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QUANTITATIVE PM_{2.5} AND PM₁₀ HOT-SPOT ANALYSIS PROTOCOL **I-710 CORRIDOR PROJECT**

CONTENTS

1.	INTRODUCTION	1
2.	PROJECT DESCRIPTION	6
2.1	Project Air Quality Study Area	6
2.2	Purpose and Need of the Project	9
2.3	Project Alternatives	9
2.3.1	Alternative 1– No Build Alternative	10
2.3.2	Alternative 5C	10
3.	INTERAGENCY CONSULTATION	15
4.	HOT-SPOT ANALYSIS METHODOLOGY	21
4.1	Hot-spot Selection	21
4.2	National Ambient Air Quality Standards (NAAQS)	23
4.2.1	PM _{2.5} NAAQS	23
4.2.2	PM ₁₀ NAAQS	23
4.3	Project-Level PM Emissions Overview	23
4.3.1	Types of Emissions Considered	24
4.3.2	Emission Factors	24
4.3.2.1	Exhaust, Tire Wear, and Brake Wear Emission Factors	24
4.3.2.2	Entrained Road Dust Emission Factors	25
4.3.3	Traffic and VMT Data	26
4.3.4	Project-Level PM ₁₀ and PM _{2.5} Emission Inventories	26
4.4	Dispersion Modeling for PM Hot-Spot Analysis	28
4.4.1	Air Dispersion Model	28
4.4.2	Source Location, Configuration, and Parameters	28
4.4.3	Receptors	29
4.4.4	Meteorology and Climate	30
4.5	Nearby Sources	30
4.6	Air Quality Trend Analysis	30
4.7	Background Concentrations	35
4.7.1	PM _{2.5}	35
4.7.2	PM ₁₀	36
4.8	Calculation of Design Values and Conformity Determination	36
4.8.1	24-Hour PM _{2.5}	37
4.8.2	Annual PM _{2.5}	37
4.8.3	24-Hour PM ₁₀	37
5.	REFERENCES	38

CONTENTS *(CONTINUED)*

TABLES

- Table 1: Level of Service Data for Operational Worst-Case Intersections Analyzed in the CO Conformity Report
- Table 2: Methodology and Assumptions for PM Hot-Spot Quantitative Analyses
- Table 3: Criteria Used for Selection of Modeled Hot-Spot Locations for Other Freeway Projects
- Table 4: Modeled Source Parameters
- Table 5: Ambient PM_{2.5} Monitoring Data at the Compton Air Monitoring Station ($\mu\text{g}/\text{m}^3$)
- Table 6: Ambient PM₁₀ Monitoring Data at the South Long Beach Station ($\mu\text{g}/\text{m}^3$)
- Table 7: Current PM_{2.5} Design Value Background Concentrations ($\mu\text{g}/\text{m}^3$)

FIGURES

- Figure 1a: AM Peak Hour Levels of Service
- Figure 1b: Mid-Day Peak Hour Levels of Service
- Figure 1c: PM Peak Hour Levels of Service
- Figure 2: General Project Study Area
- Figure 3: Project Study Areas for Air Quality Analyses
- Figure 4: Meteorological Station Locations
- Figure 5: Source-Receptor Setup for PM₁₀ Hot-Spot Modeling
- Figure 6: Source-Receptor Setup for PM_{2.5} Hot-Spot Modeling
- Figure 7: Ambient Air Monitoring Stations

APPENDICES

- Appendix A: I-710 Corridor Project: Modeling Location Selection for Quantitative PM Hot-spot Analyses
- Appendix B: I-710 Corridor Project: Selection of Analysis Year for Quantitative PM Hot-spot Analyses
- Appendix C: Emission Calculation Details

ACRONYMS AND ABBREVIATIONS

µg/m ³ :	micrograms per cubic meter
AERMET:	AMS/EPA Regulatory Model Meteorological Processor
AERMOD:	AMS/EPA Regulatory Model
AMS/EPA	American Meteorological Society/Environmental Protection Agency
AOI:	Area of Interest
AQ/HRA	Air Quality/Health Risk Assessment
AQMP:	Air Quality Management Plan
BNSF:	Burlington Northern Santa Fe Railway Company
CAA	Clean Air Act
CARB:	California Air Resources Board
CFR:	code of federal regulations
CSI:	Cambridge Systematics Incorporated
DA/SR	drive alone and shared ride vehicles
DPM	diesel particulate matter
EIR:	Environmental Impact Report
EIS:	Environmental Impact Statement
EMFAC	EMission FACtors model
FCAA:	Federal Clean Air Act
FRATIS:	freight advanced traveler information systems
FTIP:	Federal Transportation Improvement Program
GIS	geographic information system
GP:	general purpose
HDT:	heavy-duty trucks
HHDT	heavy heavy-duty trucks
I-105:	Interstate-105
I-405:	Interstate-405
I-5:	Interstate-5
I-710:	Interstate-710
ITS:	Intelligent Transportation Systems
KCQT:	University of Southern California/Downtown Los Angeles Monitoring Station

ACRONYMS AND ABBREVIATIONS *(CONTINUED)*

KLGB:	Long Beach Airport Monitoring Station
LADWP:	Los Angeles Department of Water and Power
LAJ:	Los Angeles Junction
LHDT	light heavy-duty trucks
MHDT	medium heavy-duty trucks
NAAQS:	National Ambient Air Quality Standards
NOx:	oxides of nitrogen
NZE:	near zero emission
PCH:	Pacific Coast Highway
PM:	particulate matter
PM ₁₀ :	particulate matter less than 10 microns in diameter
PM _{2.5} :	particulate matter less than 2.5 microns in diameter
POLA:	Port of Los Angeles
POLB:	Port of Long Beach
RDEIR:	Recirculated Draft Environmental Impact Report
RTP:	Regional Transportation Plan
RTP/SCS:	Regional Transportation Plan/Sustainable Communities Strategy
SB:	southbound
SCAB:	South Coast Air Basin
SCAG:	Southern California Association of Governments
SCAQMD:	South Coast Air Quality Management District
SCE:	Southern California Edison
SDEIS:	Supplemental Draft Environmental Impact Statement
SIP:	state implementation plan
SR-60:	State Route 60
SR-91:	State Route-91
TCWG:	Transportation Conformity Working Group
TDM:	Transportation Demand Management
TSM:	Transportation Systems Management
UP:	Union Pacific

ACRONYMS AND ABBREVIATIONS *(CONTINUED)*

USEPA:	United States Environmental Protection Agency
VMT:	vehicle miles traveled
WBAN:	Weather Bureau Army Navy
ZE:	zero emission

1. INTRODUCTION

Transportation conformity is required under Section 176(c) of the Federal Clean Air Act¹ (CAA) to ensure that federally supported highway and transit project activities are consistent with the purpose of the state implementation Plan (SIP). Conformity with an air quality SIP is defined as complying with a plan's purpose of maintaining the ambient air quality standards. The federal rules and regulations governing conformity are described in the Code of Federal Regulations (CFR), Chapter 40 Parts 51² and 93.³ Transportation conformity with the CAA takes place on two levels: first at the regional level and second at the project level. The proposed project must conform at both levels to be federally approved. For the proposed Interstate-710 (I-710) Corridor Project, the Southern California Association of Government's (SCAG) 2012 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS) and more recent 2016 RTP/SCS⁴ are the relevant regional planning documents, both of which have been determined to be in conformity with the SIP for achieving the goals of the CAA.^{5, 6, 7}

Transportation conformity review at the project-level is required given the proposed project is located within nonattainment and maintenance for particulate matter less than 2.5 microns in diameter (PM_{2.5}) and particulate matter less than 10 microns in diameter (PM₁₀), respectively. Specifically, under the 40 Code of Federal Regulations (CFR) 93.116 and 93.123, Ramboll will conduct the project-level conformity analyses, and, if necessary, a quantitative "hot-spot" analysis for PM_{2.5} and PM₁₀ for the preferred project alternative.⁸ As stated in 40 CFR 93.123(b)(1), PM hot-spot analyses are only required for projects of local air quality concern (POAQC), which is defined in the followings:

- (i) New highway projects that have a significant number of diesel vehicles, and expanded highway projects that have a significant increase in the number of diesel vehicles;

¹ United States Senate. 2004. The Clean Air Act. As Amended Through P.L. 108-201, February 24. Available at: <https://www.congress.gov/108/plaws/publ201/PLAW-108publ201.pdf>. Accessed: January 2018.

² Code of Federal Regulations (CFR) Title 40 Chapter I Subchapter C Part 51 – Requirement for Preparation, Adoption, and Submittal of Implementation Plans. Available at: <http://www.ecfr.gov/>. Accessed: January 2018.

³ CFR Title 40 Chapter I Subchapter C Part 51 – Determining Conformity of Federal Actions to State or Federal Implementation Plans. Available at: <http://www.ecfr.gov/>. Accessed: January 2018.

⁴ Southern California Association of Governments (SCAG). 2016. The 2016-2014 Regional Transportation Plan/Sustainable Communities Strategy: A Plan for Mobility, Accessibility, Sustainability, and a High Quality of Life. Adopted April 2016. Available at: <http://scagrtpscs.net/Documents/2016/final/f2016RTPSCS.pdf>. Accessed: January 2018.

⁵ Mammano, Vincent. 2014. Conformity Determination for SCAG's 2015 FTIP, 2015 FTIP Amendment No. 15-01, and SCAG's 2012-2035 RTP/SCS through Amendment No. 2. United States Department of Transportation. Federal Highway Administration. Division Administrator. December 15. Available at: http://ftip.scag.ca.gov/Documents/F2015_FTIPfedApproval.pdf. Accessed: January 2018.

⁶ Mammano, Vincent. 2016. Conformity Determination for SCAG 2016 RTP/SCS. United States Department of Transportation. Federal Highway Administration. Division Administrator. June 1. Available at: http://scagrtpscs.net/Documents/2016/notices/FHMW-FTA_2016RTPSCSConformityDetermination_2016-0601.pdf. Accessed: January 2018.

⁷ As noted in the 2017 Recirculated Draft Environmental Impact Report/Recirculated Supplemental Impact Statement, the full scope of project is not currently in the FTIP and the Project Description in the RTP/SCS does not match either of the currently proposed build alternatives, both the RTP and RTIP will be amended to be consistent with the preferred alternative prior to the approval of the Final EIR/EIS.

⁸ Code of Federal Regulations (CFR) Title 40 Chapter I Subchapter C Part 93 Subpart A §93.116 and §93.123. Available at: <http://www.ecfr.gov/>. Accessed: January 2018.

- (ii) Projects affecting intersections that are at Level of Service D, E, or F with a significant number of diesel vehicles, or those that will change to Level of Service 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 PM₁₀ or PM_{2.5} applicable implementation plan or implementation plan submission, as appropriate, as sites of violation or possible violation.

The I-710 Corridor Project (Alternative 5C)

The I-710 Corridor Project, and in particular Alternative 5C, is an expanded highway project described in greater detail in Section 2.3.2. In addition to traditional expanded highway project features to improve safety and mobility, Alternative 5C includes novel air quality and public health program elements. A Zero Emission/Near-Zero Emission (ZE/NZE) truck program is included to provide monetary incentives for trucks travelling most frequently on the I-710 itself compared to other trucks (equivalent to 4,000 ZE/NZE trucks that must demonstrate travel on I-710). A ZE/NZE truck has 90% lower NO_x emissions and 100% lower diesel particulate matter (DPM) emissions compared the cleanest current diesel trucks (Model Year 2010 or better). In addition to reducing NO_x levels and cancer risk along the I-710 (maximum modeled cancer risk from the Recirculated Draft Environmental Impact Report/Supplemental Draft Environmental Impact Statement (RDEIR/SDEIS) in 2012 Baseline (1,421 in a million), 2035 No-Build (57 in million) and 2035 Alternative 5C (45 in a million), respectively), ***it is calculated that the ZE/NZE program will lower diesel heavy duty truck vehicle miles travelled (VMT) along the I-710 by 15% compared to the 2035 No-Build.***⁹

Ten intersections were identified to represent the worst-case operational conditions and/or most project-affected intersections in representative geographic locations throughout the AQ/HRA study area; five intersections (#177, #19, #63, #93, and #155) were the most congested and, because the project covers a large, diverse geographic area, an additional five were chosen as most project affected and congested in other geographic locations.¹⁰ The ten intersections and related Level of Service (LOS) information for the No-Build and Alternative 5C are presented below (Table 5-2 of the June 2017 AQ/HRA Appendix G); ***LOS stays the same or improves at these intersections for Alternative 5C compared to the No Build.***

⁹ See June 2017 Air Quality/Health Risk Assessment (AQ/HRA) Report, Appendix C, Chapter 7 for technical details about how the effects of the ZE/NZE truck program were incorporated into the AQ/HRA analyses and this Protocol. As noted in this reference, the reduction in conventional heavy-heavy duty truck VMT along the I-710 is approximately 24%. Available at: <http://www.dot.ca.gov/d7/env-docs/docs/710corr-eir/Technical%20Studies/Air%20Quality%20Greenhouse%20Gas%20Health%20Risk%20Assessment%20June%202017.pdf>. Accessed: June 2018.

¹⁰ Table 5-2 of June 2017 Air Quality/Health Risk Assessment (AQ/HRA) Report, Appendix G; see Section 5.2 for more technical details about the intersection selection.

