APPENDIX J

MODIFICATIONS PERFORMED TO THE TOR

This appendix summarizes the modifications that were performed in years 2012 and 2017 to rectify calculation errors that were observed in the data presented in the Traffic Operations Report. The edits are grouped as follows:

- All of the modifications made in year 2017 are shown in blue.
- All of the modifications made in year 2012 are shown in red.

Table 3-3
Freeway Operations - Existing Conditions

Measure of Effectiveness	Existing AM	Existing PM
Northbound		
Average Travel Time (minutes)	~~23~~22 ***16***	~~15~~13 ***12***
Average Speed (mph)	~~30~~32 ***44***	~~39~~45 ***52***
Delay (minutes per vehicle)	~~14~~11 ***~~45~~***	~~6~~4 ***2***
No. of Vehicle Trips (per hour)	~~2,923~~3,329 ***3,045***	~~3,235~~3,381 ***2,805***
No. of Persons Trips (per hour)	~~3,308~~3,769 ***3,447***	~~4,024~~4,206 ***3,489***
Freeway Travel Time (VHT)	~~1,274~~1,262 ***821***	~~823~~753 ***544***
Travel Distance (VMT)	~~38,517~~39,288 ***35,933***	~~32,349~~33,807 ***28,045***
Avg. Vehicle Occupancy (persons/vehicle)	1.13 ***1.13***	1.24 ***1.24***
Density (pcpmpl)	52 ***35***	~~40~~38 ***27***
Level of Service	F ***D***	E ***D***
Southbound		
Average Travel Time (minutes)	10 ***10***	~~27~~23 ***18***
Average Speed (mph)	~~60~~61 ***61***	~~26~~30 ***39***
Delay (minutes per vehicle)	0 ***0***	~~15~~12 ***~~67~~***
No. of Vehicle Trips (per hour)	~~2,918~~2,370 ***2,332***	~~3,101~~3,160 ***~~2,885~~2,794***
No. of Persons Trips (per hour)	~~3,385~~2,749 ***2,705***	~~3,664~~3,729 ***~~3,405~~3,297***
Freeway Travel Time (VHT)	~~507~~405 ***400***	~~1,391~~1,224 ***~~858~~835***
Travel Distance (VMT)	~~30,348~~24,644 ***24,251***	~~35,661~~36,340 ***~~33,182~~32,130***
Avg. Vehicle Occupancy (persons/vehicle)	1.16 ***1.16***	1.18 ***1.18***
Density (pcpmpl)	~~24~~19 ***19***	~~59~~53 ***36***
Level of Service	C ***C***	F ***E***

Source: Wilbur Smith Associates, February 2007

NOTES:
Non-italicized and non-bold values represent peak hour values.
Bold *italicized* values represent peak period (6 AM – 12 PM and 2 PM – 8 PM) values.

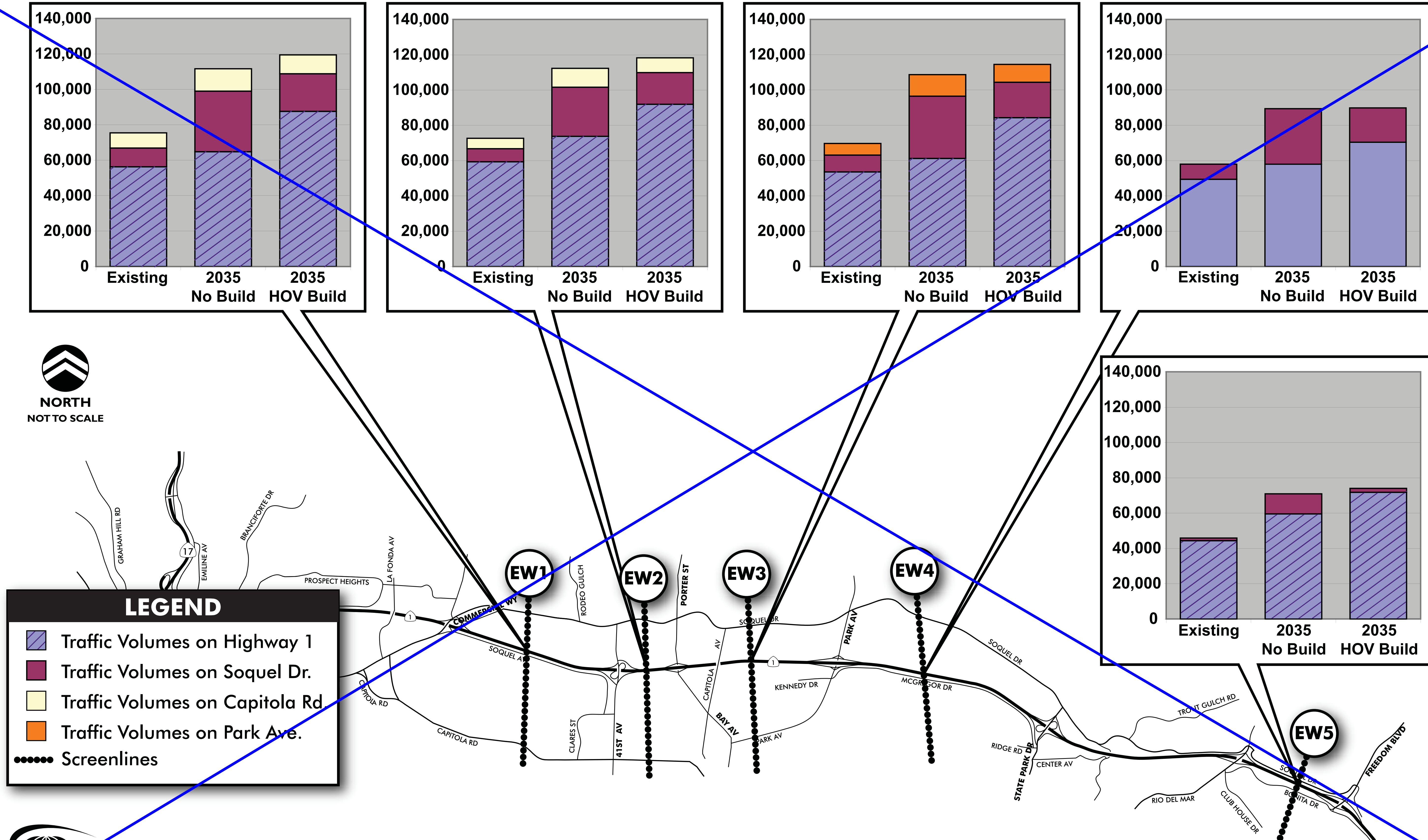

Figure 4-4
AVERAGE DAILY TRAFFIC VOLUMES ON STATE ROUTE 1 AND PARALLEL ARTERIALS AT SELECT SCREENLINE LOCATIONS EXISTING AND YEAR 2035 HOV BUILD/NO BUILD CONDITIONS

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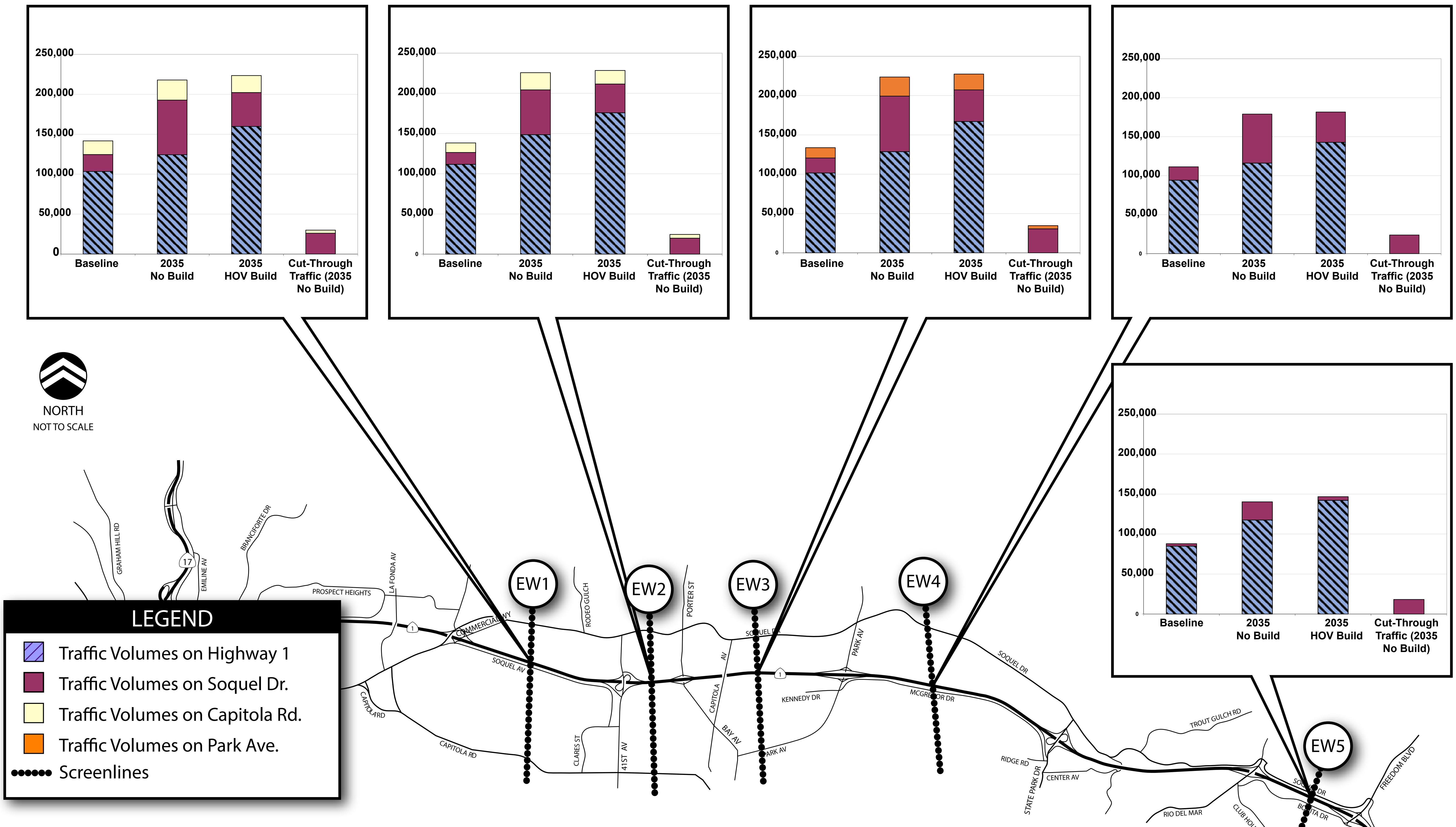

