Quantitative $PM_{2.5}$ and PM_{10} Hot-Spot Analysis Protocol

Prepared for

Caltrans
CALIFORNIA DEPARTMENT OF TRANSPORTATION

Metro
Los Angeles County
Metropolitan Transportation Authority

July 2015

QUANTITATIVE $PM_{2.5}$ AND PM_{10} HOT-SPOT ANALYSIS PROTOCOL

LOS ANGELES COUNTY, CALIFORNIA

CALIFORNIA DEPARTMENT OF TRANSPORTATION DISTRICT 7

E.A. 187900

EFIS 0700000191

07-LA-710 (SR 710)

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July 2015

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Acronyms and Abbreviations

Analysis	Quantitative Hot-Spot Analysis
AQMP	Air Quality Management Plan
AERMOD	American Meteorological Society/EPA Regulatory Model
BRT	Bus Rapid Transit
Cal State LA	California State University, Los Angeles
CAA	Clean Air Act
Caltrans	California Department of Transportation
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
EPA	United States Environmental Protection Agency
°F	degrees Fahrenheit
FR	Federal Register
ft	foot/feet
FTIP	Federal Transportation Improvement Program
GIS	geographic information system
GUI	Graphical User Interface
Guidance	Transportation Conformity Guidance for Quantitative Hot-Spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas
I-5	Interstate 5
I-10	Interstate 10
I-105	Interstate 105
I-110	Interstate 110
I-210	Interstate 210
I-405	Interstate 405
I-605	Interstate 605
I-710	Interstate 710
Lakes AERMOD View	Lakes Environmental Software AERMOD View
LOS	level of service
LRT	light rail transit
LRTP	Long Range Transportation Plan

$\mu g/m^3$	micrograms per cubic meter
Metro	Los Angeles County Metropolitan Transportation Authority
mi	mile/miles
mph	miles per hour
MSA	Metropolitan Statistical Area
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
O&M	operations and maintenance
PM	particulate matter, or afternoon
PM_{10}	particulate matter less than 10 microns in diameter
$PM_{2.5}$	particulate matter less than 2.5 microns in diameter
POAQC	project of air quality concern
ROW	right-of-way
RTP	Regional Transportation Plan
SCAB	South Coast Air Basin
SCAG	Southern California Association of Governments
SCAQMD	South Coast Air Quality Management District
SCS	Sustainable Community Strategies
SIP	State Implementation Plan
SR 2	State Route 2
SR 22	State Route 22
SR 57	State Route 57
SR 60	State Route 60
SR 91	State Route 91
SR 110	State Route 110
SR 118	State Route 118
SR 134	State Route 134
SR 170	State Route 170
SR 710	State Route 710
TCWG	Transportation Conformity Working Group
TDM	Transportation Demand Management
TSM	Transportation System Management

US-101	United States Route 101
VMT	vehicle miles of travel

1. Introduction

This technical protocol outlines the proposed methodology and assumptions for the State Route 710 (SR 710) North Study Quantitative $PM_{2.5}$[1] and PM_{10}[2] Hot-Spot Analysis.

In November 2013, the United States Environmental Protection Agency (EPA) released a final Transportation Conformity Guidance for Quantitative Hot-Spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas (Guidance) for quantifying the local air quality impacts of transportation projects and comparing them to the particulate matter national ambient air quality standards (NAAQS) (75 Federal Register [FR] 79370). The United States Environmental Protection Agency (EPA) originally released the quantitative guidance in December 2010, which has now been revised in November 2013 to reflect California's latest approved emissions model, Emission Factor Model for Onroad Motor Vehicles (EMFAC2011-PL), and EPA's 2012 particulate matter NAAQS final rule. The Guidance requires a hot-spot analysis to be completed for a project of air quality concern (POAQC). The final rule in 40 Code of Federal Regulations (CFR) 93.123(b)(1) defines the POAQC as:

i) New or expanded highway projects that have a significant number of or significant increase in diesel vehicles;

ii) Projects affecting intersections that are at Level-of-Service (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;

iii) New bus and rail terminals and transfer points that have a significant number of diesel vehicles congregating at a single location;

iv) Expanded bus and rail terminals and transfer points that significantly increase the number of diesel vehicles congregating at a single location; and

v) Projects in or affecting locations, areas, or categories of sites which are identified in the $PM_{2.5}$ and PM_{10} applicable implementation plan or implementation plan submission, as appropriate, as sites of violation or possible violation.

The project under study in this Quantitative Hot-Spot protocol (Protocol) proposes transportation improvements to improve mobility and relieve congestion in the area between State Route 2 (SR 2) and Interstates 5, 10, 210 and 605 (I-5, I-10, I-210, and I-605, respectively) in east/northeast Los Angeles and the western San Gabriel Valley. Based on the forecasted traffic data that indicate increase in the number of diesel vehicles, the project is considered to be of air quality concern as described in 40 CFR 93.123(b)(l)(i), and requires this Protocol. This Protocol has been prepared according to the procedures and methodology provided in the Guidance.

[1] Fine particulate matter less than 2.5 microns in diameter ($PM_{2.5}$).
[2] Coarse particulate matter less than 10 microns in diameter (PM_{10}).

2. Project Description

2.1 Introduction

The California Department of Transportation (Caltrans), in cooperation with the Los Angeles County Metropolitan Transportation Authority (Metro) proposes transportation improvements to improve mobility and relieve congestion in the area between State Route 2 (SR 2) and Interstates 5, 10, 210 and 605 (I-5, I-10, I-210, and I-605, respectively) in east/northeast Los Angeles and the western San Gabriel Valley. The study area for the State Route 710 (SR 710) North Study as depicted on Figure 2-1 is approximately 100 square miles and generally bounded by I-210 on the north, I-605 on the east, I-10 on the south, and I-5 and SR 2 on the west. Caltrans is the Lead Agency under the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA).

2.2 Purpose and Need

2.2.1 Purpose of the Project

Due to the lack of continuous north-south transportation facilities in the study area, there is congestion on freeways, cut-through traffic that affects local streets, and low-frequency transit operations in the study area. Therefore, the following project purpose has been established.

The purpose of the proposed action is to effectively and efficiently accommodate regional and local north-south travel demands in the study area of the western San Gabriel Valley and east/northeast Los Angeles, including the following considerations:

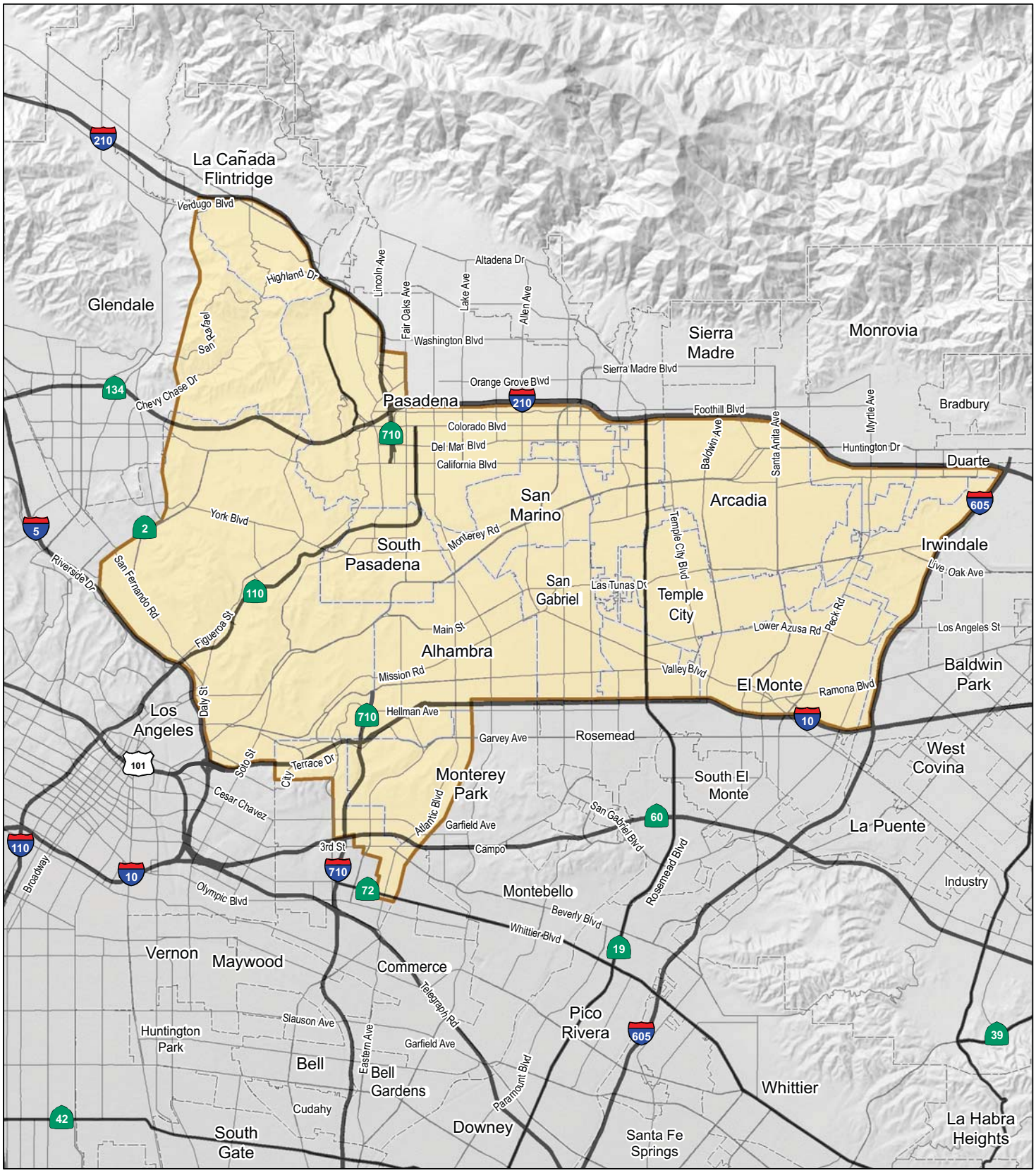
- Improve efficiency of the existing regional freeway and transit networks.
- Reduce congestion on local arterials adversely affected due to accommodating regional traffic volumes.
- Minimize environmental impacts related to mobile sources.

2.2.2 Need for the Project

The study area is centrally located within the extended urbanized area of Southern California. With few exceptions, the area from Santa Clarita in the north to San Clemente in the south (a distance of approximately 90 miles [mi]) is continuously urbanized. Physical features such as the San Gabriel Mountains and Angeles National Forest on the north, and the Puente Hills and Cleveland National Forest on the south, have concentrated urban activity between the Pacific Ocean and these physical constraints. This urbanized area functions as a single social and economic region that is identified by the Census Bureau as the Los Angeles-Long Beach-Santa Ana Metropolitan Statistical Area (MSA).

There are seven major east-west freeway routes:

- State Route 118 (SR 118)
- United States Route 101 (US-101)/State Route 134 (SR 134)/I-210
- I-10
- State Route 60 (SR 60)



LEGEND

SR 710 North Study Area

FIGURE 2-1

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MILES

SOURCE: ESRI (2008); LSA (2013)

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SR 710 North Study
Project Location

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- Interstate 105 (I-105)
- State Route 91 (SR 91)
- State Route 22 (SR 22)

There are seven major north-south freeway routes:

- Interstate 405 (I-405)
- US-101/State Route 170 (SR 170)
- I-5
- Interstate 110 (I-110)/State Route 110 (SR 110)
- Interstate 710 (I-710)
- I-605
- State Route 57 (SR 57)

All of these major routes are located in the central portion of the Los Angeles-Long Beach-Santa Ana MSA. Of the seven north-south routes, four are located partially within the study area (I-5, I-110/ SR 110, I-710, and I-605), two of which (I-110/SR 110 and I-710) terminate within the study area without connecting to another freeway. As a result, a substantial amount of north-south regional travel demand is concentrated on a few freeways, or diverted to local streets within the study area. This effect is exacerbated by the overall southwest-to-northeast orientation of I-605, which makes it an unappealing route for traffic between the southern part of the region and the urbanized areas to the northwest in the San Fernando Valley, the Santa Clarita Valley, and the Arroyo-Verdugo region.

The lack of continuous north-south transportation facilities in the study area has the following consequences, which have been identified as the elements of need for the project:

- Degradation of the overall efficiency of the larger regional transportation system
- Congestion on freeways in the study area
- Congestion on the local streets in the study area
- Poor transit operations within the study area

2.3 Alternatives

The proposed alternatives include the No Build Alternative, the Transportation System Management/Transportation Demand Management (TSM/TDM) Alternative, the Bus Rapid Transit (BRT) Alternative, the Light Rail Transit (LRT) Alternative, and the Freeway Tunnel Alternative. These alternatives are each discussed below.