Table 1. Level of Service Data for Operational Worst-Case Intersections Analyzed in the CO Conformity Report

ID	Main Street	Cross Street	Delay, LOS, and Total Afternoon Cumulative Peak-Hour Delay			
			No-Build (2035)		Alternative 5C (2035)	
			Delay (sec)/LOS	Total Delay (hr)	Delay (sec)/LOS	Total Delay (hr)
177	Washington Blvd	Soto St	196.6/F	325	192.3/F	320
19	Pacific Coast Hwy	Santa Fe Ave	151.4/F	210	179.7/F	263
63	Florence Ave	Alameda St (West	198.5/F	260	185.3/F	242
93	Ford Blvd	Whittier Blvd	212.2/F	150	241.8/F	171
155	Wilmington Ave	223rd St	157.8/F	242	151.3/F	232
1002	Pacific Coast Hwy	Harbor Ave	96.1/F	103	160.9/F	179
523	Long Beach Blvd	Victoria St	135.4/F	117	231.1/F	205
83	Indiana St	Olympic Blvd	214.0/F	177	105.7/F	92
57	Imperial Hwy	Paramount Blvd	95.5/F	148	96.3/F	149
503	I-405 SB	223rd St (On/Off)	332.3/F	235	26.4/C	20

Alternative 5C mobility improvements also improve the LOS along the freeway,¹¹ as shown in Figure 1a through Figure 1c.

¹¹ 2017. Caltrans, Metro. I-710 Corridor Project Recirculated Draft Environmental Impact Report/Subsequent Draft Environmental Impact Statement (RDEIR/SDEIS), Section 3.5. Available at: http://www.dot.ca.gov/d7/env-docs/docs/RDEIR_SDEIS%20July%202017.pdf. Accessed: June 2018.

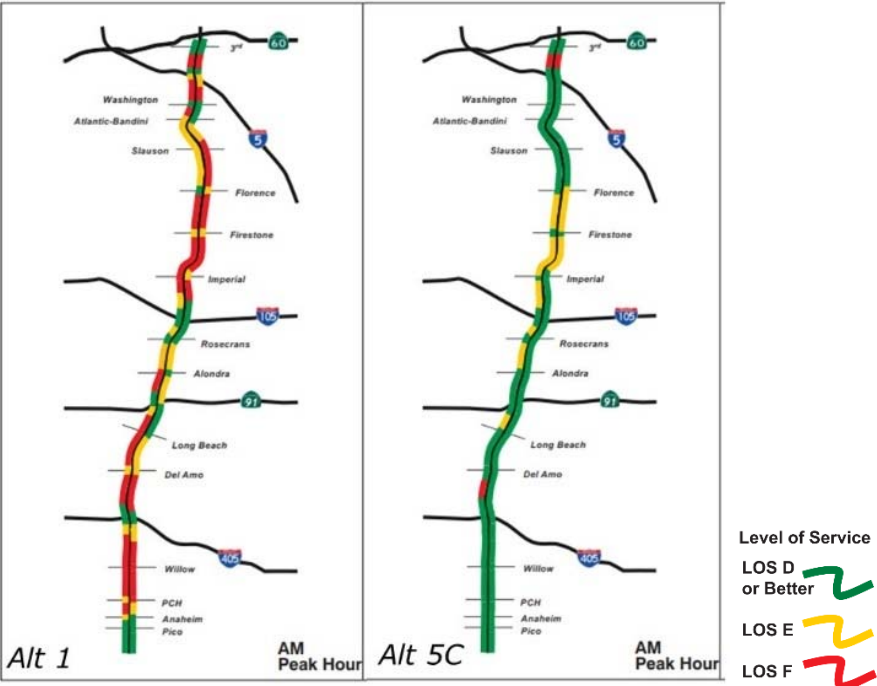


Figure 1a. AM Peak Hour Levels of Service
 A full size figure can be found in the Figures Section

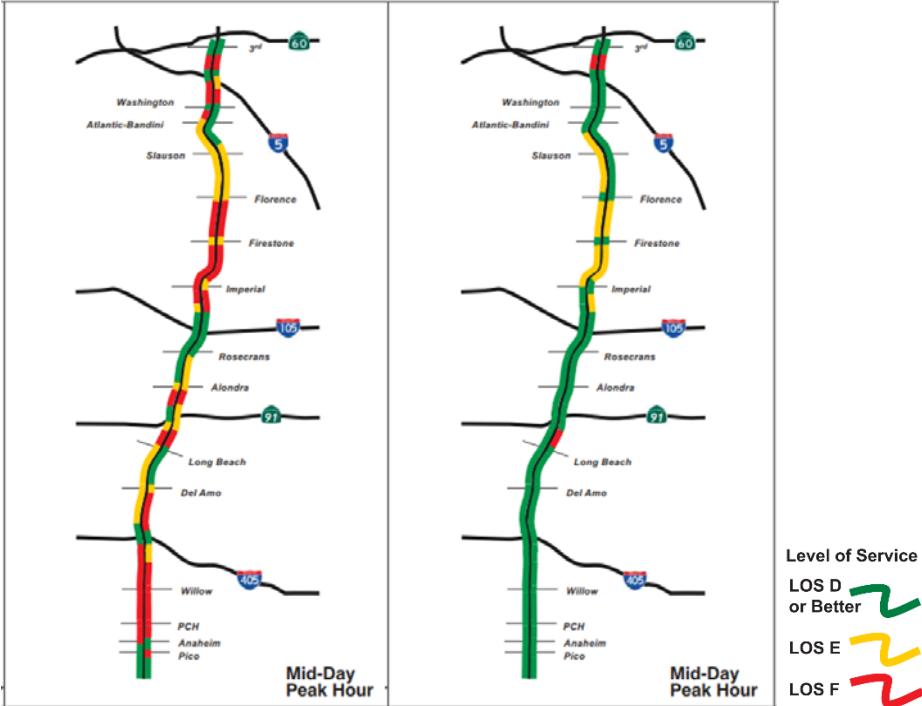


Figure 1b. Mid-Day Peak Hour Levels of Service
 A full size figure can be found in the Figures Section

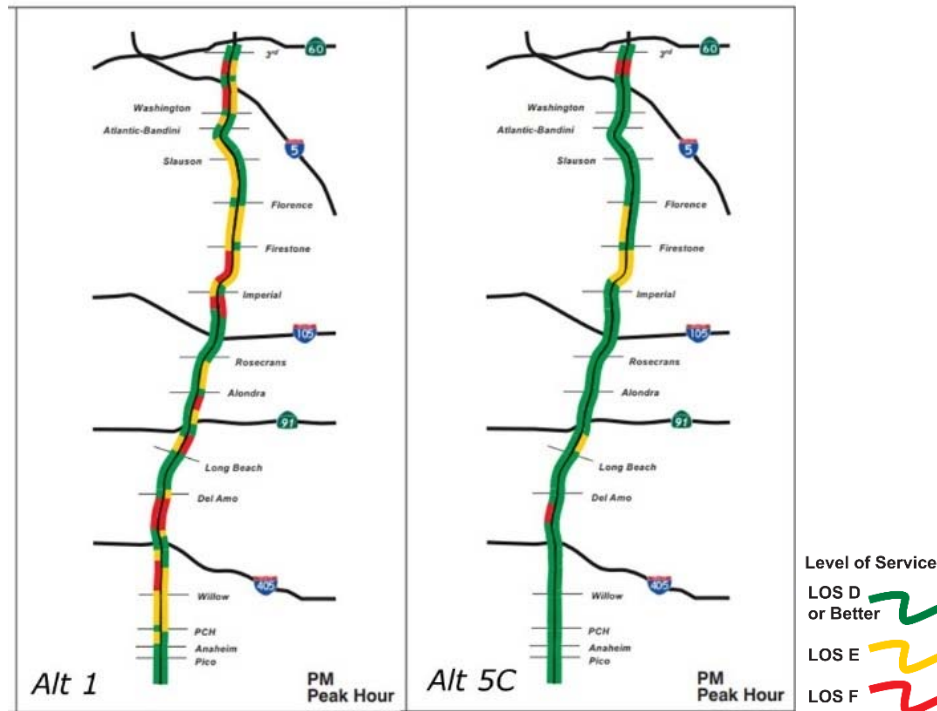


Figure 1c. PM Peak Hour Levels of Service.

A full size figure can be found in the Figures Section

According to the 2016 Air Quality Management Plan (AQMP), the Los Angeles area is in attainment of the PM₁₀ National Ambient Air Quality Standard (NAAQS) and 24-hour average and annual average PM_{2.5} levels will be below their respective NAAQS levels by 2019 and 2025, respectively.¹² For example, the entire South Coast Air Basin (SCAB) will be below the 24-hour average PM_{2.5} NAAQS of 35 µg/m³ by 2019; Los Angeles is projected to be at 27.6 µg/m³. The entire SCAB will be below the annual average PM_{2.5} NAAQS of 12 µg/m³ by 2025; Los Angeles is projected to be at 10.8 µg/m³.

As seen above, Alternative 5C may not meet the definition of a POAQC. However, if it is determined to be a POAQC, this protocol describes the proposed technical methodology, model inputs, and assumptions that will be used in the I-710 Project quantitative PM_{2.5} and PM₁₀ Hot-Spot Analysis in accordance with the applicable portions of the conformity regulations^{13, 14} and the United States Environmental Protection Agency's 2015 guidance (2015 USEPA Guidance) for PM hot-spot analyses.¹⁵

¹² SCAQMD. 2017. 2016 AQMP, Chapter 5, Future Air Quality. Available at: <http://www.aqmd.gov/docs/default-source/clean-air-plans/air-quality-management-plans/2016-air-quality-management-plan/final-2016-aqmp/chapter5.pdf?sfvrsn=4>. Accessed: June 2018.

¹³ Code of Federal Regulations (CFR) Title 40 Chapter I Subchapter C Part 93 Subpart A §93.116 and §93.123. Available at: <http://www.ecfr.gov/>. Accessed: January 2018.

¹⁴ CFR Title 40 Chapter I Subchapter C Part 93 Subpart A §93.123 - Procedures for determining localized CO, PM₁₀, and PM_{2.5} concentrations (hot-spot analysis). Available at: <http://www.ecfr.gov/>. Accessed: January 2018.

¹⁵ USEPA. 2015. Transportation Conformity Guidance for Quantitative Hot-spot Analyses in PM_{2.5} and PM₁₀ Nonattainment and Maintenance Areas (EPA-420-B-15-084). November. Office of Transportation and Air Quality. Available at: <https://www3.epa.gov/otaq/stateresources/transconf/documents/420b15084.pdf>. Accessed: January 2018.

2. PROJECT DESCRIPTION

I-710 (also known as the Long Beach Freeway) is a major north/south interstate freeway connecting the City of Long Beach to central Los Angeles. The I-710 Corridor Project study area includes the portion of Route 710 from Ocean Boulevard in Long Beach to State Route 60 (SR-60) in East Los Angeles, a distance of approximately 19 miles. At the crossing freeways, the study area extends up to one and a half miles east and west of I-710. It also traverses portions of the cities of Bell, Bell Gardens, Carson, Commerce, Compton, Cudahy, Downey, Huntington Park, Lakewood, Long Beach, Los Angeles, Lynwood, Maywood, Paramount, Signal Hill, South Gate, and Vernon.

Within the study area, the freeway serves as the principal transportation connection for goods movement between multiple facilities. These facilities include the Port of Los Angeles (POLA) and Port of Long Beach (POLB) shipping terminals, the four crossing freeways servicing destinations beyond the study area, local warehousing along I-710, and intermodal railyards located in the cities of Commerce and Vernon.

2.1 Project Air Quality Study Area

Figure 2 shows the general study area for the I-710 Corridor Project from Ocean Boulevard in Long Beach to State Route 60 (SR-60) in East Los Angeles, a distance of approximately 19 miles. However, each environmental analysis may have its own study area. In the Air Quality, Greenhouse Gas, and Health Risk Assessment Technical Study for the I-710 Corridor Revised Draft Environmental Impact Report/Supplemental Draft Environmental Impact Statement (I-710 AQ/GHG/HRA Study),¹⁶ incremental daily mass emission impacts were evaluated in the South Coast Air Basin (SCAB), Area of Interest (AOI) which is a sub-region of the SCAB that includes cities and communities along the I-710 freeway, and the I-710 freeway which may include a freight corridor and related ramps, depending on the project alternative (Figure 3).

According to 40 CFR 93.123(c)(2), hot-spot analyses must include the entire transportation project. However, due to the extent of the project area, this hot-spot analysis will focus on sub-areas where the air quality is substantially affected by the project and that result in the highest PM₁₀ and PM_{2.5} concentrations. For the PM conformity analysis, traffic data, emissions data, and modeled PM₁₀ and PM_{2.5} concentrations presented in the I-710 AQ/GHG/HRA Study will be evaluated as needed to assist in the decision on the hot-spot locations (i.e., which roadway links/areas). Per Section 3.3.2 in the 2015 USEPA Guidance, the conformity can be assumed to be met throughout the entire project area if conformity is demonstrated at such locations where highest PM concentrations are expected.

The Project-level hot-spot analyses for PM_{2.5} and PM₁₀ will be conducted for the selected hot-spot locations of Alternative 5C, the locally preferred project alternative. Detailed project descriptions for the No Build Alternative (Alternative 1) and Alternative 5C are provided in the sections below.

¹⁶ Ramboll Environ. 2017. Air Quality, Greenhouse Gas, and Health Risk Assessment Technical Study for the I-710 Corridor Revised Draft Environmental Impact Report/Supplemental Draft Environmental Impact Statement.

