
I-5 HOV LANE EXTENSION PA/ED

TRAFFIC STUDY

EA 0F9600

MAY 2010

I-5 HOV LANE EXTENSION PA/ED
Traffic Study

EA 0F9600

Prepared by:

Austin-Foust Associates, Inc.
2223 Wellington Avenue, Suite 300
Santa Ana, California 92701-3161
(714) 667-0496

May 11, 2010

- 1.0 INTRODUCTION
 - 1.1 Project Description..... 1-1
 - 1.2 Alternative 1 – No Build..... 1-1
 - 1.3 Alternative 2..... 1-3
 - 1.3.1 Auxiliary Lanes..... 1-3
 - 1.3.2 Avenida Pico Interchange Improvements 1-3
 - 1.3.2.1 Design Option A – Modified Tight Diamond Interchange..... 1-3
 - 1.3.2.2 Design Option B – NB Loop On-Ramp/Realigned NB Off-Ramp 1-4
 - 1.3.3 Ramps..... 1-4
 - 1.3.3.1 Avenida Pico 1-4
 - 1.3.3.2 Avenida Vista Hermosa..... 1-4
 - 1.3.3.3 Avenida Camino de Estrella..... 1-4
 - 1.3.3.4 Camino Las Ramblas/Pacific Coast Highway (PCH) 1-5
 - 1.3.3.5 Camino Capistrano (Stonehill Drive)..... 1-5
 - 1.3.4 Structures 1-5
 - 1.3.4.1 Via California 1-5
 - 1.3.4.2 Avenida Pico 1-5
 - 1.3.4.3 Avenida Vaquero UC 1-5
 - 1.3.4.4 NB I-5 to NB PCH Connector..... 1-5
 - 1.3.4.5 Route 5/Camino Las Ramblas UC 1-6
 - 1.3.4.6 Camino Capistrano UC 1-6
 - 1.3.5 Other Improvements..... 1-6
 - 1.4 Alternative 3..... 1-6
 - 1.4.1 Auxiliary Lanes..... 1-6
 - 1.4.2 Avenida Pico Interchange Improvements 1-6
 - 1.4.3 Ramps..... 1-6
 - 1.4.3.1 Camino Capistrano (Stonehill Drive)..... 1-7
 - 1.4.4 Structures 1-7
 - 1.4.5 Other Improvements..... 1-7
 - 1.5 Alternative 5..... 1-7
 - 1.5.1 Auxiliary Lanes..... 1-7
 - 1.5.2 Avenida Pico Interchange Improvements 1-7
 - 1.5.3 Ramps..... 1-7
 - 1.5.4 Structures 1-8
 - 1.5.5 Other Improvements..... 1-8
 - 1.6 Alternatives Comparison..... 1-8
 - 1.7 Performance Measures 1-8
 - 1.7.1 Freeway Segments 1-11
 - 1.7.2 Ramps and Ramp-Freeway Junctions 1-11
 - 1.7.3 Ramp-Arterial Junctions 1-14
- 2.0 TRANSPORTATION SETTING
 - 2.1 Existing Conditions..... 2-1
 - 2.1.1 Freeway Mainline Performance – Existing..... 2-1
 - 2.1.2 Ramp and Ramp-Freeway Junction Performance – Existing..... 2-6
 - 2.1.3 Intersection Performance – Existing 2-10

Contents (continued)

Page

2.2	2040 Traffic Forecasts.....	2-15
2.2.1	Overview	2-15
2.2.2	Demographic Data	2-16
2.2.3	Traffic Forecast Data Derivation – Freeway and HOV Volumes	2-16
2.2.4	Accident Rates	2-23
3.0	2040 NO-BUILD ANALYSIS	
3.1	Freeway Mainline Analysis – 2040 No-Build.....	3-1
3.2	Ramp and Ramp-Freeway Junction Analysis – 2040 No-Build	3-4
3.3	Intersection Analysis – 2040 No-Build.....	3-4
3.3.1	Avenida Pico Interchange	3-11
4.0	2040 BUILD ALTERNATIVES ANALYSIS	
4.1	Freeway Mainline Analysis – 2040 Build.....	4-1
4.2	Ramp and Ramp-Freeway Junction Analysis – 2040 Build.....	4-1
4.3	Intersection Analysis – 2040 Build	4-6
4.4	HOV Analysis – 2040 Build	4-21
4.5	Queuing Analysis – 2040 Build	4-21
4.6	Avenida Pico Interchange – Build Design Options	4-22
4.6.1	Design Option A – Modified Tight Diamond	4-24
4.6.2	Design Option B – Southeast Quadrant Partial Cloverleaf	4-24
4.6.3	2040 Merge/Diverge and Weaving Analysis – Avenida Pico Interchange.....	4-27
4.6.4	Ramp Metering – Avenida Pico Interchange	4-27
4.6.5	Avenida Pico Interchange 2040 High Demand Volumes	4-28
4.6.6	Summer Traffic	4-33
5.0	2018 ANALYSIS – AVENIDA PICO INTERCHANGE	
5.1	Methodology Overview	5-1
5.2	2018 Analysis – No Build Alternative	5-1
5.3	Avenida Pico Interchange – Build Design Options	5-4
5.3.1	Design Option A - Modified Tight Diamond.....	5-4
5.3.2	Design Option B - Southeast Quadrant Partial Cloverleaf.....	5-4
5.4	2018 Merge/Diverge and Weaving Analysis	5-7
5.5	Ramp Metering	5-7

APPENDICES:

- A I-5 Lane Schematics and Pico Design Options
- B Peak Hour Freeway Volumes
- C Intersection Turn Movement Volume Exhibits
- D Mainline LOS Worksheets
- E Weaving LOS Worksheets
- F Intersection LOS Worksheets
- G Intersection Queue Worksheets
- H Ramp Merge/Diverge LOS Worksheets
- I Ramp Meter Queue Worksheets
- J VMT/VHT Tables

- K Weaving LOS Worksheets – Avenida Pico Interchange
- L Intersection HCM LOS Worksheets – Avenida Pico Interchange
- M Intersection ICU Worksheets – Avenida Pico Interchange
- N Intersection Queue Worksheets – Avenida Pico Interchange
- O Ramp Meter Queue Worksheets – Avenida Pico Interchange

Figures

Page

1-1	Study Area	1-2
1-2	Interchange Improvements Design Options.....	1-10
2-1	I-5 Freeway Peak Hour and ADT Volumes – Existing (2009) Conditions	2-2
2-2	Weekday/Weekend Traffic Volume Comparison (I-5 north of Vista Hermosa)	2-3
2-3	Arterial ADT Volumes (000s) – Existing Conditions	2-12
2-4	Regional Statistical Areas (RSAs) Location Map.....	2-18
2-5	I-5 Freeway Peak Hour & ADT Volumes – 2040 No-Build Conditions	2-21
2-6	I-5 Freeway Peak Hour & ADT Volumes – 2040 Build Conditions	2-22
2-7	Arterial ADT Volumes (000s) – 2040 No-Build Conditions.....	2-24
2-8	Arterial ADT Volumes (000s) – 2040 Build Conditions	2-25
3-1	2040 Volumes and Lane Configurations – No Build.....	3-12
4-1	2040 Volume Comparison – Baseline Versus SOCMIS I-5 Alternative	4-30
5-1	2018 Volumes and Lane Configurations – No Build.....	5-2

Tables

Page

1-1	Freeway Lanes Summary by Alternative.....	1-9
1-2	Freeway Mainline Performance Criteria.....	1-12
1-3	Ramp Performance Criteria	1-13
1-4	Merge, Diverge and Weaving Performance Criteria	1-15
1-5	Arterial Intersection Performance Criteria.....	1-16
2-1	Freeway Mainline LOS Summary – Existing (2009) Conditions	2-4
2-2	Ramp Volume and Capacity Summary – Existing (2009) Conditions	2-7
2-3	Ramp Merge/Diverge Analysis Summary – Existing (2009) Conditions.....	2-9
2-4	Weaving Analysis Summary – Existing (2009) Conditions	2-11
2-5	Intersection LOS Summary (Interchanges) – Existing Conditions.....	2-13
2-6	Intersection LOS Summary (City Locations) – Existing Conditions.....	2-14
2-7	Demographic Projections.....	2-17
2-8	OCTAM 3.3 ADT Volume Comparison.....	2-19
2-9	ADT Volumes – Existing (2009) and Future (2040) Conditions.....	2-20
2-10	Accident Rate Summary – January 2006 through December 2008	2-26
3-1	Freeway Mainline LOS Summary - 2040 Conditions, Alternative 1 (No-Build).....	3-2
3-2	Ramp Volume and Capacity Summary - 2040 Conditions, Alternative 1 (No-Build)	3-5
3-3	Ramp Merge/Diverge Analysis Summary - 2040 Conditions, Alternative 1 (No-Build).....	3-7
3-4	Weaving Section LOS Summary - 2040 Conditions, Alternative 1 (No-Build).....	3-8
3-5	Intersection LOS Summary (Interchanges) - 2040 Conditions, Alternative 1 (No-Build)	3-9
3-6	Intersection LOS Summary (City Locations) - 2040 Conditions, Alternative 1 (No-Build).....	3-10
3-7	2040 Peak Hour Performance – Avenida Pico Interchange No-Build.....	3-13
4-1	Freeway Mainline LOS Summary - 2040 Conditions, Project Alternatives 2, 3 & 4 (Build)	4-2
4-2	Freeway Mainline LOS Comparison – Project Area	4-4
4-3	Ramp Lanes Comparison – Project Area.....	4-5
4-4	Ramp Volume and Capacity Summary - 2040 Conditions, Project Alternatives 2, 3 & 4 (Build).....	4-7
4-5	Ramp Merge/Diverge Analysis Summary - 2040 Conditions, Project Alternatives 2, 3 & 4 (Build).....	4-9
4-6	Interchange Merge/Diverge LOS Comparison – Project Area	4-10
4-7	Weaving Section LOS Summary – 2040 Conditions, Project Alternatives 2, 3 & 4 (Build)	4-11
4-8	Intersection Lane Geometry – Existing (2009) & 2040 Conditions	4-12
4-9	Intersection LOS Summary (Interchanges) – 2040 Conditions, Project Alternatives 2, 3 & 4 (Build)	4-19
4-10	Intersection LOS Summary (City Locations) – 2040 Conditions, Project Alternatives 2, 3 & 4 (Build)	4-20
4-11	Off-Ramp Queuing Analysis - 2040 Conditions, Project Alternatives 2, 3 & 4 (Build)	4-22
4-12	On-Ramp Metering Queue Analysis - 2040 Conditions, Project Alternatives 2, 3 & 4 (Build)	4-23
4-13	2040 Peak Hour Performance – Design Option A	4-25
4-14	2040 Peak Hour Performance – Design Option B	4-26

Tables (continued)

Page

4-15	2040 Ramp Metering Summary – Avenida Pico Interchange	4-29
4-16	2040 Peak Hour Performance – Design Option A with High Demand Volumes	4-31
4-17	2040 Peak Hour Performance – Design Option B with High Demand Volumes	4-32
4-18	Summer Volume Comparison – Avenida Pico	4-34
5-1	2018 Peak Hour Performance – No-Build	5-3
5-2	2018 Peak Hour Performance –Design Option A	5-5
5-3	2018 Peak Hour Performance – Design Option B	5-6
5-4	Year 2018 Freeway Weaving Analysis – Avenida Pico Interchange	5-8
5-5	2018 Ramp Metering Summary	5-9

Chapter 1.0

INTRODUCTION

This traffic report has been prepared as a technical study for the Project Approval/Environmental Document (PA/ED) for the section of Interstate 5 (I-5) from the San Juan Creek Road interchange to the Avenida Pico interchange. It provides the traffic operational analysis information for the PA/ED.

1.1 PROJECT DESCRIPTION

The Orange County Transportation Authority (OCTA), in cooperation with the California Department of Transportation (Caltrans), the City of Dana Point, the City of San Clemente, and the City of San Juan Capistrano, is proposing to widen I-5 between Avenida Pico and San Juan Creek Road. The project objectives are to provide continuity of the I-5 mainline high-occupancy vehicle (HOV) network within the project limits; maximize overall performance within the project limits by minimizing weaving conflicts at the termini of the HOV lanes and maintaining travel speeds for HOV lane users; provide intermittent auxiliary lanes, where needed, to relieve congestion at diverge and merge locations; minimize right-of-way acquisition; relieve congestion within interchange areas, on- and off-ramps, and local intersections; and reduce congestion on I-5 within the project limits. The project limits on I-5 extend from 0.4 mile (mi) south of the Avenida Pico Undercrossing (UC) (Post Mile [PM] 3.0) to 0.1 mi south of the San Juan Creek Road UC (PM 8.7). The proposed project will add one HOV lane in each direction on I-5 throughout the project limits, reestablish existing auxiliary lanes and construct new auxiliary lanes, and improve several existing on- and off-ramps.

Four alternatives, including the No Build Alternative, will be analyzed as part of the Draft Initial Study/Environmental Assessment (IS/EA). The project alternatives are described below.

1.2 ALTERNATIVE 1 – NO BUILD

The No Build Alternative proposes no improvements to I-5, maintaining the existing four general-purpose lanes throughout the project limits in the northbound (NB) and southbound (SB) directions. All freeway facilities would remain as is, with the exception of proposed projects that are under development or currently in construction.

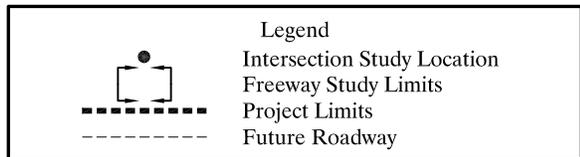
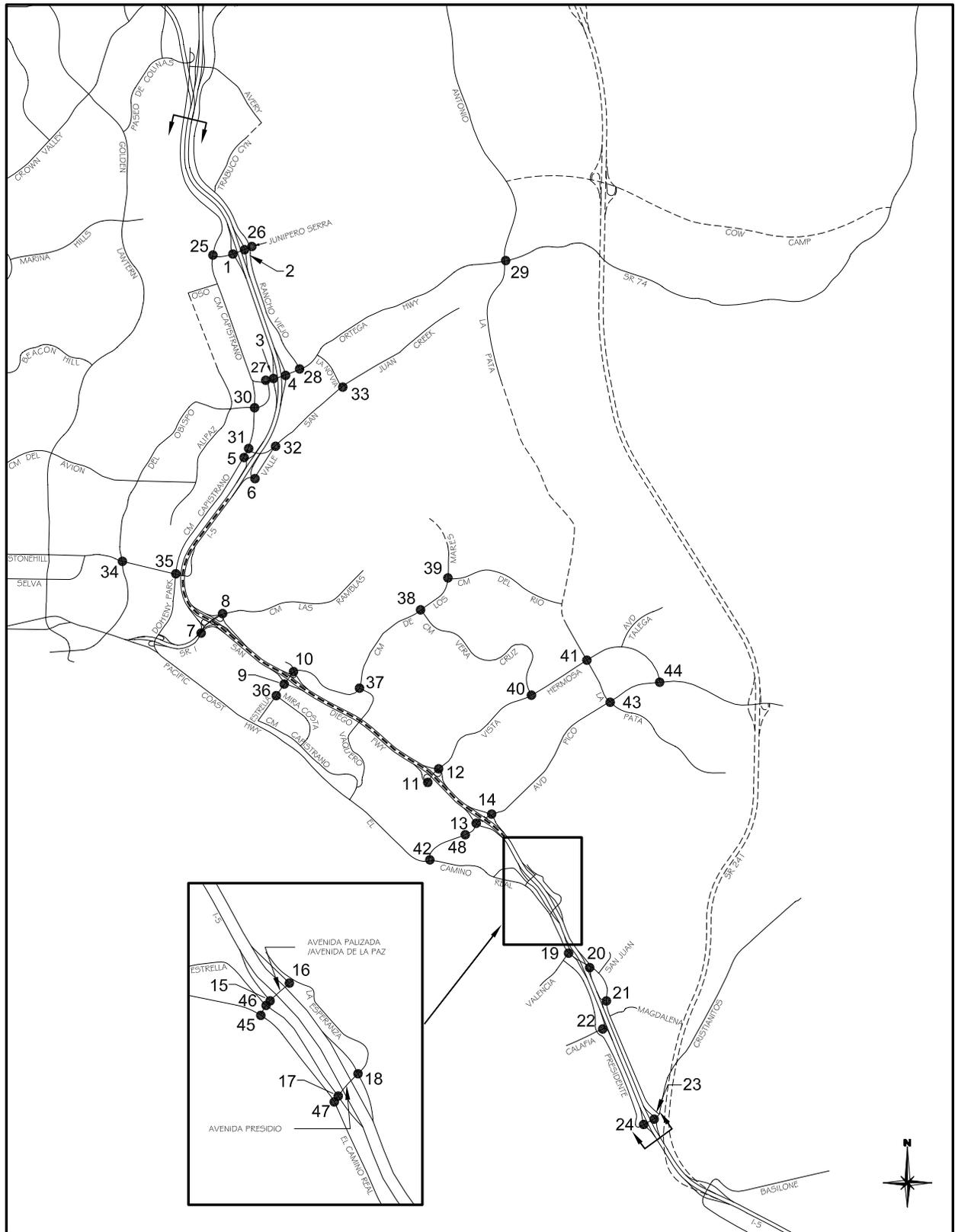


Figure 1-1
STUDY AREA

1.3 ALTERNATIVE 2

1.3.1 Auxiliary Lanes

Alternative 2 proposes to remove the existing I-5 paved shoulders and construct new traveled way and new shoulder pavement to the outside of the NB and SB lanes to accommodate HOV lanes. This alternative proposes full standard widths, including a 10-foot (ft) inside shoulder, 12 ft HOV lane, 4 ft buffer, four 12 ft general-purpose lanes, and a 10 ft outside shoulder throughout the majority of the project limits. Additionally, existing auxiliary lanes through the project limits are proposed to be reestablished, and new auxiliary lanes will be constructed at the following locations:

- To Avenida Vista Hermosa SB off-ramp
- From Avenida Vista Hermosa NB on-ramp
- From Camino de Estrella SB on-ramp

1.3.2 Avenida Pico Interchange Improvements

In addition to providing an HOV lane through the I-5/Avenida Pico interchange, the interchange configuration will also be improved. There are two options under consideration for reconfiguration of the interchange, both of which require replacement of the Avenida Pico Overcrossing structure.

1.3.2.1 Design Option A – Modified Tight Diamond Interchange

Under this option, the on- and off-ramps at Avenida Pico will be realigned and the NB on-ramp will be widened to three lanes. The overall configuration of the interchange will be similar to the existing configuration. Additionally, Avenida Pico will be improved under the structure to provide dual left-turn lanes to both the NB and SB on-ramps. This alternative will incorporate an interconnect line to optimize signal timing and operations for the closely spaced intersections at the interchange. The geometry of Avenida Pico will also be improved on the east side of I-5 to remove the existing reversing curves. Bicycle lanes and standard outside shoulders will be provided throughout the majority of the interchange in both the EB and WB directions. Sidewalk will be provided through the interchange in the EB direction. In the WB direction, space will be provided to accommodate future construction of a sidewalk through the interchange.

1.3.2.2 Design Option B – NB Loop On-Ramp/Realigned NB Off-Ramp

Under this option, a NB loop on-ramp will be added to allow for the removal of the existing left-turn lane for traffic heading eastbound on Avenida Pico to access NB I-5. (The existing directional on-ramp would remain in place for traffic heading WB to access NB I-5). Additionally, the NB off-ramp would be reconfigured around the loop, resulting in a partial cloverleaf configuration. The SB ramps will be realigned, and the geometry of Avenida Pico will be improved as proposed in Design Option A. Dual left-turn lanes will be provided under the structure to the SB on-ramp. Bicycle lanes and standard outside shoulders will be provided throughout the majority of the interchange in both the EB and WB directions. Sidewalk will be provided through the interchange in the EB direction. In the WB direction, space will be provided to accommodate future construction of a sidewalk through the interchange.

1.3.3 Ramps

All ramps within the project limits will be modified in order to accommodate the HOV lanes, which include improvements ranging from restriping to complete reconstruction. Specifically, ramp modifications under this alternative include:

1.3.3.1 Avenida Pico

- Modify ramps as described in Design Options A and B above

1.3.3.2 Avenida Vista Hermosa

- Restripe NB and SB loop on-ramps
- Restripe and reconstruct NB on- and off-ramps and SB off-ramp

1.3.3.3 Camino de Estrella

- Realign, reconstruct, and widen SB off-ramp to a two-lane ramp
- Realign and reconstruct NB and SB on-ramps and NB loop on-ramp
- Realign NB off-ramp

1.3.3.4 Camino Las Ramblas/Pacific Coast Highway (PCH)

- Realign, reconstruct and widen SB PCH to SB I-5 connector to a two-lane connector
- Realign and reconstruct SB loop on-ramp
- Realign SB off-ramp and NB on- and off-ramps
- Realign NB I-5 connector

1.3.3.5 Camino Capistrano (Stonehill Drive)

- Realign and reconstruct NB on-ramp with lower profile under the bridge to provide standard vertical clearance

1.3.4 Structures

1.3.4.1 Via California

Reduced shoulder widths are proposed under the Via California structure in order to avoid replacement of the existing Via California Overcrossing (Bridge No. 55-225). The inside shoulder is reduced to approximately 4 ft at the minimum location and the HOV buffer is eliminated in the NB direction.

1.3.4.2 Avenida Pico

This alternative also proposes to replace the Avenida Pico UC structure (Bridge No. 55-205) to accommodate the HOV lane in each direction through the interchange. In order to achieve minimum vertical clearance for this structure, the I-5 mainline profile will be raised through the interchange area. Additionally, to ensure that all existing mainline lanes are open through construction, the I-5 centerline will be realigned westerly approximately 20 ft through the interchange.

1.3.4.3 Avenida Vaquero UC (Bridge No. 55-223)

- Structure widening

1.3.4.4 NB I-5 to NB PCH Connector (Bridge No. 55-226)

- Structure widening

1.3.4.5 Route 5/Camino Las Ramblas UC (Bridge No. 55-510)

- Structure Widening

1.3.4.6 Camino Capistrano UC (Stonehill Drive) (Bridge No. 55-227L and 55-227R)

- Structure Widening

1.3.5 Other Improvements

Alternative 2 proposes to improve the existing compound curve between 0.3 mi south of Stonehill Drive and PCH. This alternative would provide a wide inside shoulder (26 ft at the maximum width) throughout the southern portion of the curve along with increasing the radius from 2,000 ft to 2,200 ft to accommodate full standard stopping sight distance in the SB direction. For the northern portion of the curve, the existing radius is increased from 3,200 ft to 3,300 ft, with a 16 ft shoulder, in order to achieve standard stopping sight distance through this portion of the compound curve. To accommodate the improvements to this compound curve, the median will be reconstructed.

1.4 ALTERNATIVE 3

Alternative 3 is very similar in nature to Alternative 2. The differences are noted.

1.4.1 Auxiliary Lanes

New auxiliary lanes will be constructed at the same locations as noted in Alternative 2.

1.4.2 Avenida Pico Interchange Improvements

Design options for the Avenida Pico interchange reconfiguration will be the same as those noted under Alternative 2.

1.4.3 Ramps

Ramp modifications will be the same as those noted under Alternative 2 with the exception of the following:

1.4.3.1 Camino Capistrano (Stonehill Drive)

- Realign and reconstruct NB on-ramp with no profile adjustment under I-5

1.4.4 Structures

Modifications and improvements to structures are the same as those noted under Alternative 2 with the exception that I-5 NB Camino Capistrano UC (Stonehill Drive) (Bridge No. 55-227R) will not be widened.

1.4.5 Other Improvements

Unlike Alternative 2, in Alternative 3, for the northern portion of the compound curve, the existing radius would not be changed and a 2 ft median shoulder would be provided, resulting in a nonstandard stopping sight distance. To accommodate the improvements to this compound curve, the median will be reconstructed.

1.5 ALTERNATIVE 4

Alternative 4 includes many of the improvements common to Alternatives 2 and 3 with a few modifications. Alternative 4 proposes no buffer instead of the 4 ft buffer proposed in Alternatives 2 and 3. Under the no buffer scenario, the HOV lane will either accommodate limited access, with ingress/egress points for the interchanges, or continuous access throughout the project limits.

1.5.1 Auxiliary Lanes

New auxiliary lanes will be constructed at the same locations as noted in Alternatives 2 and 3.

1.5.2 Avenida Pico Interchange Improvements

Design options for the Avenida Pico interchange reconfiguration will be the same as those noted under Alternative 2.

1.5.3 Ramps

Ramp modifications will be the same as those noted under Alternative 3.

1.5.4 Structures

Modifications and improvements to structures are the same as those noted under Alternatives 2 and 3.

1.5.5 Other Improvements

Unlike Alternatives 2 and 3, for the northern portion of the compound curve, the existing radius would not be changed and a standard 10 ft median shoulder would be provided, which would minimize impacts but results in a nonstandard stopping sight distance condition. To accommodate the improvements to this compound curve, the median will be reconstructed.

1.6 ALTERNATIVES COMPARISON

A summary of existing and future freeway lane configurations by segment for each alternative are shown in Table 1-1. Existing freeway mainline configurations provide the basis for the 2040 no-build analysis, and the various project segments increase in capacity under the proposed build alternatives.

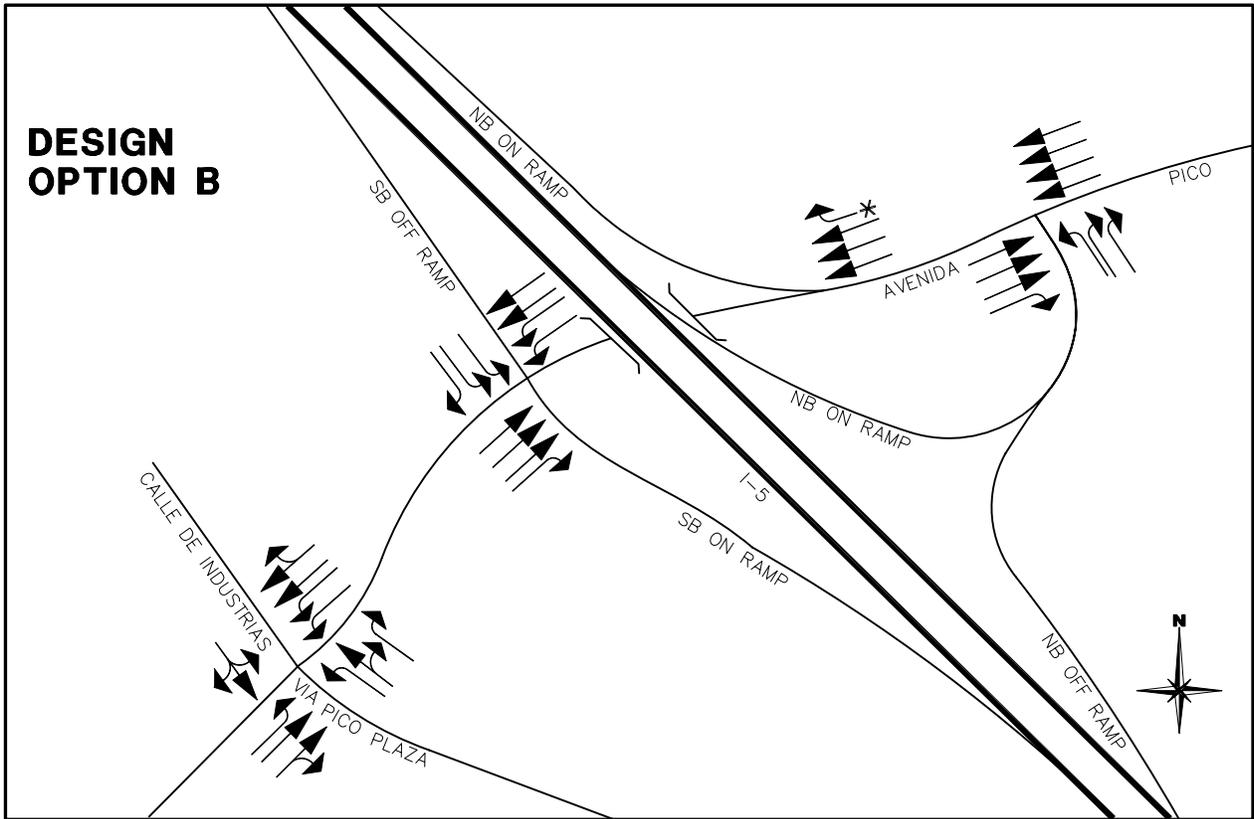
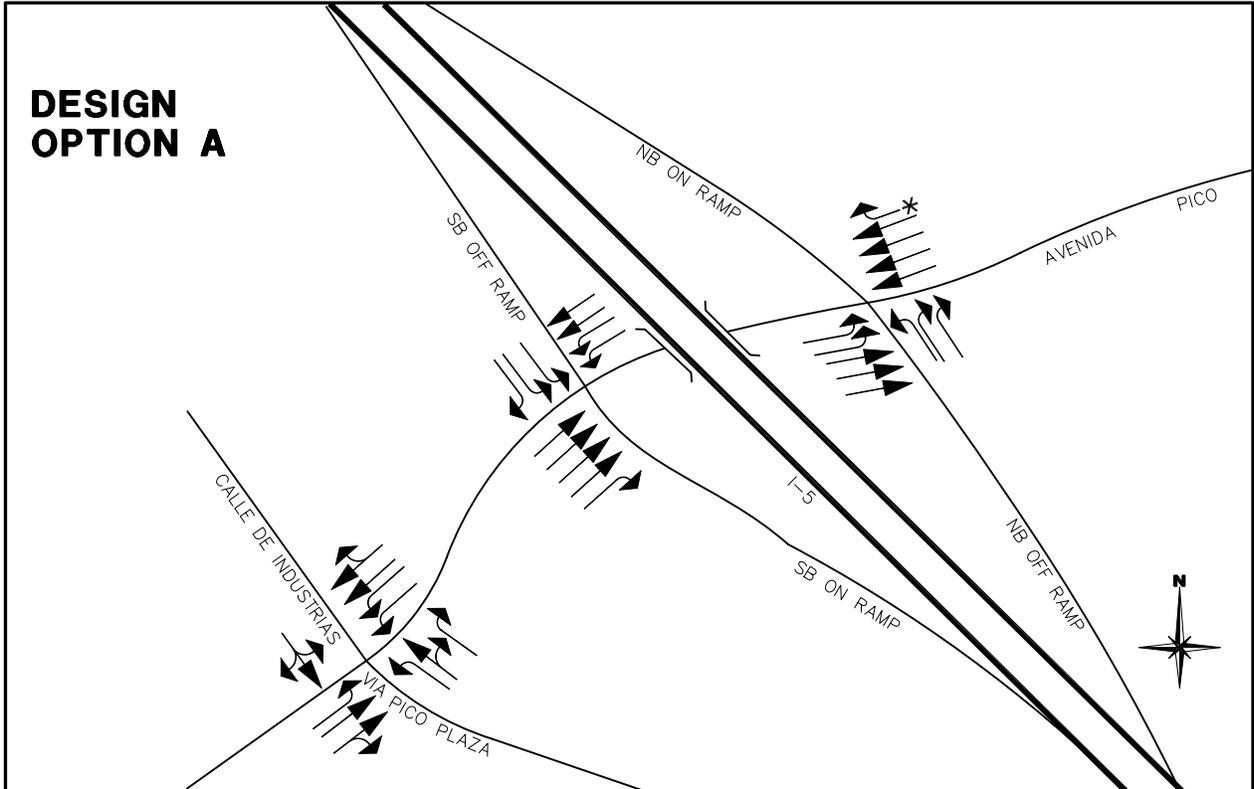
As noted above, two interchange improvement design options for the Avenida Pico interchange are evaluated here. These are illustrated conceptually in Figure 1-2. Layouts for each option are contained in Appendix A.