On May 27, 2014 the Southern California Association of Governments' (SCAG) Transportation Conformity Working Group (TCWG) reviewed a qualitative PM hot-spot analysis form for the proposed project. The TCWG determined that the TSM/TDM, LRT, and BRT Alternatives are not POAQCs. Therefore, no further analysis of these alternatives is required for transportation conformity purposes. The Freeway Tunnel Alternative was determined to be a POAQC. The final PM hot-spot analysis will only evaluate the proposed project's preferred alternative. Therefore, a

Quantitative PM Hot-Spot Analysis will only be prepared if one of the Freeway Tunnel Alternative variations is selected as the preferred alternative.

2.3.1 No Build Alternative

The No Build Alternative includes projects/planned improvements through 2035 that are contained in the Federal Transportation Improvement Program (FTIP), as listed in the SCAG 2012 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS), Measure R, and the funded portion of Metro's 2009 Long Range Transportation Plan (LRTP). The No Build Alternative does not include any planned improvements to the SR 710 Corridor. Figure 2-2 illustrates the projects in the No Build Alternative.

2.3.2 Transportation System Management/Transportation Demand Management (TSM/TDM) Alternative

The TSM/TDM Alternative consists of strategies and improvements to increase efficiency and capacity for all modes in the transportation system with lower capital cost investments and/or lower potential impacts. The TSM/TDM Alternative is designed to maximize the efficiency of the existing transportation system by improving capacity and reducing the effects of bottlenecks and chokepoints. Components of the TSM/TDM Alternative are shown on Figure 2-3. TSM strategies increase the efficiency of existing facilities (i.e., TSM strategies are actions that increase the number of vehicle trips which a facility can carry without increasing the number of through lanes). As discussed in Section 2.3, this alternative was determined to be not a POAQC. Therefore, a Quantitative PM Hot-Spot Analysis would not be required for this alternative.

2.3.3 Bus Rapid Transit (BRT) Alternative

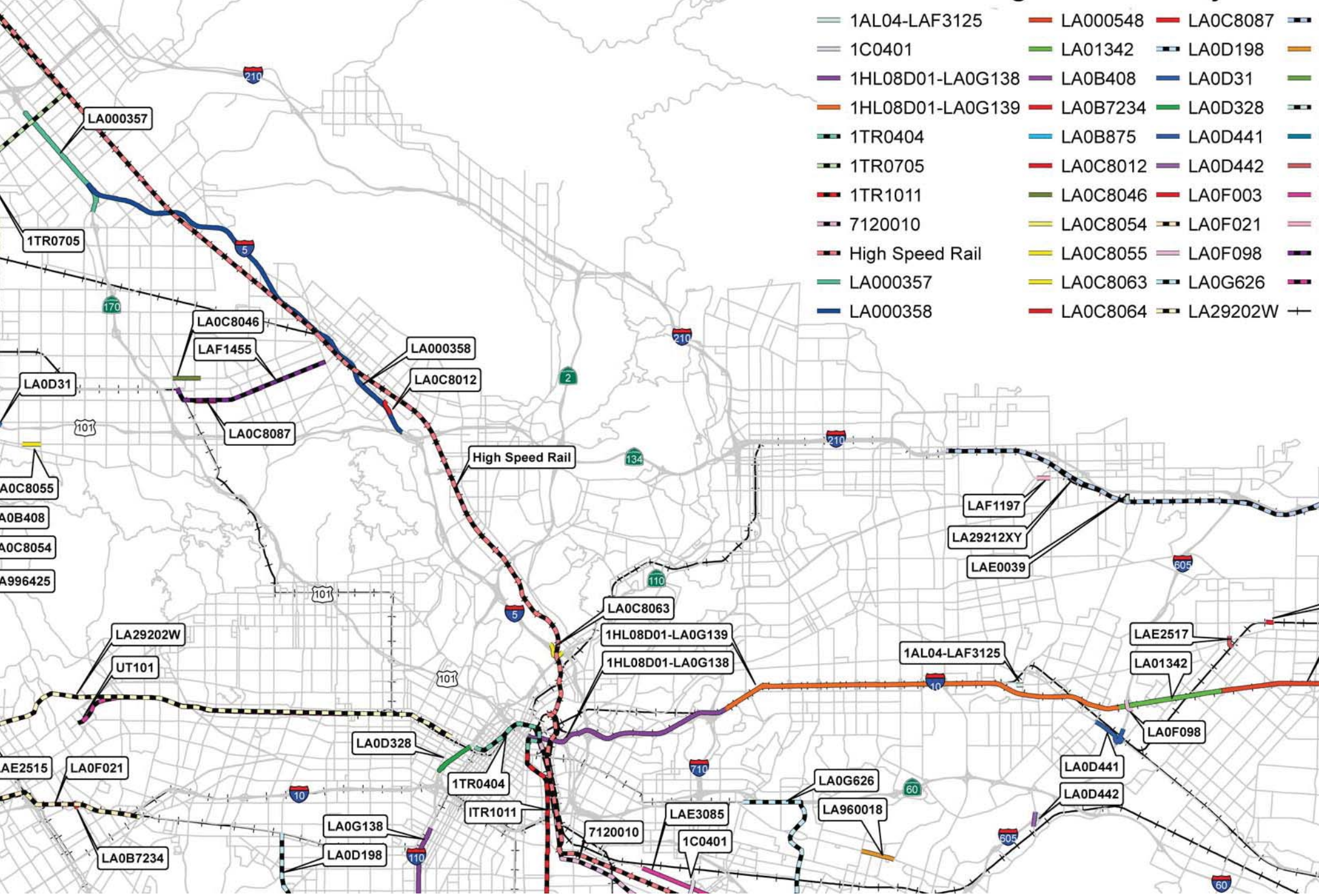
The BRT Alternative would provide high-speed, high-frequency bus service through a combination of new, dedicated, and existing bus lanes and mixed-flow traffic lanes to key destinations between East Los Angeles and Pasadena. The proposed route length is approximately 12 mi. Figure 2-4 illustrates the BRT Alternative.

The BRT Alternative includes the BRT trunk line arterial street and station improvements, frequent bus service, new bus feeder services, and enhanced connecting bus services. BRT includes bus enhancements identified in the TSM/TDM Alternative, except for improvements to Route 762. As discussed in Section 2.3, this alternative was determined to be not a POAQC. Therefore, a Quantitative PM Hot-Spot Analysis would not be required for this alternative.

2.3.4 Light Rail Transit (LRT) Alternative

The LRT Alternative would include passenger rail operated along a dedicated guideway, similar to other Metro light rail lines. The LRT alignment is approximately 7.5 mi long, with 3 mi of aerial segments and 4.5 mi of bored tunnel segments. Figure 2-5 illustrates the LRT Alternative.

The LRT Alternative would begin at an aerial station on Mednik Avenue adjacent to the existing East Los Angeles Civic Center Station on the Metro Gold Line. The alignment would remain elevated as it travels north on Mednik Avenue, west on Floral Drive, north across Corporate Center Drive, and then along the west side of I-710, primarily in Caltrans right-of-way (ROW), to a station adjacent to the California State University, Los Angeles (Cal State LA). The alignment would descend into a tunnel south of Valley Boulevard and travel northeast to Fremont Avenue, north under Fremont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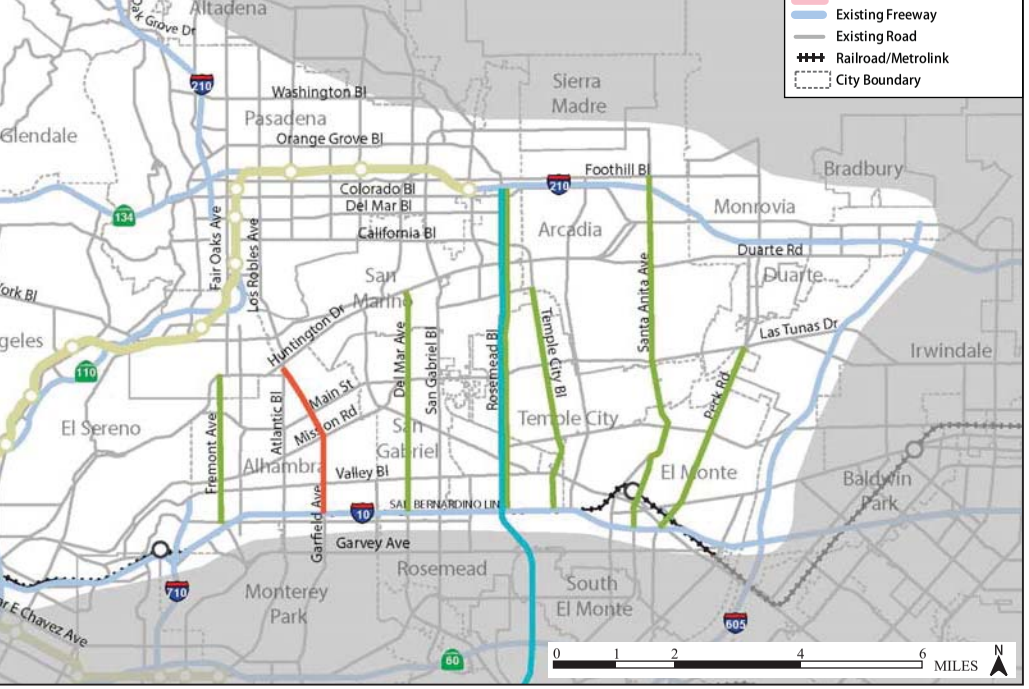