Figure 4-4
AVERAGE DAILY TRAFFIC VOLUMES ON STATE ROUTE 1 AND PARALLEL ARTERIALS AT SELECT SCREENLINE LOCATIONS
BASELINE AND YEAR 2035 HOV BUILD/NO BUILD CONDITIONS

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Table 5-1
Comparison of Measure of Effectiveness - Existing versus Year 2035 No-Build Scenarios

Measure of Effectiveness	Existing AM	Existing PM	2035 No-Build AM	2035 No-Build PM	% Difference AM	% Difference PM
Northbound						
Average Travel Time (minutes)	~~23~~22 ***16***	~~15~~13 ***12***	59 ***39***	34 ***22***	~~157~~168% ***144%***	~~127~~162% ***83%***
Average Speed (mph)	~~30~~32 ***44***	~~39~~45 ***52***	12 ***18***	17 ***28***	~~-60~~-63% ***-59%***	~~-56~~-62% ***-46%***
Delay (minutes per vehicle)	~~14~~11 ***~~45~~*** ***2***	~~6~~4 ***28***	48 ***12***	25 ***600460%***	~~243~~336% ***500%***	~~317~~525%
No. of Vehicle Trips (per hour)	~~2,923~~3,329 ***3,045***	~~3,235~~3,381 ***2,805***	2,767 ***3,129***	3,114 ***3,157***	~~-5~~-17% ***3%***	~~-4~~-8% ***13%***
No. of Persons Trips (per hour)	~~3,308~~3,769 ***3,447***	~~4,024~~4,206 ***3,489***	3,132 ***3,542***	3,874 ***3,927***	~~-5~~-17% ***3%***	~~-4~~-8% ***13%***
Freeway Travel Time (VHT)	~~1,274~~1,262 ***821***	~~823~~753 ***544***	2,749 ***2,053***	1,784 ***1,138***	~~116~~118% ***150%***	~~117~~137% ***109%***
Travel Distance (VMT)	~~38,517~~39,288 ***35,933***	~~32,349~~33,807 ***28,045***	32,646 ***36,922***	31,138 ***31,568***	~~-15~~-17% ***3%***	~~-4~~-8% ***13%***
Avg. Vehicle Occupancy (persons/vehicle)	1.13 ***1.13***	1.24 ***1.24***	1.13 ***1.13***	1.24 ***1.24***	0% ***0%***	0% ***0%***
Density (passenger cars per mile per lane)	52 ***35***	~~40~~38 ***27***	~~102~~115 ***~~78~~87***	~~84~~92 ***~~53~~56***	~~96~~121% ***~~123~~149%***	~~110~~142% ***~~96~~107%***
Level of Service	F ***D***	E ***D***	F ***F***	F ***F***	N.A. ***N.A.***	N.A. ***N.A.***
Southbound						
Average Travel Time (minutes)	10 ***10***	~~27~~23 ***18***	29 ***18***	61 ***47***	190% ***80%***	~~126~~165% ***161%***
Average Speed (mph)	~~60~~61 ***61***	~~26~~30 ***39***	22 ***35***	11 ***15***	~~-63~~-64% ***-43%***	~~-58~~-63% ***-62%***
Delay (minutes per vehicle)	0 ***0***	~~15~~12 ***~~6~~7***	19 ***8***	49 ***35***	N/A ***N/A***	~~227~~308% ***~~483~~400%***
No. of Vehicle Trips (per hour)	~~2,918~~2,370 ***2,332***	~~3,101~~3,160 ***~~2,885~~2,794***	3,101 ***2,968***	2,475 ***2,696***	~~6~~31% ***27%***	~~-20~~-22% ***~~-7~~-4%***
No. of Persons Trips (per hour)	~~3,385~~2,749 ***2,705***	~~3,664~~3,729 ***~~3,405~~3,297***	3,597 ***3,443***	2,911 ***3,168***	~~6~~31% ***27%***	~~-21~~-22% ***~~-7~~-4%***
Freeway Travel Time (VHT)	~~507~~405 ***400***	~~1,391~~1,224 ***~~858~~835***	1,498 ***884***	2,523 ***2,101***	~~195~~270% ***121%***	~~81~~106% ***~~145~~152%***
Travel Distance (VMT)	~~30,348~~24,644 ***24,251***	~~35,661~~36,340 ***~~33,182~~32,130***	32,248 ***30,863***	28,956 ***31,544***	~~6~~31% ***27%***	~~-19~~-20% ***~~-5~~-2%***
Avg. Vehicle Occupancy (persons/vehicle)	1.16 ***1.16***	1.18 ***1.18***	1.16 ***1.16***	1.18 ***1.18***	0% ***0%***	0% ***0%***
Density (passenger cars per mile per lane)	~~24~~19 ***19***	~~59~~53 ***36***	~~61~~70 ***~~37~~42***	~~95~~113 ***~~78~~90***	~~154~~268% ***~~95~~121%***	~~61~~113% ***~~117~~150%***
Level of Service	C ***C***	F ***E***	F ***E***	F ***F***	N.A. ***N.A.***	N.A. ***N.A.***

Source: Wilbur Smith Associates, February 2007

NOTES:
Non-italicized and non-bold values represent peak hour values.
Bold italicized values represent peak period (6 AM – 12 PM and 2 PM – 8 PM) values.
N.A. – Not Applicable

5.1.2 Vehicle Throughput

Under the No-Build Conditions, State Route 1 would experience a difficult time accommodating future travel demand. Under the Year 2035 No-Build scenario, vehicle throughput in the northbound direction is expected to decline by about ~~five~~ 8 to 17 percent during the AM and PM peak hours. Mobility for the southbound direction would also decrease sharply, down by as much as ~~20~~ 22 percent during the PM peak hour. When traffic flow on a corridor breaks down, it serves fewer numbers of vehicles than its maximum theoretical capacity since vehicles within the corridor are forced to stop-and-go. This will be more evident when analyzed from the delay and density standpoint, which will be discussed in the next section.

Under Year 2035 No-Build Conditions, total vehicle trips in the northbound direction would increase from 3,045 (under Existing Conditions) to 3,129 during the AM peak period; whereas, northbound total vehicle trips decreased from ~~2,923~~3,329 (under Existing Conditions) to 2,767 during the AM peak hour. Therefore, traffic in the northbound direction would exhibit "peak spreading" or redistribution of trips away from the peak hour towards the fringes of the peak period. Peak hour is a result of commuters' collective choice of optimal time to commute from home to work or vice versa. Due to the corridor's inability to serve higher future demand during the peak hour (experienced by the commuters as heavier traffic congestion), some drivers will choose to make the trip earlier or later than their optimal commute time. Instead of peaking sharply, traffic demand would be flatter, but would last longer.

The *FREQ* results showed that the year 2035 No-Build peak hour vehicle throughput decreased while the peak period throughput increased. This confirmed the earlier hypothesis of peak spreading described in Chapter 4. As congestion problems on State Route 1 would worsen (serving less vehicles) during the peak hour, commuters are expected to change their travel behavior to avoid congestion. However, as discussed in the next section, the project team identified that by year 2035 even peak spreading would do little to alleviate traffic congestion on State Route 1, as travel demand would far outweigh the capacity.

5.1.3 Delays and Densities

As vehicle throughput declines, the southbound corridor during the PM peak, which had ~~no~~ a delay~~s~~ of 12 minutes per vehicle under existing conditions, would experience up to 49 minutes of delay by year 2035. This is an increase of ~~243~~ 308 percent compared to the existing conditions (~~15~~ 37 minutes). In the northbound direction during the AM peak, traffic delays would average 48 minutes per vehicle, which amounts to a ~~227~~ 336 percent increase over the existing conditions (~~14~~ 11 minutes).