1.7 PERFORMANCE MEASURES

The operational analysis addresses the freeway mainline (both HOV and general purpose lanes), ramp termini (merging, diverging and weaving) and intersections on the local street system (ramp intersections and those immediately adjacent). Operational performance is based on measures such as speed, density and delay, with level of service (LOS) being the primary basis for comparing the Build Alternatives to the No-Build Alternative. Intersection capacity utilization (ICU) values are also used to evaluate intersections in accordance with the procedures of the local cities. The operations analysis for the Avenida Pico design options focuses on lane requirements and special features such as providing adequate queuing storage for left turns onto the freeway on-ramps. For Design Option A, traffic signal operation is also addressed with specific recommendations with respect to clustering (i.e., two intersections under one controller) and timing/phasing plans.

Table 1-1: Freeway Lanes Summary by Alternative

I-5 Location	Existing			2040 Alt 1 (No Build)			2040 Build		
	HOV	GP	AUX	HOV	GP	AUX	HOV	GP	AUX
NORTHBOUND									
NB Mainline s/o Cristianitos	0	4	0	0	4	0	0	4	0
NB Mainline s/o Avd Magdalena	0	4	0	0	4	0	0	4	0
NB Mainline s/o El Camino Real	0	4	1	0	4	1	0	4	1
NB Mainline s/o Avd Presidio	0	4	1	0	4	1	0	4	1
NB Mainline s/o Avd de la Paz	0	4	0	0	4	0	0	4	0
Begin Project									
NB Mainline s/o Avd Pico	0	4	1	0	4	1	0	4	1
NB Mainline s/o Vista Hermosa	0	4	1	0	4	1	1	4	1
NB Mainline s/o Cm De Los Mares	0	4	0	0	4	0	1	4	0
NB Mainline s/o SR-1 (PCH)/ Camino Las Ramblas	0	4	2	0	4	2	1	4	1
NB Mainline s/o Camino Capistrano/ Stonehill	1	4	0	1	4	0	1	4	0
NB Mainline s/o San Juan Creek	1	4	1 ¹	1	4	1 ¹	1	4	1 ¹
End Project									
NB Mainline s/o Ortega Hwy	1	4	0	1	4	0	1	4	0
NB Mainline s/o Junipero Serra	1	5	0	1	5	0	1	5	0
NB Mainline s/o SR-73 Junction	1	4	2	1	4	2	1	4	2
SOUTHBOUND									
SB Mainline s/o Cristianitos	0	4	0	0	4	0	0	4	0
SB Mainline s/o Avd Calafia	0	4	0	0	4	0	0	4	0
SB Mainline s/o El Camino Real	0	4	1	0	4	1	0	4	1
SB Mainline s/o Avd Presidio	0	4	1	0	4	1	0	4	1
SB Mainline s/o Avd Palizada	0	5	0	0	5	0	0	5	0
Begin Project									
SB Mainline s/o Avd Pico	0	5	1	0	5	1	0	5	1
SB Mainline s/o Vista Hermosa	0	4	1	0	4	1	1	4	1
SB Mainline s/o Cm De Estrella	0	4	0	0	4	0	1	4	0
SB Mainline s/o SR-1 (PCH)/ Camino Las Ramblas	0	4	1	0	4	1	1	4	1
SB Mainline s/o Camino Capistrano/ Stonehill	0	5	1	0	5	1	1	4	1
SB Mainline s/o San Juan Creek	0	5	0	0	5	0	1	4	0
End Project									
SB Mainline s/o Ortega Hwy	1	4	0	1	4	0	1	4	0
SB Mainline s/o Junipero Serra	1	4	1	1	4	1	1	4	1
SB Mainline s/o SR-73 Junction	1	5	1	1	5	1	1	5	1
<p>HOV – High Occupancy Vehicle lanes GP – General Purpose lanes Aux – Auxiliary lanes</p> <p>Shading denotes added or changed lane configuration.</p> <p>¹Auxiliary lane that is not continuous between successive off/on ramps and does not add mainline capacity.</p>									



Legend

Free right turn

Figure 1-2
**INTERCHANGE IMPROVEMENT
 DESIGN OPTIONS**

The following sections discuss the performance measures used in this traffic analysis.

1.7.1 Freeway Segments

The LOS for segments of freeway is estimated using the Highway Capacity Manual (HCM) methodology for basic freeway segments as listed in Table 1-2. A basic freeway segment can be characterized by three performance measures: density in terms of passenger cars per mile per lane, speed in terms of average passenger-car speed, and volume-to-capacity (v/c) ratio. Each of these measures is an indication of how well traffic flow is being accommodated by the freeway segment.

For mainline general purpose freeway segments, the measure used to provide an estimate of LOS is density and the LOS density ranges are listed in the above referenced Table 1-2. As stated in the HCM, the upper value shown for LOS “E” (45 pc/mi/ln) is the maximum density at which sustained flows at capacity are expected to occur. Flow breakdown and congestion as represented by LOS “F” occurs when queues begin to form on the freeway. Density tends to increase sharply within the queue and may be considerably higher than the maximum value of 45 pc/mi/ln for LOS E.

When demand conditions exceed capacity, forced flow results and the formulas used for estimating density and average speed are no longer applicable. As such, estimates for density and average speed are not provided for LOS “F” conditions due to this limitation of the methodology.

The HCM density calculations are not applicable to HOV lanes, so volume to capacity (V/C) ratios are instead used to estimate LOS for the HOV lanes. While an HOV lane has the ability to carry the same volume of traffic as does a general purpose lane, Caltrans’ goal is to have a maximum of 1,600 vehicles per hour (vph) in the HOV lanes in order to maintain free flowing conditions. For the purpose of this study, the capacity of an HOV lane is 2,200 vehicles per hour per lane (vph/ln) but deficiencies for HOV lanes are defined as a volume greater than 1,600 vph/lane (i.e., a V/C ratio greater than 0.73).

1.7.2 Ramps and Ramp-Freeway Junctions

While the PA/ED addresses only ramp junctions in the operational analysis, this technical report also evaluates actual ramp capacity. The performance criteria used for evaluating freeway ramps are shown in Table 1-3. They are based on the maximum volume that can be accommodated by the various types of ramp configurations that are utilized within the project area. The measure reported from the analysis is the volume/capacity (V/C) ratio for the ramp.

Table 1-2: Freeway Mainline Performance Criteria

LOS Calculation Methodology			
Level of service to be based on peak hour volume density for General Purpose lanes and volume/capacity (V/C) ratios for High Occupancy Vehicle (HOV) lanes.			
LOS Ranges			
<u>LOS</u>	<u>General Purpose Lanes (Density¹)</u>	<u>HOV Lanes</u>	
		<u>V/C</u>	<u>Max. Volume</u>
A	0.0 – 11.0	0.00 – 0.32	700
B	11.1 – 18.0	0.33 – 0.53	1,170
C	18.1 – 26.0	0.54 – 0.73	1,600 ²
D	26.1 – 35.0	0.74 – 0.90	1,980
E	35.1 – 45.0	0.91 – 1.00	2,200
F	> 45.0	≥ 1.00	n/a

¹Passenger cars per mile per lane (pc/mi/ln)
²1,650 vph represents the maximum desired HOV volume for 1 lane and represents LOS C conditions (source: Caltrans HOV Guidelines, 2003 Edition). Planning studies in District 12 have historically utilized 1,600 vph as the maximum desired HOV volume for 1 lane and 1,750 vph for 2 lanes. Segments exceeding these maximum desired volumes will be identified.

Table 1-3: Ramp Performance Criteria

Methodology

Analysis based on peak hour volume/capacity (V/C) ratios using the following maximum capacities:

Freeway to Arterial Road Interchanges:

Metered On-Ramps:

900 vehicles per hour (vph) for a one-lane metered on-ramp with only one mixed-flow lane at the meter.

1,080 (20 percent greater than 900) vph for a one-lane metered on-ramp with one mixed-flow lane at the meter plus one HOV preferential lane at the meter.

1,500 vph for a one-lane metered on-ramp with two mixed-flow lanes at the meter.

1,800 vph for a one-lane metered on-ramp (with mainline auxiliary lane) with two mixed-flow lanes at the meter plus one HOV preferential lane at the meter, or a two-lane metered on-ramp (with mainline auxiliary lane for 2nd lane) with two mixed-flow lanes at the meter.

Non-Metered On-Ramps and Off-Ramps:

1,500 vph for a one-lane ramp.

2,250 (50 percent greater than 1,500) vph for a two-lane on-ramp that tapers to one merge lane at or beyond the freeway mainline junction point (labeled as 1.5 lanes in the volume and capacity summary tables).

2,250 (50 percent greater than 1,500) for a two-lane off-ramp with only one auxiliary lane (labeled as 1.5 lanes in the volume and capacity summary tables).

3,000 vph for a two-lane on-ramp that has two receiving lanes.

3,000 vph for a two-lane off-ramp with two auxiliary lanes.

Freeway to Freeway Interchanges:

2,000 vph for a one-lane ramp.

4,000 vph for a two-lane ramp.

For ramp-freeway junctions (i.e., on and off the freeway), merge, diverge, and weaving analyses are carried out to give operational performance measures. Table 1-4 summarizes the methodology which is based on vehicle density, and the corresponding LOS ranges. In accordance with the HCM procedures, a weaving analysis is only carried out when the distance between an on-ramp and the next off-ramp is less than 2,500 feet.

1.7.3 Ramp-Arterial Junctions

For the operational analysis of the arterial roadway intersections serving the freeway interchange ramps, the HCM average vehicle delay procedures are utilized to derive LOS. For the study area intersections not serving freeway ramps, the intersection capacity utilization (ICU) methodology is used. The performance criteria for both the delay and ICU procedures are summarized in Table 1-5. In this case, an actual performance threshold is defined (LOS “D”).

Table 1-4: Merge, Diverge and Weaving Performance Criteria

<p>Operations Methodology</p> <p>Based on the Highway Capacity Manual (HCM) methodology which calculates density in passenger cars/mile/lane (pc/mi/ln) for the section of freeway in the merge, diverge and weaving section.</p>														
<p>Level of Service Ranges</p> <p>The level of service (LOS) for range of density are as follows:</p> <table><thead><tr><th><u>LOS</u></th><th><u>Density (pc/mi/ln)</u></th></tr></thead><tbody><tr><td>A</td><td>≤ 10</td></tr><tr><td>B</td><td>$> 10 - 20$</td></tr><tr><td>C</td><td>$> 20 - 28$</td></tr><tr><td>D</td><td>$> 28 - 35$</td></tr><tr><td>E</td><td>$> 35 - 43$</td></tr><tr><td>F</td><td>> 43</td></tr></tbody></table>	<u>LOS</u>	<u>Density (pc/mi/ln)</u>	A	≤ 10	B	$> 10 - 20$	C	$> 20 - 28$	D	$> 28 - 35$	E	$> 35 - 43$	F	> 43
<u>LOS</u>	<u>Density (pc/mi/ln)</u>													
A	≤ 10													
B	$> 10 - 20$													
C	$> 20 - 28$													
D	$> 28 - 35$													
E	$> 35 - 43$													
F	> 43													

Table 1-5: Arterial Intersection Performance Criteria

<p>LOS Calculation Methodology</p> <p>Caltrans Intersections: Level of service to be based on average vehicle delay (seconds/vehicle) as calculated by the Highway Capacity Manual (HCM) procedures for signalized intersections.</p> <p>Cites of San Juan Capistrano and Dana Point Intersections: Level of service to be based on Intersection Capacity Utilization (ICU) values as calculated by the following parameters:</p> <table border="0"> <tr> <td>Lane Capacity:</td> <td>1,700</td> <td>vph</td> </tr> <tr> <td>Clearance Interval:</td> <td>0.05</td> <td></td> </tr> <tr> <td>Right-turn-on-red Utilization Factor</td> <td>0.75</td> <td></td> </tr> </table> <p>City of San Clemente Intersections: Level of service to be based on Intersection Capacity Utilization (ICU) values as calculated by the following parameters:</p> <table border="0"> <tr> <td>Lane Capacity:</td> <td>1,600</td> <td>vph</td> </tr> <tr> <td>Clearance Interval:</td> <td>0.00</td> <td></td> </tr> <tr> <td>Right-turn-on-red Utilization Factor</td> <td>0.75</td> <td></td> </tr> </table> <p>Unincorporated County Intersections: Level of service to be based on Intersection Capacity Utilization (ICU) values as calculated by the following parameters:</p> <table border="0"> <tr> <td>Lane Capacity:</td> <td>1,700</td> <td>vph</td> </tr> <tr> <td>Clearance Interval:</td> <td>0.05</td> <td></td> </tr> <tr> <td>Right-turn-on-red Utilization Factor</td> <td>0.00</td> <td></td> </tr> </table>			Lane Capacity:	1,700	vph	Clearance Interval:	0.05		Right-turn-on-red Utilization Factor	0.75		Lane Capacity:	1,600	vph	Clearance Interval:	0.00		Right-turn-on-red Utilization Factor	0.75		Lane Capacity:	1,700	vph	Clearance Interval:	0.05		Right-turn-on-red Utilization Factor	0.00	
Lane Capacity:	1,700	vph																											
Clearance Interval:	0.05																												
Right-turn-on-red Utilization Factor	0.75																												
Lane Capacity:	1,600	vph																											
Clearance Interval:	0.00																												
Right-turn-on-red Utilization Factor	0.75																												
Lane Capacity:	1,700	vph																											
Clearance Interval:	0.05																												
Right-turn-on-red Utilization Factor	0.00																												
<p>LOS Ranges – Signalized Intersections</p> <table border="0"> <thead> <tr> <th><u>LOS</u></th> <th><u>Average Delay¹</u></th> <th><u>ICU²</u></th> </tr> </thead> <tbody> <tr> <td>A</td> <td>0.0 – 10.0</td> <td>0.00 – 0.60</td> </tr> <tr> <td>B</td> <td>10.1 – 20.0</td> <td>0.61 – 0.70</td> </tr> <tr> <td>C</td> <td>20.1 – 35.0</td> <td>0.71 – 0.80</td> </tr> <tr> <td>D</td> <td>35.1 – 55.0</td> <td>0.81 – 0.90</td> </tr> <tr> <td>E</td> <td>55.1 – 80.0</td> <td>0.91 – 1.00</td> </tr> <tr> <td>F</td> <td>> 80.0</td> <td>> 1.00</td> </tr> </tbody> </table> <p>¹seconds of delay per vehicle (average) ²Intersection Capacity Utilization</p>			<u>LOS</u>	<u>Average Delay¹</u>	<u>ICU²</u>	A	0.0 – 10.0	0.00 – 0.60	B	10.1 – 20.0	0.61 – 0.70	C	20.1 – 35.0	0.71 – 0.80	D	35.1 – 55.0	0.81 – 0.90	E	55.1 – 80.0	0.91 – 1.00	F	> 80.0	> 1.00						
<u>LOS</u>	<u>Average Delay¹</u>	<u>ICU²</u>																											
A	0.0 – 10.0	0.00 – 0.60																											
B	10.1 – 20.0	0.61 – 0.70																											
C	20.1 – 35.0	0.71 – 0.80																											
D	35.1 – 55.0	0.81 – 0.90																											
E	55.1 – 80.0	0.91 – 1.00																											
F	> 80.0	> 1.00																											
<p>Performance Standard</p> <p>LOS “D”</p>																													

Chapter 2.0

TRANSPORTATION SETTING

This chapter discusses the transportation setting for the proposed project. Existing conditions are first presented followed by the assumptions and methodology used in preparing traffic forecasts.

2.1 EXISTING CONDITIONS

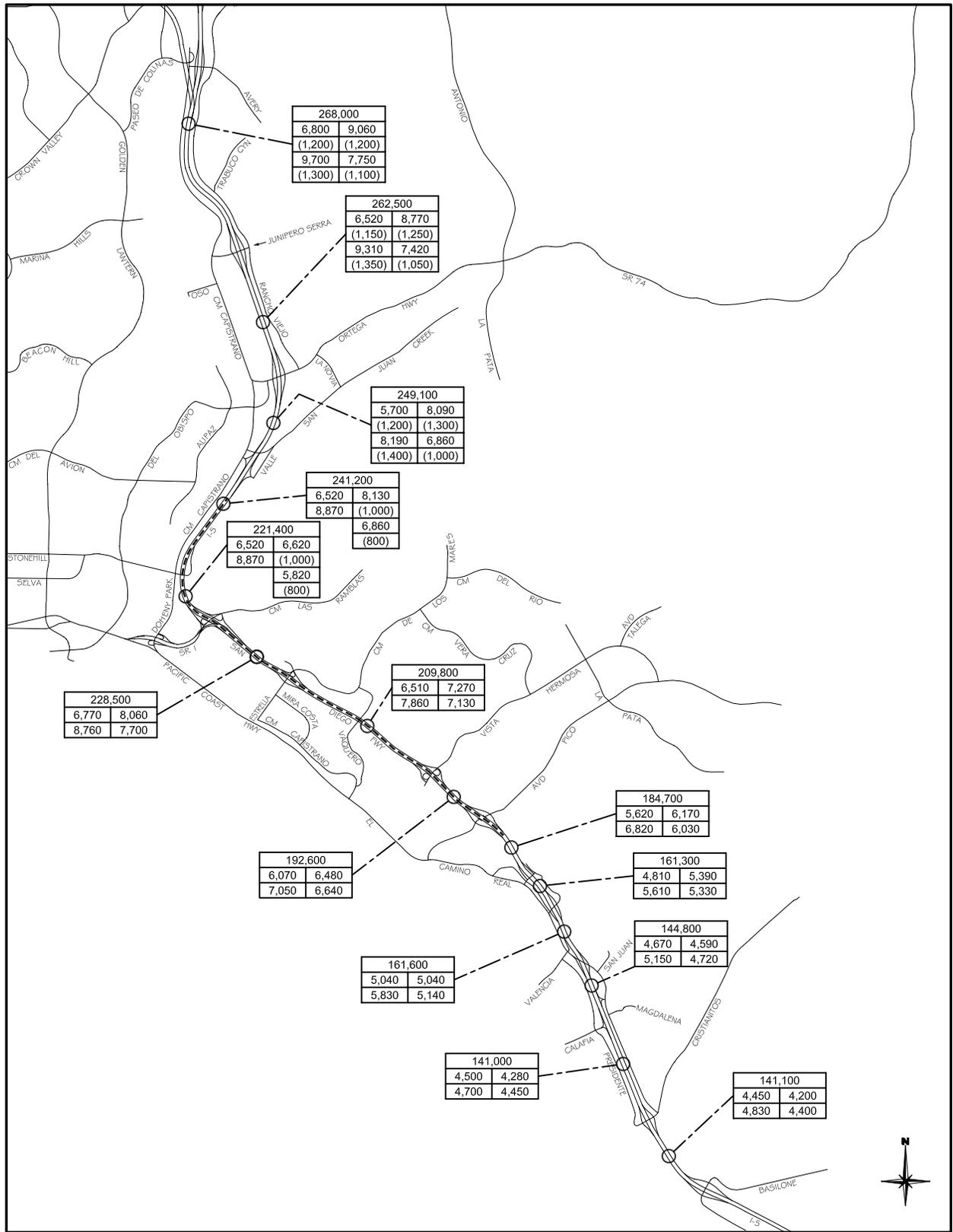
This section discusses existing conditions in the study area. Existing traffic data was assembled for the highway system components (freeway mainline segments, ramps, and intersections), and the performance procedures described in the previous section applied. The following are the results for each system component.

2.1.1 Freeway Mainline Performance – Existing

The project section of I-5 generally consists of four general purpose lanes in each direction. North of SR-1 (PCH), there is also one HOV lane in each direction. Northbound, the HOV lane starts at this interchange, and in the southbound direction, the HOV lane ends at the San Juan Creek Road interchange. North of Ortega Highway, there are five general purpose lanes in the northbound direction, and south of Avenida Pico there are five general purpose lanes in the southbound direction. The fifth southbound lane ends at the Avenida Presidio interchange.

Traffic data for existing freeway conditions was compiled from published Caltrans data, traffic volume information from the California Freeway Performance Measurement System (PeMS), and traffic counts collected on the local roadways and the SR-1 (PCH)/I-5 junction. The data as presented here represents average weekday volumes for 2009. PeMS data collected over a one week period in mid-April 2009 formed the basis for the freeway mainline volumes. On an ADT basis, trucks are around four percent of the traffic on this section of I-5 according to the 2007 Caltrans Truck Traffic Report.

Figure 2-1 shows the existing (2009) mainline freeway volumes, and a freeway flow continuity table is provided in Appendix B.



Legend	
ADT Volume	
AM SB GP Volume	AM NB GP Volume
(AM SB HOV Volume)	(AM NB HOV Volume)
PM SB GP Volume	PM NB GP Volume
(PM SB HOV Volume)	(PM NB HOV Volume)

----- Project Limits

Figure 2-1
I-5 FREEWAY PEAK HOUR & ADT VOLUMES
 - EXISTING (2009) CONDITIONS

A summary of the operational analysis for existing freeway mainline conditions is provided in Table 2-1 for each segment (actual worksheets are provided in Appendix D). Highlighted in this table are segments with performance LOS “E” or “F,” these being as follows:

- Northbound between Camino Capistrano/Stonehill Drive and San Juan Creek Road (AM)
- Northbound between San Juan Creek Road and Ortega Highway (AM)
- Southbound between Camino De Estrella and Vista Hermosa (PM)
- Southbound between Ortega Highway and San Juan Creek Road (PM)

Two of these segments, Camino Capistrano/Stonehill Drive to San Juan Creek Road (NB) and Camino De Estrella to Vista Hermosa (SB), are within the project limits. For both of these, the LOS “E” or “F” conditions reflect the high northbound volumes in the AM and high southbound volumes in the PM.

For the HOV lanes, no segments of the study area currently exceed 1,600 vph/lane, the desired maximum peak hour volume for this facility.

Weekend volumes within the study area can equal or exceed the typical weekday volumes. Figure 2-2 provides a comparison between typical Monday-Thursday volumes, Friday volumes, weekend volumes, and holiday volumes.

Figure 2-2: Weekday/Weekend Traffic Volume Comparison (I-5 north of Vista Hermosa)

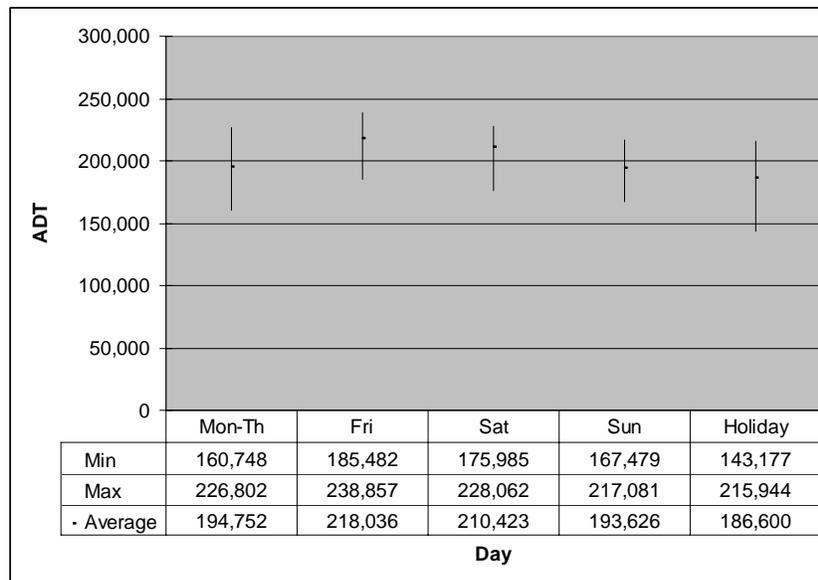


Table 2-1: Freeway Mainline LOS Summary – Existing (2009) Conditions

Location	Lanes			AM Peak Hour						PM Peak Hour					
				Mainline				HOV		Mainline				HOV	
	HOV	GP	Aux	Vol	Speed	Density	LOS	Vol	V/C ¹	Vol	Speed	Density	LOS	Vol	V/C ¹
NORTHBOUND															
NB Mainline s/o Cristianitos	0	4	0	4,200	70.0	17.0	B	0	--	4,400	70.0	17.8	B	0	--
NB Mainline s/o Avd Magdalena	0	4	0	4,280	70.0	17.4	B	0	--	4,450	70.0	18.0	C	0	--
NB Mainline s/o El Camino Real	0	4	1	4,590	70.0	15.2	B	0	--	4,720	70.0	15.6	B	0	--
NB Mainline s/o Avd Presidio	0	4	1	5,040	70.0	16.4	B	0	--	5,140	70.0	16.7	B	0	--
NB Mainline s/o Avd de la Paz	0	4	0	5,390	69.7	21.9	C	0	--	5,330	69.8	21.7	C	0	--
Begin Project															
NB Mainline s/o Avd Pico	0	4	1	6,170	70.0	20.0	C	0	--	6,030	70.0	19.6	C	0	--
NB Mainline s/o Vista Hermosa	0	4	1	6,480	69.9	21.1	C	0	--	6,640	69.8	21.6	C	0	--
NB Mainline s/o Camino De Los Mares	0	4	0	7,270	62.7	33.5	D	0	--	7,130	63.6	32.4	D	0	--
NB Mainline s/o SR-1 (PCH)/Camino Las Ramblas	0	4	2	8,060	69.7	21.9	C	0	--	7,700	69.9	20.8	C	0	--
NB Mainline s/o Camino Capistrano/Stonehill	1	4	0	6,620	66.9	28.1	D	1,000	0.45	5,820	69.1	23.9	C	800	0.36
NB Mainline s/o San Juan Creek	1	4	1*	8,130	56.7	40.7	E	1,000	0.45	6,860	65.8	29.6	D	800	0.36
End Project															
NB Mainline s/o Ortega Hwy	1	4	0	8,090	57.1	40.2	E	1,300	0.59	6,860	65.8	29.6	D	1,000	0.45
NB Mainline s/o Junipero Serra	1	5	0	8,770	65.0	30.6	D	1,250	0.57	7,420	68.9	24.5	C	1,050	0.48
NB Mainline s/o SR-73 Junction	1	4	2	9,060	68.7	25.0	C	1,200	0.55	7,750	69.9	21.0	C	1,100	0.50

(Continued)

Table 2-1: Freeway Mainline LOS Summary – Existing (2009) Conditions (Continued)

Location	Lanes			AM Peak Hour						PM Peak Hour					
				Mainline				HOV		Mainline				HOV	
	HOV	GP	Aux	Vol	Speed	Density	LOS	Vol	V/C ¹	Vol	Speed	Density	LOS	Vol	V/C ¹
SOUTHBOUND															
SB Mainline s/o Cristianitos	0	4	0	4,450	70.0	18.0	C	0	--	4,830	70.0	19.6	C	0	--
SB Mainline s/o Avd Calafia	0	4	0	4,500	70.0	18.3	C	0	--	4,700	70.0	19.1	C	0	--
SB Mainline s/o El Camino Real	0	4	1	4,670	70.0	15.2	B	0	--	5,150	70.0	16.7	B	0	--
SB Mainline s/o Avd Presidio	0	4	1	5,040	70.0	16.4	B	0	--	5,830	70.0	18.9	C	0	--
SB Mainline s/o Avd Palizada	0	5	0	4,810	70.0	15.6	B	0	--	5,610	70.0	18.2	C	0	--
Begin Project															
SB Mainline s/o Avd Pico	0	5	1	5,620	70.0	16.1	B	0	--	6,820	70.0	19.5	C	0	--
SB Mainline s/o Vista Hermosa	0	4	1	6,070	70.0	19.7	C	0	--	7,050	69.4	23.1	C	0	--
SB Mainline s/o Camino De Estrella	0	4	0	6,510	67.3	27.5	D	0	--	7,860	59.2	37.7	E	0	--
SB Mainline s/o SR-1 (PCH)/Camino Las Ramblas	0	4	1	6,770	69.7	22.1	C	0	--	8,760	65.1	30.6	D	0	--
SB Mainline s/o Camino Capistrano/Stonehill	0	5	1	6,520	70.0	17.6	B	0	--	8,870	69.0	24.3	C	0	--
SB Mainline s/o San Juan Creek	0	5	0	6,520	69.8	21.2	C	0	--	8,870	64.6	31.2	D	0	--
End Project															
SB Mainline s/o Ortega Hwy	1	4	0	5,700	69.3	23.3	C	1,200	0.55	8,190	56.1	41.4	E	1,400	0.64
SB Mainline s/o Junipero Serra	1	4	1	6,520	69.8	21.2	C	1,150	0.52	9,310	62.4	33.9	D	1,350	0.61
SB Mainline s/o SR-73 Junction	1	5	1	6,800	70.0	18.4	C	1,200	0.55	9,700	67.4	27.2	D	1,300	0.59
HOV – High Occupancy Vehicle Lane GP – General Purpose Lane AUX – Auxiliary Lane															
Bold = Level of service (LOS) “E” or “F” (mainline), or exceeds 1,600 vph/ln (HOV)															
¹ V/C ratios calculated based on a maximum capacity for the HOV lane of 2,200 vph/ln, the maximum desired HOV lane volume is 1,600 vph/ln (see Table 1-2).															
*Auxiliary lane that is not continuous between successive off/on ramps and does not add mainline capacity.															