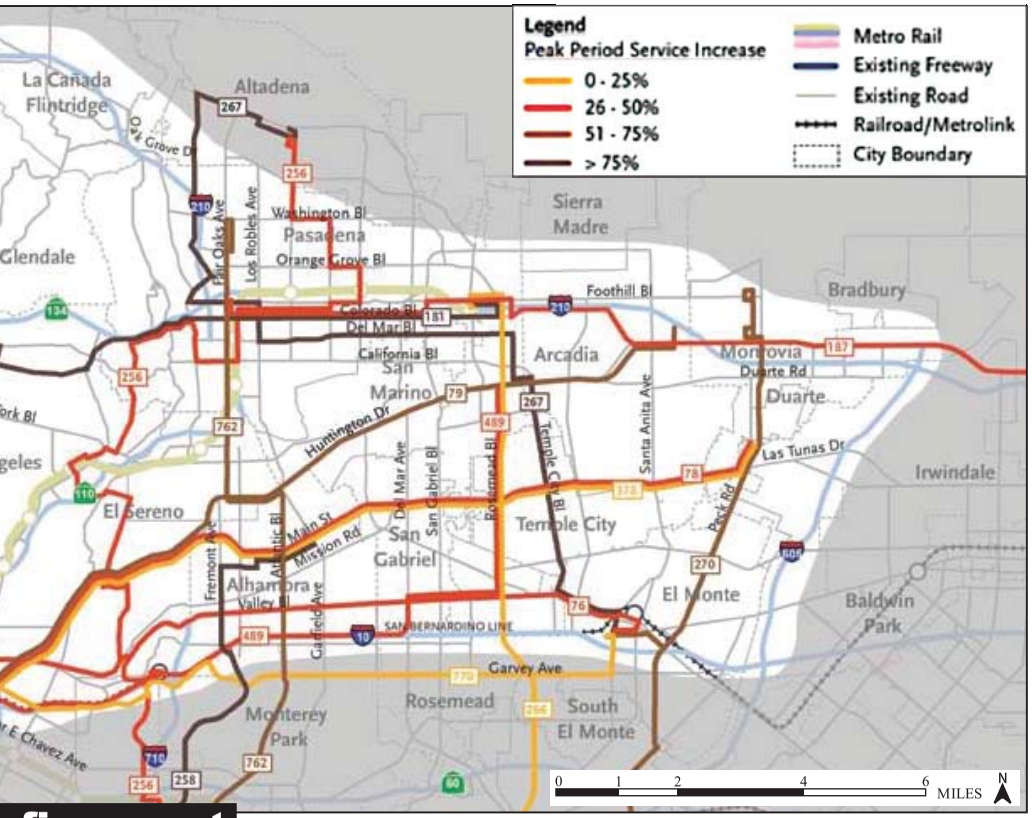

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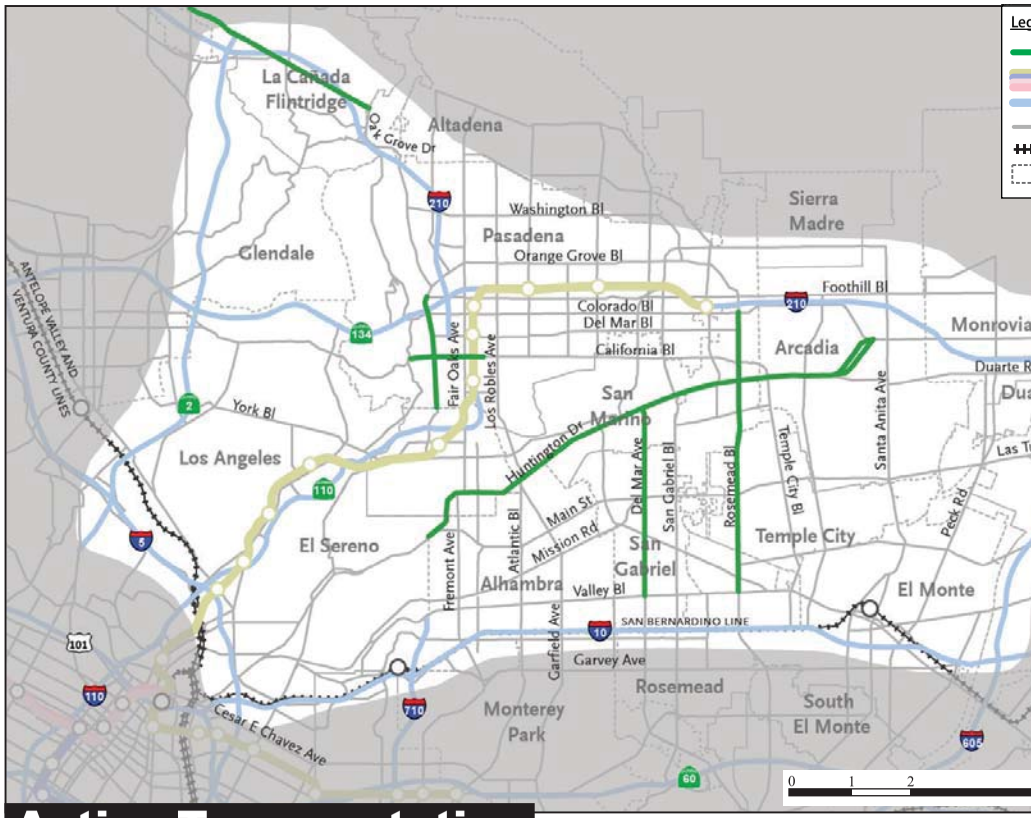

Active Transportation

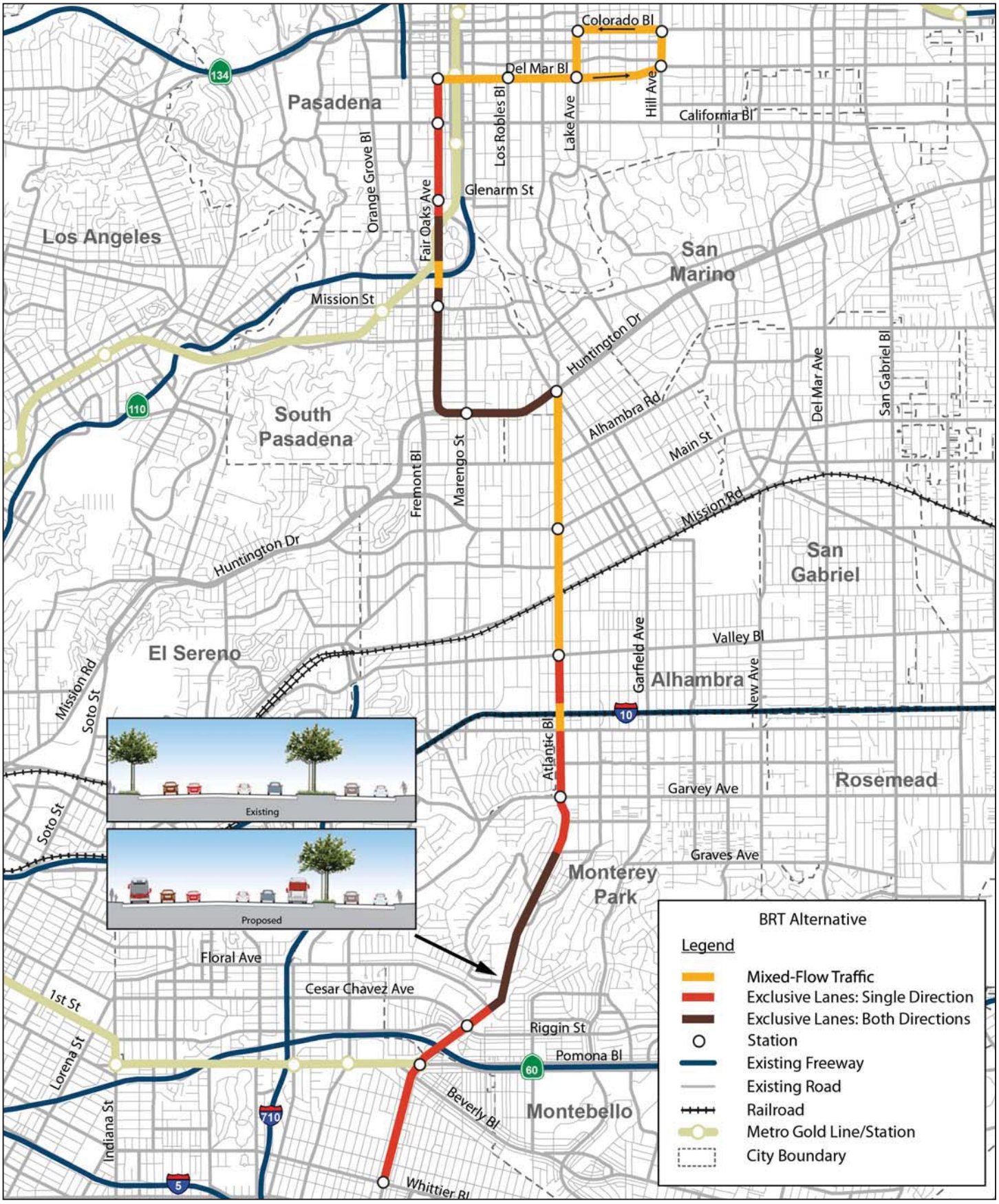

FIGURE 2-4

SR 710 North Study

BRT Alternative

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SOURCE: CH2M HILL (2013)

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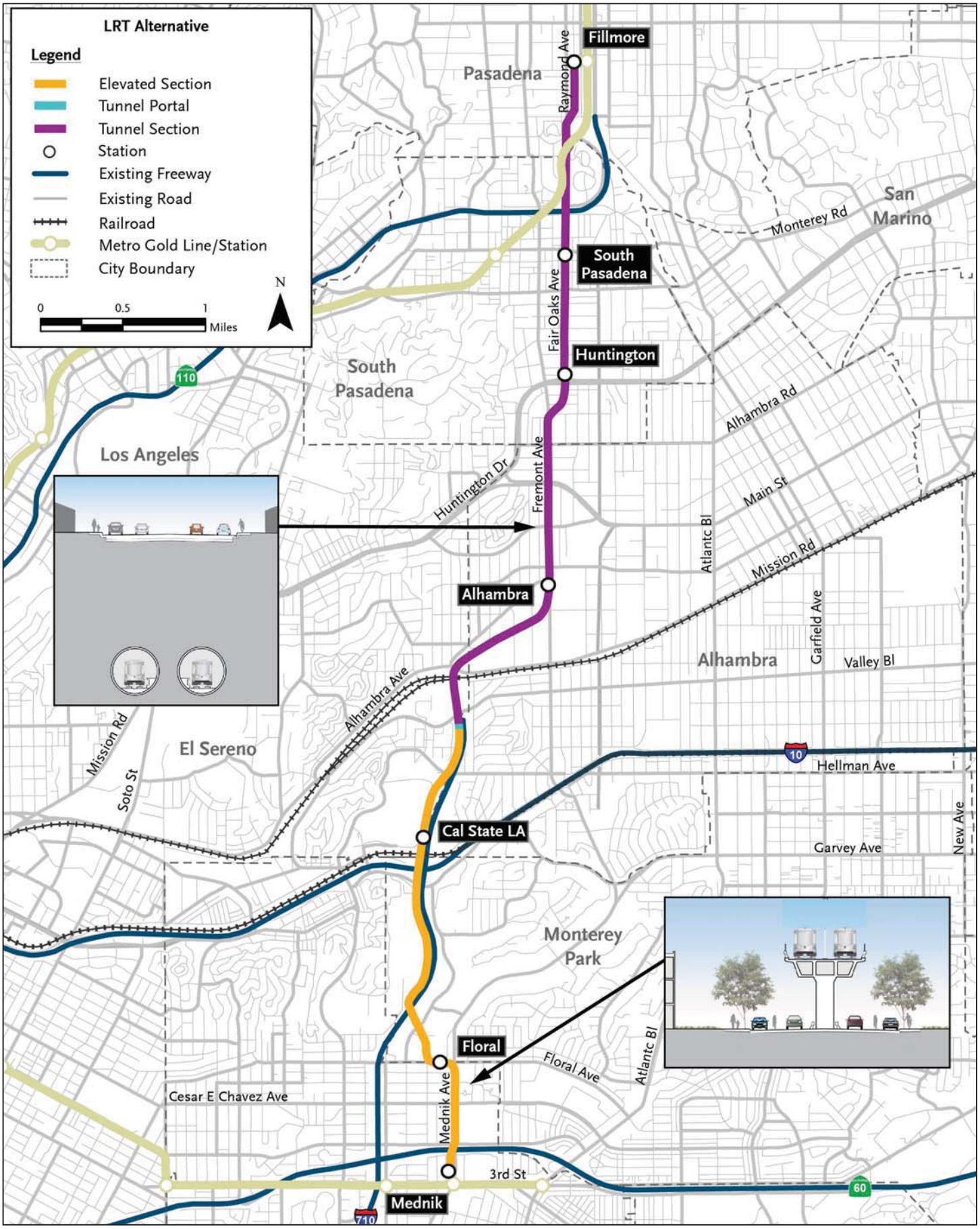

FIGURE 2-5

SR 710 North Study

LRT Alternative

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SOURCE: AECOM (2013)

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Avenue, and easterly to Fair Oaks Avenue. The alignment would then cross under SR 110 and end at an underground station beneath Raymond Avenue adjacent to the existing Fillmore Station on the Metro Gold Line.

Two directional tunnels are proposed with tunnel diameters approximately 20 feet (ft) each, located approximately 60 ft below the ground surface. Other supporting tunnel systems include emergency evacuation cross passages for pedestrians, a ventilation system consisting of exhaust fans at each portal and an exhaust duct along the entire length of the tunnel, fire detection and suppression systems, communications and surveillance systems, and 24-hour monitoring, similar to the existing LRT system.

The TSM/TDM Alternative improvements would also be constructed as part of the LRT Alternative. These improvements would provide the additional enhancements to maximize the efficiency of the existing transportation system by improving capacity and reducing the effects of bottlenecks and chokepoints. The only component of the TSM/TDM Alternative improvements that would not be constructed with the LRT Alternative is Other Road Improvement T-1 (Valley Boulevard to Mission Road Connector Road). As discussed in Section 2.3, this alternative was determined to be not a POAQC. Therefore, a Quantitative PM Hot-Spot Analysis would not be required for this alternative.

2.3.5 Freeway Tunnel Alternative

The alignment for the Freeway Tunnel Alternative starts at the existing southern stub of SR 710 in Alhambra, just north of I-10, and connects to the existing northern stub of SR 710, south of the I-210/SR 134 interchange in Pasadena. The Freeway Tunnel Alternative would include the following tunnel support systems: emergency evacuation for pedestrians and vehicles, air scrubbers, a ventilation system consisting of exhaust fans at each portal, an exhaust duct along the entire length of the tunnel and jet fans within the traffic area of the tunnel, fire detection and suppression systems, communications and surveillance systems, and 24-hour monitoring. An operations and maintenance (O&M) building would be constructed at the northern and southern ends of the tunnel. There would be no operational restrictions for the tunnel, with the exception of vehicles carrying flammable or hazardous materials. As part of both design variations of the Freeway Tunnel Alternative, the I-710 northbound off-ramp and southbound on-ramp at Valley Boulevard would be modified.