Under Existing Conditions, the peak commute directions (northbound direction during the AM peak hour and southbound direction during the PM peak hour) are experiencing heavy congestion, resulting in densities of 52 and ~~59~~ 53 passenger cars per mile per lane (pcpmpl), respectively (LOS F). Refer to *Table 2-1* for descriptions of service levels and their relationships with density values. This shows that existing traffic operations on State Route 1 are already at stop-and-go conditions and operating below their optimal level.

By year 2035, conditions on State Route 1 for all peak hours and directions would operate at LOS F, with densities ranging from ~~95~~ 113 pcpmpl (southbound direction during PM peak hour) to ~~102~~ 115 pcpmpl (northbound direction during the AM peak hour). The reverse commute directions (northbound during the PM peak hour and southbound during AM peak hour) are expected to operate at traffic densities of ~~84~~ 92 and ~~61~~ 70 pcpmpl (LOS F) during the PM and AM peak hours, respectively.

Thus, the operating conditions in the reverse commute directions are also expected to breakdown in the future. In addition, the operating conditions in the peak commute direction would worsen in the future. Travel demand would continue to increase, as population grows and the region becomes fully developed. At the same time, the corridor's ability to serve the number of vehicles would decrease, as delays and densities soar.

As previously mentioned, some commuters would choose to change the time of their travel to avoid congestion. Unfortunately, by year 2035, the demand would be so high compared to the available capacity that peak spreading would do little to alleviate congestion. Under Existing Conditions, State Route 1 during the peak period operates at LOS D or better (except in the southbound direction during PM peak hour, which operates at LOS E). By year 2035, under No-Build Conditions, all but the southbound direction during the AM peak hour (reverse commute direction) would operate at LOS F.

According to the Project Traffic Operations Sub-Committee, the peak period considered for this study is six hours long. The AM peak period is from 6 AM to 12 noon, while the PM peak period is from 2 PM to 8 PM. A corridor operating at LOS F for six continuous hours, twice a day, assuming that there would be no accidents or incidents, is in serious need of solutions, both from demand management and capacity increases.

5.1.4 Travel Speed and Travel Time

The study corridor would experience substantial decline in traffic performance by year 2035 under No-Build Conditions. In the northbound direction, the average vehicle speed would reduce from existing conditions (~~30~~ 32 mph and ~~39~~ 45 mph during the AM and PM peak hours, respectively) to 12 mph and 17 mph during the AM and PM peak hours, respectively under Year 2035 No-Build Conditions. As such, the average AM peak and PM peak travel times along the study corridor would increase by ~~157~~ 168 percent and ~~127~~ 162 percent, respectively. During the AM peak hour, the average northbound travel time would be as high as 59 minutes, up from ~~23~~ 22 minutes under existing conditions. Of the 59 minutes, 48 minutes would be attributable to traffic delays.

Likewise, a substantial decline in southbound traffic performance can be observed. In the year 2035, travel time for the southbound direction during the PM peak hour would average 61 minutes, up from ~~27~~ 23 minutes under existing conditions. Speeds would decline accordingly, with an average of 11 mph during the PM peak hour.

Table 5-3
Comparison of Measure of Effectiveness - Year 2035 No-Build versus Year 2035 HOV Build Scenarios

Measure of Effectiveness	2035 No-Build AM	2035 No-Build PM	2035 HOV Build AM	2035 HOV Build PM	% Difference AM	% Difference PM
Northbound						
Average Travel Time (minutes)	59 ***39***	34 ***22***	16 ***13***	13 ***11***	-73% ***-67%***	-62% ***-50%***
Average Speed (mph)	12 ***18***	17 ***28***	39 ***46***	42 ***52***	225% ***156%***	147% ***86%***
Delay (minutes per vehicle)	48 ***28***	25 ***12***	6 ***3***	4 ***2***	-88% ***-89%***	-84% ***-83%***
No. of Vehicle Trips (per hour)	2,767 ***3,129***	3,114 ***3,157***	4,510 ***4,213***	4,898 ***4,118***	63% ***35%***	57% ***30%***
No. of Persons Trips (per hour)	3,132 ***3,542***	3,874 ***3,927***	5,742 ***5,271***	6,276 ***5,271***	83% ***49%***	62% ***34%***
Freeway Travel Time (VHT)	2,749 ***2,053***	1,784 ***1,138***	1,285 ***1,025***	1,126 ***773***	-53% ***-50%***	-37% ***-32%***
Travel Distance (VMT)	32,646 ***36,922***	31,138 ***31,568***	50,360 ***47,269***	47,555 ***40,048***	54% ***28%***	53% ***27%***
Avg. Vehicle Occupancy (persons/vehicle)	1.13 ***1.13***	1.24 ***1.24***	1.27 ***1.25***	1.28 ***1.28***	12% ***11%***	3% ***3%***
Density (passenger cars per mile per lane)	~~102~~115 ~~***78***~~***87***	~~84~~92 ~~***53***~~***56***	~~38~~ 42 (14) ~~***31***~~ ***34 (12)***	~~39 (19)~~ 37(20) ***27 (14)***	N.A. ***N.A.***	N.A. ***N.A.***
Level of Service	F ***F***	F ***F***	E (B) ***D (B)***	E (C) ***D (B)***	N.A. ***N.A.***	N.A. ***N.A.***
Southbound						
Average Travel Time (minutes)	29 ***18***	61 ***47***	12 ***10***	19 ***15***	-59% ***-44%***	-69% ***-68%***
Average Speed (mph)	22 ***35***	11 ***15***	52 ***59***	33 ***42***	136% ***69%***	200% ***180%***
Delay (minutes per vehicle)	19 ***8***	49 ***35***	2 ***1***	9 ***5***	-89% ***-88%***	-82% ***-86%***
No. of Vehicle Trips (per hour)	3,101 ***2,968***	2,475 ***2,696***	4,253 ***3,369***	4,431 ***4,294***	37% ***14%***	79% ***59%***
No. of Persons Trips (per hour)	3,597 ***3,443***	2,911 ***3,168***	5,181 ***4,090***	5,684 ***5,443***	44% ***19%***	95% ***72%***
Freeway Travel Time (VHT)	1,498 ***884***	2,523 ***2,101***	834 ***584***	1,502 ***1,144***	-44% ***-34%***	-40% ***-46%***
Travel Distance (VMT)	32,248 ***30,863***	28,956 ***31,544***	43,081 ***34,179***	49,038 ***47,692***	34% ***11%***	69% ***51%***
Avg. Vehicle Occupancy (persons/vehicle)	1.16 ***1.16***	1.18 ***1.18***	1.22 ***1.21***	1.28 ***1.27***	5% ***5%***	9% ***8%***
Density (passenger cars per mile per lane)	~~61~~70 ~~***37***~~***42***	~~95~~113 ~~***78***~~***90***	~~28 (10)~~ 29(11) ~~***19***~~ ***20 (8)***	~~48 (15)~~ 37(19 ~~***36***~~ ***35 (13)***	N.A. ***N.A.***	N.A. ***N.A.***
Level of Service	F ***E***	F ***F***	D (A) ***C (A)***	~~F~~ E (B) ***E (B)***	N.A. ***N.A.***	N.A. ***N.A.***

Source: Wilbur Smith Associates, February 2007

NOTES:
28 (10) – Density of mixed-flow lanes (Density of HOV lane)
D (A) – LOS of mixed-flow lanes (LOS of HOV lane)
Non-italicized and non-bold values represent peak hour values.
Bold *italicized* values represent peak period (6 AM – 12 PM and 2 PM – 8 PM) values.

5.2.2 Vehicle Throughput

Adding HOV lanes, ramp metering, and auxiliary lanes is expected to improve the ability of State Route 1 to meet future travel demand within the study area. During the peak hours, vehicle throughput would increase by 63 percent in the northbound direction during the AM peak hour and 79 percent in the southbound direction during the PM peak hour. The improved corridor conditions would draw vehicles traveling on parallel arterials onto State Route 1, relieving the local city streets from excessive cut-through commuter traffic.

Person-mobility in the southbound direction during the PM peak hour would almost double from 2,911 to 5,684 persons per hour and in the northbound direction, during AM peak hour, person trips would increase by 83 percent, from 3,132 to 5,742 persons per hour. The simulation results show that the addition of the HOV lane would encourage commuters to carpool, increasing the average vehicle occupancy (AVO) in the corridor by 8 and 12 percent for the commute directions (northbound direction in the morning and southbound direction in the evening). The reverse commute directions would also experience increases in AVO but by a smaller margin of 3 to 5 percent. Since less congestion is expected on mixed-flow lanes in the reverse commute directions, commuters would be less compelled to carpool.

5.2.3 Delays and Densities

Compared to the Year 2035 No-Build scenario, the Year 2035 HOV Build alternative would reduce delays along the State Route 1 corridor. Vehicle delays are expected to decrease by 42 minutes (88 percent) in the northbound direction during the AM peak hour and by 40 minutes (82 percent) in the southbound direction during the PM peak hour. Similarly, the traffic density in the northbound direction during AM peak hour would improve from ~~102~~ 115 pcpmpl (LOS F) to ~~38~~ 42 pcpmpl (LOS E) on the mixed-flow lanes and 14 pcpmpl (LOS B) on the HOV lanes. Likewise, traffic density in the southbound direction during PM peak hour would improve from ~~95~~ 113 pcpmpl (LOS F) to ~~48~~ 37 pcpmpl (LOS ~~F~~E) on the mixed-flow lanes and ~~15~~ 19 pcpmpl (LOS B) on the HOV lanes. Overall traffic performance would improve from LOS F to as high as LOS D for the mixed-flow lanes, and as high as LOS A for the HOV lanes.