This data, which represents an average of daily traffic volumes between September 2008 and August 2009, indicates that the average Friday ADT volume exceeds the average ADT for the other days of the week. The maximum Saturday ADT volumes are about equal to the maximum Monday-Thursday ADT volumes. However the average Saturday ADT volume exceeds the average Monday-Thursday ADT volume by approximately eight percent. The average Sunday ADT volume is comparable to the average Monday-Thursday ADT volume.

A review of PeMS data indicates that in addition to the differences noted here, a primary difference between the Friday/weekend and the Monday-Thursday conditions is that the Friday/weekend peaks typically occur midday while the Monday-Thursday peaks occur during the typical morning and evening commute times.

2.1.2 Ramp and Ramp-Freeway Junction Performance – Existing

Existing ramp data was assembled from PeMS counts and intersection counts at ramp-arterial junctions. A summary of the existing ramp configurations, capacities, and peak hour volumes together with the corresponding V/C ratios is provided in Table 2-2. The following ramp has a V/C ratio that is greater than 1.0:

- SR-1 (PCH)/Camino Las Ramblas Southbound On-Ramp (PM)

The results of the merge/diverge analysis for existing conditions can be found in Table 2-3 (actual worksheets are provided in Appendix H). The following interchanges have merge/diverge areas at LOS “E” or “F” based on existing conditions:

- Vista Hermosa Southbound Diverge (AM & PM)
- Camino de Los Mares/Estrella Northbound Diverge (AM & PM)
- Camino de Los Mares/Estrella Southbound Diverge (PM)
- Camino de Los Mares/Estrella Southbound Merge (PM)
- SR-1 (PCH)/Camino Las Ramblas Northbound Merge (PM)
- Camino Capistrano/Stonehill Northbound Merge (AM)
- San Juan Creek Northbound Diverge (AM)
- San Juan Creek Northbound Merge (AM)
- San Juan Creek Southbound Diverge (PM)
- Ortega Highway Northbound Diverge (AM & PM)
- Ortega Highway Northbound Merge (AM)
- Ortega Highway Southbound Diverge (PM)
- Ortega Highway Southbound Merge (PM)

Table2-2: Ramp Volume and Capacity Summary – Existing (2009) Conditions

Location	Northbound							Location	Southbound						
	Lanes		Cap	AM Pk. Hr.	V/C Ratio	PM Pk. Hr.	V/C Ratio		Lanes		Cap	AM Pk. Hr.	V/C Ratio	PM Pk. Hr.	V/C Ratio
	R.	Aux							R.	Aux					
I-5															
Cristianitos NB Off	1	0	1,500	170	0.11	150	0.10	Cristianitos SB On	1	0	1,500	120	0.08	310	0.21
Cristianitos NB On	1	0	1,500	250	0.17	200	0.13	Cristianitos SB Off	1	0	1,500	170	0.11	180	0.12
Avd Magdalena NB Off	1	0	1,500	140	0.09	160	0.11	Avd Calafia SB On	1	0	900	90	0.10	70	0.08
Avd Magdalena NB On	1	1	900	450	0.50	430	0.43	Avd Calafia SB Off	1	1	1,500	260	0.17	520	0.35
El Camino Real NB Off	1	1	1,500	130	0.09	130	0.09	El Camino Real SB On	1	1	1,500	140	0.09	200	0.13
El Camino Real NB On	1	1	1,080	580	0.54	550	0.51	El Camino Real SB Off	1	1	1,500	510	0.34	880	0.59
Avd Presidio NB Off	1	1	1,500	180	0.12	230	0.15	Avd Presidio SB On	1	1	900	230	0.26	220	0.24
Avd Presidio NB On	1	0	1,080	530	0.49	420	0.39								
Avd de la Paz NB On	1	1	1,500	780	0.52	700	0.47	Avd Palizada SB Off	1	1	1,500	810	0.54	1,210	0.81
Begin Project															
Avd Pico NB Off	1	1	1,500	800	0.53	760	0.51	Avd Pico SB On	1	1	1,500	550	0.37	790	0.53
Avd Pico NB On	1	1	1,500	1,110	0.74	1,370	0.91	Avd Pico SB Off	1.5	1	2,250	1,000	0.44	1,020	0.45
Vista Hermosa NB Off	1	0	1,500	330	0.22	420	0.28	Vista Hermosa SB On	1	1	1,500	420	0.28	390	0.26
Vista Hermosa NB Loop On	1	0	1,500	80	0.05	70	0.05	Vista Hermosa SB Off	1	0	1,500	860	0.57	1,200	0.80
Vista Hermosa NB Direct On	1	0	1,500	1,040	0.69	840	0.56								
Camino De Los Mares NB Off	1	0	1,500	390	0.26	530	0.35	Camino De Estrella SB On	1	0	1,500	480	0.32	520	0.35
Camino De Los Mares NB Loop On	1	1	900	380	0.42	300	0.33	Camino De Estrella SB Off	1	1	1,500	740	0.49	1,420	0.95
Camino De Los Mares NB Direct On	1	1	1,500	800	0.53	800	0.53								

(Continued)

Table2-2: Ramp Volume and Capacity Summary – Existing (2009) Conditions (Continued)

Location	Northbound							Location	Southbound						
	Lanes		Cap	AM Pk. Hr.	V/C Ratio	PM Pk. Hr.	V/C Ratio		Lanes		Cap	AM Pk. Hr.	V/C Ratio	PM Pk. Hr.	V/C Ratio
	R.	Aux							R.	Aux					
I-5 (cont.)															
SR-1 (PCH)/Camino Las Ramblas NB Off	1.5	1	2,250	1,220	0.54	1,630	0.72	SR-1 (PCH)/Camino Las Ramblas SB On	1	0	900	890	0.99	1,070	1.19
SR-1 (PCH)/Camino Las Ramblas NB On	1	0	1,500	780	0.52	550	0.37	SR-1 (PCH)/Camino Las Ramblas SB Loop On	1	0	900	120	0.13	90	0.10
								SR-1 (PCH)/Camino Las Ramblas SB Off	1.5	1	2,250	760	0.34	1,270	0.56
Camino Capistrano/Stonehill NB On	1.5	1	1,800	1,510	0.84	1,040	0.58								
San Juan Creek NB Off	1	0	1,500	60	0.04	100	0.07	San Juan Creek SB On	1	0	1,500	350	0.23	440	0.29
San Juan Creek NB On	1	0	1,500	320	0.21	300	0.20	San Juan Creek SB Off	1	1	1,500	730	0.49	1,160	0.77
End Project															
Ortega NB Off	1	0	1,500	750	0.50	710	0.47	Ortega SB On	1	1	1,500	590	0.39	610	0.41
Ortega NB On	1	1	1,500	1,380	0.92	1,320	0.88	Ortega SB Off	1.5	1	2,250	1,360	0.60	1,680	0.75
Junipero Serra NB Off	1	0	1,500	320	0.21	280	0.19	Junipero Serra SB On	1	0	1,080	330	0.31	360	0.33
Junipero Serra NB On	1	1	1,080	560	0.52	660	0.61	Junipero Serra SB Off	1	1	1,500	660	0.44	700	0.47
<p>Bold = exceeds volume/capacity ratio of 1.0</p> <p>R. = Ramp termini lanes - 1.5 denotes a two-lane off-ramp with one dedicated and one optional lane, or a two-lane on-ramp entering the freeway as one merge lane and an auxiliary lane</p> <p>Aux. = Auxiliary lanes</p> <p>Cap. = Capacity</p>															

Table 2-3: Ramp Merge/Diverge Analysis Summary – Existing (2009) Conditions

Location	AM Peak Hour				PM Peak Hour			
	Volumes		Density	LOS	Volumes		Density	LOS
	Fwy.	Ramp			Fwy.	Ramp		
I-5 at Cristianitos								
NB Diverge	4,200	170	22.2	C	4,400	150	22.9	C
NB Merge	4,030	250	20.1	C	4,250	200	20.5	C
SB Diverge	4,500	170	23.5	C	4,700	180	24.4	C
SB Merge	4,330	120	20.4	C	4,520	310	22.6	C
I-5 at Calafia/Magdalen								
NB Diverge	4,280	140	22.3	C	4,450	160	23.2	C
SB Merge	4,410	90	20.5	C	4,630	70	21.1	C
I-5 at Vista Hermosa								
NB Merge	6,230	1,040	34.3	D	6,290	840	32.9	D
SB Diverge	6,510	860	35.8	E	7,860	1,200	43.4	E
I-5 at Camino de Los Mares/Estrella								
NB Diverge	7,270	390	36.5	E	7,130	530	36.6	E
SB Diverge	6,770	740	23.7	C	8,760	1,420	35.9	F
SB Merge	6,030	480	30.2	D	7,340	520	35.2	E
I-5 at SR-1 (PCH)/Camino Las Ramblas								
NB Merge	6,140	780	32.5	D	7,700	800	38.2	F
SB Diverge	6,520	760	18.8	B	8,870	1,270	29.6	D
SB Merge	5,880	890	25.9	C	7,690	1,070	31.6	D
I-5 at Camino Capistrano/Stonehill								
NB Merge	6,620	1,510	35.6	E	5,820	1,040	28.8	D
I-5 at San Juan Creek								
NB Diverge	8,130	60	38.3	E	6,860	100	33.1	D
NB Merge	8,070	320	35.0	E	6,760	300	30.2	D
SB Diverge	5,700	730	31.6	D	8,190	1,160	44.6	E
SB Merge	4,970	350	24.7	C	7,030	440	32.8	D
I-5 at Ortega Highway								
NB Diverge	8,090	750	41.9	E	6,860	710	36.5	E
NB Merge	7,340	1,380	33.6	F	6,150	1,320	28.9	D
SB Diverge	6,520	1,360	26.0	C	9,310	1,680	39.7	F
SB Merge	5,110	590	27.9	C	7,580	610	36.8	E
I-5 at Junipero Serra								
NB Diverge	8,770	320	35.0	D	7,420	280	30.2	D
NB Merge	8,450	560	22.9	C	7,140	660	19.7	B
SB Diverge	6,800	660	17.5	B	9,700	700	27.6	C
SB Merge	6,190	330	23.3	C	8,950	360	31.4	D
LOS Criteria based on Density (pc/mi/ln): A ≤ 10 D > 28 - 35 B > 10 - 20 E > 35 C > 20 - 28 F Demand exceeds capacity (mainline or ramp)								
Bold = Level of service (LOS) "E" or "F"								

Of the 13 interchanges with merge/diverge areas at LOS “E” or “F” for existing conditions, 7 are within the project limits.

The weaving analysis results are summarized in Table 2-4 (actual worksheets are provided in Appendix E and Avendia Pico worksheets are in Appendix K). Of the nine weaving sections within the study area, none show LOS “E” or LOS “F” for existing conditions.

2.1.3 Intersection Performance – Existing

Arterial ADT volumes for segments within the study area are shown in Figure 2-3. These are for reference purposes, since ADT volumes are not used in the traffic analysis.

For study area intersections, traffic count data was assembled from available information within the Cities of San Clemente and San Juan Capistrano. In addition, traffic counts were carried out in early 2009 for selected locations where no current data was available. For intersections within close proximity of each other, as at a freeway interchange, volume balancing was carried out to ensure flow continuity.

Intersection turning movement volumes for the study area intersections can be found in Appendix C.

A summary of the existing intersection LOS is provided in Table 2-5 for interchange locations and in Table 2-6 for City intersections (actual worksheets are provided in Appendix F and L, for Avenida Pico). The following intersections do not achieve the performance standard based on existing conditions:

- Southbound Ramps & Ortega Highway (PM)
- Northbound Ramps & Avenida Palizada (AM)
- South El Camino Real & I-5 Northbound Ramps (AM & PM)

Each of the above intersections are ramp-arterial junctions, however none are within the project limits. The Ortega Highway intersection is controlled by a traffic signal and the South El Camino Real intersection is stop sign controlled. The Avenida Palizada intersection is not controlled by a signal or stop signs, but the left-turns onto the ramp experience delay due to the yield to opposing movements.

For the Avenida Pico interchange, the intersection results for existing conditions show LOS “C” or better in both the HCM and ICU calculations. However, queuing between the ramp intersections can exceed the available space and blocking sometimes presents the theoretical LOS values from being achieved. Hence, actual operations tend to be worse than indicated by the theoretical values given here.

Table 2-4: Weaving Analysis Summary – Existing (2009) Conditions

Location	AM Peak Hour			PM Peak Hour								
	Speed	Density	LOS	Speed	Density	LOS						
NORTHBOUND												
NB – Magdalena to El Camino Real	58.8	17.8	B	58.8	18.2	B						
NB – El Camino Real to Presidio	61.4	18.7	B	61.1	19.2	B						
NB – Palizada to Pico	53.8	26.1	C	54.9	25.0	C						
NB – Pico to Vista Hermosa	53.1	27.8	C	49.6	30.4	D						
NB – Cm de Los Mares to SR-1 (PCH)/Camino Las Ramblas	57.4	27.2	C	54.3	27.9	C						
SOUTHBOUND												
SB – El Camino Real to Magdalena	66.9	15.9	B	64.0	18.3	B						
SB – Presidio to El Camino Real	53.5	21.5	C	48.6	27.3	C						
SB – Pico to Palizada	54.2	20.1	C	48.0	27.8	C						
SB – Vista Hermosa to Pico	56.0	24.7	C	55.0	29.7	D						
<p>LOS Criteria based on Density (pc/mi/ln):</p> <table> <tr> <td>A ≤ 10</td> <td>D > 28 - 35</td> </tr> <tr> <td>B > 10 - 20</td> <td>E > 35</td> </tr> <tr> <td>C > 20 - 28</td> <td>F Demand exceeds capacity</td> </tr> </table> <p>Bold = Level of service (LOS) “E” or “F”</p>							A ≤ 10	D > 28 - 35	B > 10 - 20	E > 35	C > 20 - 28	F Demand exceeds capacity
A ≤ 10	D > 28 - 35											
B > 10 - 20	E > 35											
C > 20 - 28	F Demand exceeds capacity											

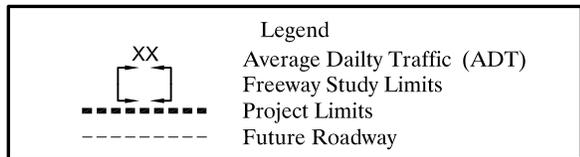
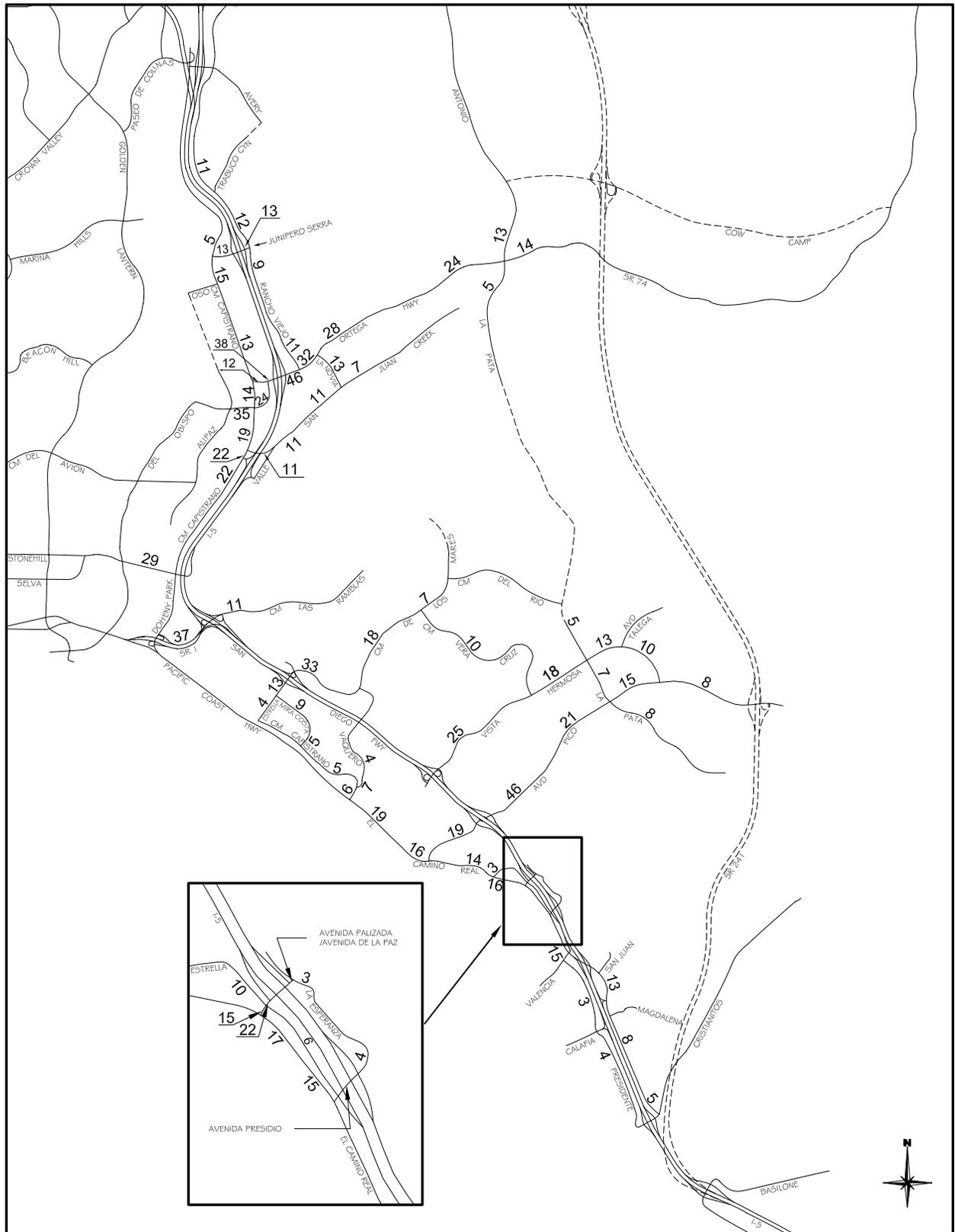


Figure 2-3
ARTERIAL ADT VOLUMES (000s)
- EXISTING CONDITIONS

Table 2-5: Intersection LOS Summary (Interchanges) – Existing Conditions

Location	AM Peak Hour		PM Peak Hour	
	Delay	LOS	Delay	LOS
1. I-5 SB Ramps & Junipero Serra	16.2	B	19.6	B
2. I-5 NB Ramps & Junipero Serra	16.0	B	16.5	B
3. I-5 SB Ramps & Ortega Hwy	37.3	D	59.1	E
4. I-5 NB Ramps & Ortega Hwy	33.5	C	25.8	C
5. Camino Capistrano & I-5 SB Ramps	18.7	B	27.0	C
6. Valle Rd & I-5 NB Ramps	11.6 ¹	B ¹	16.4 ¹	C ¹
7. I-5 SB Ramps & Las Ramblas	2.6	A	3.3	A
8. I-5 NB Ramps & Las Ramblas	3.9	A	4.0	A
9. I-5 SB Ramps & Camino De Estrella	16.4	B	25.6	C
10. I-5 NB Ramps & Camino De Estrella	11.1	B	13.1	B
11. I-5 SB Ramps & Avd Vista Hermosa	9.6	A	8.4	A
12. I-5 NB Ramps & Avd Vista Hermosa	6.7	A	5.9	A
13. I-5 SB Ramps & Avd Pico	25.4	C	24.6	C
14. I-5 NB Ramps & Avd Pico	11.5	B	15.9	B
15. I-5 SB Ramps & Avd Palizada	8.3	A	8.5	A
16. I-5 NB Ramp & Avd Palizada	52.2 ²	F²	33.3 ²	D ²
17. I-5 SB Ramps & Avd Presidio	17.0 ³	C ³	17.1 ³	C ³
18. I-5 NB Ramps & Avd Presidio	15.1	B	16.8	B
19. I-5 SB Ramps & El Camino Real/Valencia	14.3	B	19.9	B
20. I-5 NB Ramps & El Camino Real	5.2	A	5.3	A
21. S. El Camino Real & I-5 NB Ramps	38.2 ³	E³	39.0 ³	E³
22. Avd Presidente & Avd Calafia	9.6 ¹	A ¹	11.0 ¹	B ¹
23. I-5 NB Ramps & Cristianitos	15.7 ³	C ³	16.2 ³	C ³
24. I-5 SB Ramps & Cristianitos	10.8 ³	B ³	16.7 ³	C ³

LOS Criteria based on Average Delay (sec/veh):

<u>LOS</u>	<u>Average Delay</u>
A	0.0 – 10.0
B	10.1 – 20.0
C	20.1 – 35.0
D	35.1 – 55.0
E	55.1 – 80.0
F	> 80.0

Bold = exceeds performance standard of level of service (LOS) “D”

¹All-way stop – delay represents the intersections average vehicle delay

²Yield – delay represents the yielding movement with highest approach delay

³Two-way stop – delay represents the movement with highest control delay

Table 2-6: Intersection LOS Summary (City Locations) – Existing Conditions

Location	AM Peak Hour		PM Peak Hour	
	ICU	LOS	ICU	LOS
25. Camino Capistrano & Junipero Serra	.42	A	.39	A
26. Rancho Viejo & Junipero Serra	.53	A	.64	B
27. Del Obispo & Ortega	.50	A	.53	A
28. Rancho Viejo & Ortega	.72	C	.83	D
29. La Pata & Ortega	.80	C	.68	B
30. Camino Capistrano & Del Obispo	.68	B	.79	C
31. Camino Capistrano & San Juan Crk	.36	A	.40	A
32. Valle & San Juan Creek	.68	B	.65	B
33. La Novia & San Juan Creek	.48	A	.37	A
34. Del Obispo & Stonehill	.69	B	.65	B
35. Camino Capistrano & Stonehill	.64	B	.68	B
36. Camino Mira Costa & Camino Estrella	.33	A	.33	A
37. Avd Vaquero & Camino De Los Mares	.36	A	.38	A
38. Camino Vera Cruz & Camino De Los Mares	.32	A	.36	A
39. Camino Del Rio & Camino De Los Mares	.25	A	.20	A
40. Camino Vera Cruz & Avd Vista Hermosa	.70	B	.73	C
41. La Pata & Avd Vista Hermosa	.46	A	.35	A
42. N. El Camino Real & Avd Pico	.44	A	.46	A
43. La Pata & Avd Pico	.25	A	.38	A
44. Avd Vista Hermosa & Avd Pico	.24	A	.23	A
45. N. El Camino Real & Avd Palizada	.49	A	.59	A
46. Camino Estrella & Avd Palizada	.46	A	.55	A
47. N. El Camino Real & Avd Presidio/Victoria	.38	A	.41	A

LOS Criteria based on ICU:

<u>LOS</u>	<u>ICU</u>
A	0.00 – 0.60
B	0.61 – 0.70
C	0.71 – 0.80
D	0.81 – 0.90
E	0.91 – 1.00
F	> 1.00

Bold = exceeds performance standard of level of service (LOS) “D”

2.2 2040 TRAFFIC FORECASTS

The traffic analysis results for future conditions are based on 2040 forecasts. This section describes the derivation of the traffic forecasts used in this analysis.

2.2.1 Overview

To derive the 2040 forecast volumes, several sources of data were used. For the freeway volumes, year 2035 traffic volumes were prepared by the Orange County Transportation Authority (OCTA) using the Orange County Traffic Analysis Model (OCTAM) Version 3.3. Volumes for the study area interchanges were obtained from the sub-area models used by the local cities. These models use land use projections based on current General Plans for the Cities. The specific sub-area models used for this analysis were the South County Sub Area Model (SCSAM), and the San Clemente Traffic Model (SCTM).

The OCTAM volumes were produced using the OCTAM 3.3 year 2035 “constrained network” (i.e., includes committed and/or environmentally cleared highway improvements only). This constrained network includes the SR-241 extension to I-5 (i.e., the ultimate improvement which extends past Avenida Pico south to the I-5), but does not include some elements of the County Master Plan of Arterial Highways (MPAH) that are not currently committed. Examples include the Camino Las Ramblas extension to La Pata Avenue and the Camino de Los Mares extension to Camino Las Ramblas. For the build alternative, a special OCTAM run was prepared that included the southerly extension of the HOV lanes to the Avenida Pico interchange.

Due to the difference between the OCTAM 3.3 horizon year of 2035 and the project study horizon year of 2040, volumes for the freeway mainline segments were increased to reflect 2040 conditions. At the same time, refinements were made to the OCTAM data to ensure flow continuity throughout the corridor and provide consistency between regional and local data to the extent possible.

For the local forecasts from the City models, the volumes were assumed to represent 2040 since they are based on buildout of the General Plan of those jurisdictions. Consistent with the OCTAM forecasts, the constrained network versions of the subarea model forecasts were used.

2.2.2 Demographic Data

As background to the 2040 analysis year forecasts, demographic data is presented for the areas that generally contribute to traffic growth along the project corridor. This information is taken from the Orange County Projections 2006 (OCP-2006), and shows growth in population and employment in five-year intervals from 2005 to 2035 (OCP-2006 does not provide projections past 2035). The OCP-2006 projections of population and employment for selected areas in the vicinity of the project can be seen in Table 2-7 and the area delineations can be seen in Figure 2-4. The study area starts at the midpoint of Regional Statistical Area (RSA) D-40 and ends along the D-40/San Diego County border. Population growth in this area between 2005 and 2035 is anticipated to be around 19 percent and employment growth is anticipated to be approximately 36 percent.

2.2.3 Traffic Forecast Data Derivation – Freeway and HOV Volumes

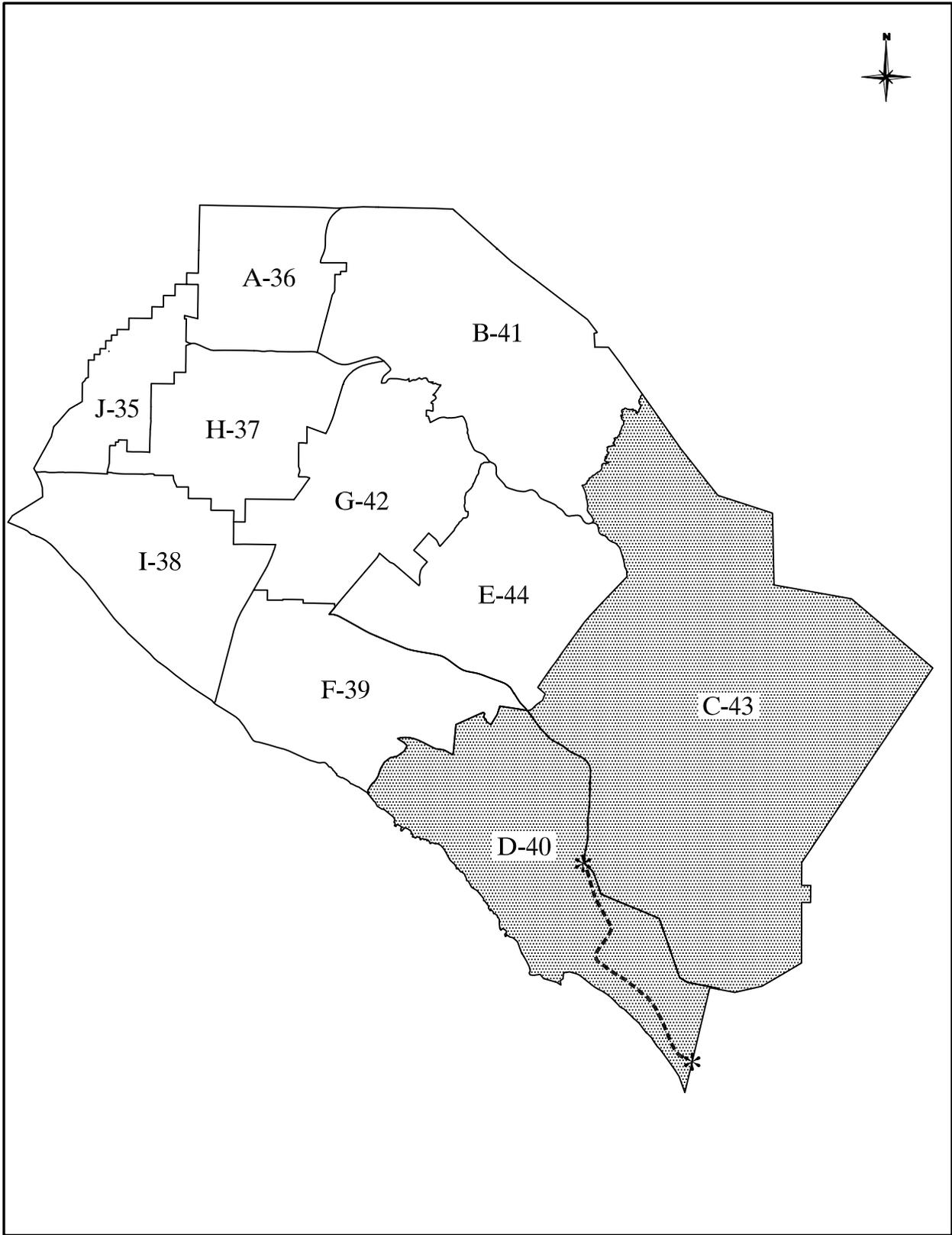
As noted earlier, the 2040 freeway and HOV projections was derived using forecast data from OCTAM 3.3. A comparison between OCTAM's 2005 existing conditions baseline counts and the OCTAM 2035 forecasts is presented in Table 2-8 together with the resulting growth factors. Year-2040 growth factors were derived for use in this study by extrapolating the 2035 growth by an additional five years. Since the year-2035 forecasts are based on County buildout conditions, the extrapolation recognizes that growth rates decrease over time and will be substantially lower than existing growth rates beyond the year-2035.

