peak Merge, Diverge, and Weaving LOS

Route	Section	Analysis type	LOS	Comments
I-680	**Northbound**			
	NB I-680 off-ramp to SR 262	Diverge with lane drop	B	
	NB I-680 segment north of the off-ramp to SR 262		D	
	NB I-680 CD Road	Weave	E	
	On-ramp from 262 to NB I-680	Merge	E	
	Southbound			
	SB I-680 off-ramp to WB SR 262	Diverge with lane drop	D	Queue on the ramp due to the spill back from downstream intersection
	SB I-680 segment south of off-ramp to WB SR 262		C	
	SB I-680 CD Road	Weave	A	
	SB I-880 on-ramp from SR 262	Merge	B	
I-880	**Northbound**			
	NB I-880 off-ramp to SR 262	Diverge with lane drop	B	
	NB I-880 segment north of off-ramp to SR 262		C	
	SR 262 on-ramp to Fremont Blvd off-ramp	Weave	C	
	Southbound			
	Fremont Blvd SB to SB I-880 off-ramp to West Warren	Weave	D	
	SB I-880 off-ramp to SR 262	Diverge	F	
	On-ramp from SR 262	Merge with lane add	F	
SR 262	**Eastbound**			
	SB I-880 off-ramp at NB I-880 off-ramp to SR 262	Merge	B	
	EB 262 on-ramp to I-680 SB	Diverge with lane drop	A	
	EB 262 segment east of on-ramp to I-680 SB		A	
	SB I-680 off-ramp to EB SR 262 TO EB SR 262 on-ramp to NB I-680	Weave	B	
	NB I-680 off-ramp to EB 262	Merge	B	
	Westbound			
	WB SR 262 off-ramp to NB I-880 and SB I-880	Major Diverge	C	
	WB SR 262 on-ramp to NB I-680	Diverge	B	
	NB I-680 off-ramp to WB SR 262 TO WB SR 262 on-ramp to SB I-680	Weave	C	
	SB I-680 off-ramp to WB SR 262	Merge	C	

Table 8 Existing PM Peak Merge, Diverge, and Weaving LOS

Route	Section	Analysis type	LOS	Comments
I-680	**Northbound**			
	NB I-680 off-ramp to SR 262	Diverge with lane drop	B	
	NB I-680 segment north of the off-ramp to SR 262		D	
	NB I-680 CD Road	Weave	D	
	On-ramp from 262 to NB I-680	Merge	E	
	Southbound			
	SB I-680 off-ramp to WB SR 262	Diverge with lane drop	C	
	SB I-680 segment south of off-ramp to WB SR 262		B	
	SB I-680 CD Road	Weave	A	
	SB I-880 on-ramp from SR 262	Merge	B	
I-880	**Northbound**			
	NB I-880 off-ramp to SR 262	Diverge with lane drop	B	Queue on the ramp due to the spill back from downstream intersection
	NB I-880 segment north of off-ramp to SR 262		D	
	SR 262 on-ramp to Fremont Blvd off-ramp	Weave	D	
	Southbound			
	Fremont Blvd SB to SB I-880 off-ramp to West Warren	Weave	C	
	SB I-880 off-ramp to SR 262	Diverge	F	
	On-ramp from SR 262	Merge with lane add	D	
SR 262	**Eastbound**			
	SB I-880 off-ramp at NB I-880 off-ramp to SR 262	Merge	C	
	EB 262 on-ramp to I-680 SB	Diverge with lane drop	B	
	EB 262 segment east of on-ramp to I-680 SB		B	
	SB I-680 off-ramp to EB SR 262 TO EB SR 262 on-ramp to NB I-680	Weave	B	
	NB I-680 off-ramp to EB 262	Merge	B	
	Westbound			
	WB SR 262 off-ramp to NB I-880 and SB I-880	Major Diverge	B	
	WB SR 262 on-ramp to NB I-680	Diverge	A	
	NB I-680 off-ramp to WB SR 262 TO WB SR 262 on-ramp to SB I-680	Weave	B	
	SB I-680 off-ramp to WB SR 262	Merge	B	