The TSM/TDM Alternative improvements would also be constructed as part of the Freeway Tunnel Alternative, including either the dual-bore or single-bore design variations. These improvements would provide the additional enhancements to maximize the efficiency of the existing transportation system by improving capacity and reducing the effects of bottlenecks and chokepoints. The only components of the TSM/TDM Alternative improvements that would not be constructed with the Freeway Tunnel Alternative are Other Road Improvements T-1 (Valley Boulevard to Mission Road Connector Road) and T-3 (St. John Avenue Extension between Del Mar Boulevard and California Avenue).

2.3.5.1 Design Variations

The Freeway Tunnel Alternative includes two design variations. These variations relate to the number of tunnels constructed. The dual-bore design variation includes two tunnels that independently convey northbound and southbound vehicles. The single-bore design variation includes one tunnel that carries both northbound and southbound vehicles. Figure 2-6 illustrates the

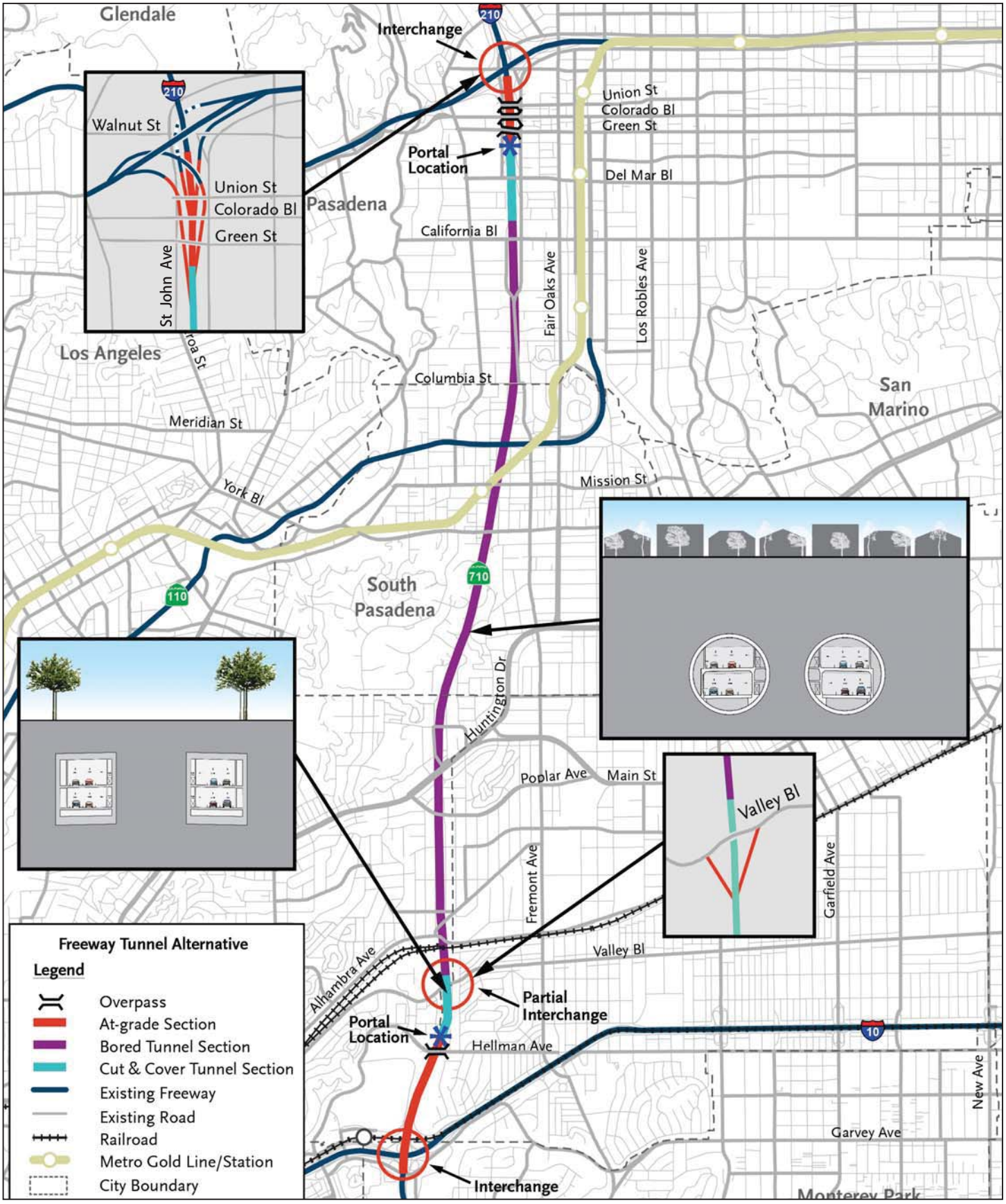

FIGURE 2-6

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SOURCE: CH2M HILL (2013)

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Freeway Tunnel Alternative
Single and Dual Bore
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dual-bore and single-bore tunnel design variations for the Freeway Tunnel Alternative. Each of these design variations is described below.

Dual-Bore Tunnel: The dual-bore tunnel design variation is approximately 6.3 mi long, with 4.2 mi of bored tunnel, 0.7 mi of cut-and-cover tunnel, and 1.4 mi of at-grade segments. The dual-bore tunnel design variation would consist of two side-by-side tunnels (the east tunnel would convey northbound traffic, and the west tunnel would convey southbound traffic). Each tunnel would have two levels with traffic traveling in the same direction. Each tunnel would consist of two lanes of traffic on each level, traveling in one direction, for a total of four lanes in each tunnel. The eastern tunnel would be constructed for northbound traffic, and the western tunnel would be constructed for southbound traffic. Each bored tunnel would have an outside diameter of approximately 58.5 ft and would be located approximately 120 to 250 ft below the ground surface. Vehicle cross passages would be provided throughout this tunnel variation that would connect one tunnel to the other tunnel for use in an emergency situation. Figure 2-6 illustrates the dual-bore tunnel variation of the Freeway Tunnel Alternative.

Short segments of cut-and-cover tunnels would be located at the south and north termini to provide access via portals to the bored tunnels. The portal at the southern terminus would be located south of Valley Boulevard. The portal at the northern terminus would be located north of Del Mar Boulevard. No intermediate interchanges are planned for the tunnel.

- **Single-Bore Tunnel:** The single-bore tunnel design variation is also approximately 6.3 mi long, with 4.2 mi of bored tunnel, 0.7 mi of cut-and-cover tunnel, and 1.4 mi of at-grade segments. The single-bore tunnel design variation would consist of one tunnel with two levels. Each level would have two lanes of traffic traveling in one direction. The northbound traffic would traverse the upper level, and the southbound traffic would traverse the lower level. The single-bore tunnel would provide a total of four lanes. The single-bore tunnel would also have an outside diameter of approximately 58.5 ft and would be located approximately 120 to 250 ft below the ground surface. The single-bore tunnel would be in the same location as the northbound tunnel in the dual-bore tunnel design variation. Figure 2-7 illustrates the single-bore tunnel variation cross section of the Freeway Tunnel Alternative.

2.3.5.2 Operational Variations

There were three different parameters related to the operational variations of the Freeway Tunnel Alternative:

- **Tolling:** Tolls could be charged for vehicles using the tunnel, or it could be free for all drivers (a conventional freeway).
- **Trucks:** Trucks could be prohibited or allowed.
- **Express Bus:** A dedicated Express Bus could be operated using the tunnel. The Express Bus route would start at the Commerce Station on the Orange County Metrolink line, and then serve the Montebello Station on the Riverside Metrolink line and East Los Angeles College before entering I-710 at Floral Drive. The bus would travel north to Pasadena via the proposed freeway tunnel, making a loop serving Pasadena City College, the California Institute of Technology, and downtown Pasadena before re-entering the freeway and making the reverse trip.

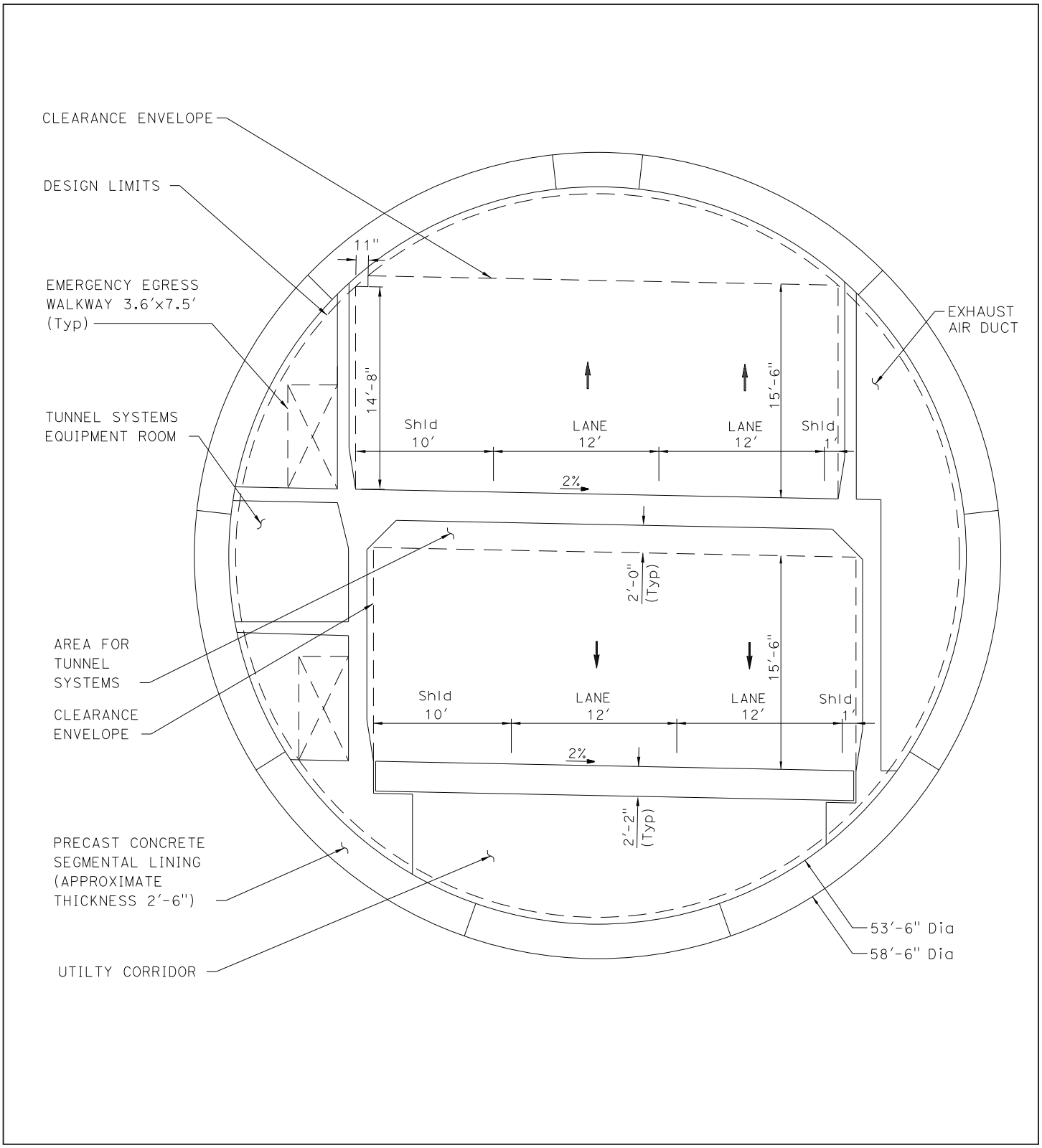

FIGURE 2-7

SR 710 North Study
Freeway Tunnel Alternative
Single Bore Cross Section
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SOURCE: CH2M HILL (2014)

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The following operational variations have been studied for the Freeway Tunnel Alternative:

- **Freeway Tunnel Alternative without Tolls:** The facility would operate as a conventional freeway with lanes open to all vehicles. Trucks would be allowed and there would be no Express Bus service. This operational variation would be considered for only the dual-bore tunnel design variation.
- **Freeway Tunnel Alternative with Trucks Excluded:** The facility would operate as a conventional freeway; however, trucks would be excluded from using the tunnel. There would be no Express Bus service. Signs would be provided along I-210, SR 134, I-710, and I-10 to provide advance notice of the truck restriction. This operational variation would be considered for the dual-bore tunnel only.
- **Freeway Tunnel Alternative with Tolls:** All vehicles, including trucks, using the tunnel would be tolled. There would be no Express Bus service. This operational variation would be considered for both the dual- and single-bore tunnels described above.
- **Freeway Tunnel Alternative with Trucks Excluded and with Tolls:** The facility would be tolled for all automobiles. There would be no Express Bus service. Trucks would be excluded from using the tunnel. Signs would be provided along I-210, SR 134, I-710, and I-10 to provide advance notice of the truck restriction. This operational variation would be considered for the single-bore tunnel only.
- **Freeway Tunnel Alternative with Toll and Express Bus:** The freeway tunnel would operate as a tolled facility and include an Express Bus component. The Express Bus would be allowed in any of the travel lanes in the tunnel; no bus-restricted lanes would be provided. Trucks would be Pursuant to 40 CFR 93.105(c)(1)(i), the conformity rule requires interagency consultation to evaluate and choose models and associated methods and assumptions. The interagency consultation for the area where this project is proposed has been established as a Transportation Conformity Working Group (TCWG) organized by the Southern California Association of Governments (SCAG). As required by the conformity rule, this Protocol has been submitted to the TCWG for interagency consultation and approval.