While major LOS improvements are observed on the HOV facilities, density comparisons showed that the mixed-flow lanes would also improve, reducing vehicle density by approximately 50 percent. However, due to the extent of congestion before the addition of the HOV lanes (discussed in the Year 2035 No-Build section); the improved densities would still result in LOS E or LOS F. Nonetheless, the main goal of the HOV Lane Widening project is to improve person-mobility, and as the results show, person-mobility is expected to improve under the Year 2035 HOV Build scenario.

5.2.4 Travel Speed and Travel Time

The addition of the HOV lane and other geometric improvements would result in substantial traffic performance improvements, especially on the HOV lanes. Even during peak hours, the vehicles on the HOV lanes would operate at or near free-flow speed. Carpool Commuters traveling at speeds as low as 11 mph under the Year 2035 No-Build Conditions would be able to travel at free-flow speed (approximately 60 mph) on the HOV lanes. Overall (combining both

Table 5-7
Comparison of Measure of Effectiveness - Year 2035 No-Build versus Year 2035 TSM Build Scenarios

Measure of Effectiveness	2035 No-Build		2035 TSM Build		% Difference	
	AM	PM	AM	PM	AM	PM
Northbound						
Average Travel Time (minutes)	59 ***39***	34 ***22***	34 ***27***	29 ***18***	-42% ***-31%***	-15% ***-18%***
Average Speed (mph)	12 ***18***	17 ***28***	21 ***27***	21 ***33***	75% ***50%***	24% ***18%***
Delay (minutes per vehicle)	48 ***28***	25 ***12***	22 ***15***	19 ***9***	-54% ***-46%***	-24% ***-25%***
No. of Vehicle Trips (per hour)	2,767 ***3,129***	3,114 ***3,157***	3,986 ***3,645***	3,858 ***3,546***	44% ***16%***	24% ***12%***
No. of Persons Trips (per hour)	3,132 ***3,542***	3,874 ***3,927***	4,847 ***4,441***	4,870 ***4,474***	55% ***25%***	26% ***14%***
Freeway Travel Time (VHT)	2,749 ***2,053***	1,784 ***1,138***	2,260 ***1,612***	1,871 ***1,080***	-18% ***-21%***	5% ***-5%***
Travel Distance (VMT)	32,646 ***36,922***	31,138 ***31,568***	47,030 ***43,009***	38,582 ***35,455***	44% ***16%***	24% ***12%***
Avg. Vehicle Occupancy (persons/vehicle)	1.13 ***1.13***	1.24 ***1.24***	1.22 ***1.22***	1.23 ***1.26***	7% ***8%***	1% ***1%***
Density (passenger cars per mile per lane)	~~102~~115 ~~***78***~~***87***	~~84~~92 ~~***53***~~***56***	~~69~~76 ~~***51***~~***54***	~~67~~73 ~~***39***~~***43***	-~~32~~34% -~~35~~38%	-~~20~~21% -~~26~~23%
Level of Service	F ***F***	F ***F***	F ***F***	F ***E***	N.A. ***N.A.***	N.A. ***N.A.***
Southbound						
Average Travel Time (minutes)	29 ***18***	61 ***47***	12 ***11***	62 ***33***	-59% ***-39%***	2% ***-30%***
Average Speed (mph)	22 ***35***	11 ***15***	54 ***59***	10 ***21***	145% ***69%***	-9% ***40%***
Delay (minutes per vehicle)	19 ***8***	49 ***35***	2 ***1***	50 ***21***	-89% ***-88%***	2% ***-40%***
No. of Vehicle Trips (per hour)	3,101 ***2,968***	2,475 ***2,696***	3,873 ***3,050***	3,091 ***3,479***	25% ***3%***	25% ***29%***
No. of Persons Trips (per hour)	3,597 ***3,443***	2,911 ***3,168***	4,623 ***3,638***	3,750 ***4,216***	29% ***6%***	29% ***33%***
Freeway Travel Time (VHT)	1,498 ***884***	2,523 ***2,101***	756 ***540***	3,165 ***1,903***	-50% ***-39%***	25% ***-9%***
Travel Distance (VMT)	32,248 ***30,863***	28,956 ***31,544***	40,278 ***31,715***	36,169 ***40,707***	25% ***3%***	25% ***29%***
Avg. Vehicle Occupancy (persons/vehicle)	1.16 ***1.16***	1.18 ***1.18***	1.19 ***1.19***	1.21 ***1.21***	3% ***3%***	3% ***3%***
Density (passenger cars per mile per lane)	~~61~~70 ~~***37***~~***42***	~~95~~113 ~~***78***~~***90***	~~27~~29 ~~***19***~~***21***	~~102~~124 ~~***60***~~***66***	-~~56~~59% -~~49~~50%	~~7~~10% -~~23~~27%
Level of Service	F ***E***	F ***F***	D ***C***	F ***F***	N.A. ***N.A.***	N.A. ***N.A.***

Source: Wilbur Smith Associates, February 2007

NOTES:
Non-italicized and non-bold values represent peak hour values.
Bold italicized values represent peak period (6 AM – 12 PM and 2 PM – 8 PM) values.
N.A. – Not Applicable

5.3.2 Vehicle Throughput

The addition of ramp metering and auxiliary lanes within the study area is expected to serve more traffic demand on State Route 1 than under the No-Build Conditions. The traffic demand on State Route 1 within the project limits would increase by 44 percent in the northbound direction during the AM peak hour and 25 percent in the southbound direction during the PM peak hour. At the same time, the number of person-trips would increase by 55 percent and 29 percent in the northbound direction during AM peak hour and in the southbound direction during PM peak hour, respectively. The AVO under the Year 2035 TSM Build Condition is expected to range between 1.19 and 1.26 persons per vehicle, a slight increase from the Year 2035 No-Build Condition.

Metering the corridor's on-ramps would increase the motorists traffic delays before entering the freeway and the performance measures of the arterials and the local intersections will be discussed in the following sections. However, as shown in *Table 5-7*, the overall freeway operations would improve with ramp metering. The increase in traffic throughput in the southbound direction during the PM peak hour (25 percent) would be caused by the extra capacity provided by the auxiliary lanes. However, the additional traffic on the corridor along with the already-congested conditions in the southbound direction during the PM peak hour (under No-Build Conditions), would cause traffic operations in the corridor to worsen slightly. These are discussed in the next section.

5.3.3 Delays and Densities

In the southbound direction during the PM peak, although the total vehicle throughput would increase by approximately 25 percent, delay per vehicle and total VHT would increase by only two percent. Traffic delay in the northbound direction during the AM peak hour is expected to average 22 minutes per vehicle, while in the southbound direction during the PM peak hour it is expected to be 50 minutes per vehicle, an increase of one minute per vehicle compared to the Year 2035 No-Build scenario. Thus, in the southbound direction during the PM peak hour, the addition of ramp metering and auxiliary lanes would not improve the mainline operations.

Similarly, there would be little improvements in densities and LOS values. Densities would improve slightly but not enough to operate at a higher LOS value. The corridor would operate at densities of ~~69~~ 76 pcpmpl (LOS F) in the northbound direction during the AM peak hour and ~~102~~ 124 pcpmpl (LOS F) in the southbound direction during PM peak hour. The reverse commute conditions (northbound direction during PM peak hour and southbound direction during the AM peak hour) would improve, especially in the southbound direction during the AM peak hour, which would improve from LOS F to LOS D.