A comparison between existing and the 2040 ADT volumes derived for this analysis is given in Table 2-9. Appendix B has detailed information on the 2040 freeway volumes. As can be seen, the volume increase between 2009 and 2040 is around 20 to 45 percent, depending on location within the project corridor, reflecting the growth indicated by the demographic data projections presented earlier.

The 2040 AM and PM peak hour volumes along with the ADT volumes for the study area freeway mainline segments are shown in Figure 2-5 for no-build conditions and in Figure 2-6 for build conditions. The peak hour data presented here shows the peak period directionality in the project segment, with high AM northbound and high PM southbound volumes for the majority of the study area.

Table 2-7: Demographic Projections

	2005	2010	2015	2020	2025	2030	2035
POPULATION							
RSA C-43							
Amount	284,955	300,281	323,325	339,723	354,229	361,412	362,060
5 Year Growth	--	5.38%	7.67%	5.07%	4.27%	2.03%	0.18%
Cumulative Growth	--	5.38%	13.47%	19.22%	24.31%	26.83%	27.06%
RSA D-40							
Amount	313,588	333,109	341,433	347,397	349,346	351,739	352,638
5 Year Growth	--	6.23%	2.50%	1.75%	0.56%	0.68%	0.26%
Cumulative Growth	--	6.23%	8.88%	10.78%	11.40%	12.17%	12.45%
COMBINED TOTAL							
Amount	598,543	633,390	664,758	687,120	703,575	713,151	714,698
5 Year Growth	--	5.82%	4.95%	3.36%	2.39%	1.36%	0.22%
Cumulative Growth	--	5.82%	11.06%	14.80%	17.55%	19.15%	19.41%
EMPLOYMENT							
RSA C-43							
Amount	84,269	110,740	123,773	130,961	135,104	135,511	135,684
5 Year Growth	--	31.41%	11.77%	5.81%	3.16%	0.30%	0.13%
Cumulative Growth	--	31.41%	46.88%	55.41%	60.32%	60.81%	61.01%
RSA D-40							
Amount	130,949	144,067	149,668	152,328	153,447	155,508	156,035
5 Year Growth	--	10.02%	3.89%	1.78%	0.73%	1.34%	0.34%
Cumulative Growth	--	10.02%	14.29%	16.33%	17.18%	18.75%	19.16%
COMBINED TOTAL							
Amount	215,218	254,807	273,441	283,289	288,551	291,019	291,719
5 Year Growth	--	18.39%	7.31%	3.60%	1.86%	0.86%	0.24%
Cumulative Growth	--	18.39%	27.05%	31.63%	34.07%	35.22%	35.55%
* See Figure 2-4 for Regional Statistical Area (RSA) locations.							



Legend

-  Project Adjacent RSA's
-  I-5 Study Area Start/End

Figure 2-4

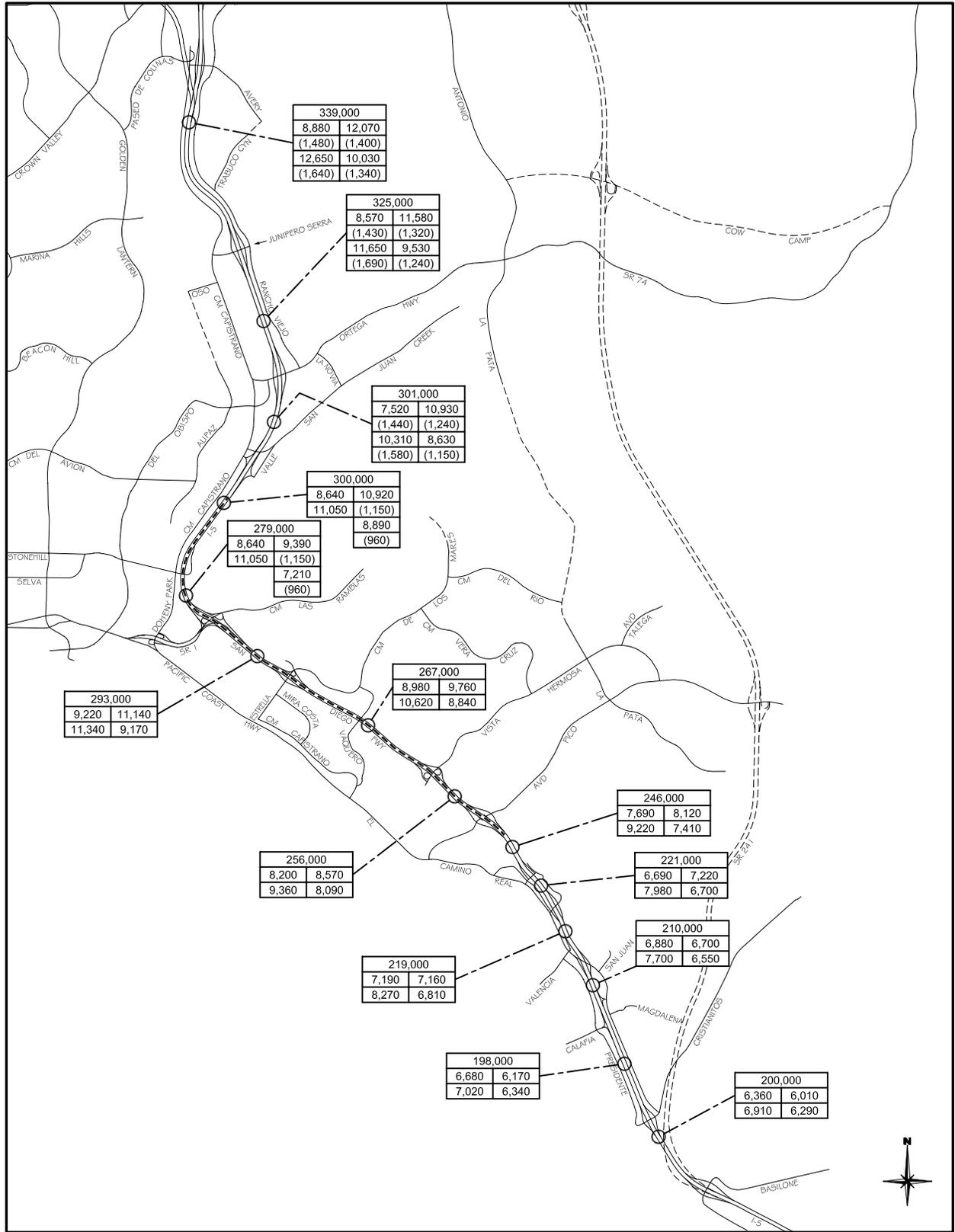
REGIONAL STATISTICAL AREAS (RSA's)
LOCATION MAP

Table 2-8: OCTAM 3.3 ADT Volume Comparison

Segment Location	OCTAM 3.3 Counts (2005)	OCTAM 3.3 2035		
		Volume	Total Growth	Average Annual
I-5				
s/o Cristianitos Interchange	134,400	195,500	45%	1.5%
s/o Magdalena/Calafia Interchange	134,400	194,300	45%	1.5%
s/o El Camino Real Interchange	152,300	205,200	35%	1.2%
s/o Presidio Interchange	158,000	214,200	36%	1.2%
s/o De La Paz/Palizada Interchange	155,900	216,300	39%	1.3%
s/o Pico Interchange	180,400	240,700	33%	1.1%
s/o Vista Hermosa Interchange	202,600	261,700	29%	1.0%
s/o De Los Mares/Estrella Interchange	202,600	260,500	29%	1.0%
s/o Rte. 1/Las Ramblas Interchange	227,300	286,300	26%	0.9%
s/o Cm. Capistrano/Stonehill Interchange	222,600	283,800	27%	0.9%
s/o San Juan Creek Interchange	235,200	291,400	24%	0.8%
s/o Rte. 74/Ortega Hwy Interchange	237,200	294,100	24%	0.8%
s/o Junipero Serra Interchange	252,400	317,000	26%	0.9%
s/o Rte. 73 Junction	260,000	330,600	27%	0.9%
SR-73				
n/o I-5 Junction	49,800	54,600	10%	0.3%
Note: Volumes shown are 2-way total of HOV & GP lanes (NB & SB)				

Table 2-9: ADT Volumes – Existing (2009) and Future (2040) Conditions

Location	2009	2040	Growth (%)
s/o Cristianitos Interchange	141,000	200,000	42%
s/o Magdalena/Calafia Interchange	141,000	198,000	40%
s/o El Camino Real Interchange	145,000	210,000	45%
s/o Presidio Interchange	161,000	219,000	36%
s/o De La Paz/Palizada Interchange	161,000	222,000	38%
s/o Pico Interchange	185,000	254,000	37%
s/o Vista Hermosa Interchange	193,000	260,000	35%
s/o De Los Mares/Estrella Interchange	210,000	270,000	29%
s/o Rte. 1/Las Rambles Interchange	229,000	296,000	29%
s/o Cm. Capistrano/Stonehill Interchange	221,000	280,000	27%
s/o San Juan Creek Interchange	241,000	300,000	24%
s/o Rte. 74/Ortega Hwy Interchange	249,000	302,000	21%
s/o Junipero Serra Interchange	263,000	325,000	24%
s/o Rte. 73 Junction	268,000	339,000	26%
Note: Volumes shown are 2-way total of HOV & GP lanes (NB & SB)			



Legend

ADT Volume	
AM SB GP Volume	AM NB GP Volume
AM SB HOV Volume	AM NB HOV Volume
PM SB GP Volume	PM NB GP Volume
PM SB HOV Volume	PM NB HOV Volume

Project Limits
 Future Roadway

Figure 2-5
 I-5 FREEWAY PEAK HOUR & ADT VOLUMES
 - 2040 NO-BUILD CONDITIONS

In the southernmost section of the study area, such as south of the Calafia interchange, the PM northbound volumes are slightly higher than the AM northbound volumes.

Year 2040 arterial ADT volumes for the study area are shown in Figure 2-7 for no-build conditions and in Figure 2-8 for build conditions. Increases in these compared to existing volumes represent growth in the adjacent Cities served by the interchanges in the study area.

2.2.4 Accident Rates

A summary of accident rates for the project area is provided in Table 2-10 with a comparison to the statewide average. This data, which is for the thirty-six month period of January 2006 through December 2008, indicates that multiple segments of the freeway mainline within the study area have a higher accident rate than the statewide average for fatal accidents, fatal plus injury accidents, and for total accidents. The following two locations experienced one or more fatal accidents within the thirty-six month period.

- PM 3.160 to PM 3.659 (between Palizada & Pico)
- PM 4.660 to PM 5.159 (between Pico & Estrella)

There are a total of 30 on- and off-ramps within the study area. Of these ramps, 14 have an accident rate greater than the statewide average in at least one of the three categories. None of the ramp locations experienced a fatal accident within the thirty-six month period.

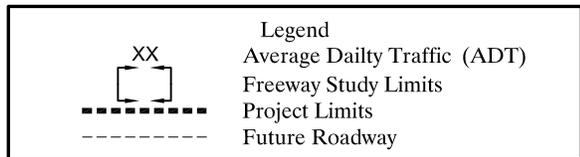
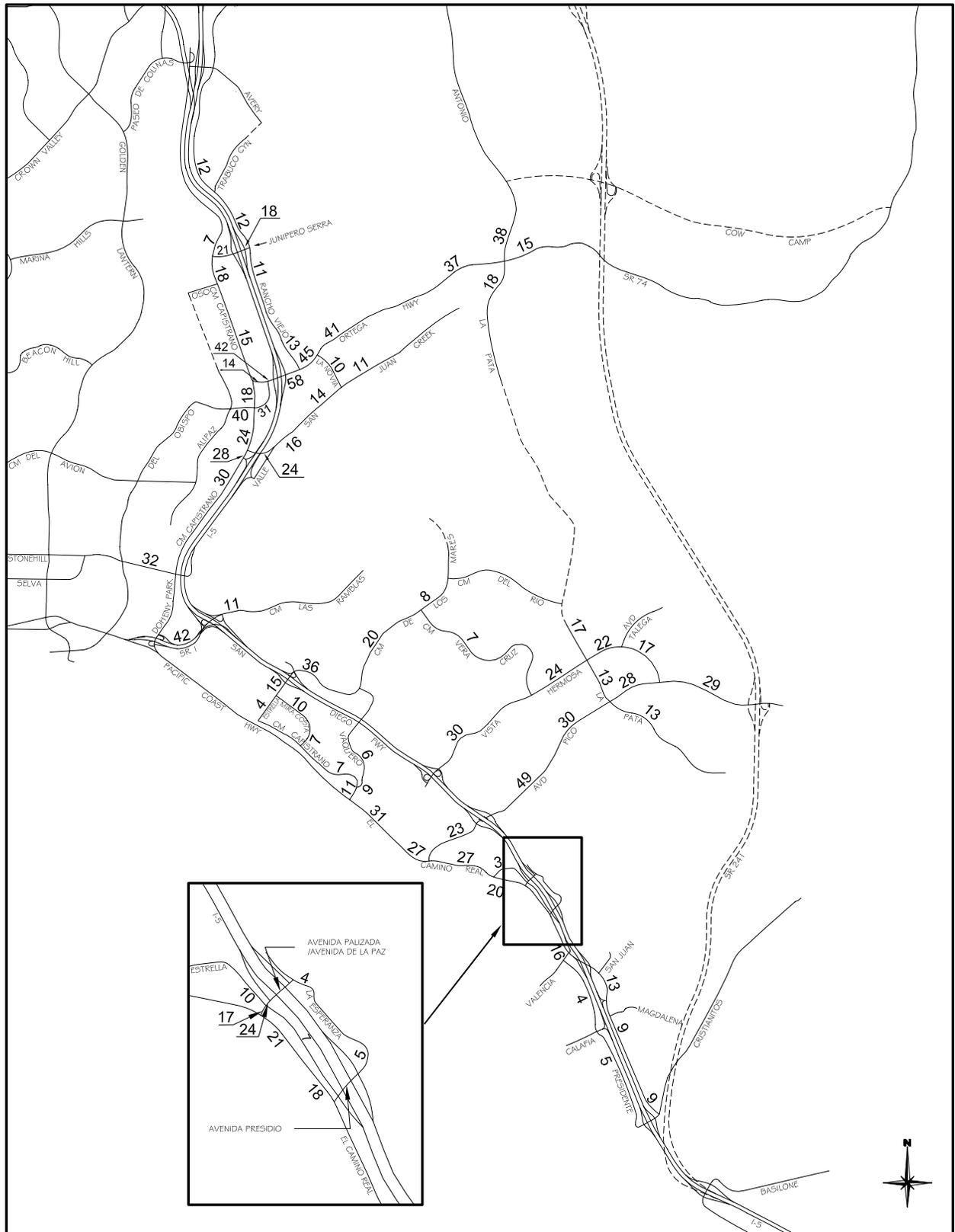
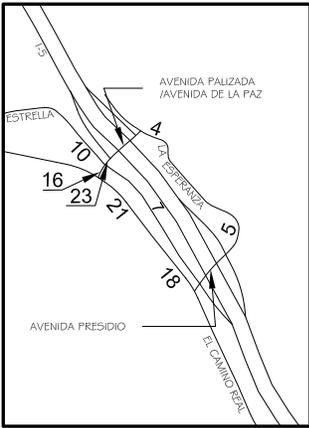
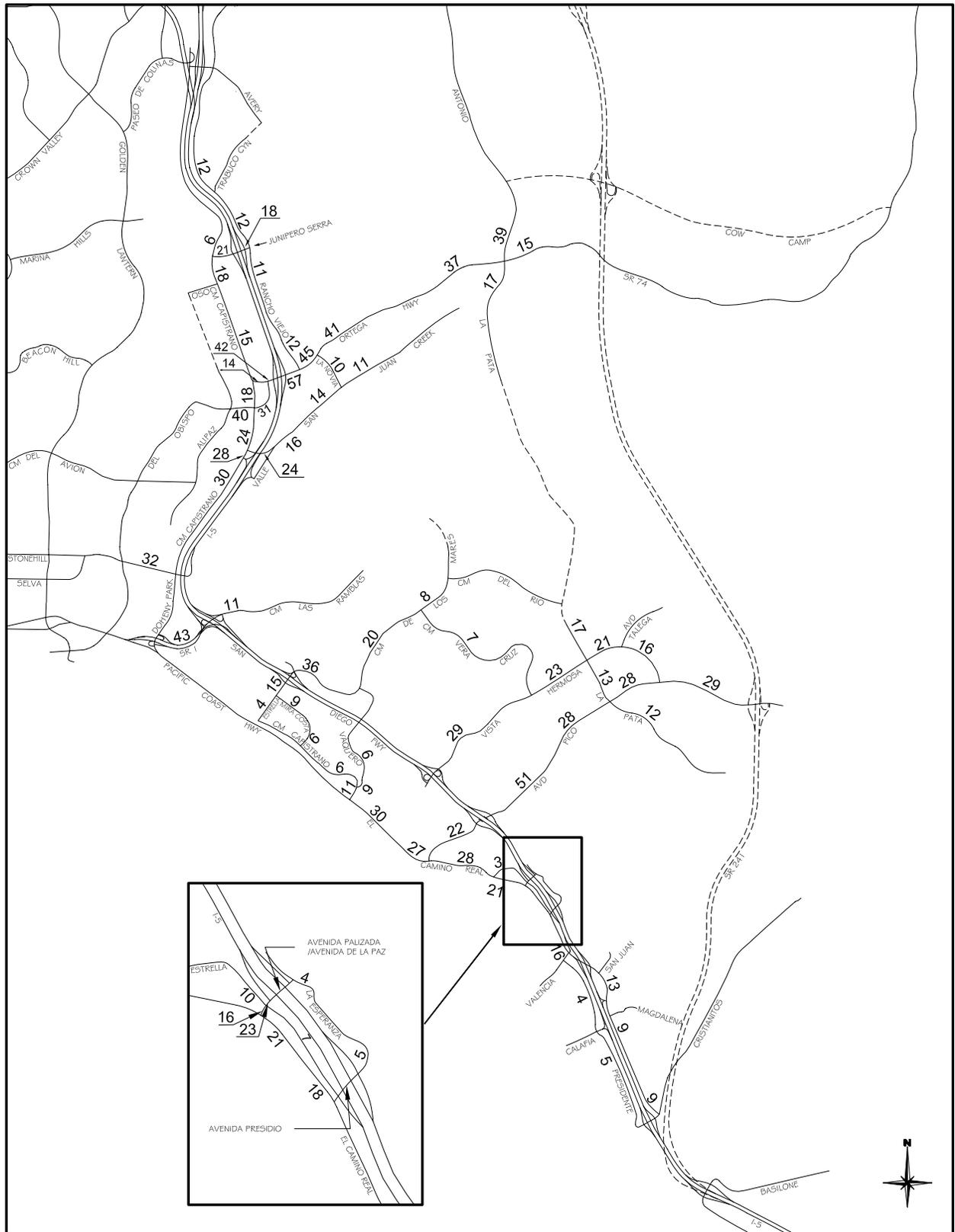


Figure 2-7
ARTERIAL ADT VOLUMES (000s)
 - 2040 NO-BUILD CONDITIONS



XX	Legend
[]	Average Daily Traffic (ADT)
[]	Freeway Study Limits
[]	Project Limits
[]	Future Roadway

Figure 2-8
ARTERIAL ADT VOLUMES (000s)
 - 2040 BUILD CONDITIONS

Table 2-10: Accident Rate Summary – January 2006 through December 2008

Post Mile	Description	MVM or MV ¹	Segment Accident Rates			Statewide Average Rates		
			Fatal Accidents	Fatal + Injury	Total Accidents	Fatal Accidents	Fatal + Injury	Total Accidents
<i>Northbound Mainline</i>								
2.660 – 3.159	Palizada Interchange Area	50.64	0.000	0.30	0.85	0.008	0.25	0.85
3.160 – 3.659	Palizada to Pico	52.85	0.038	0.72	2.18	0.010	0.31	1.00
3.660 – 4.159	Pico Interchange Area	55.15	0.000	0.42	1.47	0.010	0.30	0.98
4.160 – 4.659	Pico to Vista Hermosa	55.66	0.000	0.41	1.15	0.011	0.34	1.11
4.660 – 5.159	Vista Hermosa Interchange Area	56.17	0.018	0.30	0.77	0.011	0.35	1.12
5.160 – 5.659	Vista Hermosa to Camino Estrella	56.68	0.000	0.25	0.97	0.011	0.35	1.12
5.660 – 6.159	Camino Estrella Interchange Area	60.87	0.000	0.31	1.25	0.010	0.31	1.02
6.160 – 6.659	Camino Estrella to SR-1 (PCH)	62.38	0.000	0.16	0.67	0.010	0.31	1.02
6.660 – 7.159	SR-1 (PCH) Interchange Area	60.09	0.000	0.27	0.73	0.011	0.33	1.09
7.160 – 7.659	Camino Capistrano Interchange Area	61.96	0.000	0.21	0.71	0.010	0.32	1.03
7.660 – 8.159	North of Camino Capistrano	63.48	0.000	0.08	0.32	0.011	0.32	1.05
8.160 – 8.659	South of San Juan Creek	63.48	0.000	0.05	0.30	0.011	0.32	1.05
8.660 – 8.872	San Juan Creek Interchange Area	27.29	0.000	0.07	0.29	0.011	0.32	1.05
<i>Southbound Mainline</i>								
2.660 – 3.159	Palizada Interchange Area	50.64	0.000	0.12	0.43	0.008	0.25	0.85
3.160 – 3.659	Palizada to Pico	52.85	0.000	0.15	0.36	0.010	0.31	1.00
3.660 – 4.159	Pico Interchange Area	55.15	0.000	0.20	0.53	0.010	0.30	0.98
4.160 – 4.659	Pico to Vista Hermosa	55.66	0.000	0.07	0.31	0.011	0.34	1.11
4.660 – 5.159	Vista Hermosa Interchange Area	56.17	0.000	0.21	0.61	0.011	0.35	1.12
5.160 – 5.659	Vista Hermosa to Camino Estrella	56.68	0.000	0.18	0.35	0.011	0.35	1.12
5.660 – 6.159	Camino Estrella Interchange Area	60.87	0.000	0.35	0.99	0.010	0.31	1.02
6.160 – 6.659	Camino Estrella to SR-1 (PCH)	62.38	0.000	0.37	0.98	0.010	0.31	1.02
6.660 – 7.159	SR-1 (PCH) Interchange Area	60.09	0.000	0.07	0.55	0.011	0.33	1.09

(Continued)

Table 2-10: Accident Rate Summary – January 2006 through December 2008 (Continued)

Post Mile	Description	MVM or MV ¹	Segment Accident Rates			Statewide Average Rates		
			Fatal Accidents	Fatal + Injury	Total Accidents	Fatal Accidents	Fatal + Injury	Total Accidents
<i>Southbound Mainline (Cont.)</i>								
7.160 – 7.659	Camino Capistrano Interchange Area	61.96	0.000	0.13	0.58	0.010	0.32	1.03
7.660 – 8.159	North of Camino Capistrano	63.48	0.000	0.08	0.13	0.011	0.32	1.05
8.160 – 8.659	South of San Juan Creek	63.48	0.000	0.14	0.33	0.011	0.32	1.05
8.660 – 8.871	San Juan Creek Interchange Area	27.15	0.000	0.26	0.92	0.011	0.32	1.05
<i>Northbound Ramps</i>								
2.798	Palizada NB On-Ramp	9.97	0.000	0.00	0.30	0.002	0.26	0.75
3.271	Pico NB Off-Ramp	9.32	0.000	0.32	0.97	0.004	0.42	1.20
3.556	Pico NB On-Ramp	16.77	0.000	0.06	0.24	0.002	0.26	0.75
3.896	Vista Hermosa NB Off-Ramp	3.29	0.000	1.52	1.83	0.004	0.42	1.20
4.045	Vista Hermosa NB On-Ramp (Loop)	0.16	0.000	0.00	6.10	0.004	0.20	0.70
4.248	Vista Hermosa NB On-Ramp (Slip)	1.10	0.000	0.91	4.56	0.003	0.20	0.65
5.629	Estrella NB Off-Ramp	7.34	0.000	0.14	0.82	0.004	0.42	1.20
5.761	Estrella NB On-Ramp (Loop)	4.27	0.000	0.23	0.23	0.004	0.20	0.70
5.932	Estrella NB On-Ramp (Slip)	10.74	0.000	0.09	0.28	0.003	0.20	0.65
6.359	SR-1 (PCH)/Las Ramblas NB Off-Ramp (before split)	16.66	0.000	0.00	0.00	0.002	0.09	0.30
6.511	Las Ramblas NB Off-Ramp	1.53	0.000	0.00	0.65	0.004	0.42	1.20
6.512	SR-1 (PCH) NB Off-Ramp	16.33	0.000	0.31	0.55	0.005	0.20	0.60
6.807	SR-1 (PCH) NB On-Ramp (Loop)	6.30	0.000	0.00	0.95	0.004	0.20	0.70
6.808	Las Ramblas NB On-Ramp (Slip)	3.89	0.000	0.26	1.80	0.003	0.20	0.65
7.116	SR-1 (PCH)/Las Ramblas NB On-Ramp (after merge)	10.19	0.000	0.10	0.10	0.002	0.06	0.20
7.535	Camino Capistrano NB On-Ramp	15.89	0.000	0.31	0.63	0.002	0.26	0.75
8.417	San Juan Creek NB Off-Ramp	7.34	0.000	0.27	0.68	0.004	0.28	0.95
8.691	San Juan Creek NB On-Ramp	4.38	0.000	0.00	0.00	0.002	0.16	0.55

(Continued)

Table 2-10: Accident Rate Summary – January 2006 through December 2008 (Continued)

Post Mile	Name	MVM or MV ¹	Segment Accident Rates			Statewide Average Rates		
			Fatal Accidents	Fatal + Injury	Total Accidents	Fatal Accidents	Fatal + Injury	Total Accidents
<i>Southbound Ramps</i>								
2.841	Palizada SB Off-Ramp	14.47	0.000	0.14	0.42	0.004	0.42	1.20
3.225	Pico SB On-Ramp	10.14	0.000	0.10	0.69	0.002	0.26	0.75
3.612	Pico SB Off-Ramp	16.22	0.000	0.25	0.56	0.004	0.42	1.20
4.101	Vista Hermosa SB On-Ramp	2.90	0.000	0.00	0.34	0.002	0.26	0.80
4.250	Vista Hermosa SB Off-Ramp	11.40	0.000	0.18	0.35	0.004	0.42	1.20
5.587	Estrella SB On-Ramp	6.80	0.000	0.29	0.88	0.002	0.26	0.75
5.970	Estrella SB Off-Ramp	12.28	0.000	0.57	1.22	0.004	0.42	1.20
6.670	SR-1 (PCH) SB On-Ramp (Slip)	11.40	0.000	0.00	0.00	0.003	0.11	0.35
6.818	SR-1 (PCH) SB On-Ramp (Loop)	1.37	0.000	0.00	1.46	0.003	0.19	0.65
6.972	SR-1 (PCH) SB Off-Ramp	13.92	0.000	0.00	0.14	0.002	0.31	1.00
8.631	San Juan Creek SB On-Ramp	6.47	0.000	0.00	0.93	0.002	0.16	0.55
8.765	San Juan Creek SB Off-Ramp	11.95	0.000	0.25	1.17	0.004	0.28	0.95
<p>Bold = exceeds statewide average for similar facilities</p> <p>MVM = Million Vehicle Miles MV = Million Vehicles</p> <p>Accident rates are expressed as # of accidents/MVM¹</p> <p>¹For mainline segments, MVM is used for accident rates. For ramps, MV is used for accident rates.</p>								

Chapter 3.0

2040 NO-BUILD ANALYSIS

This chapter evaluates the 2040 traffic forecasts for the No-Build Alternative (also referred to as “Alternative 1”). The information addresses freeway mainline segments, interchange ramps, and intersections including the No-Build (existing) configuration for the Avenida Pico interchange.

