FINAL
AIR QUALITY ANALYSIS FOR THE PROPOSED INTERSTATE 5 HOV LANE IMPROVEMENTS (SR-55 TO SR-57) PROJECT

12-ORA-5-30.20/34.20

12-0C8900

October 2013

Caltrans

AIR QUALITY ANALYSIS

ORANGE COUNTY TRANSPORTATION AUTHORITY (OCTA)
INTERSTATE 5 HOV LANE IMPROVEMENT PROJECT
ORANGE COUNTY, CALIFORNIA

12-ORA-5-30.20/34.20
EA 0C8900
RTIP ID: 2H0703
Caltrans EFIS ID: 12-0000-0085

Prepared for:

United States Department of Transportation
Federal Highway Administration, California Division
and the
California Department of Transportation, District 12
and the
Orange County
Transportation Authority

Prepared by:

AECOM
1420 Kettner Boulevard, Suite 500
San Diego, California 92101
Phone: (619) 233-1454
Fax: (619) 233-0952

October 2013

AIR QUALITY ANALYSIS

ORANGE COUNTY TRANSPORTATION AUTHORITY (OCTA)
INTERSTATE 5 HOV LANE IMPROVEMENT PROJECT
ORANGE COUNTY, CALIFORNIA

12-ORA-5-30.20/34.20
EA 0C8900
RTIP ID: 2H0703
Caltrans EFIS ID: 12-0000-0085

October 2013

STATE OF CALIFORNIA
Department of Transportation

Prepared By: _____ Date: 10/30/13
Jason Paukovits
Air Quality Analyst
(213) 593-7744
AECOM
515 South Flower Street, Los Angeles, CA 90071

Approved By: _____ Date: _____
Reza Aurasteh, Ph.D., P.E.,
Branch Chief, Environmental Engineering
(949) 724-2738
Caltrans – District 12

The environmental review, certification, and any other action required in accordance with applicable federal laws for this project is being, or has been, carried out by Caltrans under its assumption of responsibility pursuant to 23 U.S.C. 327.

TABLE OF CONTENTS

Section **Page**

EXECUTIVE SUMMARY v

CHAPTER 1 – INTRODUCTION 1
- Project Purpose and Need 1
- Project Description 4
  - Alternative 2A 5
  - Alternative 2B 6
  - Alternative 5A 6
  - Alternative 5B 7
- Design Options 7
  - Option A 7
  - Option B 8
- Existing Traffic Conditions 9

CHAPTER 2 – AIR POLLUTANTS 13
- Carbon Monoxide (CO) 13
- Ozone 14
- Nitrogen Dioxide (NO_2) 14
- Sulfur Dioxide (SO_2) 14
- Lead 14
- Particulate Matter (PM) 14
  - Fine Particulate Matter ($PM_{2.5}$) 15
  - Inhalable Particulate Matter (PM_{10}) 15
- Toxic Air Contaminants (TACs) 15
  - Mobile Source Air Toxics 16
- Asbestos 16
  - Naturally Occurring Asbestos (NOA)-bearing Serpentine 16
- Climate Change and Greenhouse Gases (GHGs) 17

CHAPTER 3 – REGULATORY SETTING 19
- Federal and State Standards 19
  - Conformity of Federal Actions 22
  - Hazardous Air Pollutants 23
- Regional Authority 23

Southern California Association of Governments 23
South Coast Air Quality Management District 24
SCAQMD Rules and Regulations 24
Climate Change 25
Federal 25
State 27
Adaptation Strategies 29

CHAPTER 4 – EXISTING ENVIRONMENTAL SETTING 33
Topography, Meteorology, and Climate 33
Regional and Local Air Quality 34
Sensitive Receptors 37
Greenhouse Gases and Climate Change 37

CHAPTER 5 – IMPACT ANALYSIS 39
Construction Impacts 39
Operational Impacts 41
Consistency with Regional Plans 48
CO Hot-Spot Analysis 49
Particulate Matter ($PM_{2.5}$ and PM_{10}) Hot-Spot Analysis 61
Mobile Source Air Toxics (MSATs) 64
Climate Change 68
Construction 69
Operations 69
Assembly Bill 32 Compliance 71
Cumulative Impacts 74

CHAPTER 6 – POTENTIAL AVOIDANCE, MINIMIZATION, AND/OR MITIGATION MEASURES 77
Permanent Impacts 77
Temporary Impacts 77

CHAPTER 7 – REFERENCES 79

CHAPTER 8 – PREPARER QUALIFICATIONS 83

APPENDICES

A Construction Emissions Worksheets
B Additional Traffic Data
C CO Hot-Spot Analysis
D Transportation Conformity Working Group Form
E MSAT Emissions Analysis
F Criteria Pollutant and GHG Emissions Analysis

LIST OF FIGURES

Figure **Page**

1 Regional Map....2
2 Project Area....3
3 California GHG Inventory Forecast....38
4a CO Protocol....51
4b CO Protocol (continued)....52
5a CO Protocol....54
5b CO Protocol (continued)....55
6 National MSAT Emission Trends 2010 to 2050....65
7 Possible Effect of Traffic Operation Strategies in Reducing On-Road CO_2 Emissions....70
8 Mobility Pyramid....72

LIST OF TABLES

Table **Page**

1 Existing (2011) Average Daily Traffic 10
2 Existing (2011) LOS for Signalized Intersections 11
3 National and California Ambient Air Quality Standards 20
4 National and California Attainment Status for Orange County Portion of the SCAB 35
5 Summary of Annual Ambient Air Quality Data (2010–2012) 36
6 Summary of Construction-Related Emissions of Criteria Air Pollutants and Precursors 40
7 Opening Year (2018) ADT 42
8 Future Year (2040) ADT 43
9 Freeway Mainline LOS Summary for Alternatives 2B/5B – Opening Year (2018) Conditions 44
10 Freeway Mainline LOS Summary for Alternatives 2B/5B – Future Year (2040) Conditions 45
11 Freeway HOV LOS Summary for Alternatives 2A/5A – Opening Year (2018) Conditions 46
12 Freeway HOV LOS Summary for Alternatives 2A/5A – Future Year (2040) Conditions 47
13 Opening Year (2018) LOS for Signalized Intersections 58
14 Opening Year (2040) LOS for Signalized Intersections 59
15 Horizon Year 2040 Carbon Monoxide Concentrations 60
16 MSAT Emissions – Operational Emissions (Pounds per Day) 68
17 Annual CO_2 Emissions – Metric Tons 71
18 Climate Change Strategies 73
19 Opening Year (2018) Operational Emissions 74
20 Future Year (2040) Operational Emissions 74

EXECUTIVE SUMMARY

The Orange County Transportation Authority (OCTA), in cooperation with the California Department of Transportation – District 12 (Caltrans), proposes to improve Interstate 5 (I-5) between State Route (SR) 55 and SR-57 within the cities of Tustin, Santa Ana, and Orange in Orange County, California. The proposed improvements include the addition of a high-occupancy vehicle (HOV) lane in each direction of the project segment on I-5 to provide additional capacity and reduce congestion in the HOV and general-purpose lanes. The proposed project is primarily funded by OCTA with the Renewed Measure M2 local sales tax. Construction is proposed to start in 2016 and be completed in 2018. This air quality report addresses the potential impacts of the proposed improvements.

Impacts would be primarily from air pollutant emissions associated with construction of the proposed project and changes in vehicle traffic operation in future years. Construction emissions were estimated to be less than the South Coast Air Quality Management District's (SCAQMD) significance thresholds. Operational emissions would include changes in vehicle activity (e.g., vehicle speeds, idling) in future years as a result of the proposed project. Criteria pollutant emissions were estimated to decrease as a result of the proposed project in 2018 and 2040, respectively. Therefore, the analyses indicate that the worst-case scenario for the proposed project and alternatives would not result in any substantial air quality impacts.

If the design concept and scope of a proposed transportation project are consistent with the project description in the Regional Transportation Plan (RTP) and Regional Transportation Improvement Program (RTIP), then the proposed project would conform to the State Implementation Plan (SIP). The proposed project is included in the Southern California Association of Government's (SCAG) 2012 RTP (SCAG 2012) and 2008 RTIP (SCAG 2008) as RTP/RTIP ID #2H0703 (I-5 from SR-55 to SR-57 – add one high-occupancy vehicle (HOV) lane in each direction). The design concept and scope of the proposed project are consistent with the project description in the 2012 RTP, the 2008 RTIP, and the assumptions in SCAG's regional emissions analysis. Therefore, the project would conform with the SIP.

The potential for the proposed project to generate a carbon monoxide (CO) hot-spot at the signalized intersections was evaluated using CALINE4 pursuant to the *Transportation Project-Level Carbon Monoxide Protocol* (UCD ITS 1997). The screening analysis included the three worst-case intersections affected by the proposed project, according to *I-5 from SR-55 to SR-57 HOV Improvements Project PA/ED, Transportation Analysis Report, Draft* (AECOM 2013). The proposed project's future traffic conditions would not result in or contribute to any exceedances

of the 1-hour or 8-hour CO standards during the AM or PM peak periods at any of the analyzed intersections, even considering conservative assumptions. Therefore, no localized CO impacts would occur.

A particulate matter (PM) Conformity Hot-spot Analysis and Project Summary Form for Interagency Consultation was prepared and submitted to Caltrans and the SCAG Transportation Conformity Working Group for discussion and review during their monthly meeting on October 23, 2012. The project was reviewed and approved by Interagency Consultation and a determination was made that the project is not a "project of air quality concern". Therefore, the project meets the Clean Air Act requirements and 40 Code of Federal Regulations 93.116 without an explicit hot-spot analysis, and no additional interagency consultation is required. The project would not create a new, or worsen an existing, PM equal to or less than 10 microns in diameter (PM_{10}) or PM equal to or less than 2.5 microns in diameter ($PM_{2.5}$) violation.

Mobile Source Air Toxics (MSAT) emissions for operation of the proposed project were estimated using CT-EMFAC, Version 4.1. MSAT emissions would not vary significantly between Build and No Build Alternatives in 2018 and 2040. Also, regardless of the alternative chosen, emissions would likely be lower than present levels in the design year as a result of U.S. Environmental Protection Agency's (USEPA) national control programs. MSAT emissions in the project area would decrease from existing conditions by an average of 38% in 2018 and 60% in 2040. Therefore, under the Build Alternatives in 2018 and 2040, MSAT emissions would be expected to be reduced compared to existing conditions. No local or regional MSAT impacts related to the proposed project would occur.

An ever-increasing body of scientific research attributes climate changes to greenhouse gases (GHGs), particularly those generated from the production and use of fossil fuels. The proposed project is a capacity-increasing project. However, the project itself would not generate additional traffic, but is intended to accommodate projected regional growth and allow for acceptable roadway operations. The proposed project would contribute to reducing fuel consumption from idling vehicles by minimizing stop-and-go activity and allowing smoother traffic flow on HOV and general-purpose lanes of the I-5 project segment. The overall GHG emissions from the Build Alternatives were estimated to be less than the No Build Alternative in 2040. Therefore, the project would not generate GHG emissions, either directly or indirectly, that may have an impact on the environment. The proposed project's effect on roadway operations would not hinder California's ability to attain the goals identified in Assembly Bill 32.

No adverse air quality impacts were identified for project operations. No mitigation measures would be required. The estimated emissions of this air quality report are considerably less than the Caltrans, Federal Highway Administration, and USEPA standards. Therefore, the project will not have significant air quality impacts, as long as the project scope as described will be the same as in the Final Environmental Document. If changes in the project description in the Final Environmental Document cause insignificant air quality impacts, that analysis will be reflected in the Environmental Document, and no revisions will be made to this air quality report. However, if there are major changes to the scope of this project that significantly affect traffic data, then this air quality report will be revised to address those changes.

This page intentionally left blank.

CHAPTER 1
INTRODUCTION

The Orange County Transportation Authority (OCTA), in cooperation with the California Department of Transportation – District 12 (Caltrans), proposes to improve Interstate 5 (I-5) between State Route (SR) 55 and SR-57 within the cities of Tustin, Santa Ana, and Orange in Orange County, California. Figures 1 and 2 locate the project regionally and locally, respectively.

The proposed improvements include the addition of a high-occupancy vehicle (HOV) lane in each direction of the project segment on I-5 to provide additional capacity and reduce congestion in the HOV and general-purpose lanes. In addition, improvements to the 1st Street Entrance ramp to southbound (SB) I-5 are proposed to improve traffic operations in the general-purpose lanes. All proposed improvements and temporary construction-related activities (staging areas and easements) would be constructed within the existing Caltrans right-of-way (ROW) limits.

OCTA is the lead agency for the project's California Environmental Quality Act (CEQA) document, and Caltrans, as assigned by the Federal Highway Administration (FHWA), is the lead agency for the project's National Environmental Policy Act (NEPA) document. This air quality report addresses the potential short-term and long-term air quality impacts of the proposed improvements.

Project Purpose and Need

The primary purpose of the proposed project is to improve traffic operations and reduce congestion on I-5 from north of SR-55 to south of SR-57. This would improve the safe and efficient local and regional movement of people and goods while minimizing environmental and community impacts. I-5 is the primary freeway route connecting Los Angeles, Orange, and San Diego Counties. The project would extend along I-5 for approximately 4.1 miles through the urban core of Orange County. In Orange County, I-5 continues to experience significant traffic congestion, making the proposed project integral to the local community and the region.

The proposed segments of I-5 are adjacent to a variety of land uses and receptors, including multi-family residential, single-family residential, parks, and commercial land uses. A 300-foot-wide buffer along each side of the I-5 project segment is referred to as the project study area. Adjacent land uses within 300 feet of the Caltrans ROW are the following:

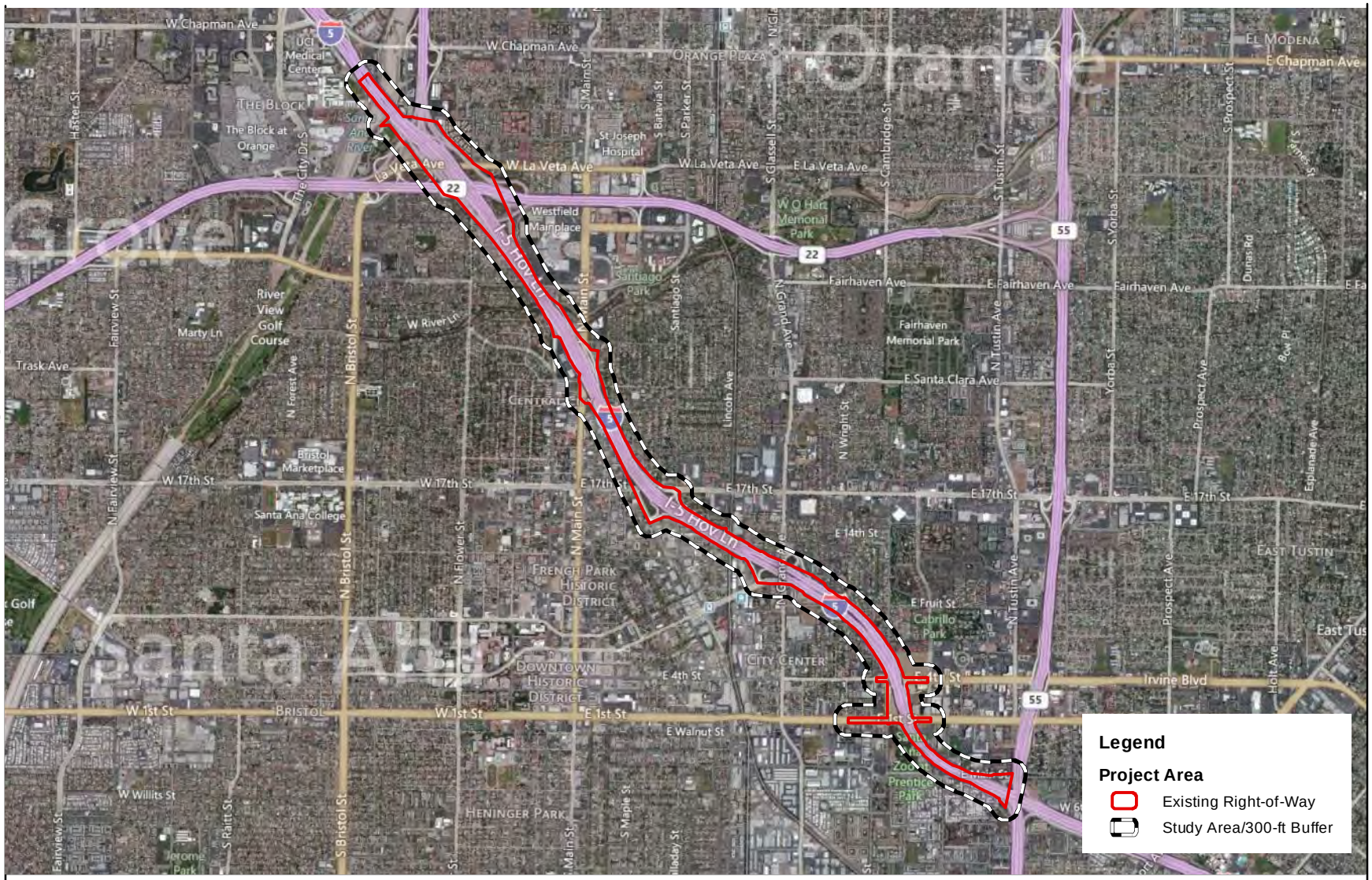
Source: ESRI 2011

4 2 0 4 Miles

Scale: 1:250,000; 1 inch = 4 miles

Figure 1
Regional Map

Path: P:\2011\60220190\06GIS\6.3_Layout\OCTA_I-5\regional_map2.mxd, 8/8/2012, LeeDA



Source: ESRI 2012; AECOM Transportation 2012

3,500 0 3,500 Feet

Scale: 1:42,000; 1 inch = 3,500 feet

Figure 2
Project Area

City of Tustin

- High Density Residential
- Medium Density Residential
- Mobile Home Park
- Professional Office
- Public/Institutional

City of Santa Ana

- Medium Density Residential
- Low Density Residential
- Urban Neighborhood
- Professional & Administrative Office
- District Center
- Open Space
- General Commercial
- Industrial

City of Orange

- Medium Density Residential
- Low Density Residential
- Low Medium Residential
- General Commercial

The proposed project is designed to address the following issues:

- Congestion and travel delay in the HOV lanes within the project limits
- Congestion in the Southbound (SB) general-purpose lanes between 4th Street and SR-55

The traffic congestion results in substantial motorist delay, reduced traffic circulation and level of service (LOS), and increased air pollution from idling vehicles.

Project Description

The proposed improvements to I-5 would occur along an approximately 4-mile section of I-5 from the SR-55 interchange (post mile 30.2) to the SR-57 interchange (post mile 34.2) in the cities of Tustin, Santa Ana, and Orange. The proposed project is primarily funded by OCTA with the Renewed Measure M2 local sales tax. Construction is proposed to start in 2016 and be completed in 2018.

The proposed improvements include the addition of one HOV lane in each direction of I-5 to provide additional HOV capacity and reduce congestion in the HOV lanes. In addition, improvements to the 1st Street entrance ramp to SB I-5 are proposed to improve operations in the general-purpose lanes of the proposed project's segment of I-5. All proposed improvements would be constructed within the existing Caltrans ROW limits, including temporary construction-related activities (staging areas).

Alternatives (2A, 2B, 5A, and/or 5B) are currently under consideration, with two Design Options (Options A and B) that may be applied to each alternative. The following are proposed project-

related improvements that would be consistent across all of the Build Alternatives (Alternatives 2A, 2B, 5A, and 5B):

- The following entrance/exit ramp areas would be slightly adjusted to accommodate the HOV widening:
    - SB I-5 Grand Avenue HOV entrance ramp
    - SB I-5 to Santa Ana Boulevard exit ramp
    - 17th Street to SB I-5 entrance ramp
    - SB I-5 to 17th Street exit ramp
    - Northbound (NB) I-5 to 17th Street exit ramp
    - SB I-5 to Main Street/Broadway exit ramp
    - Santa Clara Avenue to NB I-5 entrance ramp
    - Westbound (WB) SR-22 to NB I-5 entrance ramp
    - Eastbound (EB) SR-22 to SB I-5 connector
    - SB I-5 to EB SR-22 connector
    - NB I-5 to NB SR-57 connector
    - Main Street to SB I-5 entrance ramp
- Closure of the HOV barrier gap (between Lincoln Avenue and north of 17th Street) and relocation of the existing HOV concrete barriers on the NB side of I-5 between Lincoln Avenue and the Santa Clara Avenue overcrossing entrance ramp would occur.
- Design options would apply to each of the two Build Alternatives under evaluation. These design options involve existing structures that may be removed, including the Main Street HOV drop exit and entrance ramps and the SB I-5 1st Street "horseshoe" exit ramp. The SB I-5 1st Street ramp design options are independent of the HOV alternative selected. Additional detail is provided below following the Alternative 2A, 2B, 5A, and 5B descriptions.

The proposed project includes additional design features, such as retaining walls, drainage inlets, and sign structures, that are not discussed in detail in this analysis. For the purposes of this report, the project description focuses on those features that would primarily affect traffic operations and air quality impacts.

Alternative 2A

This alternative is a combination of Alternatives 2 and 4 from the previously prepared Project Study Report (Caltrans 2010a). Alternative 2A would eliminate or minimize some of the design elements of the two separate alternatives. Alternative 2A proposes the following design features:

- The existing concrete barriers located between the HOV-1 lane and general-purpose lanes would be removed and new concrete barriers approximately 2 feet to 6 feet toward the existing freeway centerline would be constructed.
- A new concrete barrier would be constructed to continuously separate the two HOV lanes.
- A new HOV-2 lane would be added in the general-purpose lane area, with continuous ingress/egress striping throughout the project limits.
- The HOV-1 facility would feature a modified left shoulder, the HOV-1 lane, and a modified right shoulder.
- The HOV-2 and adjacent general-purpose lanes would consist of a modified left shoulder, the HOV-2 lane, four general-purpose lanes, and a modified right shoulder.
- Three general-purpose lanes (in each direction) between 17th Street to the SB I-5 entrance ramp and Broadway Bridge would be reduced to 11 feet wide to avoid widening the 17th Street undercrossing, avoid reconstructing the 900 feet of sound wall on the retaining wall, avoid reconstructing the Main Street to SB I-5 entrance ramp, and avoid the existing bridge columns.

All improvements would be within the existing freeway/roadway ROW boundaries.

Alternative 2B

Alternative 2B would include the same improvements as Alternative 2A. However, this alternative would remove the Main Street HOV drop entrance and exit ramps.

Alternative 5A

This alternative is a combination of features from Alternatives 2, 3, and 4 from the previously prepared Project Study Report (Caltrans 2010a). This combination of features would require the least amount of design exceptions. Alternative 5A proposes to add the new HOV-2 lane adjacent to the existing HOV-1 lane and has the following design features:

- The existing concrete barriers between the HOV-1 lane and the general-purpose lanes would be removed, providing a continuous ingress/egress striping throughout the project limits, except at bridge columns.

- New SB/NB separated concrete barriers would be constructed closer to the freeway centerline from the existing barrier location to provide space and eliminate design exceptions.
- In each direction on I-5, the HOV facility would feature a modified left shoulder, the two HOV-1 and HOV-2 lanes, and a modified right shoulder between the HOV lanes and the general-purpose lanes at bridge columns.
- In each direction on I-5, there would be five general-purpose lanes, with a modified right shoulder and a modified left shoulder between the general-purpose lanes and the HOV lanes at the bridge columns.

All improvements would be within the existing freeway/roadway ROW boundaries.

Alternative 5B

Alternative 5B would include the same improvements as Alternative 5A. However, this alternative would remove the Main Street HOV drop entrance and exit ramps.

Design Options

The following design options (Options A and B) may be combined with any of the above alternatives (2A, 2B, 5A, and/or 5B).

- Alternative 2A with Design Option A
- Alternative 2A with Design Option B
- Alternative 2B with Design Option A
- Alternative 2B with Design Option B
- Alternative 5A with Design Option A
- Alternative 5A with Design Option B
- Alternative 5B with Design Option A
- Alternative 5B with Design Option B

Option A

This design option would close the existing I-5 SB entrance ramp at 1st Street and construct an entrance ramp at the 4th Street interchange. This would result in an approximately 825-foot increase of weaving length (1,550 to 2,375 feet) along SB I-5 between the 4th Street entrance ramp and SR-55.

Proposed Engineering Features

- Remove the existing 1st Street to SB I-5 entrance ramp and construct a new entrance ramp at 4th Street to create a full diamond interchange. Remove the traffic signal at 1st Street and the SB I-5 entrance ramp, restripe the entrance ramp to the I-5 mainline, and reconstruct the gore area.
- Close the NB I-5 "horseshoe" exit ramp to Mabury Street/1st Street, add a second left-turn lane on the NB I-5 exit ramp to WB 4th Street, and restripe portions of the NB exit ramp at this location.
- Convert the EB 4th Street inside through-lane to a second left-turn lane to the NB I-5 entrance ramp.
- Reconfigure Mabury Street into a two-way street from Palm Street to 1st Street and modify the Mabury Street/1st Street intersection accordingly. Add a left-turn lane at EB 1st Street to NB Mabury Street. Close existing access to Mabury Street from 4th Street.
- Restripe portions of 1st Street, 4th Street, and Mabury Street to ensure operational continuity. Remove a portion of the existing slope and construct the retaining (tie-back) wall in front of the existing west abutment of the 1st Street overcrossing and the adjacent storm water pump station.

Option B

This design option would close the existing SB I-5 entrance ramp at 1st Street and construct an entrance loop ramp on the vacant parcel between 1st Street and 4th Street, and between Mabury Street and the SB I-5 mainline within the ROW. This would result in a 725-foot increase of the weaving length (1,550 feet to 2,275 feet) along SB I-5 between the proposed 1st Street entrance loop ramp and along SB I-5 to the SB SR-55 connector.

Proposed Engineering Features

- Remove the 1st Street entrance ramp and construct the new entrance loop ramp within the vacant parcel between 1st Street, 4th Street, and the SB I-5 mainline. Remove the traffic signal at 1st Street and the SB I-5 entrance ramp. Restripe the entrance ramp to the mainline and reconstruct the gore area.
- Modify the NB I-5 exit ramp to Mabury Street/1st Street to remove the second ramp lane prior to the interface with Mabury Street.

- Reconfigure Mabury Street as a two-way street and modify the Mabury Street/1st Street intersection accordingly. Add dual left-turn lanes at EB 1st Street and an exclusive right-turn lane for WB 1st Street to the NB Mabury Street/SB I-5 entrance ramp.
- Restripe portions of 1st Street, South Elk Lane, and Mabury Street to ensure operational continuity.
- Realign the NB I-5 to Main Street off-ramp, the Santa Clara Avenue to NB I-5 on-ramp, the WB SR-22 to NB I-5 on-ramp, the EB SR-22 to SB I-5 on-ramp, the NB SR-57 to SB I-5 on-ramp, and the Main Street to SB I-5 on-ramp to accommodate widening.

Existing Traffic Conditions

Currently, the segments of I-5 that would be affected by the proposed project experience annual average daily traffic (AADT) levels from 320,000 to 349,000 (Caltrans 2011a). Truck traffic levels along the same proposed segments of I-5 range from 15,290 to 19,195 AADT, or 5.5% to 7% of total vehicle volumes (Caltrans 2011b). Table 1 indicates the total average daily traffic (ADT) and truck ADT based on *I-5 from SR-55 to SR-57 HOV Improvements Project PA/ED, Transportation Analysis Report, Draft* (AECOM 2013). For the purposes of the traffic analysis, truck percentages within the study area were assumed to be approximately 6% in the weekday AM and PM peak hours (AECOM 2013).

Of the mainline I-5 segments considered in the Transportation Analysis Report, eight segments currently operate at LOS E or F during the AM peak hour and seven segments currently operate at LOS E or F during the PM peak hour (AECOM 2013). The existing peak hour speeds for the majority of the freeway sections operate at or near the free-flow speed of 65 miles per hour (mph). At a few locations, the speeds drop to between 30 and 40 mph, indicating congested conditions consistent with LOS F conditions (AECOM 2013).

The northbound and southbound I-5 HOV lanes between SR-55 and SR-57 are considered degraded facilities, which are defined as facilities where vehicles fail to maintain a minimum average operating speed of 45 mph for HOV facilities with speed limits of 50 mph or greater (AECOM 2013). The existing HOV lanes on I-5 currently have two locations at which bottlenecks (i.e., when two HOV lanes converge to one lane) constrain the ability of vehicles to proceed through the HOV lanes. Under current conditions, the average vehicle speed at the HOV bottlenecks during peak hours was determined to be approximately 15 mph compared with the posted vehicle speed of 65 mph.

Table 1
Existing (2011) Average Daily Traffic

Roadway Segment	Total ADT	Truck ADT
SR-57 between Chapman off-ramp and SR-22 off-ramp	254,885	15,293
I-5 between Chapman on-ramp and SR-22 off-ramp	285,025	17,102
I-5 at SR-57 HOV merge	227,022	13,621
I-5 between SR-57 HOV merge and Main HOV off-ramp	271,258	16,275
I-5 between Main HOV off-ramp and HOV entrance south of Lincoln overcrossing	349,842	20,991
I-5 between HOV lane merge and HOV lane exit north of Lincoln overcrossing	338,293	20,298
I-5 between HOV entrance and Grand HOV on-ramp	316,487	18,989
I-5 between 4th on-ramp and Grand off-ramp	380,097	22,806
I-5 south of SR-55 HOV	363,016	21,781
I-5 between SR-55 on-ramp and 1st/4th off-ramp	295,476	17,729
SR-55 south of I-5 HOV	269,133	16,148

Source: AECOM 2013

As shown in Table 2, all study area intersections operate acceptably (LOS D or better) with the exception of the SR-55 SB Ramps/4th Street intersection. The SR-55 SB Ramps/4th Street intersection operates at LOS F in the AM peak hour due to the high volume of traffic destined to the SR-55 southbound on-ramp (AECOM 2013).

Table 2
Existing (2011) LOS for Signalized Intersections

Intersection	AM Peak Hour		PM Peak Hour	
	Delay	**LOS**	**Delay**	**LOS**
Main/4th	11.3	B	12	B
Grand/4th	33.6	C	42.2	D
I-5 SB Ramp/4th	11.6	B	15.2	B
I-5 NB Ramp/4th	8.9	A	18.2	B
Cabrillo/4th	27.7	C	31.7	C
Tustin/4th	29.9	C	38.2	D
Main/1st	40.9	D	37	D
Grand/1st	36.1	D	40.7	D
I-5 SB Ramp/1st	8.3	A	10.4	B
Cabrillo/1st	25.7	C	25.8	C
Tustin/1st	15.5	B	16.5	B
I-5 Ramp/Santa Ana	19.9	B	51.4	D
Grand/Santa Ana	27.6	C	35.1	D
Mabury/Elk/1st	28.6	C	39.5	D
Lyon/1st	19.2	B	17.5	B
Cabrillo/State Fund	4.2	A	5.9	A
Cabrillo/Xerox Center	4.4	A	8.1	A
Golden Circle/4th	7.9	A	10.2	B
Golden Circle/1st	7.5	A	7.5	A
SR-55 SB Ramps/4th	**>80.0**	**F**	19.9	B
SR-55 NB Ramps/4th	19.1	B	36.8	D

Source: AECOM 2013.

Traffic data relevant to the proposed project and alternatives for the Opening Year (2018) and Future Year (2040) conditions are discussed in more detail throughout the report.

This page intentionally left blank.

CHAPTER 2
AIR POLLUTANTS

"Air pollution" is a general term that refers to one or more chemical substances that degrade the quality of the atmosphere. Individual air pollutants may adversely affect human or animal health, reduce visibility, damage property, and reduce the productivity or vigor of crops and natural vegetation.

Six air pollutants have been identified by the U.S. Environmental Protection Agency (USEPA) as being of concern nationwide: ozone; carbon monoxide (CO); nitrogen dioxide (NO_2); sulfur dioxide (SO_2); lead; and particulate matter (PM), which is subdivided into two classes based on particle size: PM equal to or less than 10 microns in diameter (PM_{10}) and PM equal to or less than 2.5 microns in diameter ($PM_{2.5}$). These pollutants are collectively referred to as criteria pollutants and are discussed in detail below and later in this report. The sources of these pollutants, their effects on human health and the nation's welfare, and their final deposition in the atmosphere vary considerably.

The criteria pollutants that are most important for this air quality analysis are those that can be traced principally to motor vehicles and construction activities. Of these pollutants, ozone, CO, $PM_{2.5}$, and PM_{10} are evaluated on a regional basis. CO and PM are also often analyzed on a localized or "microscale" basis in cases of congested traffic conditions. In addition to the criteria pollutants, toxic air contaminants (TACs), asbestos, and greenhouse gases (GHGs) are air pollutants of concern.

Carbon Monoxide (CO)

CO is a colorless and odorless gas that, in the urban environment, is associated primarily with the incomplete combustion of fossil fuels in motor vehicles. Relatively high concentrations are typically found near crowded intersections and along heavily used roadways carrying slow-moving traffic. Even under most severe meteorological and traffic conditions, high concentrations of CO are limited to locations within a relatively short distance (300 to 600 feet) of heavily traveled roadways. Vehicle traffic emissions can cause localized CO impacts, and severe vehicle congestion at major signalized intersections can generate elevated CO levels, called "hot-spots," that can be hazardous to human receptors adjacent to the intersections.

Ozone

Ozone is the principal component of smog and is formed in the atmosphere through a series of reactions involving reactive organic gases (ROG) and nitrogen oxides (NO_X) in the presence of sunlight. ROG and NO_X are called precursors of ozone. NO_X includes various combinations of nitrogen and oxygen, including nitrogen oxide (NO), nitrogen dioxide (NO_2), and others. Ozone is a principal cause of lung and eye irritation in the urban environment. Significant ozone concentrations are usually produced only in the summer, when atmospheric inversions are greatest and temperatures are high. ROG and NO_X emissions are both considered critical in ozone formation.

Nitrogen Dioxide (NO_2)

NO_2 is a product of combustion and is generated in vehicles and in stationary sources such as power plants and boilers. NO_2 can cause lung damage. As noted above, NO_2 is part of the NO_X family and is a principal contributor to ozone and smog generation.

Sulfur Dioxide (SO_2)

SO_2 is a combustion product, with the primary source being power plants and heavy industries that use coal or oil as fuel. SO_2 is also a product of diesel engine combustion. The health effects of SO_2 include lung disease and breathing problems for asthmatics. SO_2 in the atmosphere contributes to the formation of acid rain.

Lead

Lead is a highly toxic metal that may cause a range of human health effects. Previously, the lead used in gasoline anti-knock additives represented a major source of lead emissions to the atmosphere. USEPA began working to reduce lead emissions soon after its inception, issuing the first reduction standards in 1973. Lead emissions have significantly decreased due to the near elimination of leaded gasoline use.

Particulate Matter (PM)

PM is a complex mixture of extremely small particles and liquid droplets. PM is made up of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals,

and soil or dust particles. Natural sources of particulates include windblown dust and ocean spray.

The size of PM is directly linked to the potential for causing health problems. USEPA is concerned about particles that are 10 micrometers in diameter or smaller because those are the particles that generally pass through the throat and nose and enter the lungs. Once inhaled, these particles can affect the heart and lungs and cause serious health effects. Health studies have shown an association between exposure to PM and premature death. Other important effects include aggravation of respiratory and cardiovascular disease, lung disease, decreased lung function, asthma attacks, and certain cardiovascular problems such as heart attacks and irregular heartbeat (USEPA 2007). Individuals particularly sensitive to fine particle exposure include older adults, people with heart and lung disease, and children. USEPA groups PM into two categories: $PM_{2.5}$ and PM_{10}, as described below.

Fine Particulate Matter ($PM_{2.5}$)

Fine particles, such as those found in smoke and haze, are $PM_{2.5}$. Sources of fine particles include all types of combustion activities (motor vehicles, power plants, wood burning, etc.) and certain industrial processes. $PM_{2.5}$ is the major cause of reduced visibility (haze) in California.

Inhalable Particulate Matter (PM_{10})

PM_{10} includes both fine and coarse dust particles; the fine particles are $PM_{2.5}$. Coarse particles, such as those found near roadways and dusty industries, are larger than 2.5 micrometers and smaller than 10 micrometers in diameter. Sources of coarse particles include crushing or grinding operations and dust from paved or unpaved roads. The health effects of PM_{10} are similar to $PM_{2.5}$. Control of PM_{10} is primarily achieved through the control of dust at construction and industrial sites, the cleaning of paved roads, and the wetting or paving of frequently used unpaved roads.

Toxic Air Contaminants (TACs)

In addition to criteria air pollutants, USEPA regulates TACs, also known as hazardous air pollutants. Concentrations of TACs are also used as indicators of ambient air quality conditions. A TAC is defined as an air pollutant that may cause or contribute to an increase in mortality or in serious illness, or that may pose a hazard to human health. TACs are usually present in minute quantities in ambient air; however, their high toxicity may pose a threat to public health even at low concentrations. Most TACs originate from human-made sources, including on-road mobile

sources, nonroad mobile sources (e.g., airplanes), area sources (e.g., dry cleaners), and stationary sources (e.g., factories and refineries).

Mobile Source Air Toxics

Mobile Source Air Toxics (MSATs) are compounds emitted from highway vehicles and nonroad equipment. Some toxic compounds are present in fuel and are emitted to the air when the fuel evaporates or passes through the engine unburned. Other toxics are formed as secondary combustion products. Metal air toxics also result from engine wear or from impurities in oil or gasoline.

MSATs are a subset of the 188 air toxics defined by the Clean Air Act (CAA). USEPA identified seven MSAT compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risks. These MSATs include acrolein, benzene, 1,3-butidiene, diesel particulate matter plus diesel exhaust organic gases (diesel PM), formaldehyde, naphthalene, and polycyclic organic matter. While the FHWA considers these the priority MSATs, the list is subject to change and may be adjusted in consideration of future USEPA rules.

Asbestos

The CAA requires USEPA to develop and enforce regulations to protect the general public from exposure to airborne contaminants that are known to be hazardous to human health. Asbestos is a known carcinogen and inhalation of asbestos may result in the development of lung cancer or mesothelioma. The proposed project does not include construction activities that would involve asbestos.

Naturally Occurring Asbestos (NOA)-bearing Serpentine

Serpentine is a mineral commonly found in seismically active regions of California, usually in association with ultramafic rocks and along associated faults. Certain types of serpentine occur naturally in a fibrous form known generically as asbestos. According to the report *A General Location Guide for Ultramafic Rocks in California Area Likely to Contain Naturally Occurring Asbestos* (CDC 2000), the NOA-bearing Serpentine is not typically found in the geological formations present on the proposed project site (CDC 2000).

Climate Change and Greenhouse Gases (GHGs)

Climate change refers to long-term changes in temperature, precipitation, wind patterns, and other elements of the earth's climate system. An ever-increasing body of scientific research attributes these climatological changes to GHGs, particularly those generated from the production and use of fossil fuels. While climate change has been a concern for several decades, the establishment of the Intergovernmental Panel on Climate Change (IPCC) by the United Nations and World Meteorological Organization in 1988 has led to increased efforts devoted to GHG emissions reduction and climate change research and policy. These efforts are primarily concerned with the emissions of GHGs related to human activity that include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), tetrafluoromethane, hexafluoroethane, sulfur hexafluoride, hydrofluorocarbon (HFC)-23 (fluoroform), HFC-134a (s,s,s,2 –tetrafluoroethane), and HFC-152a (difluoroethane).

This page intentionally left blank.

CHAPTER 3
REGULATORY SETTING

Federal and State Standards

At the federal level, USEPA has been charged with implementing national air quality programs. USEPA's air quality mandates are drawn primarily from the federal CAA, which was enacted in 1970. The most recent major amendments to the CAA were made by Congress in 1990.

The federal CAA required USEPA to establish National Ambient Air Quality Standards (NAAQS) for criteria pollutants. USEPA has established primary and secondary NAAQS for the following criteria air pollutants: ozone, CO, NO_2, SO_2, PM_{10}, $PM_{2.5}$, and lead. Primary standards protect the public health and secondary standards protect public welfare. The federal CAA also required each state to prepare an air quality control plan referred to as a State Implementation Plan (SIP). The federal CAA Amendments of 1990 (CAAA) added requirements for states with nonattainment areas to revise their SIPs to incorporate additional control measures to reduce air pollution. The SIP is modified periodically to reflect the latest emissions inventories, planning documents, and rules and regulations of the air basins as reported by their jurisdictional agencies. USEPA must review all SIPs to determine whether they conform to the mandates of the federal CAA and the amendments thereof, and to determine whether implementing the SIPs will achieve air quality goals.

The California Air Resources Board (ARB) is responsible for coordination and oversight of state and local air pollution control programs in California, and for implementation of the California Clean Air Act (CCAA). The CCAA, which was adopted in 1988, required ARB to establish California Ambient Air Quality Standards (CAAQS). ARB established CAAQS for the above-mentioned criteria air pollutants, and, in addition, sulfates, hydrogen sulfide, vinyl chloride, and visibility-reducing PM. In most cases, the CAAQS are more stringent than the NAAQS. Differences in the standards are generally explained through interpretation of the health-effects studies considered during the standard-setting process. In addition, the CAAQS incorporate a margin of safety to protect sensitive individuals. Federal and state standards are shown in Table 3.

Table 3
National and California Ambient Air Quality Standards

Pollutant	Averaging Time	California Standards [a]		National Standards [b]		
		Concentration [c]	Method	Primary [c,d]	Secondary [c,e]	Method
Ozone	1 hour	0.09 ppm (180 μg/m^3)	Ultraviolet Photometry	–	Same as primary standard	Ultraviolet Photometry
	8 hours	0.070 ppm (137 μg/m^3)		0.075 ppm (147 μg/m^3)		
Respirable particulate matter (PM_{10})	24 hours	50 μg/m^3	Gravimetric or Beta Attenuation	150 μg/m^3	Same as primary standard	Inertial Separation and Gravimetric Analysis
	Annual arithmetic mean	20 μg/m^3		–		
Fine particulate matter ($PM_{2.5}$)	24 hours	–	Gravimetric or Beta Attenuation	35 μg/m^3	Same as primary standard	Inertial Separation and Gravimetric Analysis
	Annual arithmetic mean	12 μg/m^3		12 μg/m^3		
Carbon monoxide	8 hours	9.0 ppm (10 mg/m^3)	Non-Dispersive Infrared Photometry (NDIR)	9 ppm (10 mg/m^3)	None	Non-Dispersive Infrared Photometry (NDIR)
	1 hour	20 ppm (23 mg/m^3)		35 ppm (40 mg/m^3)		
	8 hours (Lake Tahoe)	6 ppm (7 mg/m^3)		–	–	
Nitrogen dioxide [f]	Annual arithmetic mean	0.030 ppm (57 μg/m^3)	Gas Phase Chemiluminescence	0.053 ppm (100 μg/m^3)	Same as primary standard	Gas Phase Chemiluminescence
	1 hour	0.18 ppm (339 μg/m^3)		100 ppb (188 μg/m^3)	None	
Sulfur dioxide [g]	Annual Arithmetic Mean	–	Ultraviolet Fluorescence	0.030 ppm (for certain areas) [g]	–	Spectrophotometry (Paraosaniline Method)
	24 hours	0.04 ppm (105 μg/m^3)		0.14 ppm (for certain areas) [g]	–	
	3 hours	—		–	0.5 ppm (1,300 μg/m^3)	
	1 hour	0.25 ppm (655 μg/m^3)		0.075 ppm (196 μg/m^3)	–	
Lead [h,i]	30-day average	1.5 μg/m^3	Atomic Absorption	–	–	
	Calendar quarter	–		1.5 μg/m^3 (for certain areas) [i]	Same as primary standard	High Volume Sampler and Atomic Absorption
	Rolling 3-month average	–		0.15 μg/m^3		
Visibility-reducing particles [j]	8 hours	See footnote j	Beta Attenuation and Transmittance through Filter Tape.	No national standards		
Sulfates	24 hours	25 μg/m^3	Ion Chromatography			
Hydrogen sulfide	1 hour	0.03 ppm (42 μg/m^3)	Ultraviolet Fluorescence			
Vinyl chloride [j]	24 hours	0.01 ppm (26 μg/m^3)	Gas Chromatography			

Table 3 (continued)
National and California Ambient Air Quality Standards

Notes: mg/m^3 = milligrams per cubic meter; $PM_{2.5}$ = fine particulate matter with an aerodynamic resistance diameter of 2.5 micrometers or less; PM_{10} = respirable particulate matter with an aerodynamic resistance diameter of 10 micrometers or less; ppb = parts per billion; ppm = parts per million; $\mu g/m^3$ = micrograms per cubic meter

[a] California standards for ozone, carbon monoxide (except 8-hour Lake Tahoe), sulfur dioxide (1- and 24-hour), nitrogen dioxide, and particulate matter (PM_{10}, $PM_{2.5}$, and visibility-reducing particles), are values that are not to be exceeded. All others are not to be equaled or exceeded. California ambient air quality standards are listed in the Table of Standards in Section 70200 of Title 17 of the California Code of Regulations.

[b] National standards (other than ozone, particulate matter, and those based on annual arithmetic mean) are not to be exceeded more than once a year. The ozone standard is attained when the fourth highest 8-hour concentration measured at each site in a year, averaged over 3 years, is equal to or less than the standard. For PM_{10}, the 24-hour is attained when the expected number of days per calendar year with a 24-hour average concentration above 150 $\mu g/m^3$ is equal to or less than 1. For $PM_{2.5}$, the 24-hour standard is attained when 98% of the daily concentrations, averaged over 3 years, are equal to or less than the standards. Contact USEPA for further clarification and current national policies.

[c] Concentration expressed first in the units in which it was promulgated. Equivalent units given in parentheses are based upon a reference temperature of 25 degrees Celsius (°C) and a reference pressure of 760 torr. Most measurements of air quality are to be corrected to a reference temperature of 25°C and reference pressure of 760 torr; parts per million (ppm) in this table refers to ppm by volume, or micromoles of pollutant per mole of gas.

[d] National Primary Standards: The levels of air quality necessary, with an adequate margin of safety to protect the public health.

[e] National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

[f] To attain the 1-hour national standard, the 3-year average of the annual 98th percentile of the 1-hour daily maximum concentrations at each site must not exceed 100 ppb. Note the national 1-hour standard is in units of parts per billion (ppb). California standards are in units of ppm. To directly compare the national 1-hour standard to the California standards the units can be converted from ppb to ppm. In this case, the national standard of 100 ppb is identical to 0.100 ppm.

Source: ARB 2013a

[g] On June 2, 2010, a new 1-hour SO_2 standard was established and the existing 24-hour and annual primary standards were revoked. To attain the 1-hour national standard, the 3-year average of the annual 99th percentile of the 1-hour daily maximum concentrations at each site must not exceed 75 ppb. The 1971 SO_2 national standards (24-hour and annual) remain in effect until 1 year after an area is designated for the 2010 standard, except that in areas designated nonattainment for the 1971 standards, the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standards are approved.

Note that the 1-hour national standard is in units of ppb. California standards are in units of ppm. To directly compare the 1-hour national standard to the California standard, the units can be converted to ppm. In this case, the national standard of 75 ppb is identical of 0.075 ppm.

[h] The California Air Resources Board (ARB) has identified lead and vinyl chloride as toxic air contaminants with no threshold level of exposure for adverse health effects determined. These actions allow for the implementation of control measures at levels below the ambient concentrations specified for these pollutants.

[i] The national standard for lead was revised on October 15, 2008, to a rolling 3-month average. The 1978 lead standard (1.5 $\mu g/m^3$ as a quarterly average) remains in effect until 1 year after an area is designated for the 2008 standard, except that in areas designated nonattainment for the 1978 standard, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standards are approved.

[j] In 1989, ARB converted both the general statewide 10-mile visibility standard and the Lake Tahoe 30-mile visibility standard to instrumental equivalents, which are “extinction of 0.23 per kilometer” and the “extinction of 0.07 per kilometer” for the statewide and Lake Tahoe Air Basin standards, respectively.

Conformity of Federal Actions

Section 176(c) of the CAA requires the following:

> No department, agency, or instrumentality of the Federal Government shall engage in, support in any way, or provide financial assistance for, license or permit, or approve, any activity which does not conform to an implementation plan after it has been approved.

Conformity to an implementation plan is defined as follows:

A. Conformity to an implementation plan's purpose of eliminating or reducing the severity and number of violations of the national ambient air quality standards and achieving expeditious attainment of such standards; and

B. that such activities will not:

   i. cause or contribute to any new violation of any standard in any area;

   ii. increase the frequency or severity of any existing violation of any standard in any area; or

   iii. delay timely attainment of any standard or any required interim emission reductions or other milestones in any area.

The determination of conformity is based on the most recent estimates of emissions, and such estimates are determined from the most recent population, employment, travel, and congestion estimates made by the metropolitan planning organization (MPO) or other agency authorized to make such estimates.

The U.S. Department of Transportation (USDOT) and USEPA developed guidance in November 1993 for determining conformity of transportation plans, programs, and projects. This guidance is denoted as the Transportation Conformity Rule (40 Code of Federal Regulations [CFR] Sections 51.390 and 40 CFR Sections 93.100–129).

The CAA requires a demonstration that federal actions conform to the SIP and similar approved plans in areas that are designated as nonattainment or have maintenance plans for criteria pollutants. Transportation projects, such as the proposed project, are analyzed for conformity with the SIP as part of the Regional Transportation Plan (RTP) and Regional Transportation

Improvement Program (RTIP). If the design concept and scope of a proposed transportation project are consistent with the project description in the applicable RTP and RTIP and the assumptions in the regional emissions analysis for the RTP and RTIP, then the proposed project would conform to the SIP, and no adverse regional air quality impact would occur as a result of the project.