5.3.4 Travel Speed and Travel Time

Compared to the Year 2035 No-Build Conditions, traffic performance under Year 2035 TSM Build Conditions would show improvements during the AM peak hour, in both northbound (42 percent reduction in travel time) and southbound (15 percent reduction in travel time) directions. However, in the southbound direction during the PM peak hour, there would be a slight increase in the average travel time (62 minutes, two percent increase), while the average travel speed would slightly decrease (10 mph, nine percent decrease). As previously mentioned, this would

Table 6-1
Comparison of Measure of Effectiveness - Existing versus Year 2015 No-Build Scenarios

Measure of Effectiveness	Existing AM	Existing PM	2015 No-Build AM	2015 No-Build PM	% Difference AM	% Difference PM
Northbound						
Average Travel Time (minutes)	~~23~~22 ***16***	~~15~~13 ***12***	24 ***20***	12 ***11***	49% ***25%***	~~-20~~-8% ***-8%***
Average Speed (mph)	~~30~~32 ***44***	~~39~~45 ***52***	29 ***36***	49 ***53***	~~-3~~-9% ***-18%***	~~26~~9% ***2%***
Delay (minutes per vehicle)	~~14~~11 ***~~45~~***	~~6~~4 ***2***	13 ***8***	3 ***2***	~~-7~~18% ***~~100~~60%***	~~-50~~-25% ***0%***
No. of Vehicle Trips (per hour)	~~2,923~~3,329 ***3,045***	~~3,235~~3,381 ***2,805***	3,449 ***3,376***	3,878 ***3,189***	~~18~~4% ***11%***	~~20~~15% ***14%***
No. of Persons Trips (per hour)	~~3,308~~3,769 ***3,447***	~~4,024~~4,206 ***3,489***	3,904 ***3,822***	4,825 ***3,967***	~~18~~4% ***11%***	~~20~~15% ***14%***
Freeway Travel Time (VHT)	~~1,274~~1,262 ***821***	~~823~~753 ***544***	1,436 ***1,119***	797 ***602***	~~13~~14% ***36%***	~~-36~~% ***11%***
Travel Distance (VMT)	~~38,517~~39,288 ***35,933***	~~32,349~~33,807 ***28,045***	40,698 ***39,841***	38,783 ***31,889***	~~6~~4% ***11%***	~~20~~15% ***14%***
Avg. Vehicle Occupancy (persons/vehicle)	1.13 ***1.13***	1.24 ***1.24***	1.13 ***1.13***	1.24 ***1.24***	0% ***0%***	0% ***0%***
Density (passenger cars per mile per lane)	52 ***35***	~~40~~38 ***27***	~~56~~59 ***~~45~~47***	~~38~~40 ***~~28~~30***	~~8~~13% ***~~29~~34%***	~~-5~~5% ***~~4~~11%***
Level of Service	F ***D***	E ***D***	F ***~~E~~F***	E ***D***	N.A. ***N.A.***	N.A. ***N.A.***
Southbound						
Average Travel Time (minutes)	10 ***10***	~~27~~23 ***18***	12 ***11***	47 ***28***	20% ***10%***	~~7~~4104% ***56%***
Average Speed (mph)	~~60~~61 ***61***	~~26~~30 ***39***	51 ***58***	15 ***25***	~~-15~~-16% ***-5%***	~~-42~~-50% ***-36%***
Delay (minutes per vehicle)	0 ***0***	~~15~~12 ***~~6~~7***	2 ***1***	35 ***16***	N.A. ***170%***	~~133~~192% ***~~167~~129%***
No. of Vehicle Trips (per hour)	~~2,918~~2,370 ***2,332***	~~3,101~~3,160 ***~~2,885~~2,794***	3,239 ***2,596***	2,900 ***2,933***	~~11~~37% ***11%***	~~-6~~-8% ***~~2~~5%***
No. of Persons Trips (per hour)	~~3,385~~2,749 ***2,705***	~~3,664~~3,729 ***~~3,405~~3,297***	3,757 ***3,011***	3,421 ***3,456***	~~11~~37% ***11%***	~~-7~~-8% ***~~1~~5%***
Freeway Travel Time (VHT)	~~507~~405 ***400***	~~1,391~~1,224 ***~~858~~835***	661 ***463***	2,254 ***1,371***	~~30~~63% ***16%***	~~62~~84% ***~~60~~64%***
Travel Distance (VMT)	~~30,348~~24,644 ***24,251***	~~35,661~~36,340 ***~~33,182~~32,130***	33,683 ***26,996***	33,929 ***34,311***	~~11~~37% ***11%***	~~-5~~-7% ***~~3~~7%***
Avg. Vehicle Occupancy (persons/vehicle)	1.16 ***1.16***	1.18 ***1.18***	1.16 ***1.16***	1.18 ***1.18***	0% ***0%***	0% ***0%***
Density (passenger cars per mile per lane)	~~24~~19 ***19***	~~59~~53 ***36***	~~28~~32 ***~~20~~22***	~~84~~97 ***~~51~~59***	~~17~~68% ***~~5~~16%***	42~~83~~% ***~~42~~64%***
Level of Service	C ***C***	F ***E***	D ***C***	F ***F***	N.A. ***N.A.***	N.A. ***N.A.***

Source: Wilbur Smith Associates, April 2007

NOTES:
Non-italicized and non-bold values represent peak hour values.
Bold italicized values represent peak period (6 AM – 12 PM and 2 PM – 8 PM) values.
N.A. – Not Applicable

As discussed in *Chapter 5*, a corridor would only be able to serve a smaller number of vehicles when it breaks down, since vehicles within the corridor are forced to stop-and-go, reducing efficient and smooth travel that would result in lower average speeds and flow capacities. The existing bottlenecks within the study area would increase the additional traffic demand, worsening the overall performance and experiencing a decline in vehicle throughput and an increase in average vehicle delays. Levels of service and travel delay as performance measures will be discussed in greater detail in the following sections.

6.1.3 Delays and Densities

By year 2015, traffic operations are expected to deteriorate compared to Existing Conditions. Under Year 2015 No-Build Conditions, average vehicle density during the northbound AM peak hour would increase from 52 pcpmpl (LOS F) to ~~56~~ 59 pcpmpl (LOS F). For a complete description of service levels and their relationships with density values, refer to *Table 2-3* in *Chapter 2*.

In the northbound direction during the PM peak hour (reverse commute), future traffic operations ~~show a slight improvement~~would worsen slightly; traffic densities would ~~decrease~~ increase from ~~40~~ 38 pcpmpl (LOS E) to ~~38~~ 40 pcpmpl (LOS E). This improvement is likely to be caused by the implementation of the non-HOV improvements already planned by Caltrans for the area (*Route 1/17 Widening for Merge Lanes Project* and *Highway 1 Soquel to Morrissey Auxiliary Lanes Project*, between Morrissey Boulevard and Soquel Avenue interchanges) for congestion relief. There is a bigger contrast in travel delay measures, where there would be a ~~50~~ 25 percent reduction in average vehicle delay (from ~~six~~ four minutes to three minutes) from Existing to Year 2015 No-Build Conditions. Note that, while moving in the same direction, the measures of density, LOS, and delay performance measures do not share a linear relationship with each other. When traffic operations start to break down, a relatively small number of vehicles added to the network can potentially increase delay and travel time by much larger orders of magnitude.

Southbound State Route 1 would experience a higher increase in density during the PM peak hour, from ~~59~~ 53 pcpmpl (LOS F) under existing conditions to ~~84~~ 97 pcpmpl (LOS F) by year 2015, a ~~42~~ 83 percent increase. As mentioned in *Section 6.1.2*, the southbound State Route 1 is already experiencing heavy congestion under Existing Conditions during the PM peak hour and would worsen by year 2015. This would result in an average vehicle delay increase of ~~133~~ 192 percent, from ~~15~~ 12 minutes under Existing Conditions to 35 minutes under Year 2015 No-Build Conditions.

In the northbound direction, average travel time and vehicle delay on State Route 1 would increase during the AM peak hour as speed decreases~~, but average delay per vehicle would also decrease. This phenomenon can be explained by the algebraic expression of average delay per vehicle which is Freeway Travel Time divided by vehicle throughput and by year 2015, vehicle throughput would increase much rapidly than the reduction in speed. As a result, although the total delay (VHT) would increase, the average delay per vehicle would decrease, due to a larger increase in the denominator.~~

6.1.4 Travel Speed and Travel Time

Under Year 2015 No-Build Conditions, average travel time would increase slightly in the peak commute directions compared to Existing Conditions. During the northbound AM peak hour, average travel time would increase by ~~one~~ two minutes (from ~~23~~ 22 to 24 minutes per vehicle) and average speeds would reduce by ~~one~~ 3 mph (from ~~30~~ 32 to 29 mph). During the southbound PM peak hour, average travel time would increase from ~~27~~ 23 minutes to 47 minutes (~~74~~ 104 percent increase) and average speed would decrease from ~~26~~ 30 mph to 15 mph (~~42~~ 50 percent reduction).

Following similar trends discussed earlier for non-peak commute directions, northbound State Route 1 during the PM peak hour would experience a slight reduction in average vehicle travel time and an increase in average travel speed. Average travel time would decrease by ~~20~~ 8 percent, down from ~~15~~ 13 minutes under existing conditions to 12 minutes under Year 2015 No-Build Conditions, while speeds would increase by ~~26~~ 9 percent, up from ~~39~~ 45 mph to 49 mph.

6.1.5 Intersections Operation Analysis

Using the methodology described in *Section 4.5*, turning movement volumes at the study intersections were estimated for the Year 2015 No-Build Conditions. *Figures 6-2A, 6-2B,* and *6-2C* exhibit the intersection volumes under Year 2015 No-Build AM and PM peak hours.