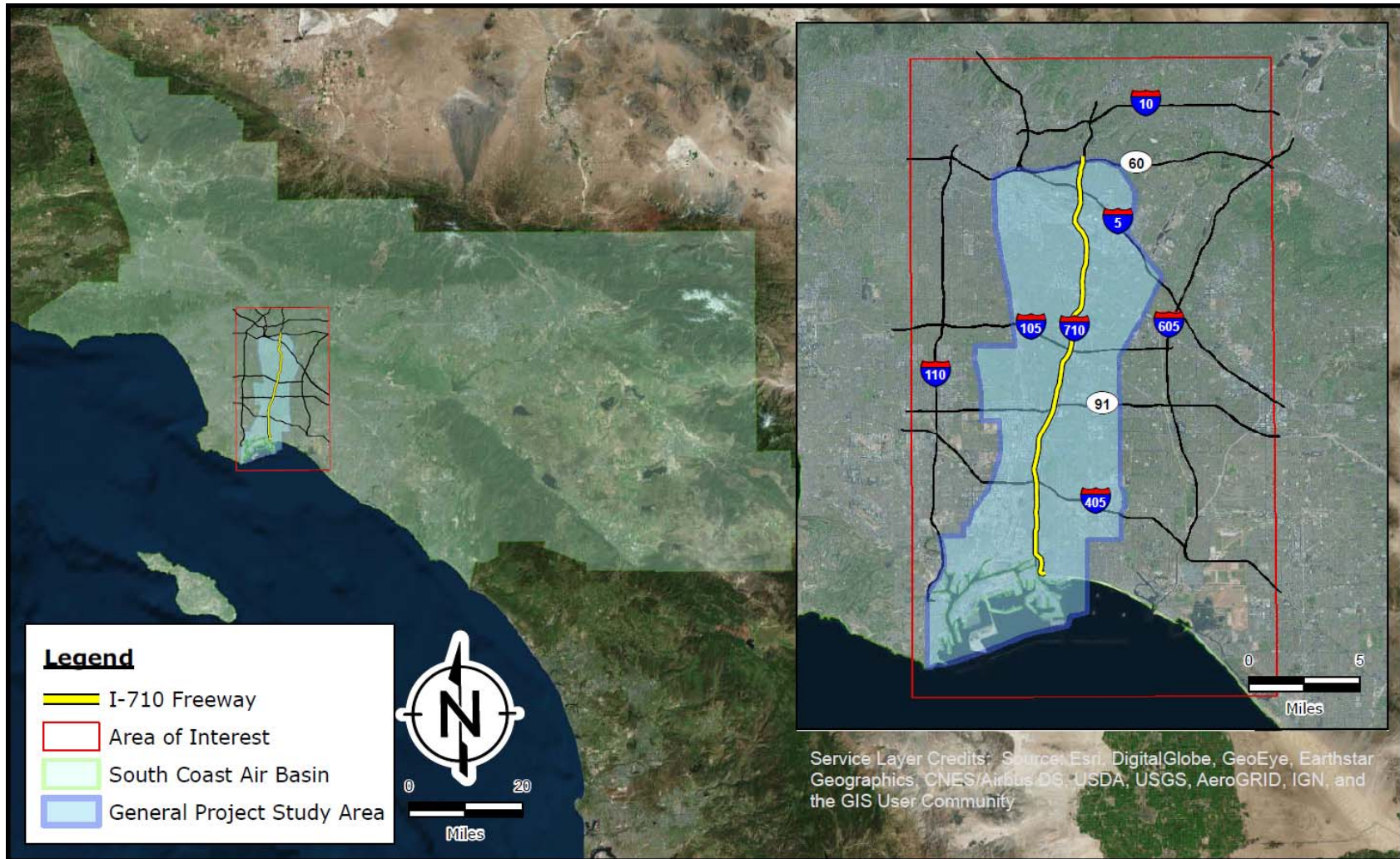


Figure 3. Project Study Areas for Air Quality Analyses
A full size figure can be found in the Figures Section

2.2 Purpose and Need of the Project

I-710 is an essential component of the regional, statewide, and national transportation system and serves both passenger and goods movement vehicles. As a result of population growth, cargo container growth, increasing traffic volumes, and aging infrastructure, the I-710 Freeway experiences serious congestion and safety issues. Moreover, the number of Heavy-Duty Trucks (HDT) traveling along the I-710 corridor has also increased, resulting in high levels of air pollution, particularly diesel particulate matter (DPM) emissions, and other negative impacts to the communities near the I-710. As a result of this strain, I-710 is unable to accommodate current or future traffic demands. The purpose¹⁷ of the proposed I-710 Corridor Project is to:

- Improve air quality and public health;
- Improve traffic safety;
- Address design deficiencies;
- Address projected traffic volumes; and
- Address projected growth in population, employment, and activities related to goods movement.

The need for the proposed I-710 Corridor Project is as follows:

- I-710 experiences high heavy-duty truck volumes, resulting in high concentrations of diesel particulate emissions within the I-710 Corridor.
- I-710 experiences accident rates, especially truck-related, that are well above the statewide average for freeways of this type.
- At many locations along I-710, the on- and off-ramps do not meet current design standards, and weaving sections within and between interchanges are of insufficient length.
- High volumes of both trucks and cars have led to severe traffic congestion throughout most of the day (6:00 a.m. to 7:00 p.m.) on I-710 as well as on the connecting freeways. This is projected to worsen over the next 25 years.
- Increases in population, employment, and goods movement between now and 2035 will lead to more traffic demand on I-710 and on the streets and roadways within the I-710 Corridor as a whole.

2.3 Project Alternatives

Project alternatives were developed by a multidisciplinary technical team to achieve the needs and purpose of the I-710 Corridor Project. Various committees involved in the I-710 Corridor Project community participation framework reviewed the alternatives. In May 2009, the Alternative Screening process for this Project recommended that three build alternatives (Alternative 5A, 6A, and 6B) be evaluated along with Alternative 1, the 2035 No Build.¹⁸

¹⁷ A full description of the Need and Purpose of the I-710 Corridor Project can be found in the Notice of Preparation (http://www.metro.net/projects_studies/I710/images/710_NOP.pdf) and the I-710 Major Corridor Study Final Report (http://media.metro.net/projects_studies/710_final_report/default.htm).

¹⁸ URS Corporation. 2009. Technical Memorandum – Alternatives Screening Analysis (Final); Prepared for Los Angeles County Metropolitan Transportation Authority.

Subsequently in late 2010, the Funding Partners added a fourth build alternative (Alternative 6C). These five project alternatives were evaluated in the I-710 Draft Environmental Impact Report/ Environmental Impact Statement (EIR/EIS)¹⁹ that was released in June 2012. Based on the feedback obtained from the communities and stakeholders, the project team redefined the Project build alternatives to two build alternatives (Alternative 5C and 7). These build alternatives were evaluated along with the future No Build Alternative (Alternative 1) in the Revised Draft Environmental Impact Report/Supplemental Draft Environmental Impact Statement (RDEIR/SDEIS). On March 1, 2018 the Los Angeles Metropolitan Transportation Authority (LA Metro) Board adopted Alternative 5C as the locally preferred project alternative²⁰. Hence, Alternative 5C will be evaluated in the quantitative PM hot-spot analyses. The following sub-sections provide a brief description of Alternative 1 and Alternative 5C.

2.3.1 Alternative 1– No Build Alternative

Alternative 1 is the future no-build condition, for which the build alternatives proposed for the I-710 Corridor Project will be compared. The No Build Alternative does not include any improvements within the I-710 Corridor Project Study Area other than those projects that are already funded and/or committed to be constructed by or before the planning horizon year of 2035. The projects included in this alternative are based on SCAG's 2012-2035 Regional Transportation Plan Sustainable Communities Strategy (2012 RTP/SCS) Future Baseline Scenario for the Year 2035²¹ and 2011 Federal Transportation Improvement Program (FTIP) project list, including freeway, arterial, and transit improvements within the SCAG region. This alternative also includes current plans and projects related to goods movement to and from the Ports, such as maximum utilization of existing and planned railroad capacity as well as application of advanced technologies and programs to manage transportation systems and travel demand within the I-710 Corridor. Additionally, Alternative 1 assumes an expansion of transit service within the I-710 Corridor commensurate with future population and employment growth.

2.3.2 Alternative 5C

Alternative 5C proposes increasing the number of general purpose (GP) lanes on the freeway and reconfiguring the access points to/from I-710 and its crossing freeways. This alternative will:

- Shift the freeway centerline at several locations to minimize right-of-way impacts.
- Add up to one GP through lane in each direction between Anaheim Street and Olympic Boulevard to address capacity deficient segments on the freeway.
- Add two truck bypass lanes in each direction around the I-405 freeway-to-freeway interchange to address safety and operational deficiencies.
- Add a lane buffer in each direction between Pacific Coast Highway and Shoreline Drive to address safety and operational deficiencies.

¹⁹ Caltrans. 2012. I-710 Corridor Project: Draft EIR/EIS Report.

²⁰ Available at: <https://metro.legistar.com/View.ashx?M=A&ID=582362&GUID=281A07CD-E6CA-4A14-9DD6-ED7F71FB664E>. Accessed: April 2018.

²¹ SCAG. 2012. 2012-2035 Regional Transportation Plan/Sustainable Communities Strategy Print Version. Available at: <http://rtpscs.scag.ca.gov/Pages/2012-2035-RTP-SCS.aspx>. Accessed: January 2018.

- Modify freeway-to-freeway interchanges at I-405, SR-91, I-105, and I-5 to address safety, operational, and capacity deficiencies. Modification varies by location and may entail realignment of freeway connectors, adding and/or extending auxiliary lanes to connectors, and modification to the crossing freeways.
 - At the I-405 interchange, modification entails realignment and replacement of eight of the existing eight freeway-to-freeway connectors. Modifications also include the removal of the local interchange at Wardlow Road on I-710, the removal of the local interchange at Pacific Place on I-405, and modification of the local interchange on I-405 at Santa Fe Avenue.
 - At the SR-91 interchange, modification entails realignment and replacement of one of the existing eight freeway-to-freeway connectors and modification to ramp connection points on I-710. These modifications necessitate modification to the local interchange at Artesia Boulevard on I-710, the local interchange at Santa Fe Avenue on SR-91, the local interchange at Long Beach Boulevard on SR-91, and the local interchange at Atlantic Avenue on SR-91.
 - At the I-105 interchange, modifications entail relocating ramp connection points on I-710.
 - At the I-5 interchange, modifications include new collector-distributor roads that service local interchanges at Washington Boulevard and Bandini Boulevard and relocating ramp connection points on I-710.
- Modify local interchanges on I-710 to address safety, operational, and capacity deficiencies. Modification varies by location and may entail realignment of entrance and exit ramps, adding or extending auxiliary lanes to ramps, realignment of the local street crossings, and modification to adjacent intersecting local streets. Local interchange locations include:
 - Shoreline Drive,
 - Anaheim Street,
 - Pacific Coast Highway (PCH)/State Route 1,
 - Willow Street,
 - Del Amo Boulevard,
 - Long Beach Boulevard,
 - Alondra Boulevard,
 - Rosecrans Avenue,
 - MLK Jr. Boulevard,
 - Imperial Highway,
 - Firestone Boulevard,
 - Florence Avenue,
 - Atlantic Boulevard/Bandini Boulevard,

- Washington Boulevard, and
- Olympic Boulevard.
- Add or modify local crossings of I-710, as follows:
 - Add a local street crossing over I-710 at Southern Avenue in the City of South Gate to address capacity deficiencies.
 - Remove local one-way crossings over I-710 at Shoreline Drive (eastbound 9th Street to 6th Street and westbound 7th Street to 9th Street) to address safety and operational deficiencies.
 - On local street crossings, include pedestrian paths, which are comprised of sidewalks, curb ramps, and crosswalks.
 - On local street crossings, the cross section will have sufficient outside shoulder width to accommodate Class II bikeways.
 - Add five pedestrian/Class I bikeway crossings over I-710 and one pedestrian/Class I bikeway crossing under I-405.
- Replace, widen, add, and remove roadway or railway grade separation structures to accommodate lane additions, modified freeway realignments, and reconfigured interchanges. Some intersecting roadways and railroad crossings entail realignment of local streets and/or railroads. Railroad crossing locations where modifications are proposed include:
 - Union Pacific Railroad (UP Railroad) San Pedro Subdivision at I-405 in Long Beach,
 - UP Railroad San Pedro Subdivision at I-710 in Long Beach,
 - UP Railroad San Pedro Subdivision at I-710 in South Gate,
 - UP Railroad Patata Industrial Lead at I-710 in South Gate,
 - UP Railroad La Habra Subdivision at I-710 in Bell,
 - Los Angeles Junction (LAJ) Railway Laguna Line at I-710 in Bell,
 - LAJ Railway Laguna Line at I-710 in Vernon,
 - Burlington Northern and Santa Fe Railway Company (BNSF) Hobart Yard at I-710 in Commerce/Vernon, and,
 - UP Railroad East Yard at I-710 in Commerce.

- Replace, modify, enhance, add, and remove storm water conveyance and treatment systems, roadside equipment, maintenance, and access features, to accommodate freeway modifications.
- Replace, modify, and relocate critical infrastructure that crosses proposed freeway modifications. Critical infrastructure includes, but is not limited to, flood control facilities and major utilities. Prominent infrastructure crossings include the Los Angeles River, Compton Creek, Southern California Edison (SCE) transmission lines, and Los Angeles County Department of Water and Power (LADWP) transmission lines.
- Incorporate aesthetic enhancements that include thematic surface treatment of structures and paved surfaces, enhanced roadside landscaping, and irrigation consistent with a corridor-wide aesthetic master plan.