Hazardous Air Pollutants

The federal CAA requires USEPA to develop and enforce regulations to protect the general public from exposure to airborne contaminants that are known to be hazardous to human health. In accordance with the CAA Section 112, USEPA established National Emissions Standards for Hazardous Air Pollutants to protect public health. As mentioned earlier, the CAA identified 188 compounds as hazardous air pollutants. USEPA has assessed this expansive list of toxics and identified a group of 21 as MSATs.

USEPA has issued a number of regulations that will dramatically decrease MSATs through cleaner fuels and cleaner engines. In February 2007, USEPA issued a final rule (Control of Hazardous Air Pollutants from Mobile Sources [Federal Register, Vol. 72, No. 37, Page 8430, February 26, 2007]) to reduce hazardous air pollutants from mobile sources. The final standards will significantly lower emissions of benzene and the other air toxics in three ways: (1) by lowering benzene content in gasoline; (2) by reducing exhaust emissions from passenger vehicles operated at cold temperatures (under 75 degrees Fahrenheit); and (3) by reducing emissions that evaporate from, and permeate through, portable fuel containers.

Regional Authority

Southern California Association of Governments

The Southern California Association of Governments (SCAG) is the applicable MPO for the proposed project site. SCAG's jurisdiction covers six counties—Los Angeles, Orange, San Bernardino, Riverside, Ventura, and Imperial—and approximately 18 million residents. One of the main responsibilities of SCAG is to maintain and develop comprehensive transportation planning for the region through RTPs and RTIPs. These transportation planning documents are intended to improve future transportation networks and options for residents. This analysis will evaluate the consistency of the proposed project with SCAG's current RTP and RTIP. In addition to transportation planning, SCAG is also responsible for planning the region's growth management, hazardous waste management, and air quality. With respect to air quality

responsibilities, SCAG is tasked with determining conformity under the federal CAA for projects, plans, and programs.

South Coast Air Quality Management District

The South Coast Air Quality Management District (SCAQMD) attains and maintains air quality conditions in the South Coast Air Basin (SCAB) through a comprehensive program of planning, regulation, enforcement, technical innovation, and promotion of the understanding of air quality issues. The clean air strategy of SCAQMD includes preparation of plans for the attainment of ambient air quality standards, adoption and enforcement of rules and regulations concerning sources of air pollution, and issuance of permits for stationary sources of air pollution. SCAQMD also inspects stationary sources of air pollution; responds to citizen complaints; monitors ambient air quality and meteorological conditions; and implements programs and regulations required by the CAA, CAAA, and CCAA.

SCAQMD Rules and Regulations

All projects are subject to SCAQMD rules and regulations in effect at the time of construction. Specific rules applicable to the construction of the proposed project may include the following:

> *Rule 401 – Visible Emissions.* A person shall not discharge into the atmosphere from any single source of emission whatsoever any air contaminant for a period or periods aggregating more than three minutes in any one hour which is as dark or darker in shade as that designated No. 1 on the Ringelmann Chart, as published by the United States Bureau of Mines.
>
> *Rule 402 – Nuisance.* A person shall not discharge from any source whatsoever such quantities of air contaminants or other material which cause injury, detriment, nuisance, or annoyance to any considerable number of persons or to the public, or which endanger the comfort, repose, health or safety of any such persons or the public, or which cause or have a natural tendency to cause injury or damage to business or property. The provisions of this rule do not apply to odors emanating from agricultural operations necessary for the growing of crops or the raising of fowl or animals.
>
> *Rule 403 – Fugitive Dust.* This rule is intended to reduce the amount of particulate matter entrained in the ambient air as a result of anthropogenic (human-made) fugitive dust

sources by requiring actions to prevent, reduce, or mitigate fugitive dust emissions. Rule 403 applies to any activity or human-made condition capable of generating fugitive dust.

Rule 1113 – Architectural Coatings. No person shall apply or solicit the application of any architectural coating within the SCAQMD with volatile organic compound content in excess of the values specified in a table incorporated in Rule 1113.

Climate Change

Federal

Although climate change and GHG reduction is a concern at the federal level, no regulations or legislation have been enacted to specifically address project-level reductions of GHG emissions or climate change. Climate change and its associated effects are being addressed through various efforts to improve fuel economy and energy efficiency, such as the National Clean Car Program and Executive Order 13514, "Federal Leadership in Environmental, Energy, and Economic Performance."

Executive Order 13514 focuses on reducing GHG emissions internally through the missions, programs, and operations of federal agencies. However, it also directs federal agencies to participate in the interagency Climate Change Adaptation Task Force, which is developing a U.S. strategy for adapting to climate change.

On April 2, 2007, in *Massachusetts v. USEPA*, 549 U.S. 497 (2007), the U.S. Supreme Court found that GHGs are air pollutants covered by the CAA and that USEPA has the authority to regulate GHGs. The court held that the USEPA Administrator must determine (1) whether emissions of GHGs from new motor vehicles cause or contribute to air pollution, which may reasonably be anticipated to endanger public health or welfare, or (2) whether the science is too uncertain to make a reasoned decision.

On December 7, 2009, the USEPA Administrator signed two distinct findings regarding GHGs under Section 202(a) of the CAA:

- **Endangerment Finding:** The current and projected atmospheric concentrations of the six key well-mixed GHGs— CO_2, CH_4, N_2O, HFCs, perfluorocarbons, and sulfur hexafluoride—threaten the public health and welfare of current and future generations.

- **Cause or Contribute Finding:** The combined emissions of these well-mixed GHGs from new motor vehicles and engines of new motor vehicles contribute to GHG pollution, which threatens public health and welfare.

Although these findings did not themselves impose any requirements on industry or other entities, this action was a prerequisite to finalizing USEPA's *Proposed Greenhouse Gas Emission Standards for Light-Duty Vehicles*, published on September 15, 2009. On May 7, 2010, the *Final Rule for Light-Duty Vehicle Greenhouse Gas Emissions Standards and Corporate Average Fuel Economy Standards* was published in the Federal Register (75 Federal Register 25323–25728).

USEPA and the National Highway Traffic Safety Administration (NHTSA) are taking coordinated steps to enable automakers to produce a new generation of vehicles that emit fewer GHGs and offer improved fuel efficiency. These next steps include developing the first-ever GHG regulations for heavy-duty engines and vehicles, as well as additional GHG regulations for light-duty vehicles. These steps were outlined by President Barack Obama in a memorandum on May 21, 2010.

The final combined USEPA/NHTSA standards that make up the first phase of this national program apply to passenger cars, light-duty trucks, and medium-duty passenger vehicles, covering model years 2012 through 2016. The standards require that these vehicles meet an estimated combined average emissions level of 250 grams of CO_2 per mile, which would be equivalent to 35.5 miles per gallon if the automobile industry were to meet this CO_2 level solely through fuel-economy improvements. These standards will cut GHG emissions by an estimated 960 million metric tons and cut oil use by 1.8 billion barrels over the lifetime of the vehicles sold under the program (model years 2012 through 2016).

On January 24, 2011, USEPA, along with USDOT and the State of California, announced a single timeframe for proposing fuel-economy and GHG standards for model year 2017 through 2025 cars and light trucks. Proposal of the new standards in the same timeframe (September 1, 2011) signals continued collaboration among these agencies and the state, which could lead to an extension of the current National Clean Car Program.

Neither USEPA nor FHWA has promulgated explicit guidance or methodology to conduct project-level GHG analysis. As stated on FHWA's climate change website (http://www.fhwa.dot.gov/hep/climate/index.htm), climate change considerations should be integrated throughout the transportation decision-making process—from planning through

project development and delivery. Addressing climate change mitigation and adaptation during the planning process will facilitate decision making and improve efficiency at the program level, and will inform the analysis and stewardship needs of project-level decision making. Climate change benefits are related to many planning factors, such as supporting economic vitality and global efficiency, increasing safety and mobility, enhancing the environment, promoting energy conservation, and improving quality of life.

State

With the passage of several Senate Bills (SBs) and Assembly Bills (ABs), and issuance of several executive orders, as described below, California launched a proactive approach to dealing with GHG emissions and climate change.

Assembly Bill 1493

AB 1493 (Chapter 200, Statutes of 2002) requires that ARB develop and implement regulations to reduce GHG emissions from automobiles and light-duty trucks. These stricter emissions standards were designed to apply to automobiles and light-duty trucks beginning with the 2009 model year. In June 2009, the USEPA Administrator granted a CCAA waiver of preemption to the State of California, which allowed the state to implement its own GHG emissions standards for motor vehicles beginning with model year 2009. California agencies will work with federal agencies to conduct joint rulemaking to reduce GHG emissions for passenger car model years 2017 through 2025.

Executive Order S-3-05

The goal of Executive Order S-3-05, signed by then-governor Arnold Schwarzenegger on June 1, 2005, is to reduce California's GHG emissions to year 2000 levels by 2010, to 1990 levels by 2020, and to 80% below the 1990 levels by the year 2050. In 2006, this goal was reinforced with the passage of AB 32, described below.

Assembly Bill 32

AB 32, the Global Warming Solutions Act of 2006, sets the same overall goals for GHG emissions reduction as outlined in Executive Order S-3-05, and further mandates that ARB create a plan that includes market mechanisms and implement rules to achieve "real, quantifiable, cost-effective reductions of greenhouse gases." Executive Order S-20-06 further

directs state agencies to begin implementing AB 32, including the recommendations made by the state's Climate Action Team.

Executive Order S-01-07

Then-governor Schwarzenegger set forth the low-carbon fuel standard for California in Executive Order S-01-07, signed January 18, 2007. Under this executive order, the carbon intensity of California's transportation fuels is to be reduced by at least 10% by 2020.

Senate Bill 97

SB 97 (Chapter 185, Statutes of 2007) required the Governor's Office of Planning and Research to develop recommended amendments to the State CEQA Guidelines for addressing GHG emissions. The amendments became effective on March 18, 2010. The amendments include the following additions to Appendix G of the guidelines. An impact related to global climate change is considered significant if the proposed project would do either of the following:

- generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment; or
- conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of GHGs.

Senate Bill 375

SB 375, signed in September 2008, aligns regional transportation planning efforts, regional GHG reduction targets, and land use and housing allocation. SB 375 requires each MPO to adopt a sustainable communities strategy or alternative planning strategy to prescribe land use allocation in that MPO's RTP. On September 23, 2010, ARB adopted regional GHG targets for passenger vehicles and light-duty trucks for 2020 and 2035 for the 18 MPOs in California. Should an MPO not meet the GHG reduction targets, transportation projects in the region served by that MPO would not be eligible for funding after January 1, 2012.

SB 375 also extends the minimum time period for the regional housing-needs-allocation cycle from 5 years to 8 years for local governments located within MPOs that meet certain requirements. City or county land use policies (including general plans) are not required to be consistent with the RTP (and associated sustainable communities strategy or alternative planning strategy). However, new provisions of CEQA would incentivize qualified projects that are

consistent with an approved sustainable communities strategy or alternative planning strategy, categorized as "transit priority projects."

California Department of Transportation

Caltrans and its parent agency, the Business, Transportation, and Housing Agency, have taken an active role in addressing GHG emissions and climate change. Recognizing that 98% of California's GHG emissions are from the burning of fossil fuels and 40% of all human-made GHG emissions are from transportation (Caltrans 2006), Caltrans created and is implementing the *Climate Action Program at Caltrans*, published in December 2006.

Council of Environmental Quality

The Council on Environmental Quality (CEQ) issued a draft guidance memorandum in February 2010 for analyzing the environmental effects of GHG emissions and climate change in NEPA documents. Specifically, the guidance states that, if a proposed action would be reasonably anticipated to cause direct emissions of 25,000 metric tons (MT) or more of CO_2 equivalent (CO_2e) GHG emissions on an annual basis, agencies should consider this an indicator that a quantitative and qualitative assessment may be meaningful to decision makers and the public. For long-term actions that have annual direct emissions of less than 25,000 MT of CO_2e, CEQ encourages federal agencies to consider whether the action's long-term emissions should receive similar analysis. CEQ does not propose this as an indicator of a threshold of significant effects, but rather as an indicator of a minimum level of GHG emissions that may warrant some description in the appropriate NEPA analysis for agency actions involving direct emissions of GHGs (CEQ 2010).

Adaptation Strategies

"Adaptation strategies" refer to how Caltrans and others can plan for the effects of climate change on California's transportation infrastructure and strengthen or protect the facilities from damage. Climate change is expected to produce increased variability in precipitation, rising temperatures, rising sea levels, storm surges and intensity, and the frequency and intensity of wildfires. These changes may affect the transportation infrastructure in various ways, such as damaging roadbeds by longer periods of intense heat, increasing storm damage from flooding and erosion, and inundation from rising sea levels. These effects will vary by location and may, in the most extreme cases, require that a facility be relocated or redesigned. Economic and strategic ramifications may result from these types of impacts to the transportation infrastructure.

At the federal level, the Climate Change Adaptation Task Force, co-chaired by the White House Council on Environmental Quality, the Office of Science and Technology Policy, and the National Oceanographic and Atmospheric Administration, released its interagency report October 14, 2010, outlining recommendations to President Obama regarding how federal agency policies and programs can better prepare the United States to respond to the impacts of climate change. The Progress Report of the Interagency Climate Change Adaptation Task Force recommends that the federal government implement actions to expand and strengthen the nation's capacity to better understand, prepare for, and respond to climate change.

Climate change adaption must also involve the natural environment as well. Efforts are underway on a statewide level to develop strategies to cope with impacts to habitat and biodiversity through planning and conservation. The results of these efforts will help California agencies plan and implement mitigation strategies for programs and projects.

On November 14, 2008, Governor Schwarzenegger signed Executive Order S-13-08, which directed a number of state agencies to address California's vulnerability to sea level rise caused by climate change. This Executive Order set in motion several agencies and actions to address the concern of sea level rise.

The California Natural Resources Agency was directed to coordinate with local, regional, state, and federal public and private entities to develop the California Climate Adaptation Strategy (December 2009), which summarizes the best known science on climate change impacts to California, assesses California's vulnerability to the identified impacts, and then outlines solutions that can be implemented within and across state agencies to promote resiliency.

The strategy outline is in direct response to Executive Order S-13-08, which specifically asked the California Natural Resources Agency to identify how state agencies can respond to rising temperatures, changing precipitation patterns, sea level rise, and extreme natural events. Numerous other state agencies were involved in the creation of the California Climate Adaptation Strategy document, including Environmental Protection; Business, Transportation and Housing; Health and Human Services; and the Department of Agriculture. The document is broken down into strategies for different sectors that include Public Health, Biodiversity and Habitat, Ocean and Coastal Resources, Water Management, Agriculture, Forestry, and Transportation and Energy Infrastructure. As data continue to be developed and collected, California's adaptation strategy will be updated to reflect current findings.

Furthermore, Executive Order S-13-08 directed the Business, Transportation, and Housing Agency to prepare a report to assess the vulnerability of transportation systems to sea level that affects safety, maintenance, and operational improvements of the system, and the economy of California. Caltrans continues to work on assessing the transportation system vulnerability to climate change, including the effect of a rise in sea level.

Currently, Caltrans is working to assess which transportation facilities are at greatest risk from climate change effects. However, without statewide planning scenarios for relative sea level rise and other climate change impacts, Caltrans has not been able to determine what change, if any, may be made to its design standards for its transportation facilities. Once statewide planning scenarios become available, Caltrans will be able to review its current design standards to determine what changes, if any, may be warranted in order to protect the transportation system from sea level rise.

Climate change adaptation for transportation infrastructure involves long-term planning and risk management to address vulnerabilities in the transportation system from increased precipitation and flooding, the increased frequency and intensity of storms and wildfires, rising temperatures, and rising sea levels. Caltrans is an active participant in the efforts being conducted in response to Executive Order S-13-08 and is mobilizing to be able to respond to the National Academy of Science report on Sea Level Rise Assessment.

This page intentionally left blank.

CHAPTER 4
EXISTING ENVIRONMENTAL SETTING

The proposed project lies within the SCAB, a 6,600-square-mile coastal plain bounded by the Pacific Ocean to the southwest and the San Gabriel, San Bernardino, and San Jacinto Mountains to the north and east. The SCAB includes all of Orange County and the nondesert portions of Los Angeles, Riverside, and San Bernardino Counties.

The ambient concentrations of air pollutant emissions are determined by the amount of emissions released by sources, and the atmosphere's ability to transport and dilute such emissions. Natural factors that affect transport and dilution of pollutants include terrain, wind, atmospheric stability, and sunlight. Therefore, existing air quality conditions are determined by natural factors such as topography, meteorology, and climate, in addition to the amount of emissions released by existing air pollutant sources, as discussed separately below.

Topography, Meteorology, and Climate

The distinctive climate of the SCAB is determined by its terrain and geographic location. The SCAB is a coastal plain with connecting broad valleys and low hills, bounded by the Pacific Ocean to the southwest and high mountains around the rest of its perimeter. The general region lies in the semipermanent high-pressure zone of the eastern Pacific, resulting in a mild climate tempered by cool sea breezes with light average wind speeds. The usually mild climatological pattern is interrupted occasionally by periods of extremely hot weather, winter storms, or Santa Ana winds.

Winds in the project area are usually driven by the dominant land and sea breeze circulation system. Regional wind patterns are dominated by daytime onshore sea breezes. At night, the wind generally slows and reverses direction, traveling toward the sea. Local canyons can also alter wind direction, with wind tending to flow parallel to the canyons.

The vertical dispersion of air pollutants in the SCAB is hampered by the presence of persistent temperature inversions. High-pressure systems, such as the semipermanent high-pressure zone in which the SCAB is located, are characterized by an upper layer of dry air that warms as it descends, restricting the mobility of cooler, marine-influenced air near the ground surface, and resulting in the formation of subsidence inversions. Such inversions restrict the vertical dispersion of air pollutants released into the marine layer and, together with strong sunlight, can

produce worst-case conditions for the formation of photochemical smog. The basin-wide occurrence of inversions at 3,500 feet above mean sea level or lower averages 191 days per year (SCAQMD 1993).

The atmospheric pollution potential of an area is largely dependent on winds, atmospheric stability, solar radiation, and terrain. The combination of low wind speeds and low inversions produces the greatest concentration of air pollutants. On days without inversions, or on days with winds averaging faster than 15 mph, smog potential is greatly reduced.

Regional and Local Air Quality

Both ARB and USEPA designate regional areas according to their attainment status for NAAQS and CAAQS of criteria air pollutants. The purpose of these designations is to identify the areas where pollutant concentrations exceed the ambient air quality standards and thereby initiate planning efforts for improvement. The three basic designation categories are "nonattainment," "attainment," and "unclassified." Unclassified is used for an area that cannot be classified on the basis of available information as meeting or not meeting the standards. In addition, the California designations include a subcategory of "nonattainment-transitional," which is given to nonattainment areas that are progressing and nearing attainment.

As shown in Table 4, the SCAB is currently classified as a federal nonattainment area for ozone (extreme) and the 2006 $PM_{2.5}$ standard, and as a federal attainment/maintenance area for CO, PM_{10}, and NO_2 (USEPA 2013a). The SCAB is classified as a state nonattainment area for ozone, PM_{10}, $PM_{2.5,}$ and NO_2 and an attainment area for CO. The SCAB currently meets the federal and state standards for SO_2, and lead, and is classified as an attainment area for these pollutants (ARB 2013b).

Table 4
National and California Attainment Status for
Orange County Portion of the SCAB

Pollutant	Designation/Classification	
	California[a]	**National[b]**
Ozone (1-Hour)	Nonattainment	-
Ozone (8-Hour)	Nonattainment	Nonattainment [a]
Carbon Monoxide (CO)	Attainment	Attainment/Maintenance
Nitrogen Dioxide (NO_2)	Nonattainment	Attainment/Maintenance
Sulfur Dioxide (SO_2)	Attainment	Attainment
Respirable Particulate Matter (PM_{10})	Nonattainment	Attainment/Maintenance
Fine Particulate Matter ($PM_{2.5}$)	Nonattainment	Nonattainment [b]
Lead	Attainment	Unclassifiable/Attainment
Sulfates	Attainment	No National Standards
Hydrogen Sulfide	Unclassified	
Vinyl Chloride	- [c]	
Visibility Reducing Particles	Unclassified	

Notes:

[a] On September 22, 2011, the U.S. Environmental Protection Agency (USEPA) announced it will implement the current 8-hour ozone standard of 75 parts per billion. USEPA finalized area designations for the 2008 8-hour ozone standard in mid-2012 for which the South Coast Air Basin (SCAB) was designated as nonattainment.

[b] USEPA lowered the 24-hour $PM_{2.5}$ standard from 65 micrograms per cubic meter ($\mu g/m^3$) to 35 $\mu g/m^3$ in 2006. The SCAB was designated as nonattainment for the new 35 $\mu g/m^3$ standard.

[c] No information is available to designate the region for vinyl chloride.

Source: ARB 2013b, USEPA 2013a

ARB and USEPA use ambient air quality monitoring data, such those shown in Table 5 for the proposed project, to determine a region's attainment status for ambient air quality standards. Table 5 presents ambient air quality monitoring data obtained from the 1630 Pampas Lane monitoring station in Anaheim, California, which is the closest monitoring station, located approximately 5 miles northwest of the proposed project site. The 1630 Pampas Lane monitoring station is located in the SCAB, as is the proposed project site. Air basin boundaries have been established to group areas that have similar climate, meteorology, and topography, which are the main factors that affect air quality. Considering the proximity to the proposed project site and the same air basin, ambient air quality monitored at this station would be representative of recent air quality conditions. It should be noted that ambient air quality data for SO_2 were obtained from the Mesa Verde Drive monitoring station in Costa Mesa, California, which is the next closest monitoring station that monitors for SO_2 within Orange County.

Table 5
Summary of Annual Ambient Air Quality Data (2010–2012) [1]

	2010	2011	2012
OZONE			
Maximum concentration (1-hour/8-hour, ppm)	0.104/0.088	0.088/0.072	0.079/0.067
Number of days state standard exceeded (1-hour/8-hour)	1/1	0/1	0/0
Number of days national standard exceeded (1-hour/8-hour) [2]	0/1	0/0	0/0
CARBON MONOXIDE (CO)			
Maximum concentration (1-hour/8-hour, ppm)	2.7/1.98	2.7/2.08	3.0/2.34
Number of days state standard exceeded (8-hour)	0	0	0
Number of days national standard exceeded (1-hour/8-hour)	0/0	0/0	0/0
NITROGEN DIOXIDE (NO_2)			
Maximum concentration (1-hour, ppm)	0.073	0.074	0.059
Number of days state standard exceeded	0	0	0
Annual average (ppm)	0.018	0.017	—
SULFUR DIOXIDE (SO_2) [3]			
Maximum concentration (24-hour, ppm)	0.002	0.002	0.001
Number of days standard exceeded (National/California)	0/0	0/0	0/0
Annual Average (ppm)	0.000	—	—
FINE PARTICULATE MATTER ($PM_{2.5}$)			
Maximum concentration (μg/m^3) (National/California[4])	31.7/31.7	39.2/39.2	50.1/50.1
Number of days national standard exceeded (measured/calculated[5])[6]	0/0.0	2/2.0	4/4.0
State annual average (μg/m^3) (National/California)	10.5/—	11.0/11.0	10.9/11.0
RESPIRABLE PARTICULATE MATTER (PM_{10})			
Maximum concentration (μg/m^3) (National/California[4])	43.0/43.0	53.0/53.0	48.0/48.0
Number of days state standard exceeded (measured/calculated[5])	0/—	2/12.2	0/0.0
Number of days national standard exceeded (measured/calculated[5])	0/0.0	0/0.0	0/0.0
Annual average (μg/m^3) (National/California)	22.5/—	24.9/24.7	22.4/22.3

Notes: μg/m^3 = micrograms per cubic meter; ppm = parts per million; — = data not available

[1] Measurements were recorded at the 1630 Pampas Lane monitoring station in Anaheim, California, unless noted otherwise.

[2] The 8-hour national ozone standard was revised to 0.075 ppm in March 2008. The 1-hour national ozone standard was revoked on June 15, 2005. Statistics for the 1-hour national ozone standard are shown for informational purposes.

[3] Measurements were recorded at the Mesa Verde Drive monitoring station in Costa Mesa, California, which is the only monitoring station in Orange County that still monitors for SO_2.

[4] State and national statistics may differ for the following reasons: State statistics are based on California-approved samplers, whereas national statistics are based on samplers using federal reference or equivalent methods. State and national statistics may therefore be based on different samplers. State statistics are based on local conditions while national statistics are based on standard conditions. State criteria for ensuring that data are sufficiently complete for calculating valid annual averages are more stringent than the national criteria.

[5] Measured days are those days that an actual measurement was greater than the level of the state daily standard or the national daily standard. Measurements are typically collected every 6 days. Calculated days are the estimated number of days that a measurement would have been greater than the level of the standard had measurements been collected every day. The number of days above the standard is not necessarily the number of violations of the standard for the year.

[6] The national $PM_{2.5}$ 24-hour standard was revised from 65 μg/m^3 to 35 μg/m^3 in 2006.

Source: ARB 2013c; USEPA 2013b

Sensitive Receptors

Some members of the population are especially sensitive to air pollutant emissions and should be given special consideration when evaluating air quality impacts from projects. These people include children, older adults, persons with preexisting respiratory or cardiovascular illness, and athletes and others who engage in frequent exercise. Structures that house these persons or places where they gather are defined as sensitive receptors by SCAQMD. According to SCAQMD, sensitive receptors include residences, schools, playgrounds, child care centers, athletic facilities, long-term health care facilities, rehabilitation centers, convalescent centers, and retirement homes. Sensitive receptors in the vicinity of the project include residential land uses located along the project corridor.

The sensitive receptors that would be potentially affected by the proposed project are located with the project study area along the 4-mile project segment of I-5. Therefore, during construction of the proposed project, a number of different receptors would be exposed to construction emissions. Sensitive receptors along the affected segments of I-5 include single-family residences and multi-family residences, which are located approximately 500 feet from the boundary of proposed construction activities in many cases.

Greenhouse Gases and Climate Change

Certain gases in Earth's atmosphere, classified as GHGs, play a critical role in determining Earth's surface temperature. Solar radiation enters Earth's atmosphere from space. A portion of the radiation is absorbed by Earth's surface, and a smaller portion of this radiation is reflected back toward space. This absorbed radiation is then emitted from Earth as low-frequency infrared radiation. The frequencies at which bodies emit radiation are proportional to temperature. Earth has a much lower temperature than the sun; therefore, Earth emits lower-frequency radiation. Most solar radiation passes through GHGs; however, infrared radiation is absorbed by these gases. As a result, radiation that otherwise would have escaped back into space is instead "trapped," resulting in a warming of the atmosphere. This phenomenon, known as the greenhouse effect, is responsible for maintaining a habitable climate on Earth. Without the greenhouse effect, Earth would not be able to support life as we know it.

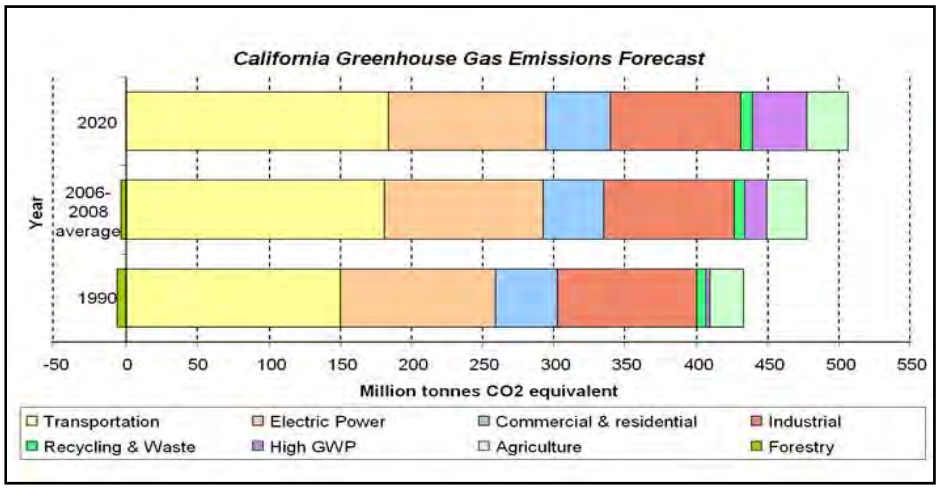
Prominent GHGs contributing to the greenhouse effect are CO_2, CH_4, N_2O, HFCs, perfluorocarbons, and sulfur hexafluoride. Human-caused emissions of these GHGs in excess of natural ambient concentrations are responsible for intensifying the greenhouse effect and have led to a trend of unnatural warming of Earth's climate, known as global climate change or global

warming. It is unlikely that global climate change of the past 50 years can be explained without contribution from human activities (IPCC 2007).

Emissions of GHGs contributing to global climate change are attributable, in large part, to human activities associated with the transportation, industrial/manufacturing, utility, residential, commercial, and agricultural sectors (ARB 2010). In California, the transportation sector is the largest emitter of GHGs, followed by electricity generation. Emissions of CO_2 are byproducts of fossil fuel combustion. CH_4, a highly potent GHG, results from off-gassing (the release of chemicals from nonmetallic substances under ambient or greater pressure conditions) and is largely associated with agricultural practices and landfills. N_2O is also largely attributable to agricultural practices and soil management. CO_2 sinks, or reservoirs, include vegetation and the ocean, which absorb CO_2 through sequestration and dissolution, respectively.

In December 2008, ARB approved the AB 32 Scoping Plan, which contains the main strategies California will use to reduce GHGs. As part of its supporting documentation for the Scoping Plan, ARB released the GHG inventory for California. The forecast is an estimate of the emissions expected to occur in the year 2020 if none of the foreseeable measures included in the Scoping Plan were implemented (see Figure 3). The base year used for forecasting emissions is the average of statewide emissions in the GHG inventory for 2006, 2007, and 2008.

Figure 3. California GHG Inventory Forecast



Source: ARB Greenhouse Gas Inventory – 2020 Emissions Forecast. 2010.

CHAPTER 5
IMPACT ANALYSIS

The project would result in short-term construction emissions and changes to long-term operational emissions. Construction-related emissions would be considered short term and temporary, because all construction emissions would cease following completion of the proposed project. Operational emissions would include changes in vehicle activity (e.g., vehicle speeds, idling) as a result of the proposed project. The resulting long-term operational changes would continue to affect vehicle emissions throughout the lifetime of the project.

This analysis includes short-term construction-related impacts and long-term operational impacts. The long-term operational impacts include detailed discussions of the following:

- Traffic changes (e.g., LOS)
- Consistency with regional plans
- CO hot-spot analysis
- PM hot-spot analysis
- MSAT emissions
- GHG emissions
- Cumulative impacts

The analyses indicate that the worst-case scenario for the proposed project and alternatives would not result in any substantial air quality impacts.

Construction Impacts

Construction-related activities would result in project-generated emissions of criteria air pollutants of fugitive PM dust (PM_{10} and $PM_{2.5}$) and ozone precursors (e.g., ROG and NO_X). Emissions of fugitive PM dust are associated primarily with ground disturbance activities during site preparation for construction (e.g., clearing vegetation, soil grading and excavation, and construction-vehicle travel on paved and unpaved roads). PM emissions vary as a function of parameters such as soil-silt content, soil moisture, wind speed, acreage of disturbance area, and vehicle miles traveled (VMT). A secondary source of pollutants during construction would be from the engine exhaust from construction vehicles and equipment. The primary pollutants of concern from exhaust emissions would be NO_X and ROG emissions that would contribute to the formation of ozone, a regional air pollutant. Emissions of NO_X and ROG would be primarily

associated with off-road gas and diesel construction vehicle and equipment exhaust; secondary sources would include on-road gas and diesel trucks for the import and export of materials and daily construction worker commuting.

Project-generated, construction-related emissions were modeled using the Roadway Construction Model, Version 7.1.2. This model was developed and published by the Sacramento Metropolitan Air Quality Management District (SMAQMD), and is recommended for use by SCAQMD. The model incorporates on-road mobile, off-road equipment, and fugitive dust emissions factors from ARB's EMFAC2011 and OFFROAD2011 models. Default values in the model were used for the mix of construction equipment, number of workers and commute distance, and soil hauling distances. Construction activities for this project would begin in 2016 and end in 2018. As described above, following the proposed project's completion in 2018, all construction activities would cease. Therefore, construction emissions are considered temporary and short term.

Table 6 presents the estimated daily emissions from construction activities. The modeling output sheets are included in Appendix A.

Table 6
Summary of Construction-Related Emissions of Criteria Air Pollutants and Precursors

Project Phases	Emissions (pounds per day)				
	ROG	**NO_X**	**CO**	**PM_{10}**	**$PM_{2.5}$**
Grubbing/Land Clearing	5.9	43.2	25.4	52.2	12.4
Grading/Excavation	6.9	53.6	32.0	52.7	12.9
Drainage/Utilities/Sub-Grade	5.7	41.7	26.1	52.3	12.5
Paving	3.6	21.3	21.1	1.3	1.2
Maximum Daily Emissions	6.9	53.6	32.0	52.7	12.9
SCAQMD Threshold of Significance (pounds per day)[1]	***75***	***100***	***550***	***150***	***55***
SCAQMD Threshold Exceeded?	No	No	No	No	No

Notes: ROG = reactive organic gases; NO_X = oxides of nitrogen; CO = carbon monoxide; PM_{10} = particulate matter with aerodynamic diameter less than 10 microns; $PM_{2.5}$ = particulate matter with aerodynamic diameter less than 2.5 microns

[1] Daily significance thresholds for construction emissions as adopted by the Sacramento Metropolitan Air Quality Management District (SMAQMD).
Refer to Appendix A for detailed assumptions and modeling output files.
Source: SMAQMD Road Construction Model Version 7.1.2

As shown in Table 6, all estimated construction emissions would be less than SCAQMD's significance thresholds.

Operational Impacts

Typically, transportation projects, such as the proposed project, are analyzed for regional air quality impacts by determining conformity with the SIP. This section describes the project-specific traffic modeling and air quality modeling, and discusses the impact on regional emissions.

The project's traffic study, *I-5 from SR-55 to SR-57 HOV Improvements Project PA/ED, Transportation Analysis Report, Draft* (AECOM 2013), is the basis for modeling and evaluating the air quality impacts of the proposed project. Intersection traffic analysis was performed by monitoring weekday AM and PM peak hours. The analysis of Opening Year (2018) and Future Year (2040) conditions was performed using the most current version (version 3.3) of OCTA's Orange County Transportation Analysis Model (OCTAM) at the commencement of the study. OCTAM was used to develop traffic forecasts along the project segment of I-5. Additional details can be found in the project's Transportation Analysis Report (AECOM 2013).

Overall, provision of the Build Alternatives would result in the elimination of critical bottlenecks on the HOV network, thereby increasing HOV activity and facilitating HOV throughput. The proposed project would add additional HOV capacity to the project segment of I-5, as detailed in the project's Transportation Analysis Report (AECOM 2013). Tables 7 and 8 provide the year 2018 (i.e., the opening year) and year 2040 (i.e., the future analysis year) traffic volumes under the Build and No Build Alternatives.

With all of the Build Alternatives, the additional HOV lane capacity would result in higher HOV lane volumes as compared to the No Build Alternative. Therefore, the potential would exist for a corresponding decrease in volume within the I-5 mainline. However, the traffic modeling indicated that any diversion of vehicles from the general-purpose lanes to the HOV lanes would be replaced by rerouted trips from other facilities or from local streets. The results of the project's increase in HOV capacity are anticipated to generate additional traffic volumes along the I-5 mainline of 1.39% and 4.04% in 2018 and 2040, respectively. The segment that is estimated to experience the greatest increase in ADT is along the I-5 mainline between the SR-55 on-ramp and 1st/4th off-ramp, which could result in a 6% increase by 2018 and a 10% increase by 2040.

Table 7
Opening Year (2018) ADT

Roadway Segment	No Build (ADT)	No Build (Truck ADT)	Build Alternatives (ADT)	Build Alternatives (Truck ADT)	Percent Increase
SR-57 between Chapman off-ramp and SR-22 off-ramp	261,151	15,669	262,260	15,736	0.42%
I-5 between Chapman on-ramp and SR-22 off-ramp	266,928	16,016	268,950	16,137	0.76%
I-5 at SR-57 HOV merge	236,837	14,210	236,837	14,210	0.00%
I-5 between SR-57 HOV merge and Main HOV off-ramp	280,757	16,845	284,460	17,068	1.32%
I-5 between Main HOV off-ramp and HOV entrance south of Lincoln overcrossing	359,556	21,573	364,990	21,899	1.51%
I-5 between HOV lane merge and HOV lane exit north of Lincoln overcrossing	349,185	20,951	354,150	21,249	1.42%
I-5 between HOV entrance and Grand HOV on-ramp	326,445	19,587	328,939	19,736	0.76%
I-5 between 4th on-ramp and Grand off-ramp	392,019	23,521	397,000	23,820	1.27%
I-5 south of SR-55 HOV	374,294	22,458	378,120	22,687	1.02%
I-5 between SR-55 on-ramp and 1st/4th off-ramp	294,334	17,660	313,010	18,781	6.35%
SR-55 south of I-5 HOV	273,216	16,393	273,340	16,400	0.05%
Average	310,429	18,626	314,732	18,884	1.39%

Source: AECOM 2013

Table 8
Future Year (2040) ADT

Roadway Segment	No Build (ADT)	No Build (Truck ADT)	Build Alternatives (ADT)	Build Alternatives (Truck ADT)	Percent Increase
SR-57 between Chapman off-ramp and SR-22 off-ramp	280,905	16,854	285,430	17,126	1.61%
I-5 between Chapman on-ramp and SR-22 off-ramp	293,840	17,630	307,560	18,454	4.67%
I-5 at SR-57 HOV merge	267,426	16,046	267,641	16,058	0.08%
I-5 between SR-57 HOV merge and Main HOV off-ramp	305,527	18,332	325,950	19,557	6.68%
I-5 between Main HOV off-ramp and HOV entrance south of Lincoln overcrossing	391,115	23,467	412,610	24,757	5.50%
I-5 between HOV lane merge and HOV lane exit north of Lincoln overcrossing	385,549	23,133	404,010	24,241	4.79%
I-5 between HOV entrance and Grand HOV on-ramp	357,716	21,463	361,820	21,709	1.15%
I-5 between 4th on-ramp and Grand off-ramp	429,748	25,785	450,150	27,009	4.75%
I-5 south of SR-55 HOV	413,267	24,796	425,630	25,538	2.99%
I-5 between SR-55 on-ramp and 1st/4th off-ramp	332,711	19,963	368,150	22,089	10.65%
SR-55 south of I-5 HOV	286,302	17,178	286,590	17,195	0.10%
Average	340,373	20,422	354,140	21,248	4.04%

Source: AECOM 2013

Tables 7 and 8 conservatively indicate that the increase in truck ADT is similar to the overall increase in ADT. However, the proposed project would only add HOV lane capacity, which would likely increase light-duty vehicles that would use those lanes. Therefore, it is likely that the increase in truck ADT would be substantially less than the numbers presented in Tables 7 and 8.

Tables 9 through 12 indicate the freeway mainline and HOV LOS for the No Build and Build Alternatives in 2018 and 2040. The freeway mainline LOS (Tables 9 and 10) indicate the LOS for Build Alternatives 2B/5B; Build Alternatives 2B/5B present the worst-case scenario for freeway mainline operations. All other Build Alternatives would have better freeway mainline LOS than Build Alternatives 2B/5B. The HOV LOS (Tables 11 and 12) indicate the volumes and

Table 9
Freeway Mainline LOS Summary for Alternatives 2B/5B – Opening Year (2018) Conditions

Locations		No Build Alternative						Build Alternatives					
		AM Peak Hour			PM Peak Hour			AM Peak Hour			PM Peak Hour		
		Volume	Density	LOS	Volume	Density	LOS	Volume	Density	LOS	Volume	Density	LOS
SR-57 between Chapman off-ramp and SR-22 off-ramp	SB	7,490	>45.0	F	7,670	>45.0	F	8,005	>45.0	F	8,125	>45.0	F
I-5 between Chapman on-ramp and SR-22 off-ramp	SB	9,170	32.2	D	8,050	27.2	D	10,734	43.9	E	9,124	32.0	D
I-5 between Main on-ramp and 17th/Penn off-ramp	SB	10,075	38.0	E	9,705	35.4	E	11,641	>45.0	F	10,872	>45.0	F
I-5 between 17th on-ramp and Santa Ana off-ramp	SB	10,600	42.6	E	10,065	38.0	E	12,170	>45.0	F	11,200	>45.0	F
I-5 between Grand on-ramp and 4th off-ramp	SB	10,330	40.1	E	10,285	39.7	E	12,025	>45.0	F	11,490	>45.0	F
I-5 between 4th off-ramp and 1st Street on-ramp	SB	9,595	34.7	D	9,805	36.1	E	11,290	>45.0	F	11,010	>45.0	F
I-5 between 4th on-ramp and Grand off-ramp	NB	11,790	>45.0	F	9,754	35.7	E	12,433	>45.0	F	10,629	42.8	E
I-5 between Grand Ave on-ramp and 17th off-ramp	NB	11,125	>45.0	F	9,149	32.1	D	11,768	>45.0	F	9,939	37.0	E
I-5 between 17th on-ramp and Main/Broadway off-ramp	NB	11,640	>45.0	F	10,379	40.5	E	12,373	>45.0	F	11,380	>45.0	F
I-5 between Main on-ramp and SR-22 exit	NB	9,515	>45.0	F	9,219	>45.0	F	10,501	>45.0	F	10,565	>45.0	F
I-5 between SR-22 on-ramp and Chapman off-ramp	NB	9,395	33.5	D	10,364	40.4	E	9,927	37.8	E	11,691	>45.0	F
SR-57 between Chapman off-ramp and Chapman on-ramp	NB	7,485	>45.0	F	6,235	41.2	E	8,140	>45.0	F	6,740	>45.0	F

Source: AECOM 2013

Table 10
Freeway Mainline LOS Summary for Alternatives 2B/5B – Future Year (2040) Conditions

Locations		No Build Alternative						Build Alternatives					
		AM Peak Hour			PM Peak Hour			AM Peak Hour			PM Peak Hour		
		Volume	Density	LOS	Volume	Density	LOS	Volume	Density	LOS	Volume	Density	LOS
SR-57 between Chapman off-ramp and SR-22 off-ramp	SB	8,005	>45.0	F	8,125	>45.0	F	8,005	>45.0	F	8,125	>45.0	F
I-5 between Chapman on-ramp and SR-22 off-ramp	SB	10,445	41.1	E	8,990	31.3	D	10,445	41.1	E	8,990	31.3	D
I-5 between Main on-ramp and 17th/Penn off-ramp	SB	11,605	>45.0	F	10,860	>45.0	F	11,605	>45.0	F	10,860	>45.0	F
I-5 between 17th on-ramp and Santa Ana off-ramp	SB	12,170	>45.0	F	11,200	>45.0	F	12,170	>45.0	F	11,200	>45.0	F
I-5 between Grand on-ramp and 4th off-ramp	SB	12,025	>45.0	F	11,490	>45.0	F	12,025	>45.0	F	11,490	>45.0	F
I-5 between 4th off-ramp and 1st Street on-ramp	SB	11,290	>45.0	F	11,010	>45.0	F	11,290	>45.0	F	11,010	>45.0	F
I-5 between 4th on-ramp and Grand off-ramp	NB	12,433	>45.0	F	10,629	42.8	E	12,433	>45.0	F	10,629	42.8	E
I-5 between Grand Ave on-ramp and 17th off-ramp	NB	11,768	>45.0	F	9,939	37	E	11,768	>45.0	F	9,939	37	E
I-5 between 17th on-ramp and Main/Broadway off-ramp	NB	12,348	>45.0	F	11,239	>45.0	F	12,348	>45.0	F	11,239	>45.0	F
I-5 between Main on-ramp and SR-22 exit	NB	10,408	>45.0	F	10,134	>45.0	F	10,408	>45.0	F	10,134	>45.0	F
I-5 between SR-22 on-ramp and Chapman off-ramp	NB	9,858	36.5	E	11,254	>45.0	F	9,858	36.5	E	11,254	>45.0	F
SR-57 between Chapman off-ramp and Chapman on-ramp	NB	8,140	>45.0	F	6,740	>45.0	F	8,140	>45.0	F	6,740	>45.0	F

Source: AECOM 2013

Table 11
Freeway HOV LOS Summary for Alternatives 2A/5A – Opening Year (2018) Conditions

Locations	No Build Alternative						Build Alternatives					
	AM Peak Hour			PM Peak Hour			AM Peak Hour			PM Peak Hour		
	Volume	Capacity (V/C)	LOS	Volume	Capacity (V/C)	LOS	Volume	Capacity (V/C)	LOS	Volume	Capacity (V/C)	LOS
SR-57 north of I-5 HOV merge	1,254	0.66	C	1,522	0.80	D	1,425	0.75	D	1,585	0.83	D
I-5 north of SR-57 HOV merge	1,096	0.58	C	938	0.49	B	1,195	0.63	C	990	0.52	C
I-5 at SR-57 HOV merge	2,350	1.24	F	2,460	1.29	F	2,620	0.69	C	2,575	0.68	C
I-5 between SR-57 HOV merge and Main HOV off-ramp	1,550	0.82	D	1,550	0.82	D	2,620	0.69	C	2,575	0.68	C
I-5 between Main HOV off-ramp and HOV entrance south of Lincoln overcrossing	1,406	0.74	D	1,485	0.78	D	2,440	0.64	C	2,495	0.66	C
I-5 between HOV entrance and Grand HOV on-ramp	1,746	0.92	E	1,765	0.93	E	2,780	0.73	D	2,775	0.73	D
I-5 between Grand HOV on-ramp and SR-55 HOV diverge	2,026	0.53	C	2,005	0.53	C	3,060	0.81	D	3,015	0.79	D
I-5 south of SR-55 HOV diverge	1,257	0.66	C	1,387	0.73	D	2,075	1.09	F	2,320	1.22	F
SR-55 south of I-5 HOV diverge	769	0.40	B	618	0.33	B	985	0.52	C	695	0.37	B
SR-55 south of I-5 HOV merge	507	0.27	A	849	0.45	B	550	0.29	A	950	0.50	C
I-5 south of SR-55 HOV merge	1,158	0.61	C	1,356	0.71	D	1,245	0.66	C	1,525	0.80	D
I-5 between SR-55 HOV merge and Grand HOV off-ramp	1,665	0.44	B	2,205	0.58	C	1,795	0.47	B	2,475	0.65	C
I-5 at HOV lane merge (2 to 1 lane)	1,350	0.71	D	1,940	1.02	F	1,480	0.39	B	2,210	0.58	C
I-5 between HOV lane merge and HOV lane exit north of Lincoln overcrossing	1,350	0.71	D	1,900	1.00	F	1,480	0.39	B	2,210	0.58	C
I-5 between HOV exit and Main HOV off-ramp	965	0.51	C	1,649	0.87	D	1,095	0.29	A	1,925	0.51	C
I-5 between Main HOV on-ramp and SR-57 diverge	1,020	0.54	C	1,964	1.03	F	1,160	0.31	B	2,280	0.60	C
I-5 north of SR-57 diverge	530	0.28	A	1,316	0.69	C	670	0.35	B	1,545	0.81	D
SR-57 north of I-5 HOV diverge	490	0.26	A	648	0.34	B	490	0.26	A	735	0.39	B

Note: v/c = volume to capacity
Source: AECOM 2013

Table 12
Freeway HOV LOS Summary for Alternatives 2A/5A – Future Year (2040) Conditions

Locations	No Build Alternative						Build Alternatives					
	AM Peak Hour			PM Peak Hour			AM Peak Hour			PM Peak Hour		
	Volume	Capacity (V/C)	LOS	Volume	Capacity (V/C)	LOS	Volume	Capacity (V/C)	LOS	Volume	Capacity (V/C)	LOS
SR-57 north of I-5 HOV merge	1,276	0.67	C	1,597	0.84	D	1,975	1.04	F	1,840	0.97	E
I-5 north of SR-57 HOV merge	1,209	0.64	C	1,048	0.55	C	1,610	0.85	D	1,255	0.66	C
I-5 at SR-57 HOV merge	2,485	1.31	F	2,645	1.39	F	3,585	0.94	E	3,095	0.81	D
I-5 between SR-57 HOV merge and Main HOV off-ramp	1,550	0.82	D	1,550	0.82	D	3,585	0.94	E	3,095	0.81	D
I-5 between Main HOV off-ramp and HOV entrance south of Lincoln overcrossing	1,406	0.74	D	1,485	0.78	D	3,295	0.87	D	2,960	0.78	D
I-5 between HOV entrance and Grand HOV on-ramp	1,746	0.92	E	1,765	0.93	E	3,635	0.96	E	3,240	0.85	D
I-5 between Grand HOV on-ramp and SR-55 HOV diverge	2,061	0.54	C	2,020	0.53	C	3,950	1.04	F	3,495	0.92	E
I-5 south of SR-55 HOV diverge	1,292	0.68	C	1,402	0.74	D	2,295	1.21	F	2,570	1.35	F
SR-55 south of I-5 HOV diverge	769	0.4	B	618	0.33	B	1,655	0.87	D	925	0.49	B
SR-55 south of I-5 HOV merge	575	0.3	B	988	0.52	C	740	0.39	B	1,395	0.73	D
I-5 south of SR-55 HOV merge	1,260	0.66	C	1,477	0.78	D	1,595	0.84	D	2,170	1.14	F
I-5 between SR-55 HOV merge and Grand HOV off-ramp	1,835	0.48	B	2,465	0.65	C	2,335	0.61	C	3,565	0.94	E
I-5 at HOV lane merge (2 to 1 lane)	1,500	0.79	D	2,140	1.13	F	2,000	0.53	C	3,240	0.85	D
I-5 between HOV lane merge and HOV lane exit north of Lincoln overcrossing	1,500	0.79	D	1,900	1	F	2,000	0.53	C	3,240	0.85	D
I-5 between HOV exit and Main HOV off-ramp	1,050	0.55	C	1,649	0.87	D	1,550	0.41	B	2,860	0.75	D
I-5 between Main HOV on-ramp and SR-57 diverge	1,105	0.58	C	1,964	1.03	F	1,655	0.44	B	3,345	0.88	D
I-5 north of SR-57 diverge	355	0.19	A	1,316	0.69	C	905	0.48	B	2,315	1.22	F
SR-57 north of I-5 HOV diverge	750	0.39	B	648	0.34	B	750	0.39	B	1,030	0.54	C

Note: v/c = volume to capacity
Source: AECOM 2013

LOS for Build Alternatives 2A/5A; Build Alternatives 2A/5A present the worst-case scenario for freeway HOV operations All other Build Alternatives would have better freeway HOV LOS than Build Alternatives 2A/5A. Additional LOS tables for all Build Alternatives associated with the proposed project are presented in Appendix B. With both the No Build Alternative and Build Alternatives 2B/5B, all freeway mainline segments would operate at LOS D, E, or F during the peak hours in both 2018 and 2040. Build Alternatives 2A/5A would result in one segment of freeway HOV lanes (I-5 south of SR-55 HOV diverge) operating at LOS F during the AM and PM peak hours in 2018, and several segments of freeway HOV lanes operating at LOS E or F during the AM and PM peaks hour in 2040. Those segments include, but are not limited to, I-5 south of SR-55 HOV diverge, I-5 between SR-55 HOV merge and Grand HOV off-ramp, and I-5 north of SR-57 diverge.