During Year 2015 No-Build AM peak hour conditions, 17 of the 25 study intersections would operate under an unacceptable level of service (LOS E or F). The eight (8) intersections that would operate under an acceptable level of service (LOS D or better) are:

- Soquel Avenue/ State Route 1 Southbound Ramps
- 41st Avenue/ State Route 1 Northbound Off-Ramp
- 41st Avenue/ State Route 1 Southbound Ramps
- Porter Street/ State Route 1 Northbound Ramps
- State Park Drive/ State Route 1 Northbound Ramps
- State Park Drive/ State Route 1 Southbound Ramps
- Rio Del Mar Boulevard/ State Route 1 Southbound Ramps
- San Andreas Road/ Larkin Road/ State Route 1 Northbound Off- Ramp

During Year 2015 No-Build PM peak hour, 12 of the 25 study intersections would operate under an unacceptable level of service. The 13 intersections that would operate under an acceptable level of service are:

- Morrissey Boulevard/ Rooney Street/ Pacheco Avenue
- Rooney Street/ State Route 1 Northbound Ramps
- Soquel Drive/ Paul Sweet Road/ Commercial Way
- 41st Avenue/ State Route 1 Northbound Off-Ramp
- 41st Avenue/ State Route 1 Southbound Ramps
- Porter Street/ State Route 1 Northbound Ramps
- Bay Avenue/ State Route 1 Southbound Ramps
- Park Avenue/ State Route 1 Northbound Ramps
- Park Avenue/ State Route 1 Southbound Ramps

6.2 2015 HOV BUILD ALTERNATIVE ANALYSIS

6.2.1 Proposed Improvements and Network Assumptions

Similar to the Year 2035 HOV Build scenario, simulation was performed to quantify the benefits of implementing HOV lanes, ramp metering, and supporting auxiliary lanes on State Route 1, assuming the final lane and intersection geometrics evaluated and finalized in a technical memorandum dated August 25, 2006, (northbound Scenario 11 and southbound Scenario 7) and included in *Appendix A-7* of this report. The AM and PM corridor volumes for the Year 2015 HOV Build scenario are presented in *Figures 6-3A* and *6-3B*, respectively. The results of the *FREQ* analyses are summarized in *Table 6-3*, while the output is exhibited in *Appendix E-6*.

6.2.2 Vehicle Throughput

The addition of the HOV lanes, ramp metering, and auxiliary lanes within the State Route 1 study area is expected to improve overall traffic performance while at the same time increase vehicle throughput. The *FREQ* results identified that in the northbound direction during the AM peak hour, vehicle throughput would increase from 3,449 vehicles per hour under the Year 2015 No-Build scenario to 3,935 vehicles per hour under the Year 2015 HOV Build scenario, an increase of 14 percent. Similarly, the southbound direction in the PM peak hour would have a vehicle throughput increase of 39 percent, from 2,900 vehicles to 4,029 vehicles. The improved corridor conditions would draw vehicles traveling on parallel arterials onto State Route 1, relieving the local city streets from excessive cut-through commuter traffic.

Person-trips would also increase along with higher vehicle throughput, showing increases of 27 percent and 49 percent in the northbound direction during the AM peak period and southbound direction during the PM peak period, respectively. Comparing the person and vehicle throughputs, it can be observed that the Average Vehicle Occupancies (AVO) between the two scenarios would increase as well. This suggests that while the addition of the HOV lanes would increase travel demand, it would also encourage motorists to take better advantage of the new facility by carpooling. In the northbound direction during the AM peak hour, the AVO is expected to be 1.26 vehicles per person, while in the southbound direction during PM peak hour, the AVO would be 1.27 persons per vehicle.

6.2.3 Delays and Densities

The State Route 1 corridor seems to accommodate the increased travel demand with no difficulties, as the increased vehicle volumes resulted in improved levels of service, especially on the HOV lanes. The HOV lanes under this scenario would not operate below LOS B. In the northbound direction during the AM peak hour, the traffic density would improve from ~~56~~ 59 pcpmpl (LOS F) overall to ~~23~~ 22 pcpmpl on the mixed-flow lanes (LOS C) and 12 pcpmpl (LOS A) on the HOV lanes. In the southbound direction during the PM peak hour, densities would improve from ~~84~~ 97 pcpmpl (LOS F) overall to 22 pcpmpl (LOS C) on the mixed-flow lanes and 12 pcpmpl (LOS B) on the HOV lanes.

Table 6-3
Comparison of Measure of Effectiveness - Year 2015 No-Build versus Year 2015 HOV Build Scenarios

Measure of Effectiveness	2015 No-Build AM	2015 No-Build PM	2015 HOV Build AM	2015 HOV Build PM	% Difference AM	% Difference PM
Northbound						
Average Travel Time (minutes)	24 ***20***	12 ***11***	10 ***10***	9 ***9***	-58% ***-50%***	-25% ***-18%***
Average Speed (mph)	29 ***36***	49 ***53***	59 ***60***	62 ***61***	103% ***67%***	27% ***15%***
Delay (minutes per vehicle)	13 ***8***	3 ***2***	1 ***0***	0 ***0***	-95% ***-95%***	-95% ***-96%***
No. of Vehicle Trips (per hour)	3,449 ***3,376***	3,878 ***3,189***	3,935 ***3,534***	3,979 ***3,192***	14% ***5%***	3% ***0%***
No. of Persons Trips (per hour)	3,904 ***3,822***	4,825 ***3,967***	4,947 ***4,436***	5,112 ***4,070***	27% ***16%***	6% ***3%***
Freeway Travel Time (VHT)	1,436 ***1,119***	797 ***602***	754 ***658***	627 ***505***	-47% ***-41%***	-21% ***-16%***
Travel Distance (VMT)	40,698 ***39,841***	38,783 ***31,889***	44,397 ***39,599***	38,584 ***30,996***	9% ***-1%***	-1% ***-3%***
Avg. Vehicle Occupancy (persons/vehicle)	1.13 ***1.13***	1.24 ***1.24***	1.26 ***1.26***	1.28 ***1.28***	11% ***11%***	3% ***3%***
Density (passengers per mile per lane)	~~56~~59 ***~~45~~47***	~~38~~40 ***~~28~~30***	~~23~~ 22 (12) ***~~20~~ 19 (10)***	~~21~~ 20 (14) ***~~17~~ 16 (11)***	N.A. ***N.A.***	N.A. ***N.A.***
Level of Service	F ***~~E~~F***	E ***D***	C (B) ***C (A)***	C (B) ***B (A)***	N.A. ***N.A.***	N.A. ***N.A.***
Southbound						
Average Travel Time (minutes)	12 ***11***	47 ***28***	9 ***9***	10 ***10***	-25% ***-18%***	-79% ***-64%***
Average Speed (mph)	51 ***58***	15 ***25***	62 ***61***	59 ***60***	22% ***5%***	293% ***140%***
Delay (minutes per vehicle)	2 ***1***	35 ***16***	0 ***0***	1 ***1***	-97% ***-79%***	-98% ***-97%***
No. of Vehicle Trips (per hour)	3,239 ***2,596***	2,900 ***2,93***	3,470 ***2,649***	4,029 ***3,207***	7% ***2%***	39% ***9%***
No. of Persons Trips (per hour)	3,757 ***3,011***	3,421 ***3,456***	4,253 ***3,224***	5,109 ***4,043***	13% ***7%***	49% ***17%***
Freeway Travel Time (VHT)	661 ***463***	2,254 ***1,371***	570 ***439***	752 ***599***	-14% ***-5%***	-67% ***-56%***
Travel Distance (VMT)	33,683 ***26,996***	33,929 ***34,311***	35,070 ***26,848***	44,740 ***35,698***	4% ***-1%***	32% ***4%***
Avg. Vehicle Occupancy (persons/vehicle)	1.16 ***1.16***	1.18 ***1.18***	1.23 ***1.22***	1.27 ***1.26***	6% ***5%***	7% ***7%***
Density (passengers per mile per lane)	~~28~~32 ***~~20~~22***	~~84~~97 ***~~51~~59***	19 (9) ***~~14~~ 15 (6)***	22 (12) ***18 (9)***	N.A. ***N.A.***	N.A. ***N.A.***
Level of Service	D ***C***	F ***F***	C (A) ***B (A)***	C (B) ***B (A)***	N.A. ***N.A.***	N.A. ***N.A.***

Source: Wilbur Smith Associates, April 2007

NOTES:
28 (10) – Density of mixed-flow lanes (Density of HOV lane)
D (A) – LOS of mixed-flow lanes (LOS of HOV lane)
Non-italicized and non-bold values represent peak hour values.
Bold italicized values represent peak period (6 AM – 12 PM and 2 PM – 8 PM) values.
N.A. – Not Applicable

Table 6-6
Comparison of Measure of Effectiveness - Year 2015 No-Build versus Year 2015 TSM Build Scenarios