3.1 FREEWAY MAINLINE ANALYSIS – 2040 NO-BUILD

Table 3-1 summarizes the 2040 performance analysis results for the freeway mainline segments. For this No-Build Alternative, the following segments of the project area have mainline general purpose lanes at LOS “E” or “F”:

- Northbound between Vista Hermosa and Camino De Los Mares (AM & PM)
- Northbound between SR-1 (PCH)/Camino Las Ramblas and Camino Capistrano/Stonehill (AM)
- Northbound between Camino Capistrano/Stonehill and San Juan Creek Road (AM & PM)
- Southbound between Vista Hermosa and Camino De Estrella (AM & PM)
- Southbound between Camino De Estrella and SR-1 (PCH)/Camino Las Ramblas (PM)
- Southbound between Camino Capistrano/Stonehill and San Juan Creek Road (PM)

Outside of the project area, the following segments have mainline general purpose lanes at LOS “E” or “F”:

- Northbound between San Juan Creek Road and Ortega Highway (AM & PM)
- Northbound between Ortega Highway and Junipero Serra Road (AM & PM)
- Northbound between Junipero Serra Road and SR-73 (AM)
- Southbound between San Juan Creek Road and Ortega Highway (PM)
- Southbound between Ortega Highway and Junipero Serra Road (PM)
- Southbound between Junipero Serra Road and SR-73 (PM)

Outside of the project area, the following two HOV segments have volumes that exceed 1,600 vph/lane:

- Southbound between Ortega Highway and Junipero Serra Road (PM)
- Southbound between Junipero Serra Road and SR-73 (PM)

Table 3-1: Freeway Mainline LOS Summary – 2040 Conditions, Alternative 1 (No-Build)

Location	Lanes			AM Peak Hour						PM Peak Hour					
				Mainline				HOV		Mainline				HOV	
	HOV	GP	Aux	Vol	Speed	Density	LOS	Vol	V/C ¹	Vol	Speed	Density	LOS	Vol	V/C ¹
NORTHBOUND															
NB Mainline s/o Cristianitos	0	4	0	6,010	68.8	24.8	C	0	--	6,290	68.0	26.3	D	0	--
NB Mainline s/o Avd Magdalena	0	4	0	6,170	68.3	25.6	C	0	--	6,340	67.9	26.5	D	0	--
NB Mainline s/o El Camino Real	0	4	1	6,700	69.7	22.2	C	0	--	6,550	69.8	21.7	C	0	--
NB Mainline s/o Avd Presidio	0	4	1	7,160	69.3	23.5	C	0	--	6,810	69.7	22.2	C	0	--
NB Mainline s/o Avd de la Paz	0	4	0	7,220	63.8	32.1	D	0	--	6,700	66.5	28.6	D	0	--
Begin Project															
NB Mainline s/o Avd Pico	0	4	1	8,120	67.3	27.4	D	0	--	7,410	68.9	24.4	C	0	--
NB Mainline s/o Vista Hermosa	0	4	1	8,570	65.8	29.6	D	0	--	8,090	67.4	27.2	D	0	--
NB Mainline s/o Camino De Los Mares	0	4	0	9,760	<53.3	>45.0	F	0	--	8,840	<53.3	>45.0	F	0	--
NB Mainline s/o SR-1 (PCH)/Camino Las Ramblas	0	4	2	11,140	62.5	33.7	D	0	--	9,170	68.5	25.3	C	0	--
NB Mainline s/o Camino Capistrano/Stonehill	1	4	0	9,390	<53.3	>45.0	F	1,150	0.52	7,210	63.9	32.0	D	960	0.44
NB Mainline s/o San Juan Creek	1	4	1*	10,920	<53.3	>45.0	F	1,150	0.52	8,890	<53.3	>45.0	F	960	0.44
End Project															
NB Mainline s/o Ortega Hwy	1	4	0	10,930	<53.3	>45.0	F	1,240	0.56	8,630	<53.3	>45.0	F	1,150	0.52
NB Mainline s/o Junipero Serra	1	5	0	11,580	<53.3	>45.0	F	1,320	0.60	9,530	61.1	35.4	E	1,240	0.56
NB Mainline s/o SR-73 Junction	1	4	2	12,070	57.5	39.7	E	1,400	0.64	10,030	66.6	28.5	D	1,340	0.61

(Continued)

Table 3-1: Freeway Mainline LOS Summary – 2040 Conditions, Alternative 1 (No-Build) (Cont.)

Location	Lanes			AM Peak Hour						PM Peak Hour					
				Mainline				HOV		Mainline				HOV	
	HOV	GP	Aux	Vol	Speed	Density	LOS	Vol	V/C ¹	Vol	Speed	Density	LOS	Vol	V/C ¹
SOUTHBOUND															
SB Mainline s/o Cristianitos	0	4	0	6,360	67.8	26.6	D	0	--	6,910	65.5	29.9	D	0	--
SB Mainline s/o Avd Calafia	0	4	0	6,680	66.6	28.5	D	0	--	7,020	65.0	30.7	D	0	--
SB Mainline s/o El Camino Real	0	4	1	6,880	69.6	22.5	C	0	--	7,700	68.4	25.6	C	0	--
SB Mainline s/o Avd Presidio	0	4	1	7,190	69.3	23.6	C	0	--	8,270	66.9	28.1	D	0	--
SB Mainline s/o Avd Palizada	0	5	0	6,690	69.7	21.8	C	0	--	7,980	67.7	26.8	D	0	--
Begin Project															
SB Mainline s/o Avd Pico	0	5	1	7,690	69.7	22.1	C	0	--	9,220	67.3	27.4	D	0	--
SB Mainline s/o Vista Hermosa	0	4	1	8,200	67.1	27.8	D	0	--	9,360	62.1	34.2	D	0	--
SB Mainline s/o Camino De Estrella	0	4	0	8,980	<53.3	>45.0	F	0	--	10,620	<53.3	>45.0	F	0	--
SB Mainline s/o SR-1 (PCH)/Camino Las Ramblas	0	4	1	9,220	62.9	33.3	D	0	--	11,340	<53.3	>45.0	F	0	--
SB Mainline s/o Camino Capistrano/Stonehill	0	5	1	8,640	69.2	23.6	C	0	--	11,050	62.9	33.2	D	0	--
SB Mainline s/o San Juan Creek	0	5	0	8,640	65.5	29.9	D	0	--	11,050	<53.3	>45.0	F	0	--
End Project															
SB Mainline s/o Ortega Hwy	1	4	0	7,520	61.9	34.5	D	1,440	0.65	10,310	<53.3	>45.0	F	1,580	0.72
SB Mainline s/o Junipero Serra	1	4	1	8,570	65.8	29.6	D	1,430	0.65	11,650	<53.3	>45.0	F	1,690	0.77
SB Mainline s/o SR-73 Junction	1	5	1	8,880	68.9	24.4	C	1,480	0.67	12,650	53.6	44.7	E	1,640	0.75
HOV – High Occupancy Vehicle Lane GP – General Purpose Lane AUX – Auxiliary Lane Bold = Level of service (LOS) “E” or “F” (mainline), or exceeds 1,600 vph/ln (HOV) ¹ V/C ratios calculated based on a maximum capacity for the HOV lane of 2,200 vph/ln, the maximum desired HOV lane volume is 1,600 vph/ln (see Table 1-2). *Auxiliary lane that is not continuous between successive off/on ramps and does not add mainline capacity.															

The 12 occurrences of mainline segments at LOS “E” or “F” is an increase from four occurrences for existing conditions. Six of the 12 occurrences are within the project limits. The number of occurrences of HOV lane volumes exceeding 1,600 vph/lane increases from none for existing to two for 2040 No-Build conditions, both of which are outside of the project limits.

3.2 RAMP AND RAMP-FREEWAY JUNCTION ANALYSIS – 2040 NO-BUILD

Year 2040 ramp volumes and V/C’s are summarized in Table 3-2 for 2040 no-build conditions. The following ramps are found to have V/C ratios greater than 1.0:

- Avenida Pico Northbound On-Ramp (PM)
- Ortega Hwy Northbound On-Ramp (AM & PM)
- Junipero Serra Northbound On-Ramp (AM)
- Vista Hermosa Southbound Off-Ramp (PM)
- SR-1 (PCH)/Camino Las Ramblas Southbound On-Ramp (AM & PM)

Three of the five ramps listed above are within the project limits.

The 2040 merge/diverge analysis results for the No-Build Alternative are given in Table 3-3. All interchanges, with the exception of the Calafia/Magdalena interchange, show at least one occurrence of entry or exit ramps with LOS “E” or “F,” and five of these interchanges are within the project limits.

The 2040 weaving analysis results for the No-Build Alternative are summarized in Table 3-4 (worksheets are in Appendix E and K, for Avenida Pico). Six of the nine weave sections show LOS “E” or “F,” three of which are within the project limits.

3.3 INTERSECTION ANALYSIS – 2040 NO-BUILD

Year 2040 intersection lane configurations for the No-Build Alternative assume existing conditions except for select locations in which future lane improvements were assumed per committed improvement projects. A listing of the existing and 2040 intersection lane configurations is provided in Section 4.3.

Peak hour intersection turning movement volumes for year 2040 are shown in Appendix C. The peak hour intersection levels of service were calculated using the performance criteria presented earlier, and are presented in Table 3-5 for interchange locations and in Table 3-6 for City intersections (actual

Table 3-2: Ramp Volume and Capacity Summary – 2040 Conditions, Alternative 1 (No-Build)

Location	Northbound							Location	Southbound						
	Lanes		Cap	AM Pk. Hr.	V/C Ratio	PM Pk. Hr.	V/C Ratio		Lanes		Cap	AM Pk. Hr.	V/C Ratio	PM Pk. Hr.	V/C Ratio
	R.	Aux							R.	Aux					
I-5															
Cristianitos NB Off	1	0	1,500	240	0.16	220	0.15	Cristianitos SB On	1	0	1,500	160	0.11	340	0.23
Cristianitos NB On	1	0	1,500	400	0.27	270	0.18	Cristianitos SB Off	1	0	1,500	480	0.32	450	0.30
Avd Magdalena NB Off	1	0	1,500	210	0.14	240	0.16	Avd Calafia SB On	1	0	900	130	0.14	90	0.10
Avd Magdalena NB On	1	1	900	740	0.82	450	0.50	Avd Calafia SB Off	1	1	1,500	330	0.22	770	0.51
El Camino Real NB Off	1	1	1,500	190	0.13	300	0.20	El Camino Real SB On	1	1	1,500	200	0.13	310	0.21
El Camino Real NB On	1	1	1,080	650	0.60	560	0.52	El Camino Real SB Off	1	1	1,500	510	0.34	880	0.59
Avd Presidio NB Off	1	1	1,500	470	0.31	540	0.36	Avd Presidio SB On	1	1	900	500	0.56	290	0.32
Avd Presidio NB On	1	0	1,080	530	0.49	430	0.40								
Avd de la Paz NB On	1	1	1,500	900	0.60	710	0.47	Avd Palizada SB Off	1	1	1,500	1,000	0.67	1,240	0.83
Begin Project															
Avd Pico NB Off	1	1	1,500	830	0.55	900	0.60	Avd Pico SB On	1	1	1,500	740	0.49	960	0.64
Avd Pico NB On	1	1	1,500	1,280	0.85	1,580	1.05	Avd Pico SB Off	1.5	1	2,250	1,250	0.56	1,100	0.49
Vista Hermosa NB Off	1	0	1,500	520	0.35	600	0.40	Vista Hermosa SB On	1	1	1,500	520	0.35	430	0.29
Vista Hermosa NB Loop On	1	0	1,500	300	0.20	320	0.21	Vista Hermosa SB Off	1	0	1,500	1,300	0.87	1,690	1.13
Vista Hermosa NB Direct On	1	0	1,500	1,410	0.94	1,030	0.69								
Camino De Los Mares NB Off	1	0	1,500	470	0.31	820	0.55	Camino De Estrella SB On	1	0	1,500	590	0.39	770	0.51
Camino De Los Mares NB Loop On	1	1	900	470	0.52	330	0.37	Camino De Estrella SB Off	1	1	1,500	830	0.55	1,490	0.99
Camino De Los Mares NB Direct On	1	1	1,500	1,380	0.92	820	0.55								

(Continued)

Table 3-2: Ramp Volume and Capacity Summary – 2040 Conditions, Alternative 1 (No-Build) (Continued)

Location	Northbound							Location	Southbound						
	Lanes		Cap	AM Pk. Hr.	V/C Ratio	PM Pk. Hr.	V/C Ratio		Lanes		Cap	AM Pk. Hr.	V/C Ratio	PM Pk. Hr.	V/C Ratio
	R.	Aux							R.	Aux					
I-5 (cont.)															
SR-1 (PCH)/Camino Las Ramblas NB Off	1.5	1	2,250	1,410	0.63	1,640	0.73	SR-1 (PCH)/Camino Las Ramblas SB On	1	0	900	1,180	1.31	1,380	1.53
SR-1 (PCH)/Camino Las Ramblas NB On	1	0	1,500	810	0.54	640	0.43	SR-1 (PCH)/Camino Las Ramblas SB Loop On	1	0	900	230	0.26	190	0.21
								SR-1 (PCH)/Camino Las Ramblas SB Off	1.5	1	2,250	830	0.37	1,280	0.57
Camino Capistrano/Stonehill NB On	1.5	1	1,800	1,530	0.85	1,680	0.93								
San Juan Creek NB Off	1	0	1,500	690	0.46	550	0.37	San Juan Creek SB On	1	0	1,500	750	0.50	600	0.40
San Juan Creek NB On	1	0	1,500	790	0.53	480	0.32	San Juan Creek SB Off	1	1	1,500	1,070	0.71	1,440	0.96
End Project															
Ortega NB Off	1	0	1,500	1,180	0.79	940	0.63	Ortega SB On	1	1	1,500	760	0.51	760	0.51
Ortega NB On	1	1	1,500	1,910	1.27	1,930	1.29	Ortega SB Off	1.5	1	2,250	1,800	0.80	2,210	0.98
Junipero Serra NB Off	1	0	1,500	610	0.41	390	0.26	Junipero Serra SB On	1	0	1,080	500	0.46	530	0.49
Junipero Serra NB On	1	1	1,080	1,180	1.09	990	0.92	Junipero Serra SB Off	1	1	1,500	860	0.57	1,480	0.99
<p>Bold = exceeds volume/capacity ratio of 1.0</p> <p>R. = Ramp termini lanes - 1.5 denotes a two-lane off-ramp with one dedicated and one optional lane, or a two-lane on-ramp entering the freeway as one merge lane and an auxiliary lane</p> <p>Aux. = Auxiliary lanes</p> <p>Cap. = Capacity</p>															

Table 3-3: Ramp Merge/Diverge Analysis Summary – 2040 Conditions, Alternative 1 (No-Build)

Location	AM Peak Hour				PM Peak Hour			
	Volumes		Density	LOS	Volumes		Density	LOS
	Fwy.	Ramp			Fwy.	Ramp		
I-5 at Cristianitos								
NB Diverge	6010	240	30.3	D	6920	220	34.0	D
NB Merge	5770	400	27.6	C	6070	270	27.5	C
SB Diverge	6680	480	34.4	D	7020	450	35.7	E
SB Merge	6200	160	27.3	C	6570	340	30.1	D
I-5 at Calafia/Magdalena								
NB Diverge	6170	210	30.8	D	6340	240	31.7	D
SB Merge	6810	130	29.3	D	6930	90	29.4	D
I-5 at Vista Hermosa								
NB Merge	8350	1410	44.9	F	7810	1030	39.8	F
SB Diverge	8980	1300	48.7	F	10620	1690	60.6	F
I-5 at Camino de Los Mares/Estrella								
NB Diverge	9760	470	52.2	F	8840	820	45.5	F
SB Diverge	9220	830	34.6	F	11340	1490	55.1	F
SB Merge	8390	590	39.5	F	9850	770	46.2	F
I-5 at SR-1 (PCH)/Camino Las Ramblas								
NB Merge	9030	360	39.2	F	6690	220	29.8	D
SB Diverge	8640	830	26.4	C	11050	1280	37.1	F
SB Merge	8040	1180	33.8	D	9960	1380	42.3	F
I-5 at Camino Capistrano/Stonehill								
NB Merge	9390	1530	45.5	F	7210	1680	39.1	F
I-5 at San Juan Creek								
NB Diverge	10920	690	63.6	F	8890	550	44.2	F
NB Merge	10230	790	46.6	F	8340	480	37.3	F
SB Diverge	7520	1070	41.3	E	10310	1440	57.6	F
SB Merge	6450	750	33.3	D	8870	600	40.6	F
I-5 at Ortega Highway								
NB Diverge	10930	1180	63.7	F	8630	940	45.3	F
NB Merge	9750	1910	46.5	F	7690	1930	39.4	F
SB Diverge	8570	1800	37.2	F	11650	2210	58.1	F
SB Merge	6760	760	35.1	E	9550	760	45.0	F
I-5 at Junipero Serra								
NB Diverge	11580	610	47.4	F	9530	390	38.0	E
NB Merge	10970	1180	37.0	F	9530	390	25.3	C
SB Diverge	8880	860	25.7	C	12650	1480	43.1	F
SB Merge	8070	500	29.5	D	11120	530	40.5	F
LOS Criteria based on Density (pc/mi/ln): A ≤ 10 D > 28 - 35 B > 10 - 20 E > 35 C > 20 - 28 F Demand exceeds capacity (mainline or ramp)								
Bold = Level of service (LOS) "E" or "F"								

Table 3-4: Weaving Section LOS Summary – 2040 Conditions, Alternative 1 (No-Build)

Location	AM Peak Hour			PM Peak Hour														
	Speed	Density	LOS	Speed	Density	LOS												
NORTHBOUND																		
NB – Magdalena to El Camino Real	52.1	29.3	D	53.9	27.7	C												
NB – El Camino Real to Presidio	56.2	29.0	D	56.7	27.3	C												
NB – Palizada to Pico	52.7	35.1	E	54.0	31.1	D												
NB – Pico to Vista Hermosa	49.9	39.1	E	46.8	39.4	E												
NB – Cm de Los Mares to SR-1 (PCH)/Camino Las Ramblas	53.7	40.7	E	54.9	32.5	D												
SOUTHBOUND																		
SB – El Camino Real to Magdalena	63.2	24.8	C	58.9	29.8	D												
SB – Presidio to El Camino Real	47.6	34.4	D	45.0	41.8	E												
SB – Pico to Palizada	50.9	29.1	D	47.4	37.5	E												
SB – Vista Hermosa to Pico	53.1	34.8	D	54.7	38.9	E												
<p>LOS Criteria based on Density (pc/mi/ln):</p> <table> <tr> <td>A</td> <td>≤ 10</td> <td>D</td> <td>> 28 - 35</td> </tr> <tr> <td>B</td> <td>> 10 - 20</td> <td>E</td> <td>> 35</td> </tr> <tr> <td>C</td> <td>> 20 - 28</td> <td>F</td> <td>Demand exceeds capacity</td> </tr> </table> <p>Bold = Level of service (LOS) “E” or “F”</p>							A	≤ 10	D	> 28 - 35	B	> 10 - 20	E	> 35	C	> 20 - 28	F	Demand exceeds capacity
A	≤ 10	D	> 28 - 35															
B	> 10 - 20	E	> 35															
C	> 20 - 28	F	Demand exceeds capacity															

Table 3-5: Intersection LOS Summary (Interchanges) – 2040 Conditions, Alternative 1 (No-Build)

Location	AM Peak Hour		PM Peak Hour	
	Delay	LOS	Delay	LOS
1. I-5 SB Ramps & Junipero Serra	20.9	C	42.0	D
2. I-5 NB Ramps & Junipero Serra	14.5	B	19.7	B
3. I-5 SB Ramps & Ortega Hwy	26.4	C	36.2	D
4. I-5 NB Ramps & Ortega Hwy	25.3	C	19.2	B
5. Camino Capistrano & I-5 SB Ramps	78.8	E	152.0	F
6. Valle Rd & I-5 NB Ramps	22.5 ¹	C ¹	40.0 ¹	E ¹
7. I-5 SB Ramps & Las Ramblas	3.2	A	5.2	A
8. I-5 NB Ramps & Las Ramblas	6.5	A	6.9	A
9. I-5 SB Ramps & Camino De Estrella	18.6	B	33.0	C
10. I-5 NB Ramps & Camino De Estrella	13.7	B	15.5	B
11. I-5 SB Ramps & Avd Vista Hermosa	18.0	B	17.6	B
12. I-5 NB Ramps & Avd Vista Hermosa	8.9	A	7.3	A
13. I-5 SB Ramps & Avd Pico	46.2	D	73.4	E
14. I-5 NB Ramps & Avd Pico	15.1	B	63.5	E
15. I-5 SB Ramps & Avd Palizada	8.9	A	9.0	A
16. I-5 NB Ramp & Avd Palizada	67.1 ²	F ²	40.6 ²	E ²
17. I-5 SB Ramps & Avd Presidio	74.8 ³	F ³	36.7 ³	E ³
18. I-5 NB Ramps & Avd Presidio	15.7	B	16.7	B
19. I-5 SB Ramps & El Camino Real/Valencia	14.3	B	19.3	B
20. I-5 NB Ramps & El Camino Real	5.2	A	5.9	A
21. S. El Camino Real & I-5 NB Ramps	>300 ³	F ³	189.7 ³	F ³
22. Avd Presidente & Avd Calafia	12.8 ¹	B ¹	31.5 ¹	D ¹
23. I-5 NB Ramps & Cristianitos	28.7 ³	D ³	42.4 ³	E ³
24. I-5 SB Ramps & Cristianitos	32.1 ³	D ³	288.5 ³	F ³

LOS Criteria based on Average Delay (sec/veh):

LOS	Average Delay
A	0.0 – 10.0
B	10.1 – 20.0
C	20.1 – 35.0
D	35.1 – 55.0
E	55.1 – 80.0
F	> 80.0

Bold = exceeds performance standard of level of service (LOS) “D”
>300 – delay is greater than 300 sec/veh

¹All-way stop – delay represents the intersections average vehicle delay
²Yield – delay represents the yielding movement with highest approach delay
³Two-way stop – delay represents the movement with highest control delay

Table 3-6: Intersection LOS Summary (City Locations) – 2040 Conditions, Alternative 1 (No-Build)

Location	AM Peak Hour		PM Peak Hour	
	ICU	LOS	ICU	LOS
25. Camino Capistrano & Junipero Serra	.52	A	.54	A
26. Rancho Viejo & Junipero Serra	.88	D	.78	C
27. Del Obispo & Ortega	.55	A	.67	B
28. Rancho Viejo & Ortega	.77	C	.94	E
29. La Pata & Ortega	.74	C	.73	C
30. Camino Capistrano & Del Obispo	.95	E	.90	D
31. Camino Capistrano & San Juan Crk	.65	B	.70	B
32. Valle & San Juan Creek	.75	C	.79	C
33. La Novia & San Juan Creek	.77	C	.74	C
34. Del Obispo & Stonehill	.79	C	.72	C
35. Camino Capistrano & Stonehill	.90	D	.84	D
36. Camino Mira Costa & Camino Estrella	.35	A	.36	A
37. Avd Vaquero & Camino De Los Mares	.44	A	.41	A
38. Camino Vera Cruz & Camino De Los Mares	.34	A	.34	A
39. Camino Del Rio & Camino De Los Mares	.38	A	.32	A
40. Camino Vera Cruz & Avd Vista Hermosa	.74	C	.73	C
41. La Pata & Avd Vista Hermosa	.58	A	.58	A
42. N. El Camino Real & Avd Pico	.55	A	.70	B
43. La Pata & Avd Pico	.46	A	.47	A
44. Avd Vista Hermosa & Avd Pico	.44	A	.60	A
45. N. El Camino Real & Avd Palizada	.56	A	.70	B
46. Camino Estrella & Avd Palizada	.53	A	.59	A
47. N. El Camino Real & Avd Presidio/Victoria	.44	A	.46	A

LOS Criteria based on ICU:

<u>LOS</u>	<u>ICU</u>
A	0.00 – 0.60
B	0.61 – 0.70
C	0.71 – 0.80
D	0.81 – 0.90
E	0.91 – 1.00
F	> 1.00

Bold = exceeds performance standard of level of service (LOS) “D”

worksheets are provided in Appendix F and Avenida Pico worksheets are in Appendix L). As can be seen, a total of nine intersections do not meet the performance criteria for 2040 No-Build conditions:

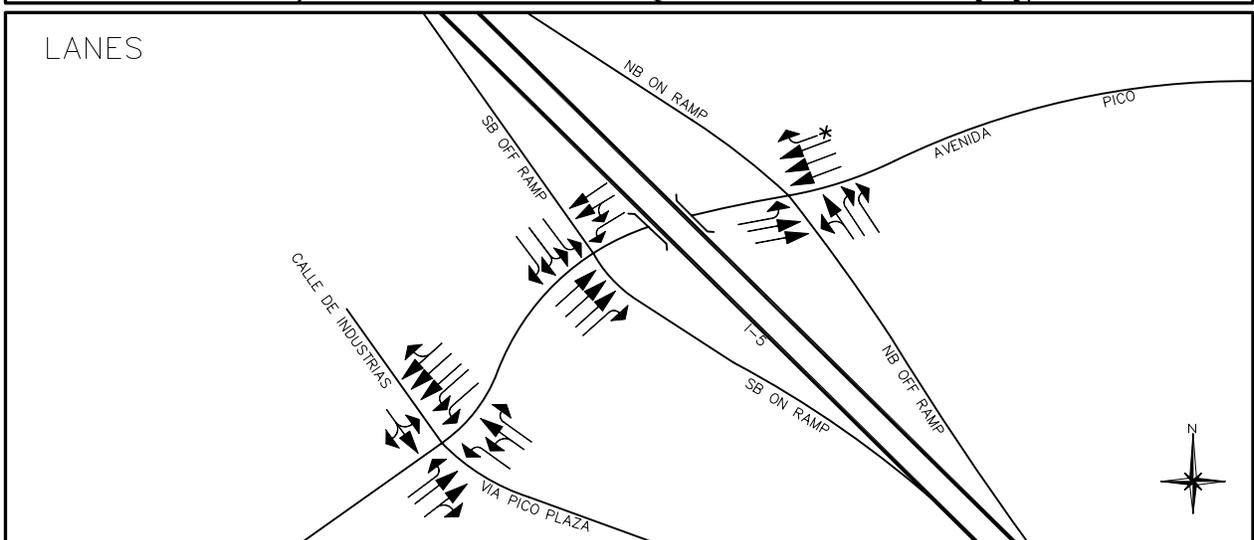
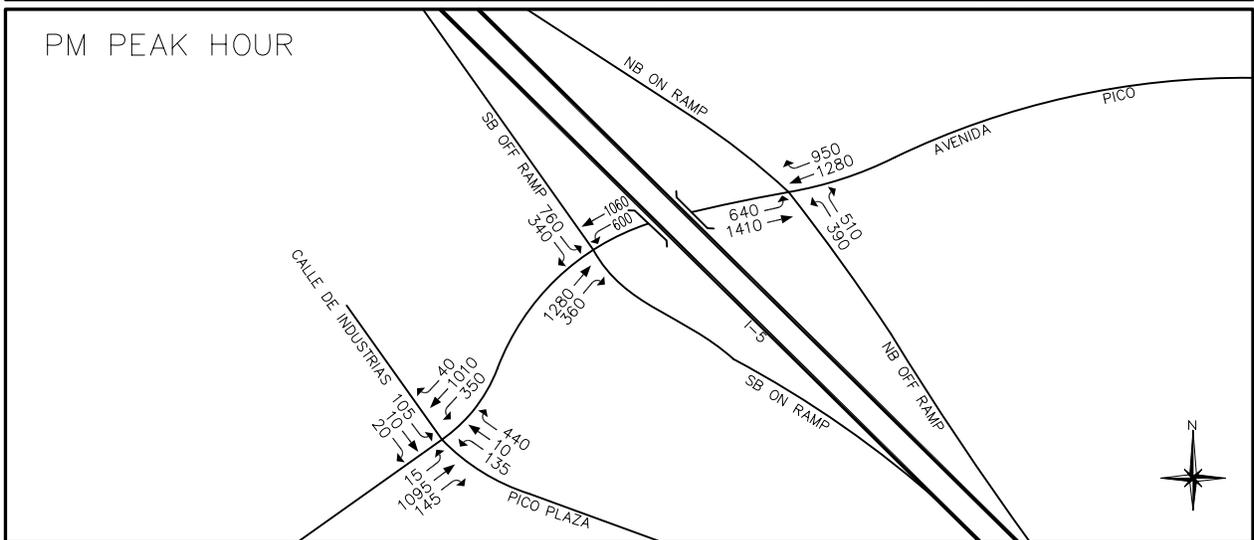
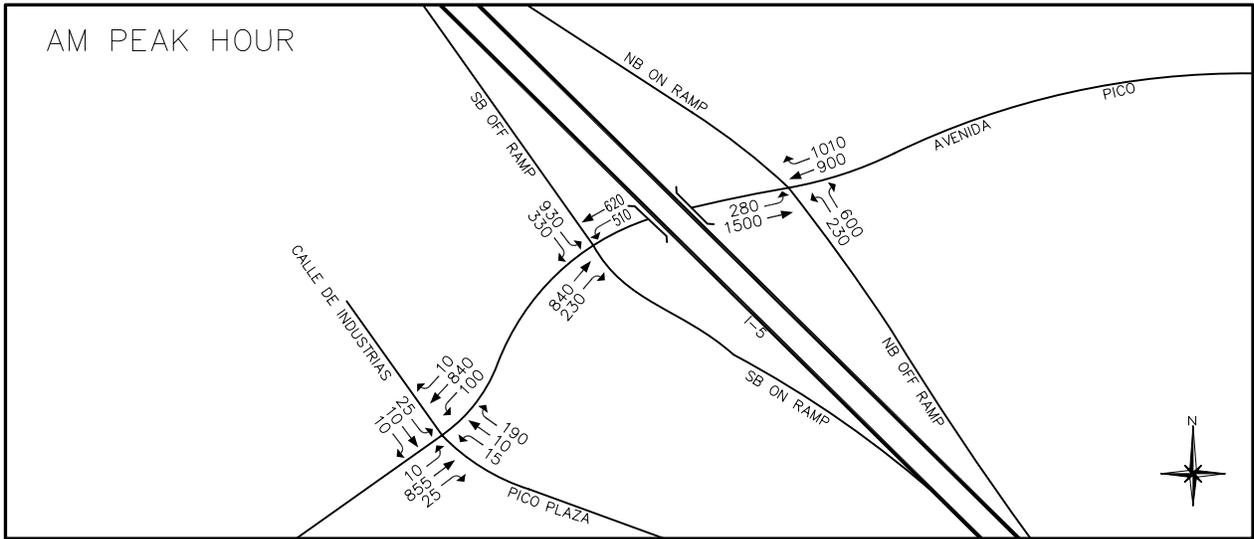
- 1 intersection during just the AM peak hour
- 4 intersections during just the PM peak hour
- 4 intersections during both the AM and PM peak hours

Of these, seven are ramp-arterial junctions (two of which are within the project limits) and two are City intersections.