Overall, implementation of the Build Alternatives would result in the elimination of critical bottlenecks on the HOV network, thereby increasing HOV activity and facilitating HOV usage. Under Future Year (2040) conditions, the increased demand for HOV facilities would result in new bottleneck and over-capacity conditions, primarily at intermediate access points (such as at the Grand Avenue direct HOV lane entrance to southbound I-5) and where the two-lane segment narrows to one lane along I-5 at the SR-57 and SR-55 HOV lane diverges. Therefore, although the additional HOV lane in each direction would accommodate the anticipated demand in 2018, the demand for the HOV facilities would be higher than the provided capacity, resulting in new congested locations by 2040.

Consistency with Regional Plans

Conformity to the SIP means that transportation activities will not create new air quality violations, worsen existing violations, or delay attainment of the NAAQS. MPOs are responsible for preparation of RTPs and RTIPs, and the associated air quality analyses; the MPO in the project area is SCAG.

The applicable transportation plans for the proposed project are the *2012–2035 Regional Transportation Plan/Sustainable Communities Strategy: Toward a Sustainable Future 2012 (*2012 RTP*)*, adopted on April 4, 2012 (SCAG 2012); and the *2008 Regional Transportation Improvement Program* (2008 RTIP), adopted on July 17, 2008 (SCAG 2008). USDOT made a positive conformity determination for the 2012 RTP on June 4, 2012 (USDOT 2012) and for the 2008 RTIP on November 17, 2008 (USDOT 2008). During preparation of the 2012 RTP and 2008 RTIP, SCAG prepared an air quality conformity analysis that assessed all transportation-related projects in the region. If the design concept and scope of a proposed transportation project are consistent with the project description in the 2012 RTP and 2008 RTIP and the

assumptions in the regional emissions analysis for the 2012 RTP and 2008 RTIP, then the proposed project would conform to the SIP, and no adverse regional air quality impact would occur as a result of the project.

The proposed project is included in SCAG's 2012 RTP (SCAG 2012) and 2008 RTIP (SCAG 2008) as RTP/RTIP ID #2H0703 (I-5 from SR-55 to SR-57 – add one HOV lane in each direction). Therefore, the proposed project is as described in the current applicable RTP and RTIP. The design concept and scope of the proposed project are consistent with the project description in the 2012 RTP, the 2008 RTIP, and the assumptions in SCAG's regional emissions analysis. Therefore, the project would conform with the SIP.

CO Hot-Spot Analysis

The SCAB is currently designated an attainment/maintenance area for the federal CO standard and an attainment area for the state CO standard. An appropriate screening procedure is provided in the procedures and guidelines contained in the *Transportation Project-Level Carbon Monoxide Protocol* (CO Protocol) to determine whether a project poses the potential for a CO "hot-spot" (UCD ITS 1997). A CO hot-spot is an area of localized CO pollution caused by severe vehicle congestion on major roadways, typically near intersections.

The project's Transportation Analysis Report (AECOM 2013) analyzed the traffic impacts related to the project change. The Transportation Analysis Report shows that all signalized intersections analyzed for the proposed project would operate at LOS D or better in years 2018 and 2040 under all alternatives (i.e., Alternatives 2A/2B, Alternatives 5A/5B, and Design Options A and B) except for the following (see Tables 13 and 14):

- The Grand Avenue and 1st Street intersection would operate at LOS E in the AM peak hour and LOS F in the PM peak hour in 2040 with the Build Alternatives.
- The I-5 ramp at Santa Ana Boulevard would operate at LOS F during peak PM hours for all Build Alternatives in 2040.
- The SR-55 SB ramp at 4th Street would operate at LOS F during the AM peak hour for all Build Alternatives.

As discussed above, it is possible that the three intersections identified by the project's Transportation Analysis Report (AECOM 2013) could operate at LOS E or F and could result in CO hot-spots. This analysis complies with the CO Protocol's recommended approach to determining if quantitative modeling is required.

The procedures of the CO Protocol (as shown in Figures 4a and 4b) are provided for the proposed project to determine the level of analysis (if any):

Question 3.1.1: Is the project exempt from all emissions analyses?

Answer: No. The proposed project is not exempt from all emissions analyses as it does not meet the criteria for projects exempt from all emissions analyses listed in Table 1 of the CO Protocol. *Go to Question 3.1.2*.

Question 3.1.2: Is the project exempt from regional emissions analyses?

Answer: No. The proposed project is not exempt from regional emissions analyses as it does not meet the criteria for projects exempt from regional emissions analyses listed in Table 2 of the CO Protocol. *Go to Question 3.1.3*.

Question 3.1.3: Is the project locally defined as regionally significant?

Answer: Yes. Regionally significant projects are defined in 40 CFR 93.101 as projects that would normally be included in the modeling of a metropolitan area's transportation network, which is the case for this project. *Go to Question 3.1.4*.

Question 3.1.4: Is the project in a federal attainment area?

Answer: No. The SCAB is designated as an attainment/maintenance area for the federal CO standards. Since the SCAB must demonstrate "maintenance" of the federal standards, it is not considered a federal attainment area for the purposes of this analysis. *Go to Question 3.1.5*.

Question 3.1.5: Is there a currently conforming RTP and TIP?

Answer: Yes. The applicable plans are the 2012 RTP, adopted on April 4, 2012 (SCAG 2012), and the 2008 RTIP, adopted on July 17, 2008 (SCAG 2008). USDOT made a positive conformity determination for the 2012 RTP on June 4, 2012 (USDOT 2012) and for the 2008 RTIP on November 17, 2008 (USDOT 2008). *Go to Question 3.1.6*.

Question 3.1.6: Is the project included in the regional emissions analysis supporting the currently conforming RTP and TIP?

Answer: Yes. The proposed project is included in SCAG's 2012 RTP and 2008 RTIP as RTP/RTIP ID #2H0703 (SCAG 2008, 2012). *Go to Question 3.1.7*.

Question 3.1.7: Has the project design concept and/or scope changed significantly from that in the regional analysis?

Figure 4a
CO Protocol

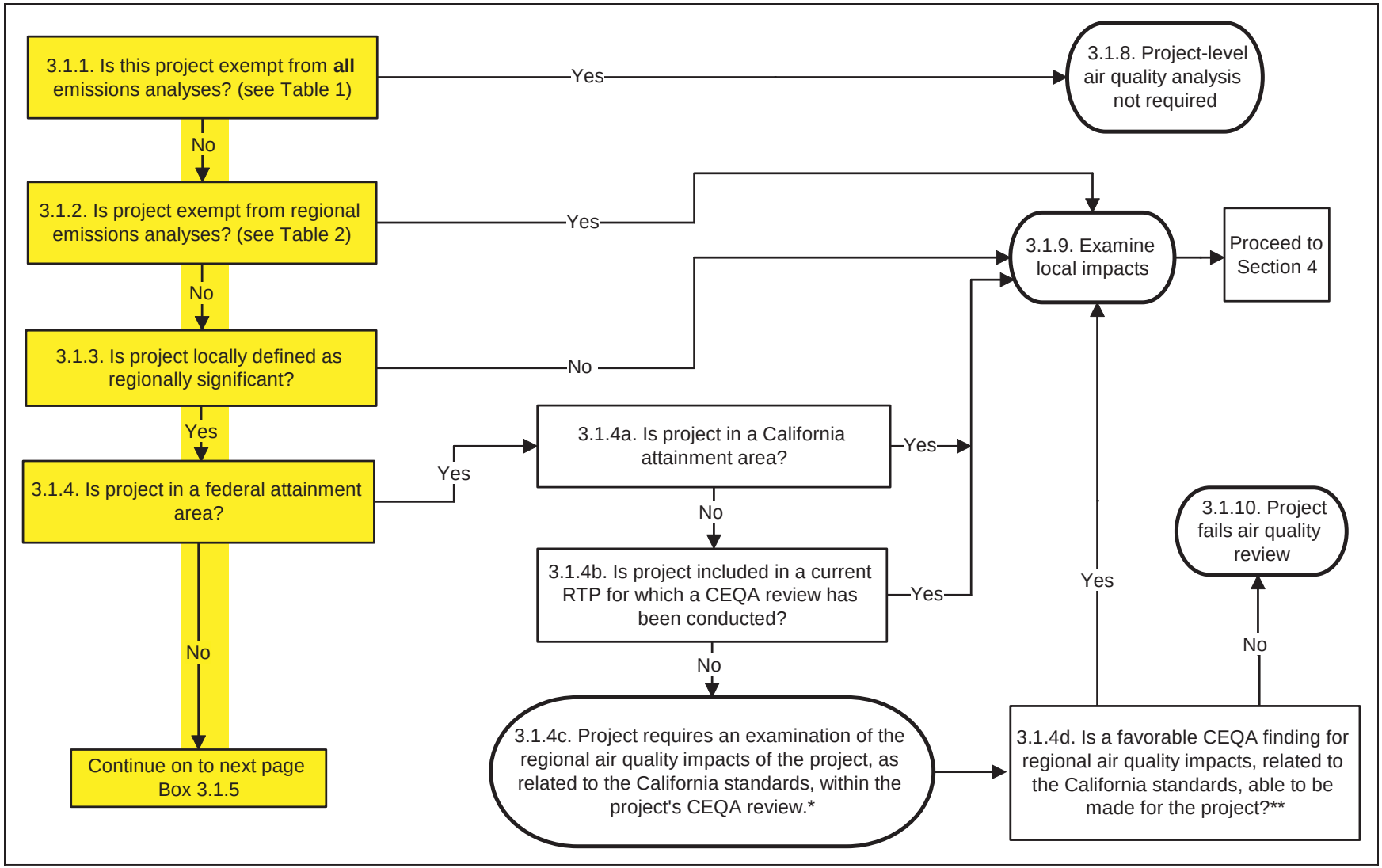
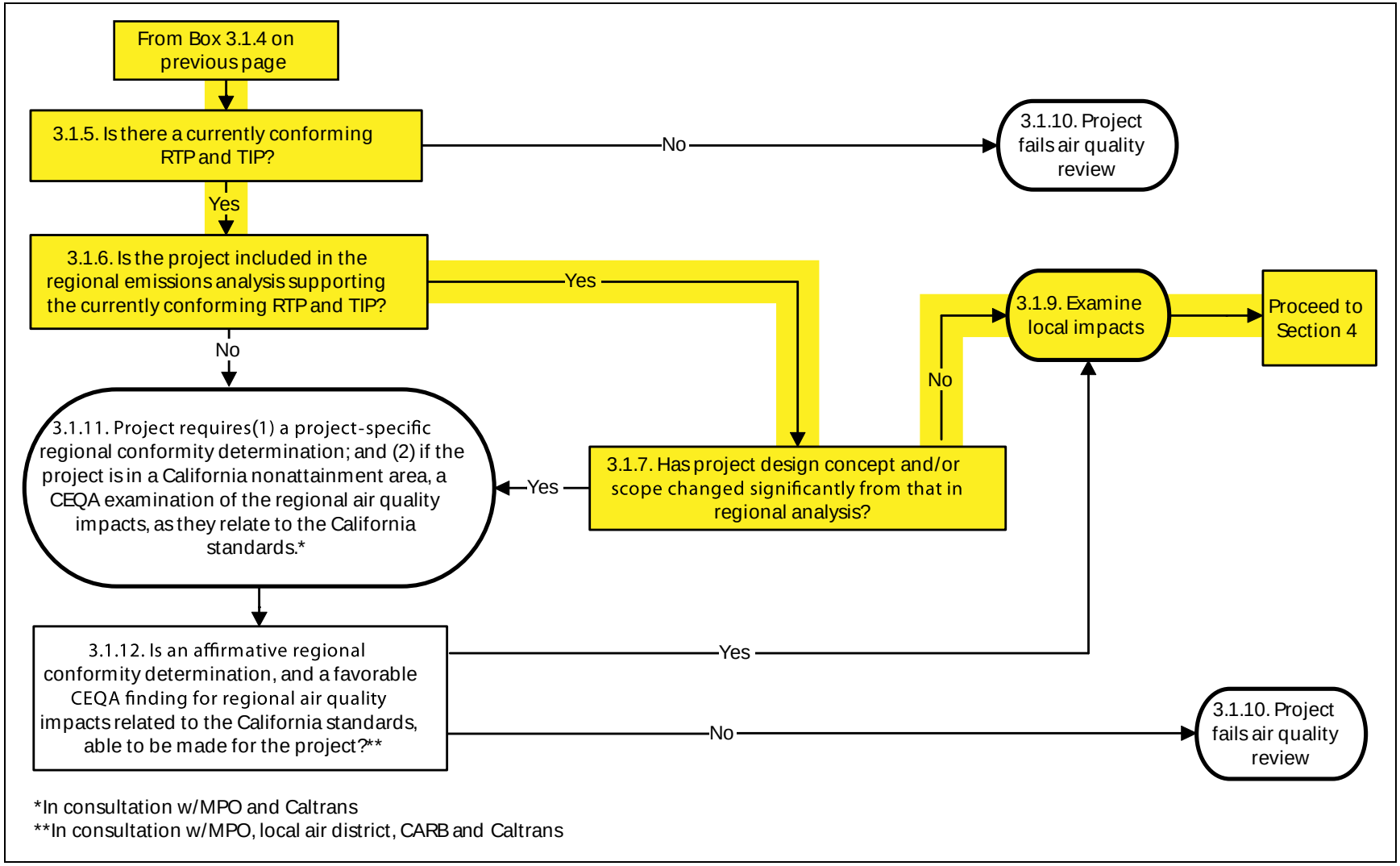


Figure 4b


From Box 3.1.4 on previous page
3.1.5. Is there a currently conforming RTP and TIP?
No
3.1.10. Project fails air quality review
Yes
3.1.6. Is the project included in the regional emissions analysis supporting the currently conforming RTP and TIP?
Yes
No
3.1.9. Examine local impacts
Proceed to Section 4
No
3.1.11. Project requires(1) a project-specific regional conformity determination; and (2) if the project is in a California nonattainment area, a CEQA examination of the regional air quality impacts, as they relate to the California standards.*
Yes
3.1.7. Has project design concept and/or scope changed significantly from that in regional analysis?
3.1.12. Is an affirmative regional conformity determination, and a favorable CEQA finding for regional air quality impacts related to the California standards, able to be made for the project?**
Yes
No
3.1.10. Project fails air quality review
*In consultation w/MPO and Caltrans
**In consultation w/MPO, local air district, CARB and Caltrans

Answer: No. The proposed project is described as improvements from "I-5 from SR-55 to SR-57 – add one HOV lane in each direction" (SCAG 2008, 2012). The design concept and scope of the proposed project are consistent with the project description in the 2012 RTP, the 2008 RTIP, and the assumptions in SCAG's regional emissions analysis. *Proceed to Step 3.1.9, Examine Local Impacts; Go to Section 4 – Figure 3 of the Protocol*.

Section 3.1.9 requires an examination of the local CO impacts, as outlined in Section 4 of the CO Protocol.

The procedures of Section 4 and Figure 3 of the CO Protocol (as shown in Figures 5a and 5b) are provided for the proposed project to identify level of effort.

Level 1

Question: Is the project in a CO nonattainment area?

Answer: No. The SCAB is designated as an attainment/maintenance area for the federal CO standards. *Go to next question.*

Question: Was the area redesignated as "attainment" after the 1990 Clean Air Act?

Answer: Yes. The SCAB was redesignated as an attainment/maintenance area, effective June 11, 2007. *Go to next question*.

Question: Has "continued attainment" been verified with the local air district (if appropriate)?

Answer: Yes. The Carbon Monoxide Redesignation Request and Maintenance Plan (ARB 2005) demonstrates continued attainment in the SCAB. In addition, the monitoring station data included in Table 5 indicate that the local project area has not recorded an exceedance for CO in the past 3 years. *Proceed to Level 7 (Section 4.7.1)*.

Level 7

Question: Does the project worsen air quality?

Figure 5a
CO Protocol

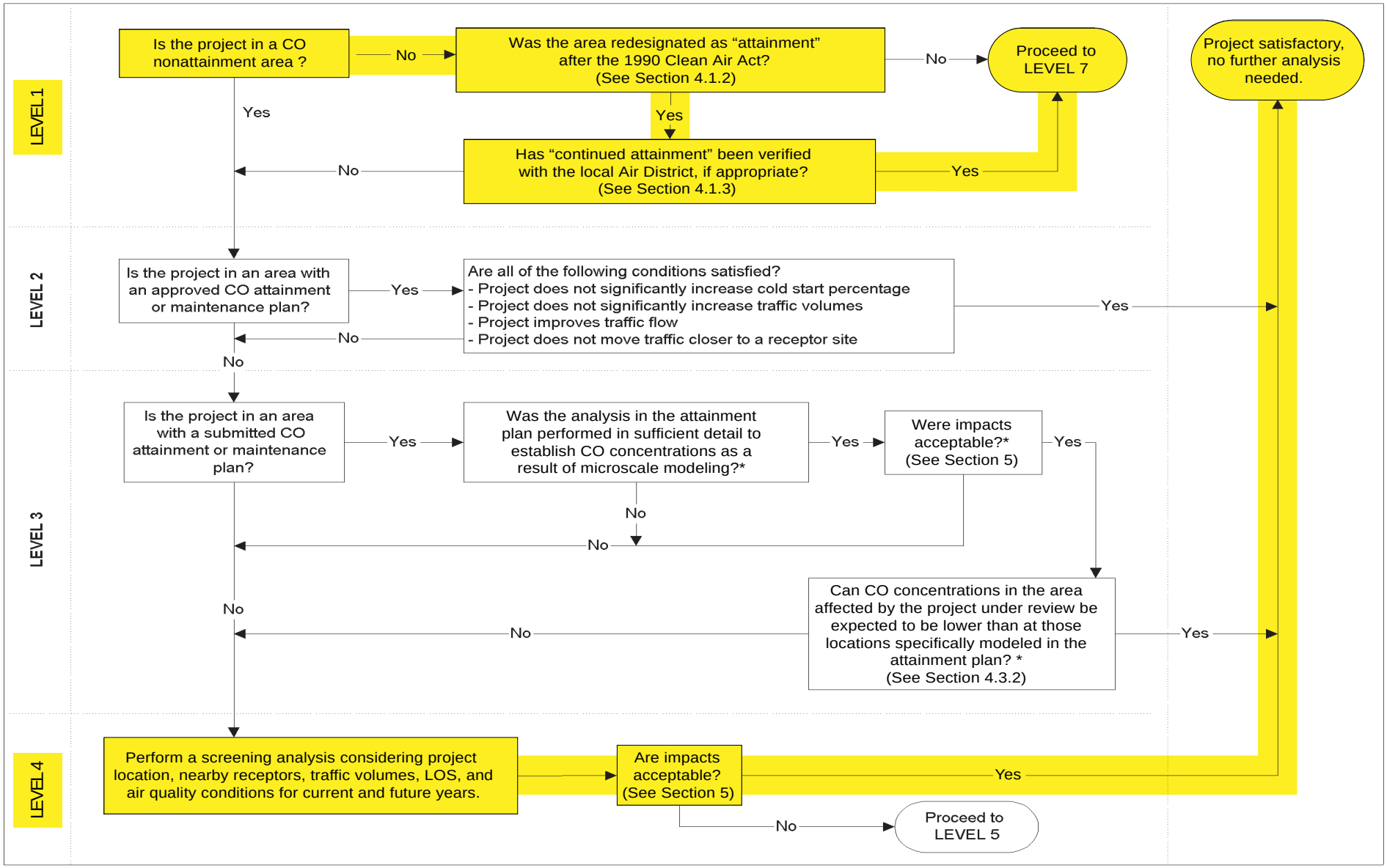
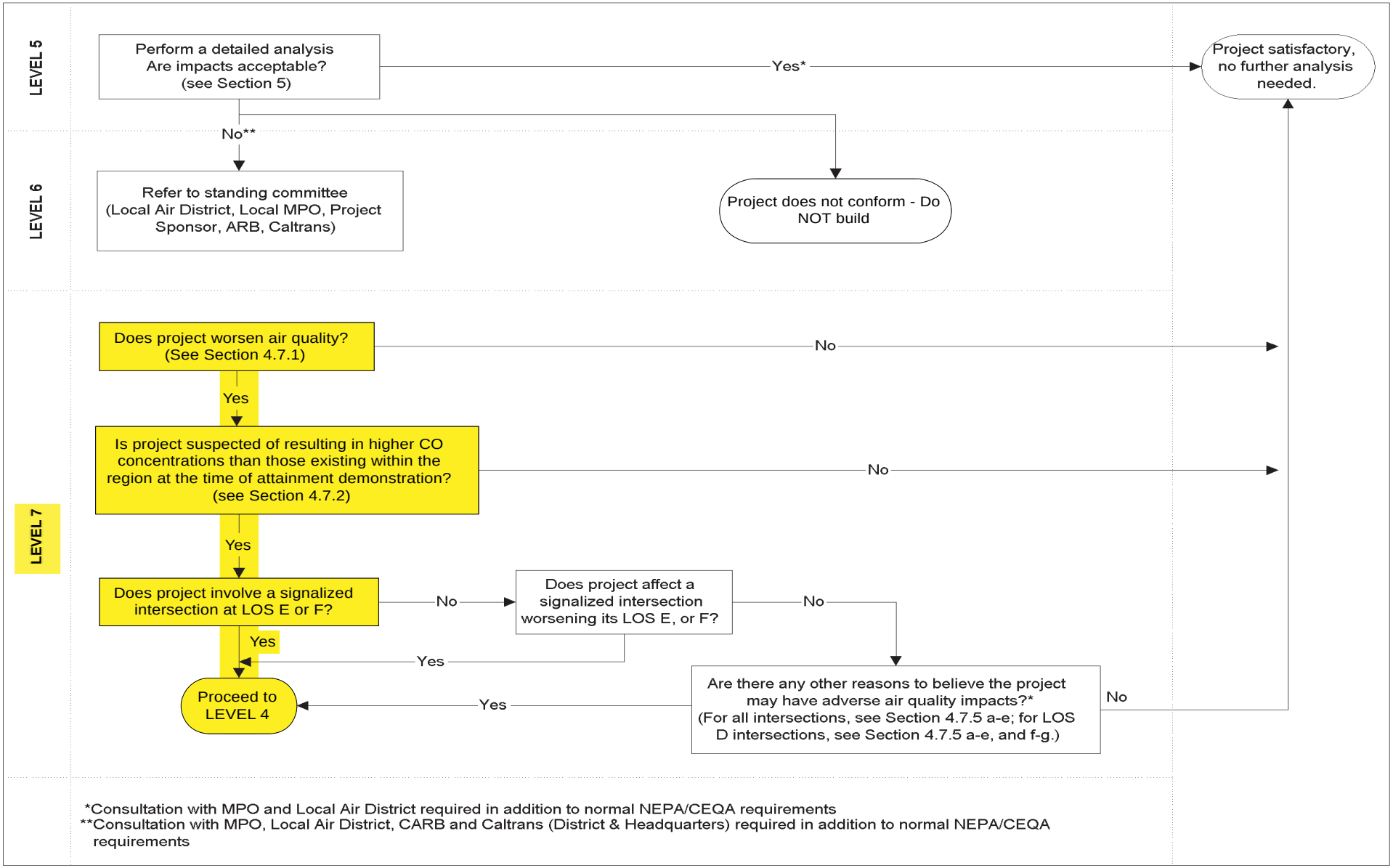


Figure 5b


LEVEL 5
Perform a detailed analysis
Are impacts acceptable?
(see Section 5)
Yes*
Project satisfactory, no further analysis needed.
No**
LEVEL 6
Refer to standing committee
(Local Air District, Local MPO, Project Sponsor, ARB, Caltrans)
Project does not conform - Do NOT build
LEVEL 7
Does project worsen air quality?
(See Section 4.7.1)
No
Yes
Is project suspected of resulting in higher CO concentrations than those existing within the region at the time of attainment demonstration?
(see Section 4.7.2)
No
Yes
Does project involve a signalized intersection at LOS E or F?
No
Does project affect a signalized intersection worsening its LOS E, or F?
No
Yes
Yes
Proceed to LEVEL 4
Yes
Are there any other reasons to believe the project may have adverse air quality impacts?*
(For all intersections, see Section 4.7.5 a-e; for LOS D intersections, see Section 4.7.5 a-e, and f-g.)
No
*Consultation with MPO and Local Air District required in addition to normal NEPA/CEQA requirements
**Consultation with MPO, Local Air District, CARB and Caltrans (District & Headquarters) required in addition to normal NEPA/CEQA requirements

Section 4.7.1 provides criteria to evaluate if a project is likely to worsen air quality. The CO Protocol states that, "only those projects that are likely to worsen air quality necessitate further analysis." To determine whether a project is likely to worsen air quality for the area substantially affected by the project, see Section 4.7.1:

> Question: Would the project significantly increase the percentage of vehicles operating in cold start mode? An increase of as little as 2% should be considered significant.
>
> Answer: No. The proposed project would add an additional HOV lane in both the north and south directions of I-5 and, therefore, would not affect vehicles operating in cold start mode. The percentage of vehicles operating in cold start mode in the region would be similar for the Build Alternatives as compared to the percentage for the No Build Alternative. Therefore, this condition is met.
>
> Question: Would the project significantly increase traffic volumes? Increases in traffic volumes of 5% or more should be considered potentially significant. Additionally, an increase of less than 5% may still be potentially significant if there is also a reduction in average speeds.
>
> Answer. Yes. The proposed project is not anticipated to increase overall traffic volumes, as it is not a trip-generating project such as a residential, commercial, or industrial land use. However, some vehicle trips may be rerouted from local roadways to the proposed project's segments along I-5 as a result of increased HOV capacity and improved traffic circulation. According to the CO Protocol, the criteria should be applied on an hourly basis for the time periods when the highest CO concentrations are expected to occur. The project's Transportation Analysis Report (AECOM 2013) analyzed peak hour mainline volumes for the years 2018 and 2040 along all of the project's segments of I-5 under the No Build and Build Alternatives (AECOM 2013). As determined from the traffic modeling, the peak hour mainline volumes along the project's segments of I-5 for all Build Alternatives would not increase above 3% from the No Build Alternative. It is anticipated that some of the traffic added to the project segments of I-5 would be diverted from local roadways, which would reduce CO emissions by allowing vehicles to operate at more efficient speeds and reducing delays and idling.
>
> However, certain intersections were determined to experience an increase in traffic volumes that could cause CO impacts. For example, traffic volumes at the Grand Avenue/1st Street intersection are estimated to increase by 12% for Design Option A combined with any of the Build Alternatives in 2040 compared to the No Build Alternative.

While overall traffic volumes in the region are not anticipated to increase as a result of the proposed project, individual intersections could experience a significant increase in traffic volumes. For a conservative approach to this analysis, it was assumed that the proposed project could result in a significant increase in traffic volumes based on the changes in individual roadway and/or intersection volumes. Therefore, this condition is not met.

Question: Would the project worsen traffic flow? For uninterrupted roadway segments, a reduction in average speeds (within a range of 3 to 50 mph) should be considered as worsening traffic flow. For intersection segments, a reduction in average speed or an increase in average delay should be considered as worsening traffic flow.

Answer: Yes. The proposed project would not substantially affect the traffic flow along the mainline lanes of I-5. Some additional weaving would be required as a result of changes to ramps; however, the change would not be substantial. The project's HOV lanes would experience an increase in traffic flow as a result of the proposed project, as the purpose of the project is to provide additional HOV capacity to reduce existing congestion. As discussed above and indicated in Tables 13 and 14, the LOS for most intersections would remain the same under the Build Alternatives (Design Option A is the worst-case scenario) and the No Build Alternatives for intersections operating at LOS D, E, or F. However, as shown in Table 14, the I-5 ramp and Santa Ana Boulevard intersection would degrade from LOS E to LOS F in 2040 as a result of the proposed project. Therefore, this condition is not met.

The proposed project would not meet the criteria above used in Section 4.7.1 to determine if a project is likely to worsen air quality for the area. *Go to Question 4.7.2.*

Question 4.7.2: Is the project suspected of resulting in higher CO concentrations than those existing within the region at the time of attainment demonstration?

Answer: Yes. The guidance for this question states: "Projects potentially creating CO concentrations higher than those existing within the region at the time of attainment demonstration should proceed to Section 4.7.3; other projects should be deemed satisfactory and no further analysis is needed." The information required to determine if current concentrations would be higher than those at the time of attainment is not readily available. Therefore, as a conservative estimate, and because of the addition of HOV travel lanes and intersection volumes, it is assumed that current and proposed future CO concentrations could be higher than those at the time of attainment demonstration. *Go to Question 4.7.3.*

Table 13
Opening Year (2018) LOS for Signalized Intersections

	No Build				Design Option A			
	AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
Intersection	**Delay**	**LOS**	**Delay**	**LOS**	**Delay**	**LOS**	**Delay**	**LOS**
Main/4th	11.3	B	12	B	11.6	B	12	B
Grand/4th	33.4	C	42.2	D	49	D	54	D
I-5 SB Ramp/4th	11.4	B	15.1	B	19.9	B	18.4	B
I-5 NB Ramp/4th	8.9	A	18.1	B	8.7	A	21.8	C
Cabrillo/4th	28.2	C	32.4	C	28.3	C	32.3	C
Tustin/4th	31.5	C	41.5	D	32.1	C	46.1	D
Main/1st	41	D	36.9	D	52.2	D	36	D
Grand/1st	**61.9**	**E**	**71.5**	**E**	**65.8**	**E**	**76.1**	**E**
I-5 SB Ramp/1st	8.2	A	10.2	B	Ramp Removed			
Cabrillo/1st	25.8	C	26.1	C	26.3	C	26.6	C
Tustin/1st	15.9	B	16.7	B	15.9	B	16.9	B
I-5 Ramp/Santa Ana	19.7	B	**57.7**	**E**	19.7	B	**57.7**	**E**
Grand/Santa Ana	27.6	C	35.2	D	27.6	C	35.2	D
Mabury/Elk/1st	27.8	C	39.4	D	17.7	B	30.1	C
Lyon/1st	19.3	B	18	B	31.8	C	18.9	B
Cabrillo/State Fund	4.5	A	6	A	4.4	A	6.6	A
Cabrillo/Xerox Center	4.4	A	7.1	A	4.4	A	9.3	A
Golden Circle/4th	8.2	A	10.1	B	8.1	A	10.2	B
Golden Circle/1st	7.5	A	7.7	A	8.9	A	8.7	A
SR-55 SB Ramps/4th	**>80.0**	**F**	20.2	C	**>80.0**	**F**	20.7	C
SR-55 NB Ramps/4th	17.8	B	36.6	D	18.4	B	37.7	D

Note: Bold indicates intersection operating at unacceptable LOS.
Source: AECOM 2013.

Table 14
Opening Year (2040) LOS for Signalized Intersections

	No Build				Design Option A			
	AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
Intersection	**Delay**	**LOS**	**Delay**	**LOS**	**Delay**	**LOS**	**Delay**	**LOS**
Main/4th	11.3	B	12	B	11.9	B	12.1	B
Grand/4th	34	C	43.7	D	50.3	D	54.8	D
I-5 SB Ramp/4th	11.2	B	15.1	B	20.7	C	18.8	B
I-5 NB Ramp/4th	9	A	18.5	B	8.9	A	25.8	C
Cabrillo/4th	29.4	C	35.4	D	31.1	C	37.7	D
Tustin/4th	42	D	44.5	D	46.7	D	49	D
Main/1st	45	D	40.7	D	46.6	D	41.6	D
Grand/1st	**71.5**	**E**	**>80.0**	**F**	**74.3**	**E**	**>80.0**	**F**
I-5 SB Ramp/1st	8.4	A	10.4	B	Ramp Removed			
Cabrillo/1st	26.6	C	27.7	C	28.6	C	29.9	C
Tustin/1st	17.8	B	17.3	B	18.2	B	17.8	B
I-5 Ramp/Santa Ana	20.6	C	**62.1**	**E**	20.9	C	**>80.0**	**F**
Grand/Santa Ana	27.4	C	36.5	D	27.8	C	37.9	D
Mabury/Elk/1st	28.8	C	43.3	D	29.8	C	21.4	C
Lyon/1st	19.6	B	18.8	B	30.3	C	28.7	C
Cabrillo/State Fund	4.5	A	5.9	A	4.5	A	6	A
Cabrillo/Xerox Center	4.3	A	7	A	4.2	A	9.9	A
Golden Circle/4th	8	A	10.3	B	8.8	A	11.8	B
Golden Circle/1st	7.6	A	7.9	A	9.1	A	8.8	A
SR-55 SB Ramps/4th	**>80.0**	**F**	24.2	C	**>80.0**	**F**	26.6	C
SR-55 NB Ramps/4th	15.9	B	48.4	D	17.5	B	51.5	D

Note: Bold indicates intersection operating at unacceptable LOS.
Source: AECOM 2013.

Question 4.7.3: Does the project involve a signalized intersection at LOS E or F?

Answer: Yes. The Grand Avenue/1st Street and the I-5 SB Ramps/Santa Ana Boulevard intersections will operate at LOS F in 2040. *Proceed to Level 4.*

Question: Level 4: Perform a screening analysis considering project location, nearby receptors, traffic volumes, LOS, and air quality conditions for current and future years. Are impacts acceptable?

Answer: Yes. CO concentrations at the affected intersections were modeled for the Build Alternative's future (2040) conditions. These conditions represent the maximum traffic volumes at the affected intersections. All other alternatives and operational years would be anticipated to result in lower traffic volumes and fewer CO impacts than the 2040 Build Alternative conditions. As shown in Table 15, the proposed project would not cause an exceedance of the state 1-hour or 8-hour CO ambient air quality standards under any operating scenario or year.

Table 15
Horizon Year 2040 Carbon Monoxide Concentrations

Intersection	Period	1-Hour CO Concentrations (ppm)	8-Hour CO Concentrations (ppm)
		Build	Build
Grand Avenue/1st Street	AM	3.9	3.0
	PM	4.1	3.2
I-5 SB Ramps/Santa Ana Boulevard	AM	3.9	3.0
	PM	3.7	2.9
SR-55 NB Ramps/4th Street	AM	3.7	2.9
	PM	3.7	2.9
Federal CO standards		35	9
State CO standards		20	9
Exceed Federal/State Standards		No	No

ppm = parts per million
Source: AECOM 2013

The potential for the proposed project to generate a CO hot-spot at the signalized intersections was evaluated using CALINE4 pursuant to the CO Protocol. The screening analysis included the three worst-case intersections affected by the proposed project, according to the Transportation Analysis Report. These intersections include Grand Avenue/1st Street, I-5 SB Ramps/Santa Ana Boulevard, and SR-55 NB Ramps/4th Street. These intersections were determined to experience

the highest changes to delay times while operating at LOS D, E, or F, and therefore would have the highest potential to cause a CO hot-spot.

CO impacts were modeled using the following assumptions:

- Background CO concentration used was 3.0 parts per million (ppm) from the Anaheim monitoring station (based on 2012 data);
- Mixing height of 300 meters;
- Atmospheric stability class set at Class 7 (worst-case conditions);
- Wind direction standard deviation of 5 degrees (worst-case conditions);
- Minimum wind speed of 0.5 meters per second (worst-case conditions);
- Emission rates for the year 2018 (most conservative emission factor); and
- Traffic volumes for 2040 (highest volumes).

The results of the quantitative CO hot-spot analysis for the 1-hour and 8-hour CO concentrations are presented in Table 15. As mentioned above, CALINE4 was used to estimate the 1-hour CO concentrations. According to Appendix B of the CO Protocol, estimates of the 8-hour CO concentrations are usually based on the 1-hour CO concentrations (UCD ITS 1997). A persistence factor is the ratio between the 1-hour and 8-hour CO concentrations and is used to relate the concentrations (UCD ITS 1997). The CO protocol provides generalized persistence factors that are recommended for use in the CO hot-spot analysis. Therefore, consistent with the CO protocol, the 8-hour concentrations shown in Table 15 were calculated from the 1-hour modeled estimates using a persistence factor for urban areas of 0.78. CO concentrations estimated at the studied intersections were compared to the federal and state 1-hour CO standards of 35 ppm and 20 ppm, respectively, and the federal and state 8-hour CO standards of 9 ppm. Additional modeling details are included in Appendix C.

As shown in Table 15, the proposed project's future traffic conditions would not result in or contribute to any exceedances of the 1-hour or 8-hour CO standards during the AM or PM peak periods at any of the analyzed intersections, even considering conservative assumptions. According to the CO Protocol, the proposed project is considered satisfactory and no further CO analysis is required. Therefore, no localized CO impacts would occur.

Particulate Matter ($PM_{2.5}$ and PM_{10}) Hot-Spot Analysis

As discussed in more detail in this section, the PM hot-spot analysis for the proposed project has been approved by the SCAG Transportation Conformity Working Group (TCWG), and the

project would not create a new, or worsen an existing, PM_{10} or $PM_{2.5}$ violation. Appendix D also includes a summary of the TCWG approval of the approach to the PM hot-spot analysis.

On March 10, 2006, USEPA published a final rule that establishes the transportation conformity criteria and procedures for determining which transportation projects must be analyzed for local air quality impacts in $PM_{2.5}$ and PM_{10} nonattainment and maintenance areas. Based on that rule, USEPA and FHWA published *Transportation Conformity Guidance for Qualitative Hot-Spot Analysis in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas* (PM Guidance) (FHWA 2006a). In December 2010, USEPA released its final PM Guidance for quantitative hot-spot analyses for new or expanded highway projects with significant increase in diesel traffic in federal $PM_{2.5}$ and PM_{10} nonattainment and maintenance areas (USEPA 2010). Following a 2-year grace period, quantitative hot-spot analyses are now required for these types of projects in federal $PM_{2.5}$ and PM_{10} nonattainment and maintenance areas, effective December 2012.

The proposed project is located in a nonattainment area for federal $PM_{2.5}$ standards and an attainment/maintenance area for federal PM_{10} standards. Therefore, to meet the hot-spot analysis requirements, the proposed project is assessed using the procedure outlined in the PM Guidance.

The PM Guidance describes a qualitative hot-spot analysis method that does not involve dispersion modeling. This qualitative $PM_{2.5}$ and PM_{10} hot-spot analysis involves a more streamlined review of local factors such as local monitoring data near a proposed project.

The $PM_{2.5}$ and PM_{10} hot-spot analysis method in the March 2006 PM Guidance involves two steps: determining whether a project is a “project of air quality concern” (POAQC) and, if it is a POAQC, preparing a more detailed analysis of the project. The PM Guidance defines the following types of projects as POAQCs:

- New or expanded highway projects that have a significant number of or significant increase in diesel vehicles.
- Projects affecting intersections that are at LOS D, E, or F with a significant number of diesel vehicles, or those that will change to LOS D, E, or F because of increased traffic volumes from a significant number of diesel vehicles related to the project.
- New bus and rail terminals, and transfer points, that have a significant number of diesel vehicles congregating at a single location.
- Expanded bus and rail terminals, and transfer points, that significantly increase the number of diesel vehicles congregating at a single location.

- Projects in, or affecting, locations, areas, or categories of sites that are identified in the $PM_{2.5}$ applicable implementation plan or implementation plan submission, as appropriate, as sites of violation or possible violation.

A significant volume for a new highway is defined as an AADT volume of 125,000 vehicles or more, and a significant number of diesel vehicles is defined as 8% or more of that total AADT, or more than 10,000 truck AADT. A significant increase in diesel truck traffic is normally considered to be approximately 10%.

The proposed project is not a POAQC based on a review of USEPA criteria in Section 93.123(b)(1). Although the proposed project would add HOV capacity along the proposed segments of I-5, as determined in the traffic study, the project would not generate additional passenger vehicle or diesel vehicle traffic in the region. The proposed segments of I-5 currently experience approximately 5.5% to 7% of diesel vehicles, which is less than the 10% described above (Caltrans 2010b). According to the Transportation Analysis Report, truck percentages within the study area were approximately 6.0% in the weekday AM and PM peak hours (AECOM 2013). The proposed additional HOV lanes would not be available for heavy-duty diesel trucks to travel within; therefore, the increased capacity would not accommodate additional heavy-duty diesel trucks.

Implementation of the proposed project would not degrade intersections to LOS D, E, or F with a significant number of diesel vehicles. In addition, the proposed project does not include the construction of a new bus or rail terminal, nor expand an existing bus or rail terminal. Lastly, the proposed project is not located within and would not affect sites that are identified as sites of possible $PM_{2.5}$ violations pursuant to the $PM_{2.5}$ applicable implementation plan. The proposed project would increase the HOV capacity of certain segments of I-5, which would reduce current congestion and improve operation of the HOV lanes.

Considering the above, the proposed project would not exceed any of the thresholds or standards used to identify a POAQC; therefore, the proposed project would not be considered a POAQC pursuant to the PM Guidance's definition.

A PM Conformity Hot-spot Analysis and Project Summary Form for Interagency Consultation was prepared and submitted to Caltrans for review. The form was subsequently submitted to the SCAG TCWG for discussion and review during their monthly meeting on October 23, 2012. The purpose of this form is to provide sufficient information to allow the TCWG to determine if a project requires a project-level PM hot-spot analysis pursuant to Federal Conformity

Regulations. The project was reviewed and approved by Interagency Consultation and a determination was made that the project is not a POAQC. The form and supporting determination are provided in Appendix D.

Therefore, the project meets the CAA requirements and 40 CFR 93.116 without an explicit hot-spot analysis, and no additional interagency consultation is required. The project would not create a new, or worsen an existing, PM_{10} or $PM_{2.5}$ violation, and the impact would be *less than significant*.

Mobile Source Air Toxics (MSATs)

In February 2006, FHWA issued its FHWA Interim Guidance (FHWA 2006b) to advise when and how to analyze MSATs in the NEPA process for highways. However, USEPA recommends following the report, *Analyzing, Documenting, and Communicating the Impacts of Mobile Source Air Toxic Emissions in the NEPA Process* (AASHTO 2007). In September 2009, FHWA released an update to the FHWA Interim Guidance (FHWA 2009). The 2009 Guidance did not change any project analysis thresholds, recommendations, or guidelines; however, seven updated primary MSATs were identified as having significant contributions from mobile sources that are among the national- and regional-scale cancer risk drivers. In December 2012, FHWA released Interim Guidance Update on Mobile Source Air Toxic Analysis in NEPA, as an update to the 2009 FHWA Interim Guidance (FHWA 2012).

This 2012 update reflects recent changes in methodology for conducting emissions analysis and updates of research in the MSAT arena. The interim guidance update reflects recent regulatory changes, addresses stakeholder requests to broaden the horizon years of emission trends, and updates stakeholders on the status of scientific research on air toxics. The guidance is described as interim because MSAT science is still evolving. As the science progresses, FHWA will update the guidance. The 2012 update supersedes the September 2009 Interim Guidance and should be referenced in air quality analyses. This analysis follows the most recent FHWA guidance update.

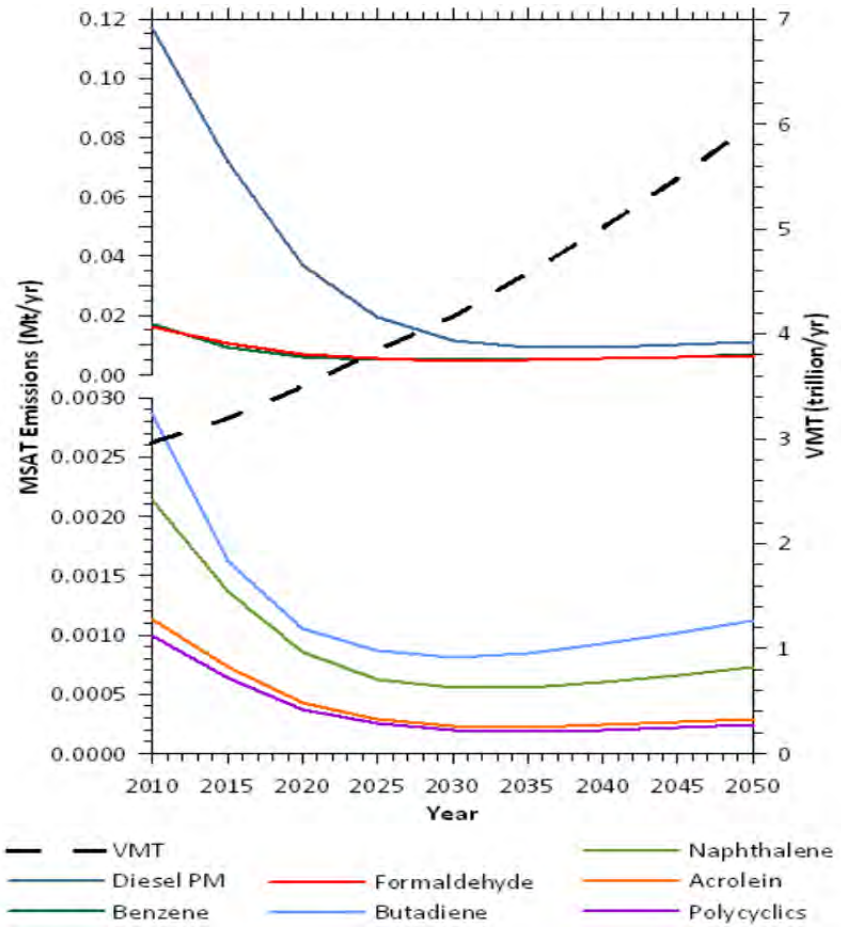
On February 8, 2011, USEPA issued guidance on using the EMFAC Models in NEPA Evaluation. The guidance indicates that project sponsors in California should use EMFAC 2007 to conduct emissions analysis for NEPA purposes beginning on December 20, 2012.

Introduction to MSATs

As discussed earlier, MSATs are a subset of the 188 air toxics defined by the CAA. USEPA is the lead federal agency for administering the CAA and has certain responsibilities regarding the

health effects of MSATs. USEPA rules (Control of Hazardous Air Pollutants from Mobile Sources [Federal Register, Vol. 72, No. 37, Page 8430, February 20, 2007]) require controls that will dramatically decrease MSAT emissions through cleaner fuels and cleaner engines. According to an FHWA analysis, even if VMT increases by 102% as assumed from 2010 to 2050, a combined reduction of 83% in the total annual emissions for the priority MSAT is projected for the same time period, as shown in Figure 6.

Figure 6. National MSAT Emission Trends 2010 to 2050



Source: FHWA 2012

Air toxics analysis is a continuing area of research. While much work has been done to assess the overall health risk of air toxics, many questions remain unanswered. In particular, the tools and techniques for assessing project-specific health outcomes as a result of lifetime MSAT exposure remain limited. These limitations impede the ability to evaluate how potential public health risks

posed by MSAT exposure should be factored into project-level decision making within the context of NEPA.

Consideration of MSAT Effects

FHWA has developed a tiered approach with three categories for analyzing MSATs in NEPA documents, depending on specific project circumstances:

- *Category 1: No analysis for projects with no potential for meaningful MSAT effects.*
  - Projects qualifying as a categorical exclusion under 23 CFR 771.117(c);
  - Projects exempt under the Clean Air Act conformity rule under 40 CFR 93.126; or
  - Other projects with no meaningful impacts on traffic volumes or vehicle mix.
- *Category 2: Qualitative analysis for projects with low potential MSAT effects.*
  - Projects that serve to improve operations of highway, transit, or freight without adding substantial new capacity or without creating a facility that is likely to meaningfully increase MSAT emissions.
  - Project examples include minor widening projects; new interchanges; replacing a signalized intersection on a surface street; or projects where design year traffic is projected to be less than 140,000 to 150,000 annual average daily traffic (AADT).
  - Any projects not meeting the criteria in Category (1) or Category (3) should be included in this category.
- *Category 3: Projects with Higher Potential MSAT Effects.*
  - Create or significantly alter a major intermodal freight facility that has the potential to concentrate high levels of diesel particulate matter in a single location, involving a significant number of diesel vehicles for new projects or accommodating with a significant increase in the number of diesel vehicles for expansion projects; or
  - Create new capacity or add significant capacity to urban highways such as interstates, urban arterials, or urban collector-distributor routes with traffic volumes where the AADT is projected to be in the range of 140,000 to 150,000 or greater by the design year; and
  - Proposed to be located in proximity to populated areas.

If the analysis for a project indicates meaningful differences in levels of MSAT emissions among alternatives, mitigation options should be identified and considered.