In addition to the freeway features described, the alternative includes added transit, new transportation system features and strategies, and programmatic elements, as follows:

- A program to address future congestion at selected local arterial intersections to reduce traffic delay and improve operations within the Study Area. The I-710 Corridor Congestion Relief Program will make funding available to local jurisdictions in order to improve deficient intersections under Alternative 1 (No Build) conditions. Eligible intersection projects consist of improvements such as signal phasing/timing adjustments, lane restriping, median modification, and/or spot widening to provide intersection turn lanes. Under this program, eligible projects must comply with Caltrans' "Complete Streets" guidelines and principles.
- Transportation Systems Management/Transportation Demand Management (TSM/TDM) elements including adaptive ramp metering, updated traffic signals, parking restrictions during peak periods, and improved arterial signage for access to I-710.
- Intelligent Transportation Systems (ITS) elements including updated fiber-optic communications to interconnect traffic signals along major arterial streets to improve traffic flow. Proposed I-710 ITS elements also incorporate selected components from the Los Angeles/Gateway Freight Technology Program specific to the I-710 Corridor. These include freeway smart corridor strategies that would deploy dedicated short-range communications roadside units alongside I-710 to manage and control traffic in real time based on prevailing conditions, applying operational strategies such as queue warning systems, variable speed limits/speed harmonization, and dynamic corridor ramp metering. Also included are Los Angeles/Gateway Freight Technology Program improvements that would expand in-vehicle freight advanced traveler information systems (FRATIS) to include intermodal trucks, managing truck movements among drayage operators and the marine terminals at the two Ports.
- Transit improvements, including increased revenue vehicle service hours for light rail service (Blue Line/Green Line), Metro Rapid routes, local bus service, and community bus service within the I-710 Corridor.
- New express bus/rapid service routes serving key activity centers and transit connections within the I-710 Corridor.
- A program that would provide air quality improvements in the I-710 Corridor. The I-710 Corridor Project Zero Emission/Near Zero Emission Truck Deployment Program would provide funding for facilities needed to support zero emission/near zero emission

(ZE/NZE) trucks, such as charging and/or refueling stations; as well as funding for ZE/NZE trucks through existing programs (e.g., Measures ONRD-03 and ONRD-04 in the 2012 Air Quality Management Plan) and/or through new programs such as the Gateway Cities Technology Deployment Program currently under development;

- A community health and benefit program that would take the form of a grant program structured to provide corridor communities the opportunity to implement projects or outreach activities that would improve air quality and public health related to I-710 travel and goods movement.
- Use of best available control technology construction equipment as defined by the California Air Resources Board during project construction.

3. INTERAGENCY CONSULTATION

Table 2 summarizes the methodology and input assumptions included in the protocol that will require approval through interagency consultation.

Table 2. Methodology and Assumptions for PM Hot-Spot Quantitative Analyses	
Input	Proposed Action
Modeled Hot-Spot Location	<p>The modeled hot-spot location for Alternative 5C was chosen based on traffic data, emission estimates, and ambient air quality modeling results that are presented in the I-710 AQ/GHG/HRA Study. The following locations were chosen:</p> <ul style="list-style-type: none"> • The section of I-710 freeway between Willow Street and Wardlow Road for PM₁₀ hot-spot analysis; and • The section of the I-710 freeway between Firestone Boulevard and north of Florence Avenue for PM_{2.5} hot-spot analysis. <p>Details on the hot-spot location selection are included in Appendix A.</p>
Analysis Year	The horizon year 2035 was determined to be the peak emissions year for the Alternative 5C (See Appendix B for details) and is therefore, chosen as the analysis year.
Ambient Air Quality Standards	<ol style="list-style-type: none"> 1) PM₁₀ 24-hour NAAQS: 150 µg/m³ 2) PM_{2.5} 24-hour NAAQS: 35 µg/m³ 3) PM_{2.5} Annual NAAQS: 12 µg/m³
Types of Emissions ¹	<ol style="list-style-type: none"> 1) Direct emissions from vehicles: PM₁₀ and PM_{2.5} exhaust, tire wear, and brake wear 2) Entrained road dust: PM₁₀ and PM_{2.5}
Emission Model ²	<ol style="list-style-type: none"> 1) EMFAC2014 for direct emissions 2) 2014 California Air Resources Board (CARB) methodology <ol style="list-style-type: none"> a. VMT-growth approach using USEPA's Compilation of Air Pollutant Emission Factors (AP-42) equation b. County-specific silt loading c. California-specific particle size multiplier for PM_{2.5} d. No precipitation adjustment for daily maximum emissions
Dispersion Model	The latest version of AERMOD (version 18081 at the time of this report).

Table 2. Methodology and Assumptions for PM Hot-Spot Quantitative Analyses	
Input	Proposed Action
Meteorological Data	<p>The following meteorological stations (Figure 4) were chosen based on their proximity to the selected hot-spot locations:</p> <ol style="list-style-type: none"> 1) Long Beach Airport (KLGB, WBAN ID: 23129) for PM₁₀ hot-spot analysis. 2) University of Southern California/Downtown Los Angeles (KCQT, SCAQMD ID: 93134) for PM_{2.5} hot-spot analysis. <p>Five-year meteorological data sets (2012-2016) will be used for both KLGB and KCQT.</p>
Background Monitoring Station	<p>The following background monitoring stations were chosen based on their proximity of the station to the selected hot-spot locations:</p> <ol style="list-style-type: none"> 1) Compton for PM_{2.5} monitoring data 2) South Long Beach for PM₁₀ monitoring data
Receptors	<ol style="list-style-type: none"> 1) 25-meter right-of-way following grid starting as near as the edge of the right-of-way and extending to 100 meters from the edge of the right-of-way on the modeled hot-spot location on the I-710 freeway 2) 100-meter right-of-way following grid from a distance of 100-meters to 500-meters from the edge of the right-of-way on the modeled hot-spot location on the I-710 freeway 3) Receptors will be placed as close to the source as possible, but not closer than 5 meters per the 2015 USEPA guidance⁴. Note, some model receptors may be in areas not accessible to the public. These receptors will be excluded from the analysis. Figure 5 and Figure 6 show the modeled sources and receptor setup for the identified PM₁₀ and PM_{2.5} hot-spots, respectively. 4) Discrete receptors will be placed at sensitive receptors located within 500 meters from the edge of the right-of-way on the modeled hot-spot location on the I-710 freeway.

Table 2. Methodology and Assumptions for PM Hot-Spot Quantitative Analyses	
Input	Proposed Action
Other Input Parameters	Follows recommendations in the 2015 USEPA Guidance ³
<p>Notes:</p> <p>¹ The projected traffic data account for any potential increase in the regional level based on the RTP as a result of the proposed project. Entrained road PM_{2.5} emissions are considered only if the USEPA or state agency has made a finding that such emissions are a significant contributor to the PM_{2.5} air quality problem (40 CFR 93.102(b)(3) and 93.119(f)(8)). The SCAQMD has identified paved road dust as major source of direct PM_{2.5} emissions in the 2016 AQMP. Available at: http://www.aqmd.gov/docs/default-source/clean-air-plans/air-quality-management-plans/2016-air-quality-management-plan/final-2016-aqmp/appendix-vi.pdf?sfvrsn=4. Accessed: June 2018.</p> <p>PM₁₀ and PM_{2.5} hot-spot analyses are not required to consider construction-related activities, which cause temporary increases in emissions (40 CFR 93.123(c)(5)). Although construction of the project as a whole is expected to take more than five years to complete, based on the construction staging analysis, construction would not occur at any single individual location for more than five years. Therefore, construction-related emissions may be considered temporary; and any construction-related PM_{2.5} and PM₁₀ emissions due to this project were not included in this hot-spot analysis.</p> <p>² EMFAC2014 is the approved model by USEPA for PM hot-spot analyses, which includes CARB's truck and bus rule and updated PM emission factors for heavy-duty trucks</p> <p>³ USEPA. 2015. Transportation Conformity Guidance for Quantitative Hot-spot Analyses in PM_{2.5} and PM₁₀ Nonattainment and Maintenance Areas (EPA-420-B-15-084). November. Office of Transportation and Air Quality. Available at: https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100NMXM.pdf. Accessed: January 2018.</p>	

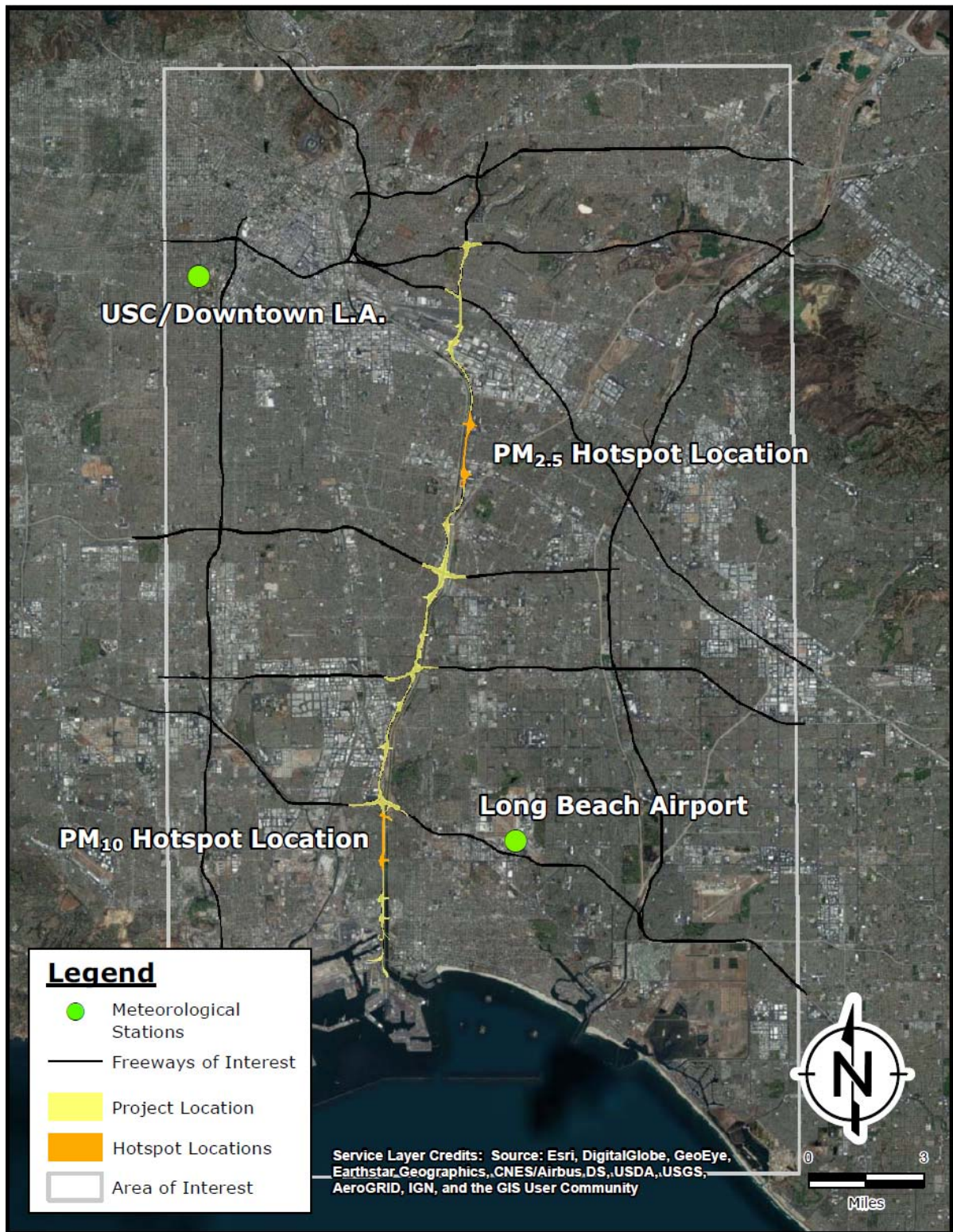


Figure 4. Meteorological Station Locations
A full size figure can be found in the Figures Section

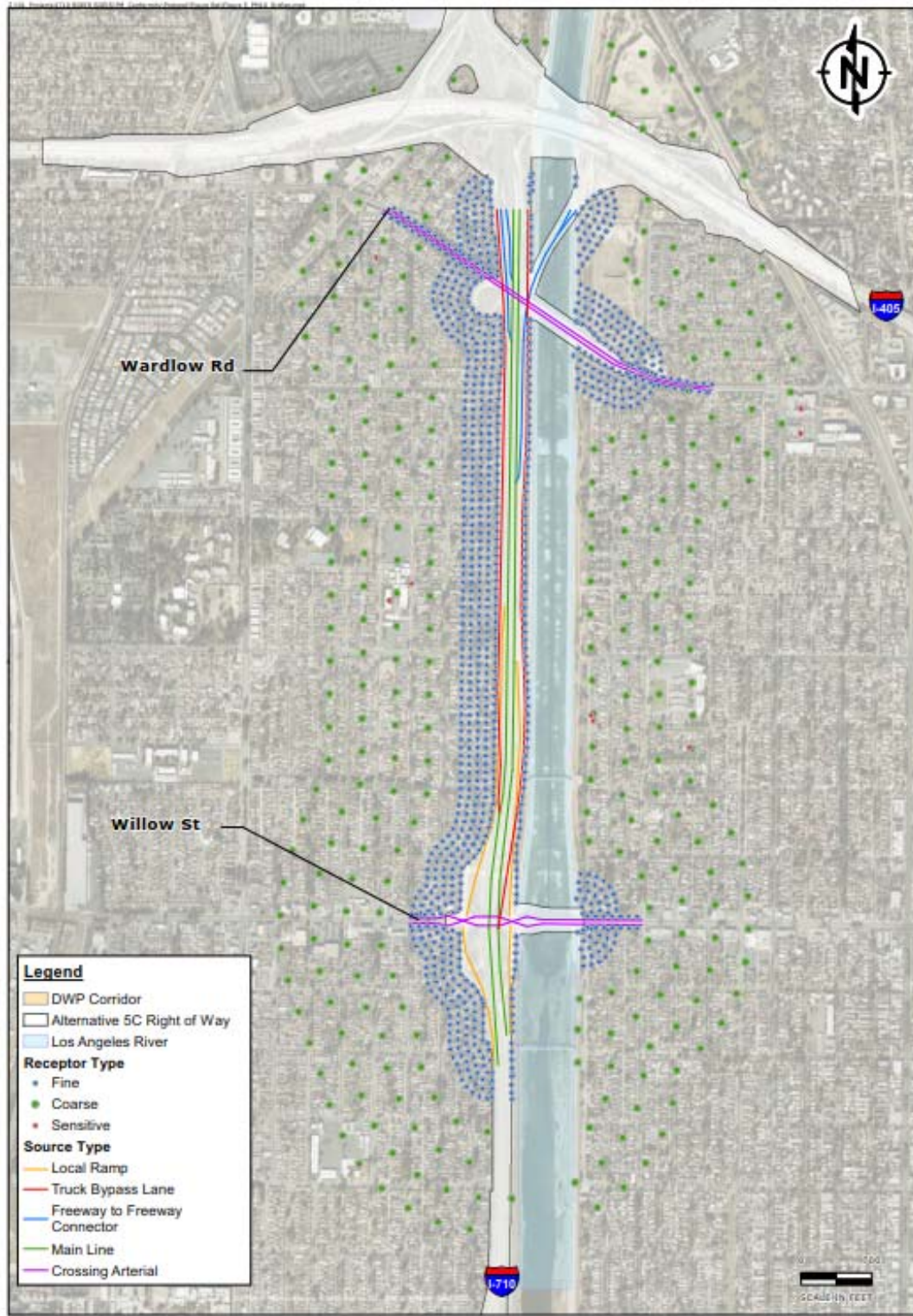


Figure 5. PM₁₀ Hot-Spot Modeling – Source-Receptor Setup
A full size figure can be found in the Figures Section