3.3.1 Avenida Pico Interchange

For the Avenida Pico interchange, year 2040 volumes and lane configurations for the No-Build Alternative can be found in Figure 3-1. The 2040 LOS and ICU values for the intersections and ramps can be found in Table 3-7 (HCM and ICU worksheets are in Appendices L and M respectively). Queuing distances for the interchange intersections are shown in the previously referenced Table 3-7 (see Appendix G for actual worksheets).

The results indicate significant delays at the ramp intersections due to LOS “E” conditions, and certain movements fail due to insufficient storage, as queues cause blockage between intersections. As such, the number of vehicles that can be accommodated through the interchange would be less than the 2040 demand.



Legend

Free right turn

Figure 3-1
2040 VOLUMES AND
LANE CONFIGURATIONS
- NO BUILD

Table 3-7: 2040 Peak Hour Performance – Avenida Pico Interchange No-Build

Intersection	AM Peak Hour		PM Peak Hour									
	Delay	LOS	Delay	LOS								
HCM Delay												
48.Calle de Industrias & Avenida Pico	14.1	B	27.4	C								
13. I-5 SB Ramps & Avenida Pico	46.2	D	73.4	E								
14. I-5 NB Ramps & Avenida Pico	15.1	B	63.5	E								
ICUs												
Intersection	AM Peak Hour		PM Peak Hour									
	ICU	LOS	ICU	LOS								
48.Calle de Industrias & Avenida Pico	0.44	A	0.78	C								
13. I-5 SB Ramps & Avenida Pico	0.71	C	0.86	D								
14. I-5 NB Ramps & Avenida Pico	0.66	B	0.91	E								
<p>Note: Delay is average control delay per vehicle in seconds See Tables 3-5 and 3-6 for LOS criteria</p> <p>Bold = exceeds performance standard of level of service (LOS) “D”</p>												
95 TH PERCENTILE QUEUE LENGTHS												
Intersection	Northbound			Southbound			Eastbound			Westbound		
	L	T	R	L	T	R	L	T	R	L	T	R
13. I-5 Southbound Ramps & Avenida Pico												
Storage Available	--	--	--	1,350'	1,350'	1,075'	--	400'	350'	260'	300'	--
AM	--	--	--	533'	570'	82'	--	282'	78'	587'	495'	--
PM	--	--	--	501'	535'	67'	--	397'	17'	209'	460'	--
14. I-5 Northbound Ramps & Avenida Pico												
Storage Available	930'	--	395'	--	--	--	260'	300'	--	--	1,050'	400'
AM	155'	--	316'	--	--	--	0'	6'	--	--	333'	0'
PM	235'	--	550'	--	--	--	78'	279'	--	--	490'	0'
48. Calle de Industrias & Avenida Pico												
Storage Available	200'	500'	500'	--	560'	--	100'	ND	--	150'	400'	--
AM	26'	21'	40'	--	53'	--	23'	ND	--	38'	32'	--
PM	81'	83'	216'	--	127'	--	30'	ND	--	115'	180'	--
<p>Note: Queue length represents maximum length of queue in the lane with the longest queue. Shaded entries are where available storage is exceeded ND - Not determined since intersection to the west is not included in the network</p>												

Chapter 4.0

2040 BUILD ALTERNATIVES ANALYSIS

This chapter discusses the 2040 analysis results for the Build Alternatives (see Appendix A for lane schematics). In the sections that follow, the performance results are given for each of the roadway components in the study area. The final section in the chapter addresses the two Build design options for the Avenida Pico interchange.

4.1 FREEWAY MAINLINE ANALYSIS – 2040 BUILD

The 2040 freeway mainline analysis results for Alternatives 2, 3 and 4 are summarized in Table 4-1. A comparison between the No-Build and Build Alternatives is given in Table 4-2. As can be seen from this comparison, operational improvements occur in five segments. In two instances, conditions worsen from LOS “D” to LOS “E” due to a reduced number of mainline general purpose or auxiliary lanes in the Build Alternative compared to the No-Build Alternative.

4.2 RAMP AND RAMP-FREEWAY JUNCTION ANALYSIS – 2040 BUILD

The Build Alternatives feature ramp improvements at several locations in comparison to the No-Build Alternative, as shown in Table 4-3. With the Build Alternatives, the following ramp improvements are implemented:

- Avenida Pico Northbound On-Ramp – Ramp lanes increase from 2 to 3 (at meter) for Design Option A and a loop on ramp is added for Design Option B
- Avenida Vista Hermosa Northbound Off-Ramp – Ramp lanes at diverge point increase from 1 to 2 and auxiliary lane is provided
- Avenida Vista Hermosa Northbound (Slip) On-Ramp – Auxiliary lane is provided
- SR-1 (PCH)/Camino Las Ramblas Southbound On-Ramp – Ramp lanes increase from 1 to 2 (at meter) and auxiliary lane is provided
- Camino de Estrella Southbound Off-Ramp – Ramp lanes at diverge point increase from 1 to 2
- Camino de Estrella Southbound On-Ramp – Auxiliary lane is provided
- Avenida Vista Hermosa Southbound Off-Ramp – Ramp lanes at diverge point increase from 1 to 2 and auxiliary lane is provided

Table 4-1: Freeway Mainline LOS Summary – 2040 Conditions, Project Alternatives 2, 3 & 4 (Build)

Location	Lanes			AM Peak Hour						PM Peak Hour					
				Mainline				HOV		Mainline				HOV	
	HOV	GP	Aux	Vol	Speed	Density	LOS	Vol	V/C ¹	Vol	Speed	Density	LOS	Vol	V/C ¹
NORTHBOUND															
NB Mainline s/o Cristianitos	0	4	0	6,010	68.8	24.8	C	0	--	6,290	68.0	26.3	D	0	--
NB Mainline s/o Avd Magdalena	0	4	0	6,170	68.3	25.6	C	0	--	6,340	67.9	26.5	D	0	--
NB Mainline s/o El Camino Real	0	4	1	6,700	69.7	22.2	C	0	--	6,550	69.8	21.7	C	0	--
NB Mainline s/o Avd Presidio	0	4	1	7,170	69.3	23.5	C	0	--	6,820	69.6	22.2	C	0	--
NB Mainline s/o Avd de la Paz	0	4	0	7,250	63.7	32.3	D	0	--	6,730	66.4	28.8	D	0	--
Begin Project															
NB Mainline s/o Avd Pico	0	4	1	8,180	67.1	27.7	D	0	--	7,440	68.9	24.5	C	0	--
NB Mainline s/o Vista Hermosa	1	4	1	7,640	68.5	25.3	C	1,010	0.46	7,420	68.9	24.5	C	720	0.33
NB Mainline s/o Camino De Los Mares	1	4	0	8,750	<53.3	>45.0	F	1,010	0.46	8,090	55.7	42.0	E	820	0.37
NB Mainline s/o SR-1 (PCH)/Camino Las Ramblas	1	4	1	10,090	57.3	40.0	E	1,140	0.52	8,350	66.6	28.5	D	870	0.40
NB Mainline s/o Camino Capistrano/Stonehill	1	4	0	9,340	<53.3	>45.0	F	1,270	0.58	7,180	64.1	31.8	D	1,020	0.46
NB Mainline s/o San Juan Creek	1	4	1*	10,860	<53.3	>45.0	F	1,270	0.58	8,850	<53.3	>45.0	F	1,020	0.46
End Project															
NB Mainline s/o Ortega Hwy	1	4	0	10,870	<53.3	>45.0	F	1,360	0.62	8,580	<53.3	>45.0	F	1,220	0.55
NB Mainline s/o Junipero Serra	1	5	0	11,540	<53.3	>45.0	F	1,440	0.65	9,500	61.3	35.2	E	1,320	0.60
NB Mainline s/o SR-73 Junction	1	4	2	12,030	57.8	39.4	E	1,520	0.69	10,000	66.7	28.4	D	1,420	0.65

(Continued)

Table 4-1: Freeway Mainline LOS Summary – 2040 Conditions, Project Alternatives 2, 3 & 4 (Build) (Cont.)

Location	Lanes			AM Peak Hour						PM Peak Hour					
				Mainline				HOV		Mainline				HOV	
	HOV	GP	Aux	Vol	Speed	Density	LOS	Vol	V/C ¹	Vol	Speed	Density	LOS	Vol	V/C ¹
SOUTHBOUND															
SB Mainline s/o Cristianitos	0	4	0	6,360	67.8	26.6	D	0	--	6,910	65.5	29.9	D	0	--
SB Mainline s/o Avd Calafia	0	4	0	6,680	66.6	28.5	D	0	--	7,020	65.0	30.7	D	0	--
SB Mainline s/o El Camino Real	0	4	1	6,890	69.6	22.5	C	0	--	7,710	68.4	25.6	C	0	--
SB Mainline s/o Avd Presidio	0	4	1	7,210	69.2	23.6	C	0	--	8,300	66.8	28.2	D	0	--
SB Mainline s/o Avd Palizada	0	5	0	6,710	69.7	21.9	C	0	--	8,010	67.6	26.9	D	0	--
Begin Project															
SB Mainline s/o Avd Pico	0	5	1	7,700	69.7	22.1	C	0	--	9,270	67.2	27.6	D	0	--
SB Mainline s/o Vista Hermosa	1	4	1	7,510	68.8	24.8	C	720	0.33	8,030	67.6	27.0	D	1,400	0.64
SB Mainline s/o Camino De Estrella	1	4	0	8,060	57.4	39.9	E	970	0.44	9,210	<53.3	>45.0	F	1,500	0.68
SB Mainline s/o SR-1 (PCH)/Camino Las Ramblas	1	4	1	8,090	67.4	27.2	D	1,180	0.54	9,870	58.9	38.1	E	1,580	0.72
SB Mainline s/o Camino Capistrano/Stonehill	1	4	1	7,300	69.1	24.0	C	1,370	0.62	9,480	61.4	35.1	E	1,680	0.76
SB Mainline s/o San Juan Creek	1	4	0	7,300	63.4	32.7	D	1,370	0.62	9,480	<53.3	>45.0	F	1,680	0.76
End Project															
SB Mainline s/o Ortega Hwy	1	4	0	7,490	62.1	34.2	D	1,490	0.68	10,240	<53.3	>45.0	F	1,730	0.79
SB Mainline s/o Junipero Serra	1	4	1	8,560	65.9	29.5	D	1,540	0.70	11,640	<53.3	>45.0	F	1,750	0.80
SB Mainline s/o SR-73 Junction	1	5	1	8,860	69.0	24.3	C	1,590	0.72	12,620	53.8	44.4	E	1,700	0.77
HOV – High Occupancy Vehicle Lane GP – General Purpose Lane AUX – Auxiliary Lane Bold = Level of service (LOS) “E” or “F” (mainline), or exceeds 1,600 vph/ln (HOV) ¹ V/C ratios calculated based on a maximum capacity for the HOV lane of 2,200 vph/ln, the maximum desired HOV lane volume is 1,600 vph/ln (see Table 1-2). * Auxiliary lane that is not continuous between successive off/on ramps and does not add mainline capacity.															

Table 4-2: Freeway Mainline LOS Comparison – Project Area

	AM Peak Hour LOS		PM Peak Hour LOS	
	No-Build	Build	No-Build	Build
NORTHBOUND				
NB s/o Avd Pico	D	D	C	C
NB s/o Vista Hermosa	D	C	D	C
NB s/o Camino De Los Mares	F	F	F	E
NB s/o SR-1 (PCH)/Cm Las Ramblas	D	E*	C	D*
NB s/o Camino Capistrano/Stonehill	F	F	D	D
NB s/o San Juan Creek	F	F	F	F
SOUTHBOUND				
SB s/o Avd Pico	C	C	D	D
SB s/o Vista Hermosa	D	C	D	D
SB s/o Camino De Estrella	F	E	F	F
SB s/o SR-1 (PCH)/Cm Las Ramblas	D	D	F	E
SB s/o Camino Capistrano/Stonehill	C	C	D	E*
SB s/o San Juan Creek	D	D	F	F
<p>Bold = Level of service (LOS) “E” or “F” Shading = LOS improved compared to No-Build * LOS worsens compared to No-Build</p>				

Table 4-3: Ramp Lanes Comparison – Project Area

Northbound Lanes					Southbound Lanes				
Location	No-Build		Build		Location	No-Build		Build	
	R	Aux	R	Aux		R	Aux	R	Aux
Avd Pico NB Off	1	1	1	1	Avd Pico SB On	1	1	1	1
Avd Pico NB On – Option A	1	1	1.5	1	Avd Pico SB Off	1.5	1	1.5	1
Avd Pico NB On (Slip) - Option B	1	1	1	0					
Avd Pico NB On (Loop) - Option B	N/A	N/A	1.5	1					
Vista Hermosa NB Off	1	0	1.5	1	Vista Hermosa SB On	1	1	1	1
Vista Hermosa NB Loop On	1	0	1	0	Vista Hermosa SB Off	1	0	1.5	1
Vista Hermosa NB Direct On	1	0	1	1					
Camino De Los Mares NB Off	1	0	1	0	Camino De Estrella SB On	1	0	1	1
Camino De Los Mares NB Loop On	1	1	1	0	Camino De Estrella SB Off	1	1	1.5	1
Camino De Los Mares NB Direct On	1	1	1	1					
SR-1 (PCH)/Camino Las Ramblas NB Off	1.5	1	1.5	1	SR-1 (PCH)/Camino Las Ramblas SB On	1	0	1	1
SR-1 (PCH)/Camino Las Ramblas NB On	1	0	1	0	SR-1 (PCH)/Camino Las Ramblas SB Loop On	1	0	1	0
					SR-1 (PCH)/Camino Las Ramblas SB Off	1.5	1	1.5	1
San Juan Creek NB Off	1	0	1	0	San Juan Creek SB On	1	0	1	0

Bold = change from No-Build Alternative Aux. = Auxiliary lanes

R = Ramp termini lanes – 1.5 denotes a two lane off-ramp with one dedicated lane (auxiliary lane) and one optional lane, or a two lane on-ramp entering the freeway as one merge lane and one auxiliary lane

In addition to the ramp improvements noted above, the following change also occurs at the ramps with the implementation of the additional mainline lanes:

- Camino de Estrella Northbound Loop On-Ramp – The northbound lane that is added after this ramp under existing conditions is added at Avenida Pico with the Build Alternative (it replaces the lane that is taken up as the HOV lane).

The ramp V/C analysis results for Alternatives 2, 3 and 4 are summarized in Table 4-4. Two ramps show a V/C ratio greater than 1.0 (Ortega Highway northbound on-ramp and Junipero Serra northbound off-ramp).

The merge/diverge analysis results for Alternatives 2, 3 and 4 are given in Table 4-5. A comparison of the LOS values for the Build Alternatives and the No-Build Alternative is given in Table 4-6. As can be seen, the ramp-freeway junction improvements for the Build Alternatives result in improved LOS at many of the ramp-freeway junctions.

At the northbound off-ramp at San Juan Creek Road, a comparison to the no-build volumes presented in the prior Chapter indicates that the ramp volumes at that location are not affected by the HOV lane extension (the AM volume shows a decrease of 10 vehicles per hour and the PM volume is unchanged). The ramp V/C analysis referenced above shows that the additional capacity provided by an auxiliary lane is not needed to accommodate the ramp volumes. As such, the HOV lane extension does not result in the need to construct an auxiliary lane for the San Juan Creek Road off-ramp.

Table 4-7 summarizes the weaving analysis results for the Build Alternatives, which has four weaving sections at LOS “E”, and no segments at LOS “F” (see Appendix E). In comparison, the No-Build Alternative has six weaving sections at LOS “E”. The table also summarizes weaving for the Avenida Pico interchange per design option which is further discussed later in this chapter. As can be seen, there are two weaving sections at LOS “E” for both design options at the Avenida Pico interchange (weaving worksheets can be seen in Appendix K).

4.3 INTERSECTION ANALYSIS – 2040 BUILD

Lane configurations at the interchange intersections are listed in Table 4-8 for the existing, the future No-Build and the future Build Alternatives. The 2040 intersection LOS results for the Build Alternatives are summarized in Table 4-9 for interchange locations and in Table 4-10 for City intersections (actual worksheets are provided in Appendix F).

With the Build Alternatives, the LOS at the following ramp intersection improves:

- I-5 Southbound Ramps & Ortega Highway – LOS D to LOS C (PM)

Text continued on Page 4-21

Table 4-4: Ramp Volume and Capacity Summary – 2040 Conditions, Project Alternatives 2, 3 and 4 (Build)

Location	Northbound							Location	Southbound						
	Lanes		Cap	AM Pk. Hr.	V/C Ratio	PM Pk. Hr.	V/C Ratio		Lanes		Cap	AM Pk. Hr.	V/C Ratio	PM Pk. Hr.	V/C Ratio
	R.	Aux							R.	Aux					
I-5															
Cristianitos NB Off	1	0	1,500	240	0.16	220	0.15	Cristianitos SB On	1	0	1,500	150	0.10	330	0.22
Cristianitos NB On	1	0	1,500	400	0.27	270	0.18	Cristianitos SB Off	1	0	1,500	470	0.31	440	0.29
Avd Magdalena NB Off	1	0	1,500	200	0.13	230	0.15	Avd Calafia SB On	1	0	900	130	0.14	90	0.10
Avd Magdalena NB On	1	1	900	730	0.81	440	0.49	Avd Calafia SB Off	1	1	1,500	340	0.23	780	0.52
El Camino Real NB Off	1	1	1,500	190	0.13	300	0.20	El Camino Real SB On	1	1	1,500	200	0.13	310	0.21
El Camino Real NB On	1	1	1,080	660	0.61	570	0.53	El Camino Real SB Off	1	1	1,500	520	0.35	900	0.60
Avd Presidio NB Off	1	1	1,500	470	0.31	540	0.36	Avd Presidio SB On	1	1	900	500	0.56	290	0.32
Avd Presidio NB On	1	0	1,080	550	0.51	450	0.42								
Avd de la Paz NB On	1	1	1,500	930	0.62	710	0.47	Avd Palizada SB Off	1	1	1,500	990	0.66	1,260	0.84
Begin Project															
Avd Pico NB Off	1	1	1,500	820	0.55	890	0.59	Avd Pico SB On	1	1	1,500	730	0.49	950	0.63
Avd Pico NB On – Option A	1.5	1	1,800	1,290	0.72	1,590	0.88	Avd Pico SB Off	1.5	1	2,250	1,260	0.56	1,110	0.49
Avd Pico NB On (Slip) - Option B	1	0	1,500	1,060	.71	1,020	.68								
Avd Pico NB On (Loop) - Option B	1.5	1	1,800	230	.13	570	.32								
Vista Hermosa NB Off	1.5	1	2,250	510	0.23	590	0.26	Vista Hermosa SB On	1	1	1,500	510	0.34	420	0.28
Vista Hermosa NB Loop On	1	0	1,500	300	0.20	320	0.21	Vista Hermosa SB Off	1.5	1	2,250	1,310	0.58	1,700	0.76
Vista Hermosa NB Direct On	1	1	1,500	1,420	0.95	1,040	0.69								
Camino De Los Mares NB Off	1	0	1,500	470	0.31	830	0.55	Camino De Estrella SB On	1	1	1,500	580	0.39	760	0.51
Camino De Los Mares NB Loop On	1	0	900	470	0.52	330	0.37	Camino De Estrella SB Off	1.5	1	2,250	820	0.36	1,500	0.67
Camino De Los Mares NB Direct On	1	0	1,500	1,370	0.91	810	0.54								

(Continued)

Table 4-4: Ramp Volume and Capacity Summary – 2040 Conditions, Project Alternatives 2, 3 and 4 (Build) (Continued)

Location	Northbound							Location	Southbound						
	Lanes		Cap	AM Pk. Hr.	V/C Ratio	PM Pk. Hr.	V/C Ratio		Lanes		Cap	AM Pk. Hr.	V/C Ratio	PM Pk. Hr.	V/C Ratio
	R.	Aux							R.	Aux					
I-5 (cont.)															
SR-1 (PCH)/Camino Las Ramblas NB Off	1.5	1	2,250	1,420	0.63	1,650	0.73	SR-1 (PCH)/Camino Las Ramblas SB On	1	1	1,500	1,380	0.92	1,460	0.97
SR-1 (PCH)/Camino Las Ramblas NB On	1	0	1,500	800	0.53	630	0.42	SR-1 (PCH)/Camino Las Ramblas SB Loop On	1	0	900	230	0.26	210	0.23
								SR-1 (PCH)/Camino Las Ramblas SB Off	1.5	1	2,250	820	0.36	1,280	0.57
Camino Capistrano/ Stonehill NB On	1.5	1	1,800	1,520	0.84	1,670	0.93								
San Juan Creek NB Off	1	0	1,500	680	0.45	550	0.37	San Juan Creek SB On	1	0	1,500	770	0.51	610	0.41
San Juan Creek NB On	1	0	1,500	780	0.52	480	0.32	San Juan Creek SB Off	1	1	1,500	1,080	0.72	1,420	0.95
End Project															
Ortega NB Off	1	0	1,500	1,180	0.79	940	0.63	Ortega SB On	1	1	1,500	760	0.51	770	0.51
Ortega NB On	1	1	1,500	1,930	1.29	1,960	1.31	Ortega SB Off	1.5	1	2,250	1,880	0.84	2,190	0.97
Junipero Serra NB Off	1	0	1,500	610	0.41	390	0.26	Junipero Serra SB On	1	0	1,080	500	0.46	530	0.49
Junipero Serra NB On	1	1	1,080	1,180	1.09	990	0.92	Junipero Serra SB Off	1	1	1,500	850	0.57	1,460	0.97
<p>Bold = exceeds volume/capacity ratio of 1.0</p> <p>R. = Ramp termini lanes - 1.5 denotes a two-lane off-ramp with one dedicated and one optional lane, or a two-lane on-ramp entering the freeway as one merge lane and an auxiliary lane</p> <p>Aux. = Auxiliary lanes</p> <p>Cap. = Capacity</p>															

Table 4-5: Ramp Merge/Diverge Analysis Summary – 2040 Conditions, Project Alts. 2, 3&4 (Build)

Location	AM Peak Hour				PM Peak Hour			
	Volumes		Density	LOS	Volumes		Density	LOS
	Fwy.	Ramp			Fwy.	Ramp		
I-5 at Cristianitos								
NB Diverge	6,010	240	30.3	D	6,920	220	34.0	D
NB Merge	5,770	400	27.6	C	6,070	270	27.5	C
SB Diverge	6,680	480	34.4	D	7,020	440	35.7	E
SB Merge	6,210	150	27.3	C	6,580	330	30.1	D
I-5 at Calafia/Magdalenita								
NB Diverge	6,170	200	30.7	D	6,340	230	31.6	D
SB Merge	6,680	130	28.8	D	6,930	90	29.4	D
I-5 at Vista Hermosa								
NB Merge	7,430	1,420	34.2	F	7,050	1,040	29.7	D
SB Diverge	8,060	1,310	32.3	D	9,210	1,700	39.3	F
I-5 at Camino de Los Mares/Estrella								
NB Diverge	8,750	470	43.2	F	8,090	830	42.4	E
SB Diverge	8,090	820	29.7	D	9,870	1,500	41.0	F
SB Merge	7,480	580	27.4	C	8,450	760	32.3	F
I-5 at SR-1 (PCH)/Camino Las Ramblas								
NB Merge	8,890	350	38.6	F	6,670	210	29.6	D
SB Diverge	7,300	820	28.0	C	9,480	1,280	39.8	F
SB Merge	6,710	1,380	24.6	C	8,410	1,460	30.2	D
I-5 at Camino Capistrano/Stonehill								
NB Merge	9,340	1,520	45.3	F	7,180	1,670	38.9	F
I-5 at San Juan Creek								
NB Diverge	10,860	680	63.0	F	8,850	550	44.1	F
NB Merge	10,180	780	46.3	F	8,300	480	37.2	F
SB Diverge	7,490	1,080	41.2	E	10,240	1,420	56.9	F
SB Merge	6,410	770	33.3	D	8,820	610	40.6	F
I-5 at Ortega Highway								
NB Diverge	10,870	1,180	63.1	F	8,580	940	45.1	F
NB Merge	9,690	1,930	46.5	F	7,640	1,960	39.5	F
SB Diverge	8,560	1,880	37.6	F	11,640	2,190	58.0	F
SB Merge	6,730	760	35.0	E	9,470	770	44.8	F
I-5 at Junipero Serra								
NB Diverge	11,540	610	47.1	F	9,500	390	37.9	E
NB Merge	10,930	1,180	36.8	F	9,110	990	28.8	D
SB Diverge	8,860	850	25.6	C	12,620	1,460	42.9	F
SB Merge	8,060	500	29.5	D	11,120	530	40.5	F
LOS Criteria based on Density (pc/mi/ln): A ≤ 10 D > 28 - 35 B > 10 - 20 E > 35 C > 20 - 28 F Demand exceeds capacity (mainline or ramp)								
Bold = Level of service (LOS) "E" or "F"								

Table 4-6: Interchange Merge/Diverge LOS Comparison – Project Area

Location	AM Peak Hour		PM Peak Hour	
	No-Build	Build	No-Build	Build
I-5 at Vista Hermosa				
NB Merge	F	F	F	D
SB Diverge	F	D	F	F
I-5 at Camino de Los Mares/Estrella				
NB Diverge	F	F	F	E
SB Diverge	F	D	F	F
SB Merge	F	C	F	F
I-5 at SR-1 (PCH)/Camino Las Ramblas				
NB Merge	F	F	D	D
SB Diverge	C	C	F	F
SB Merge	D	C	F	D
I-5 at Camino Capistrano/Stonehill				
NB Merge	F	F	F	F
I-5 at San Juan Creek				
NB Diverge	F	F	F	F
SB Merge	D	D	F	F
Bold = Level of service (LOS) "E" or "F" Shading = LOS improved compared to No-Build				

Table 4-7: Weaving Section LOS Summary – 2040 Conditions, Project Alternatives 2, 3 & 4 (Build)

Location	AM Peak Hour			PM Peak Hour								
	Speed	Density	LOS	Speed	Density	LOS						
NORTHBOUND												
NB – Magdalena to El Camino Real	52.2	29.2	D	54.0	27.6	C						
NB – El Camino Real to Presidio	56.1	29.1	D	56.6	27.4	C						
NB – Cm de Los Mares to SR-1 (PCH)/Camino Las Ramblas	53.3	37.0	E	54.5	30.1	D						
SOUTHBOUND												
SB – El Camino Real to Magdalena	63.1	24.8	C	58.8	29.8	D						
SB – Presidio to El Camino Real	47.5	34.5	D	44.8	42.1	E						
Avenida Pico Interchange Design Option A												
Location	AM Peak Hour			PM Peak Hour								
	Speed	Density	LOS	Speed	Density	LOS						
NORTHBOUND												
NB – Palizada to Pico	54.0	34.5	D	55.3	30.6	D						
NB – Pico to Vista Hermosa	50.0	34.8	D	46.7	36.2	E						
SOUTHBOUND												
SB – Pico to Palizada	50.9	29.1	D	47.1	37.9	E						
SB – Vista Hermosa to Pico	52.7	32.4	D	54.7	33.4	D						
Avenida Pico Interchange Design Option B												
Location	AM Peak Hour			PM Peak Hour								
	Speed	Density	LOS	Speed	Density	LOS						
NORTHBOUND												
NB – Palizada to Pico	53.2	35.0	D	54.5	31.1	D						
NB – Pico to Vista Hermosa	49.5	35.1	E	46.2	36.6	E						
SOUTHBOUND												
SB – Pico to Palizada	50.9	29.1	D	47.1	37.9	E						
SB – Vista Hermosa to Pico	52.7	32.4	D	54.7	33.4	D						
<p>Note:</p> <p>For the Southbound direction, Design Options A and B have the same configuration, hence the same values.</p> <p>LOS Criteria based on Density (pc/mi/ln):</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">A ≤ 10</td> <td style="width: 50%;">D > 28 - 35</td> </tr> <tr> <td>B > 10 - 20</td> <td>E > 35</td> </tr> <tr> <td>C > 20 - 28</td> <td>F Demand exceeds capacity</td> </tr> </table> <p>Bold = Level of service (LOS) “E” or “F”</p>							A ≤ 10	D > 28 - 35	B > 10 - 20	E > 35	C > 20 - 28	F Demand exceeds capacity
A ≤ 10	D > 28 - 35											
B > 10 - 20	E > 35											
C > 20 - 28	F Demand exceeds capacity											

Table 4-8: Intersection Lane Geometry – Existing (2009) & 2040 Conditions

Intersection	Southbound			Westbound			Northbound			Eastbound			Source
	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	
1. I-5 SB Ramps & Junipero Serra													
Existing	1	1	0	1	1	0	0	0	0	0	2	0	
2040	1	1	0	1	1	0	0	0	0	0	2	0	
2. I-5 NB Ramps & Junipero Serra													
Existing	0	0	0	0	2	0	1	1	0	1	1	0	
2040	0	0	0	0	2	0	1	1	0	2	1	0	(1)
3. I-5 SB Ramps & Ortega Hwy													
Existing	1.5	0	1.5	1	2	0	0	0	0	0	3	0	
2040	2.5	0	1.5	2	2	0	0	0	0	0	3	f	(2)
4. I-5 NB Ramps & Ortega Hwy													
Existing	0	0	0	0	2	1	0.5	0	1.5	2	2	0	
2040	0	1	0	0	3	0	0.5	0	1.5	1	3	f	(2)
5. Camino Capistrano & I-5 SB Ramps													
Existing	2	1	0	1	0	1	0	2	0	0	0	0	
2040	2	1	0	1	0	1	0	2	0	0	0	0	
6. Valle Rd & I-5 NB Ramps													
Existing	0	1	1	0.5	0.5	1	1	1	1	1	0	1	
2040	0	1	1	0.5	0.5	1	1	1	1	1	0	1	
7. I-5 SB Ramps & Las Ramblas													
Existing	2	0	f	0	1	f	0	0	0	0	2	f	
2040	2	0	f	0	1	f	0	0	0	0	2	f	