Evaluation of the Proposed Project MSAT Impacts

The proposed project does not meet the Category (1) criteria for projects with no potential for meaningful MSAT effects. As mentioned earlier, the segments of I-5 that would be affected by the proposed project currently experience AADT levels from 320,000 to 349,000 (Caltrans 2011a). In 2040, the maximum ADT for the No Build Alternative is 430,000 vehicles, and the Build Alternatives result in a maximum ADT of 450,000 vehicles. The average ADT increase on I-5 as a result of the Build Alternatives would be 4%, while some segments would have an increase of 10%. However, overall VMT in the project corridor would increase by only 0.4% as a result of the proposed Build Alternatives. The proposed projects would add HOV lanes and serve to improve operations of highway, transit, and freight without adding substantial new capacity or without creating a facility that is likely to meaningfully increase MSAT emissions. The description of the proposed project is consistent with Category (2) projects that would require qualitative analysis for projects with low potential MSAT effects. However, since the traffic volumes with the proposed project would be substantially greater than the FHWA range of 140,000 to 150,000 AADT, this analysis also includes quantification of MSAT emissions.

For each alternative in this analysis, the amount of MSATs emitted would be proportional to the VMT, assuming that other variables such as fleet mix are the same for each alternative. Because the estimated VMT under each of the Build Alternatives is approximately the same, no appreciable difference would be expected in overall MSAT emissions among the various alternatives. The lane volumes and subsequent VMT estimated for each of the Build Alternatives are slightly higher than those for the No Build Alternative, because the additional capacity increases the efficiency of the roadway and attracts rerouted trips from elsewhere in the transportation network.

MSAT emissions for operation of the proposed project were estimated using CT-EMFAC, Version 4.1, a project-level analysis tool designed to model MSAT emissions using the EMFAC model. Table 16 presents the estimated MSAT emissions for the Existing (2011), Opening Year (2018) No Build and Build Alternatives, and Future Year (2040) No Build and Build Alternatives. Additional details are included in Appendix E.

Table 16
MSAT Emissions – Operational Emissions (Pounds per Day)

Pollutant	Existing	2018		2040	
		No Build	Build	No Build	Build
Diesel PM	63.71	41.02	41.04	31.33	31.39
Diesel Exhaust Organic Gas (DEOG)	101.35	69.84	69.75	57.94	57.76
Benzene	50.60	30.78	30.78	15.79	15.78
Acrolein	2.20	1.25	1.25	0.56	0.56
Acetaldehyde	14.76	9.21	9.21	5.92	5.91
Formaldehyde	44.51	27.14	27.15	15.81	15.80
Butadiene	9.71	5.48	5.49	2.51	2.52

Notes: Emissions are pounds per day. Additional details are provided in Appendix E.
Source: AECOM 2013

As shown in Table 16, MSAT emissions would not vary significantly between Build and No Build Alternatives in 2018 and 2040. Also, regardless of the alternative chosen, emissions would likely be lower than present levels in the design year as a result of USEPA's national control programs. MSAT emissions in the project area would decrease from existing conditions by an average of 38% in 2018 and 60% in 2040. Under the Build Alternatives, there may be localized areas where VMT would increase, and other areas where VMT would decrease, which could result in localized increases and decreases in MSATs. However, even if these increases did occur, they would be substantially reduced compared to existing conditions due to implementation of USEPA's vehicle and fuel regulations.

Therefore, under the Build Alternatives in 2018 and 2040, reduced MSAT emissions would be expected to be reduced compared to existing conditions in the immediate area of the project due to USEPA's MSAT reduction programs. Also, since the MSAT emissions would be similar for the No Build and Build Alternatives, there would be no local or regional MSAT impacts related to the proposed project.

Climate Change

An individual project does not generate enough GHG emissions to significantly influence global climate change. Rather, global climate change is a cumulative impact. This means that a project may participate in a potential impact through its incremental contribution combined with the contributions of all other sources of GHGs. Assessment of cumulative impacts must determine if a project's incremental contribution to a greater effect is "cumulatively considerable."

Construction

Construction of the proposed project would generate short-term emissions of GHGs. Construction GHG emissions would be associated with vehicle engine exhaust from construction equipment, vendor trips, and construction worker trips. GHG emissions generated by the proposed project would predominantly consist of CO_2. In comparison to criteria air pollutants such as ozone and PM_{10}, CO_2 emissions persist in the atmosphere for a substantially longer period of time. While emissions of other GHGs such as CH_4 and N_2O are important with respect to global climate change, their relative contribution to the project's GHG emissions, even considering their global warming potentials, is small (i.e., less than 5%). Therefore, this analysis will focus on quantifying construction-related CO_2 emissions.

Construction emissions would be generated intermittently during the construction period from 2016 through 2018, and would cease following completion of the proposed project. Construction of the proposed project would generate a finite, total quantity of approximately 1,478 MT of CO_2 over the duration of construction activities, which is substantially less than the 25,000 MT CO_2e per year threshold recommended by CEQ guidance. Construction emissions would be finite and temporary, and would not hinder California's ability to attain the GHG reductions outlined in AB 32.

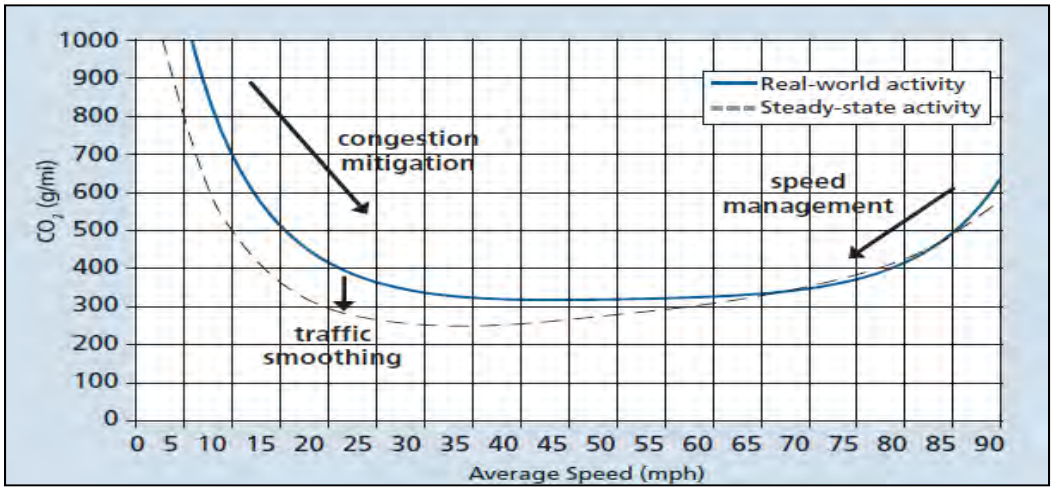
Operations

The proposed project is not a land use development and would not generate vehicle trips in comparison to the current configuration. The proposed project is a capacity-increasing project. However, the project itself would not generate additional traffic but is intended to accommodate projected regional growth and allow for acceptable roadway operations. However, it is anticipated that some vehicles would divert their routes from local roadways to the project's segments of I-5. As determined in the traffic study, the proposed project could result in an average 4% increase in mainline ADT volumes on I-5 in 2040.

Caltrans and its parent agency, the Business, Transportation, and Housing Agency, have taken an active role in addressing GHG emissions reduction and climate change. Recognizing that 98% of California's GHG emissions are from the burning of fossil fuels and 40% of all human-made GHG emissions are from transportation, Caltrans has created and is implementing the *Climate Action Program at Caltrans* that was published in December 2006 (Caltrans 2006).

One of the main strategies in Caltrans' Climate Action Program to reduce GHG emissions is to make California's transportation system more efficient. The highest levels of CO_2 from mobile sources, such as automobiles, occur at stop-and-go speeds (0 to 25 mph) and speeds more than 55 mph (see Figure 7). To the extent that a project relieves congestion by enhancing operations and improving travel times in high-congestion travel corridors, GHG emissions, particularly CO_2, may be reduced.

Figure 7. Possible Effect of Traffic Operation Strategies in Reducing On-Road CO_2 Emissions



Source: California Department of Transportation Environmental Impact Report/Environmental Impact Statement Annotated Outline, October 2012.

Pursuant to the Climate Action Program, the proposed project would improve road operations by reducing traffic congestion on the segments of I-5. The potential also exists for vehicles that currently qualify to use the HOV lanes but drive in the general-purpose lanes to transfer to the more efficient HOV lanes, which would also allow the general-purpose lanes to operate more efficiently. In addition, as described above, the vehicles that would divert their route from local roadways (where stop-and-go speeds are the primary flow of traffic) to I-5 would reduce GHG emissions by operating at more efficient speeds. Hence, the proposed project would contribute to reducing fuel consumption from idling vehicles by minimizing stop-and-go activity and allowing smoother traffic flow on HOV and general-purpose lanes of the I-5 project segment.

Although it is projected that certain project segments of I-5 could experience additional traffic, it is anticipated that the increased efficiency of vehicles on the project segments of I-5 would offset those increases. Table 17 indicates the overall CO_2 emissions from the proposed project.

Emissions were calculated using the total VMT by speed bin and EMFAC emission factors. Additional details are included in Appendix F.

Table 17
Annual CO_2 Emissions – Metric Tons

	2018	2040
No Build Alternative	1,010,005	1,027,776
Build Alternatives	1,008,349	1,024,260
Net Change	(1,655)	(3,515)

Note: Emissions are metric tons per year.
Source: Modeled by AECOM in 2013

As indicated in Table 17, the overall CO_2 emissions from the Build Alternatives would be less than the No Build Alternative in 2040. Therefore, the project would not generate GHG emissions, either directly or indirectly, that may have an impact on the environment.

The proposed project's effect on roadway operations would not hinder California's ability to attain the goals identified in AB 32.

Assembly Bill 32 Compliance

Caltrans continues to be actively involved on the Governor's Climate Action Team as ARB works to implement Executive Orders S-3-05 and S-01-07 and help achieve the targets set forth in AB 32. Many of the strategies Caltrans is using to help meet the targets in AB 32 come from the California Strategic Growth Plan, which is updated each year. Former Governor Arnold Schwarzenegger's Strategic Growth Plan calls for a $222 billion infrastructure improvement program to fortify the state's transportation system, education, housing, and waterways, including $100.7 billion in transportation funding during the next decade. The Strategic Growth Plan targets a significant decrease in traffic congestion below today's level and a corresponding reduction in GHG emissions. The Strategic Growth Plan proposes to do this while accommodating growth in population and the economy. A suite of investment options has been created that combined are expected to reduce congestion. The Strategic Growth Plan relies on a complete systems approach to attain CO_2 reduction goals: system monitoring and evaluation, maintenance and preservation, smart land use and demand management, and operational improvements as depicted in Figure 8, the Mobility Pyramid.

Figure 8. Mobility Pyramid

Source: California Department of Transportation Environmental Impact Report/Environmental Impact Statement Annotated Outline, October 2012.

Caltrans is supporting efforts to reduce VMT by planning and implementing smart land use strategies: job/housing proximity and the promoting of alternate modes of transportation and mobility strategies. Caltrans is working closely with local jurisdictions on planning activities; however, Caltrans does not have local land use planning authority. Table 18 summarizes Caltrans and statewide efforts that it is implementing to reduce GHG emissions. More detailed information about each strategy is included in the *Climate Action Program at Caltrans* (Caltrans 2006). The proposed project would be consistent with the Caltrans strategies for operational improvements and, therefore, would not conflict with any applicable plan, policy, or regulation for the purpose of reducing GHG emissions.

Table 18
Climate Change Strategies

Strategy	Program	Partnership		Method/Process	Estimated CO_2 Savings (MMT)	
		Lead	Agency		2010	2020
Smart Land Use	Intergovernmental Review	Caltrans	Local governments	Review and seek to mitigate development proposals	Not Estimated	Not Estimated
	Planning Grants	Caltrans	Local and regional agencies and other stakeholders	Competitive selection process	Not Estimated	Not Estimated
	Regional Plans and Blueprint Planning	Regional Agencies	Caltrans	Regional plans and application process	0.975	7.8
Operational Improvements and Intelligent Transportation System Deployment	Strategic Growth Plan	Caltrans	Regions	State ITS; Congestion Management Plan	0.07	2.17
Mainstream Energy and GHG into Plans and Projects	Office of Policy Analysis and Research; Division of Environmental Analysis	Interdepartmental effort		Policy establishment, guidelines, technical assistance	Not Estimated	Not Estimated
Educational and Information Program	Office of Policy Analysis and Research	Interdepartmental, CalEPA, ARB, CEC		Analytical report, data collection, publication, workshops, outreach	Not Estimated	Not Estimated
Fleet Greening and Fuel Diversification	Division of Equipment	Department of General Services		Fleet Replacement B20 B100	0.0045	0.0065 0.045 0.0225
Non-vehicular Conservation Measures	Energy Conservation Program	Green Action Team		Energy Conservation Opportunities	0.117	0.34
Portland Cement	Office of Rigid Pavement	Cement and Construction Industries		2.5% limestone cement mix 25% fly ash cement mix > 50% fly ash/slag mix	1.2 0.36	4.2 3.6
Goods Movement	Office of Goods Movement	CalEPA, ARB, BT&H, MPOs		Goods Movement Action Plan	Not Estimated	Not Estimated
Total					**2.72**	**18.18**

Source: California Department of Transportation Environmental Impact Report/Environmental Impact Statement Annotated Outline, October 2012.

ARB = California Air Resources Board
BT&H = Business, Transportation, and Housing Agency
CalEPA = California Environmental Protection Agency
Caltrans = California Department of Transportation
CEC = California Energy Commission
CO_2 = carbon dioxide
GHG = greenhouse gas
MMT = million metric tons
MPOs = Metropolitan Planning Organizations

Cumulative Impacts

The proposed project would help to reduce vehicle congestion and idling emissions in the HOV and general-purpose lanes of the I-5 project segment, thereby reducing the operational emissions in the project area and in the SCAB. In addition, vehicles that divert their routes from local roadways to I-5 would be anticipated to travel at more efficient speeds and avoid stop-and-go traffic circulation patterns, both of which would be expected to reduce regional criteria air pollutant emissions. As indicated in Tables 19 and 20, criteria pollutant emissions are estimated to decrease as a result of the proposed project in 2018 and 2040, respectively. Emissions were calculated using the total VMT by speed bin and EMFAC 2011 emission factors. The emission estimates are based on the total VMT for the corridor and changes in operational speeds as a result of the proposed project and alternatives. Due to the similarity in project alternatives, VMT by speed bin data did not vary by alternative. Therefore, the emissions were estimated for the No Build and Build Alternative. Additional details are provided in Appendix F.

Table 19
Opening Year (2018) Operational Emissions

	Estimated Emissions (lbs/day)				
	ROG	**NO_X**	**CO**	**PM_{10}**	**$PM_{2.5}$**
No Build	727.3	5,337.7	19,956.4	80.4	74.1
Build	723.7	5,331.4	19,931.9	80.3	74.0
Net Change	(3.6)	(6.2)	(24.6)	(0.2)	(0.1)

Note: lbs/day = pounds per day
Source: Modeled by AECOM 2013

Table 20
Future Year (2040) Operational Emissions

	Estimated Emissions (lbs/day)				
	ROG	**NO_X**	**CO**	**PM_{10}**	**$PM_{2.5}$**
No Build	471.0	2,977.1	13,034.1	88.8	82.0
Build	466.8	2,970.9	13,021.2	88.7	81.8
Net Change	(4.3)	(6.2)	(12.9)	(0.2)	(0.2)

Note: lbs/day = pounds per day
Source: Modeled by AECOM 2013

Therefore, the proposed project's long-term cumulative contribution to regional air quality would be less than significant.

The design concept and scope of the proposed project are consistent with the project description in the 2012 RTP, the 2008 RTIP, and the assumptions in SCAG's regional emissions analysis. The proposed project is included in SCAG's 2012 RTP and 2008 RTIP as RTP/RTIP ID #2H0703 (I-5 from SR-55 to SR-57 – add one HOV lane in each direction) (SCAG 2008, 2012). Therefore, the proposed project is as described in the current applicable RTP and RTIP.

The proposed project would also not result in emissions from construction activities that would exceed the daily emissions thresholds for project construction established by SCAQMD. The proposed project does not create any new CO violations or increase the frequency or severity of any existing CO violations. The proposed project would not be considered a POAQC according to the definition provided in the PM Guidance. The proposed project is in conformance with the SIP. Because the project is consistent with regional air quality planning, it would not contribute to cumulative adverse air quality effects.

This page intentionally left blank.

CHAPTER 6
POTENTIAL AVOIDANCE, MINIMIZATION, AND/OR MITIGATION MEASURES

Permanent Impacts

No adverse air quality impacts were identified for project operations. No mitigation measures would be required.

Temporary Impacts

Based on the analysis above, the air quality impacts of the proposed project would be short term and temporary. The project would be required to comply with regional rules that assist in reducing short-term air pollutant emissions. SCAQMD Rule 403 requires that fugitive dust be controlled with best available control measures so that the presence of such dust does not remain visible in the atmosphere beyond the property line of the source. In addition, SCAQMD Rule 402 requires implementation of dust-suppression techniques to prevent fugitive dust from creating a nuisance off-site. The following mitigation measures (AQ-1 and AQ-2) were identified for project construction impacts. These measures are recommended for inclusion in the project as best management practices to minimize cumulative construction impacts in the region.

AQ-1 Applicable dust-suppression techniques from Rule 403 are summarized below. Additional dust-suppression measures in the *CEQA Air Quality Handbook* (SCAQMD 1993) are included as part of the project's mitigation. Implementation of these dust-suppression techniques can reduce fugitive dust generation (and, thus, the PM_{10} component). Compliance with these rules during construction would reduce impacts on nearby sensitive receptors and will be verified by the cities of Tustin, Santa Ana, and Orange during construction.

Applicable Rule 403 Measures:

- Apply nontoxic chemical soil stabilizers according to manufacturer's specifications to all inactive construction areas (previously graded areas inactive for 10 days or more).
- Water active sites at least twice daily. (Locations where grading is to occur will be thoroughly watered prior to earthmoving.)

- All trucks hauling dirt, sand, soil, or other loose materials are to be covered or should maintain at least 2 feet of freeboard in accordance with the requirements of California Vehicle Code Section 23114 (freeboard means vertical space between the top of the load and top of the trailer).
- Pave construction access roads at least 100 feet onto the site from main road.
- Traffic speeds on all unpaved roads shall be reduced to 15 mph or less.

Additional *CEQA Air Quality Handbook* (SCAQMD 1993) Dust Measures:

- Revegetate disturbed areas as quickly as possible.
- All excavating and grading operations shall be suspended when wind speeds (as instantaneous gusts) exceed 25 mph.
- All streets shall be swept once per day if visible soil materials are carried to adjacent streets (recommend water sweepers with reclaimed water).
- Install wheel washers where vehicles enter and exit unpaved roads onto paved roads, or wash trucks and any equipment leaving the site each trip.

AQ-2 Project activities would comply with Caltrans Standard Specifications (2010) Section 14-9, including:

- Comply with air pollution control rules, regulations, ordinances, and statutes, including air pollution control rules, regulations, ordinances, and statutes provided in Government Code §11017 (Public Contract Code §10231).
- Prevent and alleviate dust by applying water, dust palliative, or both (Section 14-9.02) and by covering active and inactive stockpiles (Sections 13-4.03C[3] and 14-9.02).

CHAPTER 7
REFERENCES

AECOM

2013 *I-5 from SR-55 to SR-57 HOV Improvements Project PA/ED, Transportation Analysis Report, Draft.* March 18.

American Association of State Highway and Transportation Officials (AASHTO)

2007 *Analyzing, Documenting, and Communicating the Impacts of Mobile Source Air Toxic Emissions in the NEPA Process*. Available at http://onlinepubs.trb.org/onlinepubs/archive/NotesDocs/25-25(18)_FR.pdf.

California Air Resources Board (ARB)

2005 Carbon Monoxide Redesignation Request and Maintenance Plan. Available at http://www.arb.ca.gov/planning/sip/sccosip05/sccosip_redesig_mplan.pdf. Accessed July 2013.

2010 Greenhouse Gas Inventory. May 12. Available at http://www.arb.ca.gov/cc/inventory/data/tables/ghg_inventory_scopingplan_00-08_2010-05-12.pdf.

2013a Ambient Air Quality Standards. Available at http://www.arb.ca.gov/research/aaqs/aaqs2.pdf. Accessed July 2013.

2013b Area Designations Maps/State and National. Available at http://www.arb.ca.gov/desig/adm/adm.htm. Accessed July 2013.

2013c iADAM: Air Quality Data Statistics Top 4 Summary. Available at http://www.arb.ca.gov/adam/. Accessed June 2013.

California Department of Conservation (CDC)

2000 *A General Location Guide for Ultramafic Rocks in California – Areas More Likely to Contain Naturally Occurring Asbestos, California Department of Conservation, Geological Surveys*. Available at ftp://ftp.consrv.ca.gov/pub/dmg/pubs/ofr/ofr_2000-019.pdf.

California Department of Transportation (Caltrans)

2006 *Climate Action Program at Caltrans*. Available at http://www.dot.ca.gov/docs/ClimateReport.pdf.

2010a *Project Study Report*. November.

2010b Traffic Counts. Available at http://traffic-counts.dot.ca.gov/. Accessed August 2012.

2011a 2011 Traffic Volumes on the California State Highway System. Available at http://www.dot.ca.gov/hq/traffops/saferesr/trafdata/2011TrafficVolumesAug2012.pdf. Accessed November 2012.

2011b Annual Average Daily Truck Traffic on the California State Highway System. Available at http://www.dot.ca.gov/hq/traffops/saferesr/trafdata/truck2011final.pdf. Accessed November 2012.

Council on Environmental Quality (CEQ)

2010 *Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions*. Available at http://www.whitehouse.gov/sites/default/files/microsites/ceq/20100218-nepa-consideration-effects-ghg-draft-guidance.pdf. February 18.

Federal Highway Administration (FHWA)

2006a *Transportation Conformity Guidance for Qualitative Hot-Spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas*. March. Available at http://www.fhwa.dot.gov/environment/conformity/pmhotspotguid.pdf.

2006b Memorandum. Information: Interim Guidance on Air Toxic Analysis in NEPA Documents. From Cynthia J. Burbank, Associate Administrator for Planning, Environment and Realty. February 3.

2009 Memorandum. Information: Interim Guidance Update on Mobile Source Air Toxic Analysis in NEPA Documents. From April Marchese, Director, Office of Natural and Human Environment. September 30. Available at http://www.fhwa.dot.gov/environment/air_quality/air_toxics/policy_and_guidance/100109guidmem.cfm. Accessed August 28, 2012.

2012 Memorandum. Information: Interim Guidance Update on Mobile Source Air Toxic Analysis in NEPA. From April Marchese, Director, Office of Natural Environment. December 6.

Federal Register

2007 *Control of Hazardous Air Pollutants From Mobile Sources.* Available at http://www.gpo.gov/fdsys/pkg/FR-2007-02-26/pdf/E7-2667.pdf. Accessed July 2013.

Intergovernmental Panel on Climate Change (IPCC)

2007 *Climate Change 2007: The Physical Science Basis. Summary for Policymakers* (Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change). Boulder, Colorado. February.

South Coast Air Quality Management District (SCAQMD)

1993 *CEQA Air Quality Handbook.* April.

Southern California Association of Governments (SCAG)

2008 Regional Transportation Improvement Program (RTIP). Adopted July. Available at http://www.scag.ca.gov/RTIP/rtip2008/adopted.htm.

2012 *2012–2035 Regional Transportation Plan/Sustainable Communities Strategy: Toward a Sustainable Future 2012.* April. Available at http://rtpscs.scag.ca.gov/Pages/2012-2035-RTP-SCS.aspx. Accessed August 21, 2012.

U.C. Davis Institute of Transportation Studies (UCD ITS)

1997 *Transportation Project-Level Carbon Monoxide Protocol, UCD-ITS-97-21*. December. Davis, California.

U.S. Department of Transportation (USDOT)

2008 Letter from Gene K. Fong (USDOT) to Will Kempton (Caltrans) regarding California 2009 Federal Statewide Transportation Improvement Program. November 17.

2012 Conformity Determination for SCAG's 2012 RTP/SCS and 2010/11 FTIP through Amendment No. 11-24. June. Available at http://rtpscs.scag.ca.gov/Documents/2012/final/SCAGFF24_060412.pdf. Accessed August 21, 2012.

U.S. Environmental Protection Agency (USEPA)

2007 Six Common Pollutants, Particulate Matter. Available at http://www.epa.gov/air/particlepollution/index.html. Accessed April 2013.

2010 *Transportation Conformity Guidance for Quantitative Hot-spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas*. December.

2013a The Green Book Nonattainment Areas for Criteria Pollutants. Available at http://www.epa.gov/oar/oaqps/greenbk/index.html. Accessed July 2013.

2013b Monitor Values Report. Available at http://www.epa.gov/airdata/ad_rep_mon.html. Accessed June 2013.

CHAPTER 8
PREPARER QUALIFICATIONS

Jason Paukovits
Environmental Analyst, AECOM.

Master of Public Policy, Duke University, 2001
Master of Environmental Management, Duke University, 2001
B.S., Environmental Resource Management, Pennsylvania State University, 1996
B.A., Psychology, Pennsylvania State University, 1996

12 years of professional experience in environmental planning and air quality

This page intentionally left blank.

APPENDIX A

CONSTRUCTION EMISSIONS WORKSHEETS

Road Construction Emissions Model, Version 7.1.2

Emission Estimates for -> OCTA I-5 Project Phases (English Units)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	Total PM10 (lbs/day)	Exhaust PM10 (lbs/day)	Fugitive Dust PM10 (lbs/day)	Total PM2.5 (lbs/day)	Exhaust PM2.5 (lbs/day)	Fugitive Dust PM2.5 (lbs/day)	CO2 (lbs/day)
Grubbing/Land Clearing	5.9	25.4	43.2	52.2	2.2	50.0	12.4	2.0	10.4	4,499.8
Grading/Excavation	6.9	32.0	53.6	52.7	2.7	50.0	12.9	2.5	10.4	5,788.6
Drainage/Utilities/Sub-Grade	5.7	26.1	41.7	52.3	2.3	50.0	12.5	2.1	10.4	4,633.8
Paving	3.6	21.1	21.3	1.3	1.3	-	1.2	1.2	-	3,365.5
Maximum (pounds/day)	6.9	32.0	53.6	52.7	2.7	50.0	12.9	2.5	10.4	5,788.6
Total (tons/construction project)	1.9	9.1	14.4	14.8	0.8	14.0	3.6	0.7	2.9	1,629.0

Notes: Project Start Year -> 2016
Project Length (months) -> 30
Total Project Area (acres) -> 142
Maximum Area Disturbed/Day (acres) -> 5
Total Soil Imported/Exported (yd^3/day)-> 0

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Emission Estimates for -> OCTA I-5 Project Phases (Metric Units)	ROG (kgs/day)	CO (kgs/day)	NOx (kgs/day)	Total PM10 (kgs/day)	Exhaust PM10 (kgs/day)	Fugitive Dust PM10 (kgs/day)	Total PM2.5 (kgs/day)	Exhaust PM2.5 (kgs/day)	Fugitive Dust PM2.5 (kgs/day)	CO2 (kgs/day)
Grubbing/Land Clearing	2.7	11.5	19.6	23.7	1.0	22.7	5.6	0.9	4.7	2,045.4
Grading/Excavation	3.1	14.5	24.4	24.0	1.2	22.7	5.9	1.1	4.7	2,631.2
Drainage/Utilities/Sub-Grade	2.6	11.8	19.0	23.8	1.0	22.7	5.7	0.9	4.7	2,106.3
Paving	1.6	9.6	9.7	0.6	0.6	-	0.5	0.5	-	1,529.8
Maximum (kilograms/day)	3.1	14.5	24.4	24.0	1.2	22.7	5.9	1.1	4.7	2,631.2
Total (megagrams/construction project)	1.8	8.3	13.1	13.4	0.7	12.7	3.3	0.6	2.6	1,477.6

Notes: Project Start Year -> 2016
Project Length (months) -> 30
Total Project Area (hectares) -> 57
Maximum Area Disturbed/Day (hectares) -> 2
Total Soil Imported/Exported ($meters^3$/day)-> 0

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sume of exhaust and fugitive dust emissions shown in columns K and L.

Road Construction Emissions Model
Data Entry Worksheet

Version 7.1.2

Note: Required data input sections have a yellow background.
Optional data input sections have a blue background. Only areas with a yellow or blue background can be modified. Program defaults have a white background.
The user is required to enter information in cells C10 through C25.

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

Input Type

Project Name	OCTA I-5	
Construction Start Year	2016	Enter a Year between 2009 and 2025 (inclusive)
Project Type	2	1 New Road Construction 2 Road Widening 3 Bridge/Overpass Construction
Project Construction Time	30.0	months
Predominant Soil/Site Type: Enter 1, 2, or 3	1	1. Sand Gravel 2. Weathered Rock-Earth 3. Blasted Rock
Project Length	4.1	miles
Total Project Area	141.8	acres
Maximum Area Disturbed/Day	5.0	acres
Water Trucks Used?	1	1. Yes 2. No
Soil Imported		yd^3/day
Soil Exported		yd^3/day
Average Truck Capacity	20.0	yd^3 (assume 20 if unknown)

To begin a new project, click this button to clear data previously entered. This button will only work if you opted not to disable macros when loading this spreadsheet.

The remaining sections of this sheet contain areas that can be modified by the user, although those modifications are optional.

Note: The program's estimates of construction period phase length can be overridden in cells C34 through C37.

Construction Periods	User Override of Construction Months	Program Calculated Months	2005	%	2006	%	2007	%
Grubbing/Land Clearing		3.00	0.00	0.00	0.00	0.00	0.00	0.00
Grading/Excavation		12.00	0.00	0.00	0.00	0.00	0.00	0.00
Drainage/Utilities/Sub-Grade		10.50	0.00	0.00	0.00	0.00	0.00	0.00
Paving		4.50	0.00	0.00	0.00	0.00	0.00	0.00
Totals	0.00	30.00						

Hauling emission default values can be overridden in cells C45 through C46.

Soil Hauling Emissions

User Input	User Override of Soil Hauling Defaults	Default Values
Miles/round trip		30
Round trips/day		0
Vehicle miles traveled/day (calculated)		0

Hauling Emissions	ROG	NOx	CO	PM10	PM2.5	CO2
Emission rate (grams/mile)	0.15	8.05	0.69	0.16	0.10	1673.03
Emission rate (grams/trip)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
Tons per contruction period	0.00	0.00	0.00	0.00	0.00	0.00

Worker commute default values can be overridden in cells C60 through C65.

Worker Commute Emissions

	User Override of Worker Commute Default Values	Default Values
Miles/ one-way trip		20
One-way trips/day		2
No. of employees: Grubbing/Land Clearing		13
No. of employees: Grading/Excavation		16
No. of employees: Drainage/Utilities/Sub-Grade		15
No. of employees: Paving		15

	ROG	NOx	CO	PM10	PM2.5	CO2
Emission rate - Grubbing/Land Clearing (grams/mile)	0.147	0.194	1.744	0.047	0.020	443.650
Emission rate - Grading/Excavation (grams/mile)	0.144	0.189	1.697	0.047	0.020	443.679
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.131	0.170	1.533	0.047	0.020	443.782
Emission rate - Paving (grams/mile)	0.120	0.154	1.399	0.047	0.020	443.880
Emission rate - Grubbing/Land Clearing (grams/trip)	0.505	0.323	4.200	0.004	0.003	95.592
Emission rate - Grading/Excavation (grams/trip)	0.493	0.314	4.095	0.004	0.003	95.605
Emission rate - Draining/Utilities/Sub-Grade (gr/trip)	0.451	0.282	3.726	0.004	0.003	95.654
Emission rate - Paving (grams/trip)	0.415	0.255	3.410	0.004	0.003	95.711
Pounds per day - Grubbing/Land Clearing	0.222	0.254	2.431	0.053	0.023	509.112
Tons per const. Period - Grub/Land Clear	0.007	0.008	0.080	0.002	0.001	16.801
Pounds per day - Grading/Excavation	0.217	0.247	2.366	0.053	0.023	509.146
Tons per const. Period - Grading/Excavation	0.029	0.033	0.312	0.007	0.003	67.207
Pounds per day - Drainage/Utilities/Sub-Grade	0.198	0.222	2.140	0.053	0.022	509.266
Tons per const. Period - Drain/Util/Sub-Grade	0.023	0.026	0.247	0.006	0.003	58.820
Pounds per day - Paving	0.208	0.202	1.954	0.053	0.022	607.154
Tons per const. Period - Paving	0.010	0.010	0.097	0.003	0.001	30.054
tons per construction period	0.069	0.077	0.736	0.018	0.007	172.882

Water truck default values can be overriden in cells C91 through C93 and E91 through E93.

Water Truck Emissions	User Override of Default # Water Trucks	Program Estimate of Number of Water Trucks	User Override of Truck Miles Traveled/Day	Default Values Miles Traveled/Day
Grubbing/Land Clearing - Exhaust		1		40
Grading/Excavation - Exhaust		1		40
Drainage/Utilities/Subgrade		1		40

	ROG	NOx	CO	PM10	PM2.5	CO2
Emission rate - Grubbing/Land Clearing (grams/mile)	0.16	8.25	0.70	0.17	0.10	1679.86
Emission rate - Grading/Excavation (grams/mile)	0.15	8.05	0.69	0.16	0.10	1673.03
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.15	7.32	0.66	0.16	0.09	1648.57
Pounds per day - Grubbing/Land Clearing	0.01	0.73	0.06	0.01	0.01	148.00
Tons per const. Period - Grub/Land Clear	0.00	0.10	0.01	0.00	0.00	19.54
Pound per day - Grading/Excavation	0.01	0.71	0.06	0.01	0.01	147.40
Tons per const. Period - Grading/Excavation	0.00	0.09	0.01	0.00	0.00	19.46
Pound per day - Drainage/Utilities/Subgrade	0.01	0.64	0.06	0.01	0.01	145.25
Tons per const. Period - Drainage/Utilities/Subgrade	0.00	0.07	0.01	0.00	0.00	16.78

Fugitive dust default values can be overridden in cells C110 through C112.

Fugitive Dust	User Override of Max Acreage Disturbed/Day	Default Maximum Acreage/Day	PM10 pounds/day	PM10 tons/per period	PM2.5 pounds/day	PM2.5 tons/per period
Fugitive Dust - Grubbing/Land Clearing		5	50.0	1.7	10.4	0.3
Fugitive Dust - Grading/Excavation		5	50.0	6.6	10.4	1.4
Fugitive Dust - Drainage/Utilities/Subgrade		5	50.0	5.8	10.4	1.2

Off-Road Equipment Emissions

Grubbing/Land Clearing Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*	Type	ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	CO2 pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
	1	Rubber Tired Dozers	1.28	4.41	13.72	0.64	0.59	943.69
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
	1	Scrapers	1.46	7.25	17.70	0.71	0.66	1608.02
	8	Signal Boards	2.98	11.19	10.82	0.78	0.72	1290.96
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grubbing/Land Clearing	pounds per day	5.7	22.9	42.2	2.1	2.0	3842.7
	Grubbing/Land Clearing	tons per phase	0.2	0.8	1.4	0.1	0.1	126.8

Grading/Excavation	Default Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
	0	Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
	1	Excavators	0.40	2.79	4.36	0.21	0.20	572.84
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
	1	Graders	1.05	3.48	10.20	0.57	0.53	670.58
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
	1	Other Construction Equipment	0.34	1.80	3.60	0.19	0.17	327.06
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
	1	Rubber Tired Loaders	0.52	3.12	6.40	0.22	0.20	662.66
	1	Scrapers	1.43	7.25	17.37	0.70	0.64	1608.00
	8	Signal Boards	2.89	11.11	10.72	0.76	0.70	1290.96
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grading/Excavation	pounds per day	6.6	29.5	52.7	2.7	2.4	5132.1
	Grading	tons per phase	0.9	3.9	7.0	0.4	0.3	677.4

Drainage/Utilities/Subgrade Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*		ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	CO2 pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
	1	Graders	0.98	3.47	9.45	0.53	0.49	668.97
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
	1	Plate Compactors	0.04	0.21	0.25	0.01	0.01	34.45
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
	1	Scrapers	1.34	7.25	16.07	0.64	0.59	1608.04
	8	Signal Boards	2.59	10.83	10.37	0.69	0.63	1290.96
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
	1	Trenchers	0.56	2.10	4.70	0.37	0.34	376.83
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Drainage	pounds per day	5.5	23.9	40.8	2.2	2.1	3979.2
	Drainage	tons per phase	0.6	2.8	4.7	0.3	0.2	459.6

Paving	Default Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
	1	Pavers	0.33	2.84	3.45	0.17	0.16	482.19
	1	Paving Equipment	0.24	2.69	2.59	0.13	0.12	426.37
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
	2	Rollers	0.54	3.02	4.95	0.34	0.31	558.85
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
	8	Signal Boards	2.32	10.58	10.06	0.61	0.57	1290.96
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Paving	pounds per day	3.4	19.1	21.0	1.3	1.2	2758.4
	Paving	tons per phase	0.2	0.9	1.0	0.1	0.1	136.5
Total Emissions all Phases (tons per construction period) =>			1.9	8.4	14.1	0.7	0.7	1400.4

Equipment default values for horsepower and hours/day can be overridden in cells C289 through C322 and E289 through E322.

Equipment		Default Values Horsepower		Default Values Hours/day
Aerial Lifts		63		8
Air Compressors		106		8
Bore/Drill Rigs		206		8
Cement and Mortar Mixers		10		8
Concrete/Industrial Saws		64		8
Cranes		226		8
Crawler Tractors		208		8
Crushing/Proc. Equipment		142		8
Excavators		163		8
Forklifts		89		8
Generator Sets		66		8
Graders		175		8
Off-Highway Tractors		123		8
Off-Highway Trucks		400		8
Other Construction Equipment		172		8
Other General Industrial Equipment		88		8
Other Material Handling Equipment		167		8
Pavers		126		8
Paving Equipment		131		8
Plate Compactors		8		8
Pressure Washers		26		8
Pumps		53		8
Rollers		81		8
Rough Terrain Forklifts		100		8
Rubber Tired Dozers		255		8
Rubber Tired Loaders		200		8
Scrapers		362		8
Signal Boards		20		8
Skid Steer Loaders		65		8
Surfacing Equipment		254		8
Sweepers/Scrubbers		64		8
Tractors/Loaders/Backhoes		98		8
Trenchers		81		8
Welders		45		8

0

END OF DATA ENTRY SHEET

APPENDIX B

ADDITIONAL TRAFFIC DATA

Freeway Mainline LOS Summary – Opening Year (2018) Conditions – No Build

Map Ref #	Locations		Lanes		AM Peak Hour			PM Peak Hour		
			GP	Aux	Volume	Density[1]	LOS	Volume	Density[1]	LOS
1	SR-57 between Chapman off-ramp and SR-22 off-ramp	SB	3	0	**7,490**	**>45.0**	**F**	**7,670**	**>45.0**	**F**
2	I-5 between Chapman on-ramp and SR-22 off-ramp	SB	5	2	9,170	32.2	D	8,050	27.2	D
5	I-5 between Main on-ramp and 17th/Penn off-ramp	SB	5	1	**10,075**	**38.0**	**E**	**9,705**	**35.4**	**E**
6	I-5 between 17th on-ramp and Santa Ana off-ramp	SB	5	1	**10,600**	**42.6**	**E**	**10,065**	**38.0**	**E**
8	I-5 between Grand on-ramp and Fourth off-ramp	SB	5	1	**10,330**	**40.1**	**E**	**10,285**	**39.7**	**E**
9	I-5 between Fourth off-ramp and First Street on-ramp	SB	5	1	9,595	34.7	D	**9,805**	**36.1**	**E**
8	I-5 between Fourth on-ramp and Grand off-ramp	NB	5	1	**11,790**	**>45.0**	**F**	**9,754**	**35.7**	**E**
6	I-5 between Grand Ave on-ramp and 17th off-ramp	NB	5	1	**11,125**	**>45.0**	**F**	9,149	32.1	D
5	I-5 between 17th on-ramp and Main/Broadway off-ramp	NB	5	1	**11,640**	**>45.0**	**F**	**10,379**	**40.5**	**E**
4	I-5 between Main on-ramp and SR-22 exit	NB	4	1	**9,515**	**>45.0**	**F**	**9,219**	**>45.0**	**F**
2	I-5 between SR-22 on-ramp and Chapman off-ramp	NB	5	1	9,395	33.5	D	**10,364**	**40.4**	**E**
1	SR-57 between Chapman off-ramp and Chapman on-ramp	NB	3	0	**7,485**	**>45.0**	**F**	**6,235**	**41.2**	**E**

Source: AECOM 2013.
Notes: **Bold** indicates freeway segment operating at unacceptable LOS.
[1] Density is shown in passenger cars / miles / lane (pc/mi/ln)

Freeway Mainline LOS Summary – Opening Year (2018) Conditions – HOV Lane Alternative 2A

Map Ref #	Locations		Lanes		AM Peak Hour			PM Peak Hour		
			GP	Aux	Volume	Density[1]	LOS	Volume	Density[1]	LOS
1	SR-57 between Chapman off-ramp and SR-22 off-ramp	SB	3	0	**7,490**	**>45.0**	**F**	**7,670**	**>45.0**	**F**
2	I-5 between Chapman on-ramp and SR-22 off-ramp	SB	5	2	9,170	32.2	D	8,050	27.2	D
5	I-5 between Main on-ramp and 17th/Penn off-ramp	SB	5	1	**10,075**	**38.0**	**E**	**9,705**	**35.4**	**E**
6	I-5 between 17th on-ramp and Santa Ana off-ramp	SB	5	1	**10,600**	**42.6**	**E**	**10,065**	**38.0**	**E**
8	I-5 between Grand on-ramp and Fourth off-ramp	SB	5	1	**10,330**	**40.1**	**E**	**10,285**	**39.7**	**E**
9	I-5 between Fourth off-ramp and First Street on-ramp	SB	5	1	9,595	34.7	D	**9,805**	**36.1**	**E**
8	I-5 between Fourth on-ramp and Grand off-ramp	NB	5	1	**11,790**	**>45.0**	**F**	**9,754**	**35.7**	**E**
6	I-5 between Grand Ave on-ramp and 17th off-ramp	NB	5	1	**11,125**	**>45.0**	**F**	9,149	32.1	D
5	I-5 between 17th on-ramp and Main/Broadway off-ramp	NB	5	1	**11,640**	**>45.0**	**F**	**10,379**	**40.5**	**E**
4	I-5 between Main on-ramp and SR-22 exit	NB	4	1	**9,515**	**>45.0**	**F**	**9,219**	**>45.0**	**F**
2	I-5 between SR-22 on-ramp and Chapman off-ramp	NB	5	1	9,395	33.5	D	**10,364**	**40.4**	**E**
1	SR-57 between Chapman off-ramp and Chapman on-ramp	NB	3	0	**7,485**	**>45.0**	**F**	**6,235**	**41.2**	**E**

Source: AECOM 2013.
Notes: **Bold** indicates freeway segment operating at unacceptable LOS.
[1] Density is shown in passenger cars / miles / lane (pc/mi/ln)

Freeway Mainline LOS Summary – Opening Year (2018) Conditions – HOV Lane Alternative 2B

Map Ref #	Locations		Lanes		AM Peak Hour			PM Peak Hour		
			GP	Aux	Volume	Density[1]	LOS	Volume	Density[1]	LOS
1	SR-57 between Chapman off-ramp and SR-22 off-ramp	SB	3	0	**7,490**	**>45.0**	**F**	**7,670**	**>45.0**	**F**
2	I-5 between Chapman on-ramp and SR-22 off-ramp	SB	5	2	9,351	33.3	D	8,129	27.8	D
5	I-5 between Main on-ramp and 17th/Penn off-ramp	SB	5	1	**10,098**	**38.2**	**E**	**9,712**	**35.5**	**E**
6	I-5 between 17th on-ramp and Santa Ana off-ramp	SB	5	1	**10,600**	**42.6**	**E**	**10,065**	**38.0**	**E**
8	I-5 between Grand on-ramp and Fourth off-ramp	SB	5	1	**10,330**	**40.1**	**E**	**10,285**	**39.7**	**E**
9	I-5 between Fourth off-ramp and First Street on-ramp	SB	5	1	9,595	34.7	D	**9,805**	**36.1**	**E**
8	I-5 between Fourth on-ramp and Grand off-ramp	NB	5	1	**11,790**	**>45.0**	**F**	**9,754**	**35.7**	**E**
6	I-5 between Grand Ave on-ramp and 17th off-ramp	NB	5	1	**11,125**	**>45.0**	**F**	9,149	32.1	D
5	I-5 between 17th on-ramp and Main/Broadway off-ramp	NB	5	1	**11,656**	**>45.0**	**F**	**10,445**	**41.1**	**E**
4	I-5 between Main on-ramp and SR-22 exit	NB	4	1	**9,584**	**>45.0**	**F**	**9,518**	**>45.0**	**F**
2	I-5 between SR-22 on-ramp and Chapman off-ramp	NB	5	1	9,449	33.8	D	**10,668**	**43.2**	**E**
1	SR-57 between Chapman off-ramp and Chapman on-ramp	NB	3	0	**7,485**	**>45.0**	**F**	**6,235**	**41.2**	**E**

Source: AECOM 2013.
Notes: **Bold** indicates freeway segment operating at unacceptable LOS.
[1] Density is shown in passenger cars / miles / lane (pc/mi/ln)

Freeway Mainline LOS Summary – Opening Year (2018) Conditions – HOV Lane Alternative 5A

Map Ref #	Locations		Lanes		AM Peak Hour			PM Peak Hour		
			GP	Aux	Volume	Density[1]	LOS	Volume	Density[1]	LOS
1	SR-57 between Chapman off-ramp and SR-22 off-ramp	SB	3	0	**7,490**	**>45.0**	**F**	**7,670**	**>45.0**	**F**
2	I-5 between Chapman on-ramp and SR-22 off-ramp	SB	5	2	9,170	32.2	D	8,050	27.2	D
5	I-5 between Main on-ramp and 17th/Penn off-ramp	SB	5	1	**10,075**	**38.0**	**E**	**9,705**	**35.4**	**E**
6	I-5 between 17th on-ramp and Santa Ana off-ramp	SB	5	1	**10,600**	**42.6**	**E**	**10,065**	**38.0**	**E**
8	I-5 between Grand on-ramp and Fourth off-ramp	SB	5	1	**10,330**	**40.1**	**E**	**10,285**	**39.7**	**E**
9	I-5 between Fourth off-ramp and First Street on-ramp	SB	5	1	9,595	34.7	D	**9,805**	**36.1**	**E**
8	I-5 between Fourth on-ramp and Grand off-ramp	NB	5	1	**11,790**	**>45.0**	**F**	**9,754**	**35.7**	**E**
6	I-5 between Grand Ave on-ramp and 17th off-ramp	NB	5	1	**11,125**	**>45.0**	**F**	9,149	32.1	D
5	I-5 between 17th on-ramp and Main/Broadway off-ramp	NB	5	1	**11,640**	**>45.0**	**F**	**10,379**	**40.5**	**E**
4	I-5 between Main on-ramp and SR-22 exit	NB	4	1	**9,515**	**>45.0**	**F**	**9,219**	**>45.0**	**F**
2	I-5 between SR-22 on-ramp and Chapman off-ramp	NB	5	1	9,395	33.5	D	**10,364**	**40.4**	**E**
1	SR-57 between Chapman off-ramp and Chapman on-ramp	NB	3	0	**7,485**	**>45.0**	**F**	**6,235**	**41.2**	**E**

Source: AECOM 2013.
Notes: **Bold** indicates freeway segment operating at unacceptable LOS.
[1] Density is shown in passenger cars / miles / lane (pc/mi/ln)

Freeway Mainline LOS Summary – Opening Year (2018) Conditions – HOV Lane Alternative 5B

Map Ref #	Locations		Lanes		AM Peak Hour			PM Peak Hour		
			GP	Aux	Volume	Density[1]	LOS	Volume	Density[1]	LOS
1	SR-57 between Chapman off-ramp and SR-22 off-ramp	SB	3	0	**7,490**	**66.4**	**F**	**7,670**	**72.4**	**F**
2	I-5 between Chapman on-ramp and SR-22 off-ramp	SB	5	2	9,351	33.3	D	8,129	27.8	D
5	I-5 between Main on-ramp and 17th/Penn off-ramp	SB	5	1	**10,098**	**38.2**	**E**	**9,712**	**35.5**	**E**
6	I-5 between 17th on-ramp and Santa Ana off-ramp	SB	5	1	**10,600**	**42.6**	**E**	**10,065**	**38.0**	**E**
8	I-5 between Grand on-ramp and Fourth off-ramp	SB	5	1	**10,330**	**40.1**	**E**	**10,285**	**39.7**	**E**
9	I-5 between Fourth off-ramp and First Street on-ramp	SB	5	1	9,595	34.7	D	**9,805**	**36.1**	**E**
8	I-5 between Fourth on-ramp and Grand off-ramp	NB	5	1	**11,790**	**>45.0**	**F**	**9,754**	**35.7**	**E**
6	I-5 between Grand Ave on-ramp and 17th off-ramp	NB	5	1	**11,125**	**>45.0**	**F**	9,149	32.1	D
5	I-5 between 17th on-ramp and Main/Broadway off-ramp	NB	5	1	**11,656**	**>45.0**	**F**	**10,445**	**41.1**	**E**
4	I-5 between Main on-ramp and SR-22 exit	NB	4	1	**9,584**	**>45.0**	**F**	**9,518**	**>45.0**	**F**
2	I-5 between SR-22 on-ramp and Chapman off-ramp	NB	5	1	9,449	33.8	D	**10,668**	**43.2**	**E**
1	SR-57 between Chapman off-ramp and Chapman on-ramp	NB	3	0	**7,485**	**66.2**	**F**	**6,235**	**41.2**	**E**

Source: AECOM 2013.
Notes: **Bold** indicates freeway segment operating at unacceptable LOS.
[1] Density is shown in passenger cars / miles / lane (pc/mi/ln)