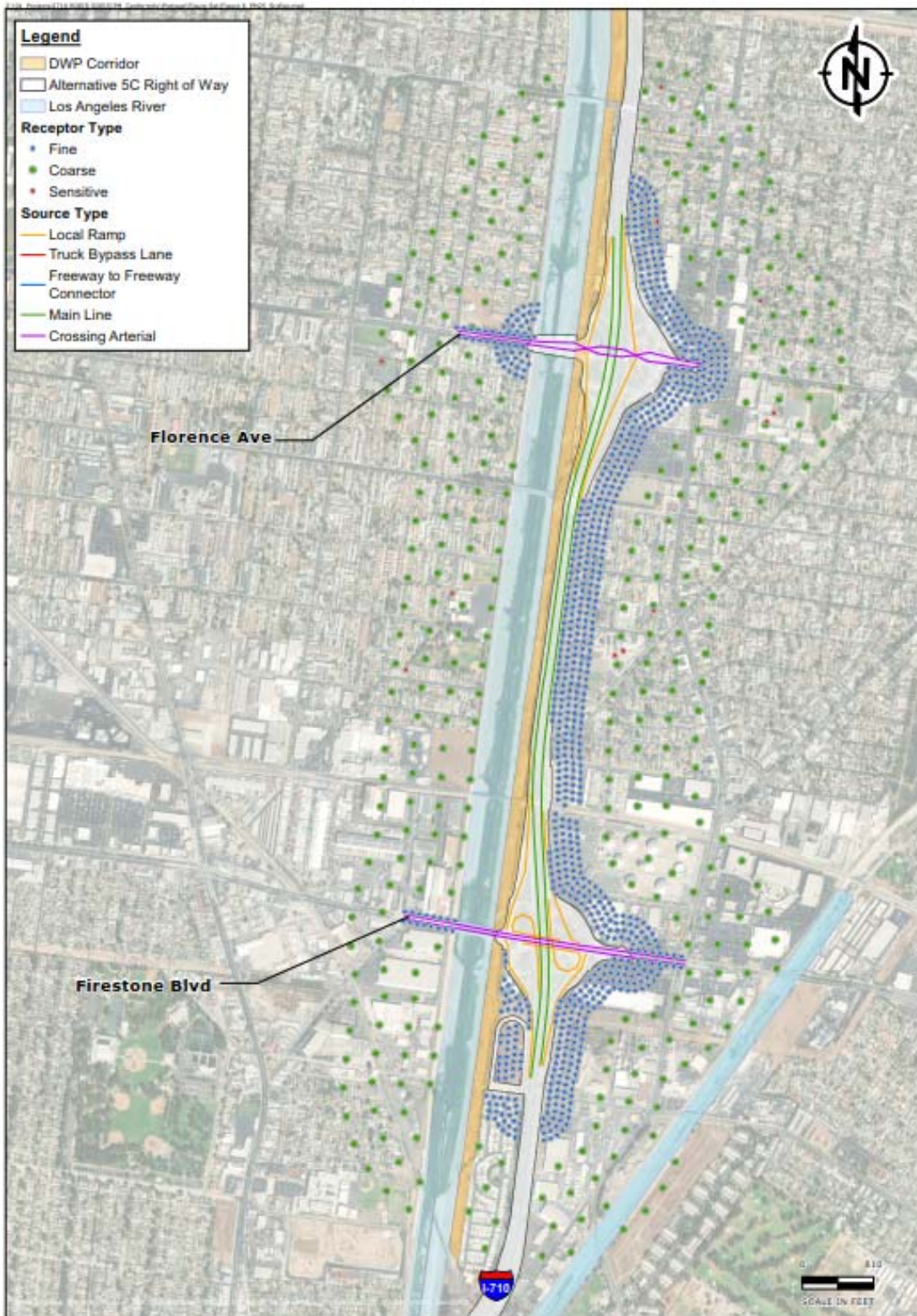


Figure 6. PM_{2.5} Hot-spot Modeling – Source-Receptor Setup
A full size figure can be found in the Figures Section

4. HOT-SPOT ANALYSIS METHODOLOGY

Per requirements in 40 CFR 93.116, the primary goals of a project-level conformity determination²² are to ensure that federally supported transportation projects in nonattainment and/or maintenance areas do not:

- Cause or contribute to new air quality violations, or
- Worsen existing violations, or
- Delay timely attainment of the National Ambient Air Quality Standards (NAAQS) or interim milestones

If required, a quantitative hot-spot analysis will be conducted for both PM_{2.5} and PM₁₀ in accordance with USEPA's transportation conformity rules (40 CFR 51.390 and Part 93) and following the 2015 USEPA Guidance. A hot-spot analysis is an estimation of likely future localized pollutant concentrations and a comparison of those concentrations to the relevant NAAQS, as defined in the 40 CFR 93.101. A project-level hot-spot analysis evaluates the air quality impacts on a smaller scale (i.e., project area) than an entire nonattainment or maintenance area and subsequently determines if a transportation project meets CAA conformity requirements.

4.1 Hot-spot Selection

As stated in 40 CFR 93.123(c)(2), hot-spot analyses must include the entire transportation project. However, for large projects like the I-710 Corridor Project (a 19-mile-long section of freeway), Section 3.3.2 of the 2015 USEPA Guidance states that the PM hot-spot analysis can focus on a sub-area where the air quality is substantially affected by the project resulting in the highest modeled PM₁₀ and PM_{2.5} concentrations. In addition to the recommendations in the 2015 USEPA Guidance, Ramboll reviewed the selection process used for the modeled locations used in the recent quantitative hot-spot analyses as examples.²³ As shown in Table 3, criteria such as traffic and truck traffic data, emission estimates, and results from a screening model run were used to choose the hot-spot location. For these analyses, Ramboll chose the hot-spot location for Alternative 5C based on a review of the traffic data, emission estimates, and modeled PM₁₀ and PM_{2.5} concentrations in the vicinity of the I-710 freeway that are presented in the I-710 AQ/GHG/HRA Study. Details on how this was done are shown in Appendix A of this Protocol.

²² 40 CFR Title 40 Chapter I Subchapter C Part 93 Subpart A §93.116 - Criteria and procedures: Localized CO, PM₁₀, and PM_{2.5} violations (hot-spots). Available at: <http://www.ecfr.gov/>. Accessed: January 2018.

²³ Submitted to the Transportation Conformity Working Group (TCWG). Available at <http://www.scag.ca.gov/programs/Pages/ProjectLevel.aspx>.

Table 3. Criteria Used for Selection of Modeled Hot-Spot Locations for Other Freeway Projects			
Project¹	Project Study Area or Distance	Modeled Roadway Segment Length	Criteria for Selecting Hot-Spot Modeled Location
SR 710 North ¹	100 sq miles	6 miles	Projected increase of total annual daily traffic (ADT) and diesel truck ADT between build and no build scenario
I-405 ²	8.5 miles	1 mile	Highest emission segment
High Desert Corridor ³	63 miles	2 - 3 miles	Area near the highest PM ₁₀ concentration based on the first round model run with AERMOD's non-default FASTALL option
I-10 Corridor Project ⁴	33 miles	7 miles	Top four emission segments
I-15 Corridor Improvement Project ⁵	16 miles	1 mile	Highest total ADT and truck ADT Highest emission segment on per mile basis Highest number of nearby sources
Notes:			
¹ Quantitative PM _{2.5} and PM ₁₀ Hot-Spot Analysis Protocol. Available at: http://www.scag.ca.gov/programs/TCWG%20Document%20Library/4.2-1_18790/18790SR-710Protocol.pdf . Accessed: January 2018. ² Interagency Consultation for Interstate 405 South Improvements Project from Interstate 5 to Interstate 55, Irvine, California. Available at: http://www.scag.ca.gov/programs/TCWG%20Document%20Library/I-405%20South%20Improvements%20Project/I-405Project.pdf . Accessed: January 2018. ³ Updated Quantitative PM ₁₀ Hot-Spot Analysis High Desert Corridor. Available at: http://www.scag.ca.gov/programs/TCWG%20Document%20Library/High%20Desert%20Corridor%20Project/High%20Desert%20Corridor%20Project.pdf . Accessed: January 2018. ⁴ Quantitative PM _{2.5} and PM ₁₀ Hot-Spot Analysis, Interstate 10 Corridor Project. Available at: http://www.scag.ca.gov/programs/TCWG%20Document%20Library/Interstate%2010%20Corridor%20Project/Interstate%2010%20Corridor%20Project.pdf . Accessed: January 2018. ⁵ Quantitative PM _{2.5} and PM ₁₀ Hot-Spot Analysis, Interstate 15 Corridor Improvement Project Tolled Express Lane. Available at: http://www.scag.ca.gov/programs/TCWG%20Document%20Library/RIV071267/RIV071267QuanAnalysis.pdf . Accessed: January 2018.			

4.2 National Ambient Air Quality Standards (NAAQS)

Given that the Project is located within the SCAB, which is designated as a maintenance area for PM₁₀ and a non-attainment area PM_{2.5}, a quantitative PM hot-spot analysis, if required, will be performed for the 24-hour PM₁₀ NAAQS and 24-hour and annual PM_{2.5} NAAQS, following the requirements in the CAA and transportation conformity regulations.^{24,25} Both primary and secondary NAAQS apply to PM hot-spot analyses.

4.2.1 PM_{2.5} NAAQS

PM_{2.5} nonattainment and maintenance areas are required to attain and maintain the following NAAQS²⁶:

- 24-hour Standard: 35 micrograms per cubic meter (µg/m³)
- Annual Standard
 - Primary: 12 µg/m³
 - Secondary: 15 µg/m³

Both PM_{2.5} 24-hour primary and secondary standards are 35 µg/m³ based on a 3-year average of the 98th percentile of 24-hour PM_{2.5} concentrations. PM_{2.5} annual primary and secondary standards are 12 µg/m³ and 15 µg/m³, respectively, based on a 3-year average of annual mean PM_{2.5} concentrations.²⁷

4.2.2 PM₁₀ NAAQS

PM₁₀ nonattainment and maintenance areas are required to attain and maintain the following NAAQS²⁸:

- 24-hour Standard: 150 µg/m³

Both PM₁₀ 24-hour primary and secondary standards are 150 µg/m³. The 24-hour PM₁₀ NAAQS is attained when the average number of exceedances per year in the previous 3 calendar years is less than or equal to 1. For the 24-hour standard for PM₁₀, concentrations are rounded to the nearest 10 before being compared to the standard of 150 µg/m³. Therefore, the number of exceedances are counted for any concentrations that are greater than or equal to 155 µg/m³.

4.3 Project-Level PM Emissions Overview

As required in the 2015 USEPA Guidance, Ramboll will use EMFAC2014, the latest USEPA-approved emissions model for use in California, to estimate the PM emissions for the quantitative PM hot-spot analysis. The PM emissions will be calculated using the

²⁴ Code of Federal Regulations (CFR) Title 40 Chapter I Subchapter C Part 93 Subpart A §93.116 and §93.123. Available at: <http://www.ecfr.gov/>. Accessed: January 2018.

²⁵ United States Senate. 2004. The Clean Air Act. As Amended Through P.L. 108-201, February 24. Available at: <https://www.congress.gov/108/plaws/publ201/PLAW-108publ201.pdf>. Accessed: January 2018.

²⁶ USEPA. NAAQS Table. Available at: <https://www.epa.gov/criteria-air-pollutants/naqs-table>. Accessed: January 2018.

²⁷ In December 2012, USEPA promulgated a revised annual primary PM_{2.5} NAAQS of 12.0 µg/m³. Designations for this NAAQS were effective on April 15, 2015. The one-year conformity grace period expired on April 15, 2016.

²⁸ Ibid.

emission factors from EMFAC2014, and the projected traffic data for the analysis year. As stated in Table 2, the peak emission year is the Project's horizon year 2035 (refer to Appendix B of the Protocol for details).

4.3.1 Types of Emissions Considered

Ramboll will estimate the direct PM_{2.5} and PM₁₀ emissions for the quantitative hot-spot analyses in accordance with the 2015 USEPA Guidance. Types of PM_{2.5} and PM₁₀ emissions considered in the analysis include 1) vehicle exhaust, brake wear, and tire wear emissions, and 2) entrained road dust. PM_{2.5} and PM₁₀ precursors are not considered in analysis because it takes time for precursors to form into secondary PM at the regional level (i.e., beyond the immediate area of concern for localized analysis). Secondary emissions of PM_{2.5} and PM₁₀ are considered in the regional emissions analysis prepared for the conforming RTP and FTIP.