Measure of Effectiveness	2015 No-Build AM	2015 No-Build PM	2015 TSM Build AM	2015 TSM Build PM	% Difference AM	% Difference PM
Northbound						
Average Travel Time (minutes)	24 ***20***	12 ***11***	13 ***12***	10 ***10***	-46% ***-40%***	-17% ***-9%***
Average Speed (mph)	29 ***36***	49 ***53***	53 ***58***	60 ***60***	83% ***61%***	22% ***13%***
Delay (minutes per vehicle)	13 ***8***	3 ***2***	2 ***0***	0 ***0***	-85% ***-94%***	-90% ***-88%***
No. of Vehicle Trips (per hour)	3,449 ***3,376***	3,878 ***3,189***	3,690 ***3,377***	3,846 ***3,186***	7% ***0%***	-1% ***0%***
No. of Persons Trips (per hour)	3,904 ***3,822***	4,825 ***3,967***	4,486 ***4,118***	4,875 ***4,028***	15% ***8%***	1% ***2%***
Freeway Travel Time (VHT)	1,436 ***1,119***	797 ***602***	830 ***691***	639 ***527***	-42% ***-38%***	-20% ***-12%***
Travel Distance (VMT)	40,698 ***39,841***	38,783 ***31,889***	43,540 ***39,844***	38,463 ***31,855***	7% ***0%***	-1% ***0%***
Avg. Vehicle Occupancy (persons/vehicle)	1.13 ***1.13***	1.24 ***1.24***	1.22 ***1.22***	1.27 ***1.26***	7% ***8%***	2% ***2%***
Density (passenger cars per mile per lane)	~~56~~59 ***~~45~~47***	~~38~~40 ***~~28~~30***	~~27~~28 ***23***	~~24~~26 ***~~20~~21***	-~~52~~53% ***-49%***	-~~37~~35% ***-~~29~~30%***
Level of Service	F ***~~E~~F***	E ***D***	D ***C***	C ***C***	N.A. ***N.A.***	N.A. ***N.A.***
Southbound						
Average Travel Time (minutes)	12 ***11***	47 ***28***	10 ***10***	17 ***14***	-17% ***-9%***	-64% ***-50%***
Average Speed (mph)	51 ***58***	15 ***25***	61 ***61***	41 ***51***	20% ***5%***	173% ***104%***
Delay (minutes per vehicle)	2 ***1***	35 ***16***	0 ***0***	5 ***2***	-89% ***-68%***	-85% ***-86%***
No. of Vehicle Trips (per hour)	3,239 ***2,596***	2,900 ***2,93***	3,332 ***2,601***	3,674 ***3,076***	3% ***0%***	27% ***5%***
No. of Persons Trips (per hour)	3,757 ***3,011***	3,421 ***3,456***	3,979 ***3,105***	4,456 ***3,727***	6% ***3%***	30% ***8%***
Freeway Travel Time (VHT)	661 ***463***	2,254 ***1,371***	571 ***445***	1,037 ***713***	-14% ***-4%***	-54% ***-48%***
Travel Distance (VMT)	33,683 ***26,996***	33,929 ***34,311***	34,649 ***27,045***	42,986 ***35,989***	3% ***0%***	27% ***5%***
Avg. Vehicle Occupancy (persons/vehicle)	1.16 ***1.16***	1.18 ***1.18***	1.19 ***1.19***	1.21 ***1.21***	3% ***3%***	3% ***3%***
Density (passenger cars per mile per lane)	~~28~~32 ***~~20~~22***	~~84~~97 ***~~51~~57***	~~21~~22 ***~~16~~17***	~~33~~36 ***~~23~~24***	-~~25~~31% ***-~~20~~23%***	-~~61~~63% ***-~~55~~59%***
Level of Service	D ***C***	F ***F***	C ***B***	~~D~~E ***C***	N.A. ***N.A.***	N.A. ***N.A.***

Source: Wilbur Smith Associates, February 2007

NOTES:
Non-italicized and non-bold values represent peak hour values.
Bold *italicized* values represent peak period (6 AM – 12 PM and 2 PM – 8 PM) values.
N.A. – Not Applicable

6.3.2 Vehicle Throughput

With the implementation of only ramp metering and auxiliary lanes as part of the TSM Build scenario, the State Route 1 corridor is expected to improve only marginally over the Year 2015 No-Build Conditions. There would be a minor increase in vehicle throughput. In the northbound direction during the AM peak hour, vehicle throughput would increase by seven percent.

The major improvement would be experienced in the southbound direction during the PM peak hour. This commute traffic direction currently serves approximately 3,100 vehicles during the peak hour, which would be reduced to 2,900 vehicles under the Year 2015 No-Build scenario. With the addition of ramp metering and auxiliary lanes under the TSM Build scenario, vehicle throughput is expected to increase to approximately 3,700 vehicles during the peak hour. Thus, the ramp metering and auxiliary lanes planned for State Route 1 would help alleviate the existing bottlenecks in the southbound direction and prevent the freeway from reaching breakdown point.

The person throughput would increase by 15 percent in the northbound direction during the AM peak and 30 percent in the southbound direction during the PM peak. Also, the AVOs would increase slightly, in the range of two to seven percent. Thus, even without the addition of the HOV lanes, the increased travel demand in the year 2015 TSM Build Alternative would encourage some motorists to carpool, although not to the extent observed under the Year 2015 HOV Build scenario.

Vehicle trips would decrease slightly, by about 30 vehicles, in the northbound direction during the PM peak hour, while the travel time would decrease and the average speed would increase. There is no operational explanation for this slight drop in throughput, which is likely caused by changes in travel demand patterns that would slightly reduce travel demand for the reverse commute direction in year 2015 compared to the Existing Conditions. However, the decrease is small enough to be negligible.

6.3.3 Delays and Densities

Compared to the Year 2015 No-Build Conditions, the Year 2015 TSM Build scenario would show improvements in LOS, although not as substantial as under Year 2015 HOV Build scenario. In the northbound direction during AM peak hour, the density would improve from ~~56~~ 59 pcpmpl (LOS F) to ~~27~~ 28 pcpmpl (LOS D). Under Year 2015 HOV Build scenario, the density would be ~~23~~ 22 pcpmpl (LOS C) for the mixed-flow lanes and 12 pcpmpl (LOS B) for the HOV lanes, one or two service levels better, depending on lane type. Similarly, the southbound direction during the PM peak hour would improve from ~~84~~ 97 pcpmpl (LOS F) to ~~33~~ 36 pcpmpl (LOS ~~D~~E) under the Year 2015 TSM Build scenario. On the other hand, under the Year 2015 HOV Build scenario it is expected that the mixed-flow lanes would operate at LOS C and the HOV lanes operate at LOS B.

Similar to the Year 2015 HOV Build scenario discussion presented in the *Section 6.2*, the reductions in delay would be the most drastic. In the northbound direction during the AM peak hour, average delay would be two minutes per vehicle, an 85 percent reduction, and in the

Southbound SR 1 – AM Peak Period

The summary of performance measures in *Table 8-4* indicates that only Alternative S2 would improve the overall corridor operations under Year 2015 Conditions during the AM peak period. Alternatives S1, S3, S4, and S5 would have either negligible or no affect on the MOE's of the overall corridor operations. During the AM peak period, the study corridor in the southbound direction would operate at LOS A with an AVO value of 1.16 under with and without auxiliary lane scenarios

A comparison of the *FREQ* graphical outputs indicate that no hotspots are created in the study corridor during the AM peak period due to Alternatives S1, ~~S2,~~ S3, S4, and S5. However, Alternative S2 would expose a hidden bottleneck in subsections 21, 22, and 24 (from Eastbound State Park Drive On-Ramp to Rio Del Mar Boulevard Off-Ramp and from Rio Del Mar Boulevard On-Ramp to Freedom Boulevard Off-Ramp) between 7:15 and 7:45 AM.

Southbound SR 1 – PM Peak Period

As shown in *Table 8-5*, alternatives S2, S4, and S5 would improve the overall corridor operations under Year 2015 Conditions during the PM peak period. Alternatives S1 and S3 would worsen the traffic operations of the overall study corridor in the southbound direction. A comparison of the average travel time, average speed, travel delay, freeway travel time, and average density values under with and without auxiliary lane scenarios indicate that Alternative S5 would provide the most improvement in the overall freeway operations, while Alternative S1 would provide the least improvement. However, similar to the AM peak period, the average LOS and AVO values for the study corridor will not change with any of the auxiliary lane improvements. During the PM peak period, Southbound SR 1 would operate at LOS F with an AVO value of 1.18 under with and without auxiliary lane scenarios.

Based on the *FREQ* graphical outputs, hotspots created along Southbound SR 1 during the PM peak period due to the auxiliary lane improvements are summarized in *Table 8-6*. Alternatives S2, S3, and S4 create hotspots. However, Alternatives S1 and N5 create none.

Table 8-4
Summary of Freeway Operations - Southbound SR 1 (AM Peak Period)