Freeway Mainline LOS Summary – Future Year (2040) Conditions – No Build

Map Ref #	Locations		Lanes		AM Peak Hour			PM Peak Hour		
			GP	Aux	Volume	Density[1]	LOS	Volume	Density[1]	LOS
1	SR-57 between Chapman off-ramp and SR-22 off-ramp	SB	3	0	**8,005**	**>45.0**	**F**	**8,125**	**>45.0**	**F**
2	I-5 between Chapman on-ramp and SR-22 off-ramp	SB	5	2	**10,445**	**41.1**	**E**	8,990	31.3	D
5	I-5 between Main on-ramp and 17th/Penn off-ramp	SB	5	1	**11,605**	**>45.0**	**F**	**10,860**	**>45.0**	**F**
6	I-5 between 17th on-ramp and Santa Ana off-ramp	SB	5	1	**12,170**	**>45.0**	**F**	**11,200**	**>45.0**	**F**
8	I-5 between Grand on-ramp and Fourth off-ramp	SB	5	1	**12,025**	**>45.0**	**F**	**11,490**	**>45.0**	**F**
9	I-5 between Fourth off-ramp and First Street on-ramp	SB	5	1	**11,290**	**>45.0**	**F**	**11,010**	**>45.0**	**F**
8	I-5 between Fourth on-ramp and Grand off-ramp	NB	5	1	**12,433**	**>45.0**	**F**	**10,629**	**42.8**	**E**
6	I-5 between Grand Ave on-ramp and 17th off-ramp	NB	5	1	**11,768**	**>45.0**	**F**	**9,939**	**37.0**	**E**
5	I-5 between 17th on-ramp and Main/Broadway off-ramp	NB	5	1	**12,348**	**>45.0**	**F**	**11,239**	**>45.0**	**F**
4	I-5 between Main on-ramp and SR-22 exit	NB	4	1	**10,408**	**>45.0**	**F**	**10,134**	**>45.0**	**F**
2	I-5 between SR-22 on-ramp and Chapman off-ramp	NB	5	1	**9,858**	**36.5**	**E**	**11,254**	**>45.0**	**F**
1	SR-57 between Chapman off-ramp and Chapman on-ramp	NB	3	0	**8,140**	**>45.0**	**F**	**6,740**	**>45.0**	**F**

Source: AECOM 2013.
Notes: **Bold** indicates freeway segment operating at unacceptable LOS.
[1] Density is shown in passenger cars / miles / lane (pc/mi/ln)

Freeway Mainline LOS Summary – Future Year (2040) Conditions – HOV Lane Alternative 2A

Map Ref #	Locations		Lanes		AM Peak Hour			PM Peak Hour		
			GP	Aux	Volume	Density[1]	LOS	Volume	Density[1]	LOS
1	SR-57 between Chapman off-ramp and SR-22 off-ramp	SB	3	0	**8,005**	**>45.0**	**F**	**8,125**	**>45.0**	**F**
2	I-5 between Chapman on-ramp and SR-22 off-ramp	SB	5	2	**10,445**	**41.1**	**E**	8,990	31.3	D
5	I-5 between Main on-ramp and 17th/Penn off-ramp	SB	5	1	**11,605**	**>45.0**	**F**	**10,860**	**>45.0**	**F**
6	I-5 between 17th on-ramp and Santa Ana off-ramp	SB	5	1	**12,170**	**>45.0**	**F**	**11,200**	**>45.0**	**F**
8	I-5 between Grand on-ramp and Fourth off-ramp	SB	5	1	**12,025**	**>45.0**	**F**	**11,490**	**>45.0**	**F**
9	I-5 between Fourth off-ramp and First Street on-ramp	SB	5	1	**11,290**	**>45.0**	**F**	**11,010**	**>45.0**	**F**
8	I-5 between Fourth on-ramp and Grand off-ramp	NB	5	1	**12,433**	**>45.0**	**F**	**10,629**	**42.8**	**E**
6	I-5 between Grand Ave on-ramp and 17th off-ramp	NB	5	1	**11,768**	**>45.0**	**F**	**9,939**	**37.0**	**E**
5	I-5 between 17th on-ramp and Main/Broadway off-ramp	NB	5	1	**12,348**	**>45.0**	**F**	**11,239**	**>45.0**	**F**
4	I-5 between Main on-ramp and SR-22 exit	NB	4	1	**10,408**	**>45.0**	**F**	**10,134**	**>45.0**	**F**
2	I-5 between SR-22 on-ramp and Chapman off-ramp	NB	5	1	**9,858**	**36.5**	**E**	**11,254**	**>45.0**	**F**
1	SR-57 between Chapman off-ramp and Chapman on-ramp	NB	3	0	**8,140**	**>45.0**	**F**	**6,740**	**>45.0**	**F**

Source: AECOM 2013.
Notes: **Bold** indicates freeway segment operating at unacceptable LOS.
[1] Density is shown in passenger cars / miles / lane (pc/mi/ln)

Freeway Mainline LOS Summary – Future Year (2040) Conditions – HOV Lane Alternative 2B

Map Ref #	Locations		Lanes		AM Peak Hour			PM Peak Hour		
			GP	Aux	Volume	Density[1]	LOS	Volume	Density[1]	LOS
1	SR-57 between Chapman off-ramp and SR-22 off-ramp	SB	3	0	**8,005**	**>45.0**	**F**	**8,125**	**>45.0**	**F**
2	I-5 between Chapman on-ramp and SR-22 off-ramp	SB	5	2	**10,734**	**43.9**	**E**	9,124	32.0	D
5	I-5 between Main on-ramp and 17th/Penn off-ramp	SB	5	1	**11,641**	**>45.0**	**F**	**10,872**	**>45.0**	**F**
6	I-5 between 17th on-ramp and Santa Ana off-ramp	SB	5	1	**12,170**	**>45.0**	**F**	**11,200**	**>45.0**	**F**
8	I-5 between Grand on-ramp and Fourth off-ramp	SB	5	1	**12,025**	**>45.0**	**F**	**11,490**	**>45.0**	**F**
9	I-5 between Fourth off-ramp and First Street on-ramp	SB	5	1	**11,290**	**>45.0**	**F**	**11,010**	**>45.0**	**F**
8	I-5 between Fourth on-ramp and Grand off-ramp	NB	5	1	**12,433**	**>45.0**	**F**	**10,629**	**42.8**	**E**
6	I-5 between Grand Ave on-ramp and 17th off-ramp	NB	5	1	**11,768**	**>45.0**	**F**	**9,939**	**37.0**	**E**
5	I-5 between 17th on-ramp and Main/Broadway off-ramp	NB	5	1	**12,373**	**>45.0**	**F**	**11,380**	**>45.0**	**F**
4	I-5 between Main on-ramp and SR-22 exit	NB	4	1	**10,501**	**>45.0**	**F**	**10,565**	**>45.0**	**F**
2	I-5 between SR-22 on-ramp and Chapman off-ramp	NB	5	1	**9,927**	**37.8**	**E**	**11,691**	**>45.0**	**F**
1	SR-57 between Chapman off-ramp and Chapman on-ramp	NB	3	0	**8,140**	**>45.0**	**F**	**6,740**	**>45.0**	**F**

Source: AECOM 2013.
Notes: **Bold** indicates freeway segment operating at unacceptable LOS.
[1] Density is shown in passenger cars / miles / lane (pc/mi/ln)

Freeway Mainline LOS Summary – Future Year (2040) Conditions – HOV Lane Alternative 5A

Map Ref #	Locations		Lanes		AM Peak Hour			PM Peak Hour		
			GP	Aux	Volume	Density[1]	LOS	Volume	Density[1]	LOS
1	SR-57 between Chapman off-ramp and SR-22 off-ramp	SB	3	0	**8,005**	**>45.0**	**F**	**8,125**	**>45.0**	**F**
2	I-5 between Chapman on-ramp and SR-22 off-ramp	SB	5	2	**10,445**	**41.1**	**E**	8,990	31.3	D
5	I-5 between Main on-ramp and 17th/Penn off-ramp	SB	5	1	**11,605**	**>45.0**	**F**	**10,860**	**>45.0**	**F**
6	I-5 between 17th on-ramp and Santa Ana off-ramp	SB	5	1	**12,170**	**>45.0**	**F**	**11,200**	**>45.0**	**F**
8	I-5 between Grand on-ramp and Fourth off-ramp	SB	5	1	**12,025**	**>45.0**	**F**	**11,490**	**>45.0**	**F**
9	I-5 between Fourth off-ramp and First Street on-ramp	SB	5	1	**11,290**	**>45.0**	**F**	**11,010**	**>45.0**	**F**
8	I-5 between Fourth on-ramp and Grand off-ramp	NB	5	1	**12,433**	**>45.0**	**F**	**10,629**	**42.8**	**E**
6	I-5 between Grand Ave on-ramp and 17th off-ramp	NB	5	1	**11,768**	**>45.0**	**F**	**9,939**	**37.0**	**E**
5	I-5 between 17th on-ramp and Main/Broadway off-ramp	NB	5	1	**12,348**	**>45.0**	**F**	**11,239**	**>45.0**	**F**
4	I-5 between Main on-ramp and SR-22 exit	NB	4	1	**10,408**	**>45.0**	**F**	**10,134**	**>45.0**	**F**
2	I-5 between SR-22 on-ramp and Chapman off-ramp	NB	5	1	**9,858**	**36.5**	**F**	**11,254**	**>45.0**	**F**
1	SR-57 between Chapman off-ramp and Chapman on-ramp	NB	3	0	**8,140**	**>45.0**	**F**	**6,740**	**>45.0**	**F**

Source: AECOM 2013.

Notes: **Bold** indicates freeway segment operating at unacceptable LOS.

[1] Density is shown in passenger cars / miles / lane (pc/mi/ln)

Freeway Mainline LOS Summary – Future Year (2040) Conditions – HOV Lane Alternative 5B

Map Ref #	Locations		Lanes		AM Peak Hour			PM Peak Hour		
			GP	Aux	Volume	Density[1]	LOS	Volume	Density[1]	LOS
1	SR-57 between Chapman off-ramp and SR-22 off-ramp	SB	3	0	**8,005**	**>45.0**	**F**	**8,125**	**>45.0**	**F**
2	I-5 between Chapman on-ramp and SR-22 off-ramp	SB	5	2	**10,734**	**43.9**	**E**	9,124	32.0	D
5	I-5 between Main on-ramp and 17th/Penn off-ramp	SB	5	1	**11,641**	**>45.0**	**F**	**10,872**	**>45.0**	**F**
6	I-5 between 17th on-ramp and Santa Ana off-ramp	SB	5	1	**12,170**	**>45.0**	**F**	**11,200**	**>45.0**	**F**
8	I-5 between Grand on-ramp and Fourth off-ramp	SB	5	1	**12,025**	**>45.0**	**F**	**11,490**	**>45.0**	**F**
9	I-5 between Fourth off-ramp and First Street on-ramp	SB	5	1	**11,290**	**>45.0**	**F**	**11,010**	**>45.0**	**F**
8	I-5 between Fourth on-ramp and Grand off-ramp	NB	5	1	**12,433**	**>45.0**	**F**	**10,629**	**42.8**	**E**
6	I-5 between Grand Ave on-ramp and 17th off-ramp	NB	5	1	**11,768**	**>45.0**	**F**	**9,939**	**37.0**	**E**
5	I-5 between 17th on-ramp and Main/Broadway off-ramp	NB	5	1	**12,373**	**>45.0**	**F**	**11,380**	**>45.0**	**F**
4	I-5 between Main on-ramp and SR-22 exit	NB	4	1	**10,501**	**>45.0**	**F**	**10,565**	**>45.0**	**F**
2	I-5 between SR-22 on-ramp and Chapman off-ramp	NB	5	1	**9,927**	**37.8**	**E**	**11,691**	**>45.0**	**F**
1	SR-57 between Chapman off-ramp and Chapman on-ramp	NB	3	0	**8,140**	**>45.0**	**F**	**6,740**	**>45.0**	**F**

Source: AECOM 2013.

Notes: **Bold** indicates freeway segment operating at unacceptable LOS.

[1] Density is shown in passenger cars / miles / lane (pc/mi/ln)

HOV LOS Summary – Opening Year (2018) Conditions – No Build

Map Ref #	Location		# of Lanes	AM Peak Hour			PM Peak Hour		
				Vol.	Capacity (V/C)	LOS	Vol.	Capacity (V/C)	LOS
1	SR-57 north of I-5 HOV merge	SB	1	1,254	0.66	C	1,522	0.80	D
2	I-5 north of SR-57 HOV merge	SB	1	1,096	0.58	C	938	0.49	B
3	I-5 at SR-57 HOV merge	SB	1	***2,350***	***1.24***	***F***	***2,460***	***1.29***	***F***
4	I-5 between SR-57 HOV merge and Main HOV off-ramp[1]	SB	1	1,550	0.82	D	1,550	0.82	D
5	I-5 between Main HOV off-ramp and HOV entrance south of Lincoln overcrossing	SB	1	1,406	0.74	D	1,485	0.78	D
7	I-5 between HOV entrance and Grand HOV on-ramp	SB	1	***1,746***	***0.92***	***E***	***1,765***	***0.93***	***E***
8	I-5 between Grand HOV on-ramp and SR-55 HOV diverge	SB	2	2,026	0.53	C	2,005	0.53	C
9	I-5 south of SR-55 HOV diverge	SB	1	1,257	0.66	C	1,387	0.73	D
11	SR-55 south of I-5 HOV diverge	SB	1	769	0.40	B	618	0.33	B
11	SR-55 south of I-5 HOV merge	NB	1	507	0.27	A	849	0.45	B
9	I-5 south of SR-55 HOV merge	NB	1	1,158	0.61	C	1,356	0.71	D
8	I-5 between SR-55 HOV merge and Grand HOV off-ramp	NB	2	1,665	0.44	B	2,205	0.58	C
7	I-5 at HOV lane merge (2 to 1 lane)	NB	1	1,350	0.71	D	***1,940***	***1.02***	***F***
6	I-5 between HOV lane merge and HOV lane exit north of Lincoln overcrossing	NB	1	1,350	0.71	D	***1,900***	***1.00***	***F***
5	I-5 between HOV exit and Main HOV off-ramp	NB	1	965	0.51	C	*1,649*	*0.87*	*D*
4	I-5 between Main HOV on-ramp and SR-57 diverge	NB	1	1,020	0.54	C	***1,964***	***1.03***	***F***
2	I-5 north of SR-57 diverge	NB	1	530	0.28	A	1,316	0.69	C
1	SR-57 north of I-5 HOV diverge	NB	1	490	0.26	A	648	0.34	B

Source: AECOM 2013.

Notes: **Bold** indicates HOV segment operating at LOS E/F. *Italics* indicate locations where the HOV lane has greater than 1,600 vphpl for 1-lane segment; 1,750 vphpl for 2-lane segment.

[1] Bottleneck location which constrains downstream volumes.

HOV LOS Summary – Opening Year (2018) Conditions - HOV Lane Alternative 2A

Map Ref #	Location		# of Lanes	AM Peak Hour			PM Peak Hour		
				Vol.	Capacity (V/C)	LOS	Vol.	Capacity (V/C)	LOS
1	SR-57 north of I-5 HOV merge	SB	1	1,425	0.75	D	1,585	0.83	D
2	I-5 north of SR-57 HOV merge	SB	1	1,195	0.63	C	990	0.52	C
3	I-5 at SR-57 HOV merge	SB	2	2,620	0.69	C	2,575	0.68	C
4	I-5 between SR-57 HOV merge and Main HOV off-ramp	SB	2	2,620	0.69	C	2,575	0.68	C
5	I-5 between Main HOV off-ramp and HOV entrance south of Lincoln overcrossing	SB	2	2,440	0.64	C	2,495	0.66	C
7	I-5 between HOV entrance and Grand HOV on-ramp	SB	2	2,780	0.73	D	2,775	0.73	D
8	I-5 between Grand HOV on-ramp and SR-55 HOV diverge	SB	2	3,060	0.81	D	3,015	0.79	D
9	I-5 south of SR-55 HOV diverge	SB	1	***2,075***	***1.09***	***F***	***2,320***	***1.22***	***F***
11	SR-55 south of I-5 HOV diverge	SB	1	985	0.52	C	695	0.37	B
11	SR-55 south of I-5 HOV merge	NB	1	550	0.29	A	950	0.50	C
9	I-5 south of SR-55 HOV merge	NB	1	1,245	0.66	C	1,525	0.80	D
8	I-5 between SR-55 HOV merge and Grand HOV off-ramp	NB	2	1,795	0.47	B	2,475	0.65	C
7	I-5 at HOV lane merge (2 to 1 lane)	NB	2	1,480	0.39	B	2,210	0.58	C
6	I-5 between HOV lane merge and HOV lane exit north of Lincoln overcrossing	NB	2	1,480	0.39	B	2,210	0.58	C
5	I-5 between HOV exit and Main HOV off-ramp	NB	2	1,095	0.29	A	1,925	0.51	C
4	I-5 between Main HOV on-ramp and SR-57 diverge	NB	2	1,160	0.31	B	2,280	0.60	C
2	I-5 north of SR-57 diverge	NB	1	670	0.35	B	1,545	0.81	D
1	SR-57 north of I-5 HOV diverge	NB	1	490	0.26	A	735	0.39	B

Source: AECOM 2013.

Notes: **Bold** indicates HOV segment operating at LOS E/F. *Italics* indicate locations where the HOV lane has greater than 1,600 vphpl for 1-lane segment; 1,750 vphpl for 2-lane segment.

HOV LOS Summary – Opening Year (2018) Conditions - HOV Lane Alternative 2B

Map Ref #	Location		# of Lanes	AM Peak Hour			PM Peak Hour		
				Vol.	Capacity (V/C)	LOS	Vol.	Capacity (V/C)	LOS
1	SR-57 north of I-5 HOV merge	SB	1	1,425	0.75	D	1,585	0.83	D
2	I-5 north of SR-57 HOV merge	SB	1	1,015	0.53	C	910	0.48	B
3	I-5 at SR-57 HOV merge	SB	2	2,440	0.64	C	2,495	0.66	C
4	I-5 between SR-57 HOV merge and Main HOV off-ramp	SB	2	2,440	0.64	C	2,495	0.66	C
5	I-5 between Main HOV off-ramp and HOV entrance south of Lincoln overcrossing	SB	2	2,440	0.64	C	2,495	0.66	C
7	I-5 between HOV entrance and Grand HOV on-ramp	SB	2	2,780	0.73	D	2,775	0.73	D
8	I-5 between Grand HOV on-ramp and SR-55 HOV diverge	SB	2	3,060	0.81	D	3,015	0.79	D
9	I-5 south of SR-55 HOV diverge	SB	1	***2,075***	***1.09***	***F***	***2,320***	***1.22***	***F***
11	SR-55 south of I-5 HOV diverge	SB	1	985	0.52	C	695	0.37	B
11	SR-55 south of I-5 HOV merge	NB	1	550	0.29	A	950	0.50	C
9	I-5 south of SR-55 HOV merge	NB	1	1,245	0.66	C	1,525	0.80	D
8	I-5 between SR-55 HOV merge and Grand HOV off-ramp	NB	2	1,795	0.47	B	2,475	0.65	C
7	I-5 at HOV lane merge (2 to 1 lane)	NB	2	1,480	0.39	B	2,210	0.58	C
6	I-5 between HOV lane merge and HOV lane exit north of Lincoln overcrossing	NB	2	1,480	0.39	B	2,210	0.58	C
5	I-5 between HOV exit and Main HOV off-ramp	NB	2	1,095	0.29	A	1,925	0.51	C
4	I-5 between Main HOV on-ramp and SR-57 diverge	NB	2	1,150	0.30	B	2,240	0.59	C
2	I-5 north of SR-57 diverge	NB	1	681	0.36	B	1,597	0.84	D
1	SR-57 north of I-5 HOV diverge	NB	1	490	0.26	A	735	0.39	B

Source: AECOM 2013.

Notes: **Bold** indicates HOV segment operating at LOS E/F. *Italics* indicate locations where the HOV lane has greater than 1,600 vphpl for 1-lane segment; 1,750 vphpl for 2-lane segment.

HOV LOS Summary – Opening Year (2018) Conditions - HOV Lane Alternative 5A

Map Ref #	Location		# of Lanes	AM Peak Hour			PM Peak Hour		
				Vol.	Capacity (V/C)	LOS	Vol.	Capacity (V/C)	LOS
1	SR-57 north of I-5 HOV merge	SB	1	1,425	0.75	D	1,585	0.83	D
2	I-5 north of SR-57 HOV merge	SB	1	1,195	0.63	C	990	0.52	C
3	I-5 at SR-57 HOV merge	SB	2	2,620	0.69	C	2,575	0.68	C
4	I-5 between SR-57 HOV merge and Main HOV off-ramp	SB	2	2,620	0.69	C	2,575	0.68	C
5	I-5 between Main HOV off-ramp and HOV entrance south of Lincoln overcrossing	SB	2	2,440	0.64	C	2,495	0.66	C
7	I-5 between HOV entrance and Grand HOV on-ramp	SB	2	2,780	0.73	D	2,775	0.73	D
8	I-5 between Grand HOV on-ramp and SR-55 HOV diverge	SB	2	3,060	0.81	D	3,015	0.79	D
9	I-5 south of SR-55 HOV diverge	SB	1	***2,075***	***1.09***	***F***	***2,320***	***1.22***	***F***
11	SR-55 south of I-5 HOV diverge	SB	1	985	0.52	C	695	0.37	B
11	SR-55 south of I-5 HOV merge	NB	1	550	0.29	A	950	0.50	C
9	I-5 south of SR-55 HOV merge	NB	1	1,245	0.66	C	1,525	0.80	D
8	I-5 between SR-55 HOV merge and Grand HOV off-ramp	NB	2	1,795	0.47	B	2,475	0.65	C
7	I-5 at HOV lane merge (2 to 1 lane)	NB	2	1,480	0.39	B	2,210	0.58	C
6	I-5 between HOV lane merge and HOV lane exit north of Lincoln overcrossing	NB	2	1,480	0.39	B	2,210	0.58	C
5	I-5 between HOV exit and Main HOV off-ramp	NB	2	1,095	0.29	A	1,925	0.51	C
4	I-5 between Main HOV on-ramp and SR-57 diverge	NB	2	1,160	0.31	B	2,280	0.60	C
2	I-5 north of SR-57 diverge	NB	1	670	0.35	B	1,545	0.81	D
1	SR-57 north of I-5 HOV diverge	NB	1	490	0.26	A	735	0.39	B

Source: AECOM 2013.

Notes: **Bold** indicates HOV segment operating at LOS E/F. *Italics* indicate locations where the HOV lane has greater than 1,600 vphpl for 1-lane segment; 1,750 vphpl for 2-lane segment.

HOV LOS Summary – Opening Year (2018) Conditions - HOV Lane Alternative 5B

Map Ref #	Location		# of Lanes	AM Peak Hour			PM Peak Hour		
				Vol.	Capacity (V/C)	LOS	Vol.	Capacity (V/C)	LOS
1	SR-57 north of I-5 HOV merge	SB	1	1,425	0.75	D	1,585	0.83	D
2	I-5 north of SR-57 HOV merge	SB	1	1,015	0.53	C	910	0.48	B
3	I-5 at SR-57 HOV merge	SB	2	2,440	0.64	C	2,495	0.66	C
4	I-5 between SR-57 HOV merge and Main HOV off-ramp	SB	2	2,440	0.64	C	2,495	0.66	C
5	I-5 between Main HOV off-ramp and HOV entrance south of Lincoln overcrossing	SB	2	2,440	0.64	C	2,495	0.66	C
7	I-5 between HOV entrance and Grand HOV on-ramp	SB	2	2,780	0.73	D	2,775	0.73	D
8	I-5 between Grand HOV on-ramp and SR-55 HOV diverge	SB	2	3,060	0.81	D	3,015	0.79	D
9	I-5 south of SR-55 HOV diverge	SB	1	***2,075***	***1.09***	***F***	***2,320***	***1.22***	***F***
11	SR-55 south of I-5 HOV diverge	SB	1	985	0.52	C	695	0.37	B
11	SR-55 south of I-5 HOV merge	NB	1	550	0.29	A	950	0.50	C
9	I-5 south of SR-55 HOV merge	NB	1	1,245	0.66	C	1,525	0.80	D
8	I-5 between SR-55 HOV merge and Grand HOV off-ramp	NB	2	1,795	0.47	B	2,475	0.65	C
7	I-5 at HOV lane merge (2 to 1 lane)	NB	2	1,480	0.39	B	2,210	0.58	C
6	I-5 between HOV lane merge and HOV lane exit north of Lincoln overcrossing	NB	2	1,480	0.39	B	2,210	0.58	C
5	I-5 between HOV exit and Main HOV off-ramp	NB	2	1,095	0.29	A	1,925	0.51	C
4	I-5 between Main HOV on-ramp and SR-57 diverge	NB	2	1,150	0.30	B	2,240	0.59	C
2	I-5 north of SR-57 diverge	NB	1	681	0.36	B	1,597	0.84	D
1	SR-57 north of I-5 HOV diverge	NB	1	490	0.26	A	735	0.39	B

Source: AECOM 2013.

Notes: **Bold** indicates HOV segment operating at LOS E/F. *Italics* indicate locations where the HOV lane has greater than 1,600 vphpl for 1-lane segment; 1,750 vphpl for 2-lane segment.

HOV LOS Summary – Future Year (2040) Conditions – No Build

Map Ref #	Location		# of Lanes	AM Peak Hour			PM Peak Hour		
				Vol.	Capacity (V/C)	LOS	Vol.	Capacity (V/C)	LOS
1	SR-57 north of I-5 HOV merge	SB	1	1,276	0.67	C	1,597	0.84	D
2	I-5 north of SR-57 HOV merge	SB	1	1,209	0.64	C	1,048	0.55	C
3	I-5 at SR-57 HOV merge	SB	1	***2,485***	***1.31***	***F***	***2,645***	***1.39***	***F***
4	I-5 between SR-57 HOV merge and Main HOV off-ramp[1]	SB	1	1,550	0.82	D	1,550	0.82	D
5	I-5 between Main HOV off-ramp and HOV entrance south of Lincoln overcrossing	SB	1	1,406	0.74	D	1,485	0.78	D
7	I-5 between HOV entrance and Grand HOV on-ramp	SB	1	***1,746***	***0.92***	***E***	***1,765***	***0.93***	***E***
8	I-5 between Grand HOV on-ramp and SR-55 HOV diverge	SB	2	2,061	0.54	C	2,020	0.53	C
9	I-5 south of SR-55 HOV diverge	SB	1	1,292	0.68	C	1,402	0.74	D
11	SR-55 south of I-5 HOV diverge	SB	1	769	0.40	B	618	0.33	B
11	SR-55 south of I-5 HOV merge	NB	1	575	0.30	B	988	0.52	C
9	I-5 south of SR-55 HOV merge	NB	1	1,260	0.66	C	1,477	0.78	D
8	I-5 between SR-55 HOV merge and Grand HOV off-ramp	NB	2	1,835	0.48	B	2,465	0.65	C
7	I-5 at HOV lane merge (2 to 1 lane)	NB	1	1,500	0.79	D	***2,140***	***1.13***	***F***
6	I-5 between HOV lane merge and HOV lane exit north of Lincoln overcrossing	NB	1	1,500	0.79	D	***1,900***	***1.00***	***F***
5	I-5 between HOV exit and Main HOV off-ramp	NB	1	1,050	0.55	C	*1,649*	*0.87*	*D*
4	I-5 between Main HOV on-ramp and SR-57 diverge	NB	1	1,105	0.58	C	***1,964***	***1.03***	***F***
2	I-5 north of SR-57 diverge	NB	1	355	0.19	A	1,316	0.69	C
1	SR-57 north of I-5 HOV diverge	NB	1	750	0.39	B	648	0.34	B

Source: AECOM 2013.
Notes: **Bold** indicates HOV segment operating at LOS E/F. *Italics* indicate locations where the HOV lane has greater than 1,600 vphpl for 1-lane segment; 1,750 vphpl for 2-lane segment.

HOV LOS Summary – Future Year (2040) Conditions - HOV Lane Alternative 2A

Map Ref #	Location		# of Lanes	AM Peak Hour			PM Peak Hour		
				Vol.	Capacity (V/C)	LOS	Vol.	Capacity (V/C)	LOS
1	SR-57 north of I-5 HOV merge	SB	1	***1,975***	***1.04***	***F***	***1,840***	***0.97***	***E***
2	I-5 north of SR-57 HOV merge	SB	1	*1,610*	*0.85*	*D*	1,255	0.66	C
3	I-5 at SR-57 HOV merge	SB	2	***3,585***	***0.94***	***E***	3,095	0.81	D
4	I-5 between SR-57 HOV merge and Main HOV off-ramp	SB	2	***3,585***	***0.94***	***E***	3,095	0.81	D
5	I-5 between Main HOV off-ramp and HOV entrance south of Lincoln overcrossing	SB	2	3,295	0.87	D	2,960	0.78	D
7	I-5 between HOV entrance and Grand HOV on-ramp	SB	2	***3,635***	***0.96***	***E***	3,240	0.85	D
8	I-5 between Grand HOV on-ramp and SR-55 HOV diverge	SB	2	***3,950***	***1.04***	***F***	**3,495**	**0.92**	**E**
9	I-5 south of SR-55 HOV diverge	SB	1	***2,295***	***1.21***	***F***	***2,570***	***1.35***	***F***
11	SR-55 south of I-5 HOV diverge	SB	1	*1,655*	*0.87*	*D*	925	0.49	B
11	SR-55 south of I-5 HOV merge	NB	1	740	0.39	B	1,395	0.73	D
9	I-5 south of SR-55 HOV merge	NB	1	1,595	0.84	D	***2,170***	***1.14***	***F***
8	I-5 between SR-55 HOV merge and Grand HOV off-ramp	NB	2	2,335	0.61	C	***3,565***	***0.94***	***E***
7	I-5 at HOV lane merge (2 to 1 lane)	NB	2	2,000	0.53	C	3,240	0.85	D
6	I-5 between HOV lane merge and HOV lane exit north of Lincoln overcrossing	NB	2	2,000	0.53	C	3,240	0.85	D
5	I-5 between HOV exit and Main HOV off-ramp	NB	2	1,550	0.41	B	2,860	0.75	D
4	I-5 between Main HOV on-ramp and SR-57 diverge	NB	2	1,655	0.44	B	3,345	0.88	D
2	I-5 north of SR-57 diverge	NB	1	905	0.48	B	***2,315***	***1.22***	***F***
1	SR-57 north of I-5 HOV diverge	NB	1	750	0.39	B	1,030	0.54	C

Source: AECOM 2013.

Notes: **Bold** indicates HOV segment operating at LOS E/F. *Italics* indicate locations where the HOV lane has greater than 1,600 vphpl for 1-lane segment; 1,750 vphpl for 2-lane segment.

HOV LOS Summary – Future Year (2040) Conditions - HOV Lane Alternative 2B

Map Ref #	Location		# of Lanes	AM Peak Hour			PM Peak Hour		
				Vol.	Capacity (V/C)	LOS	Vol.	Capacity (V/C)	LOS
1	SR-57 north of I-5 HOV merge	SB	1	***1,975***	***1.04***	***F***	***1,840***	***0.97***	***E***
2	I-5 north of SR-57 HOV merge	SB	1	1,320	0.69	C	1,255	0.66	C
3	I-5 at SR-57 HOV merge	SB	2	3,295	0.87	D	2,960	0.78	D
4	I-5 between SR-57 HOV merge and Main HOV off-ramp	SB	2	3,295	0.87	D	2,960	0.78	D
5	I-5 between Main HOV off-ramp and HOV entrance south of Lincoln overcrossing	SB	2	3,295	0.87	D	2,960	0.78	D
7	I-5 between HOV entrance and Grand HOV on-ramp	SB	2	***3,635***	***0.96***	***E***	3,240	0.85	D
8	I-5 between Grand HOV on-ramp and SR-55 HOV diverge	SB	2	***3,950***	***1.04***	***F***	**3,495**	**0.92**	**E**
9	I-5 south of SR-55 HOV diverge	SB	1	***2,295***	***1.21***	***F***	***2,570***	***1.35***	***F***
11	SR-55 south of I-5 HOV diverge	SB	1	*1,655*	*0.87*	*D*	925	0.49	B
11	SR-55 south of I-5 HOV merge	NB	1	740	0.39	B	1,395	0.73	D
9	I-5 south of SR-55 HOV merge	NB	1	1,595	0.84	D	***2,170***	***1.14***	***F***
8	I-5 between SR-55 HOV merge and Grand HOV off-ramp	NB	2	2,335	0.61	C	***3,565***	***0.94***	***E***
7	I-5 at HOV lane merge (2 to 1 lane)	NB	2	2,000	0.53	C	3,240	0.85	D
6	I-5 between HOV lane merge and HOV lane exit north of Lincoln overcrossing	NB	2	2,000	0.53	C	3,240	0.85	D
5	I-5 between HOV exit and Main HOV off-ramp	NB	2	1,550	0.41	B	2,860	0.75	D
4	I-5 between Main HOV on-ramp and SR-57 diverge	NB	2	1,550	0.41	B	2,860	0.75	D
2	I-5 north of SR-57 diverge	NB	1	836	0.44	B	***1,958***	***1.03***	***F***
1	SR-57 north of I-5 HOV diverge	NB	1	750	0.39	B	1,030	0.54	C

Source: AECOM 2013.

Notes: **Bold** indicates HOV segment operating at LOS E/F. *Italics* indicate locations where the HOV lane has greater than 1,600 vphpl for 1-lane segment; 1,750 vphpl for 2-lane segment.

HOV LOS Summary – Future Year (2040) Conditions - HOV Lane Alternative 5A

Map Ref #	Location		# of Lanes	AM Peak Hour			PM Peak Hour		
				Vol.	Capacity (V/C)	LOS	Vol.	Capacity (V/C)	LOS
1	SR-57 north of I-5 HOV merge	SB	1	***1,975***	***1.04***	***F***	***1,840***	***0.97***	***E***
2	I-5 north of SR-57 HOV merge	SB	1	1,610	0.85	D	1,255	0.66	C
3	I-5 at SR-57 HOV merge	SB	2	***3,585***	***0.94***	***E***	3,095	0.81	D
4	I-5 between SR-57 HOV merge and Main HOV off-ramp	SB	2	***3,585***	***0.94***	***E***	3,095	0.81	D
5	I-5 between Main HOV off-ramp and HOV entrance south of Lincoln overcrossing	SB	2	3,295	0.87	D	2,960	0.78	D
7	I-5 between HOV entrance and Grand HOV on-ramp	SB	2	***3,635***	***0.96***	***E***	3,240	0.85	D
8	I-5 between Grand HOV on-ramp and SR-55 HOV diverge	SB	2	***3,950***	***1.04***	***F***	**3,495**	**0.92**	**E**
9	I-5 south of SR-55 HOV diverge	SB	1	***2,295***	***1.21***	***F***	***2,570***	***1.35***	***F***
11	SR-55 south of I-5 HOV diverge	SB	1	*1,655*	*0.87*	*D*	925	0.49	B
11	SR-55 south of I-5 HOV merge	NB	1	740	0.39	B	1,395	0.73	D
9	I-5 south of SR-55 HOV merge	NB	1	1,595	0.84	D	***2,170***	***1.14***	***F***
8	I-5 between SR-55 HOV merge and Grand HOV off-ramp	NB	2	2,335	0.61	C	***3,565***	***0.94***	***E***
7	I-5 at HOV lane merge (2 to 1 lane)	NB	2	2,000	0.53	C	3,240	0.85	D
6	I-5 between HOV lane merge and HOV lane exit north of Lincoln overcrossing	NB	2	2,000	0.53	C	3,240	0.85	D
5	I-5 between HOV exit and Main HOV off-ramp	NB	2	1,550	0.41	B	2,860	0.75	D
4	I-5 between Main HOV on-ramp and SR-57 diverge	NB	2	1,655	0.44	B	3,345	0.88	D
2	I-5 north of SR-57 diverge	NB	1	905	0.48	B	***2,315***	***1.22***	***F***
1	SR-57 north of I-5 HOV diverge	NB	1	750	0.39	B	1,030	0.54	C

Source: AECOM 2013.

Notes: **Bold** indicates HOV segment operating at LOS E/F. *Italics* indicate locations where the HOV lane has greater than 1,600 vphpl for 1-lane segment; 1,750 vphpl for 2-lane segment.

HOV LOS Summary – Future Year (2040) Conditions - HOV Lane Alternative 5B

Map Ref #	Location		# of Lanes	AM Peak Hour			PM Peak Hour		
				Vol.	Capacity (V/C)	LOS	Vol.	Capacity (V/C)	LOS
1	SR-57 north of I-5 HOV merge	SB	1	***1,975***	***1.04***	***F***	***1,840***	***0.97***	***E***
2	I-5 north of SR-57 HOV merge	SB	1	1,320	0.69	C	1,255	0.66	C
3	I-5 at SR-57 HOV merge	SB	2	3,295	0.87	D	2,960	0.78	D
4	I-5 between SR-57 HOV merge and Main HOV off-ramp	SB	2	3,295	0.87	D	2,960	0.78	D
5	I-5 between Main HOV off-ramp and HOV entrance south of Lincoln overcrossing	SB	2	3,295	0.87	D	2,960	0.78	D
7	I-5 between HOV entrance and Grand HOV on-ramp	SB	2	***3,635***	***0.96***	***E***	3,240	0.85	D
8	I-5 between Grand HOV on-ramp and SR-55 HOV diverge	SB	2	***3,950***	***1.04***	***F***	**3,495**	**0.92**	**E**
9	I-5 south of SR-55 HOV diverge	SB	1	***2,295***	***1.21***	***F***	***2,570***	***1.35***	***F***
11	SR-55 south of I-5 HOV diverge	SB	1	*1,655*	*0.87*	*D*	925	0.49	B
11	SR-55 south of I-5 HOV merge	NB	1	740	0.39	B	1,395	0.73	D
9	I-5 south of SR-55 HOV merge	NB	1	1,595	0.84	D	***2,170***	***1.14***	***F***
8	I-5 between SR-55 HOV merge and Grand HOV off-ramp	NB	2	2,335	0.61	C	***3,565***	***0.94***	***E***
7	I-5 at HOV lane merge (2 to 1 lane)	NB	2	2,000	0.53	C	3,240	0.85	D
6	I-5 between HOV lane merge and HOV lane exit north of Lincoln overcrossing	NB	2	2,000	0.53	C	3,240	0.85	D
5	I-5 between HOV exit and Main HOV off-ramp	NB	2	1,550	0.41	B	2,860	0.75	D
4	I-5 between Main HOV on-ramp and SR-57 diverge	NB	2	1,550	0.41	B	2,860	0.75	D
2	I-5 north of SR-57 diverge	NB	1	836	0.44	B	***1,958***	***1.03***	***F***
1	SR-57 north of I-5 HOV diverge	NB	1	750	0.39	B	1,030	0.54	C

Source: AECOM 2013.

Notes: **Bold** indicates HOV segment operating at LOS E/F. *Italics* indicate locations where the HOV lane has greater than 1,600 vphpl for 1-lane segment; 1,750 vphpl for 2-lane segment.

Freeway LOS Summary – Opening Year (2018) Conditions – No Build

Map Ref #	Locations		Lanes		AM Peak Hour			PM Peak Hour		
			ML	Aux	Volume	Density[1]	LOS	Volume	Density[1]	LOS
8	I-5 between Grand on-ramp and Fourth off-ramp	SB	5	1	**10,330**	**40.1**	**E**	**10,285**	**39.7**	**E**
10	I-5 between First on-ramp and SR-55 off-ramp	SB	5	1	**10,800**	**>45.0**	**F**	**10,955**	**>45.0**	**F**
10	I-5 between SR-55 on-ramp and First/Fourth off-ramp	NB	5	1	**12,095**	**>45.0**	**F**	9,620	34.9	D
8	I-5 between Fourth on-ramp and Grand off-ramp	NB	5	1	**11,790**	**>45.0**	**F**	**9,754**	**35.7**	**E**

Source: AECOM 2013.
Notes: **Bold** indicates freeway segment operating at unacceptable LOS..
[1] Density is shown in passenger cars / miles / lane (pc/mi/ln)

Freeway LOS Summary – Opening Year (2018) Conditions – Ramp Alternative A

Map Ref #	Locations		Lanes		AM Peak Hour			PM Peak Hour		
			ML	Aux	Volume	Density[1]	LOS	Volume	Density[1]	LOS
8	I-5 between Grand on-ramp and Fourth off-ramp	SB	5	1	**10,330**	**40.1**	**E**	**10,285**	**39.7**	**E**
10	I-5 between First on-ramp and SR-55 off-ramp	SB	5	1	**10,750**	**44.1**	**E**	**10,885**	**>45.0**	**F**
10	I-5 between SR-55 on-ramp and First/Fourth off-ramp	NB	5	1	**12,146**	**>45.0**	**F**	**9,647**	**35.0**	**E**
8	I-5 between Fourth on-ramp and Grand off-ramp	NB	5	1	**11,892**	**>45.0**	**F**	**9,808**	**36.1**	**E**

Source: AECOM 2013.
Notes: **Bold** indicates freeway segment operating at unacceptable LOS..
[1] Density is shown in passenger cars / miles / lane (pc/mi/ln)

Freeway LOS Summary – Opening Year (2018) Conditions – Ramp Alternative B

Map Ref #	Locations		Lanes		AM Peak Hour			PM Peak Hour		
			ML	Aux	Volume	Density[1]	LOS	Volume	Density[1]	LOS
8	I-5 between Grand on-ramp and Fourth off-ramp	SB	5	1	**10,330**	**40.1**	**E**	**10,285**	**39.7**	**E**
10	I-5 between First on-ramp and SR-55 off-ramp	SB	5	1	**10,790**	**44.5**	**E**	**10,934**	**>45.0**	**F**
10	I-5 between SR-55 on-ramp and First/Fourth off-ramp	NB	5	1	**12,095**	**>45.0**	**F**	9,620	34.9	D
8	I-5 between Fourth on-ramp and Grand off-ramp	NB	5	1	**11,790**	**>45.0**	**F**	**9,754**	**35.7**	**E**

Source: AECOM 2013.
Notes: **Bold** indicates freeway segment operating at unacceptable LOS..
1 Density is shown in passenger cars / miles / lane (pc/mi/ln)

Freeway LOS Summary – Future Year (2040) Conditions – No Build

Map Ref #	Locations		Lanes		AM Peak Hour			PM Peak Hour		
			ML	Aux	Volume	Density[1]	LOS	Volume	Density[1]	LOS
8	I-5 between Grand on-ramp and Fourth off-ramp	SB	5	1	**12,025**	**>45.0**	**F**	**11,490**	**>45.0**	**F**
10	I-5 between First on-ramp and SR-55 off-ramp	SB	5	1	**12,545**	**>45.0**	**F**	**12,160**	**>45.0**	**F**
10	I-5 between SR-55 on-ramp and First/Fourth off-ramp	NB	5	1	**12,760**	**>45.0**	**F**	**10,560**	**42.2**	**E**
8	I-5 between Fourth on-ramp and Grand off-ramp	NB	5	1	**12,433**	**>45.0**	**F**	**10,629**	**42.8**	**E**

Source: AECOM 2013.
Notes: **Bold** indicates freeway segment operating at unacceptable LOS..
[1] Density is shown in passenger cars / miles / lane (pc/mi/ln)

Freeway LOS Summary – Future Year (2040) Conditions – Ramp Alternative A

Map Ref #	Locations		Lanes		AM Peak Hour			PM Peak Hour		
			ML	Aux	Volume	Density[1]	LOS	Volume	Density[1]	LOS
8	I-5 between Grand on-ramp and Fourth off-ramp	SB	5	1	12,025	**>45.0**	**F**	**11,490**	**>45.0**	**F**
10	I-5 between First on-ramp and SR-55 off-ramp	SB	5	1	12,495	**>45.0**	**F**	**12,090**	**>45.0**	**F**
10	I-5 between SR-55 on-ramp and First/Fourth off-ramp	NB	5	1	12,813	**>45.0**	**F**	**10,587**	**42.4**	**E**
8	I-5 between Fourth on-ramp and Grand off-ramp	NB	5	1	12,537	**>45.0**	**F**	**10,683**	**43.4**	**E**

Source: AECOM 2013.
Notes: **Bold** indicates freeway segment operating at unacceptable LOS.
[1] Density is shown in passenger cars / miles / lane (pc/mi/ln)

Freeway LOS Summary – Future Year (2040) Conditions – Ramp Alternative B

Map Ref #	Locations		Lanes		AM Peak Hour			PM Peak Hour		
			ML	Aux	Volume	Density[1]	LOS	Volume	Density[1]	LOS
8	I-5 between Grand on-ramp and Fourth off-ramp	SB	5	1	12,025	**>45.0**	**F**	**11,490**	**>45.0**	**F**
10	I-5 between First on-ramp and SR-55 off-ramp	SB	5	1	12,534	**>45.0**	**F**	**12,138**	**>45.0**	**F**
10	I-5 between SR-55 on-ramp and First/Fourth off-ramp	NB	5	1	12,760	**>45.0**	**F**	**10,560**	**42.2**	**E**
8	I-5 between Fourth on-ramp and Grand off-ramp	NB	5	1	12,433	**>45.0**	**F**	**10,629**	**42.8**	**E**

Source: AECOM 2013.
Notes: **Bold** indicates freeway segment operating at unacceptable LOS..
[1] Density is shown in passenger cars / miles / lane (pc/mi/ln)

APPENDIX C

CO HOT-SPOT ANALYSIS

Horizon Year 2040 Carbon Monoxide Concentrations

Intersection	Period	1-Hour CO Concentrations (ppm)	Persistence Factor	8-Hour CO Concentrations (ppm)
Grand Avenue/1st Street	AM	3.9	0.78	3.0
	PM	4.1	0.78	3.2
I-5 SB Ramps/Santa Ana Boulevard	AM	3.9	0.78	3.0
	PM	3.7	0.78	2.9
SR-55 NB Ramps/4th Street	AM	3.7	0.78	2.9
	PM	3.7	0.78	2.9
Federal CO standards		35		9
State CO standards		20		9
Exceed Federal/State Standards		No		No

Notes:

1-hour CO concentrations modeled using CALINE4

Persistence factor estimated using local CO monitoring station data (8-hour/1-hour concentration, or 2.34/3.0 = 0.78)

8-hour Concentration = 1-hour Concentration * Persistence Factor

```
CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
         JUNE 1989 VERSION
         PAGE   1

     JOB: C:\Documents and Settings\paukovitsj\My
     RUN: CALINE4 RUN      (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide
```

I. SITE VARIABLES

```
      U=    .5 M/S            Z0= 100. CM           ALT=     0. (M)
    BRG= WORST CASE           VD=   .0 CM/S
   CLAS=     7 (G)            VS=   .0 CM/S
   MIXH=  300. M             AMB=  3.0 PPM
  SIGTH=    5. DEGREES       TEMP= 20.0 DEGREE (C)
```

II. LINK VARIABLES

LINK DESCRIPTION	LINK COORDINATES (M) X1	Y1	X2	Y2	TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. WBL1	300	2	0	2	AG	215	2.5	.0	19.3
B. WBT1	300	10	0	10	AG	425	2.5	.0	9.6
C. WBT2-WBR	300	13	0	13	AG	695	2.5	.0	9.6
D. NB1	-9	19	-9	319	AG	1498	2.5	.0	19.3
E. SBL	-16	319	-16	19	AG	65	2.5	.0	9.6
F. SBT1	-20	319	-20	19	AG	387	2.5	.0	9.6
G. SBT2	-23	319	-23	19	AG	387	2.5	.0	9.6
H. SBT3-SBR	-27	319	-27	19	AG	773	2.5	.0	9.6
I. WB1	-34	13	-334	13	AG	1406	2.5	.0	19.3
J. EBL1	-334	5	-34	5	AG	550	2.5	.0	19.3
K. EBT1	-334	-2	-34	-2	AG	243	2.5	.0	9.6
L. EBT2	-334	-6	-34	-6	AG	243	2.5	.0	9.6
M. EBT3-EBR	-334	-10	-34	-10	AG	388	2.5	.0	9.6
N. SB1	-27	-19	-27	-319	AG	1522	2.5	.0	29.0
O. NBL	-16	-319	-16	-19	AG	170	2.5	.0	9.6
P. NBT1	-13	-319	-13	-19	AG	289	2.5	.0	9.6
Q. NBT2	-9	-319	-9	-19	AG	289	2.5	.0	9.6
R. NBR	-5	-319	-5	-19	AG	23	2.5	.0	9.6
S. EB1	0	-10	300	-10	AG	817	2.5	.0	29.0

```
CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
         JUNE 1989 VERSION
         PAGE   2

     JOB: C:\Documents and Settings\paukovitsj\My
     RUN: CALINE4 RUN      (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide
```

III. RECEPTOR LOCATIONS

RECEPTOR	COORDINATES (M) X	Y	Z
1. R_1	0	19	1.8
2. R_2	-34	19	1.8
3. R_3	-34	-19	1.8
4. R_4	0	-19	1.8

IV. MODEL RESULTS (WORST CASE WIND ANGLE)

RECEPTOR	BRG (DEG)	PRED CONC (PPM)	CONC/LINK (PPM) A	B	C	D	E	F	G	H
1. R_1	354.	3.9	.0	.0	.0	.7	.0	.0	.0	.0
2. R_2	265.	3.9	.0	.0	.0	.0	.0	.0	.0	.0
3. R_3	6.	3.7	.0	.0	.0	.2	.0	.1	.1	.2
4. R_4	354.	3.7	.0	.0	.0	.4	.0	.0	.0	.0

RECEPTOR	CONC/LINK (PPM) I	J	K	L	M	N	O	P	Q	R	S
1. R_1	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
2. R_2	.6	.2	.0	.0	.0	.0	.0	.0	.0	.0	.0
3. R_3	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
4. R_4	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0

EXIT

```
CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
         JUNE 1989 VERSION
         PAGE   1

     JOB: C:\Documents and Settings\paukovitsj\My
     RUN: CALINE4 RUN      (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide
```

I. SITE VARIABLES

```
      U=    .5 M/S            Z0= 100. CM           ALT=     0. (M)
    BRG= WORST CASE           VD=   .0 CM/S
   CLAS=     7 (G)            VS=   .0 CM/S
   MIXH=  300. M             AMB=  3.0 PPM
  SIGTH=    5. DEGREES       TEMP= 20.0 DEGREE (C)
```