Although construction of the project as a whole is expected to take more than five years to complete, based on the construction staging analysis, construction would not occur at any single individual location for more than five years. Therefore, construction-related emissions may be considered temporary, and any construction related PM_{2.5} and PM₁₀ emissions due to the Project will not be included in this hot-spot analysis. The Project will comply with the SCAQMD Fugitive Dust Rules for fugitive dust during construction of this project. In addition, per Transportation Conformity Rule 93.117, the Project will be required to comply with any PM_{2.5} and PM₁₀ control measures in the SIP. Excavation, transportation, placement, and handling of excavated soils will 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 dust from earthwork operations.

4.3.2 Emission Factors

Emissions for diesel, gasoline, and natural gas vehicles will be calculated as described in Appendix C. PM₁₀ and PM_{2.5} emissions from the freeway traffic at the selected hot-spot locations will be calculated by multiplying emission factors (g/mi) by traffic activity (vehicles miles travelled) for all vehicles. Emission factors for directly-emitted PM (i.e., exhaust and brake/tire wear) are derived from EMFAC2014, as described in Section 4.3.2.1 and Appendix C. Emission factors for entrained road dust are derived from CARB's 2014 "Entrained Road Travel, Paved Road Dust" methodology, as described in Section 4.3.2.2 and Appendix C.

4.3.2.1 Exhaust, Tire Wear, and Brake Wear Emission Factors

PM₁₀ and PM_{2.5} emission factors for on-road vehicles in the analysis year (2035) will be estimated using EMFAC2014, the latest USEPA-approved emissions model for use in California, as recommended in the 2015 USEPA Guidance.^{29, 30} As discussed above, the following types of emission factors will be estimated for the direct PM₁₀ and PM_{2.5} vehicular emissions in the PM hot-spot analyses:

²⁹ CARB. Mobile Source Emission Inventory – Categories - On-Road Motor Vehicles - EMFAC2014. Available at: <http://www.arb.ca.gov/msei/categories.htm>. Accessed: January 2018.

³⁰ See Section 3.3.6 of Transportation Conformity Guidance for Quantitative Hot-spot Analyses in PM_{2.5} and PM₁₀ Nonattainment and Maintenance Areas. See also 40 CFR 93.111. EMFAC2014 is the most recent EPA-approved mobile source emission factor model for use in California; see 80 Federal Register 239 (December 14, 2015, pp. 77337 – 77340).

- Running Exhaust (grams per mile [g/mi]): On-road vehicles are typically fueled by gasoline, diesel, or natural gas. PM₁₀ and PM_{2.5} emissions generated by the combustion of these fuels during the vehicle movement are released from the vehicle's tail pipe and referred to as running exhaust emissions.
- Tire Wear (g/mi) and Brake Wear (g/mi): On-road vehicles generate PM₁₀ and PM_{2.5} emissions due to the operational wear of tires and brakes.

As described in greater detail in Appendix C, Ramboll will use CARB's EMFAC2014 model to generate the annual average emission factors for running exhaust, tire wear, and brake wear from on-road vehicles operating Los Angeles (LA) County. EMFAC (short for Emission FACtor) is a computer model developed by CARB and can be used for estimating emission rates for on-road mobile sources operating in California in calendar years 2000 to 2050. EMFAC2014 was released on December 30, 2014 and subsequently approved in December 2015 by USEPA for use in the conformity determinations. CARB recently released an updated version of the model called EMFAC2017 on December 22, 2017. This version has not yet been approved by USEPA for use in conformity analysis. Hence, Ramboll will use EMFAC2014.

Zero Emission/Near-Zero Emission (ZE/NZE) Trucks: Through the I-710 ZE/NZE Program, 2035 Alternative 5C will have a significant number of ZE/NZE trucks operating on the I-710 freeway. Exhaust emission factors for ZE/NZE-eligible trucks are the same as conventional heavy-duty trucks in EMFAC2014.³¹ ZE truck exhaust emissions would be zero, but brake/tire wear emission factors are the same as any other truck in EMFAC2014. As shown in the AQ/HRA, exhaust emissions are less than 3% of total PM emissions in 2035. Thus, total PM emissions would not be significantly affected if a portion of the trucks had lower or zero exhaust emissions. The hot-spot conformity analysis will conservatively assume that PM₁₀ and PM_{2.5} emission factors of ZE/NZE trucks are equal to that of a conventional heavy-duty truck.

4.3.2.2 Entrained Road Dust Emission Factors

Entrained road dust results from the re-suspension of loose particulate material from the surface of the road as a result of vehicle movement. According to the 2006 Final Rule, road dust emissions are to be considered for PM₁₀ hot-spot analyses.³² For PM_{2.5}, road dust emissions are only to be considered in hot-spot analyses if the USEPA or the State air agency has made a finding that such emissions are a significant contributor to the PM_{2.5} air quality problem (40 CFR 93.102(b)(3)). The USEPA has published a guidance on the use of AP-42 for entrained road dust for SIP development and conformity (August 2007). The SCAQMD has identified paved road dust as major source of direct PM_{2.5} emissions in the 2016 AQMP.³³ Therefore, entrained PM_{2.5} is considered in this analysis. PM₁₀ and PM_{2.5} emissions from the entrained road dust caused by the Project traffic at

³¹ EMFAC2014 contains emission factors for T7 SWCV and UBUS categories. These emission factors are used in the PM emission analysis, but the ZE/NZE truck program does not affect these categories.

³² USEPA. 2006. Transportation Conformity Rule That Addresses Requirements for Project-level Conformity Determinations in PM_{2.5} and PM₁₀ Nonattainment and Maintenance Areas. March. Available at: <https://www.epa.gov/state-and-local-transportation/march-10-2006-transportation-conformity-rule-addresses-requirements>. Accessed: January 2018.

³³ 2016 AQMP. <http://www.aqmd.gov/docs/default-source/clean-air-plans/air-quality-management-plans/2016-air-quality-management-plan/final-2016-aqmp/appendix-vi.pdf?sfvrsn=4>. Accessed: June 2018.

the selected hot-spot locations will be estimated using CARB’s methodology. Details on how entrained road dust emission factors will be calculated are included in Appendix C.

4.3.3 Traffic and VMT Data

Cambridge Systematics Incorporated (CSI), a member of the I-710 Project team, has run a more detailed version of the SCAG Regional Transportation Plan Travel Demand Model for the I-710 Study Area (hereafter referred to as the “I-710 Traffic Model”) to estimate the traffic activity data for No Build, and preferred build alternative in the analysis year (2035).

The I-710 Traffic Model represents freeways, ramps, and one-way streets as traffic links (sections of roadways) with one-directional traffic flows. All other roadways are represented as traffic links with bi-directional vehicle flow. The output of the I-710 Traffic Model provides several parameters including a unique identifier for each traffic link in the SCAG network (Link ID), description of each link (road name, route name, and road type), link lengths, and average vehicle speeds and traffic volumes for each traffic link during four different time periods (AM, mid-day, PM and night time).³⁴ For bi-directional traffic links, average vehicle speeds and traffic volumes are provided for each individual direction. The traffic volumes for each time period are sub-divided into several different vehicle classes: drive alone and shared ride vehicles (DA/SR), light heavy-duty trucks (LHDT), medium heavy-duty trucks (MHDT), heavy heavy-duty trucks (HHDT), and port trucks.

The I-710 Traffic Model results were further adjusted and/or calibrated using actual traffic counts at specific locations on the I-710 to provide more accurate traffic volumes (referred to as “post-processed traffic data” hereinafter) for the I-710 freeway and related ramps/freeway to freeway connectors.

Emissions used for the hot-spot analysis will be estimated using the traffic volumes from the post-processed traffic data, average vehicle speeds from the I-710 traffic model, and traffic link lengths obtained from the I-710 freeway’s geometric design provided by AECOM. See Appendix C for more details.

4.3.4 Project-Level PM₁₀ and PM_{2.5} Emission Inventories

As described earlier, PM₁₀, and PM_{2.5} emission inventories for freeway/roadway traffic at the selected hot-spot locations will be developed. Operational emissions from freeway/roadway traffic will be estimated for the selected hot-spot locations using the emission factors for LA County and the post-processed traffic data. Equations 4, 5, and 6 (presented below) will be used to estimate emissions on each traffic link.

$$\text{Exhaust Emissions (lb/day)} = \frac{1}{453.59} \times \sum_i \sum_j \sum_t EF_{l,S,i,j} \times VMT_{l,i,j}$$

.....Equation 4

³⁴ Note that the I-710 traffic model is based on 2012 (latest) RTP model, but combines two time periods in the RTP model (evening 7 p.m. to 9 p.m. and night 9 p.m. to 6 a.m.) and calls it the night period (from 7 p.m. to 6 a.m.).

$$\text{Tire Wear and Brake Wear Emissions (lb/day)} = \frac{1}{453.59} \times \sum_i \sum_j \sum_l EF_l \times VMT_{l,i,j}$$

.....Equation 5

$$\text{Entrained Road Dust Emissions (lb/day)} = \frac{1}{453.59} \times \sum_i \sum_j E_{i,j} \times VMT_{i,j}$$

.....Equation 6

Where,

453.59	conversion factor from pounds to grams
j	Refers to a particular time period. Traffic data will be provided for four different time periods: AM (6 a.m. to 9 a.m.), midday (9 a.m. to 3 p.m.), PM (3 a.m. to 7 p.m.), and night time (7 p.m. to 6 a.m.). Refer to Section 3 for further details on traffic data.
l	Refers to a particular vehicle class. Vehicle classes used in this analysis include DA/SR, LHDT, MHDT, HHDT, and port trucks. Refer to Appendix C for further details.
S _{i,j}	Represents the average vehicle speed on the i th traffic link during the j th time period.
EF _{l,S_{i,j}}	Represents the running exhaust emission factor emission factor of the l th vehicle class at speed S _{i,j} expressed in grams per miles.
EF _l	Represents the tire wear/brake wear emission factor for the l th vehicle class in grams per miles. Note, tire wear/brake wear emission factors are not dependent on speed.
E _{i,j}	Represents the entrained road dust emission factor for the i th traffic link during the j th time period (Equations 1 and 2).
VMT _{l,i,j}	Represents total vehicle miles traveled (VMT) by the l th vehicle class traveling on the i th traffic link during the j th time period. This is calculated as a product of length of the i th traffic link and the traffic volume of the l th vehicle class traveling on the i th traffic link during the j th time period.
VMT _{i,j}	Represents the total vehicle miles traveled on the i th traffic link during the j th time period. This is calculated as a sum of the vehicle miles traveled by all vehicle classes on the i th traffic link during the j th time period.

PM₁₀ and PM_{2.5} emissions estimated using the post processed traffic data for the selected hot-spot location will be used in the air quality dispersion modeling to evaluate the ambient air quality impacts.

4.4 Dispersion Modeling for PM Hot-Spot Analysis

This section describes the air dispersion model, modeling data inputs (e.g., source parameters, elevations, and land use), receptor locations, and meteorological data that will be used for PM Hot-spot analysis.

4.4.1 Air Dispersion Model

As recommended by the 2015 USEPA Guidance, the American Meteorological Society/EPA Regulatory Model (AERMOD), the USEPA's recommended near-field dispersion model under Appendix W 40 CFR Part 51, will be used for PM hot-spot quantitative analysis for this Project. Ramboll will use the latest version 18081 of AMS/EPA Regulatory Model (AERMOD) for air dispersion modeling. The model will be run with flat terrain, with the exception of the truck bypass lanes. The truck bypass lanes will be modeled as elevated sources to better reflect the geometrics of the freeway and to avoid nearby ground-level receptors (see Figure 5). A brief description of the model's input parameters such as source location, source parameters, land-use type, terrain data, meteorological data, and receptor locations are discussed below.

4.4.2 Source Location, Configuration, and Parameters

Vehicle emissions from freeway mainlines, freeway interchanges, and principal arterials within the hot-spot areas will be modeled as line sources represented as a series of adjoining area or volume sources. Area or volume sources will be placed in the locations (e.g., freeway mainline, interchanges, Zero Emission/Near Zero Emission Freight Corridor) where emissions occur.

Ramboll will use geographic information system (GIS) tools to place sources along modeled traffic links and assign appropriate area or volume source parameters to each source. Modeled traffic links will include the freeway, ramps, and crossing arterials at the selected hot-spot locations for the preferred build alternative. If adjacent volume sources are used, the sources will be characterized so that receptors placed at the edge of the right of way or five meters from the edge of the roadway do not fall within the receptor exclusion zone (i.e., if the width of the roadway is greater than eight meters, additional volume sources will be defined for each traffic lane or subset of traffic lanes).

Engine exhaust, tire wear, brake wear, and entrained road dust emissions generated by vehicles on the modeled traffic links will be represented in AERMOD as a series of adjacent area or volume sources, which is an accepted practice for modeling mobile sources in a dispersion model.³⁵ Emission sources for this Project will be grouped into four source groups that represent these emissions: (1) non-truck exhaust, (2) truck exhaust, (3) tire and brake wear, and (4) entrained road dust. Emission estimates of these source groups from each traffic link will be estimated using post-processed traffic data based on the methodology described in Section 4.3.

A summary of the modeled source parameters for each type of emission is presented in Table 4.

³⁵ USEPA. 2015. Transportation Conformity Guidance for Quantitative Hot-spot Analyses in PM_{2.5} and PM₁₀ Nonattainment and Maintenance Areas. November. Office of Transportation and Air Quality.