3. Interagency Consultation

As discussed in Section 2.3, on May 27, 2014, SCAG's TCWG reviewed a qualitative PM hot-spot analysis form for the proposed project. The TCWG determined that the TSM/TDM, LRT, and BRT Alternatives are not POAQCs. The Freeway Tunnel Alternatives were determined to be POAQCs.

Table 3.1 provides a summary of the methodologies and assumptions included in this Protocol that require approval through interagency consultation.

TABLE 3.1:
Summary of Methods and Assumptions

Subject	Proposed Action
Area for Analysis	Proposed Project within Los Angeles County
Analysis Years	2025 Opening Year and 2035 Horizon Year
Applicable Standards	24-Hour $PM_{2.5}$ NAAQS: 35 µg/m^3 Annual $PM_{2.5}$ NAAQS: 12 µg/m^3 24-Hour PM_{10} NAAQS: 150 µg/m^3
Types of Emissions	• Direct emissions of $PM_{2.5}$ and PM_{10} (exhaust and tire/brake wear) • Re-entrained $PM_{2.5}$ and PM_{10} road dust • There are no major industrial or commercial developments in the project area that would be affected by the proposed alternatives. Therefore, no nearby sources other than roadways will be considered. • No construction emissions considered (less than 5 years at individual locations)
Emission Model	EMFAC2011-PL for Los Angeles County
Dispersion Model	AERMOD View version 8.9.0 (which includes AERMOD version 14134) by Lakes Environmental Software
Surface Meteorology Data	Central Los Angeles Monitoring Station, 1630 North Main Street, Los Angeles, CA (Latitude: 34.066590, Longitude: -118.226880, Elevation: 87 meters)
Upper Air Meteorology Data	Miramar Station, San Diego County, CA
Background Monitoring Stations	Central Los Angeles Monitoring Station, 1630 North Main Street, Los Angeles, CA
Receptor Locations	First round modeling (Coarse Grid): • 50m grid spacing starting at the edge of all highways out to 250m • 250m grid spacing between 250m and 500m from the edge of all highways • 100m spacing on the edge of all arterials Second round modeling (Fine Grid): • 25m grid spacing starting at the edge of all highways out to 100m • 100m grid spacing between 100m and 500m from the edge of all highways • 100m spacing on the edge of all arterials
Other Input Parameters	Recommendations from EPA Hot-Spot Guidance

EPA = United States Environmental Protection Agency
m = meter
NAAQS = National Ambient Air Quality Standards
PM_{10} = particulate matter less than 10 microns in size
$PM_{2.5}$ = particulate matter less than 2.5 microns in size
µg/m^3 = micrograms per cubic meter

4. Hot-Spot Analysis Methodology

The project is located within the South Coast Air Basin (SCAB) region of Los Angeles County. The proposed project is within a nonattainment area for the federal $PM_{2.5}$ standards and within an attainment/maintenance area for the federal PM_{10} standard. A quantitative hot-spot analysis for $PM_{2.5}$ and PM_{10} is, therefore, deemed necessary to satisfactorily meet the conformity requirements in accordance with EPA's final rule and the Guidance.

A hot-spot analysis is defined in the 40 CFR 93.101 as an estimation of likely future localized pollutant concentrations and a comparison of those concentrations to the relevant air quality standards. A project-level hot-spot analysis assesses the air quality impacts on a scale smaller than an entire nonattainment or maintenance area such as a congested freeway corridor. Such an analysis is a means of demonstrating that a transportation project meets Clean Air Act (CAA) conformity requirements to support State and local air quality goals with respect to potential localized air quality impacts.

CAA Section 176(c)(1)(B) is the statutory criterion that must be met by all projects in nonattainment and maintenance areas that are subject to transportation conformity. Section 176(c)(1)(B) states that federally supported transportation projects must not “cause or contribute to any new violation of any standard in any area; increase the frequency or severity of any existing violation of any standard in any area; or delay timely attainment of any standard or any required interim emission reductions or other milestones in any area.” As aforementioned, this Protocol has been prepared according to the procedures and methodology provided in the Guidance and utilizes dispersion modeling.

According to the Guidance, a hot-spot analysis must include the entire transportation project. Due to the extent of the project area, an iterative modeling strategy will be used to identify locations along the proposed project alignments where the highest concentration would likely occur. Two rounds of modeling runs will be completed as part of this iterative process in which the first round of modeling will be run with FASTALL option and the second round of modeling will be run without. The first round model will be run with a coarser receptor grid to identify potential hot-spot locations while the second round model will be run with a finer receptor grid to encompass the hot-spot location identified from the first round model run. The non-default FASTALL option will be utilized in the first round modeling to reduce run-time greatly while predicting concentrations within 2 percent of the normal model operation.

Based on the results from the first-round model runs, hot-spot locations will be identified within the project area. The second round of modeling will be conducted surrounding the identified hot-spot locations with a finer receptor grid, but without the FASTALL option. The FASTALL option is not acceptable for estimating final design value concentrations and may not be used to demonstrate conformity.

4.1 National Ambient Air Quality Standards

4.1.1 $PM_{2.5}$

$PM_{2.5}$ nonattainment and maintenance areas are required to attain and maintain two NAAQS:

- **24-hour Standard:** 35 micrograms per cubic meter ($\mu g/m^3$).

- **Annual Standard:** In December 2012, the EPA tightened the annual $PM_{2.5}$ standard from 15 to 12 µg/m^3. In December 2014, the EPA issued designations for $PM_{2.5}$ nonattainment areas, and these designations became effective in April 2015. The new $PM_{2.5}$ standard will become applicable for conformity purposes 1 year after the effective date (April 2016).

The current 24-hour standard is based on a 3-year average of the 98th percentile of 24-hour $PM_{2.5}$ concentrations. The current annual standard is based on a 3-year average of annual mean $PM_{2.5}$ concentrations. A $PM_{2.5}$ hot-spot analysis must consider both standards unless it is determined for a given area in which meeting the controlling standard would ensure that CAA requirements are met for both standards.

4.1.2 PM_{10}

Nonattainment and maintenance areas are required to attain and maintain the following standard for PM_{10}:

- 24-hour standard: 150 µg/m^3

The 24-hour PM_{10} standard is attained when the average number of exceedances in the previous 3 calendar years is less than or equal to 1. An exceedance occurs when a 24-hour concentration of 155 µg/m^3 or greater is measured at a site. The annual PM_{10} standard of 50 µg/m^3 is no longer used for determining the federal attainment status.

4.2 Types of Emissions Considered

In accordance with the EPA Guidance, this quantitative protocol was based on directly emitted and re-entrained $PM_{2.5}$ and PM_{10} emissions. Tailpipe, brake wear, tire wear, and road dust $PM_{2.5}$ and PM_{10} emissions were therefore considered in this Protocol.

Vehicles cause dust from paved and unpaved roads to be re-entrained, or re-suspended, in the atmosphere. The South Coast Air Quality Management District (SCAQMD) 2012 Air Quality Management Plan (AQMP) identified re-entrained road dust as a substantial source of particulate matter in the area's emission budget. Therefore, re-entrained road dust was considered in this Protocol. In addition, the EPA has published guidance on the use of AP 42 for reentrained road dust for State Implementation Plan (SIP) development and conformity (January 2011); therefore, re-entrained $PM_{2.5}$ is considered in this analysis.

Secondary particles formed through $PM_{2.5}$ and PM_{10} precursor emissions from a transportation project take several hours to form in the atmosphere, giving emissions time to disperse beyond the immediate study area of concern for localized analyses; therefore, they were not considered in this protocol. Secondary emissions of $PM_{2.5}$ and PM_{10} are considered part of the regional emissions analysis prepared for the conforming RTP and FTIP.

According to the project schedules, the construction will not last more than 5 years at any individual site. Construction-related emissions due to this project are thus considered temporary as defined in 40 CFR 93.123(c)(5) and are not included in this Protocol. This project will comply with the SCAQMD Fugitive Dust Rules (Rule 403) for any fugitive dusts emitted during construction. Excavation, transportation, placement, and handling of excavated soils shall result in no visible dust migration. A water truck or tank will be available within the project limits at all times to suppress and control the migration of fugitive dusts from earthwork operations. The project is required to comply with any

State, federal, and/or local rules and regulations developed as a result of implementing control and mitigation measures proposed as part of the SIP.

4.3 Emission and Dispersion Models Used

The EPA Guidance requires use of the latest emissions model in quantitative analyses. This quantitative protocol was prepared based on the latest EPA-approved emissions model for use in California (EMFAC2011). As recommended by the EPA Guidance, this quantitative protocol applied the simplified approach, using the assessment tool EMFAC2011-PL to help generate emission rates for the traffic forecasted within the SCAB portion of Los Angeles County in the years 2025 and 2035. The opening year (2025) will be modeled to consider the effects of the additional traffic immediately after opening. The 2035 conditions will be modeled to consider the traffic impact when the project area will have been developed according to the latest planning assumptions. The emissions will be calculated for four individual periods of the day: AM (6:00 a.m. to 9:00 a.m.), mid-day (9:00 a.m. to 3:00 p.m.), PM (3:00 p.m. to 7:00 p.m.), and night time (7:00 p.m. to 6:00 a.m.).

The EPA Guidance recommends that quantitative analyses be developed consistent with the EPA's current recommended model under Appendix W to 40 CFR Part 51. While the American Meteorological Society/EPA Regulatory Model (AERMOD) is the EPA's recommended near-field dispersion model, Section 3.2 of Appendix W provides applicable guidance with which an EPA's Regional Office may determine acceptability of alternative models (e.g., some commercial Graphical User Interface [GUI] versions of AERMOD). Due to the magnitude of the study area and complexity of the project scope, the analysis will be prepared utilizing the Lakes Environmental Software AERMOD View (Lakes AERMOD View) program.

On May 27, 2014, SCAG's TCWG reviewed a qualitative PM hot-spot analysis form for the proposed project. During this initial analysis, the EPA expressed concerns with the changes in truck traffic volumes that would result from implementing the project alternatives. The first round of PM modeling will be set up to capture the areas that are potentially of air quality concern for particulates, based on this initial discussion with the EPA. Thus, the first round of $PM_{2.5}$ and PM_{10} quantitative modeling will include:

- I-210, approximately 0.5 mi east of the SR 710 interchange;
- SR 134, approximately 0.5 mi west of the SR 710 interchange;
- I-210, approximately 0.5 mi west of the SR 710 interchange;
- SR 710 South, either to the current terminus or the proposed tunnel entrance;
- I-10, between the SR 710 interchange and the I-5 interchange and approximately 0.5 mi west of the I-5 interchange;
- SR 710 North, either to the current terminus or the proposed tunnel entrance;
- I-5, approximately 0.5 mi south of the I-10 interchange;
- I-5, approximately 0.5 mi north of the SR 2 interchange;
- SR 2, approximately 0.5 mi east of the I-5 interchange;
- SR 2, approximately 0.5 mi west of the I-5 interchange;

- SR 110, approximately 0.5 mi east of the I-5 interchange;
- I-10, approximately 1 mi east of the SR 710 interchange; and
- Principal arterials Colorado Boulevard and Valley Boulevard, which are each approximately 0.5 mi on either side of SR 710.

As discussed in Section 4.1, based on the results of the first round model runs, hot-spot locations will be identified within the project area. A second round of modeling will be conducted surrounding the identified hot-spot locations with a finer receptor grid.