II. LINK VARIABLES

LINK DESCRIPTION	LINK COORDINATES (M) X1	Y1	X2	Y2	TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. WBL1	300	2	0	2	AG	110	2.5	.0	19.3
B. WBT1	300	10	0	10	AG	458	2.5	.0	9.6
C. WBT2-WBR	300	13	0	13	AG	608	2.5	.0	9.6
D. NB1	-9	19	-9	319	AG	2168	2.5	.0	19.3
E. SBL	-16	319	-16	19	AG	77	2.5	.0	9.6
F. SBT1	-20	319	-20	19	AG	245	2.5	.0	9.6
G. SBT2	-23	319	-23	19	AG	245	2.5	.0	9.6
H. SBT3-SBR	-27	319	-27	19	AG	640	2.5	.0	9.6
I. WB1	-34	13	-334	13	AG	1481	2.5	.0	19.3
J. EBL1	-334	5	-34	5	AG	758	2.5	.0	19.3
K. EBT1	-334	-2	-34	-2	AG	206	2.5	.0	9.6
L. EBT2	-334	-6	-34	-6	AG	321	2.5	.0	9.6
M. EBT3-EBR	-334	-10	-34	-10	AG	321	2.5	.0	9.6
N. SB1	-27	-19	-27	-319	AG	960	2.5	.0	29.0
O. NBL	-16	-319	-16	-19	AG	170	2.5	.0	9.6
P. NBT1	-13	-319	-13	-19	AG	630	2.5	.0	9.6
Q. NBT2	-9	-319	-9	-19	AG	630	2.5	.0	9.6
R. NBR	-5	-319	-5	-19	AG	76	2.5	.0	9.6
S. EB1	0	-10	300	-10	AG	771	2.5	.0	29.0


```
CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
         JUNE 1989 VERSION
         PAGE   2

     JOB: C:\Documents and Settings\paukovitsj\My
     RUN: CALINE4 RUN      (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide
```

III. RECEPTOR LOCATIONS

RECEPTOR	COORDINATES (M) X	Y	Z
1. R_1	0	19	1.8
2. R_2	-34	19	1.8
3. R_3	-34	-19	1.8
4. R_4	0	-19	1.8

IV. MODEL RESULTS (WORST CASE WIND ANGLE)

RECEPTOR	BRG (DEG)	PRED CONC (PPM)	CONC/LINK (PPM) A	B	C	D	E	F	G	H
1. R_1	355.	4.1	.0	.0	.0	1.0	.0	.0	.0	.0
2. R_2	265.	4.0	.0	.0	.0	.0	.0	.0	.0	.0
3. R_3	6.	3.7	.0	.0	.0	.3	.0	.0	.0	.2
4. R_4	187.	3.6	.0	.0	.0	.0	.0	.0	.0	.0

RECEPTOR	CONC/LINK (PPM) I	J	K	L	M	N	O	P	Q	R	S
1. R_1	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
2. R_2	.7	.2	.0	.0	.0	.0	.0	.0	.0	.0	.0
3. R_3	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
4. R_4	.0	.0	.0	.0	.0	.1	.0	.2	.2	.0	.0

EXIT

```
CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
         JUNE 1989 VERSION
         PAGE   1

     JOB: C:\Lakes\CALRoads View\Santa Ana Blvd -
     RUN: CALINE4 RUN      (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide
```

I. SITE VARIABLES

```
      U=   0.5 M/S            Z0= 100. CM           ALT=     0. (M)
    BRG= WORST CASE           VD=  0.0 CM/S
   CLAS=     7 (G)            VS=  0.0 CM/S
   MIXH=  300. M             AMB=  3.0 PPM
  SIGTH=    5. DEGREES       TEMP= 20.0 DEGREE (C)
```

II. LINK VARIABLES

LINK DESCRIPTION	LINK COORDINATES (M) X1	Y1	X2	Y2	TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. Link_1	300	2	0	2	AG	212	2.5	0.0	9.6
B. Link_2	300	5	0	5	AG	212	2.5	0.0	9.6
C. Link_3	300	9	0	9	AG	432	2.5	0.0	9.6
D. Link_5	-11	13	-11	313	AG	598	2.5	0.0	9.6
E. Link_4	-15	13	-15	313	AG	378	2.5	0.0	9.6
F. Link_6	-23	313	-23	13	AG	158	2.5	0.0	9.6
G. Link_7	-27	313	-27	13	AG	158	2.5	0.0	9.6
H. Link_8	-30	313	-30	13	AG	90	2.5	0.0	9.6
I. Link_9	-39	9	-339	9	AG	302	2.5	0.0	9.6
J. Link_10	-39	6	-339	6	AG	212	2.5	0.0	9.6
K. Link_11	-39	2	-339	2	AG	212	2.5	0.0	9.6
L. Link_12	-339	-3	-39	-3	AG	378	2.5	0.0	9.6
M. Link_13	-339	-7	-39	-7	AG	378	2.5	0.0	9.6
N. Link_14	-339	-10	-39	-10	AG	225	2.5	0.0	9.6
O. Link_15	-339	-14	-39	-14	AG	225	2.5	0.0	9.6
P. Link_16	-339	-18	-39	-18	AG	225	2.5	0.0	9.6
Q. Link_17	0	-17	300	-17	AG	330	2.5	0.0	9.6
R. Link_18	0	-13	300	-13	AG	330	2.5	0.0	9.6
S. Link_19	0	-9	300	-9	AG	300	2.5	0.0	9.6

1


```
CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
         JUNE 1989 VERSION
         PAGE   2

     JOB: C:\Lakes\CALRoads View\Santa Ana Blvd -
     RUN: CALINE4 RUN      (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide
```

III. RECEPTOR LOCATIONS

RECEPTOR	COORDINATES (M) X	Y	Z
1. R_001	0	13	1.8
2. R_002	-39	13	1.8
3. R_003	-39	-19	1.8
4. R_004	0	-19	1.8
5. R_005	-20	-19	1.8

IV. MODEL RESULTS (WORST CASE WIND ANGLE)

RECEPTOR	BRG (DEG)	PRED CONC (PPM)	CONC/LINK (PPM) A	B	C	D	E	F	G	H
1. R_001	96.	3.6	0.1	0.1	0.3	0.0	0.0	0.0	0.0	0.0
2. R_002	264.	3.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3. R_003	276.	3.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4. R_004	85.	3.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5. R_005	275.	3.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

RECEPTOR	CONC/LINK I	J	K	L	M	N	O	P	Q	R	S
1. R_001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
2. R_002	0.2	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
3. R_003	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0
4. R_004	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.1
5. R_005	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0

1
EXIT

```
CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
         JUNE 1989 VERSION
         PAGE   1

     JOB: C:\Documents and Settings\paukovitsj\My
     RUN: CALINE4 RUN      (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide
```

I. SITE VARIABLES

```
      U=    .5 M/S            Z0= 100. CM           ALT=     0. (M)
    BRG= WORST CASE           VD=   .0 CM/S
   CLAS=     7 (G)            VS=   .0 CM/S
   MIXH=  300. M             AMB=  3.0 PPM
  SIGTH=    5. DEGREES       TEMP= 20.0 DEGREE (C)
```

II. LINK VARIABLES

LINK DESCRIPTION	*	LINK COORDINATES (M) X1	Y1	X2	Y2	*	TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. WBL1	*	300	2	0	2	*	AG	700	2.5	.0	9.6
B. WBT1	*	298	6	-2	6	*	AG	403	2.5	.0	9.6
C. WBT2	*	298	9	-2	9	*	AG	403	2.5	.0	9.6
D. WBT3	*	298	13	-2	13	*	AG	403	2.5	.0	9.6
E. SBL1	*	-6	320	-6	20	*	AG	75	2.5	.0	9.6
F. SBL-SBT-SBR	*	-9	321	-9	21	*	AG	5	2.5	.0	9.6
G. SBR	*	-13	322	-13	22	*	AG	100	2.5	.0	9.6
H. WB1	*	-38	11	-338	11	*	AG	503	2.5	.0	9.6
I. WB2	*	-38	8	-338	8	*	AG	405	2.5	.0	9.6
J. WB3	*	-38	4	-338	4	*	AG	403	2.5	.0	9.6
K. EBT1	*	-338	-4	-38	-4	*	AG	333	2.5	.0	9.6
L. EBT2	*	-338	-8	-38	-8	*	AG	333	2.5	.0	9.6
M. EBT3-EBR	*	-338	-11	-38	-11	*	AG	1188	2.5	.0	9.6
N. SB1	*	-28	-21	-28	-321	*	AG	857	2.5	.0	9.6
O. SB2	*	-25	-21	-25	-321	*	AG	700	2.5	.0	9.6
P. EB1	*	0	-13	300	-13	*	AG	333	2.5	.0	9.6
Q. EB2	*	0	-9	300	-9	*	AG	333	2.5	.0	9.6
R. EB3	*	0	-6	300	-6	*	AG	335	2.5	.0	9.6
S. EB4	*	0	-2	300	-2	*	AG	75	2.5	.0	9.6

```
CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
         JUNE 1989 VERSION
         PAGE   2

     JOB: C:\Documents and Settings\paukovitsj\My
     RUN: CALINE4 RUN      (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide
```

III. RECEPTOR LOCATIONS

RECEPTOR	COORDINATES (M) X	Y	Z
1. R_1	-2	20	1.8
2. R_2	-38	22	1.8
3. R_3	-38	-21	1.8
4. R_4	0	-21	1.8

IV. MODEL RESULTS (WORST CASE WIND ANGLE)

RECEPTOR	BRG (DEG)	PRED CONC (PPM)	CONC/LINK (PPM) A	B	C	D	E	F	G	H
1. R_1	98.	3.7	.1	.1	.1	.2	.0	.0	.0	.0
2. R_2	97.	3.7	.1	.1	.1	.1	.0	.0	.0	.0
3. R_3	278.	3.7	.0	.0	.0	.0	.0	.0	.0	.0
4. R_4	81.	3.6	.1	.0	.0	.0	.0	.0	.0	.0

RECEPTOR	CONC/LINK (PPM) I	J	K	L	M	N	O	P	Q	R	S
1. R_1	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
2. R_2	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
3. R_3	.0	.0	.0	.0	.3	.0	.0	.0	.0	.0	.0
4. R_4	.0	.0	.0	.0	.0	.0	.0	.1	.0	.0	.0

EXIT

```
CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
         JUNE 1989 VERSION
         PAGE   1

     JOB: C:\Documents and Settings\paukovitsj\My
     RUN: CALINE4 RUN      (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide
```

I. SITE VARIABLES

```
      U=    .5 M/S            Z0= 100. CM           ALT=     0. (M)
    BRG= WORST CASE           VD=   .0 CM/S
   CLAS=     7 (G)            VS=   .0 CM/S
   MIXH=  300. M             AMB=  3.0 PPM
  SIGTH=    5. DEGREES       TEMP= 20.0 DEGREE (C)
```

II. LINK VARIABLES

LINK DESCRIPTION	*	LINK COORDINATES (M) X1	Y1	X2	Y2	*	TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. WBL1	*	300	2	0	2	*	AG	430	2.5	.0	9.6
B. WBT1	*	298	6	-2	6	*	AG	328	2.5	.0	9.6
C. WBT2	*	298	9	-2	9	*	AG	328	2.5	.0	9.6
D. WBT3	*	298	13	-2	13	*	AG	328	2.5	.0	9.6
E. SBL1	*	-6	320	-6	20	*	AG	440	2.5	.0	9.6
F. SBL-SBT-SBR	*	-9	321	-9	21	*	AG	0	2.5	.0	9.6
G. SBR	*	-13	322	-13	22	*	AG	300	2.5	.0	9.6
H. WB1	*	-38	11	-338	11	*	AG	628	2.5	.0	9.6
I. WB2	*	-38	8	-338	8	*	AG	328	2.5	.0	9.6
J. WB3	*	-38	4	-338	4	*	AG	328	2.5	.0	9.6
K. EBT1	*	-338	-4	-38	-4	*	AG	307	2.5	.0	9.6
L. EBT2	*	-338	-8	-38	-8	*	AG	307	2.5	.0	9.6
M. EBT3-EBR	*	-338	-11	-38	-11	*	AG	982	2.5	.0	9.6
N. SB1	*	-28	-21	-28	-321	*	AG	675	2.5	.0	9.6
O. SB2	*	-25	-21	-25	-321	*	AG	430	2.5	.0	9.6
P. EB1	*	0	-13	300	-13	*	AG	307	2.5	.0	9.6
Q. EB2	*	0	-9	300	-9	*	AG	307	2.5	.0	9.6
R. EB3	*	0	-6	300	-6	*	AG	307	2.5	.0	9.6
S. EB4	*	0	-2	300	-2	*	AG	440	2.5	.0	9.6

```
CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
         JUNE 1989 VERSION
         PAGE   2

     JOB: C:\Documents and Settings\paukovitsj\My
     RUN: CALINE4 RUN      (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide
```

III. RECEPTOR LOCATIONS

RECEPTOR	COORDINATES (M) X	Y	Z
1. R_1	-2	20	1.8
2. R_2	-38	22	1.8
3. R_3	-38	-21	1.8
4. R_4	0	-21	1.8

IV. MODEL RESULTS (WORST CASE WIND ANGLE)

RECEPTOR	BRG (DEG)	PRED CONC (PPM)	CONC/LINK (PPM) A	B	C	D	E	F	G	H
1. R_1	98.	3.7	.0	.0	.1	.1	.0	.0	.0	.0
2. R_2	97.	3.6	.0	.0	.0	.1	.0	.0	.0	.0
3. R_3	278.	3.6	.0	.0	.0	.0	.0	.0	.0	.0
4. R_4	82.	3.6	.0	.0	.0	.0	.0	.0	.0	.0

RECEPTOR	CONC/LINK (PPM) I	J	K	L	M	N	O	P	Q	R	S
1. R_1	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
2. R_2	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
3. R_3	.0	.0	.0	.0	.3	.0	.0	.0	.0	.0	.0
4. R_4	.0	.0	.0	.0	.0	.0	.0	.1	.0	.0	.0

EXIT

APPENDIX D

TRANSPORTATION CONFORMITY WORKING GROUP FORM

TCWG Project-Level PM Hot Spot Analysis Project Lists

Review of PM Hot Spot Interagency Review Forms

October 2012	Determination
ORA052 ORA052 - Technical Addendum	Not a POAQC – Hot Spot analysis not required.
SBD355560 SBD355560 - Layout SBD355560 - RTP Modeling	Not a POAQC – Hot Spot analysis not required.
2H0703 Revised	Not a POAQC – Hot Spot analysis not required.

RTIP ID# *(required)* 2H0703

TCWG Consideration Date September 25, 2012

Project Description *(clearly describe project)*

The Orange County Transportation Authority (OCTA), in cooperation with the California Department of Transportation - District 12 (Caltrans), is proposing improvements to the Interstate 5 Freeway (1-5) between State Route 55 (SR-55) (post mile 29.1) and State Route 57 (SR-57) (post mile 34.0), approximately 3.9 miles within the cities of Tustin, Santa Ana and Orange in Orange County. Figures 1 and 2 show the project location and vicinity, respectively. The proposed project is primarily funded by OCTA with Renewed Measure M2 local sales tax. The proposed improvements include the addition of one High Occupancy Vehicle (HOV) lane in each direction on I-5 to provide additional HOV capacity and reduce congestion in the HOV lanes. Proposed improvements to the First Street entrance ramp to southbound I-5 are to improve operations in the general purpose lanes. All proposed improvements would be constructed within Caltrans' existing ROW limits. In addition, temporary construction related activities (staging areas) would also be located within Caltrans' ROW limits. The following proposed project related improvements would be consistent across both of the proposed build alternatives in the EIS (Alternatives 2A/2B and Alternatives 5A/5B):

- The following entrance/exit ramp gore areas would be slightly adjusted to accommodate the HOV widening:
  - Southbound (SB) I-5 Grand Avenue HOV entrance ramp
  - SB I-5 to Santa Ana Boulevard exit ramp
  - 17th Street to SB I-5 entrance ramp
  - SB I-5 to 17th Street exit ramp
  - Northbound (NB) I-5 to 17th Street exit ramp
  - SB I-5 to Main Street/Broadway exit ramp
  - Santa Clara Avenue to NB I-5 entrance ramp
  - Westbound (WB) SR-22 to NB I-5 entrance ramp
  - Eastbound (EB) SR-22 to SB I-5 connector
  - SB I-5 to EB SR-22 connector
  - NB I-5 to NB SR-57 connector
  - Main Street to SB I-5 Entrance ramp.
- Reconstruction or the new construction of retaining walls, within the State ROW limits and along the proposed edge of shoulder at select locations.
- Closure of the HOV barrier gap (between Lincoln Avenue and north of 17th Street) and relocation of the existing HOV concrete barriers on the northbound (NB) side of I-5 between Lincoln Avenue and the Santa Clara Avenue over-crossing entrance ramp.
- Relocation of the existing center median concrete barrier at various locations.
- Relocation of the existing drainage inlets along the existing concrete barriers.
- Design options involve existing structures that may be removed, including Main Street HOV drop exit and entrance ramps and the SB I-5 First Street "horseshoe" exit ramp.
- Relocate overhead sign structures to allow freeway widening and install new overhead sign structures that tailor the two HOV build alternatives.
- Construct Storm Water Treatment BMPs where feasible within the existing ROW.

Type of Project *(use Table 1 on instruction sheet)*

Roadway realignment, and
Reconfigure existing interchanges

County	**Narrative Location/Route & Postmiles**
Orange	1-5 between SR-55 (post mile 29.1) and SR-57 (post mile 34.0). **Caltrans Projects – EA#** 12-ORA-5-30.26/34.00

Lead Agency: OCTA, in cooperation with Caltrans-District 12

Contact Person	**Phone#**	**Fax#**	**Email: dmak @octa.net**
Dennis Mak, P.E.	(714) 560-5826		

Hot Spot Pollutant of Concern *(check one or both)* **PM2.5 X** **PM10 X**

Federal Action for which Project-Level PM Conformity is Needed *(check appropriate box)*

Categorical Exclusion (NEPA)	X **EA or Draft EIS**	**FONSI or Final EIS**	**PS&E or Construction**	**Other**

Scheduled Date of Federal Action: Jan 2014

NEPA Delegation – Project Type *(check appropriate box)*

Exempt	**Section 6004 – Categorical Exemption**	X **Section 6005 – Non-Categorical Exemption**

Current Programming Dates *(as appropriate)*

	PE/Environmental	**ENG**	**ROW**	**CON**
Start	Jan 2011	Jan 2014	n/a (all Caltrans ROW)	2016
End	Jan 2014	Dec 2014	n/a (all Caltrans ROW)	2018

Project Purpose and Need (Summary): *(attach additional sheets as necessary)*

The primary purpose of the proposed project is to improve traffic operations and reduce congestion on the I-5 from north of the SR-55 to south of the SR-57 to improve the safe and efficient local and regional movement of people and goods, while minimizing environmental and community impacts. The project is needed to address the following issues:

- Congestion and travel delay in the HOV lanes within the project limits.
- Congestion in the SB general purpose lanes between Fourth Street and SR-55.

Surrounding Land Use/Traffic Generators *(especially effect on diesel traffic)*

The land uses adjacent to the 3.9 mile improvement area consist of the following:

City of Tustin

- High Density Residential
- Medium Density Residential
- Mobile Home Park
- Professional Office
- Public/Institutional

City of Santa Ana

- Medium Density Residential
- Low Density Residential
- Urban Neighborhood
- Professional & Admin. Office
- District Center
- Open Space
- General Commercial
- Industrial

City of Orange

- Medium Density Residential
- Low Density Residential
- Low Medium Residential
- General Commercial Max.

Opening Year (2018): HOV Build and No Build:

LOS, AADT, % and # trucks, truck AADT of proposed facility
LOS = (see Table 4-2 No Build; Tables 4-8, 4-9, 4-16, 4-17 Build)

AADT = 183,000 to 190,000 (SB); 160,000 to 175,000 (NB)

Truck AADT = 9,500 to 10,500 (SB); 9,000 (NB)

Truck % = 5.4 % (SB and NB)

RTP Horizon Year / Design Year(2040): HOV Build and No Build:

LOS, AADT, % and # trucks, truck AADT of proposed facility
LOS = (see Table 4-23 No Build; Tables 4-29, 4-30, 4-37, 4-38 Build)

AADT = 191,000 to 216,000 (SB); 181,000 to 199,000 (NB)

Truck AADT = 10,500 to 12,000 (SB); 10,500 to 11,000 (NB)

Truck % = 5.7 % (SB); 5.3 % (NB)

Opening Year(2018): If facility is an interchange(s) or intersection(s), Build and No Build cross-street AADT, % and # trucks, truck AADT

See Tables 1, 2, 3, and 4

RTP Horizon Year / Design Year: If facility is an interchange (s) or intersection(s), Build and No Build cross-street AADT, % and # trucks, truck AADT

See Tables 1, 2, 3, and 4

Describe potential traffic redistribution effects of congestion relief *(impact on other facilities)*

Provision of any of the HOV Lane Alternatives, 2A, 2B, 5A, and 5B, eliminates capacity constraints, thereby attracting additional HOV users to the study segment. The additional HOV users would increase density of the HOV lanes, but would cause only one location to fail. Several HOV locations would have demand for more than 1,600 vehicles per lane, which exceeds Caltrans' preferences. Since the mainline volumes are not substantially affected by the project, there would be only minor changes in queues and weaving along the I-5. In addition, there would be minor changes to local intersection volumes due to increases in HOV volumes. Overall, HOV Lane Alternatives 2A/2B and 5A/5B would be almost identical operationally. HOV Lane Alternatives 2B and 5B would result in additional rerouting of vehicles on local streets and slight worsening in mainline operations and localized intersections due to the elimination of the Main Street direct HOV ramps. However, these changes would not impact any of the study area intersections, as evidenced by the intersection level of service analysis.
Ramp Alternatives A and B would improve the weave density with Ramp Alternative A performing slightly better due to the longer weaving distance available with this alternative. However, the magnitude of improvements is limited due to the overall over capacity conditions on the I-5 mainline. Reconfiguring and relocating the First Street southbound on-ramp (and the associated changes to the Fourth Street northbound off-ramp) would cause changes in the local circulation patterns, both on the mainline and surface streets. As such, both alternatives would cause a minor diversion of vehicles to SR-55; however, these would not be substantial enough to affect roadway and freeway conditions. In addition to the diversion of vehicles to the SR-55, the local streets circulation patterns would further be disrupted by the redistribution required for the ramp reconfigurations. As shown in the intersection level of service analysis under Ramp Alternative A and B, none of the key ramp locations would be impacted due to the rerouting of vehicles due to the closure of the I-5 southbound on-ramp at First Street or any other configuration changes. Evaluation of queuing at ramp locations also identified that adequate storage is provided to accommodate anticipated queues (AECOM Project Traffic Report 2012)

Comments/Explanation/Details *(attach additional sheets as necessary)*

The proposed project is within a nonattainment area for federal PM2.5 and PM10 standards. Therefore, per 40 CFR Part 93 analyses are required for conformity purposes. However, the EPA does not require hotspot analyses, qualitative or quantitative, for projects that are not listed in Section 93.123(b)(1) as an air quality concern.

This project fits the example of projects that are not an air quality concern in in Appendix A of the 2006 EPA guidance (Transportation Conformity Guidance for Qualitative Hot-spot Analysis in PM Nonattainment and Maintenance Areas):

> Any new or expanded highway project that primarily services gasoline vehicle traffic (i.e., does not involve a significant number or increase in the number of diesel vehicles), including such projects involving congested intersections operating at Level-of-Service D, E, or F;

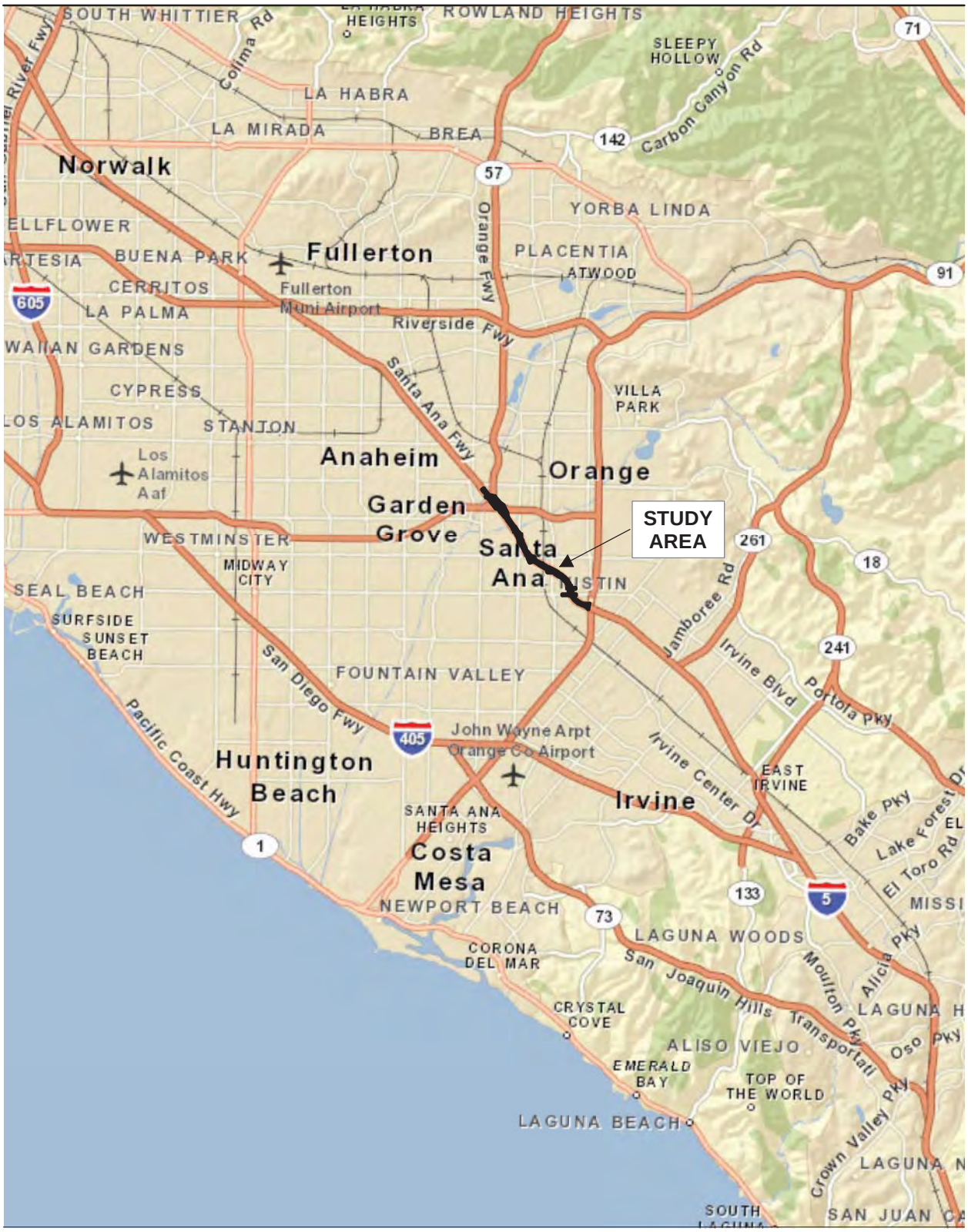
This project proposes additional HOV Lanes which primarily services gasoline vehicle traffic. The truck volume for no build and all alternatives for existing conditions, year 2018 and year 2040, and LOS is provided in the table on the following page.

Therefore, the proposed project is not a project of air quality concern (POAQC) and meets the Clean Air Act requirements and 40 CFR 93.116 without any explicit hot-spot analysis. The proposed project would not create a new, or worsen an existing, PM10 or PM2.5 violation.

OCTA I-5 TCWG Form
Supplemental Traffic Data

Location		ADT				
		Existing	2018 No Build	2018 Build	2040 No Build	2040 Build
I-5 s/o SR-57 HOV ramp merge (N of Main HOV off)	SB	117,628	120,206	121,640	128,316	134,240
I-5 n/o 17th/Penn off-ramp	SB	183,147	187,571	190,530	202,967	213,740
I-5 n/o Santa Ana off-ramp	SB	176,136	180,202	183,570	195,774	206,940
I-5 n/o SR-55 HOV exit (S of Grand HOV on)	SB	182,509	187,250	190,600	202,272	216,020
I-5 s/o SR-55 HOV exit	SB	165,428	169,525	171,720	185,791	191,500
I-5 s/o SR-55 HOV ramp merge (south of Grand HOV off)	NB	197,588	204,769	206,400	227,476	234,130
I-5 s/o 17th off-ramp	NB	162,157	168,983	170,580	189,775	197,070
I-5 s/o Main/Broadway off-ramp	NB	166,695	171,985	174,460	188,148	198,870
I-5 s/o SR-57 HOV exit (North of Main HOV on)	NB	153,630	160,551	162,820	177,211	191,710

Location		Truck ADT			
		HV %	Existing	2018	2040
I-5 s/o SR-57 HOV ramp merge (N of Main HOV off)	SB	5.50%	6,470	6,690	7,380
I-5 n/o 17th/Penn off-ramp	SB	5.50%	10,073	10,480	11,760
I-5 n/o Santa Ana off-ramp	SB	5.50%	9,687	10,100	11,380
I-5 n/o SR-55 HOV exit (S of Grand HOV on)	SB	5.50%	10,038	10,480	11,880
I-5 s/o SR-55 HOV exit	SB	5.50%	9,099	9,440	10,530
I-5 s/o SR-55 HOV ramp merge (south of Grand HOV off)	NB	5.50%	10,867	11,350	12,880
I-5 s/o 17th off-ramp	NB	5.50%	8,919	9,380	10,840
I-5 s/o Main/Broadway off-ramp	NB	5.50%	9,168	9,600	10,940
I-5 s/o SR-57 HOV exit (North of Main HOV on)	NB	5.50%	8,450	8,960	10,540



Source: ESRI 2011

4 2 0 4 Miles

Scale: 1:250,000; 1 inch = 4 miles

Figure 1
Regional Map

Path: P:\2011\60220190\06GIS\6.3_Layout\OCTA_I-5\regional_map.mxd, 5/23/2012, augellop

Figure 2
Vicinity Map

Path: P:\2011\60220190\06GIS\6.3_Layout\OCTA_I-5\vicinity_map.mxd, 5/23/2012, augellop

ORANGE COUNTY RTP PROJECTS

ORANGE COUNTY RTP PROJECTS								
CATEGORY	RTP ID	ROUTE #	ROUTE NAME	FROM	TO	DESCRIPTION	PROJECT COMPLE-TION BY*	PROJECT COST ($1,000'S)
ARTERIAL	2A0703	0	M1 ROADWAY PROJ-ECTS	COUNTYWIDE		COMPLETION OF MEASURE M ROADWAY PROJECTS	ONGOING	$37,118
ARTERIAL	2A0704	0	REGIONAL CAPACITY PROGRAM	COUNTYWIDE		COMPLETE MPAH, IMPROVE ARTERIAL CAPACITY	ONGOING	$1,124,497
ARTERIAL	2A0705	0	SIGNAL SYNCHRONI-ZATION PROGRAM	COUNTYWIDE		SYNCHRONIZE SIGNALS ACROSS JURISDICTIONS AND SMART STREETS	ONGOING	$823,265
ARTERIAL	2A0706	0	IRVINE CENTER DRIVE	AT I-405		WIDEN OVERCROSSING	2025	$11,176
AUXILIARY	2M01108	5	I-5 SB	LA PAZ ROAD	OSO PARKWAY	EXTEND AUXILIARY LANE THROUGH INTERCHANGE	2030	$5,322
AUXILIARY	2M01110	5	I-5 SB	ALICIA PARKWAY	LA PAZ ROAD	EXTEND AUXILIARY LANE THROUGH INTERCHANGE	2030	$19,510
AUXILIARY	2M0704	55	SR-55 NB	DYER	EDINGER	ADD AUXILIARY LANE	2030	$146,633
AUXILIARY	2M01125	91	SR-91 WB	NB SR-55	WB SR-91 AT TUSTIN	ADD 1 AUX LANE WESTBOUND	2014	$115,394
AUXILIARY	2M04130	405	I-405 SB	SR-133	IRVINE CENTER DRIVE	ADD 2ND AUXILIARY LANE	2020	$10,892
AUXILIARY	2M04131	405	I-405 NB	JEFFREY	CULVER	ADD AUXILIARY LANE	2020	$13,927
GRADE SEPA-RATION	2GL04	0	GRADE SEPARATION	LOSSAN/BNSF		CONSTRUCT GRADE SEPARATIONS AT SELECT LOCATIONS ALONG THE LOSSAN AND BNSF CORRIDORS	ONGOING	$718,976
HOV	2H01143	5	I-5	COAST HIGHWAY	PICO	ADD 1 HOV LANE EACH DIRECTION	2018	$202,680
HOV	2H0702	5	I-5	BARRANCA PARKWAY		BARRANCA PARKWAY HOV INTERCHANGE IMPROVEMENT - ADD SB HOV ON-RAMP AND NB HOV OFF-RAMP	2021	$24,966
HOV	2H0703	5	I-5	SR-55	SR-57	ADD 1 HOV LANE EACH DIRECTION	2035	$600,929
HOV	2H0705	57	SR-57	CERRITOS		HOV DROP RAMP	2035	$277,056
HOV	2H0706	73	SR-73	I-405		HOV CONNECTOR	2035	$664,935
HOV	2H0707	73	SR-73	I-405	MACARTHUR	ADD 1 HOV LANE EACH DIRECTION	2035	$236,421
HOV	2H01148	405	I-405	AT VON KARMAN		HOV DROP RAMP	2020	$139,275
HOV	2H0701	405	I-405	BEAR		HOV DROP RAMP	2020	$133,918
IC/RAMPS	2M01107	5	I-5	SR-55		RECONFIGURE INTERCHANGE TO REDUCE WEAVING - INTERIM PROJECT	2035	$811,254

COUNTY - COMPREHENSIVE MODELING LISTING

CO	SYS*	LEAD AGENCY	RTIP/RTP ID	RTE	BEG PM	END PM	PROJECT / ROUTE NAME	FROM	TO	PROJECT DESCRIPTION	ADDITIONAL PROJECT DETAILS, IF AVAILABLE	2008 RTIP	NO BUILD	NETWORK YEAR (PROJECT COMPLETION BY) 2008	2009	2010	2012	2014	2016	2020	2023	2030	2035
OR	S	ORANGE COUNTY TRANS AUTHORITY (OCTA)	ORA020112	5	15.1	16.3	I-5	AT OSO PARKWAY EXIT LANE AND NORTHBOUND ON RAMP		I-5 SOUTHBOUND AT OSO PARKWAY EXIT LANE AND INTERCHANGE IMPROVEMENTS. WIDEN FROM 1 TO 2 LANES AND ADD AN EXIT/STORAGE LANE. PLUS SIGHT DISTANCE IMPROV. TO N/B OFF RAMP.	WIDEN FROM 1 TO 2 LANES AND ADD AN EXIT/STORAGE LANE PLUS SIGHT DISTANCE IMPROVEMENT TO NORTHBOUND ON RAMP	√	√		√								
OR	S	CALTRANS	2M01108	5	15.2	16.5	I-5 SB	La Paz Road	Oso Parkway	EXTEND AUXILIARY LANE THROUGH INTERCHANGE	Existing Configuration: aux drops at La Paz, and resumes south of La Paz											√	
OR	S	LAGUNA HILLS	ORA000122	5	16.5	16.5	I-5	LA PAZ INTERCHANGE		I-5 @ LA PAZ INTERCHANGE IMPROVEMENTS. EXPAND LA PAZ RD. FROM 4 TO 6 LANES TOTAL. (99-LHILL-GMA-1125)	ON RAMP EXTENTION LANES	√	√			√							
OR	S	CALTRANS	2M01109	5	16.5	0.0	I-5	La Paz Road		RE-CONSTRUCT INTERCHANGE TO INCREASE STORAGE CAPACITY OF RAMPS	Existing Configuration: 1 to 2 lane on-ramps, 1 to 3 lane SB off-ramp, 1 to 4 lane NB off-ramp										√		
OR	S	CALTRANS	2M01110	5	16.5	17.5	I-5 SB	Alicia Parkway	La Paz Road	EXTEND AUXILIARY LANE THROUGH INTERCHANGE	Existing Config: aux drops at Alicia, and resumes south of Alicia											√	
OR	S	ORANGE COUNTY TRANS AUTHORITY (OCTA)	2M0718	5	17.0	0.0	I-5	Marguerite Parkway		ADD NEW INTERCHANGE AT MARGUERITE PARKWAY (SADDLEBACK CC CONNECTION)	Existing Config: No interchange									√			
OR	S	CALTRANS	2M0717	5	18.0	0.0	I-5	El Toro Road (Los Alisos)		ADD RAMPS AT LOS ALISOS OR AVE. DE LA CARLOTA	Existing Config: No ramps between El Toro & Alicia										√		
OR	S	CALTRANS	2H0702	5	22.7	0.0	I-5	Barranca Parkway		I-5 @ BARRANCA, ADD SB HOV ON-RAMP AND NB HOV OFF-RAMP	Existing Config: NB HOV on-ramp and SB HOV off-ramp										√		
OR	S	CALTRANS	2M0731	5	23.1	30.3	I-5	SR-133	SR-55	ADD 1 MF LANE EACH DIRECTION	Existing Config: 5 lanes each direction											√	
OR	S	ORANGE COUNTY TRANS AUTHORITY (OCTA)	ORA020108	5	26.9	26.9	I-5	CULVER DRIVE	SOUTH SOUND OFF RAMP	I-5 AT CULVER DRIVE S/B OFFRAMP WIDENING FROM ONE TO TWO LANES	WIDENING FROM 1 TO 2 LANES	√	√		√								
OR	S	CALTRANS	ORA120359	5	27.5	28.1	I-5	JAMBOREE INTERCHANGE		I-5 @ JAMBOREE - CONSTRUCT AUX LN ON I-5 SB; WIDEN SB OFF-RAMP FROM 1 TO 2 LANES; AND WIDENING JAMBOREE RD EB UNDERCROSSING TO CREATE A TURN LANE TO NB ON-RAMP	CONSTRUCT AUXILIARY LANE AND WIDEN OFF-RAMP FROM 1 TO 2 LANES	√	√				√						
OR	S	CALTRANS	2M01107	5	30.3	0.0	I-5	SR-55		RECONFIGURE INTERCHANGE TO REDUCE WEAVING - INTERIM PROJECT	Existing Configuration: 2 lanes on all MF connectors; 1 lane HOV for NB 55/5 & SB 5/55												√
OR	S	CALTRANS	2H0703	5	30.3	34.0	I-5	SR-55	SR-57	ADD 1 HOV LANE EACH DIRECTION	1 to 2 HOV Lanes												√
OR	S	ANAHEIM	ORA000100	5	34.0	43.5	I-5	GENE AUTRY WAY WEST @1-5 HOV TRANSITWAY		GENE AUTRY WAY WEST @ I-5 (I-5 HOV TRANSITWAY TO HASTER) ADD OVERCROSSING ON I-5 (S)/MANCHESTER AND EXTEND GENE AUTRY WAY WEST FROM I-5 TO HASTER (3 LANES IN EA DIR.)	ADD OVERCROSSING ON I-5 SOUTH MANCHESTER EXTEND GENE AUTRY WAY WEST FROM I-5 TO HASTER.	√	√		√								
OR	S	CALTRANS	2M0732	5	34.0	42.1	I-5	SR-57	SR-91	ADD 1 LANE EACH DIRECTION	Existing Config: 4 to 6 lanes each direction											√	

4.1.2 HOV LANE PERFORMANCE

Freeway HOV volumes are shown in Figure 9, and the HOV analysis results are summarized in Table 4-2. Forecast weekday AM and PM peak-hour HOV volumes by direction and measures of effectiveness are included in Table 4-2. As shown, all HOV lane segments are projected to operate at satisfactory LOS during both peak hours in Opening Year (2018) No Build conditions. However, there are 2 HOV lane segments during the weekday AM peak hour and 6 HOV lane segments during the weekday PM peak hour that operate over the Caltrans' desire of 1,600 vph (note that 1 of the 2 weekday AM peak hour locations and 2 of the 6 weekday PM peak hour locations are outside the project limits).

As noted previously, there is a severe bottleneck where the HOV lane from I-5 southbound connects with the HOV lane from SR-57 southbound, with a capacity limit of 1,550 vph. North of this bottleneck, there is substantial congestion on both the I-5 southbound and SR-57 SB HOV lanes, which would be worsened under Opening Year (2018) Conditions. During both weekday AM and PM peak hours, there would be an unmet demand of about 800 and 910 vehicles, respectively. However, since this bottleneck restricts downstream volumes, analysis locations to the south tend to operate under capacity.

Similarly, there is a bottleneck where the HOV lane from I-5 northbound merges with the HOV lane from SR-55 northbound, with a capacity limit of 1,900 vph (also identified through a review of Caltrans PeMS data) – note that this merge is located to the north of the Grand Avenue HOV direct exit ramp. At this location, there would be an unmet demand of about 40 vehicles in the weekday PM peak hour, resulting in minor delays to traffic flows along the I-5 HOV lane. However, since this bottleneck restricts downstream volumes, analysis locations to the north tend to operate under capacity. HOV lane calculations can be seen in Appendix D.

Table 4-2: Freeway HOV LOS Summary – Opening Year (2018) Conditions – No Build

Location		# of Lanes	AM Peak Hour			PM Peak Hour		
			Vol.	Density[1]	LOS	Vol.	Density[1]	LOS
SR-57 s/o Chapman on-ramp	SB	1	1,594	24.5	C	**1,842**	28.3	D
I-5 s/o Chapman on-ramp	SB	1	1,096	16.9	B	938	14.4	B
I-5 s/o SR-57 HOV ramp merge (N of Main HOV off)	SB	1	1,550	23.8	C	1,550	23.8	C
I-5 n/o 17th/Penn off-ramp	SB	1	1,406	21.6	C	1,485	22.8	C
I-5 n/o Santa Ana off-ramp	SB	1	**1,746**	26.9	D	**1,765**	27.2	D
I-5 n/o SR-55 HOV exit (S of Grand HOV on)	SB	2	2,026	15.6	B	2,005	15.4	B
I-5 s/o SR-55 HOV exit	SB	1	1,257	19.3	C	1,387	21.3	C
SR-55 s/o HOV exit	SB	1	**1,790**	27.5	D	1,365	21.0	C
SR-55 s/o HOV entrance	NB	1	952	14.6	B	**1,649**	25.4	C
I-5 s/o SR-55 HOV ramp merge (south	NB	2	1,665	12.8	B	2,205	17.0	B

Location		# of Lanes	AM Peak Hour			PM Peak Hour		
			Vol.	Density[1]	LOS	Vol.	Density[1]	LOS
of Grand HOV off)								
I-5 s/o 17th off-ramp	NB	1	1,350	20.8	C	**1,900**	29.2	D
I-5 s/o Main/Broadway off-ramp	NB	1	965	14.8	B	**1,649**	25.4	C
I-5 s/o SR-57 HOV exit (north of Main HOV on)	NB	1	1,020	15.7	B	**1,964**	30.2	D
I-5 s/o Chapman off-ramp	NB	1	200	3.1	A	1,029	15.8	B
SR-57 south of Chapman off-ramp	NB	1	485	7.5	A	735	11.3	B

Source: AECOM, 2012.
Notes: **Bolding** indicates HOV segment operating at unacceptable LOS. ***Bold italics*** indicate locations where the HOV lane has greater than 1,600 vpl.
(1) Density is shown in passenger cars / miles / lane (pc/mi/ln)

4.1.3 WEAVING PERFORMANCE

Under Opening Year (2018) conditions, the weaving section on the I-5 Freeway northbound between the Main Street on-ramp and the SR-22 exit would operate at LOS F during both the weekday AM and PM peak hours, as shown in Table 4-3, with an increase in density over Existing conditions due to the general increase in volumes in the area. Weaving calculations can be seen in Appendix E.

Table 4-3: Weaving LOS Summary – Opening Year (2018) Conditions – No Build

Location		Weave Distance	AM Peak Hour		PM Peak Hour	
			Density[1]	LOS	Density[1]	LOS
Main On to SR 57 Off	NB	1,650	47.0	**F**	48.7	**F**

Source: AECOM, 2012.
Notes: **Bolding** indicates weaving segment operating at unacceptable LOS.
(1) Density is shown in passenger cars / miles / lane (pc/mi/ln)

4.1.4 INTERSECTION OPERATIONS

A level of service analysis was conducted to evaluate Opening Year (2018) No Build intersection operating conditions during the weekday AM and PM peak hours. Table 4-4 summarizes the Opening Year (2018) No Build level of service at the study area intersections. Traffic volumes for Opening Year (2018) are included in Appendix B. Level of service calculation worksheets are included in Appendix F.

As shown in Table 4-4, all study area intersections would operate acceptably (LOS D or better) under Opening Year (2018) No Build conditions, with the exception of the following locations:

- Grand Avenue/First Street: LOS E in the AM and PM peak hour
- I-5 SB Ramps/Santa Ana Boulevard: LOS E in the PM peak hour
- SR-55 SB Ramps/Fourth Street: LOS F in the AM peak hour

Table 4-8: HOV LOS Summary – Opening Year (2018) Conditions - HOV Lane Alternative 2A

Location		# of Lanes	AM Peak Hour			PM Peak Hour		
			Volume	Density[1]	LOS	Volume	Density[1]	LOS
SR-57 s/o Chapman on-ramp	SB	1	***1,765***	27.2	D	***1,905***	29.3	D
I-5 s/o Chapman on-ramp	SB	1	1,195	18.4	C	990	15.2	B
I-5 s/o SR-57 HOV ramp merge (N of Main HOV off)	SB	2	2,620	20.2	C	2,575	19.8	C
I-5 n/o 17th/Penn off-ramp	SB	2	2,440	18.8	C	2,495	19.2	C
I-5 n/o Santa Ana off-ramp	SB	2	2,780	21.4	C	2,775	21.3	C
I-5 n/o SR-55 HOV exit (S of Grand HOV on)	SB	2	3,060	23.5	C	3,015	23.2	C
I-5 s/o SR-55 HOV exit	SB	1	***2,075***	31.9	D	***2,320***	35.7	**E**
SR-55 s/o HOV exit	SB	1	***1,790***	27.5	D	1,365	21.0	C
SR-55 s/o HOV entrance	NB	1	995	15.3	B	***1,750***	26.9	D
I-5 s/o SR-55 HOV ramp merge (south of Grand HOV off)	NB	2	1,795	13.8	B	2,475	19.0	C
I-5 s/o 17th off-ramp	NB	2	1,480	11.4	B	2,210	17.0	B
I-5 s/o Main/Broadway off-ramp	NB	2	1,095	8.4	A	1,925	14.8	B
I-5 s/o SR-57 HOV exit (North of Main HOV on)	NB	2	1,160	8.9	A	2,280	17.5	B
I-5 s/o Chapman off-ramp	NB	1	340	5.2	A	1,250	19.2	C
SR-57 south of Chapman off-ramp	NB	1	485	7.5	A	735	11.3	B

Source: AECOM, 2012.
Notes: **Bolding** indicates HOV segment operating at unacceptable LOS. ***Bold italics*** indicate locations where the HOV lane has greater than 1,600 vpl.
(1) Density is shown in passenger cars / miles / lane (pc/mi/ln)

Table 4-9: HOV LOS Summary – Opening Year (2018) Conditions - HOV Lane Alternative 2B

Location		# of Lanes	AM Peak Hour			PM Peak Hour		
			Volume	Density[1]	LOS	Volume	Density[1]	LOS
SR-57 s/o Chapman on-ramp	SB	1	***1,675***	25.8	C	***1,865***	28.7	D
I-5 s/o Chapman on-ramp	SB	1	1,015	15.6	B	910	14.0	B
I-5 s/o SR-57 HOV ramp merge (N of Main HOV off)	SB	2	2,440	18.8	C	2,495	19.2	C
I-5 n/o 17th/Penn off-ramp	SB	2	2,440	18.8	C	2,495	19.2	C
I-5 n/o Santa Ana off-ramp	SB	2	2,780	21.4	C	2,775	21.3	C
I-5 n/o SR-55 HOV exit (S of Grand HOV on)	SB	2	3,060	23.5	C	3,015	23.2	C
I-5 s/o SR-55 HOV exit	SB	1	***2,075***	31.9	D	**2,320**	35.7	**E**
SR-55 s/o HOV exit	SB	1	***1,790***	27.5	D	1,365	21.0	C
SR-55 s/o HOV entrance	NB	1	995	15.3	B	**1,750**	26.9	D

Location		# of Lanes	AM Peak Hour			PM Peak Hour		
			Volume	Density[1]	LOS	Volume	Density[1]	LOS
I-5 s/o SR-55 HOV ramp merge (south of Grand HOV off)	NB	2	1,795	13.8	B	2,475	19.0	C
I-5 s/o 17th off-ramp	NB	2	1,480	11.4	B	2,210	17.0	B
I-5 s/o Main/Broadway off-ramp	NB	2	1,095	8.4	A	1,925	14.8	B
I-5 s/o SR-57 HOV exit (North of Main HOV on)	NB	2	1,150	8.8	A	2,240	17.2	B
I-5 s/o Chapman off-ramp	NB	1	351	5.4	A	1,302	20.0	C
SR-57 south of Chapman off-ramp	NB	1	485	7.5	A	735	11.3	B

Source: AECOM, 2012.
Notes: **Bolding** indicates HOV segment operating at unacceptable LOS. ***Bold italics*** indicate locations where the HOV lane has greater than 1,600 vpl.
(1) Density is shown in passenger cars / miles / lane (pc/mi/ln)

4.2.3 WEAVING PERFORMANCE

With HOV Lane Alternative 2A, conditions at the I-5 Freeway weaving segment would be the same as with No Build, as there would be no change to freeway mainline or Main Street on-ramp volumes with Alternative 2A, as illustrated in Table 4-10. Weaving calculations can be seen in Appendix E.