Table 4. Modeled Source Parameters				
Source Parameter Name	Source Parameter Value¹ (meters)			
	Non-Truck Exhaust	Truck Exhaust	Tire and Brake Wear	Entrained Road Dust
Width	Road Width ²	Road Width ²	Road Width ²	Road Width ²
Initial Lateral Dispersion Coefficient (volume sources only)	Width ÷ 2.15	Width ÷ 2.15	Width ÷ 2.15	Width ÷ 2.15
Initial Vertical Dimension ^{3, 4}	2.6	6.8	2.6	2.6
Initial Vertical Dispersion Coefficient ⁵	1.2	3.2	1.2	1.2
Release Height ⁶	1.3	3.4	1.3	1.3
Notes: ¹ Developed based on 2015 USEPA Guidance. ² Road width is estimated as a product of the number of lanes and the width of a lane (12 feet for I-710 mainline and ramps, 11 feet for arterials). ³ The initial vertical dimension for non-truck and truck exhaust is assumed to be equal to 1.7 times the vehicle heights (1.53 meters for non-trucks and 4 meters for trucks). Vehicles heights are based on the 2015 USEPA Guidance. ⁴ The initial vertical dimension for tire wear, brake wear, and entrained road dust is assumed to be similar to non-truck exhaust. ⁵ The initial vertical dispersion coefficient is estimated as the initial vertical dimension divided by 2.15. ⁶ Release height is estimated as half of the initial vertical dimension.				

4.4.3 Receptors

Ramboll will place the receptors in the following receptor networks at the selected hot-spot locations in order to capture the highest concentration and the impact of the project.

- 25-meter right-of-way following grid starting as near as the edge of the I-710 right-of-way and extending to 100 meters from the edge of the I-710 right-of-way.
- 100-meter right-of-way following grid from a distance of 100 meters to 500 meters from the edge of the I-710 right-of-way.
- Receptors will be placed as close to the source as possible, but not closer than 5 meters per the 2015 USEPA guidance. Note, some model receptors may be in areas not accessible to the public.
- Discrete receptors will be placed at sensitive receptors described in Appendix D of the June 2017 AQ/GHG/HRA Report located within 500 meters from the edge of the right-of-way in the modeled hot-spot locations on the I-710 freeway.

Results from model receptors falling in any right-of-way, on a limited access highway, or other areas, which are not generally accessible to the public, will be calculated but excluded from the conformity analysis.

4.4.4 Meteorology and Climate

Hourly-resolution meteorological surface data, such as wind speed and direction, and upper air data must be provided as inputs to AERMOD for pollutant transport calculations. This information is generally acquired from existing meteorological stations near the project site that continuously monitor such data.

SCAQMD provides pre-processed AERMOD-ready meteorological data files processed with AERMET Version 16216r for all its monitoring stations.³⁶ Data from Long Beach Airport (KLGB), a Weather Bureau Army Navy (WBAN) meteorological station, and University of Southern California/Downtown Los Angeles station (KCQT), a SCAQMD meteorological station, will be used for the dispersion modeling. KLGB and KCQT are located in the vicinity of the selected PM₁₀ and PM_{2.5} hot-spot locations, respectively, and are representative of the meteorology and climate at the selected hot-spot locations. The five-year meteorological data set for 2012 through 2016 will be used for both stations. The locations of the KLGB and KCQT stations is shown in Figure 4.

4.5 Nearby Sources

As stated in Section 8.2 of the 2015 USEPA Guidance, nearby PM sources that are affected by the project and could contribute to PM concentration in the project area will need to be included in the analysis. The PM roadway emissions for the Preferred Alternative are based on the results of the I-710 Traffic Model, which reflects all projects in the 2012 SCAG RTP/SCS (except the I-710 Corridor Project), projected port-related growth, and additional near-dock rail projects.³⁷ Any stationary sources in the vicinity of the project not directly affected by the I-710 corridor project would be included in representative background concentrations and none of them depend upon the implementation of the project. Therefore, no additional projects are modeled in this analysis.

4.6 Air Quality Trend Analysis

The latest approved and available full year of air quality data from the SCAQMD is 2016. Ramboll will use the South Long Beach monitoring station for PM₁₀ data and the Compton monitoring station for PM_{2.5} data, see Figure 7.

Table 5 summarizes the past five years of the ambient monitoring data for PM_{2.5} at the Compton station. The 24-hour PM_{2.5} NAAQS was exceeded in 2014 and 2015. The annual average NAAQS was exceeded in 2013 and 2014. The data shows that PM_{2.5} data was

³⁶ These data files are available on the SCAQMD website at <https://www.aqmd.gov/home/air-quality/air-quality-data-studies/meteorological-data/aermod-table-1>. As seen on the webpage, five-year meteorological data (2012-2016) are available for both stations to be used (KCQT and LKGB).

³⁷ From the 2017 RDEIR/SDEIS, page 1-31: "In 2013, the assumptions related to goods movement within the SCAG region were further developed and updated to more closely align with the changed economic conditions, drawing on the Updated Cargo Forecast (2009), the 2012 RTP Travel Demand Forecast Model (2012), the San Pedro Bay Ports estimates of marine terminal capacity (2013), port cargo market shares (2013), and truck trip distribution (2013). The *Model Input Data and Key Assumptions Technical Memorandum for Goods Movement* (May 2013) was then reviewed and discussed by the I-710 Technical Advisory Committee and the Port growth assumptions were approved for use in traffic forecasting performed in support of this RDEIR/SDEIS. These assumptions include a 2035 total annual cargo container throughput at both ports of 41.4 million TEUs, and the construction and/or implementation of both the BNSF Railroad Southern California International Gateway (SCIG) near-dock intermodal yard and the expansion of the UP Railroad near-dock Intermodal Container Transfer Facility (ICTF)."

incomplete in 2014. This is the case for all stations in Los Angeles County. Since 2017 monitoring data is not yet available, 2013 monitoring data for PM_{2.5} will be used instead of 2014 data.

Table 6 summarizes the PM₁₀ concentrations monitored at the South Long Beach station. The 24-hour PM₁₀ NAAQS was not exceeded in any year. The average of the first highest PM₁₀ concentration measured across the last five years (2012 to 2016) was 57 µg/m³, which is well below the 24-hour PM₁₀ NAAQS of 150 µg/m³.

PP

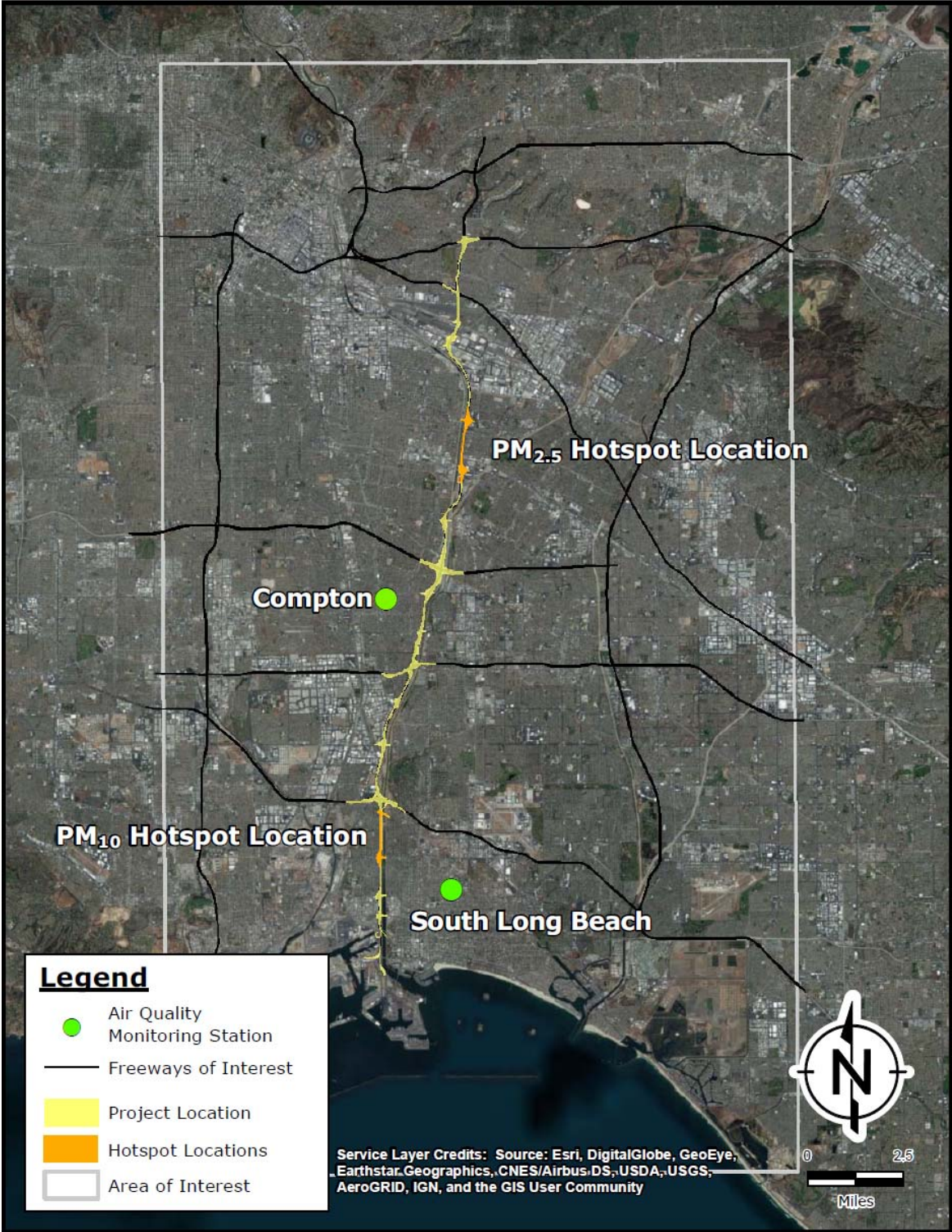


Figure 7. Ambient Air Monitoring Stations
A full size figure can be found in the Figures Section

Description of PM_{2.5} Monitoring Data	2012	2013	2014	2015	2016
3-year 24-hour average 98th percentile – PM _{2.5}	30.3	24.3	35.8	37.2	26.3
Exceeds Federal 24-hour standard (35 µg/m ³)?	No	No	Yes	Yes	No
3-year National annual average	11.69	12.05	16.64	11.91	11.03
Exceeds Federal annual average standard (12 µg/m ³)?	No	Yes	Yes	No	No
Notes: ¹ Data obtained from USEPA AirData Annual Summary Data. State Code 6, County Code 37, Monitoring Stations 1302 (Compton). Available at: https://aqs.epa.gov/aqsweb/airdata/download_files.html . Accessed: January 2018. ² Red text indicates that the regulatory data completeness criteria for valid summary data were not met for the monitor. Per USEPA guidance, ³ a valid data set requires ≥90% data completeness. Invalid data includes lost data due to calibrations or other quality assurance procedures. PM _{2.5} data for 2014 is incomplete for all stations in Los Angeles County. ³ USEPA. 2000. Meteorological Monitoring Guidance for Regulatory Modeling Applications. EPA-454/R-99-005. February. Available at: https://www3.epa.gov/scram001/guidance/met/mmgrma.pdf . Accessed: January 2018.					

Table 6. Ambient PM₁₀ Monitoring Data at the South Long Beach Station (µg/m³)					
Description of Ambient PM₁₀ Monitoring Data	2012	2013	2014	2015	2016
First Highest (µg/m ³)	54	54	59	62	56
Second Highest (µg/m ³)	39	43	58	51	52
Third Highest (µg/m ³)	39	43	43	50	51
Fourth Highest (µg/m ³)	38	41	41	44	50
Number of days above National 24-hour standard (150 µg/m ³)	0	0	0	0	0
Notes: ¹ Data obtained from USEPA AirData Annual Summary Data. State Code 6, County Code 37, Monitoring Station 4004 (South Long Beach). Available at: https://aqs.epa.gov/aqsweb/airdata/download_files.html . Accessed: January 2018.					

4.7 Background Concentrations

As required by 40 CFR 93.123(c)(1) and discussed in the 2015 USEPA Guidance, “estimated pollutant concentrations must be based on the total emissions burden which may result from the implementation of the project, summed together with future background concentrations....” For purposes of this analysis, Ramboll will use ambient PM₁₀ and PM_{2.5} concentrations across the most recent three years of data available at the monitoring stations located in the vicinity of the modeled hot-spot locations.³⁸ Figure 6 shows the locations of the Compton and South Long Beach monitoring stations and Tables 5 and 6 present the PM₁₀ and PM_{2.5} background concentrations recorded at these stations during the calendar years 2012 to 2016.

If needed, future year values from the 2016 AQMP may be used to calculate future background values. These 2016 AQMP projected values are based on photochemical modeling approved for State Implementation Plan (SIP) use. SCAQMD projects that, in Los Angeles, 24-hour average PM_{2.5} will be 27.6 µg/m³ by 2019 and annual average PM_{2.5} will be 10.8 µg/m³ by 2025.³⁹ As shown in the 2016 AQMP (Figures 5-13 and 5-15), PM_{2.5} background concentrations at Los Angeles would be expected to be the same or higher than the background concentrations along the I-710 corridor;⁴⁰ thus, use of these future background concentrations would be conservative (i.e., the same or greater than expected future background concentrations anywhere along the I-710 project). Further, the background concentrations along the I-710 corridor would be projected to stay the same or decrease, based on the PM_{2.5} emission trend in the 2016 AQMP (Figure III-2-18).⁴¹ See also Appendix B of this Protocol for additional discussion of projected future concentrations in the project area.

4.7.1 PM_{2.5}

Based on the methodology described in Section K.4.2 of the 2015 USEPA Guidance, average 98th percentile 24-hour background concentrations of the most recent three years of monitoring data at the Compton monitoring station will be calculated. Since monitoring data for 2014 is incomplete, this analysis will use monitoring data from 2013, 2015, and 2016.

For annual PM_{2.5} background concentration, in accordance with Section K.3.2 of the 2015 USEPA Guidance, the average quarterly PM_{2.5} concentrations will be first calculated to obtain the annual average and then a 3-year average will be calculated.