In addition to the roadways, the modeling will include the freeway tunnel ventilation towers at both the north and south portals. The subsections below describe each source type to be modeled in AERMOD. The AERMOD model will be configured to run with either the PM_{10} or $PM_{2.5}$ pollutant ID used for the separate analyses for each pollutant.

Vehicle emissions from highways and principal arterials will be modeled as area sources. Emissions from the freeway tunnel ventilation towers were modeled as point sources. A summary of the parameters used for each type of source is shown in Table 4.1 and explained further in the following sections.

TABLE 4.1:
AERMOD Source Parameters for the $PM_{2.5}$ and PM_{10} Hot-Spot Analysis

Source Type	Source Description	AERMOD Source Type	Release Height (ft)	Source Width	Line Source Spacing	Exit Velocity (fpm)	Exit Temperature (˚F)	Stack Diameter (ft)
Vehicle Exhaust Emissions	Highway Mainlines	AREA	Various[1]	Various[2]	Various[2]	-	-	-
	Highway Interchanges	AREA	Various[3]	Various[2]	Various[2]	-	-	-
	Principal Arterials	AREA	Various[4]	Various[2]	Various[2]	-	-	-
Vehicle Fugitive Emissions	Highway Mainlines	AREA	1	Various[2]	Various[2]	-	-	-
	Principal Arterials	AREA	1	Various[2]	Various[2]	-	-	-
Tunnel Ventilation Towers	North and South Portal Exhaust and Fugitive	Point	50[5]	-	-	Various[5]	Ambient	22.97[6]

1 Vehicle emissions from all highway and arterial mainlines were modeled with area source dimensions corresponding to trucks. Initial release heights of 11 ft for trucks and 4 ft for cars are assumed. A weighted average of the vehicle mix will be used to determine an average release height for each roadway segment. Selected values are consistent with the parameters used in the *Human Health Risk Assessment for the Schuyler-Heim Bridge Replacement and SR 47 Expressway Project* (Western Solutions, Inc. October 2008).
2 Source width and line spacing are dependent on specific road width.
3 A highway interchange release height of 30 ft will be used to capture over- and underpasses of the interchange.
4 Vehicle emissions from all principal arterials were modeled with source dimensions corresponding to the weighted average of the vehicle mix for each roadway segment. The initial release height relative to the roadbed will be 11 ft for trucks (EPA Guidance, November 2013) and 4 ft for cars.
5 Exhaust flow exit velocity is dependent on the tunnel design and traffic directions.
6 Stack height and diameter were based on preliminary engineering design specifications.

°F = degrees Fahrenheit
AERMOD = American Meteorological Society/EPA Regulatory Model
EIR/EIS = Environmental Impact Report/Environmental Impact Statement
EPA = United States Environmental Protection Agency
fpm = feet per minute
ft = feet
PM_{10} = particulate matter less than 10 microns in size
$PM_{2.5}$ = particulate matter less than 2.5 microns in size
SR 47 = State Route 47

For area sources, initial horizontal and vertical dimensions (X_{init} and σ_{zinit}, respectively) were based on Section 3.3.2.3 AREA Source Inputs in the User's Guide for the AMS/EPA Regulatory Model-AERMOD EPA-454/B-03-001 (September 2004). As specified in the EPA Guidance, initial vertical dimensions (σ_{zinit}) were used to model the turbulent vehicle exhaust emissions, based on a weighted average of the vehicle mix (22 ft for trucks and 8.5 ft for cars) with initial vertical dimensions (σ_{zinit})

equal to the weighted average divided by 4.3. Similarly, the release height relative to the roadbed will be based on a weighted average of the vehicle mix (11 ft for trucks [EPA Guidance, November 2013] and 4 ft for cars). The line source spacing, or separation of the area sources, will be twice the width of each individual area source. The width of the area source for each roadway segment will be calculated based on the average width of the roadway, and all area sources will be square (Y_{init} left blank). The proposed area source spacing is based on the EPA's 1995 User's Guide for the Industrial Source Complex (ISC3) Dispersion Models for volume sources, as shown on Figure 4-1.

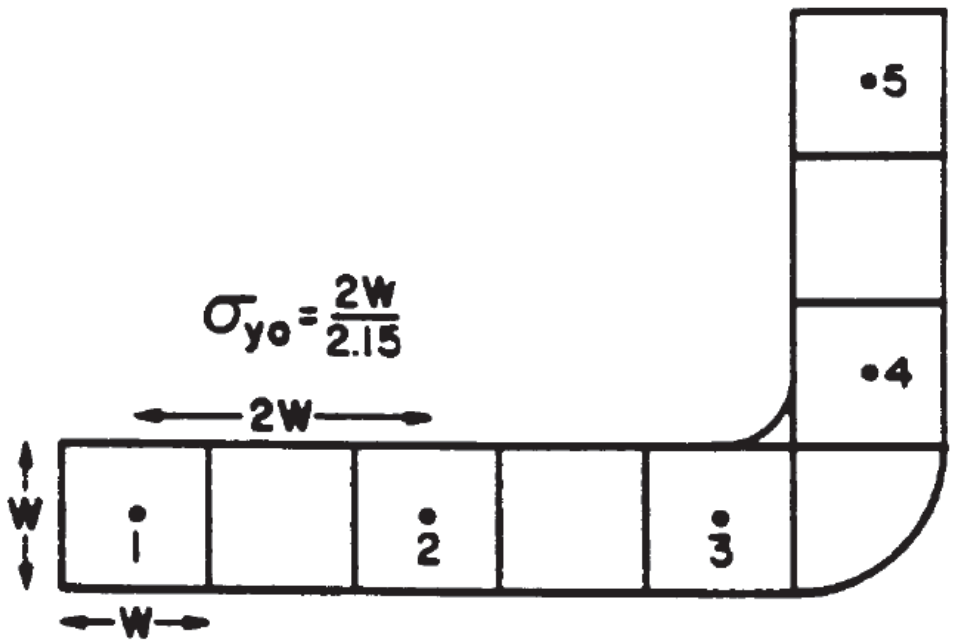


Figure 4-1: Volume Emission Source Spacing to Approximate a Line Source

4.3.1 Freeway Mainlines

The freeway mainline roads modeled in AERMOD will include existing roadways as well as new alignments to be constructed as part of the project. Roadway alignments and widths will be determined using engineering drawings, geographic information system (GIS) layers, and aerial photographs of the project. The operational vehicle exhaust emissions from roadways will be modeled as a line of area sources. Area source representations of the highways were developed based on roadway configurations and assumed vertical dimensions for car and truck traffic. The major freeways will be modeled with the average width of each specific freeway. Roadway area source spacings will be determined based on road widths. The initial release height relative to the roadbed will be 11 ft for trucks (EPA Guidance, November 2013) and 4 ft for cars. A weighted average of the vehicle mix will be used to determine an average release height for each roadway segment. Because the fugitive PM emissions can be characterized with the same modeling parameters as the vehicle exhaust (other than release height), they will be modeled with identical area sources, except for the release heights, which will be set to 1 ft.

4.3.2 Freeway Interchanges

Similar to the freeway mainlines, a line of area sources following the average centerline of the interchange will be used. The width of the area source and source spacing will be adjusted to the average width of each specific freeway interchange.

4.3.3 Principal Arterials

Principal arterials will be modeled as a line of area sources using the average centerline of the roadway. Most major arterials will be modeled with the width of a four-lane roadway, with the exception of a few arterials that are mainly two-lane roadways. Vehicle exhaust and fugitive dust emissions from principal arterials will be modeled the same way the freeway mainlines were.

4.3.4 Tunnel Ventilation Towers

The tunnel ventilation tower emissions for the north and south tunnel portals will be modeled as point sources. Exhaust flow rates of the ventilation towers vary depending on the tunnel design variation (i.e., single-bore or dual-bore). For the Freeway Tunnel Alternative, emissions from the freeway tunnel will be adjusted to take into account the control efficiency of an air pollution control system. The PM emissions from the SR 710 new freeway tunnel will be treated with PM filters. Control efficiency of the PM filter is dependent on the particle size distribution and varies between a low of 80 percent and a high of greater than 99 percent for the proposed PM emission control system (ILF Consulting Engineers 2013). To be conservative, the lowest control efficiency of 80 percent will be used to estimate the emissions from the ventilation towers such that 20 percent of total PM emissions will be released to the atmosphere. It is assumed that both ventilation towers of the tunnel (i.e., the southbound and northbound ventilation towers) will be equipped with PM control systems. As such, emissions will be separately calculated for each ventilation tower to most accurately represent controlled emissions associated with either the northbound or southbound traffic.

4.3.5 Nearby Sources

Section 8.2 of the PM Guidance states that nearby sources of particulate matter need to be included in the air quality model on when those sources would be affected by the project. A search of nearby sources was conducted using the State Facility Inventory Database. It was determined that none of the nearby sources would be affected by the proposed project. Therefore, nearby sources will not be included in the dispersion modeling.

4.3.6 Vehicle Characterization

For all roadway and tunnel ventilation modeling sources, the emissions will be modeled as the combination of cars and trucks described in the traffic analysis. For every segment of roadway, the traffic data prescribed a unique volume of traffic, percentage of light-duty vehicles (cars and light trucks), 2-axle trucks, 3-axle trucks, trucks with 4 or more axles, and average speed for four periods of the day: morning, mid-day, afternoon, and night. Thus, the PM hot-spot analysis will characterize these vehicle emissions as varying throughout the day. The vehicle traffic will be assumed to not vary throughout the year.

4.4 Meteorology and Climate

The SCAB climate is determined by its terrain and geographical location. The SCAB is a coastal plain with connecting broad valleys and low hills. The Pacific Ocean forms the southwestern boundary of

the SCAB, and high mountains surround the rest of the SCAB. The region lies in the semipermanent high-pressure zone of the eastern Pacific Ocean. The resulting climate is mild and tempered by cool ocean breezes. This climatological pattern is rarely interrupted. However, periods of extremely hot weather, winter storms, and Santa Ana wind conditions do occur in the SCAB.

The annual average temperature varies little throughout the SCAB, ranging from the low to middle 60s (measured in degrees Fahrenheit [°F]). With a more pronounced oceanic influence, coastal areas show less variability in annual minimum and maximum temperatures than inland areas. The climatological station closest to the site monitoring temperature is the Pasadena Station.[1] The annual average maximum temperature recorded at this station is 76.8°F, and the annual average minimum is 51.0°F. January is typically the coldest month in this area of the SCAB.