(Continued)

Table 4-8: Intersection Lane Geometry – Existing (2009) & 2040 Conditions (Continued)

Intersection	Southbound			Westbound			Northbound			Eastbound			Source
	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	
8. I-5 NB Ramps & Las Ramblas													
Existing	1	0	1	0	3	0	0	1	1	1	2	f	
2040	1	0	1	0	3	0	0	1	1	1	2	f	
9. I-5 SB Ramps & Camino De Estrella													
Existing	1.5	0.5	1	1	2	0	0	0	0	0	2	1	
2040	1.5	0.5	1	1	2	0	0	0	0	0	2	1	
10. I-5 NB Ramps & Camino De Estrella													
Existing	1	0	1	0	3	0	0.5	0	1.5	0	3	1	
2040	1	0	1	0	3	0	0.5	0	1.5	0	3	1	
11. I-5 SB Ramps & Avenida Vista Hermosa													
Existing	1.5	0	1.5	0	2	f	0	0	0	1	3	0	
2040	1.5	0	1.5	0	2	f	0	0	0	1	3	0	
12. I-5 NB Ramps & Avenida Vista Hermosa													
Existing	0	0	0	0	1.5	1.5	1.5	0	1.5	0	2	f	
2040	0	0	0	0	1.5	1.5	1.5	0	1.5	0	2	f	
13. I-5 SB Ramps & Avenida Pico													
Existing	1.5	0	1.5	1.5	1.5	0	0	0	0	0	3	1	
2040 – Option A	1.5	0.5	1	2	2	0	0	0	0	0	4	1	
2040 – Option B	1.5	.5	1	2	2	0	0	0	0	0	3	1	
14. I-5 NB Ramps & Avenida Pico													
Existing	0	0	0	0	3	f	.5	.5	2	1	2	0	
2040 – Option A	0	0	0	0	4	f	1	0	2	2	3	0	
2040 – Option B	0	0	0	0	4	0	1	0	2	0	3	1	

(Continued)

Table 4-8: Intersection Lane Geometry – Existing (2009) & 2040 Conditions (Continued)

Intersection	Southbound			Westbound			Northbound			Eastbound			Source
	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	
15. I-5 SB Ramps & Avenida Palizada													
Existing	0.5	0	1.5	0	2	0	0	0	0	0	2	0	
2040	0.5	0	1.5	0	2	0	0	0	0	0	2	0	
16. I-5 NB Ramp & Avenida Palizada													
Existing	0	0	0	0	1	0	0	0	0	1	1	0	
2040	0	0	0	0	1	0	0	0	0	1	1	0	
17. I-5 SB Ramps & Avenida Presidio													
Existing	0	1	1	1	1	1	0	0	0	0.5	1.5	0	
2040	0	1	1	1	1	1	0	0	0	0.5	1.5	0	
18. I-5 NB Ramps & Avenida Presidio													
Existing	0	0	0	0	1	1	1	0	1	1	2	0	
2040	0	0	0	0	1	1	1	0	1	1	2	0	
19. I-5 SB Ramps & El Camino Real/Valencia													
Existing	1	1	1	1	2	0	1	0	1	0	2	0	
2040	1	1	1	1	2	0	1	0	1	0	2	0	
20. I-5 NB Ramps & El Camino Real													
Existing	0	0	0	0	2	0	1.5	0	0.5	0	2	0	
2040	0	0	0	0	2	0	1.5	0	0.5	0	2	0	
21. S. El Camino Real & I-5 NB Ramps													
Existing	0	2	0	0	0	0	1	2	0	1	0	1	
2040	0	2	0	0	0	0	1	2	0	1	0	1	

(Continued)

Table 4-8: Intersection Lane Geometry – Existing (2009) & 2040 Conditions (Continued)

Intersection	Southbound			Westbound			Northbound			Eastbound			Source
	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	
22. Avenida Presidente & Avenida Calafia													
Existing	1	1	0	1	1	0	1	1	0	0	1	0	
2040	1	1	0	1	1	0	1	1	0	0	1	0	
23. I-5 NB Ramps & Cristianitos													
Existing	0	0	0	0	1	0	1	1	0	1	1	0	
2040	0	0	0	0	1	0	1	1	0	1	1	0	
24. I-5 SB Ramps & Cristianitos													
Existing	0	1	1	1	1	0	0	0	0	0	1	0	
2040	0	1	1	1	1	0	0	0	0	0	1	0	
25. Camino Capistrano & Junipero Serra													
Existing	1	1	0	2	1	1	1	1	2	1	1	0	
2040	1	1	0	2	1	1	1	1	2	1	1	0	
26. Rancho Viejo & Junipero Serra													
Existing	1	1	1	0.5	1.5	0	1	2	0	1	1	0	
2040	1	1	1	0.5	1.5	0	1	2	0	1	1	0	
27. Del Obispo & Ortega													
Existing	0	0	0	2	1	0	1	0	2	0	3	0	
2040	0	2	1	1	1	0	1	3	0	2	1	0	(2)
28. Rancho Viejo & Ortega													
Existing	1.5	0.5	1	1	3	1	2	1	0	1	2	1	
2040	1.5	0.5	1	1	3	1	2	1	1	1	2	1	(1)

(Continued)

Table 4-8: Intersection Lane Geometry – Existing (2009) & 2040 Conditions (Continued)

Intersection	Southbound			Westbound			Northbound			Eastbound			Source
	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	
29. La Pata & Ortega													
Existing	1	2	2	1	1	1	2	2	1	2	1	f	(3)
2040	1	3	2	1	2	1	2	3	1	2	2	1	
30. Camino Capistrano & Del Obispo													
Existing	1	1	1	1	2	1	2	1	1	1	2	1	(1)
2040	1	2	0	2	2	1	2	1	1	2	2	1	
31. Camino Capistrano & San Juan Creek													
Existing	2	2	0	1.5	0	1.5	0	2	1	0	0	0	
2040	2	2	0	1.5	0	1.5	0	2	1	0	0	0	
32. Valle & San Juan Creek													
Existing	0	0	0	1	1	0	0	1	0	0	1	1	(1)
2040	0	0	0	1	2	0	1	0	1	0	1	1	
33. La Novia & San Juan Creek													
Existing	1	1	1	1	1	1	1	1	1	1	1	1	
2040	1	1	1	1	1	1	1	1	1	1	1	1	
34. Del Obispo & Stonehill													
Existing	1	2	0	1	2	1	1	2	0	1	2	1	
2040	1	2	0	1	2	1	1	2	0	1	2	1	
35. Camino Capistrano & Stonehill													
Existing	1	2	2	0	0	0	1.5	0.5	1	1	2	1	
2040	1	2	2	0	0	0	1.5	0.5	1	1	2	1	

(Continued)

Table 4-8: Intersection Lane Geometry – Existing (2009) & 2040 Conditions (Continued)

Intersection	Southbound			Westbound			Northbound			Eastbound			Source
	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	
36. Camino Mira Costa & Camino De Estrella													
Existing	0	0	0	1	2	0	1	0	1	0	2	0	
2040	0	0	0	1	2	0	1	0	1	0	2	0	
37. Avenida Vaquero & Camino De Los Mares													
Existing	0	0	0	1	2	0	1.5	0	0.5	0	2	1	
2040	0	0	0	1	2	0	1.5	0	0.5	0	2	1	
38. Camino Vera Cruz & Camino De Los Mares													
Existing	0	1	0	1	2	0	1.5	0.5	1	1	2	1	
2040	0	1	0	1	2	0	1.5	0.5	1	1	2	1	
39. Camino Del Rio & Camino De Los Mares													
Existing	0	1	0	0.5	1.5	0	1	1	1	0.5	1.5	0	
2040	0	1	0	0.5	1.5	0	1	1	1	0.5	1.5	0	
40. Camino Vera Cruz & Avenida Vista Hermosa													
Existing	1	2	0	1	2	1	1	2	0	1	2	1	
2040	1	2	0	1	2	1	1	2	0	1	2	1	
41. La Pata & Avenida Vista Hermosa													
Existing	1	3	1	2	2	1	2	3	1	1	2	1	
2040	1	3	1	2	2	1	2	3	1	1	2	1	
42. N. El Camino Real & Avenida Pico													
Existing	1	2	0	1	1	1	1	2	0	1	1	0	(4)
2040	2	2	0	2	1	1	1	2	0	1	1	0	

(Continued)

Table 4-8: Intersection Lane Geometry – Existing (2009) & 2040 Conditions (Continued)

Intersection	Southbound			Westbound			Northbound			Eastbound			Source
	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	
43. La Pata & Avenida Pico													
Existing	1	3	d	2	3	1	1	3	d	2	3	1	(4)
2040	2	2	1	2	3	1	1	3	d	2	3	1	
44. Avenida Vista Hermosa & Avenida Pico													
Existing	2	1	2	1	3	0	2	2	0	2	3	1	
2040	2	1	2	1	3	0	2	2	0	2	3	1	
45. N. El Camino Real & Avenida Palizada													
Existing	1	2	0	1	1	1	1	2	0	1	1	0	
2040	1	2	0	1	1	1	1	2	0	1	1	0	
46. Camino De Estrella & Avenida Palizada													
Existing	1	1	0	1	2	0	1	1	0	0.5	1.5	0	
2040	1	1	0	1	2	0	1	1	0	0.5	1.5	0	
47. N. El Camino Real & Avenida Presidio/Victoria													
Existing	1	2	0	1	0	1	1	2	1	1	0	1	
2040	1	2	0	1	0	1	1	2	1	1	0	1	
Sources: (1) SCRIP (2) I-5/Ortega Highway Interchange Project (3) Antonio Parkway Widening Project (4) RCFPP													

Table 4-9: Intersection LOS Summary (Interchanges) – 2040 Conditions, Proj. Alts. 2, 3&4 (Build)

Location	AM Peak Hour		PM Peak Hour	
	Delay	LOS	Delay	LOS
1. I-5 SB Ramps & Junipero Serra	21.5	C	41.8	D
2. I-5 NB Ramps & Junipero Serra	18.2	B	17.5	B
3. I-5 SB Ramps & Ortega Hwy	27.6	C	34.8	C
4. I-5 NB Ramps & Ortega Hwy	23.4	C	19.1	B
5. Camino Capistrano & I-5 SB Ramps	78.9	E	151.4	F
6. Valle Rd & I-5 NB Ramps	21.2 ¹	C ¹	40.0 ¹	E ¹
7. I-5 SB Ramps & Las Ramblas	3.7	A	6.0	A
8. I-5 NB Ramps & Las Ramblas	4.4	A	8.4	A
9. I-5 SB Ramps & Camino De Estrella	18.7	B	33.0	C
10. I-5 NB Ramps & Camino De Estrella	13.5	B	15.6	B
11. I-5 SB Ramps & Avd Vista Hermosa	18.4	B	15.4	B
12. I-5 NB Ramps & Avd Vista Hermosa	8.2	A	7.1	A
13. I-5 SB Ramps & Avd Pico	See Section 4.6			
14. I-5 NB Ramps & Avd Pico	See Section 4.6			
15. I-5 SB Ramps & Avd Palizada	8.8	A	9.2	A
16. I-5 NB Ramp & Avd Palizada	63.8 ²	F ²	35.9 ²	E ²
17. I-5 SB Ramps & Avd Presidio	74.8 ³	F ³	36.7 ³	E ³
18. I-5 NB Ramps & Avd Presidio	16.0	B	16.9	B
19. I-5 SB Ramps & El Camino Real/Valencia	14.3	B	19.3	B
20. I-5 NB Ramps & El Camino Real	5.2	A	5.9	A
21. S. El Camino Real & I-5 NB Ramps	>300 ³	F ³	153.6 ³	F ³
22. Avd Presidente & Avd Calafia	12.8 ¹	B ¹	33.4 ¹	D ¹
23. I-5 NB Ramps & Cristianitos	28.7 ³	D ³	42.4 ³	E ³
24. I-5 SB Ramps & Cristianitos	32.1 ³	D ³	288.5 ³	F ³

LOS Criteria based on Average Delay (sec/veh):

LOS	Average Delay
A	0.0 – 10.0
B	10.1 – 20.0
C	20.1 – 35.0
D	35.1 – 55.0
E	55.1 – 80.0
F	> 80.0

Bold = exceeds performance standard of level of service (LOS) “D”
 >300 – delay is greater than 300 sec/veh

¹All-way stop – delay represents the intersections average vehicle delay
²Yield – delay represents the yielding movement with highest approach delay
³Two-way stop – delay represents the movement with highest control delay

Table 4-10: Intersection LOS Summary (City Locations) – 2040 Conditions, Proj. Alts. 2,3&4 (Build)

Location	AM Peak Hour		PM Peak Hour	
	ICU	LOS	ICU	LOS
25. Camino Capistrano & Junipero Serra	.52	A	.54	A
26. Rancho Viejo & Junipero Serra	.90	D	.81	D
27. Del Obispo & Ortega	.55	A	.67	B
28. Rancho Viejo & Ortega	.77	C	.94	E
29. La Pata & Ortega	.74	C	.74	C
30. Camino Capistrano & Del Obispo	.95	E	.89	D
31. Camino Capistrano & San Juan Crk	.65	B	.70	B
32. Valle & San Juan Creek	.75	C	.79	C
33. La Novia & San Juan Creek	.76	C	.73	C
34. Del Obispo & Stonehill	.79	C	.72	C
35. Camino Capistrano & Stonehill	.90	D	.84	D
36. Camino Mira Costa & Camino Estrella	.35	A	.36	A
37. Avd Vaquero & Camino De Los Mares	.44	A	.41	A
38. Camino Vera Cruz & Camino De Los Mares	.34	A	.34	A
39. Camino Del Rio & Camino De Los Mares	.38	A	.32	A
40. Camino Vera Cruz & Avd Vista Hermosa	.73	C	.72	C
41. La Pata & Avd Vista Hermosa	.57	A	.58	A
42. N. El Camino Real & Avd Pico	.57	A	.71	C
43. La Pata & Avd Pico	.45	A	.48	A
44. Avd Vista Hermosa & Avd Pico	.44	A	.60	A
45. N. El Camino Real & Avd Palizada	.55	A	.68	B
46. Camino Estrella & Avd Palizada	.52	A	.60	A
47. N. El Camino Real & Avd Presidio/Victoria	.44	A	.47	A

LOS Criteria based on ICU:

<u>LOS</u>	<u>ICU</u>
A	0.00 – 0.60
B	0.61 – 0.70
C	0.71 – 0.80
D	0.81 – 0.90
E	0.91 – 1.00
F	> 1.00

Bold = exceeds performance standard of level of service (LOS) “D”

With the Build Alternatives, the LOS at the following ramp intersections worsen due to the slight change in traffic patterns that result from the HOV lane extension:

- Rancho Viejo & Junipero Serra – LOS C to LOS D (PM)
- North El Camino Real & Avenida Pico – LOS B to LOS C (PM)

4.4 HOV ANALYSIS – 2040 BUILD

The freeway operations analysis in the HCM focuses only on mainline and ramp volumes using density as the operational measure to determine LOS. Hence the HOV lanes are analyzed using a volume-to-capacity (V/C) ratio. The capacity and LOS relationships were summarized in Section 1.7.1 of this report, and results for 2040 no-build conditions were presented in Section 3.1 (see Table 3-1 in that section). As noted there, for the 2040 No-Build Alternative, two HOV lanes are projected to exceed 1,600 vph/lane.

The HOV analysis results for the design year (2040) were included in the mainline analysis in Section 4.1 (see Table 4-1). The results showed five segments with HOV lanes that exceed 1,600 vph/lane for the Build Alternatives, two of which are within the project limits.

4.5 QUEUEING ANALYSIS – 2040 BUILD

This section evaluates queuing for the design year (2040) at the off-ramp intersections and at the on-ramp meters. For the off-ramps, the results show the potential for vehicle queuing to extend back to the freeway mainline. For the ramp meters, the analysis shows the meter discharge rates needed for the ramp to have adequate storage without queuing back onto the surface streets.

Table 4-11 summarizes the 95th percentile queue lengths in feet compared to the off-ramp storage provided in the Build Alternatives configurations (queuing calculation worksheets are contained in Appendix G). The queuing analysis indicates that no vehicle queues are projected to extend onto the mainline freeway.

The 13 on-ramps along the project corridor were also analyzed for ramp meter queuing for the Build Alternatives. As identified in the Caltrans Ramp Meter Design Manual, ramp meters have practical lower and upper metering rates of 240 and 900 vehicles per hour per lane (vph/lane), respectively. Using

Table 4-11: Off-Ramp Queuing Analysis – 2040 Conditions, Project Alternatives 2, 3 & 4 (Build)

Location	Northbound			Southbound		
	AM ¹	PM ¹	Storage ²	AM ¹	PM ¹	Storage ²
I-5 Off-Ramp at:						
Avenida Pico	See Section 4.6					
Vista Hermosa	215 ft.	132 ft.	1,400 ft.	357 ft.	261 ft.	1,440 ft.
Camino de Los Estrella	160 ft.	225 ft.	1,300 ft.	194 ft.	443 ft.	1,200 ft.
SR-1 (PCH)/Camino Las Ramblas	95 ft.	77 ft.	1,450 ft.	57 ft.	96 ft.	1,380 ft.
San Juan Creek	589 ft.	470 ft.	1,150 ft.	399 ft.	400 ft.	720 ft.
Notes: ¹ Queue length is 95 th percentile queue as measured from the intersection. ² Storage is length of off-ramp from the diverge point to the intersection. Bold = 95 th percentile queue exceeds storage length						

these criteria, a minimum ramp metering discharge rate is selected until the calculated queue per lane is just less than the available storage, thus giving a rate that will prevent queues extending back into the local intersections.

Table 4-12 presents the ramp metering queuing analysis results for each of the on-ramps within the corridor. Appendix I contains the ramp meter queuing analysis worksheets. At one location, the Avenida Vista Hermosa northbound loop on-ramp, 2040 traffic volumes exceed the volume that can be serviced by a 900 vph/lane metering rate. To accommodate these volumes, a metering rate of 1,050 vph/lane would be required unless an additional lane is added to the ramp at the meter location.

4.6 AVENIDA PICO INTERCHANGE – BUILD DESIGN OPTIONS

The following sections present detailed performance results for the two Build Design Options for the Avenida Pico interchange.

Table 4-12: On-Ramp Metering Queue Analysis – 2040 Conditions, Project Alternatives 2, 3 & 4 (Build)

I-5 NB On Ramp at:	NORTHBOUND						I-5 SB On Ramp at:	SOUTHBOUND					
	Peak Hour	Volume	Lanes	Max Q/Lane		Meter Rate ¹		Peak Hour	Volume	Lanes	Max Q/Lane		Meter Rate ¹
				Vehicles	Feet						Vehicles	Feet	
Avenida Pico	See Section 4.6						Avenida Pico	See Section 4.6					
Visa Hermosa (Loop)	AM	2070	2	11	337	1,050	Vista Hermosa	AM	510	2	0	0	300
Visa Hermosa (Slip)	AM	1,420	2	20	597	700							
Estrella (Loop)	AM	470	1	0	0	500	Estrella	PM	760	2	2	61	400
Estrella (Slip)	AM	1,370	2	5	162	700							
SR-1 (PCH)/Las Ramblas	AM	450	1	9	255	450	SR-1 (PCH)/Las Ramblas (Slip)	PM	1,460	2	9	279	750
							SR-1 (PCH)/Las Ramblas (Loop)	AM	230	1	0	0	400
Camino Capistrano/Stonehill	PM	1,670	2	13	394	850							
							San Juan Creek	AM	770	2	1	24	400
¹ Meter Rate in vehicles per lane per hour Bold = Exceeds 900 vph/lane metering rate													

4.6.1 Design Option A - Modified Tight Diamond

The configuration for this design option has nine lanes under the reconstructed bridge and features lane selection requirements for traffic making left turns onto the on-ramps. Westbound, two lanes on Avenida Pico are designated as “freeway only” east of the northbound ramp intersection. This provides around 400 feet of additional storage for the westbound left turn to the southbound on-ramp. For eastbound left turns onto the northbound on-ramp, one lane on Avenida Pico is designated as “freeway only” west of the southbound ramp intersection. The two interchange intersections operate under one signal controller with leading-alternating phasing.

The 2040 LOS, ICU and queuing results for Design Option A are summarized in Table 4-13 (Worksheets can be seen in Appendix L, M and N respectively). As can be seen, LOS “C” or better is achieved at the intersections under the HCM and ICU methodologies. At the northbound ramp the 95th percentile queue length is shown to be slightly greater than the available storage. The SimTraffic simulation does not show this occurring, and hence it is anticipated that future signal timing could ensure that queue length problems do not occur.

For the queuing between the two ramp intersections, use has been made of the queuing reports generated by SimTraffic (see Appendix N). The standard HCM queue results do not account for signal coordination, or in this case, two intersections operating off a single controller. Hence, the SimTraffic results are used here for the eastbound queues at the northbound ramp intersection and the westbound queues at the southbound ramp intersection.

In the westbound direction, the maximum queue length between the ramp intersections is 53 feet in the AM and 77 feet in the PM. An additional 170 feet of queuing occurs east of the northbound ramp intersection in the AM and 280 feet in the PM. Eastbound, the maximum queue between the two ramp intersections is 146 feet in the AM and 150 feet in the PM. An additional 168 feet of queuing occurs at the southbound ramp intersection in the AM and 237 feet in the PM.

4.6.2 Design Option B - Southeast Quadrant Partial Cloverleaf

The analysis results for Design Option B are summarized in Table 4-14. Three intersections are included in the analysis, the two ramp intersections and the existing signalized intersection at Calle

Table 4-13: 2040 Peak Hour Performance – Design Option A

Intersection	AM Peak Hour		PM Peak Hour									
	Delay	LOS	Delay	LOS								
HCM Delay												
13. I-5 SB Ramps & Avenida Pico	21.4	C	23.8	C								
14. I-5 NB Ramps & Avenida Pico	17.6	B	21.0	C								
48. Calle de Industrias & Avenida Pico	16.3	B	25.2	C								
Intersection	AM Peak Hour		PM Peak Hour									
	ICU	LOS	ICU	LOS								
ICUs												
13. I-5 SB Ramps & Avenida Pico	0.59	A	0.65	B								
14. I-5 NB Ramps & Avenida Pico	0.51	A	0.59	A								
48. Calle de Industrias & Avenida Pico	0.43	A	0.77	C								
Note: Delay is average control delay per vehicle in seconds												
95 TH PERCENTILE QUEUE LENGTHS												
Intersection	Northbound			Southbound			Eastbound			Westbound		
	L	T	R	L	T	R	L	T	R	L	T	R
13. I-5 Southbound Ramps & Avenida Pico												
Storage Available	--	--	--	1,350'	--	1,075'	--	420'	150'	180'	220'	--
AM	--	--	--	159'	--	68'	--	168'	144'	23	53'	--
PM	--	--	--	300'	--	269'	--	237'	67'	0'	77'	--
14. I-5 Northbound Ramps & Avenida Pico												
Storage Available	930'	--	395'	--	--	--	180'	230'	--	--	1,050'	400'
AM	68'	--	134'	--	--	--	2'	146'	--	--	170'	N/A
PM	300'	--	227'	--	--	--	0'	150'	--	--	280'	N/A
48. Calle de Industrias & Avenida Pico												
Storage Available	200'	500'	500'	--	560'	--	100'	380'	--	200'	400'	--
AM	25'	38'	31'	--	53'	--	23'	283'	--	58'	153'	--
PM	156'	83'	73'	--	162'	--	30'	394'	--	170'	123'	--
Note: Queue length represents maximum length of queue in the lane with the longest queue. N/A – Not applicable since movement is a free right turn except when interrupted for pedestrians												

Table 4-14: 2040 Peak Hour Performance – Design Option B

Intersection	AM Peak Hour		PM Peak Hour									
	Delay	LOS	Delay	LOS								
HCM Delay												
13. I-5 SB Ramps & Avenida Pico	23.5	C	20.9	C								
14. I-5 NB Ramps & Avenida Pico	14.0	B	18.6	B								
48. Calle de Industrias & Avenida Pico	15.6	B	29.1	C								
Intersection	AM Peak Hour		PM Peak Hour									
	ICU	LOS	ICU	LOS								
ICUs												
13. I-5 SB Ramps & Avenida Pico	0.62	B	0.68	B								
14. I-5 NB Ramps & Avenida Pico	0.77	C	0.69	B								
48. Calle de Industrias & Avenida Pico	0.38	A	0.67	B								
Note: Delay is average control delay per vehicle in seconds												
95 TH PERCENTILE QUEUE LENGTHS												
Intersection	Northbound			Southbound			Eastbound			Westbound		
	L	T	R	L	T	R	L	T	R	L	T	R
13. I-5 Southbound Ramps & Avenida Pico												
Storage Available	--	--	--	1,350'	--	1,075'	--	420'	150'	700'	700'	--
AM	--	--	--	371'	--	108'	--	210'	137'	182'	198'	--
PM	--	--	--	286'	--	238'	--	230'	18'	232'	362'	--
14. I-5 Northbound Ramps & Avenida Pico												
Storage Available	1,000'	--	380'	--	--	--	--	700'	360'	--	750'	--
AM	131'	--	227'	--	--	--	--	145'	15'	--	259'	N/A
PM	237'	--	186'	--	--	--	--	176'	236'	--	336'	N/A
48. Calle de Industrias & Avenida Pico												
Storage Available	200'	500'	500'	--	560'	--	100'	ND	--	250'	400'	--
AM	25'	40'	31'	--	53'	--	23'	ND	--	59'	101'	--
PM	156'	80'	69'	--	162'	--	30'	ND	--	173'	379'	--
Note: Queue length represents maximum length of queue in the lane with the longest queue. N/A – Not applicable since movement is a free right turn except when interrupted for pedestrians ND - Not determined since intersection to the west is not included in the network												

Industrias/Via Pico Plaza. As can be seen, all three intersections are at LOS “C” or better under both the HCM and ICU methodologies (See Appendices L and M). No queue lengths exceed the available storage (See Appendix N).

4.6.3 2040 Merge/Diverge and Weaving Analysis – Avenida Pico Interchange

Based on the Highway Capacity Manual (HCM), analyses for freeway interchange ramp termini can be conducted using a weaving analysis or a merge/diverge analysis. A weaving analysis is conducted on segments of freeway where an on-ramp is followed by an off-ramp within 2,500 feet of the on-ramp and an auxiliary lane connects the two. For a freeway segment that does not include an auxiliary lane connection between interchange junctions, the analysis focuses on the individual ramp junctions in a merge/diverge analysis. Ramp junctions are points at which on-ramps and off-ramps join the freeway and vehicles using these junctions must either merge into or diverge out from the main line freeway traffic flow. Because the Avenida Pico interchange ramp junctions are connected by auxiliary lanes to Avenida Vista Hermosa to the north and Avenida Palizada to the south, and the spacing is less than 2,500 feet, a weaving analysis is used here.

Both design options feature a single southbound off-ramp with the existing configuration. For the northbound on-ramp under Design Option A, the existing configuration with single lane entry is improved to a two lane entry with an auxiliary lane. With Design Option B, there are two northbound on-ramps. The loop on-ramp adds an auxiliary lane as it enters the freeway, and the direct ramp merges into this auxiliary lane. The southbound diverge configuration is the same as existing. To and from the south, differences in freeway access occur and weaving distances differ among the alternatives.

The results of the weaving analyses was presented earlier in this chapter (see Table 4-7). The LOS is determined from the calculated value for passenger cars per lane per mile (pc/ln/mi). As can be seen, the two northbound sections show LOS “E” although the density value is only slightly above the LOS “D” threshold (35 pc/ln/mi). Southbound, the section between Avenida Pico and Avenida Palizada shows LOS “E” in the PM peak hour for Design Option B because the weave length is slightly shorter for this alternative.

4.6.4 Ramp Metering – Avenida Pico Interchange

Ramp metering is proposed for all on-ramps in the Build Alternatives. This section discusses queuing and storage in relation to the ramp metering. For the northbound on-ramp, Design Option A has

three metered lanes. These serve the westbound free right turn lane and the two eastbound left turn lanes that are accessing the freeway in the northbound direction. Design Option B has separate metering for the direct ramp and the loop ramp.

In Design Options A and B, there is a single on-ramp with two metered lanes. Vehicle storage requirements at the meters will depend on the ramp metering rate. Peak period volumes for the ramp were obtained from weekday PeMS data and used to establish representative AM and PM demand patterns. The peak hour within the two hour peak period was then used to derive the maximum queue length for several different meter discharge rates. The results are summarized in Table 4-15 (see actual calculation forms in Appendix P), and show the minimum meter rate for queues do not back up onto Avenida Pico.

For the Design Option A northbound on-ramp, a discharge rate of 450 vehicles per hour per lane (vphpl) is adequate to serve the demand in the AM peak hour without queue buildup, and at a rate of 550 vphpl in the PM peak hour. For Design Option B (which has two northbound ramps) the discharge rates for the slip ramp are 550 and 500 for the AM and PM, respectively and 400 for both the AM and PM for the loop ramp. For the southbound ramp for both Design Options A and B, the discharge rates are 400 and 500 for the AM and PM, respectively.