Table 4-10: Weaving LOS Summary – Opening Year (2018) Conditions – HOV Lane Alternative 2A

Location		Weave Distance	AM Peak Hour		PM Peak Hour	
			Density[1]	LOS	Density[1]	LOS
Main On to SR 57 Off	NB	1,650	47.0	**F**	48.7	**F**

Source: AECOM, 2012.
Notes: **Bolding** indicates weaving segment operating at unacceptable LOS.
(1) Density is shown in passenger cars / miles / lane (pc/mi/ln)

However, since Alternative 2B would eliminate the Main Street direct HOV on-ramp, there would be an increase in volumes along both the freeway mainline and at the Main Street general-purpose on-ramp. As a result, weaving conditions under Alternative 2B would be slightly worse during both the weekday AM and PM peak hours, as shown in Table 4-11.

Table 4-11: Weaving LOS Summary – Opening Year (2018) Conditions – HOV Lane Alternative 2B

Location		Weave Distance	AM Peak Hour		PM Peak Hour	
			Density[1]	LOS	Density[1]	LOS
Main On to SR 57 Off	NB	1,650	47.2	**F**	49.7	**F**

Source: AECOM, 2012.
Notes: **Bolding** indicates weaving segment operating at unacceptable LOS.
(1) Density is shown in passenger cars / miles / lane (pc/mi/ln)

4.3.2 HOV LANE PERFORMANCE

HOV lane analysis results for the HOV Lane Alternatives 5A and 5B are summarized in Table 4-16 and Table 4-17. With the addition of the second HOV lane between SR-55 and SR-57, the number of vehicles able to use the HOV lanes would increase due to the elimination of the northbound and southbound bottleneck locations (the lane reductions at the I-5 southbound / SR-57 southbound connection and at the I-5 northbound / SR-55 northbound connection would be eliminated). For both alternatives, operating conditions improve above No Build at locations where the second lane was added. All other locations generally experience an increase in density and worse LOS due to the general increase HOV lane volumes. For both HOV Lane Alternatives, one location is forecast to operate unsatisfactorily at LOS E during the weekday PM peak hour in Opening Year (2018) conditions: southbound I-5 south of the SR-55 HOV exit. However, this location is outside the project limits. In addition, there would be 3 HOV lane segment during the weekday AM peak hour and 3 HOV lane segments during the weekday PM peak hour that operate over the Caltrans' desire of 1,600 vph (note all 4 locations are outside the project limits). HOV lane calculations can be seen in Appendix D.

Table 4-16: HOV LOS Summary – Opening Year (2018) Conditions - HOV Lane Alternative 5A

Location		# of Lanes	AM Peak Hour			PM Peak Hour		
			Volume	Density[1]	LOS	Volume	Density[1]	LOS
SR-57 s/o Chapman on-ramp	SB	1	***1,765***	27.2	D	***1,905***	29.3	D
I-5 s/o Chapman on-ramp	SB	1	1,195	18.4	C	990	15.2	B
I-5 s/o SR-57 HOV ramp merge (N of Main HOV off)	SB	2	2,620	20.2	C	2,575	19.8	C
I-5 n/o 17th/Penn off-ramp	SB	2	2,440	18.8	C	2,495	19.2	C
I-5 n/o Santa Ana off-ramp	SB	2	2,780	21.4	C	2,775	21.3	C
I-5 n/o SR-55 HOV exit (S of Grand HOV on)	SB	2	3,060	23.5	C	3,015	23.2	C
I-5 s/o SR-55 HOV exit	SB	1	***2,075***	31.9	D	***2,320***	35.7	**E**
SR-55 s/o HOV exit	SB	1	***1,790***	27.5	D	1,365	21.0	C
SR-55 s/o HOV entrance	NB	1	995	15.3	B	***1,750***	26.9	D
I-5 s/o SR-55 HOV ramp merge (south of Grand HOV off)	NB	2	1,795	13.8	B	2,475	19.0	C
I-5 s/o 17th off-ramp	NB	2	1,480	11.4	B	2,210	17.0	B
I-5 s/o Main/Broadway off-ramp	NB	2	1,095	8.4	A	1,925	14.8	B
I-5 s/o SR-57 HOV exit (North of Main HOV on)	NB	2	1,160	8.9	A	2,280	17.5	B
I-5 s/o Chapman off-ramp	NB	1	340	5.2	A	1,250	19.2	C
SR-57 south of Chapman off-ramp	NB	1	485	7.5	A	735	11.3	B

Source: AECOM, 2012.
Notes: **Bolding** indicates HOV segment operating at unacceptable LOS. ***Bold italics*** indicate locations where the HOV lane has greater than 1,600 vpl.
(1) Density is shown in passenger cars / miles / lane (pc/mi/ln)

Table 4-17: HOV LOS Summary – Opening Year (2018) Conditions - HOV Lane Alternative 5B

Location		# of Lanes	AM Peak Hour			PM Peak Hour		
			Volume	Density[1]	LOS	Volume	Density[1]	LOS
SR-57 s/o Chapman on-ramp	SB	1	***1,675***	25.8	C	***1,865***	28.7	D
I-5 s/o Chapman on-ramp	SB	1	1,015	15.6	B	910	14.0	B
I-5 s/o SR-57 HOV ramp merge (N of Main HOV off)	SB	2	2,440	18.8	C	2,495	19.2	C
I-5 n/o 17th/Penn off-ramp	SB	2	2,440	18.8	C	2,495	19.2	C
I-5 n/o Santa Ana off-ramp	SB	2	2,780	21.4	C	2,775	21.3	C
I-5 n/o SR-55 HOV exit (S of Grand HOV on)	SB	2	3,060	23.5	C	3,015	23.2	C
I-5 s/o SR-55 HOV exit	SB	1	***2,075***	31.9	D	**2,320**	35.7	**E**
SR-55 s/o HOV exit	SB	1	***1,790***	27.5	D	1,365	21.0	C
SR-55 s/o HOV entrance	NB	1	995	15.3	B	**1,750**	26.9	D
I-5 s/o SR-55 HOV ramp merge (south of Grand HOV off)	NB	2	1,795	13.8	B	2,475	19.0	C
I-5 s/o 17th off-ramp	NB	2	1,480	11.4	B	2,210	17.0	B
I-5 s/o Main/Broadway off-ramp	NB	2	1,095	8.4	A	1,925	14.8	B
I-5 s/o SR-57 HOV exit (North of Main HOV on)	NB	2	1,150	8.8	A	2,240	17.2	B
I-5 s/o Chapman off-ramp	NB	1	351	5.4	A	1,302	20.0	C
SR-57 south of Chapman off-ramp	NB	1	485	7.5	A	735	11.3	B

Source: AECOM, 2012.
Notes: **Bolding** indicates HOV segment operating at unacceptable LOS. ***Bold italics*** indicate locations where the HOV lane has greater than 1,600 vpl.
(1) Density is shown in passenger cars / miles / lane (pc/mi/ln)

4.3.3 WEAVING PERFORMANCE

With HOV Lane Alternative 5A, conditions at the I-5 Freeway weaving segment would be the same as with No Build, as there would be no change to freeway mainline or Main Street on-ramp volumes with Alternative 2A, as shown in Table 4-18. Weaving calculations can be seen in Appendix E.

Table 4-18: Weaving LOS Summary – Opening Year (2018) Conditions – HOV Lane Alternative 5A

Location		Weave Distance	AM Peak Hour		PM Peak Hour	
			Density[1]	LOS	Density[1]	LOS
Main On to SR 57 Off	NB	1,650	47.0	**F**	48.7	**F**

Source: AECOM, 2012.
Notes: **Bolding** indicates weaving segment operating at unacceptable LOS.
(1) Density is shown in passenger cars / miles / lane (pc/mi/ln)

4.4.2 HOV LANE PERFORMANCE

Freeway HOV analysis results are summarized in Table 4-23. Forecast AM and PM peak-hour HOV volumes by direction and measures of effectiveness are included in Table 4-23. As shown, all HOV lane segments are projected to operate at satisfactory LOS during both peak hours in Future Year (2040) No Build conditions. However, there are 3 HOV lane segments during the weekday AM peak hour and 7 HOV lane segments during the weekday PM peak hour that operate over the Caltrans' desire of 1,600 vph (note that 2 of the 3 weekday AM peak hour locations and 2 of the 7 weekday PM peak hour locations are outside the project limits.

As noted previously, there is a severe bottleneck where the HOV lane from I-5 southbound connects with the HOV lane from SR-57 southbound, with a capacity limit of 1,550 vph. North of this bottleneck, there is substantial congestion on both the I-5 southbound and SR-57 SB HOV lanes, which would be worsened under Future Year (2040) Conditions. During the weekday AM and PM peak hours, there would be an unmet demand of about 935 and 1,035 vehicles, respectively. However, since this bottleneck restricts downstream volumes, analysis locations to the south tend to operate under capacity.

Similarly, there is a bottleneck where the HOV lane from I-5 northbound merges with the HOV lane from SR-55 northbound, with a capacity limit of 1,900 vph. At this location, there would be an unmet demand of about 240 vehicles in the weekday PM peak hour, resulting in noticeable delays to traffic flows along the I-5 HOV lane. However, since this bottleneck restricts downstream volumes, analysis locations to the north tend to operate under capacity. HOV lane calculations can be seen in Appendix D.

Table 4-23: HOV LOS Summary – Future Year (2040) Conditions – No Build

Location		# of Lanes	AM Peak Hour			PM Peak Hour		
			Volume	Density[1]	LOS	Volume	Density[1]	LOS
SR-57 s/o Chapman on-ramp	SB	1	***1,616***	24.9	C	***1,917***	29.5	D
I-5 s/o Chapman on-ramp	SB	1	1,209	18.6	C	1,048	16.1	B
I-5 s/o SR-57 HOV ramp merge (N of Main HOV off)	SB	1	1,550	23.8	C	1,550	23.8	C
I-5 n/o 17th/Penn off-ramp	SB	1	1,406	21.6	C	1,485	22.8	C
I-5 n/o Santa Ana off-ramp	SB	1	***1,746***	26.9	D	***1,765***	27.2	D
I-5 n/o SR-55 HOV exit (S of Grand HOV on)	SB	2	2,061	15.9	B	2,020	15.5	B
I-5 s/o SR-55 HOV exit	SB	1	1,292	19.9	C	1,402	21.6	C
SR-55 s/o HOV exit	SB	1	***2,115***	32.5	D	***1,715***	26.4	D
SR-55 s/o HOV entrance	NB	1	1,125	17.3	B	***1,738***	26.7	D
I-5 s/o SR-55 HOV ramp merge (south of Grand HOV off)	NB	2	1,835	14.1	B	2,465	19.0	C
I-5 s/o 17th off-ramp	NB	1	1,500	23.1	C	***1,900***	29.2	D
I-5 s/o Main/Broadway off-ramp	NB	1	1,050	16.2	B	***1,649***	25.4	C
I-5 s/o SR-57 HOV exit (north of Main HOV on)	NB	1	1,105	17.0	B	***1,964***	30.2	D

Table 4-29: HOV LOS Summary – Future Year (2040) Conditions - HOV Lane Alternative 2A

Location		# of Lanes	AM Peak Hour			PM Peak Hour		
			Volume	Density[1]	LOS	Volume	Density[1]	LOS
SR-57 s/o Chapman on-ramp	SB	1	***2,315***	35.6	E	***2,160***	33.2	D
I-5 s/o Chapman on-ramp	SB	1	***1,610***	24.8	C	1,255	19.3	C
I-5 s/o SR-57 HOV ramp merge (N of Main HOV off)	SB	2	***3,585***	27.6	D	3,095	23.8	C
I-5 n/o 17th/Penn off-ramp	SB	2	***3,295***	25.3	C	2,960	22.8	C
I-5 n/o Santa Ana off-ramp	SB	2	***3,635***	28.0	D	***3,240***	24.9	C
I-5 n/o SR-55 HOV exit (S of Grand HOV on)	SB	2	***3,950***	30.4	D	***3,495***	26.9	D
I-5 s/o SR-55 HOV exit	SB	1	***2,295***	35.3	E	2,570	39.5	E
SR-55 s/o HOV exit	SB	1	***2,115***	32.5	D	***1,715***	26.4	D
SR-55 s/o HOV entrance	NB	1	1,290	19.8	C	***2,145***	33.0	D
I-5 s/o SR-55 HOV ramp merge (south of Grand HOV off)	NB	2	2,335	18.0	B	***3,565***	27.4	D
I-5 s/o 17th off-ramp	NB	2	2,000	15.4	B	***3,240***	24.9	C
I-5 s/o Main/Broadway off-ramp	NB	2	1,550	11.9	B	2,860	22.0	C
I-5 s/o SR-57 HOV exit (north of Main HOV on)	NB	2	1,655	12.7	B	***3,345***	25.7	C
I-5 s/o Chapman off-ramp	NB	1	575	8.8	A	***1,990***	30.6	D
SR-57 south of Chapman off-ramp	NB	1	745	11.5	B	1,025	15.8	B

Source: AECOM, 2012.
Notes: **Bolding** indicates HOV segment operating at unacceptable LOS. ***Bold italics*** indicate locations where the HOV lane has greater than 1,600 vpl.
(1) Density is shown in passenger cars / miles / lane (pc/mi/ln)

Table 4-30: HOV LOS Summary – Future Year (2040) Conditions - HOV Lane Alternative 2B

Location		# of Lanes	AM Peak Hour			PM Peak Hour		
			Volume	Density[1]	LOS	Volume	Density[1]	LOS
SR-57 s/o Chapman on-ramp	SB	1	***2,170***	33.4	D	***2,092***	32.2	D
I-5 s/o Chapman on-ramp	SB	1	1,320	20.3	C	1,120	17.2	B
I-5 s/o SR-57 HOV ramp merge (N of Main HOV off)	SB	2	***3,295***	25.3	C	2,960	22.8	C
I-5 n/o 17th/Penn off-ramp	SB	2	***3,295***	25.3	C	2,960	22.8	C
I-5 n/o Santa Ana off-ramp	SB	2	***3,635***	28.0	D	***3,240***	24.9	C
I-5 n/o SR-55 HOV exit (S of Grand HOV on)	SB	2	***3,950***	30.4	D	***3,495***	26.9	D
I-5 s/o SR-55 HOV exit	SB	1	***2,295***	35.3	E	***2,570***	39.5	E
SR-55 s/o HOV exit	SB	1	***2,115***	32.5	D	***1,715***	26.4	D
SR-55 s/o HOV entrance	NB	1	1,290	19.8	C	***2,145***	33.0	D
I-5 s/o SR-55 HOV ramp merge (south of Grand HOV off)	NB	2	2,335	18.0	B	***3,565***	27.4	D
I-5 s/o 17th off-ramp	NB	2	2,000	15.4	B	***3,240***	24.9	C
I-5 s/o Main/Broadway off-ramp	NB	2	1,550	11.9	B	2,860	22.0	C
I-5 s/o SR-57 HOV exit (North of Main HOV on)	NB	2	1,550	11.9	B	2,860	22.0	C
I-5 s/o Chapman off-ramp	NB	1	506	7.8	A	***1,633***	25.1	C
SR-57 south of Chapman off-ramp	NB	1	745	11.5	B	1,025	15.8	B

Source: AECOM, 2012.
Notes: **Bolding** indicates HOV segment operating at unacceptable LOS. ***Bold italics*** indicate locations where the HOV lane has greater than 1,600 vpl.
(1) Density is shown in passenger cars / miles / lane (pc/mi/ln)

4.5.3 WEAVING PERFORMANCE

With HOV Lane Alternative 2A, conditions at the I-5 Freeway weaving segment would be the same as with No Build, as there would be no change to freeway mainline or Main Street on-ramp volumes with Alternative 2A, as shown in Table 4-31. Weaving calculations can be seen in Appendix E.

Table 4-31: Weaving LOS Summary – Future Year (2040) Conditions – HOV Lane Alternative 2A

Location		Weave Distance	AM Peak Hour		PM Peak Hour	
			Density[1]	LOS	Density[1]	LOS
Main On to SR 57 Off	NB	1,650	51.0	**F**	54.6	**F**

Source: AECOM, 2012.
Notes: **Bolding** indicates weaving segment operating at unacceptable LOS.
(1) Density is shown in passenger cars / miles / lane (pc/mi/ln)

However, since Alternative 2B would eliminate the Main Street direct HOV on-ramp, there would be an increase in volumes along both the freeway mainline and at the Main Street general-purpose on-ramp, as shown in Table 4-32. As a result, weaving conditions under Alternative 2B would be slightly worse during both the weekday AM and PM peak hours.

Table 4-37: HOV LOS Summary – Future Year (2040) Conditions - HOV Lane Alternative 5A

Location		# of Lanes	AM Peak Hour			PM Peak Hour		
			Volume	Density[1]	LOS	Volume	Density[1]	LOS
SR-57 s/o Chapman on-ramp	SB	1	***2,315***	35.6	E	***2,160***	33.2	D
I-5 s/o Chapman on-ramp	SB	1	***1,610***	24.8	C	1,255	19.3	C
I-5 s/o SR-57 HOV ramp merge (N of Main HOV off)	SB	2	***3,585***	27.6	D	3,095	23.8	C
I-5 n/o 17th/Penn off-ramp	SB	2	***3,295***	25.3	C	2,960	22.8	C
I-5 n/o Santa Ana off-ramp	SB	2	***3,635***	28.0	D	***3,240***	24.9	C
I-5 n/o SR-55 HOV exit (S of Grand HOV on)	SB	2	***3,950***	30.4	D	***3,495***	26.9	D
I-5 s/o SR-55 HOV exit	SB	1	***2,295***	35.3	E	2,570	39.5	E
SR-55 s/o HOV exit	SB	1	***2,115***	32.5	D	***1,715***	26.4	D
SR-55 s/o HOV entrance	NB	1	1,290	19.8	C	***2,145***	33.0	D
I-5 s/o SR-55 HOV ramp merge (south of Grand HOV off)	NB	2	2,335	18.0	B	***3,565***	27.4	D
I-5 s/o 17th off-ramp	NB	2	2,000	15.4	B	***3,240***	24.9	C
I-5 s/o Main/Broadway off-ramp	NB	2	1,550	11.9	B	2,860	22.0	C
I-5 s/o SR-57 HOV exit (north of Main HOV on)	NB	2	1,655	12.7	B	***3,345***	25.7	C
I-5 s/o Chapman off-ramp	NB	1	575	8.8	A	***1,990***	30.6	D
SR-57 south of Chapman off-ramp	NB	1	745	11.5	B	1,025	15.8	B

Source: AECOM, 2012.
Notes: **Bolding** indicates HOV segment operating at unacceptable LOS. ***Bold italics*** indicate locations where the HOV lane has greater than 1,600 vpl.
(1) Density is shown in passenger cars / miles / lane (pc/mi/ln)

Table 4-38: HOV LOS Summary – Future Year (2040) Conditions - HOV Lane Alternative 5B

Location		# of Lanes	AM Peak Hour			PM Peak Hour		
			Volume	Density[1]	LOS	Volume	Density[1]	LOS
SR-57 s/o Chapman on-ramp	SB	1	***2,170***	33.4	D	***2,092***	32.2	D
I-5 s/o Chapman on-ramp	SB	1	1,320	20.3	C	1,120	17.2	B
I-5 s/o SR-57 HOV ramp merge (N of Main HOV off)	SB	2	***3,295***	25.3	C	2,960	22.8	C
I-5 n/o 17th/Penn off-ramp	SB	2	***3,295***	25.3	C	2,960	22.8	C
I-5 n/o Santa Ana off-ramp	SB	2	***3,635***	28.0	D	***3,240***	24.9	C
I-5 n/o SR-55 HOV exit (S of Grand HOV on)	SB	2	***3,950***	30.4	D	***3,495***	26.9	D
I-5 s/o SR-55 HOV exit	SB	1	***2,295***	35.3	E	***2,570***	39.5	E
SR-55 s/o HOV exit	SB	1	***2,115***	32.5	D	***1,715***	26.4	D
SR-55 s/o HOV entrance	NB	1	1,290	19.8	C	***2,145***	33.0	D
I-5 s/o SR-55 HOV ramp merge (south of Grand HOV off)	NB	2	2,335	18.0	B	***3,565***	27.4	D
I-5 s/o 17th off-ramp	NB	2	2,000	15.4	B	***3,240***	24.9	C
I-5 s/o Main/Broadway off-ramp	NB	2	1,550	11.9	B	2,860	22.0	C
I-5 s/o SR-57 HOV exit (North of Main HOV on)	NB	2	1,550	11.9	B	2,860	22.0	C
I-5 s/o Chapman off-ramp	NB	1	506	7.8	A	***1,633***	25.1	C
SR-57 south of Chapman off-ramp	NB	1	745	11.5	B	1,025	15.8	B

Source: AECOM, 2012.
Notes: **Bolding** indicates HOV segment operating at unacceptable LOS. ***Bold italics*** indicate locations where the HOV lane has greater than 1,600 vpl.
(1) Density is shown in passenger cars / miles / lane (pc/mi/ln)

4.6.3 WEAVING PERFORMANCE

With HOV Lane Alternative 5A, conditions at the I-5 Freeway weaving segment would be the same as with No Build, as there would be no change to freeway mainline or Main Street on-ramp volumes with Alternative 5A, as illustrated in Table 3-39. Weaving calculations can be seen in Appendix E.

Table 4-39: Weaving LOS Summary – Future Year (2040) Conditions – HOV Lane Alternative 5A

Location		Weave Distance	AM Peak Hour		PM Peak Hour	
			Density[1]	LOS	Density[1]	LOS
Main On to SR 57 Off	NB	1,650	51.0	F	54.6	F

Source: AECOM, 2012.
Notes: **Bolding** indicates weaving segment operating at unacceptable LOS.
(1) Density is shown in passenger cars / miles / lane (pc/mi/ln)

However, since Alternative 5B would eliminate the Main Street direct HOV on-ramp, there would be an increase in volumes along both the freeway mainline and at the Main Street general-purpose on-ramp. As a result, weaving conditions under Alternative 5B would be slightly worse during both the weekday AM and PM peak hours, as shown in Table 4-40.

Table 1: I-5 from SR-55 and SR-57 HOV Improvements Level of Service Summary

			Existing Conditions				2018 No Build Conditions				2040 No Build Conditions			
			AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
ID	Intersection	Control	Delay[1]	LOS	Delay[1]	LOS	Delay[1]	LOS	Delay[1]	LOS	Delay[1]	LOS	Delay[1]	LOS
1	Main / La Veta	SIGNAL	20.1	C	27.1	C	20.0	B	26.4	C	19.8	B	25.5	C
2	Main / Memory	SIGNAL	17.1	B	21.7	C	17.1	B	21.4	C	16.9	B	21.1	C
3	Main / Edgewood / I-5	SIGNAL	42.6	D	49.0	D	40.3	D	48.5	D	36.9	D	45.9	D
4	Broadway / Santa Clara	SIGNAL	32.7	C	27.2	C	30.6	C	28.2	C	28.8	C	32.6	C
5	Main / Santa Clara / I-5	SIGNAL	45.3	D	52.3	D	42.8	D	51.6	D	39.8	D	53.0	D
6	Main / 17th	SIGNAL	43.8	D	52.4	D	42.6	D	49.5	D	44.6	D	49.8	D
7	Penn / 17th	SIGNAL	20.7	C	33.3	C	23.3	C	37.0	D	26.0	C	40.6	D
8	Santiago / 17th	SIGNAL	32.8	C	36.3	D	32.6	C	35.5	D	33.0	C	36.4	D
9	Penn / I-5 SB Ramp	SIGNAL	24.3	C	23.1	C	24.4	C	23.1	C	25.1	C	23.1	C
10	Main / 4th	SIGNAL	11.3	B	12.0	B	11.3	B	12.0	B	11.3	B	12.0	B
11	Grand / 4th	SIGNAL	33.6	C	42.2	D	33.4	C	42.2	D	34.0	C	43.7	D
12	I-5 SB Ramp / 4th	SIGNAL	11.6	B	15.2	B	11.4	B	15.1	B	11.2	B	15.1	B
13	I-5 NB Ramp / 4th	SIGNAL	8.9	A	18.2	B	8.9	A	18.1	B	9.0	A	18.5	B
14	Cabrillo / 4th	SIGNAL	27.7	C	31.7	C	28.2	C	32.4	C	29.4	C	35.4	D
15	Tustin / 4th	SIGNAL	29.9	C	38.2	D	31.5	C	41.5	D	42.0	D	44.5	D
16	Main / 1st	SIGNAL	40.9	D	37.0	D	41.0	D	36.9	D	45.0	D	40.7	D
17	Grand / 1st	SIGNAL	36.1	D	40.7	D	36.0	D	40.9	D	37.2	D	47.6	D
18	I-5 SB Ramp / 1st	SIGNAL	8.3	A	10.4	B	8.2	A	10.2	B	8.4	A	10.4	B
19	Cabrillo / 1st	SIGNAL	25.7	C	25.8	C	25.8	C	26.1	C	26.6	C	27.7	C
20	Tustin / 1st	SIGNAL	15.5	B	16.5	B	15.9	B	16.7	B	17.8	B	17.3	B
21	I-5 Ramp / Santa Ana	SIGNAL	19.9	B	51.4	D	19.7	B	57.7	E	20.6	C	62.1	E
22	Grand / Santa Ana	SIGNAL	27.6	C	35.1	D	27.6	C	35.2	D	27.4	C	36.5	D
23	Mabury / Palm	UNSIGNAL	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A
24	Mabury / Elk / 1st	SIGNAL	28.6	C	39.5	D	27.8	C	39.4	D	28.8	C	43.3	D
25	Lyon / 1st	SIGNAL	19.2	B	17.5	B	19.3	B	18.0	B	19.6	B	18.8	B
26	Cabrillo / State Fund	SIGNAL	4.2	A	5.9	A	4.5	A	6.0	A	4.5	A	5.9	A
27	Cabrillo / Xerox Center	SIGNAL	4.4	A	8.1	A	4.4	A	7.1	A	4.3	A	7.0	A
28	Golden Circle / 4th	SIGNAL	7.9	A	10.2	B	8.2	A	10.1	B	8.0	A	10.3	B
29	Golden Circle / 1st	SIGNAL	7.5	A	7.5	A	7.5	A	7.7	A	7.6	A	7.9	A
30	SR-55 SB Ramps / 4th	SIGNAL	82.4	F	19.9	B	118.3	F	20.2	C	150.4	F	24.2	C
31	SR-55 NB Ramps / 4th	SIGNAL	19.1	B	36.8	D	17.8	B	36.6	D	15.9	B	48.4	D

Source: AECOM, 2012

Notes:

Bolding indicates intersection operating at unacceptable LOS.

(1) Delay is shown in seconds per vehicle. For signalized locations, delay reported is average delay of all approaches. For unsignalized, the LOS of the worst approach is reported, per HCM Methodology.

Table 2: I-5 from SR-55 and SR-57 HOV Improvements 2018 Level of Service Summary

			2018 No Build Conditions				2018 Option A Conditions				2018 Option B Conditions				2018 Option 2A/5A Conditions				2018 Option 2B/5B Conditions			
			AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
ID	Intersection	Control	Delay[1]	LOS	Delay[1]	LOS	Delay[1]	LOS	Delay[1]	LOS	Delay[1]	LOS	Delay[1]	LOS	Delay[1]	LOS	Delay[1]	LOS	Delay[1]	LOS	Delay[1]	LOS
1	Main / La Veta	SIGNAL	20.0	B	26.4	C	20.0	B	26.4	C	20.0	B	26.4	C	19.8	B	26.4	C	19.8	B	26.4	C
2	Main / Memory	SIGNAL	17.1	B	21.4	C	17.0	B	21.1	C	17.0	B	21.4	C	17.1	B	21.3	C	17.1	B	21.3	C
3	Main / Edgewood / I-5	SIGNAL	40.3	D	48.5	D	32.3	C	30.9	C	32.3	C	48.5	D	40.4	D	52.3	D	36.5	D	40.5	D
4	Broadway / Santa Clara	SIGNAL	30.6	C	28.2	C	32.5	C	28.6	C	32.5	C	28.2	C	30.2	C	28.1	C	30.2	C	28.1	C
5	Main / Santa Clara / I-5	SIGNAL	42.8	D	51.6	D	42.0	D	53.3	D	42.0	D	51.6	D	43.0	D	51.2	D	43.0	D	51.2	D
6	Main / 17th	SIGNAL	42.6	D	49.5	D	42.2	D	49.4	D	42.2	D	49.5	D	42.9	D	49.9	D	42.9	D	49.9	D
7	Penn / 17th	SIGNAL	10.8	B	13.6	B	10.9	B	13.9	B	10.9	B	13.6	B	10.8	B	13.6	B	10.8	B	13.6	B
8	Santiago / 17th	SIGNAL	32.6	C	35.5	D	32.6	C	35.5	D	32.6	C	35.5	D	32.6	C	35.5	D	32.6	C	35.5	D
9	Penn / I-5 SB Ramp	SIGNAL	24.4	C	23.1	C	24.5	C	23.2	C	24.5	C	23.1	C	24.4	C	23.1	C	24.4	C	23.1	C
10	Main / 4th	SIGNAL	11.3	B	12.0	B	12.4	B	12.0	B	11.3	B	12.0	B	11.3	B	12.0	B	11.3	B	12.0	B
11	Grand / 4th	SIGNAL	33.4	C	42.2	D	51.3	D	48.6	D	32.7	C	41.3	D	33.4	C	42.2	D	33.4	C	42.2	D
12	I-5 SB Ramp / 4th	SIGNAL	11.4	B	15.1	B	65.3	E	148.7	F	10.7	B	14.6	B	13.0	B	15.3	B	13.0	B	15.3	B
13	I-5 NB Ramp / 4th	SIGNAL	8.9	A	18.1	B	9.8	A	21.1	C	8.8	A	17.8	B	6.7	A	17.1	B	6.7	A	17.1	B
14	Cabrillo / 4th	SIGNAL	28.2	C	32.4	C	28.0	C	33.2	C	28.3	C	33.8	C	28.2	C	32.4	C	28.2	C	32.4	C
15	Tustin / 4th	SIGNAL	31.5	C	41.5	D	32.1	C	46.1	D	31.5	C	41.5	D	31.5	C	41.5	D	31.5	C	41.5	D
16	Main / 1st	SIGNAL	41.0	D	36.9	D	52.2	D	36.9	D	41.0	D	36.9	D	41.0	D	36.9	D	41.0	D	36.9	D
17	Grand / 1st	SIGNAL	36.0	D	40.9	D	58.8	E	83.6	F	36.9	D	47.1	D	36.0	D	40.9	D	36.0	D	40.9	D
18	I-5 SB Ramp / 1st	SIGNAL	8.2	A	10.2	B	Ramp removed				Ramp removed				6.0	A	6.8	A	6.0	A	6.8	A
19	Cabrillo / 1st	SIGNAL	25.8	C	26.1	C	24.9	C	25.4	C	30.7	C	32.4	C	25.8	C	26.1	C	25.8	C	26.1	C
20	Tustin / 1st	SIGNAL	15.9	B	16.7	B	15.9	B	16.9	B	15.9	B	16.7	B	15.9	B	16.7	B	15.9	B	16.7	B
21	I-5 Ramp / Santa Ana	SIGNAL	19.7	B	57.7	E	19.7	B	57.7	E	19.7	B	57.7	E	19.7	B	57.7	E	19.7	B	57.7	E
22	Grand / Santa Ana	SIGNAL	27.6	C	35.2	D	27.6	C	35.2	D	27.6	C	35.2	D	27.6	C	35.2	D	27.6	C	35.2	D
24	Mabury / Elk / 1st	SIGNAL	27.8	C	39.4	D	33.6	C	24.6	C	41.7	D	30.3	C	29.2	C	39.4	D	29.2	C	39.4	D
25	Lyon / 1st	SIGNAL	19.3	B	18.0	B	33.1	C	18.8	B	21.2	C	33.2	C	19.3	B	18.0	B	19.3	B	18.0	B
26	Cabrillo / State Fund	SIGNAL	4.5	A	6.0	A	4.1	A	6.3	A	4.3	A	6.1	A	4.5	A	6.0	A	4.5	A	6.0	A
27	Cabrillo / Xerox Center	SIGNAL	4.4	A	7.1	A	4.3	A	9.0	A	4.5	A	7.3	A	4.4	A	7.1	A	4.4	A	7.1	A
28	Golden Circle / 4th	SIGNAL	8.2	A	10.1	B	8.1	A	10.1	B	8.3	A	10.1	B	8.2	A	10.1	B	8.2	A	10.1	B
29	Golden Circle / 1st	SIGNAL	7.5	A	7.7	A	7.6	A	8.6	A	7.5	A	7.7	A	7.5	A	7.7	A	7.5	A	7.7	A
30	SR-55 SB Ramps / 4th	SIGNAL	118.3	F	20.2	C	128.1	F	20.7	C	120.6	F	20.4	C	118.3	F	20.2	C	118.3	F	20.2	C
31	SR-55 NB Ramps / 4th	SIGNAL	17.8	B	36.6	D	18.4	B	37.7	D	17.8	B	36.6	D	17.8	B	36.6	D	17.8	B	36.6	D

Source: AECOM, 2012

Notes:

Bolding and shading indicates intersection operating at unacceptable LOS.

(1) Delay is shown in seconds per vehicle. For signalized locations, delay reported is average delay of all approaches. For unsignalized, the LOS of the worst approach is reported, per HCM Methodology.

Table 3: I-5 from SR-55 and SR-57 HOV Improvements 2040 Level of Service Summary

			2040 No build Conditions				2040 Option A Conditions				2040 Option B Conditions				2040 Option 2A/5A Conditions				2040 Option 2B/5B Conditions			
			AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
ID	Intersection	Control	Delay[1]	LOS	Delay[1]	LOS	Delay[1]	LOS	Delay[1]	LOS	Delay[1]	LOS	Delay[1]	LOS	Delay[1]	LOS	Delay[1]	LOS	Delay[1]	LOS	Delay[1]	LOS
1	Main / La Veta	SIGNAL	19.8	B	25.5	C	20.1	C	26.6	C	20.1	C	26.6	C	20.0	C	26.5	C	20.1	C	27.5	C
2	Main / Memory	SIGNAL	16.9	B	21.1	C	17.0	B	21.4	C	17.1	B	21.8	C	17.2	B	21.6	C	17.0	B	21.4	C
3	Main / Edgewood / I-5	SIGNAL	36.9	D	45.9	D	31.9	C	50.7	D	39.7	D	48.9	D	40.3	D	70.1	E	35.9	D	41.0	D
4	Broadway / Santa Clara	SIGNAL	28.8	C	32.6	C	31.1	C	36.2	D	32.0	C	35.6	D	30.2	C	35.2	D	31.3	C	36.2	D
5	Main / Santa Clara / I-5	SIGNAL	39.8	D	53.0	D	42.1	D	63.8	E	43.6	D	62.6	E	41.6	D	60.1	E	50.8	D	76.3	E
6	Main / 17th	SIGNAL	44.6	D	49.8	D	48.8	D	56.4	E	49.5	D	56.5	E	50.8	D	58.2	E	48.8	D	54.5	D
7	Penn / 17th	SIGNAL	10.9	B	13.8	B	11.1	B	14.5	B	11.1	B	14.2	B	11.0	B	14.0	B	11.1	B	14.5	B
8	Santiago / 17th	SIGNAL	33.0	C	36.4	D	34.3	C	39.5	D	34.3	C	39.5	D	34.3	C	39.5	D	34.2	C	39.3	D
9	Penn / I-5 SB Ramp	SIGNAL	25.1	C	23.1	C	25.3	C	23.3	C	25.3	C	23.3	C	25.3	C	23.2	C	25.3	C	23.3	C
10	Main / 4th	SIGNAL	11.3	B	12.0	B	12.6	B	12.1	B	11.5	B	12.1	B	11.5	B	12.1	B	11.5	B	12.1	B
11	Grand / 4th	SIGNAL	34.0	C	43.7	D	59.4	E	52.4	D	34.2	C	45.6	D	34.9	C	46.6	D	34.9	C	46.6	D
12	I-5 SB Ramp / 4th	SIGNAL	11.2	B	15.1	B	80.4	F	159.8	F	10.9	B	14.5	B	13.2	B	15.3	B	13.2	B	15.3	B
13	I-5 NB Ramp / 4th	SIGNAL	9.0	A	18.5	B	10.0	B	22.6	C	8.9	A	18.6	B	8.0	A	17.4	B	8.0	A	17.4	B
14	Cabrillo / 4th	SIGNAL	29.4	C	35.4	D	30.3	C	39.1	D	30.3	C	39.2	D	30.1	C	37.7	D	30.1	C	37.7	D
15	Tustin / 4th	SIGNAL	42.0	D	44.5	D	46.6	D	85.7	F	45.4	D	78.0	E	45.4	D	78.0	E	45.4	D	78.0	E
16	Main / 1st	SIGNAL	45.0	D	40.7	D	59.9	E	44.6	D	49.6	D	44.6	D	49.6	D	44.6	D	49.6	D	44.6	D
17	Grand / 1st	SIGNAL	37.2	D	47.6	D	68.3	E	101.1	F	39.6	D	57.8	E	38.7	D	51.7	D	38.7	D	51.7	D
18	I-5 SB Ramp / 1st	SIGNAL	8.4	A	10.4	B	3.2	A	4.4	A	Ramp removed as part of Opt B				6.3	A	7.4	A	6.3	A	7.4	A
19	Cabrillo / 1st	SIGNAL	26.6	C	27.7	C	25.8	C	27.9	C	35.4	D	34.4	C	27.3	C	28.7	C	27.3	C	28.7	C
20	Tustin / 1st	SIGNAL	17.8	B	17.3	B	18.2	B	17.8	B	18.1	B	17.5	B	18.1	B	17.5	B	18.1	B	17.5	B
21	I-5 Ramp / Santa Ana	SIGNAL	20.6	C	62.1	E	20.9	C	80.6	F	20.9	C	80.6	F	20.9	C	80.6	F	20.9	C	80.6	F
22	Grand / Santa Ana	SIGNAL	27.4	C	36.5	D	27.8	C	37.9	D	27.8	C	37.9	D	27.8	C	37.9	D	27.8	C	37.9	D
23	Mabury / Palm	UNSIGNAL	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A
24	Mabury / Elk / 1st	SIGNAL	28.8	C	43.3	D	40.4	D	28.8	C	45.7	D	31.2	C	31.1	C	49.5	D	31.1	C	49.5	D
25	Lyon / 1st	SIGNAL	19.6	B	18.8	B	34.6	C	29.7	C	21.4	C	36.1	C	20.3	C	19.5	B	20.3	C	19.5	B
26	Cabrillo / State Fund	SIGNAL	4.5	A	5.9	A	4.1	A	6.4	A	4.2	A	6.1	A	4.1	A	6.0	A	4.1	A	6.0	A
27	Cabrillo / Xerox Center	SIGNAL	4.3	A	7.0	A	4.2	A	8.2	A	4.4	A	7.3	A	4.3	A	7.1	A	4.3	A	7.1	A
28	Golden Circle / 4th	SIGNAL	8.0	A	10.3	B	8.6	A	11.7	B	8.1	A	11.6	B	8.1	A	11.6	B	8.1	A	11.6	B
29	Golden Circle / 1st	SIGNAL	7.6	A	7.9	A	7.7	A	8.2	A	7.7	A	8.8	A	7.7	A	8.8	A	7.7	A	8.8	A
30	SR-55 SB Ramps / 4th	SIGNAL	150.4	F	24.2	C	157.4	F	26.6	C	157.4	F	26.3	C	157.8	F	26.1	C	157.8	F	26.1	C
31	SR-55 NB Ramps / 4th	SIGNAL	15.9	B	48.4	D	17.5	B	59.0	E	16.9	B	58.7	E	16.9	B	58.7	E	16.9	B	58.7	E

Source: AECOM, 2012

Notes:

Bolding and shading indicates intersection operating at unacceptable LOS.

(1) Delay is shown in seconds per vehicle. For signalized locations, delay reported is average delay of all approaches. For unsignalized, the LOS of the worst approach is reported, per HCM Methodology.

Table 4

Intersections		Existing			2018			2040		
		% Trucks	ADT	Trucks	% Trucks	ADT	Trucks	% Trucks	ADT	Trucks
1	Main / La Veta	0.18%	43,370	80	0.18%	43,740	80	0.18%	44,910	80
2	Main / Memory	0.19%	36,650	70	0.19%	37,030	70	0.18%	38,240	70
3	Main / Edgewood / I-5	0.18%	32,980	60	0.18%	33,280	60	0.18%	34,240	60
4	Broadway / Santa Clara	0.72%	27,920	200	0.71%	28,330	200	0.71%	29,600	210
5	Main / Santa Clara / I-5	0.72%	41,810	300	0.71%	42,410	300	0.72%	44,300	320
6	Main / 17th	0.72%	55,800	400	0.72%	56,610	410	0.71%	59,140	420
7	Penn / 17th	0.71%	38,260	270	0.72%	38,900	280	0.71%	40,900	290
8	Santiago / 17th	0.71%	36,450	260	0.73%	37,080	270	0.72%	39,050	280
9	Penn / I-5 SB Ramp	0.73%	13,670	100	0.72%	13,940	100	0.74%	14,770	110
10	Main / 4th	0.16%	24,490	40	0.16%	24,760	40	0.16%	25,610	40
11	Grand / 4th	0.71%	40,800	290	0.70%	41,420	290	0.71%	43,380	310
12	I-5 SB Ramp / 4th	0.39%	20,400	80	0.39%	20,730	80	0.41%	21,770	90
13	I-5 NB Ramp / 4th	0.27%	26,050	70	0.26%	26,530	70	0.29%	28,050	80
14	Cabrillo / 4th	0.19%	31,600	60	0.18%	32,650	60	0.19%	35,960	70
15	Tustin / 4th	0.07%	40,500	30	0.07%	43,240	30	0.08%	51,870	40
16	Main / 1st	0.21%	47,280	100	0.21%	48,330	100	0.21%	51,610	110
17	Grand / 1st	0.57%	45,970	260	0.57%	47,060	270	0.57%	50,490	290
18	I-5 SB Ramp / 1st	0.20%	30,690	60	0.19%	31,380	60	0.21%	33,530	70
19	Cabrillo / 1st	0.48%	24,920	120	0.46%	25,820	120	0.49%	28,660	140
20	Tustin / 1st	0.60%	20,070	120	0.62%	21,030	130	0.58%	24,040	140
21	I-5 Ramp / Santa Ana	0.70%	24,140	170	0.73%	24,780	180	0.71%	26,800	190
22	Grand / Santa Ana	0.71%	39,710	280	0.72%	40,330	290	0.71%	42,280	300
23	Mabury / Palm	0.21%	4,660	10	0.21%	4,730	10	0.20%	4,960	10
24	Mabury / Elk / 1st	0.17%	34,290	60	0.17%	35,180	60	0.18%	37,990	70
25	Lyon / 1st	0.20%	30,020	60	0.19%	30,950	60	0.21%	33,890	70
26	Cabrillo / State Fund	0.18%	11,240	20	0.17%	11,750	20	0.15%	13,340	20
27	Cabrillo / Xerox Center	0.17%	11,600	20	0.17%	12,060	20	0.15%	13,490	20
28	Golden Circle / 4th	0.17%	23,180	40	0.17%	23,730	40	0.20%	25,470	50
29	Golden Circle / 1st	0.16%	18,450	30	0.16%	19,040	30	0.19%	20,880	40
30	SR-55 SB Ramps / 4th	0.39%	33,460	130	0.40%	34,730	140	0.39%	38,710	150
31	SR-55 NB Ramps / 4th	0.25%	35,300	90	0.27%	36,560	100	0.27%	40,530	110

Source: AECOM, 2012

OCTA I-5 TCWG Form
Supplemental Traffic Data

Location		ADT				
		Existing	2018 No Build	2018 Build	2040 No Build	2040 Build
I-5 s/o SR-57 HOV ramp merge (N of Main HOV off)	SB	117,628	120,206	121,640	128,316	134,240
I-5 n/o 17th/Penn off-ramp	SB	183,147	187,571	190,530	202,967	213,740
I-5 n/o Santa Ana off-ramp	SB	176,136	180,202	183,570	195,774	206,940
I-5 n/o SR-55 HOV exit (S of Grand HOV on)	SB	182,509	187,250	190,600	202,272	216,020
I-5 s/o SR-55 HOV exit	SB	165,428	169,525	171,720	185,791	191,500
I-5 s/o SR-55 HOV ramp merge (south of Grand HOV off)	NB	197,588	204,769	206,400	227,476	234,130
I-5 s/o 17th off-ramp	NB	162,157	168,983	170,580	189,775	197,070
I-5 s/o Main/Broadway off-ramp	NB	166,695	171,985	174,460	188,148	198,870
I-5 s/o SR-57 HOV exit (North of Main HOV on)	NB	153,630	160,551	162,820	177,211	191,710

Location		Truck ADT			
		HV %	Existing	2018	2040
I-5 s/o SR-57 HOV ramp merge (N of Main HOV off)	SB	5.50%	6,470	6,690	7,380
I-5 n/o 17th/Penn off-ramp	SB	5.50%	10,073	10,480	11,760
I-5 n/o Santa Ana off-ramp	SB	5.50%	9,687	10,100	11,380
I-5 n/o SR-55 HOV exit (S of Grand HOV on)	SB	5.50%	10,038	10,480	11,880
I-5 s/o SR-55 HOV exit	SB	5.50%	9,099	9,440	10,530
I-5 s/o SR-55 HOV ramp merge (south of Grand HOV off)	NB	5.50%	10,867	11,350	12,880
I-5 s/o 17th off-ramp	NB	5.50%	8,919	9,380	10,840
I-5 s/o Main/Broadway off-ramp	NB	5.50%	9,168	9,600	10,940
I-5 s/o SR-57 HOV exit (North of Main HOV on)	NB	5.50%	8,450	8,960	10,540

APPENDIX E

MSAT EMISSIONS ANALYSIS

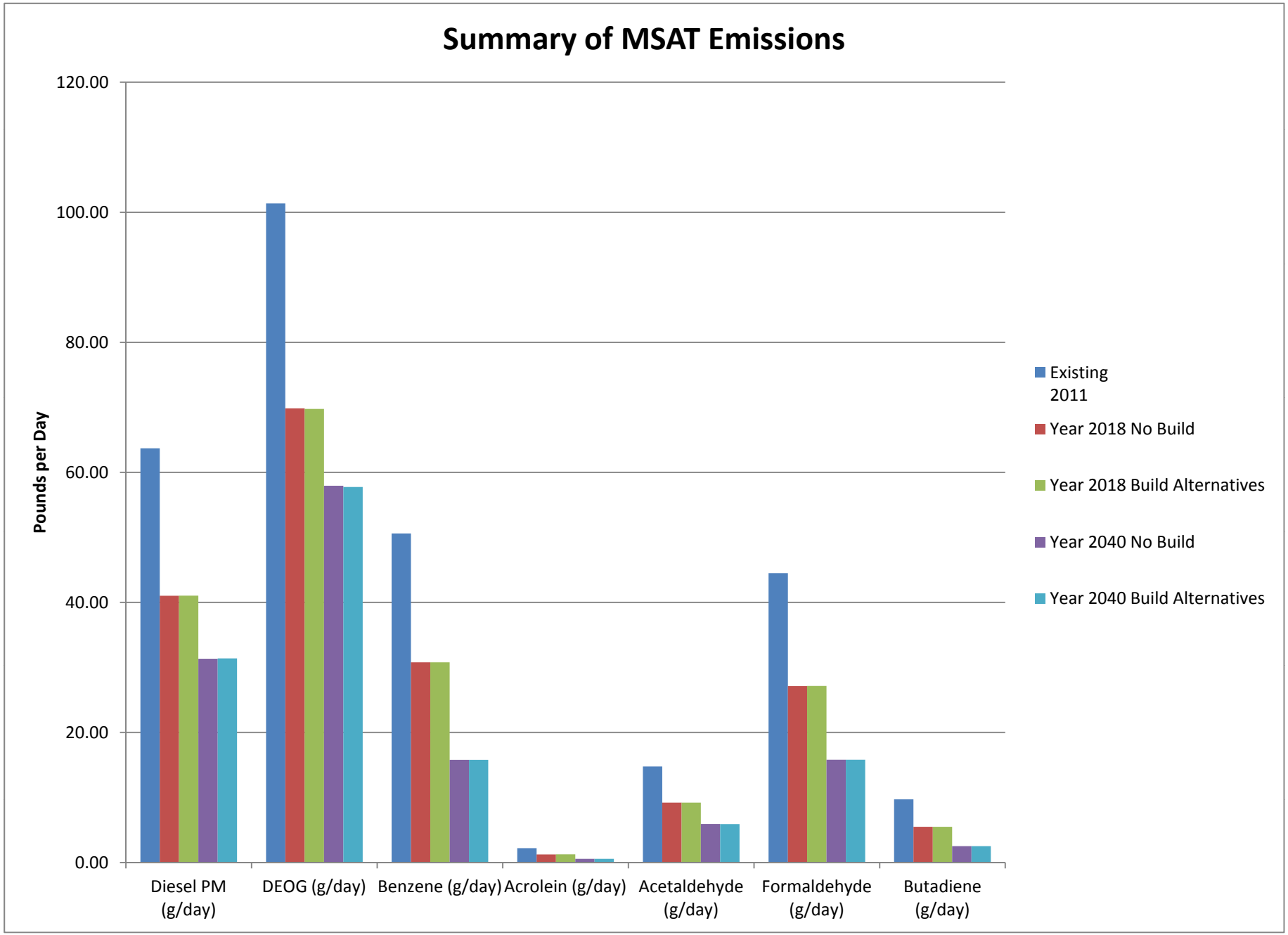
I-5 HOV (55 to 57) PR/ED - Corridor Focused Area VMT by Speed Bin