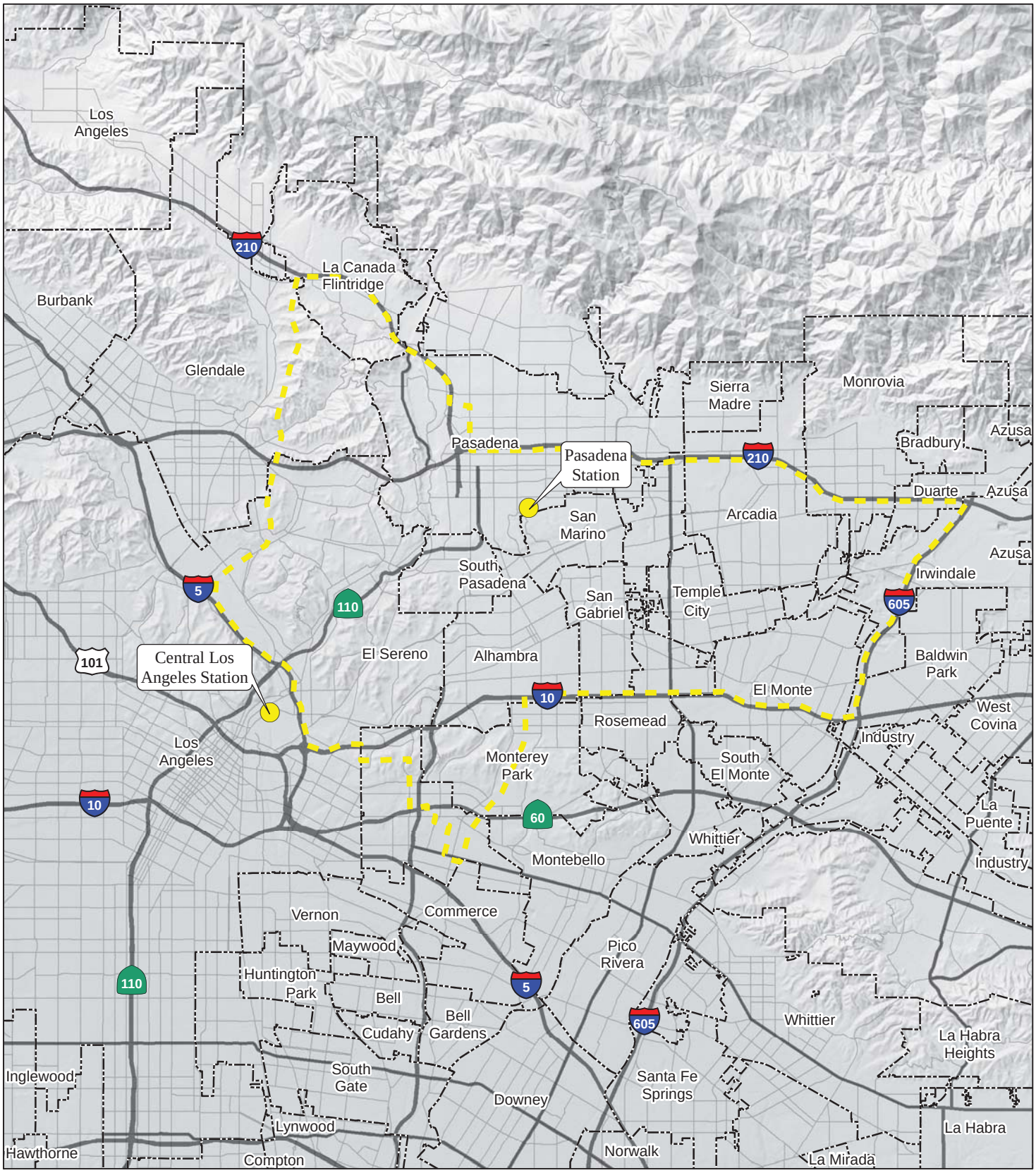
The majority of rainfall in the SCAB occurs between November and April. Summer rainfall is minimal and generally limited to scattered thundershowers in coastal regions and slightly heavier showers in the eastern part of the SCAB along the coastal side of the mountains. The climatological station closest to the project limits that monitors precipitation is the Pasadena station. Average rainfall measured at this station varied from a high of 4.54 inches in February to 0.43 inch or less between May and September, with an average annual total of 20.24 inches. Patterns in monthly and yearly rainfall totals are unpredictable due to fluctuations in the weather.

The SCAB experiences a persistent temperature inversion (increasing temperature with increasing altitude) as a result of the Pacific high. This inversion limits the vertical dispersion of air contaminants, holding them relatively near the ground. As the sun warms the ground and the lower air layer, the temperature of the lower air layer approaches the temperature of the base of the inversion (upper) layer until the inversion layer finally breaks, allowing vertical mixing with the lower layer. This phenomenon is observed from mid-afternoon to late afternoon on hot summer days, when the smog appears to clear up suddenly. Winter inversions frequently break by midmorning.

Winds in the vicinity of the study area blow predominantly from the west and southwest at relatively low velocities, with wind speeds averaging approximately 4 miles per hour (mph). Summer wind speeds average slightly higher than winter wind speeds. Low average wind speeds together with a persistent temperature inversion limit the vertical dispersion of air pollutants throughout the SCAB. Strong, dry, northerly or northeasterly winds, known as Santa Ana winds, occur during the fall and winter months, dispersing air contaminants. Santa Ana conditions tend to last for several days at a time.

Local air quality data will be obtained from the SCAQMD, using data collected at the Central Los Angeles monitoring station. The Central Los Angeles station is located approximately 5 mi southwest of the identified hot-spot location and is located less than 0.5 mi from SR 110 and I-5, with traffic volumes comparable to those forecasted for the study area. While there is another monitoring station located in Pasadena at 752 South Wilson Avenue, this monitoring station is downwind of the project site and therefore not as appropriate for this analysis as the Central Los Angeles monitoring station, which is located upwind of the project site. The Central Los Angeles monitoring station is, therefore, deemed representative of the study area based on its proximity and similarity to the study area. The locations of the Pasadena and Central Los Angeles monitoring stations are shown on Figure 4-2.

[1] Western Regional Climatic Center. 2015. http://www.wrcc.dri.edu (accessed January 29, 2015).



LEGEND

- Air Quality Monitoring Location
- Study Area
- Cities and Unincorporated Communities

N

0 1.5 3
MILES

SOURCE: ESRI (2008); SCAG (2010)

I:\CHM1105\GIS\MXD\AQA\AQ_Monitoring.mxd (6/12/2015)

FIGURE 4-2

SR 710 North Study

Air Quality Monitoring Stations

07-LA-710 (SR 710)
EA 187900
EFIS 0700000191

4.5 Air Quality Trend Analysis

As discussed in Section 4.4, predominant wind direction and speed at Central Los Angeles are due to the region's terrain and geographical features. Dry conditions and heavy winds contribute to the severity of air pollution issues in the SCAB. Figure 4-3 below indicates the predominant wind direction in the region based on meteorological data from the Central Los Angeles monitoring station.

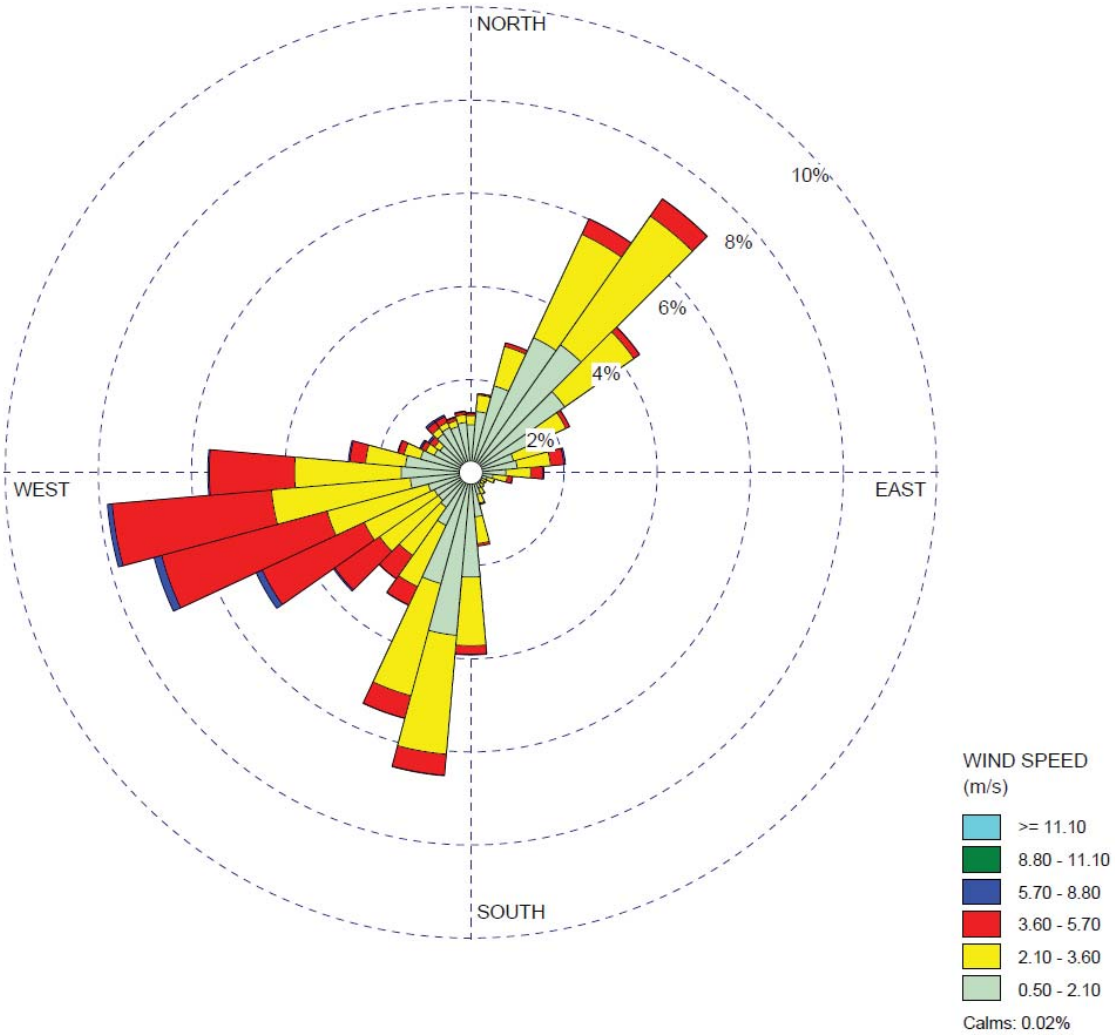


Figure 4-3: Predominant Wind Direction at Central Los Angeles Station

$PM_{2.5}$ concentrations monitored at the Central Los Angeles station are presented in Table 4.2 for the 6-year period from 2008 to 2013. This data shows that the federal 24-hour $PM_{2.5}$ air quality standard (35 µg/m^3) has been exceeded in 3 out of the past 6 years. The annual average $PM_{2.5}$ NAAQS (15 µg/m^3) has been exceeded in 2 out of the past 6 years.

TABLE 4.2:
Ambient $PM_{2.5}$ Monitoring Data ($\mu g/m^3$)

	2008	2009	2010	2011	2012	2013
Central Los Angeles Air Quality Monitoring Station						
24-hour Data						
3-year average 98th percentile	43.5	41.8	35.2	33.0	32.3	30.8
Exceeds federal 24-hour standard (35 $\mu g/m^3$)?	Yes	Yes	Yes	No	No	No
Annual Data						
3-year national average	16.8	15.7	14.9	14.1	13.7	15.0
Exceeds federal annual average standard (15 $\mu g/m^3$)?	Yes	Yes	No	No	No	No

Source: California Air Resources Board, http://www.arb.ca.gov/adam/ (accessed November 2014).
$\mu g/m^3$ = micrograms per cubic meter
$PM_{2.5}$ = particulate matter less than 2.5 microns in diameter

The PM_{10} concentrations monitored at the Central Los Angeles station are presented in Table 4.3 for the 6-year period from 2008 to 2013. This data shows that the federal 24-hour PM_{10} air quality standard (150 $\mu g/m^3$) was not exceeded in the past 6 years.

TABLE 4.3:
Ambient PM_{10} Monitoring Data ($\mu g/m^3$)

	2008	2009	2010	2011	2012	2013
Central Los Angeles Air Quality Monitoring Station						
Highest	66	72	42	53	80	57
Second highest	65	62	41	50	74	46
Third highest	50	57	41	45	64	45
Fourth highest	49	53	41	44	55	40
No. of days above national 24-hour standard (150 $\mu g/m^3$)	0	0	0	0	0	0

Source: California Air Resources Board, http://www.arb.ca.gov/adam/ (accessed November 2014).
$\mu g/m^3$ = micrograms per cubic meter
PM_{10} = particulate matter less than 10 microns in diameter

4.6 Background Concentrations

4.6.1 $PM_{2.5}$

4.6.1.1 24-Hour Concentration

In accordance with Section K.4.2 of the Guidance, the following methodology was used to calculate the 24-hour $PM_{2.5}$ background concentration. The average 98th percentile 24-hour background concentration for a first-tier analysis was calculated using the 98th percentile 24-hour concentrations of the 3 most recent years of monitoring data from the representative air quality monitoring station. The number of daily measurements conducted at the Central Los Angeles station between 2011 and 2013 varied between 324 and 344. Therefore, using Exhibit 9-5 of the Guidance, the 98th percentile concentration is represented by the seventh-highest daily measurement. Table 4.4 lists the top eight 24-hour concentrations that were measured at the Central Los Angeles station in 2011 through 2013.

TABLE 4.4:
Top Eight Monitored 24 Hour $PM_{2.5}$ Concentrations in Years 2011 – 2013 (µg/m^3)

Rank	2011	2012	2013
1	49.3	58.7	43.1
2	44.1	44.0	33.1
3	41.7	39.1	31.4
4	39.6	36.4	31.3
5	33.9	32.6	30.4
6	32.1	32.2	29.2
7	31.5	32.0	29.0
8	30.6	31.8	28.4

Source: United States Environmental Protection Agency AirData, http://www.epa.gov/airdata/ (accessed November 2014).
µg/m^3 = micrograms per cubic meter
$PM_{2.5}$ = particulate matter less than 2.5 microns in diameter

The seventh-ranked concentration of each year (highlighted in Table 4.4) is the 98th percentile value. These were averaged to determine the 24-hour $PM_{2.5}$ background concentration:

$$(31.5 + 32.0 + 29.0) \div 3 = 30.8\ \mu g/m^3$$

4.6.1.2 Annual Concentration

In accordance with Section K.3.2 of the Guidance, the following methodology was used to calculate the annual average $PM_{2.5}$ background concentration. Based on the 3 years of measurements at the Central Los Angeles station, the average monitored background concentrations in each quarter was determined. Then, for each year of background data, the four quarters were averaged to get an average annual background concentration (last column of Table 4.5). These three average annual background concentrations were averaged, and the resulting value of 12.494 µg/m^3, as shown in Table 4.5, was established as the background concentration.