4.6.5 Avenida Pico Interchange 2040 High Demand Volumes

The 2040 Baseline volumes used throughout this report assume the SR-241 extension to I-5. A set of high demand volumes were derived are based on the South Orange County Major Investment Study (SOCMIS) I-5 Alternative, which does not include the SR-241 extension by 2040. A comparison between the two sets of peak hour volumes for the interchange can be seen in Figure 4-1. They are similar in magnitude except for movements between the south and east (i.e., south to east and east to south).

A verification was made that the two Build design options would perform adequately with these higher volumes. The results are shown in Tables 4-16 and 4-17 for Design Options A and B, respectively. As can be seen, the two design options perform adequately with the higher volumes.

Without the SR-241 extension, the effect on the I-5 mainline is increased traffic volumes. As such, the demand for the proposed HOV lanes is greater without the SR-241 extension in place.

Table 4-15: 2040 Ramp Metering Summary – Avenida Pico Interchange

I-5 NB On Ramp at Avenida Pico:	NORTHBOUND						I-5 SB On Ramp at Avenida Pico:	SOUTHBOUND					
	Peak Hour	Volume	Lanes	Max Q/Lane		Meter Rate ¹		Peak Hour	Volume	Lanes	Max Q/Lane		Meter Rate ¹
				Vehicles	Feet						Vehicles	Feet	
Design Option A	AM	1,290	3	0	0	450	Design Option A	AM	730	2	0	0	400
	PM	1,590	3	5	155	550		PM	950	2	2	75	500
Design Option B (Loop)	AM	230	2	0	0	400	Design Option B	AM	730	2	0	0	400
	PM	570	2	0	0	400		PM	950	2	2	75	500
Design Option B (Slip)	AM	1,060	2	1	41	550							
	PM	1,020	2	17	513	500							
¹ Meter Rate in vehicles per lane per hour													

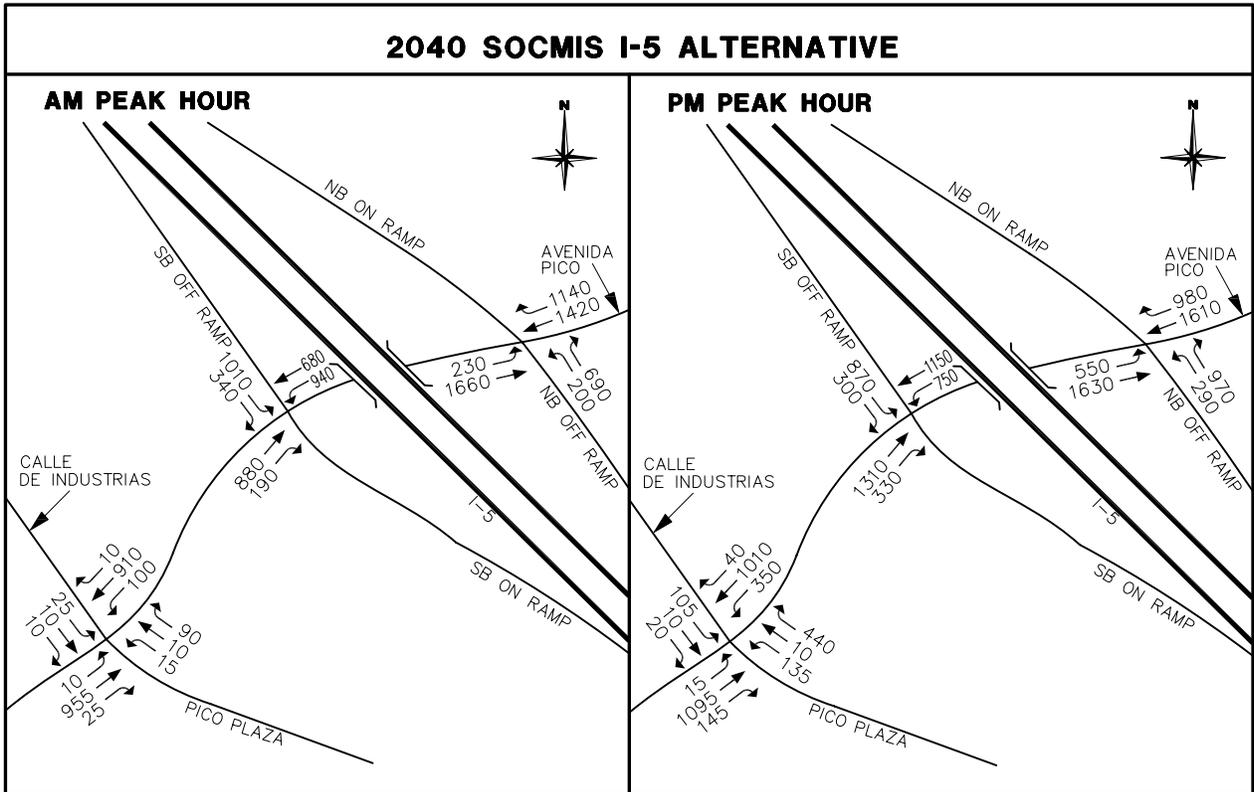
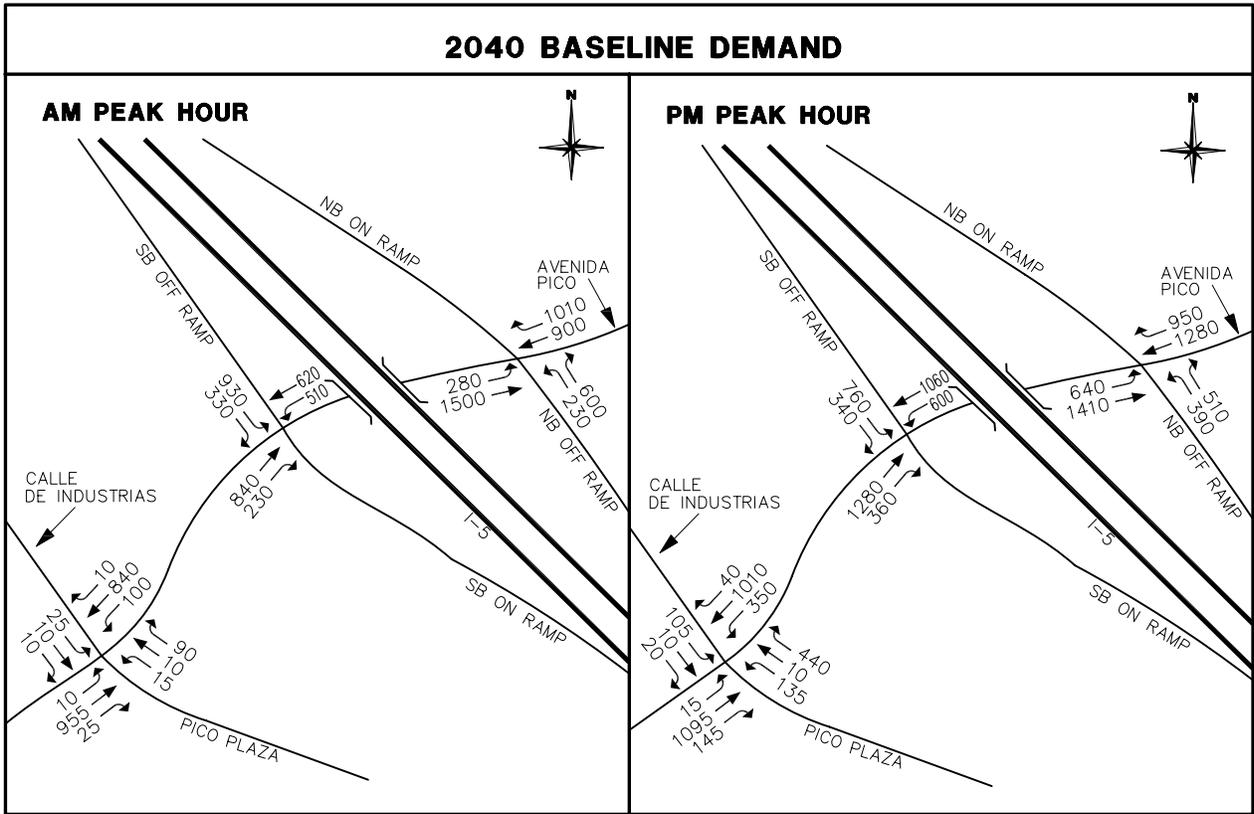


Figure 4-1
2040 VOLUME COMPARISON
- BASELINE VERSUS SOCMIS I-5 ALTERNATIVE

Table 4-16: 2040 Peak Hour Performance – Design Option A with High Demand Volumes

Intersection	AM Peak Hour		PM Peak Hour									
	Delay	LOS	Delay	LOS								
HCM Delay												
13. I-5 SB Ramps & Avenida Pico	29.6	C	28.8	C								
14. I-5 NB Ramps & Avenida Pico	22.9	C	24.2	C								
48. Calle de Industrias & Avenida Pico	15.8	B	28.8	C								
Intersection	AM Peak Hour		PM Peak Hour									
	ICU	LOS	ICU	LOS								
ICUs												
13. I-5 SB Ramps & Avenida Pico	0.75	C	0.71	C								
14. I-5 NB Ramps & Avenida Pico	0.57	A	0.66	B								
48. Calle de Industrias & Avenida Pico	0.47	A	0.78	C								
Note: Delay is average control delay per vehicle in seconds												
95 TH PERCENTILE QUEUE LENGTHS												
Intersection	Northbound			Southbound			Eastbound			Westbound		
	L	T	R	L	T	R	L	T	R	L	T	R
13. I-5 Southbound Ramps & Avenida Pico												
Storage Available	--	--	--	1,350'	--	1,075'	--	420'	150'	180'	220'	--
AM	--	--	--	281'	--	89'	--	182'	117'	158	95'	--
PM	--	--	--	339'	--	214'	--	338'	61'	167'	217'	--
14. I-5 Northbound Ramps & Avenida Pico												
Storage Available	930'	--	395'	--	--	--	180'	230'	--	--	1,050'	400'
AM	75'	--	236'	--	--	--	37'	228'	--	--	277'	N/A
PM	201'	--	473'	--	--	--	62'	49'	--	--	397'	N/A
48. Calle de Industrias & Avenida Pico												
Storage Available	200'	500'	500'	--	560'	--	100'	380'	--	200'	400'	--
AM	25'	40'	31'	--	53'	--	23'	287'	--	55'	190'	--
PM	150'	82'	71'	--	146'	--	32'	595'	--	176'	175'	--
Note: Queue length represents maximum length of queue in the lane with the longest queue. N/A – Not applicable since movement is a free right turn except when interrupted for pedestrians												

Table 4-17: 2040 Peak Hour Performance – Design Option B with High Demand Volumes

Intersection	AM Peak Hour			PM Peak Hour								
	Delay	LOS		Delay	LOS							
HCM Delay												
13. I-5 SB Ramps & Avenida Pico	29.8	C		22.9	C							
14. I-5 NB Ramps & Avenida Pico	12.8	B		25.4	C							
48. Calle de Industrias & Avenida Pico	15.6	B		30.3	C							
Intersection	AM Peak Hour			PM Peak Hour								
	ICU	LOS		ICU	LOS							
ICUs												
13. I-5 SB Ramps & Avenida Pico	0.79	C		0.77	C							
14. I-5 NB Ramps & Avenida Pico	0.58	A		0.65	B							
48. Calle de Industrias & Avenida Pico	0.42	A		0.68	B							
Note: Delay is average control delay per vehicle in seconds												
95 TH PERCENTILE QUEUE LENGTHS												
Intersection	Northbound			Southbound			Eastbound			Westbound		
	L	T	R	L	T	R	L	T	R	L	T	R
13. I-5 Southbound Ramps & Avenida Pico												
Storage Available	--	--	--	1,350'	--	1,075'	--	420'	150'	700'	700'	--
AM	--	--	--	425'	--	146'	--	235'	110'	405'	226'	--
PM	--	--	--	365'	--	206'	--	350'	43'	198'	393'	--
14. I-5 Northbound Ramps & Avenida Pico												
Storage Available	1,000'	--	380'	--	--	--	--	700'	360'	--	750'	--
AM	153'	--	280'	--	--	--	--	0'	0'	--	334'	N/A
PM	174'	--	364'	--	--	--	--	273'	180'	--	479'	N/A
48. Calle de Industrias & Avenida Pico												
Storage Available	200'	500'	500'	--	560'	--	100'	ND	--	250'	400'	--
AM	25'	37'	33'	--	53'	--	23'	ND	--	59'	112'	--
PM	136'	74'	69'	--	132'	--	28'	ND	--	180'	382'	--
Note: Queue length represents maximum length of queue in the lane with the longest queue. N/A – Not applicable since movement is a free right turn except when interrupted for pedestrians												

4.6.6 Summer Traffic

The I-5/Avenida Pico interchange is one of the freeway access routes to the various coastal recreation activities in San Clemente. In this area, the I-5 freeway also serves traffic to and from the San Diego area as it represents the only highway connection between Orange and San Diego Counties. To identify how the design volumes could differ on summer weekends and holidays, counts were taken for the following days:

- Summer weekday
- Summer Saturday
- Summer Sunday
- Labor Day

The data comprised 24-hour machine counts by 15 minute intervals on Avenida Pico north and south of the interchange. Comparisons were then made with the volumes for a non-summer weekday, which is the basis for the design volumes.

The results are summarized in Table 4-18 (see Appendix F for actual count data). For a summer weekday, the AM peak hour volumes are lower, primarily due to schools being in recess (San Clemente High School is located just to the east of the interchange), and the PM peak hour is comparable. On summer Saturdays and Sundays, the peak hour (11:00 to 12:00 for a Saturday and 12:00 to 1:00 for a Sunday) is higher than the non-summer weekday AM peak hour south of the interchange but lower to the north. The same occurs on Labor Day. In no cases do the summer peak hour volumes indicate that the PM peak hour design volumes would be exceeded. Hence, the conclusion is that the three alternatives would have adequate capacity to serve peak summer traffic.

Table 4-18: Summer Volume Comparison – Avenida Pico

SUMMER WEEKDAY (AM peak hour is 7:30 to 8:30 and PM peak hour is 4:30 to 5:30)	Percent Difference	
	N/O I-5	S/O I-5
Summer weekday AM peak hour compared to non-summer weekday AM Peak Hour	-25%	-28%
Summer weekday PM peak hour compared to non-summer weekday PM Peak Hour	-3%	-6%
Summer weekday ADT compared to non-summer weekday ADT	-5%	-3%
SUMMER SATURDAY (Summer Saturday peak occurs between 11:00 and 12:00)		
	N/O I-5	S/O I-5
Summer Saturday peak compared to non-summer weekday AM Peak Hour	-24%	32%
Summer Saturday peak compared to non-summer weekday PM Peak Hour	-24%	-7%
Summer Saturday ADT compared to non-summer weekday ADT	-25%	-16%
SUMMER SUNDAY (Summer Sunday peak occurs between 12:00 and 1:00)		
	N/O I-5	S/O I-5
Summer Sunday peak compared to non-summer weekday AM Peak Hour	-33%	8%
Summer Sunday peak compared to non-summer weekday PM Peak Hour	-32%	-24%
Summer Sunday ADT compared to non-summer weekday ADT	-35%	-33%
LABOR DAY (Labor Day peak occurs between 12:00 and 1:00)		
	N/O I-5	S/O I-5
Labor Day peak compared to non-summer weekday AM Peak Hour	-31%	6%
Labor Day peak compared to non-summer weekday PM Peak Hour	-31%	-25%
Labor Day ADT compared to non-summer weekday ADT	-36%	-93%

Chapter 5.0

2018 ANALYSIS – AVENIDA PICO INTERCHANGE

This chapter presents year 2018 analysis results for the Avenida Pico interchange. The purpose is to show operating conditions shortly after project opening.

5.1 METHODOLOGY OVERVIEW

The interim year analysis results presented here address opening year for the Avenida Pico interchange improvements. The No-Build along with the two design options are each analyzed using 2018 traffic forecasts.

Highway system assumptions for 2018 include the completion of the La Pata Avenue gap closure but not the extension of the SR-241 toll road to I-5. Other assumptions are the same as those for the constrained network, which is the basis for the 2040 volumes.

Year 2018 traffic forecasts were derived by interpolating between existing and 2040. The interpolation used 2040 volumes without the SR-241 extension thereby depicting the 2018 volumes at the interchange without the extension as per the 2018 assumptions noted above.

5.2 2018 ANALYSIS – NO-BUILD ALTERNATIVE

For the Avenida Pico interchange, year 2018 volumes and lane configurations for the No-Build Alternative can be found in Figure 5-1. The 2018 LOS and ICU values for the intersection and ramps can be found in Table 5-1 (see Appendix L and M for worksheets). Queuing distances for the interchange intersections are also shown here (See Appendix N for actual calculations).

The results indicate adequate intersection performance, but certain movements would fail due to insufficient storage, as queues cause blockage between intersections. Hence, actual performance would be worse than indicated by these theoretical performance results.

Table 5-1: 2018 Peak Hour Performance – No-Build

Intersection	AM Peak Hour			PM Peak Hour								
	Delay	LOS		Delay	LOS							
HCM Delay												
13. I-5 SB Ramps & Avenida Pico	28.6	C		30.1	C							
14. I-5 NB Ramps & Avenida Pico	13.9	B		30.5	C							
48. Calle de Industrias & Avenida Pico	15.3	B		24.4	C							
Intersection	AM Peak Hour			PM Peak Hour								
	ICU	LOS		ICU	LOS							
ICUs												
13. I-5 SB Ramps & Avenida Pico	0.66	B		0.79	C							
14. I-5 NB Ramps & Avenida Pico	0.63	B		0.76	C							
48. Calle de Industrias & Avenida Pico	0.38	A		0.68	B							
Note: Delay is average control delay per vehicle in seconds												
95 TH PERCENTILE QUEUE LENGTHS												
Intersection	Northbound			Southbound			Eastbound			Westbound		
	L	T	R	L	T	R	L	T	R	L	T	R
13. I-5 Southbound Ramps												
Storage Available	--	--	--	1,350'	1,350'	1,075'	--	400'	350'	260'	300'	--
AM	--	--	--	400'	431'	76'	--	200'	67'	390'	257'	--
PM	--	--	--	406'	436'	65'	--	317'	16'	138'	419'	--
14. I-5 Northbound Ramps												
Storage Available	930'	--	395'	--	--	--	260'	300'	--	--	1,050'	400'
AM	153'	--	239'	--	--	--	3'	1'	--	--	242'	0'
PM	299'	--	305'	--	--	--	177'	286'	--	--	352'	0'
48. Calle de Industrias												
Storage Available	200'	500'	500'	--	560'	--	100'	ND	--	150'	400'	--
AM	26'	20'	39'	--	53'	--	22'	ND	--	44'	43'	--
PM	81'	83'	145'	--	127'	--	29'	ND	--	131'	160'	--
Note: Queue length represents maximum length of queue in the lane with the longest queue. Shaded entries are where available storage is exceeded ND - Not determined since intersection to the west is not included in the network												

5.3 AVENIDA PICO INTERCHANGE – BUILD DESIGN OPTIONS

The following sections present 2018 performance results for the two Build Design Options for the Avenida Pico interchange.

5.3.1 Design Option A – Modified Tight Diamond

As discussed in the previous chapter, the configuration for this design option has nine lanes under the reconstructed bridge and features lane selection requirements for traffic making left turns onto the on-ramps. The 2018 LOS and queuing results for Design Option A are summarized in Table 5-2 (see Appendices L, M and N, for actual calculations). As can be seen, LOS “C” or better is achieved at the intersections under both the HCM and ICU methodologies.

For the queuing between the two ramp intersections, use has been made of the queuing reports generated by SimTraffic. The standard HCM queue results do not account for signal coordination, or in this case, two intersections operating off a single controller. Hence, the SimTraffic results are used here for the eastbound queues at the northbound ramp intersection and the westbound queues at the southbound ramp intersection.

In the westbound direction, the maximum queue length is 42 feet in the AM and 93 feet in the PM. An additional 197 feet of queuing occurs east of the northbound ramp intersection in the AM and 201 feet in the PM. Eastbound, the maximum queue between the two ramp intersections is 158 feet in the AM and 145 feet in the PM. An additional 153 feet of queuing occurs at the southbound ramp intersection in the AM and 222 feet in the PM.

5.3.2 Design Option B – Southeast Quadrant Partial Cloverleaf

The analysis results for Design Option B are summarized in Table 5-3 (see Appendices L, M and N). Three intersections are included in the analysis, the two ramp intersections and the existing signalized intersection at Calle Industrias/Via Pico Plaza. As can be seen, all three intersections are at LOS “C” or better under both the HCM and ICU methodologies. No queue lengths exceed the available storage.

Table 5-2: 2018 Peak Hour Performance – Design Option A

Intersection	AM Peak Hour		PM Peak Hour									
	Delay	LOS	Delay	LOS								
HCM Delay												
13. I-5 SB Ramps & Avenida Pico	20.4	C	20.4	C								
14. I-5 NB Ramps & Avenida Pico	17.4	B	20.3	C								
48. Calle de Industrias & Avenida Pico	15.8	B	24.6	C								
Intersection	AM Peak Hour		PM Peak Hour									
	ICU	LOS	ICU	LOS								
ICUs												
13. I-5 SB Ramps & Avenida Pico	0.57	A	0.61	B								
14. I-5 NB Ramps & Avenida Pico	0.48	A	0.52	A								
48. Calle de Industrias & Avenida Pico	0.38	A	0.68	B								
Note: Delay is average control delay per vehicle in seconds												
95 TH PERCENTILE QUEUE LENGTHS												
Intersection	Northbound			Southbound			Eastbound			Westbound		
	L	T	R	L	T	R	L	T	R	L	T	R
13. I-5 Southbound Ramps												
Storage Available	--	--	--	1,350'	--	1,075'	--	420'	150'	180'	220'	--
AM	--	--	--	178'	--	63'	--	153'	100'	25'	42'	--
PM	--	--	--	134'	--	87'	--	222'	62'	42'	93'	--
14. I-5 Northbound Ramps												
Storage Available	930'	--	395'	--	--	--	180'	230'	--	--	1,050'	400'
AM	66'	--	153'	--	--	--	2'	158'	--	--	182'	N/A
PM	80'	--	115'	--	--	--	53'	145'	--	--	259'	N/A
48. Calle de Industrias												
Storage Available	200'	500'	500'	--	560'	--	100'	380'	--	200'	400'	--
AM	25'	40'	31'	--	53'	--	23'	222'	--	60'	197'	--
PM	134'	75'	66'	--	134'	--	30'	321'	--	164'	201'	--
Note: Queue length represents maximum length of queue in the lane with the longest queue. N/A – Not applicable since movement is a free right turn except when interrupted for pedestrians												

Table 5-3: 2018 Peak Hour Performance – Design Option B

Intersection	AM Peak Hour			PM Peak Hour								
	Delay	LOS	Delay	LOS								
HCM Delay												
13. I-5 SB Ramps & Avenida Pico	23.0	C	20.9	C								
14. I-5 NB Ramps & Avenida Pico	13.1	B	17.3	B								
48. Calle de Industrias & Avenida Pico	15.5	B	27.0	C								
Intersection	AM Peak Hour			PM Peak Hour								
	ICU	LOS	ICU	LOS								
ICUs												
13. I-5 SB Ramps & Avenida Pico	0.61	B	0.67	B								
14. I-5 NB Ramps & Avenida Pico	0.72	C	0.64	B								
48. Calle de Industrias & Avenida Pico	0.33	A	0.58	A								
Note: Delay is average control delay per vehicle in seconds												
95 TH PERCENTILE QUEUE LENGTHS												
Intersection	Northbound			Southbound			Eastbound			Westbound		
	L	T	R	L	T	R	L	T	R	L	T	R
13. I-5 Southbound Ramps												
Storage Available	--	--	--	1,350'	--	1,075'	--	420'	150'	700'	700'	--
AM	--	--	--	294'	--	95'	--	190'	105'	235'	188'	--
PM	--	--	--	262'	--	158'	--	307'	42'	242'	314'	--
14. I-5 Northbound Ramps												
Storage Available	1,000'	--	380'	--	--	--	--	700'	360'	--	750'	--
AM	123'	--	238'	--	--	--	--	29'	3'	--	243'	N/A
PM	176'	--	242'	--	--	--	--	50'	238'	--	272'	N/A
48. Calle de Industrias												
Storage Available	200'	500'	500'	--	560'	--	100'	ND	--	250'	400'	--
AM	25'	38'	31'	--	53'	--	23'	ND	--	58'	100'	--
PM	134'	75'	66'	--	134'	--	30'	ND	--	161'	255'	--
Note: Queue length represents maximum length of queue in the lane with the longest queue. N/A – Not applicable since movement is a free right turn except when interrupted for pedestrians ND - Not determined since intersection to the west is not included in the network												

5.4 2018 MERGE/DIVERGE AND WEAVING ANALYSIS

Based on the Highway Capacity Manual (HCM), analyses for freeway interchange ramp termini can be conducted using a weaving analysis or a merge/diverge analysis. A weaving analysis is conducted on segments of freeway where an on-ramp is followed by an off-ramp within 2,500 feet of the on-ramp and an auxiliary lane connects the two. For a freeway segment that does not include an auxiliary lane connection between interchange junctions, the analysis focuses on the individual ramp junctions in a merge/diverge analysis. Ramp junctions are points at which on-ramps and off-ramps join the freeway and vehicles using these junctions must either merge into or diverge out from the main line freeway traffic flow.

Because the Avenida Pico and I-5 Freeway interchange ramp junctions are connected by auxiliary lanes to Avenida Vista Hermosa to the north and Avenida Palizada to the south, and the spacing is less than 2,500 feet, a weaving analysis is used here.

The results of the weaving and merge/diverge analyses are shown in Table 5-4 (see Appendix D for actual calculations). The LOS is determined from the calculated value for passenger cars per lane per mile (pc/ln/mi). As can be seen, all weave sections show LOS “D” or better.

5.5 RAMP METERING

Ramp metering is proposed for all on-ramps in the Build Alternatives. This section discusses queuing and storage in relation to the ramp metering. For the northbound on-ramp, Design Option A has three metered lanes. These serve the westbound free right turn lane and the two eastbound left turn lanes that are accessing the freeway in the northbound direction. Design Option B has separate metering for the direct ramp and the loop ramp.

For southbound freeway access, Design Options A and B have a single on-ramp with two metered lanes. Vehicle storage requirements at the meters will depend on the ramp metering rate. Peak period volumes for the ramp were obtained from weekday PeMS data and used to establish representative AM and PM demand patterns. The peak hour within the two hour peak period was then used to derive the maximum queue length for several different meter discharge rates. The results are summarized in Table 5-5 (see actual calculation forms in Appendix P), and show the minimum meter rate for queues do not back up onto Avenida Pico.

Table 5-4: Year 2018 Freeway Weaving Analysis – Avenida Pico Interchange

Location	I-5 Northbound						I-5 Southbound																	
	AM Peak			PM Peak			AM Peak			PM Peak														
	Speed (MPH)	Density	LOS	Speed (MPH)	Density	LOS	Speed (MPH)	Density	LOS	Speed (MPH)	Density	LOS												
DESIGN OPTION A																								
Palizada - Avd. Pico	54.8	28.2	D	55.2	27.0	C	51.4	26.6	C	47.7	34.2	D												
Avd. Pico - Vista Hermosa	52.1	29.9	D	49.1	31.8	D	53.7	27.7	C	55.5	30.2	D												
DESIGN OPTION B																								
Palizada - Avd. Pico	54.1	28.5	D	54.4	27.4	C	51.4	26.6	C	47.7	34.2	D												
Avd. Pico - Vista Hermosa	51.6	30.2	D	48.6	32.1	D	53.7	27.7	C	55.5	30.2	D												
LOS Criteria based on Density (pc/mi/ln): <table style="display: inline-table; vertical-align: top; margin-left: 20px;"> <tr> <td>A</td> <td>≤ 10</td> <td>D</td> <td>> 28 - 35</td> </tr> <tr> <td>B</td> <td>> 10 – 20</td> <td>E</td> <td>> 35 - 43</td> </tr> <tr> <td>C</td> <td>> 20 – 28</td> <td>F</td> <td>> 43 Demand exceeds capacity</td> </tr> </table>													A	≤ 10	D	> 28 - 35	B	> 10 – 20	E	> 35 - 43	C	> 20 – 28	F	> 43 Demand exceeds capacity
A	≤ 10	D	> 28 - 35																					
B	> 10 – 20	E	> 35 - 43																					
C	> 20 – 28	F	> 43 Demand exceeds capacity																					

Table 5-5: 2018 Ramp Metering Summary

I-5 NB On Ramp at Avenida Pico:	NORTHBOUND						I-5 SB On Ramp at Avenida Pico:	SOUTHBOUND					
	Peak Hour	Volume	Lanes	Max Q/Lane		Meter Rate ¹		Peak Hour	Volume	Lanes	Max Q/Lane		Meter Rate ¹
				Vehicles	Feet						Vehicles	Feet	
Design Option A	AM	1,180	3	4	116	400	Design Option A	AM	790	2	4	135	400
	PM	1,410	3	1	44	500		PM	890	2	8	245	450
Design Option B (Loop)	AM	220	2	0	0	400	Design Option B	AM	790	2	4	135	400
	PM	540	2	0	0	400		PM	890	2	8	245	450
Design Option B (Slip)	AM	960	2	2	187	500							
	PM	870	2	5	139	450							
¹ Meter Rate in vehicles per lane per hour													

For the northbound on-ramp under Design Option A, a discharge rate of 400 vehicles per hour per lane (vphpl) is adequate to serve the demand in the AM peak hour without queue buildup, and at a rate of 500 vphpl in the PM peak hour. For Design Option B (which has two northbound ramps) the discharge rates for the slip ramp are 500 and 450 for the AM and PM, respectively and 400 for both the AM and PM for the loop ramp. The southbound ramp for Design Options A and B needs discharge rates of 400 and 450 for the AM and PM, respectively.