Measure of Effectiveness	Units	Time Period	Base Model	S1	% Difference to Base	S2	% Difference to Base	S3	% Difference to Base	S4	% Difference to Base	S5	% Difference to Base
Average Travel Time	minutes per vehicle	Peak Hour	12	12	1%	11	-12%	12	0%	12	0%	12	0%
		Peak Period	11	11	0%	10	-3%	11	-1%	11	-1%	11	-1%
Average Speed	mph	Peak Hour	51	50	-1%	58	13%	51	0%	51	0%	51	0%
		Peak Period	58	58	0%	60	4%	58	1%	58	1%	58	1%
Travel Delay	minutes per vehicle	Peak Hour	2	2	0%	1	-50%	2	0%	2	0%	2	0%
		Peak Period	1	1	0%	0	-100%	1	0%	1	0%	1	0%
No. of Vehicle Trips (vehicle throughput)	vehicles per hour	Peak Hour	3,239	3,242	0%	3,272	1%	3,239	0%	3,239	0%	3,239	0%
		Peak Period	2,596	2,598	0%	2,601	0%	2,596	0%	2,596	0%	2,596	0%
No. of Person Trips (person throughput)	persons per hour	Peak Hour	3,757	3,760	0%	3,796	1%	3,757	0%	3,757	0%	3,757	0%
		Peak Period	3,011	3,013	0%	3,018	0%	3,011	0%	3,011	0%	3,011	0%
Freeway Travel Time (VHT)	vehicle-hours	Peak Hour	661	669	1%	589	-11%	659	0%	658	0%	659	0%
		Peak Period	463	465	0%	450	-3%	462	0%	462	0%	462	0%
Travel Distance (VMT)	vehicle-miles	Peak Hour	33,683	33,714	0%	34,032	1%	33,683	0%	33,683	0%	33,683	0%
		Peak Period	26,996	27,015	0%	27,054	0%	26,996	0%	26,996	0%	26,996	0%
Average Vehicle Occupancy	persons per vehicle	Peak Hour	1.16	1.16	0%	1.16	0%	1.16	0%	1.16	0%	1.16	0%
		Peak Period	1.16	1.16	0%	1.16	0%	1.16	0%	1.16	0%	1.16	0%
Average Density	passenger cars per mile per lane	Peak Hour	32	33	3%	28	-13%	32	0%	32	0%	32	0%
		Peak Period	22	22	0%	22	-3%	22	-1%	22	-1%	22	-1%
Average Level of Service (LOS)	-	Peak Hour	D	D	-	D	-	D	-	D	-	D	-
		Peak Period	C	C	-	C	-	C	-	C	-	C	-

The next step was to assign a weightage factor to each MOE. The most relevant MOE's were assigned a higher weightage factor. Weightage factors assigned to each MOE are shown in *Appendix I***.**

Based on the peak direction of travel, weightage factors were assigned to each peak period. In other words, for all the improvements proposed along northbound Highway 1, a higher weightage factor was assigned to the AM peak period than the PM peak period. This is because, for the study corridor, the northbound direction is the peak direction of travel and northbound PM is the non-peak direction of travel. These peak period adjustment factors ensure that higher weightage is given to auxiliary lane improvements that provide greater relief in congestion along the peak direction of travel. The peak period weightage factors used for this study are shown in *Appendix I* for the northbound and southbound directions.

Using the evaluation scores, MOE weightage factors, and peak period weightage factors described above, an overall score was developed for each auxiliary lane improvement. This score falls between 1 and 5. Using these overall scores, the auxiliary lane improvements were ranked and prioritized. The auxiliary lanes with the highest overall score was ranked first and given the highest priority. The overall scores and prioritization of the auxiliary lane improvements are shown in *Table 8-7*.

A detailed description of the methodology adopted to rank the auxiliary lane alternatives is provided in *Appendix I*.

Table 8-7
Prioritization of Auxiliary Lane Improvements

Northbound Highway 1 Auxiliary Lane Alternatives	Overall Score	Priority Ranking	Southbound Highway 1 Auxiliary Lane Alternatives	Overall Score	Priority Ranking
N1	5.00	1	S1	2.~~79~~86	5
N2	4.~~30~~32	2	S2	5.00	1
N3	3.~~07~~05	3	S3	3.~~47~~52	4
N4	~~2.99~~3.08	~~4~~3	S4	~~3.98~~4.00	2
N5	2.~~28~~39	~~5~~4	S5	3.~~72~~76	3

8.2 PRIORITIZATION OF INTERCHANGE AND INTERSECTION IMPROVEMENTS

This methodology would prioritize the implementation of interchange and intersection improvements that are proposed within the study corridor. These improvements may occur in addition to/alongside/independent of the freeway improvements along Highway 1 depending on the available funding.

Table 8-9
Comparison of 2015 Peak Period Performance Measures
(Highway 1 – Highway 17 to San Andreas Road/Larkin Valley Road Interchanges)

Measure of Effectiveness	2015 No Build		2015 Tier 2 Project	
	AM	PM	AM	PM
Average Travel Time (minutes per vehicle)				
Northbound	20	11	17	11
Southbound	11	28	11	29
Average Speed (mph)				
Northbound	36	53	42	56
Southbound	~~59~~58	25	~~59~~58	24
Travel Delay (minutes per vehicle)				
Northbound	8	2	5	1
Southbound	1	16	1	18
Number of Vehicle Trips (vehicles per hour)				
Northbound	3,376	3,189	3,399	3,190
Southbound	2,~~674~~596	2,933	2,~~675~~598	2,964
Number of Person Trips (persons per hour)				
Northbound	3,822	3,967	3,848	3,969
Southbound	3,~~102~~011	3,456	3,~~103~~013	3,493
Average Vehicle Occupancy (persons per vehicle)				
Northbound	1.13	1.24	1.13	1.24
Southbound	1.16	1.18	1.16	1.18
Average Density (~~pc~~vpmpl)				
Northbound	47	30	41	28
Southbound	~~23~~22	59	~~23~~22	62
Average Level of Service				
Northbound	F	D	E	D
Southbound	~~D~~C	F	~~D~~C	F

Southbound Highway 1 Corridor

- It would increase the average travel time along the corridor by 1 minute per vehicle (from 28 to 29 minutes per vehicle) and average travel delay by 2 minutes per vehicle (from 16 to 18 minutes per vehicle) during the PM peak period;
- It would reduce the average travel speed along the corridor by 1 mph (from 25 mph to 24 mph) during the PM peak period;
- It would marginally improve the vehicle throughput from 2,933 to 2,964 vehicles per hour and person throughput from 3,456 to 3,493 persons per hour during the PM peak period; and
- It would increase the average vehicle density from 59 to 62 passenger cars per mile per lane during the PM peak period; however, it would not modify the LOS of the corridor.

The implementation of the Tier 2 project would add capacity to Southbound Highway 1 between Soquel Avenue On-Ramp and 41st Avenue Off-Ramp. This increase in capacity would relieve congestion between Soquel Avenue On-Ramp and 41st Avenue Off-Ramp, but the relieved traffic would add to the queues at the downstream bottleneck located between Bay Avenue On-Ramp and Park Avenue Off-Ramp, increasing queue lengths at that location. Therefore, traffic

Table 9-1
State Route 1 Traffic Operational Analysis Summary – Peak Hour Conditions

Measure of Effectiveness	Existing Conditions		Year 2035 Conditions						Year 2015 Conditions					
			No-Build		HOV Build		TSM Build		No-Build		HOV Build		TSM Build	
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Average Travel Time (minutes)														
Northbound	~~23~~22	~~15~~13	59	34	16	13	34	29	24	12	10	9	13	10
Southbound	10	~~27~~23	29	61	12	19	12	62	12	47	9	10	10	17
Average Speed (mph)														
Northbound	~~30~~32	~~39~~45	12	17	39	42	21	21	29	49	59	62	53	60
Southbound	~~60~~61	~~26~~30	22	11	52	33	54	10	51	15	62	59	61	41
Delay (minutes per vehicle)														
Northbound	~~14~~11	~~6~~4	48	25	6	4	22	19	13	3	1	0	2	0
Southbound	0	~~15~~12	19	49	2	9	2	50	2	35	0	1	0	5
No. of Vehicle Trips (per hour)														
Northbound	~~2,923~~3,329	~~3,235~~3,381	2,767	3,114	4,510	4,898	3,986	3,858	3,449	3,878	3,935	3,979	3,690	3,846
Southbound	~~2,918~~2,370	~~3,101~~3,160	3,101	2,475	4,253	4,431	3,873	3,091	3,239	2,900	3,470	4,029	3,332	3,674
No. of Person Trips (per hour)														
Northbound	~~3,308~~3,769	~~4,024~~4,206	3,132	3,874	5,742	6,276	4,847	4,870	3,904	4,825	4,947	5,112	4,486	4,875
Southbound	~~3,385~~2,749	~~3,664~~3,729	3,597	2,911	5,181	5,684	4,623	3,750	3,757	3,421	4,253	5,109	3,979	4,456
Avg. Vehicle Occupancy (persons/vehicle)														
Northbound	1.13	1.24	1.13	1.24	1.27	1.28	1.22	1.23	1.13	1.24	1.26	1.28	1.22	1.27
Southbound	1.16	1.18	1.16	1.18	1.22	1.28	1.19	1.21	1.16	1.18	1.23	1.27	1.19	1.21
Density (pcpmpl)														
Northbound	52	~~40~~38	~~102~~115	~~84~~92	~~38 (14)~~ 42 (14)	~~39 (19)~~ 37 (20)	~~69~~76	~~67~~73	~~56~~59	~~38~~40	~~23 (12)~~ 22(12)	~~21 (14)~~ 20 (14)	~~27~~28	~~24~~26
Southbound	~~24~~19	~~59~~53	~~61~~70	~~95~~42	~~28 (10)~~ 29 (11)	~~48 (15)~~ 37 (19)	~~27~~29	~~102~~ 124	~~28~~32	~~84~~97	19 (9)	22 (12)	~~21~~22	~~33~~36
Level of Service														
Northbound	F	E	F	F	E (B)	E (C)	F	F	F	E	C (B)	C (B)	D	C
Southbound	C	F	F	F	D (A)	~~F~~ E (B)	D	F	D	F	C (A)	C (B)	C	~~D~~E

Source: Wilbur Smith Associates, April 2007

NOTES:
N.A. – Not Applicable
28 (10) – Density of mixed-flow lanes (Density of HOV lane)