TABLE 4.5:
Quarterly Average $PM_{2.5}$ Values Measured at the Central Los Angeles Station (µg/m^3)

Year	First Quarter	Second Quarter	Third Quarter	Fourth Quarter	Annual Average
2011	11.461	10.625	13.892	15.656	12.909
2012	11.770	12.406	12.349	13.591	12.529
2013	12.588	11.185	11.399	13.006	12.045
				3-year Average	**12.494**

Source: United States Environmental Protection Agency AirData, http://www.epa.gov/airdata/ (accessed November 2014).
µg/m^3 = micrograms per cubic meter
$PM_{2.5}$ = particulate matter less than 2.5 microns in diameter

4.6.2 PM_{10}

In accordance with the Guidance, 12 consecutive quarters of background concentration measurements were obtained from the Central Los Angeles station for the years of 2011, 2012, and 2013. These are the years for which a set of the measurements is made available through the EPA AirData website (http://www.epa.gov/airdata/). There were 175 measurements of 24-hour PM_{10} concentrations available at the Central Los Angeles station over the 12 quarters between January 2011 and December 2013. Among those 175 measurements, Table 4.6 summarizes first maximum concentrations in each quarter of the year.

TABLE 4.6:
Quarterly First Maximum 24-hour PM_{10} Values Measured at the Central Los Angeles Station (µg/m^3)

Year	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
2011	36	44	41	53
2012	42	80	45	40
2013	35	40	40	57

Source: United States Environmental Protection Agency AirData, http://www.epa.gov/airdata/ (accessed November 2014).
µg/m^3 = micrograms per cubic meter
PM_{10} = particulate matter less than 10 microns in diameter

The Guidance requires that the highest 24-hour background concentrations from the 3 most recent years of monitoring data be used. Thus, the background concentration that this Protocol uses is based on the highest PM_{10} value of 80 µg/m^3, which occurred in the second quarter of 2012.

4.7 Analysis Year and Traffic Data

According to the Guidance, a hot-spot analysis compares the air quality concentrations with the proposed project to the applicable NAAQS or to the concentrations without the project. These concentrations with the project are determined using a design value that is a combination of the modeled value and background concentration. The background concentration has been evaluated and determined as discussed in Section 3.6. The modeled value is determined from model runs of the proposed improvements and scope with emissions calculated for years during which peak emissions from the project are expected. A new NAAQS violation would most likely occur due to the cumulative impacts of the project and background concentrations.

The proposed project will likely affect local and regional travel patterns in the project study area upon its completion, resulting in changes in vehicle mix and traffic volumes, speeds, and vehicle miles traveled (VMT) along the SR 710 and neighboring facilities. Coupled with the declining trend for the background concentrations as discussed in Section 3.6, the study area is likely to be affected with the highest emissions from the changes in traffic immediately following the completion of the project. In addition to the opening year, which is 2025 for the Freeway Tunnel Alternatives, this Protocol also considers traffic impacts in 2035 when this study area will have been developed according to the latest planning assumptions in the 2012 RTP/SCS. Table 4.7 summarizes the traffic data in the project study area in 2012, 2025, and 2035.

The conformity rule requires that the latest planning assumptions available at the time of analysis must be used in conformity determinations (40 CFR 93.110). Furthermore, assumptions applied in hot-spot analyses must be consistent with those used in the regional emissions analyses for any inputs that are required for both analyses (40 CFR 93.123(c)(3)). Traffic data used in this Protocol have been estimated using the latest travel demand model consistent with the SCAG's model at the time the analysis began. The future forecasts have been estimated according to four individual periods of a day: AM (6:00 a.m. to 9:00 a.m.), mid-day (9:00 a.m. to 3:00 p.m.), PM (3:00 p.m. to 7:00 p.m.), evening (7:00 p.m. to 9:00 p.m.), and night time (9:00 p.m. to 6:00 a.m.). Traffic data have been developed in segments of roadways, and VMTs have been calculated based on traffic volume through and length of each segment.

TABLE 4.7:
Average Daily Traffic Data

Scenario	VMT[1]	Total Vehicles	LHD Truck (%)	MHD Truck (%)	HHD Truck (%)	Bus (%)
Existing Condition (2012 data)	5,244,158	2,904,532	1.0	0.8	2.8	0.7
2025 No Build Alternative	5,401,716	2,984,233	1.3	0.8	3.8	0.5
2025 Freeway Tunnel Alternative (Single Bore) with Toll	5,631,057	3,181,025	1.6	1.1	5.4	0.7
2025 Freeway Tunnel Alternative (Single Bore) with Toll without Trucks	5,647,169	3,188,828	1.1	0.6	3.1	0.7
2025 Freeway Tunnel Alternative (Single Bore) with Toll with Express Bus	5,621,240	3,167,369	1.6	1.1	5.5	0.7
2025 Freeway Tunnel Alternative (Dual Bore) without Toll	5,610,601	3,065,774	1.7	1.1	5.6	0.7
2025 Freeway Tunnel Alternative (Dual Bore) without Toll without Trucks	5,633,641	3,074,652	1.0	0.6	2.8	0.7
2025 Freeway Tunnel Alternative (Dual Bore) with Toll	5,605,775	3,059,535	1.4	0.9	4.5	0.7
2035 No Build Alternative	5,455,491	3,052,102	1.4	0.9	4.0	0.7
2035 Freeway Tunnel Alternative (Single Bore) with Toll	5,736,920	3,252,484	1.7	1.1	5.8	0.9
2035 Freeway Tunnel Alternative (Single Bore) with Toll without Trucks	5,731,794	3,251,518	1.3	0.8	4.0	0.9
2035 Freeway Tunnel Alternative (Single Bore) with Toll with Express Bus	5,717,589	3,247,819	1.7	1.1	5.8	0.9
2035 Freeway Tunnel Alternative (Dual Bore) without Toll	5,694,039	3,139,596	1.6	1.0	5.2	1.0
2035 Freeway Tunnel Alternative (Dual Bore) without Toll without Trucks	5,719,467	3,141,728	1.2	0.7	3.4	1.0
2035 Freeway Tunnel Alternative (Dual Bore) with Toll	5,687,872	3,129,577	1.5	0.9	4.5	1.0

Source: *Transportation Technical Report SR 710 North Study* (CH2MHill 2014).
[1] VMT is calculated by multiplying the total vehicle trips by the length of the roadway segments.
HHD = heavy-heavy-duty
LHD = light-heavy duty
MHD = medium-heavy-duty
VMT = vehicle miles traveled

4.8 Data Inputs and Receptors

The AERMOD model uses emission rates based on traffic data and emission factors, and meteorological data to estimate ground-level concentrations of $PM_{2.5}$ and PM_{10} at a series of receptors. AERMOD requires specific information for each roadway segment and emissions from vehicles operating on that roadway segment. The forecasted average daily traffic data will be applied to appropriate emission factors to estimate emissions for each of the segments along the proposed alignment. Emissions for tire and brake wear, as well as re-entrained road dust, will be calculated and included according to the same forecasted traffic data.

As provided by the SCAQMD, surface meteorological data from the Central Los Angeles Station and upper meteorological air data from the Miramar Station in San Diego for the 5-year period of 2006 through 2011 (2008 was left out because the raw data from the Central Los Angeles Station did not meet the EPA data completeness requirement for meteorological data) will be used to meet the EPA' s modeling guidance that recommends use of data sets with 90 percent or more complete per parameter and per quarter.

Receptors will be placed in order to estimate the highest concentrations of $PM_{2.5}$ and PM_{10} to determine any possible violations of the NAAQS. As specified in the EPA Guidance, a line of receptors will be placed at the ROW line or roadway boundary for conformity analysis.

For the first-round modeling (coarse grid), layers of receptor grids will be added as follows:

- 50-meter grid spacing starting at the edge of all highways/interstates out to 250 meters
- 250-meter grid spacing between 250 meters and 500 meters from the edge of all highways/interstates
- 100-meter spacing on the edge of all arterials

For the second-round modeling (fine grid), layers of receptor grids will be added as follows:

- 25-meter grid spacing starting at the edge of all highways/interstates out to 100 meters
- 100-meter grid spacing out to 500 meters from the edge of all highways/interstates
- 100-meter spacing on the edge of all arterials

4.9 Calculation of Design Values and Conformity Determination

As described in the Guidance, design values are a fundamental component of PM hot-spot analyses because they are the values compared to the NAAQS and between build and no-build scenarios. In general, a hot-spot analysis compares air quality concentrations with the proposed project (the build scenario) to air quality concentrations without the project (the no-build scenario). The conformity rule requires that the build scenario not cause or contribute to any new violations of the NAAQS, increase the frequency or severity of existing violations, or delay timely attainment as compared to the no-build scenario (40 CFR 93.116(a) and 93.123(c)(1)).

The following conformity determination, including calculation of the design values, will only be conducted for the results of the second round of modeling (fine grid). This process will begin by determining the design value for the receptor in each of the build scenarios with the highest modeled air quality concentration. If the design value for this receptor is less than or equal to the relevant NAAQS, it can be assumed that conformity requirements are met at all receptors in the project area without further analysis. If this is not the case, mitigation or control measures could be added and a new determination made of the resulting highest modeled air quality concentration. If the design value for this receptor is now less than or equal to the relevant NAAQS, it can be assumed that conformity requirements are met at all receptors in the project area without further analysis.

If the design value for this receptor is still greater than the relevant NAAQS, design values are then calculated for the no-build scenario at all receptors with design values that exceeded the NAAQS in the build scenarios. Conformity requirements are met if the design value for every appropriate receptor in all build scenarios is less than or equal to the same receptor in the no-build scenario. If not, then the project does not meet conformity requirements without further mitigation or control measures to address air quality concentrations at receptors.

4.9.1 $PM_{2.5}$

4.9.1.1 24-Hour $PM_{2.5}$ Concentration

The 24-hour $PM_{2.5}$ design value is currently defined as the average of 3 consecutive years' 98th percentile concentrations of 24-hour values for each of those years. The NAAQS is met when that 3-year average concentration is less than or equal to the 24-hour $PM_{2.5}$ NAAQS of 35 µg/m^3.

As discussed in Section 4.6.1.1, the background 24-hour $PM_{2.5}$ concentration was determined to be 30.8 µg/m^3. Using appropriate control and output pathways, AERMOD will be programmed to calculate and identify the highest average 24-hour concentration from the AERMOD run among all the receptors. As specified by the Guidance, all values will be rounded to the nearest 1 µg/m^3.

4.9.1.2 Annual $PM_{2.5}$ Concentration

The annual $PM_{2.5}$ design value is currently defined as the average of 3 consecutive years' annual averages, each estimated using equally-weighted quarterly averages. This NAAQS is met when the 3-year average concentration is less than or equal to the annual $PM_{2.5}$ NAAQS (currently 15.0 µg/m^3).

As discussed in Section 4.6.1.2, the background annual $PM_{2.5}$ concentration was determined to be 12.494 µg/m^3. Using appropriate control and output pathways, AERMOD will be programmed to calculate and identify the highest average annual concentration from the AERMOD run among all the receptors. As specified by the Guidance, all values will be rounded to the nearest 0.1 µg/m^3.

4.9.2 PM_{10}

The Guidance provides that compliance with the 24-hour PM_{10} NAAQS is based on the expected number of 24-hour exceedances of 150 µg/m^3 averaged over 3 consecutive years. The NAAQS is met when the expected number of exceedances is less than or equal to 1.0. According to the Guidance, the design value for 24-hour PM_{10} will be calculated by combining the background concentrations with the concentration values generated for receptors in AERMOD.

DV for PM_{10} = Background Concentration + the highest sixth-highest concentration from AERMOD

As discussed in Section 4.6.2, the background 24-hour PM_{10} concentration was determined to be 80 µg/m^3, which occurred in the second quarter of 2012. Using appropriate control and output pathways, AERMOD will be programmed to calculate and identify the highest of all sixth-highest concentrations from the AERMOD run among all the receptors. As specified by the Guidance, all values will be rounded to the nearest 10 µg/m^3.

5. References

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