VMT by Speed Bin - Summary					
Speed Bin	**Existing 2011**	**Year 2040**		**Year 2018**	
		No Project	With Project	No Project	With Project
0-5 mph	0	0	0	0	0
5-10 mph	9,629	14,271	14,577	11,178	11,292
10-15 mph	23,930	49,362	39,902	33,129	29,473
15-20 mph	49,130	113,079	100,315	72,535	67,576
20-25 mph	149,190	451,997	410,646	262,080	245,921
25-30 mph	797,794	1,367,089	1,374,011	997,227	999,414
30-35 mph	1,300,238	1,433,970	1,398,185	1,319,538	1,305,795
35-40 mph	939,192	826,521	886,470	872,564	895,788
40-45 mph	427,174	390,577	424,626	402,509	415,663
45-50 mph	337,257	764,410	751,106	493,365	487,876
50-55 mph	877,200	560,888	553,220	733,703	731,150
55-60 mph	1,043,885	1,111,871	1,153,487	1,044,219	1,060,239
60-65 mph	505,755	604,566	607,075	531,278	532,196
65-70 mph	311,001	244,995	255,132	277,889	281,877
70-75 mph	84,825	104,204	103,849	90,186	90,040
Total	**6,856,200**	**8,037,800**	**8,072,600**	**7,141,400**	**7,154,300**

I-5 HOV (55 to 57) PR/ED - Corridor Focused Area VMT by Speed Bin

VMT by Speed Bin - Peak and Off-Peak Hours										
Speed Bins	Existing 2011		Year 2040				Year 2018			
			No Project		With Project		No Project		With Project	
	Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak
0-5 mph	0	0	0	0	0	0	0	0	0	0
5-10 mph	1,926	7,704	2,854	11,417	2,915	11,662	2,236	8,943	2,258	9,034
10-15 mph	4,786	19,144	9,872	39,490	7,980	31,921	6,626	26,503	5,895	23,579
15-20 mph	9,826	39,304	22,616	90,464	20,063	80,252	14,507	58,028	13,515	54,061
20-25 mph	29,838	119,352	90,399	361,598	82,129	328,516	52,416	209,664	49,184	196,737
25-30 mph	159,559	638,236	273,418	1,093,671	274,802	1,099,209	199,445	797,782	199,883	799,531
30-35 mph	260,048	1,040,190	286,794	1,147,176	279,637	1,118,548	263,908	1,055,631	261,159	1,044,636
35-40 mph	187,838	751,354	165,304	661,217	177,294	709,176	174,513	698,051	179,158	716,630
40-45 mph	85,435	341,740	78,115	312,461	84,925	339,701	80,502	322,008	83,133	332,531
45-50 mph	67,451	269,805	152,882	611,528	150,221	600,885	98,673	394,692	97,575	390,301
50-55 mph	175,440	701,760	112,178	448,710	110,644	442,576	146,741	586,962	146,230	584,920
55-60 mph	208,777	835,108	222,374	889,497	230,697	922,790	208,844	835,375	212,048	848,191
60-65 mph	101,151	404,604	120,913	483,653	121,415	485,660	106,256	425,022	106,439	425,757
65-70 mph	62,200	248,800	48,999	195,996	51,026	204,106	55,578	222,311	56,375	225,501
70-75 mph	16,965	67,860	20,841	83,363	20,770	83,079	18,037	72,149	18,008	72,032
Total	1,371,240	5,484,960	1,607,560	6,430,240	1,614,520	6,458,080	1,428,280	5,713,120	1,430,860	5,723,440

VMT by Speed Bin - Peak and Off-Peak Hours - Percentage										
Speed Bins	Existing 2011		Year 2040				Year 2018			
			No Project		With Project		No Project		With Project	
	Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak
0-5 mph	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
5-10 mph	0.14%	0.14%	0.18%	0.18%	0.18%	0.18%	0.16%	0.16%	0.16%	0.16%
10-15 mph	0.35%	0.35%	0.61%	0.61%	0.49%	0.49%	0.46%	0.46%	0.41%	0.41%
15-20 mph	0.72%	0.72%	1.41%	1.41%	1.24%	1.24%	1.02%	1.02%	0.94%	0.94%
20-25 mph	2.18%	2.18%	5.62%	5.62%	5.09%	5.09%	3.67%	3.67%	3.44%	3.44%
25-30 mph	11.64%	11.64%	17.01%	17.01%	17.02%	17.02%	13.96%	13.96%	13.97%	13.97%
30-35 mph	18.96%	18.96%	17.84%	17.84%	17.32%	17.32%	18.48%	18.48%	18.25%	18.25%
35-40 mph	13.70%	13.70%	10.28%	10.28%	10.98%	10.98%	12.22%	12.22%	12.52%	12.52%
40-45 mph	6.23%	6.23%	4.86%	4.86%	5.26%	5.26%	5.64%	5.64%	5.81%	5.81%
45-50 mph	4.92%	4.92%	9.51%	9.51%	9.30%	9.30%	6.91%	6.91%	6.82%	6.82%
50-55 mph	12.79%	12.79%	6.98%	6.98%	6.85%	6.85%	10.27%	10.27%	10.22%	10.22%
55-60 mph	15.23%	15.23%	13.83%	13.83%	14.29%	14.29%	14.62%	14.62%	14.82%	14.82%
60-65 mph	7.38%	7.38%	7.52%	7.52%	7.52%	7.52%	7.44%	7.44%	7.44%	7.44%
65-70 mph	4.54%	4.54%	3.05%	3.05%	3.16%	3.16%	3.89%	3.89%	3.94%	3.94%
70-75 mph	1.24%	1.24%	1.30%	1.30%	1.29%	1.29%	1.26%	1.26%	1.26%	1.26%
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%


Summary of MSAT Emissions
Pounds per Day
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Diesel PM (g/day)
DEOG (g/day)
Benzene (g/day)
Acrolein (g/day)
Acetaldehyde (g/day)
Formaldehyde (g/day)
Butadiene (g/day)
Existing 2011
Year 2018 No Build
Year 2018 Build Alternatives
Year 2040 No Build
Year 2040 Build Alternatives

Scenario	Existing
Geographic Area	Orange
Analysis Year	2011
Season	Annual
Truck %	
PK	7
OP	7

Running Exhaust (g/mile)

PK Emission Factors (mph)	Diesel PM	DEOG	Benzene	Acrolein	Acetaldehyde	Formaldehyde	Butadiene
<5 mph	0.016152	0.060449	0.012155	0.000595	0.005970	0.016130	0.002636
5 mph ~ 10 mph	0.011624	0.035562	0.008200	0.000406	0.003711	0.010277	0.001793
10 mph ~ 15 mph	0.008320	0.019196	0.005787	0.000293	0.002257	0.006562	0.001281
15 mph ~ 20 mph	0.006275	0.011785	0.004327	0.000221	0.001533	0.004611	0.000965
20 mph ~ 25 mph	0.005265	0.009645	0.003451	0.000176	0.001245	0.003717	0.000770
25 mph ~ 30 mph	0.004524	0.007958	0.002900	0.000148	0.001045	0.003118	0.000648
30 mph ~ 35 mph	0.003996	0.006728	0.002545	0.000130	0.000908	0.002715	0.000571
35 mph ~ 40 mph	0.003671	0.005907	0.002370	0.000122	0.000827	0.002491	0.000533
40 mph ~ 45 mph	0.003572	0.005465	0.002309	0.000119	0.000792	0.002398	0.000521
45 mph ~ 50 mph	0.003623	0.005347	0.002370	0.000122	0.000803	0.002439	0.000536
50 mph ~ 55 mph	0.003859	0.005601	0.002573	0.000133	0.000864	0.002630	0.000584
55 mph ~ 60 mph	0.004235	0.006151	0.002929	0.000152	0.000978	0.002980	0.000666
60 mph ~ 65 mph	0.004801	0.007085	0.003524	0.000183	0.001164	0.003556	0.000804
65 mph ~ 70 mph	0.005491	0.008350	0.004063	0.000211	0.001381	0.004159	0.000931
>70 mph	0.006387	0.009958	0.004924	0.000256	0.001702	0.005077	0.001135

Running Loss (g/min)

(min)	TOG	Benzene	Acrolein	Acetaldehyde	Formaldehyde	Butadiene
1		0.001495	0.000000	0.000000	0.000000	0.000010
2		0.000837	0.000000	0.000000	0.000000	0.000006
3		0.000642	0.000000	0.000000	0.000000	0.000004
4		0.000559	0.000000	0.000000	0.000000	0.000004
5		0.000511	0.000000	0.000000	0.000000	0.000004
10		0.000421	0.000000	0.000000	0.000000	0.000003
15		0.000406	0.000000	0.000000	0.000000	0.000003
20		0.000397	0.000000	0.000000	0.000000	0.000003
25		0.000402	0.000000	0.000000	0.000000	0.000003
30		0.000402	0.000000	0.000000	0.000000	0.000003
35		0.000393	0.000000	0.000000	0.000000	0.000003
40		0.000391	0.000000	0.000000	0.000000	0.000003
45		0.000388	0.000000	0.000000	0.000000	0.000003
50		0.000381	0.000000	0.000000	0.000000	0.000003
55		0.000377	0.000000	0.000000	0.000000	0.000003
60		0.000371	0.000000	0.000000	0.000000	0.000003

OP Emission Factors (mph)	Diesel PM	DEOG	Benzene	Acrolein	Acetaldehyde	Formaldehyde	Butadiene
<5 mph	0.016152	0.060449	0.012155	0.000595	0.005970	0.016130	0.002636
5 mph ~ 10 mph	0.011624	0.035562	0.008200	0.000406	0.003711	0.010277	0.001793
10 mph ~ 15 mph	0.008320	0.019196	0.005787	0.000293	0.002257	0.006562	0.001281
15 mph ~ 20 mph	0.006275	0.011785	0.004327	0.000221	0.001533	0.004611	0.000965
20 mph ~ 25 mph	0.005265	0.009645	0.003451	0.000176	0.001245	0.003717	0.000770
25 mph ~ 30 mph	0.004524	0.007958	0.002900	0.000148	0.001045	0.003118	0.000648
30 mph ~ 35 mph	0.003996	0.006728	0.002545	0.000130	0.000908	0.002715	0.000571
35 mph ~ 40 mph	0.003671	0.005907	0.002370	0.000122	0.000827	0.002491	0.000533
40 mph ~ 45 mph	0.003572	0.005465	0.002309	0.000119	0.000792	0.002398	0.000521
45 mph ~ 50 mph	0.003623	0.005347	0.002370	0.000122	0.000803	0.002439	0.000536
50 mph ~ 55 mph	0.003859	0.005601	0.002573	0.000133	0.000864	0.002630	0.000584
55 mph ~ 60 mph	0.004235	0.006151	0.002929	0.000152	0.000978	0.002980	0.000666
60 mph ~ 65 mph	0.004801	0.007085	0.003524	0.000183	0.001164	0.003556	0.000804
65 mph ~ 70 mph	0.005491	0.008350	0.004063	0.000211	0.001381	0.004159	0.000931
>70 mph	0.006387	0.009958	0.004924	0.000256	0.001702	0.005077	0.001135

OP (min)	TOG	Benzene	Acrolein	Acetaldehyde	Formaldehyde	Butadiene
1		0.001495	0.000000	0.000000	0.000000	0.000010
2		0.000837	0.000000	0.000000	0.000000	0.000006
3		0.000642	0.000000	0.000000	0.000000	0.000004
4		0.000559	0.000000	0.000000	0.000000	0.000004
5		0.000511	0.000000	0.000000	0.000000	0.000004
10		0.000421	0.000000	0.000000	0.000000	0.000003
15		0.000406	0.000000	0.000000	0.000000	0.000003
20		0.000397	0.000000	0.000000	0.000000	0.000003
25		0.000402	0.000000	0.000000	0.000000	0.000003
30		0.000402	0.000000	0.000000	0.000000	0.000003
35		0.000393	0.000000	0.000000	0.000000	0.000003
40		0.000391	0.000000	0.000000	0.000000	0.000003
45		0.000388	0.000000	0.000000	0.000000	0.000003
50		0.000381	0.000000	0.000000	0.000000	0.000003
55		0.000377	0.000000	0.000000	0.000000	0.000003
60		0.000371	0.000000	0.000000	0.000000	0.000003

Running Exhaust (g/day)

Emissions	Diesel PM	DEOG	Benzene	Acrolein	Acetaldehyde	Formaldehyde	Butadiene
Entire Corridor	28897	45974	19363	997	6694	20187	4375
Segment1	28897	45974	19363	997	6694	20187	4375

Running Loss (g/day)

	TOG	Benzene	Acrolein	Acetaldehyde	Formaldehyde	Butadiene
Entire Corridor		3588	0	0	0	29
Segment1		3588	0	0	0	29

Scenario	Year 2018 - No Build
Geographic Area	Orange
Analysis Year	2018
Season	Annual
Truck %	
PK	7
OP	7

Running Exhaust (g/mile)

PK Emission Factors (mph)	Diesel PM	DEOG	Benzene	Acrolein	Acetaldehyde	Formaldehyde	Butadiene
<5 mph	0.008238	0.035266	0.006204	0.000295	0.003416	0.008999	0.001305
5 mph ~ 10 mph	0.006140	0.021008	0.004169	0.000201	0.002113	0.005698	0.000886
10 mph ~ 15 mph	0.004707	0.011814	0.002941	0.000145	0.001284	0.003625	0.000634
15 mph ~ 20 mph	0.003697	0.007719	0.002210	0.000110	0.000891	0.002581	0.000480
20 mph ~ 25 mph	0.003124	0.006460	0.001778	0.000089	0.000738	0.002115	0.000387
25 mph ~ 30 mph	0.002722	0.005439	0.001505	0.000075	0.000630	0.001797	0.000328
30 mph ~ 35 mph	0.002474	0.004711	0.001340	0.000067	0.000553	0.001584	0.000293
35 mph ~ 40 mph	0.002310	0.004159	0.001257	0.000063	0.000505	0.001457	0.000276
40 mph ~ 45 mph	0.002260	0.003786	0.001253	0.000063	0.000482	0.001411	0.000277
45 mph ~ 50 mph	0.002302	0.003591	0.001295	0.000066	0.000481	0.001423	0.000288
50 mph ~ 55 mph	0.002396	0.003562	0.001433	0.000073	0.000508	0.001525	0.000320
55 mph ~ 60 mph	0.002615	0.003670	0.001662	0.000086	0.000564	0.001718	0.000373
60 mph ~ 65 mph	0.002895	0.003959	0.002039	0.000106	0.000659	0.002044	0.000461
65 mph ~ 70 mph	0.003225	0.004419	0.002477	0.000129	0.000791	0.002457	0.000564
>70 mph	0.003681	0.005058	0.003186	0.000166	0.000998	0.003109	0.000730

OP Emission Factors (mph)	Diesel PM	DEOG	Benzene	Acrolein	Acetaldehyde	Formaldehyde	Butadiene
<5 mph	0.008238	0.035266	0.006204	0.000295	0.003416	0.008999	0.001305
5 mph ~ 10 mph	0.006140	0.021008	0.004169	0.000201	0.002113	0.005698	0.000886
10 mph ~ 15 mph	0.004707	0.011814	0.002941	0.000145	0.001284	0.003625	0.000634
15 mph ~ 20 mph	0.003697	0.007719	0.002210	0.000110	0.000891	0.002581	0.000480
20 mph ~ 25 mph	0.003124	0.006460	0.001778	0.000089	0.000738	0.002115	0.000387
25 mph ~ 30 mph	0.002722	0.005439	0.001505	0.000075	0.000630	0.001797	0.000328
30 mph ~ 35 mph	0.002474	0.004711	0.001340	0.000067	0.000553	0.001584	0.000293
35 mph ~ 40 mph	0.002310	0.004159	0.001257	0.000063	0.000505	0.001457	0.000276
40 mph ~ 45 mph	0.002260	0.003786	0.001253	0.000063	0.000482	0.001411	0.000277
45 mph ~ 50 mph	0.002302	0.003591	0.001295	0.000066	0.000481	0.001423	0.000288
50 mph ~ 55 mph	0.002396	0.003562	0.001433	0.000073	0.000508	0.001525	0.000320
55 mph ~ 60 mph	0.002615	0.003670	0.001662	0.000086	0.000564	0.001718	0.000373
60 mph ~ 65 mph	0.002895	0.003959	0.002039	0.000106	0.000659	0.002044	0.000461
65 mph ~ 70 mph	0.003225	0.004419	0.002477	0.000129	0.000791	0.002457	0.000564
>70 mph	0.003681	0.005058	0.003186	0.000166	0.000998	0.003109	0.000730

Running Loss (g/min)

(min)	TOG	Benzene	Acrolein	Acetaldehyde	Formaldehyde	Butadiene
1		0.001431	0.000000	0.000000	0.000000	0.000010
2		0.000761	0.000000	0.000000	0.000000	0.000005
3		0.000562	0.000000	0.000000	0.000000	0.000004
4		0.000474	0.000000	0.000000	0.000000	0.000003
5		0.000426	0.000000	0.000000	0.000000	0.000003
10		0.000333	0.000000	0.000000	0.000000	0.000002
15		0.000306	0.000000	0.000000	0.000000	0.000002
20		0.000296	0.000000	0.000000	0.000000	0.000002
25		0.000297	0.000000	0.000000	0.000000	0.000002
30		0.000296	0.000000	0.000000	0.000000	0.000002
35		0.000287	0.000000	0.000000	0.000000	0.000002
40		0.000287	0.000000	0.000000	0.000000	0.000002
45		0.000283	0.000000	0.000000	0.000000	0.000002
50		0.000283	0.000000	0.000000	0.000000	0.000002
55		0.000277	0.000000	0.000000	0.000000	0.000002
60		0.000273	0.000000	0.000000	0.000000	0.000002

(min)	TOG	Benzene	Acrolein	Acetaldehyde	Formaldehyde	Butadiene
1		0.001431	0.000000	0.000000	0.000000	0.000010
2		0.000761	0.000000	0.000000	0.000000	0.000005
3		0.000562	0.000000	0.000000	0.000000	0.000004
4		0.000474	0.000000	0.000000	0.000000	0.000003
5		0.000426	0.000000	0.000000	0.000000	0.000003
10		0.000333	0.000000	0.000000	0.000000	0.000002
15		0.000306	0.000000	0.000000	0.000000	0.000002
20		0.000296	0.000000	0.000000	0.000000	0.000002
25		0.000297	0.000000	0.000000	0.000000	0.000002
30		0.000296	0.000000	0.000000	0.000000	0.000002
35		0.000287	0.000000	0.000000	0.000000	0.000002
40		0.000287	0.000000	0.000000	0.000000	0.000002
45		0.000283	0.000000	0.000000	0.000000	0.000002
50		0.000283	0.000000	0.000000	0.000000	0.000002
55		0.000277	0.000000	0.000000	0.000000	0.000002
60		0.000273	0.000000	0.000000	0.000000	0.000002

Running Exhaust (g/day)

Emissions	Diesel PM	DEOG	Benzene	Acrolein	Acetaldehyde	Formaldehyde	Butadiene
Entire Corridor	18606	31680	11125	565	4176	12311	2467
Segment1	18606	31680	11125	565	4176	12311	2467

Running Loss (g/day)

	TOG	Benzene	Acrolein	Acetaldehyde	Formaldehyde	Butadiene
Entire Corridor		2836	0	0	0	21
Segment1		2836	0	0	0	21

Scenario	Opening Year - Build
Geographic Area	Orange
Analysis Year	2018
Season	Annual
Truck %	
PK	7
OP	7

Running Exhaust (g/mile)

PK Emission Factors (mph)	Diesel PM	DEOG	Benzene	Acrolein	Acetaldehyde	Formaldehyde	Butadiene
<5 mph	0.008238	0.035266	0.006204	0.000295	0.003416	0.008999	0.001305
5 mph ~ 10 mph	0.006140	0.021008	0.004169	0.000201	0.002113	0.005698	0.000886
10 mph ~ 15 mph	0.004707	0.011814	0.002941	0.000145	0.001284	0.003625	0.000634
15 mph ~ 20 mph	0.003697	0.007719	0.002210	0.000110	0.000891	0.002581	0.000480
20 mph ~ 25 mph	0.003124	0.006460	0.001778	0.000089	0.000738	0.002115	0.000387
25 mph ~ 30 mph	0.002722	0.005439	0.001505	0.000075	0.000630	0.001797	0.000328
30 mph ~ 35 mph	0.002474	0.004711	0.001340	0.000067	0.000553	0.001584	0.000293
35 mph ~ 40 mph	0.002310	0.004159	0.001257	0.000063	0.000505	0.001457	0.000276
40 mph ~ 45 mph	0.002260	0.003786	0.001253	0.000063	0.000482	0.001411	0.000277
45 mph ~ 50 mph	0.002302	0.003591	0.001295	0.000066	0.000481	0.001423	0.000288
50 mph ~ 55 mph	0.002396	0.003562	0.001433	0.000073	0.000508	0.001525	0.000320
55 mph ~ 60 mph	0.002615	0.003670	0.001662	0.000086	0.000564	0.001718	0.000373
60 mph ~ 65 mph	0.002895	0.003959	0.002039	0.000106	0.000659	0.002044	0.000461
65 mph ~ 70 mph	0.003225	0.004419	0.002477	0.000129	0.000791	0.002457	0.000564
>70 mph	0.003681	0.005058	0.003186	0.000166	0.000998	0.003109	0.000730

OP Emission Factors (mph)	Diesel PM	DEOG	Benzene	Acrolein	Acetaldehyde	Formaldehyde	Butadiene
<5 mph	0.008238	0.035266	0.006204	0.000295	0.003416	0.008999	0.001305
5 mph ~ 10 mph	0.006140	0.021008	0.004169	0.000201	0.002113	0.005698	0.000886
10 mph ~ 15 mph	0.004707	0.011814	0.002941	0.000145	0.001284	0.003625	0.000634
15 mph ~ 20 mph	0.003697	0.007719	0.002210	0.000110	0.000891	0.002581	0.000480
20 mph ~ 25 mph	0.003124	0.006460	0.001778	0.000089	0.000738	0.002115	0.000387
25 mph ~ 30 mph	0.002722	0.005439	0.001505	0.000075	0.000630	0.001797	0.000328
30 mph ~ 35 mph	0.002474	0.004711	0.001340	0.000067	0.000553	0.001584	0.000293
35 mph ~ 40 mph	0.002310	0.004159	0.001257	0.000063	0.000505	0.001457	0.000276
40 mph ~ 45 mph	0.002260	0.003786	0.001253	0.000063	0.000482	0.001411	0.000277
45 mph ~ 50 mph	0.002302	0.003591	0.001295	0.000066	0.000481	0.001423	0.000288
50 mph ~ 55 mph	0.002396	0.003562	0.001433	0.000073	0.000508	0.001525	0.000320
55 mph ~ 60 mph	0.002615	0.003670	0.001662	0.000086	0.000564	0.001718	0.000373
60 mph ~ 65 mph	0.002895	0.003959	0.002039	0.000106	0.000659	0.002044	0.000461
65 mph ~ 70 mph	0.003225	0.004419	0.002477	0.000129	0.000791	0.002457	0.000564
>70 mph	0.003681	0.005058	0.003186	0.000166	0.000998	0.003109	0.000730

Running Loss (g/min)

(min)	TOG	Benzene	Acrolein	Acetaldehyde	Formaldehyde	Butadiene
1		0.001431	0.000000	0.000000	0.000000	0.000010
2		0.000761	0.000000	0.000000	0.000000	0.000005
3		0.000562	0.000000	0.000000	0.000000	0.000004
4		0.000474	0.000000	0.000000	0.000000	0.000003
5		0.000426	0.000000	0.000000	0.000000	0.000003
10		0.000333	0.000000	0.000000	0.000000	0.000002
15		0.000306	0.000000	0.000000	0.000000	0.000002
20		0.000296	0.000000	0.000000	0.000000	0.000002
25		0.000297	0.000000	0.000000	0.000000	0.000002
30		0.000296	0.000000	0.000000	0.000000	0.000002
35		0.000287	0.000000	0.000000	0.000000	0.000002
40		0.000287	0.000000	0.000000	0.000000	0.000002
45		0.000283	0.000000	0.000000	0.000000	0.000002
50		0.000283	0.000000	0.000000	0.000000	0.000002
55		0.000277	0.000000	0.000000	0.000000	0.000002
60		0.000273	0.000000	0.000000	0.000000	0.000002

(min)	TOG	Benzene	Acrolein	Acetaldehyde	Formaldehyde	Butadiene
1		0.001431	0.000000	0.000000	0.000000	0.000010
2		0.000761	0.000000	0.000000	0.000000	0.000005
3		0.000562	0.000000	0.000000	0.000000	0.000004
4		0.000474	0.000000	0.000000	0.000000	0.000003
5		0.000426	0.000000	0.000000	0.000000	0.000003
10		0.000333	0.000000	0.000000	0.000000	0.000002
15		0.000306	0.000000	0.000000	0.000000	0.000002
20		0.000296	0.000000	0.000000	0.000000	0.000002
25		0.000297	0.000000	0.000000	0.000000	0.000002
30		0.000296	0.000000	0.000000	0.000000	0.000002
35		0.000287	0.000000	0.000000	0.000000	0.000002
40		0.000287	0.000000	0.000000	0.000000	0.000002
45		0.000283	0.000000	0.000000	0.000000	0.000002
50		0.000283	0.000000	0.000000	0.000000	0.000002
55		0.000277	0.000000	0.000000	0.000000	0.000002
60		0.000273	0.000000	0.000000	0.000000	0.000002

Running Exhaust (g/day)

Emissions	Diesel PM	DEOG	Benzene	Acrolein	Acetaldehyde	Formaldehyde	Butadiene
Entire Corridor	18615	31639	11133	565	4176	12313	2469
Segment1	18615	31639	11133	565	4176	12313	2469

Running Loss (g/day)

	TOG	Benzene	Acrolein	Acetaldehyde	Formaldehyde	Butadiene
Entire Corridor		2829	0	0	0	21
Segment1		2829	0	0	0	21

Scenario	Future Year - No Build
Geographic Area	Orange
Analysis Year	2040
Season	Annual
Truck %	
PK	7
OP	7

Running Exhaust (g/mile)

PK Emission Factors (mph)	Diesel PM	DEOG	Benzene	Acrolein	Acetaldehyde	Formaldehyde	Butadiene
<5 mph	0.004346	0.024721	0.002777	0.000124	0.002072	0.005060	0.000562
5 mph ~ 10 mph	0.003456	0.014670	0.001824	0.000083	0.001261	0.003132	0.000373
10 mph ~ 15 mph	0.002803	0.008253	0.001254	0.000059	0.000751	0.001932	0.000262
15 mph ~ 20 mph	0.002340	0.005568	0.000933	0.000044	0.000523	0.001368	0.000196
20 mph ~ 25 mph	0.002009	0.004759	0.000750	0.000035	0.000442	0.001140	0.000158
25 mph ~ 30 mph	0.001801	0.004072	0.000631	0.000030	0.000380	0.000975	0.000133
30 mph ~ 35 mph	0.001669	0.003576	0.000558	0.000026	0.000335	0.000859	0.000118
35 mph ~ 40 mph	0.001570	0.003174	0.000525	0.000025	0.000304	0.000785	0.000111
40 mph ~ 45 mph	0.001582	0.002826	0.000512	0.000025	0.000282	0.000739	0.000110
45 mph ~ 50 mph	0.001600	0.002619	0.000535	0.000026	0.000272	0.000728	0.000116
50 mph ~ 55 mph	0.001677	0.002478	0.000597	0.000030	0.000274	0.000756	0.000130
55 mph ~ 60 mph	0.001787	0.002419	0.000687	0.000034	0.000288	0.000816	0.000152
60 mph ~ 65 mph	0.001925	0.002435	0.000840	0.000043	0.000318	0.000933	0.000187
65 mph ~ 70 mph	0.002122	0.002542	0.001017	0.000052	0.000364	0.001085	0.000229
>70 mph	0.002351	0.002731	0.001305	0.000068	0.000441	0.001337	0.000297

OP Emission Factors (mph)	Diesel PM	DEOG	Benzene	Acrolein	Acetaldehyde	Formaldehyde	Butadiene
<5 mph	0.004346	0.024721	0.002777	0.000124	0.002072	0.005060	0.000562
5 mph ~ 10 mph	0.003456	0.014670	0.001824	0.000083	0.001261	0.003132	0.000373
10 mph ~ 15 mph	0.002803	0.008253	0.001254	0.000059	0.000751	0.001932	0.000262
15 mph ~ 20 mph	0.002340	0.005568	0.000933	0.000044	0.000523	0.001368	0.000196
20 mph ~ 25 mph	0.002009	0.004759	0.000750	0.000035	0.000442	0.001140	0.000158
25 mph ~ 30 mph	0.001801	0.004072	0.000631	0.000030	0.000380	0.000975	0.000133
30 mph ~ 35 mph	0.001669	0.003576	0.000558	0.000026	0.000335	0.000859	0.000118
35 mph ~ 40 mph	0.001570	0.003174	0.000525	0.000025	0.000304	0.000785	0.000111
40 mph ~ 45 mph	0.001582	0.002826	0.000512	0.000025	0.000282	0.000739	0.000110
45 mph ~ 50 mph	0.001600	0.002619	0.000535	0.000026	0.000272	0.000728	0.000116
50 mph ~ 55 mph	0.001677	0.002478	0.000597	0.000030	0.000274	0.000756	0.000130
55 mph ~ 60 mph	0.001787	0.002419	0.000687	0.000034	0.000288	0.000816	0.000152
60 mph ~ 65 mph	0.001925	0.002435	0.000840	0.000043	0.000318	0.000933	0.000187
65 mph ~ 70 mph	0.002122	0.002542	0.001017	0.000052	0.000364	0.001085	0.000229
>70 mph	0.002351	0.002731	0.001305	0.000068	0.000441	0.001337	0.000297

Running Loss (g/min)

(min)	TOG	Benzene	Acrolein	Acetaldehyde	Formaldehyde	Butadiene
1		0.000761	0.000000	0.000000	0.000000	0.000005
2		0.000404	0.000000	0.000000	0.000000	0.000003
3		0.000299	0.000000	0.000000	0.000000	0.000002
4		0.000256	0.000000	0.000000	0.000000	0.000002
5		0.000234	0.000000	0.000000	0.000000	0.000002
10		0.000187	0.000000	0.000000	0.000000	0.000001
15		0.000180	0.000000	0.000000	0.000000	0.000001
20		0.000173	0.000000	0.000000	0.000000	0.000001
25		0.000173	0.000000	0.000000	0.000000	0.000001
30		0.000171	0.000000	0.000000	0.000000	0.000001
35		0.000168	0.000000	0.000000	0.000000	0.000001
40		0.000168	0.000000	0.000000	0.000000	0.000001
45		0.000168	0.000000	0.000000	0.000000	0.000001
50		0.000167	0.000000	0.000000	0.000000	0.000001
55		0.000159	0.000000	0.000000	0.000000	0.000001
60		0.000159	0.000000	0.000000	0.000000	0.000001

(min)	TOG	Benzene	Acrolein	Acetaldehyde	Formaldehyde	Butadiene
1		0.000761	0.000000	0.000000	0.000000	0.000005
2		0.000404	0.000000	0.000000	0.000000	0.000003
3		0.000299	0.000000	0.000000	0.000000	0.000002
4		0.000256	0.000000	0.000000	0.000000	0.000002
5		0.000234	0.000000	0.000000	0.000000	0.000002
10		0.000187	0.000000	0.000000	0.000000	0.000001
15		0.000180	0.000000	0.000000	0.000000	0.000001
20		0.000173	0.000000	0.000000	0.000000	0.000001
25		0.000173	0.000000	0.000000	0.000000	0.000001
30		0.000171	0.000000	0.000000	0.000000	0.000001
35		0.000168	0.000000	0.000000	0.000000	0.000001
40		0.000168	0.000000	0.000000	0.000000	0.000001
45		0.000168	0.000000	0.000000	0.000000	0.000001
50		0.000167	0.000000	0.000000	0.000000	0.000001
55		0.000159	0.000000	0.000000	0.000000	0.000001
60		0.000159	0.000000	0.000000	0.000000	0.000001

Running Exhaust (g/day)

Emissions	Diesel PM	DEOG	Benzene	Acrolein	Acetaldehyde	Formaldehyde	Butadiene
Entire Corridor	14211	26281	5230	254	2685	7170	1128
Segment1	14211	26281	5230	254	2685	7170	1128

Running Loss (g/day)

	TOG	Benzene	Acrolein	Acetaldehyde	Formaldehyde	Butadiene
Entire Corridor		1932	0	0	0	12
Segment1		1932	0	0	0	12

Scenario	Future Year - Build
Geographic Area	Orange
Analysis Year	2040
Season	Annual
Truck %	
PK	7
OP	7

Running Exhaust (g/mile)

PK Emission Factors (mph)	Diesel PM	DEOG	Benzene	Acrolein	Acetaldehyde	Formaldehyde	Butadiene
<5 mph	0.004346	0.024721	0.002777	0.000124	0.002072	0.005060	0.000562
5 mph ~ 10 mph	0.003456	0.014670	0.001824	0.000083	0.001261	0.003132	0.000373
10 mph ~ 15 mph	0.002803	0.008253	0.001254	0.000059	0.000751	0.001932	0.000262
15 mph ~ 20 mph	0.002340	0.005568	0.000933	0.000044	0.000523	0.001368	0.000196
20 mph ~ 25 mph	0.002009	0.004759	0.000750	0.000035	0.000442	0.001140	0.000158
25 mph ~ 30 mph	0.001801	0.004072	0.000631	0.000030	0.000380	0.000975	0.000133
30 mph ~ 35 mph	0.001669	0.003576	0.000558	0.000026	0.000335	0.000859	0.000118
35 mph ~ 40 mph	0.001570	0.003174	0.000525	0.000025	0.000304	0.000785	0.000111
40 mph ~ 45 mph	0.001582	0.002826	0.000512	0.000025	0.000282	0.000739	0.000110
45 mph ~ 50 mph	0.001600	0.002619	0.000535	0.000026	0.000272	0.000728	0.000116
50 mph ~ 55 mph	0.001677	0.002478	0.000597	0.000030	0.000274	0.000756	0.000130
55 mph ~ 60 mph	0.001787	0.002419	0.000687	0.000034	0.000288	0.000816	0.000152
60 mph ~ 65 mph	0.001925	0.002435	0.000840	0.000043	0.000318	0.000933	0.000187
65 mph ~ 70 mph	0.002122	0.002542	0.001017	0.000052	0.000364	0.001085	0.000229
>70 mph	0.002351	0.002731	0.001305	0.000068	0.000441	0.001337	0.000297

Running Loss (g/min)

PK (min)	TOG	Benzene	Acrolein	Acetaldehyde	Formaldehyde	Butadiene
1		0.000761	0.000000	0.000000	0.000000	0.000005
2		0.000404	0.000000	0.000000	0.000000	0.000003
3		0.000299	0.000000	0.000000	0.000000	0.000002
4		0.000256	0.000000	0.000000	0.000000	0.000002
5		0.000234	0.000000	0.000000	0.000000	0.000002
10		0.000187	0.000000	0.000000	0.000000	0.000001
15		0.000180	0.000000	0.000000	0.000000	0.000001
20		0.000173	0.000000	0.000000	0.000000	0.000001
25		0.000173	0.000000	0.000000	0.000000	0.000001
30		0.000171	0.000000	0.000000	0.000000	0.000001
35		0.000168	0.000000	0.000000	0.000000	0.000001
40		0.000168	0.000000	0.000000	0.000000	0.000001
45		0.000168	0.000000	0.000000	0.000000	0.000001
50		0.000167	0.000000	0.000000	0.000000	0.000001
55		0.000159	0.000000	0.000000	0.000000	0.000001
60		0.000159	0.000000	0.000000	0.000000	0.000001

OP Emission Factors (mph)	Diesel PM	DEOG	Benzene	Acrolein	Acetaldehyde	Formaldehyde	Butadiene
<5 mph	0.004346	0.024721	0.002777	0.000124	0.002072	0.005060	0.000562
5 mph ~ 10 mph	0.003456	0.014670	0.001824	0.000083	0.001261	0.003132	0.000373
10 mph ~ 15 mph	0.002803	0.008253	0.001254	0.000059	0.000751	0.001932	0.000262
15 mph ~ 20 mph	0.002340	0.005568	0.000933	0.000044	0.000523	0.001368	0.000196
20 mph ~ 25 mph	0.002009	0.004759	0.000750	0.000035	0.000442	0.001140	0.000158
25 mph ~ 30 mph	0.001801	0.004072	0.000631	0.000030	0.000380	0.000975	0.000133
30 mph ~ 35 mph	0.001669	0.003576	0.000558	0.000026	0.000335	0.000859	0.000118
35 mph ~ 40 mph	0.001570	0.003174	0.000525	0.000025	0.000304	0.000785	0.000111
40 mph ~ 45 mph	0.001582	0.002826	0.000512	0.000025	0.000282	0.000739	0.000110
45 mph ~ 50 mph	0.001600	0.002619	0.000535	0.000026	0.000272	0.000728	0.000116
50 mph ~ 55 mph	0.001677	0.002478	0.000597	0.000030	0.000274	0.000756	0.000130
55 mph ~ 60 mph	0.001787	0.002419	0.000687	0.000034	0.000288	0.000816	0.000152
60 mph ~ 65 mph	0.001925	0.002435	0.000840	0.000043	0.000318	0.000933	0.000187
65 mph ~ 70 mph	0.002122	0.002542	0.001017	0.000052	0.000364	0.001085	0.000229
>70 mph	0.002351	0.002731	0.001305	0.000068	0.000441	0.001337	0.000297

OP (min)	TOG	Benzene	Acrolein	Acetaldehyde	Formaldehyde	Butadiene
1		0.000761	0.000000	0.000000	0.000000	0.000005
2		0.000404	0.000000	0.000000	0.000000	0.000003
3		0.000299	0.000000	0.000000	0.000000	0.000002
4		0.000256	0.000000	0.000000	0.000000	0.000002
5		0.000234	0.000000	0.000000	0.000000	0.000002
10		0.000187	0.000000	0.000000	0.000000	0.000001
15		0.000180	0.000000	0.000000	0.000000	0.000001
20		0.000173	0.000000	0.000000	0.000000	0.000001
25		0.000173	0.000000	0.000000	0.000000	0.000001
30		0.000171	0.000000	0.000000	0.000000	0.000001
35		0.000168	0.000000	0.000000	0.000000	0.000001
40		0.000168	0.000000	0.000000	0.000000	0.000001
45		0.000168	0.000000	0.000000	0.000000	0.000001
50		0.000167	0.000000	0.000000	0.000000	0.000001
55		0.000159	0.000000	0.000000	0.000000	0.000001
60		0.000159	0.000000	0.000000	0.000000	0.000001

Running Exhaust (g/day)

Emissions	Diesel PM	DEOG	Benzene	Acrolein	Acetaldehyde	Formaldehyde	Butadiene
Entire Corridor	14237	26198	5237	254	2681	7166	1130
Segment1	14237	26198	5237	254	2681	7166	1130

Running Loss (g/day)

	TOG	Benzene	Acrolein	Acetaldehyde	Formaldehyde	Butadiene
Entire Corridor		1923	0	0	0	12
Segment1		1923	0	0	0	12

APPENDIX F

CRITERIA POLLUTANT AND GHG EMISSIONS ANALYSIS

I-5 HOV (55 to 57) PR/ED - Corridor Focused Area VMT by Speed Bin

VMT by Speed Bin					
	Existing	**Year 2018**		**Year 2040**	
Speed Bin	**2011**	No Build	Build Alternatives	No Build	Build Alternatives
0-5 mph	0	0	0	0	0
5-10 mph	9,629	11,178	11,292	14,271	14,577
10-15 mph	23,930	33,129	29,473	49,362	39,902
15-20 mph	49,130	72,535	67,576	113,079	100,315
20-25 mph	149,190	262,080	245,921	451,997	410,646
25-30 mph	797,794	997,227	999,414	1,367,089	1,374,011
30-35 mph	1,300,238	1,319,538	1,305,795	1,433,970	1,398,185
35-40 mph	939,192	872,564	895,788	826,521	886,470
40-45 mph	427,174	402,509	415,663	390,577	424,626
45-50 mph	337,257	493,365	487,876	764,410	751,106
50-55 mph	877,200	733,703	731,150	560,888	553,220
55-60 mph	1,043,885	1,044,219	1,060,239	1,111,871	1,153,487
60-65 mph	505,755	531,278	532,196	604,566	607,075
65-70 mph	311,001	277,889	281,877	244,995	255,132
70-75 mph	84,825	90,186	90,040	104,204	103,849
Total	**6,856,200**	**7,141,400**	**7,154,300**	**8,037,800**	**8,072,600**

Source: Fehr & Peers 2013

Emission Estimates (2018) - Pounds per Day

Emission Factors (grams/mile)

Speed	ROG	NOx	CO	PM10	PM2.5	CO2	CO2 (Pavley)
5	0.24	0.72	2.64	0.02	0.02	1419.18	1150.25
10	0.18	0.71	2.40	0.02	0.02	1080.72	880.05
15	0.11	0.50	1.96	0.01	0.01	831.93	677.00
20	0.12	0.69	2.22	0.01	0.01	822.47	699.28
25	0.05	0.26	1.47	0.00	0.00	532.21	428.63
30	0.04	0.24	1.34	0.00	0.00	459.70	370.28
35	0.04	0.26	1.24	0.00	0.00	418.31	338.50
40	0.04	0.28	1.15	0.00	0.00	396.07	322.47
45	0.03	0.31	1.09	0.00	0.00	391.48	320.91
50	0.03	0.31	1.05	0.00	0.00	391.21	320.62
55	0.04	0.37	1.03	0.01	0.01	413.82	341.20
60	0.04	0.48	1.01	0.01	0.01	447.85	371.40
65	0.06	0.66	1.44	0.01	0.01	643.32	531.92
70	0.06	0.67	1.45	0.01	0.01	643.89	532.41

Source: EMFAC 2011

Emission Estimates (2018) - Pounds per Day

No Build

Speed	ROG	NOx	CO	PM10	PM2.5	CO2	CO2 (Pavley)
5	6.00	17.68	65.08	0.45	0.42	34,973.61	28,346.18
10	13.28	51.98	175.43	1.19	1.10	78,932.49	64,276.32
15	18.31	79.75	313.43	1.62	1.50	133,035.96	108,261.25
20	67.88	398.49	1,280.47	5.66	5.22	475,209.87	404,033.86
25	116.00	571.85	3,231.30	9.12	8.42	1,170,073.40	942,356.30
30	125.07	700.97	3,898.76	10.01	9.24	1,337,304.49	1,077,172.17
35	73.56	495.59	2,377.37	6.57	6.06	804,696.13	651,158.61
40	31.68	248.28	1,018.79	3.22	2.97	351,466.29	286,151.88
45	37.70	332.34	1,181.30	4.56	4.20	425,807.01	349,043.19
50	55.22	495.07	1,694.17	7.25	6.68	632,790.62	518,612.10
55	84.47	842.24	2,361.08	13.30	12.25	952,658.26	785,470.40
60	48.95	563.92	1,185.93	8.90	8.20	524,555.99	435,002.71
65	37.09	407.03	885.21	6.48	5.96	394,125.15	325,874.57
70	12.05	132.44	288.11	2.11	1.94	128,022.36	105,858.04
Total	727.3	5,337.7	19,956.4	80.4	74.1	7,443,651.6	6,081,617.6

Build Alternatives

Speed	ROG	NOx	CO	PM10	PM2.5	CO2	CO2 (Pavley)
5	6.06	17.86	65.74	0.46	0.42	35,330.12	28,635.14
10	11.82	46.25	156.07	1.06	0.98	70,222.81	57,183.85
15	17.06	74.30	292.00	1.51	1.40	123,940.28	100,859.42
20	63.69	373.92	1,201.52	5.31	4.89	445,910.29	379,122.71
25	116.25	573.11	3,238.39	9.14	8.44	1,172,639.11	944,422.67
30	123.77	693.67	3,858.16	9.90	9.14	1,323,376.19	1,065,953.20
35	75.52	508.78	2,440.64	6.74	6.22	826,114.29	668,490.15
40	32.72	256.39	1,052.08	3.32	3.06	362,952.10	295,503.24
45	37.28	328.64	1,168.16	4.51	4.15	421,069.67	345,159.88
50	55.02	493.34	1,688.28	7.22	6.65	630,589.55	516,808.18
55	85.77	855.17	2,397.30	13.50	12.43	967,273.36	797,520.60
60	49.04	564.90	1,187.98	8.92	8.21	525,462.36	435,754.35
65	37.62	412.88	897.91	6.57	6.05	399,780.63	330,550.69
70	12.03	132.23	287.64	2.10	1.94	127,814.38	105,686.07
Total	724	5,331	19,932	80	74	7,432,475	6,071,650

Summary

	ROG	NOx	CO	PM10	PM2.5	CO2	CO2 (Pavley)
No Build	727.3	5,337.7	19,956.4	80.4	74.1	7,443,651.6	6,081,617.6
Build	723.7	5,331.4	19,931.9	80.3	74.0	7,432,475.1	6,071,650.2
Net Change	(3.6)	(6.2)	(24.6)	(0.2)	(0.1)	(11,176.5)	(9,967.4)

Emission Estimates (2040) - Pounds per Day

Emission Factors

Speed	ROG	NOx	CO	PM10	PM2.5	CO2	CO2 (Pavley)
5	0.147	0.355	1.377	0.017	0.015	1452.554	997.174
10	0.098	0.356	1.248	0.013	0.012	1105.699	765.877
15	0.060	0.248	1.064	0.009	0.008	847.279	584.764
20	0.059	0.311	1.089	0.008	0.007	838.610	622.529
25	0.028	0.136	0.850	0.004	0.004	544.000	368.154
30	0.023	0.127	0.782	0.003	0.003	471.914	320.217
35	0.021	0.135	0.722	0.003	0.003	432.930	297.676
40	0.020	0.141	0.668	0.004	0.003	409.149	284.522
45	0.020	0.152	0.629	0.004	0.004	407.921	288.647
50	0.020	0.149	0.600	0.004	0.004	406.727	287.756
55	0.021	0.164	0.580	0.005	0.005	424.016	301.313
60	0.025	0.228	0.569	0.008	0.007	472.274	343.653
65	0.034	0.301	0.775	0.010	0.010	647.304	467.007
70	0.034	0.301	0.778	0.010	0.010	647.590	467.264

Emission Estimates (2040) - Pounds per Day

No Build

Speed	ROG	NOx	CO	PM10	PM2.5	CO2	CO2 (Pavley)
5	4.63	11.16	43.33	0.52	0.48	45,700.73	31,373.43
10	10.67	38.79	135.79	1.46	1.35	120,328.15	83,346.87
15	14.86	61.89	265.23	2.16	2.00	211,224.22	145,779.98
20	59.20	309.98	1,085.11	8.00	7.38	835,659.57	620,338.64
25	83.71	408.81	2,561.84	12.40	11.48	1,639,568.21	1,109,583.48
30	73.18	400.62	2,472.14	10.93	10.11	1,491,888.75	1,012,319.44
35	38.75	246.85	1,316.44	6.25	5.78	788,870.58	542,415.03
40	17.21	121.10	575.42	3.05	2.81	352,307.25	244,994.24
45	33.68	255.49	1,059.36	6.97	6.43	687,441.45	486,438.02
50	24.22	183.88	741.75	5.47	5.04	502,936.07	355,823.06
55	51.08	402.60	1,421.87	12.91	11.90	1,039,370.85	738,593.78
60	33.35	304.35	758.54	10.66	9.82	629,464.60	458,033.77
65	18.57	162.36	418.59	5.65	5.21	349,622.80	252,240.50
70	7.91	69.22	178.70	2.41	2.22	148,770.47	107,344.38
Total	471.0	2,977.1	13,034.1	88.8	82.0	8,843,153.7	6,188,624.6

Build Alternatives

Speed	ROG	NOx	CO	PM10	PM2.5	CO2	CO2 (Pavley)
5	4.73	11.40	44.26	0.53	0.49	46,680.38	32,045.95
10	8.62	31.36	109.77	1.18	1.09	97,265.98	67,372.55
15	13.18	54.90	235.29	1.91	1.77	187,380.30	129,323.69
20	53.78	281.62	985.84	7.27	6.71	759,207.96	563,586.00
25	84.14	410.88	2,574.82	12.47	11.54	1,647,870.15	1,115,201.85
30	71.36	390.62	2,410.45	10.66	9.86	1,454,659.17	987,057.35
35	41.56	264.75	1,411.93	6.71	6.20	846,088.42	581,757.12
40	18.71	131.65	625.58	3.31	3.06	383,020.23	266,352.02
45	33.10	251.05	1,040.92	6.85	6.32	675,477.24	477,972.07
50	23.89	181.36	731.61	5.39	4.97	496,060.34	350,958.53
55	52.99	417.67	1,475.09	13.40	12.35	1,078,273.41	766,238.57
60	33.48	305.61	761.69	10.70	9.86	632,076.84	459,934.59
65	19.34	169.07	435.91	5.88	5.42	364,088.67	262,677.11
70	7.88	68.99	178.09	2.40	2.21	148,264.30	106,979.15
Total	467	2,971	13,021	89	82	8,816,413	6,167,457

Summary

	ROG	NOx	CO	PM10	PM2.5	CO2	CO2 (Pavley)
No Build	471.0	2,977.1	13,034.1	88.8	82.0	8,843,153.7	6,188,624.6
Build	466.8	2,970.9	13,021.2	88.7	81.8	8,816,413.4	6,167,456.6
Net Change	(4.3)	(6.2)	(12.9)	(0.2)	(0.2)	(26,740.3)	(21,168.0)

Annual GHG Emissions - Metric Tons CO_2

	2018	2040
No Build	1,010,005	1,027,776
Build	1,008,349	1,024,260
Net Change	(1,655)	(3,515)

Notes: Extrapolated to 365 days based on daily CO2 emission estimates