Table 7 summarizes the current background design values for 24-hour and annual PM_{2.5}.

³⁸ PM_{2.5} monitoring data is incomplete for all monitoring stations in Los Angeles County for 2014. Therefore, 2013 data will be used in lieu of 2014.

³⁹ SCAQMD. 2017. 2016 AQMP, Chapter 5, Future Air Quality. Available at: <http://www.aqmd.gov/docs/default-source/clean-air-plans/air-quality-management-plans/2016-air-quality-management-plan/final-2016-aqmp/chapter5.pdf?sfvrsn=4>. Accessed: June 2018.

⁴⁰ *ibid.*

⁴¹ SCAQMD. 2017. 2016 AQMP, Appendix III, Chapter 2. Figure III-2-18. Available at: <http://www.aqmd.gov/docs/default-source/clean-air-plans/air-quality-management-plans/2016-air-quality-management-plan/final-2016-aqmp/appendix-iii.pdf?sfvrsn=6>. Accessed: June 2018.

PM_{2.5}	2013	2015	2016	Average
24-hour Average (3-year 24-hour average 98th Percentile ¹)	24.3	37.2	26.3	29.3
Annual Average (3-year Weighted Arithmetic Mean ²)	11.97	11.78	11.08	11.61
Notes:				
¹ Data obtained from USEPA Air Quality Design Value Reports. Site ID 060371302 (Compton). Available at: https://www.epa.gov/air-trends/air-quality-design-values . Accessed: June 2018.				
² Data obtained from USEPA AirData Annual Summary Data. State Code 6, County Code 37, Monitoring Stations 1302 (Compton). Available at: https://aqs.epa.gov/aqsweb/airdata/download_files.html . Accessed: January 2018.				

As noted above, future year PM_{2.5} design value concentrations are projected to be lower in future years. The nearest station with future projections is the downtown Los Angeles stations:

- 24-hour average PM_{2.5} future design value: 27.6 µg/m³
- Annual average PM_{2.5} future design value: 10.8 µg/m³

4.7.2 PM₁₀

In accordance with Section K.5.2 of the 2015 USEPA Guidance, the highest 24-hour PM₁₀ concentration in the most recent three years of South Long Beach monitoring data will be chosen. The 24-hour PM₁₀ background design value for the most recent three years (2014-2016) is 62 µg/m³.

4.8 Calculation of Design Values and Conformity Determination

To determine project-level PM conformity, design values for the preferred build alternative will be calculated and compared to the NAAQS or a comparison of the design values of the preferred build alternative and the no-build alternative will be performed. As stated in 40 CFR 93.116(a), the preferred build alternative should 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.

As suggested in the 2015 USEPA Guidance, the following steps will be used to determine the conformity by calculating design values.

- 1) If the design values for the preferred build alternative are less than or equal to the NAAQS, the project meets the conformity requirements and no further analysis is needed.

- 2) If the design values for the preferred build alternative are greater than the NAAQS, the no build alternative will be modeled at receptors where the build alternative is over the NAAQS and the design values for the preferred build alternative and the no build alternative will be compared. The conformity requirements are met if the design values for the preferred build alternative are less than or equal to those for no build alternative.
- 3) If the design values for preferred build alternative are greater than the design values for the no build alternative, further mitigation and control measures will be considered and additional modeling will be conducted to ensure the new design values for preferred build alternative are less than the no build alternative.

4.8.1 24-Hour PM_{2.5}

The 24-hour PM_{2.5} design value is defined as the average of three consecutive year's 98th percentile 24-hour concentrations per 40 CFR Part 50.13. According to Section 9.3.3 in the 2015 USEPA Guidance, design value is calculated as sum of the highest five-year average modeled 98th percentile 24-hour PM_{2.5} concentration and the three-year average of 98th percentile 24-hour ambient monitoring data. If the calculated design value is less than or equal to the 24-hour PM_{2.5} NAAQS of 35 µg/m³ for the preferred build alternative, conformity is met; otherwise, a build no-build analysis will be conducted. If the design value for the preferred build alternative is greater than the no build alternative, a second-tier approach will be used. In the second-tier approach, quarterly background concentrations will be calculated and added into AERMOD to calculate 98th percentile concentrations.

4.8.2 Annual PM_{2.5}

The annual PM_{2.5} design value is defined as the average of three consecutive year's annual averages (average of quarterly average) per 40 CFR Part 50.13. According to Section 9.3.2 in the 2015 USEPA Guidance, design value is calculated as the sum of the highest modeled annual-average PM_{2.5} concentration and the annual average monitoring data. If the calculated design value is less than or equal to the annual PM_{2.5} NAAQS of 12 µg/m³ for the build scenario, conformity is met; otherwise, a build/no-build analysis will be conducted. Conformity is met when the design value for the preferred build alternative is less than or equal to the annual PM_{2.5} NAAQS of 12 µg/m³ or when the design value of the preferred build alternative is less than the no build alternative.

4.8.3 24-Hour PM₁₀

The 24-hour PM₁₀ NAAQS is met when the 24-hour PM₁₀ concentration exceedance (greater than 150 µg/m³) is no more than once per year on average over a 3-year period. According to Section 9.3.4 in the 2015 USEPA Guidance, the 24-hr PM₁₀ design value is calculated as the highest sixth-highest concentration combined with the appropriate background concentration from the most recent three years of air quality monitoring data.⁴² Conformity is met when the calculated design value is less than or equal to the 24-hour PM₁₀ NAAQS of 150 µg /m³. If the design value is greater than the NAAQS a build non-build analysis will be performed. Conformity is met is the design value for the preferred build alternative is less than the no build alternative.

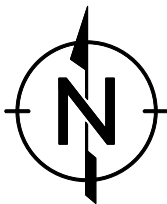
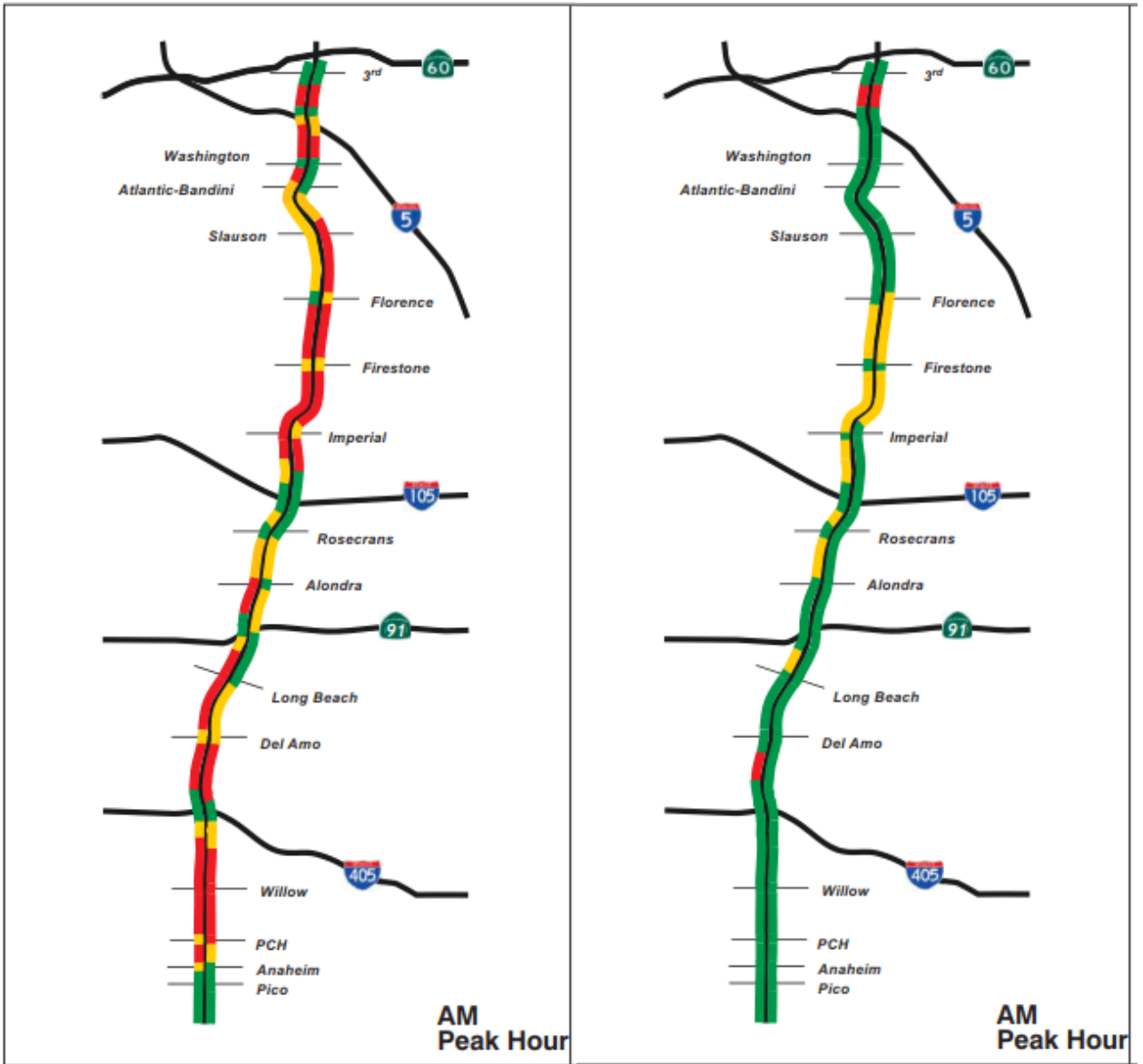
⁴² Depending on the number of observations from the selected ambient monitor station, different rank of the monitor value will be used for design value calculation.

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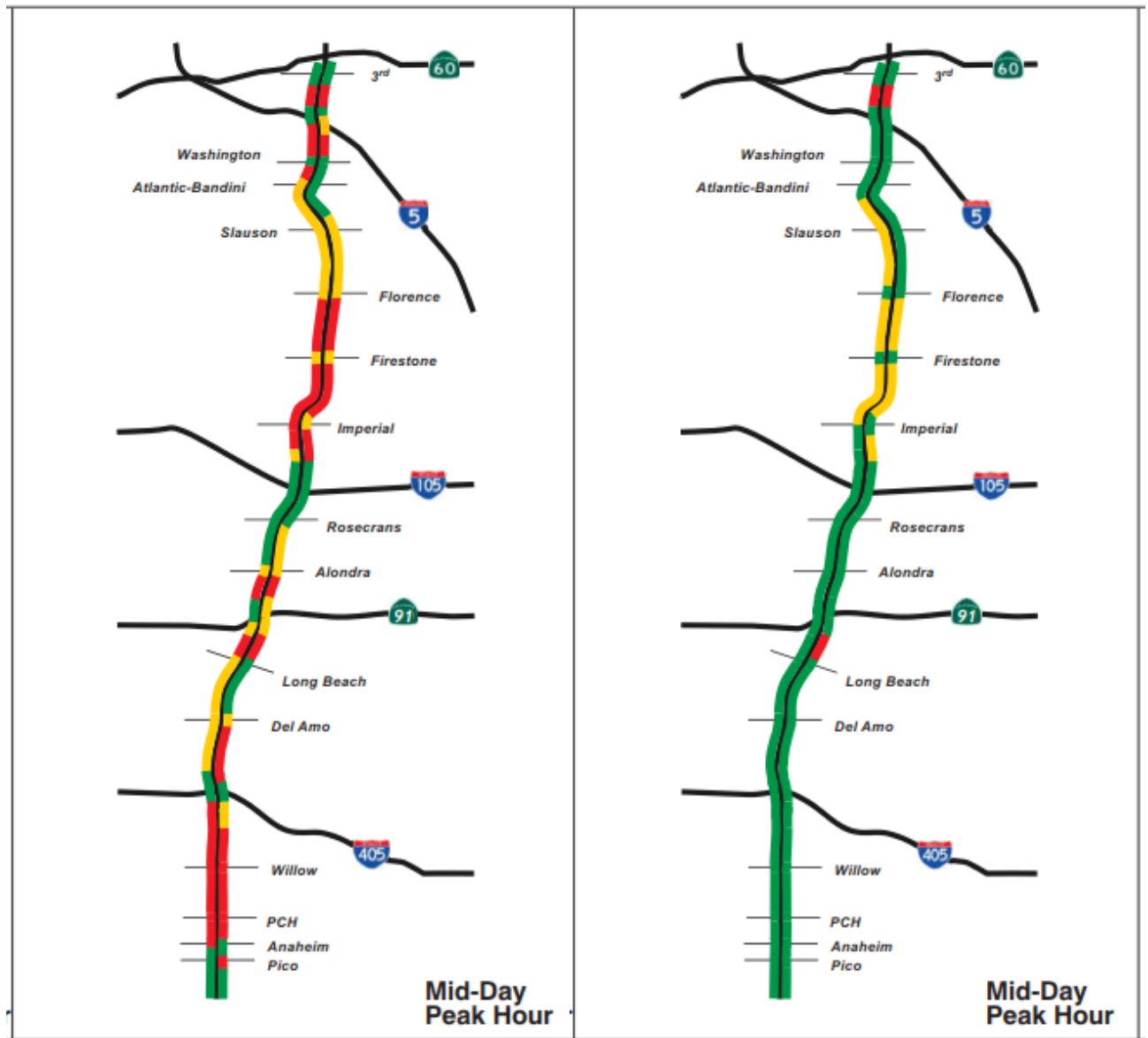
FULL SIZE FIGURES



AM Peak Hour Levels of Service

**FIGURE
1a**

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Level of Service
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Mid-Day Peak Hour Levels of Service

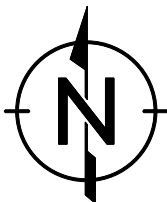
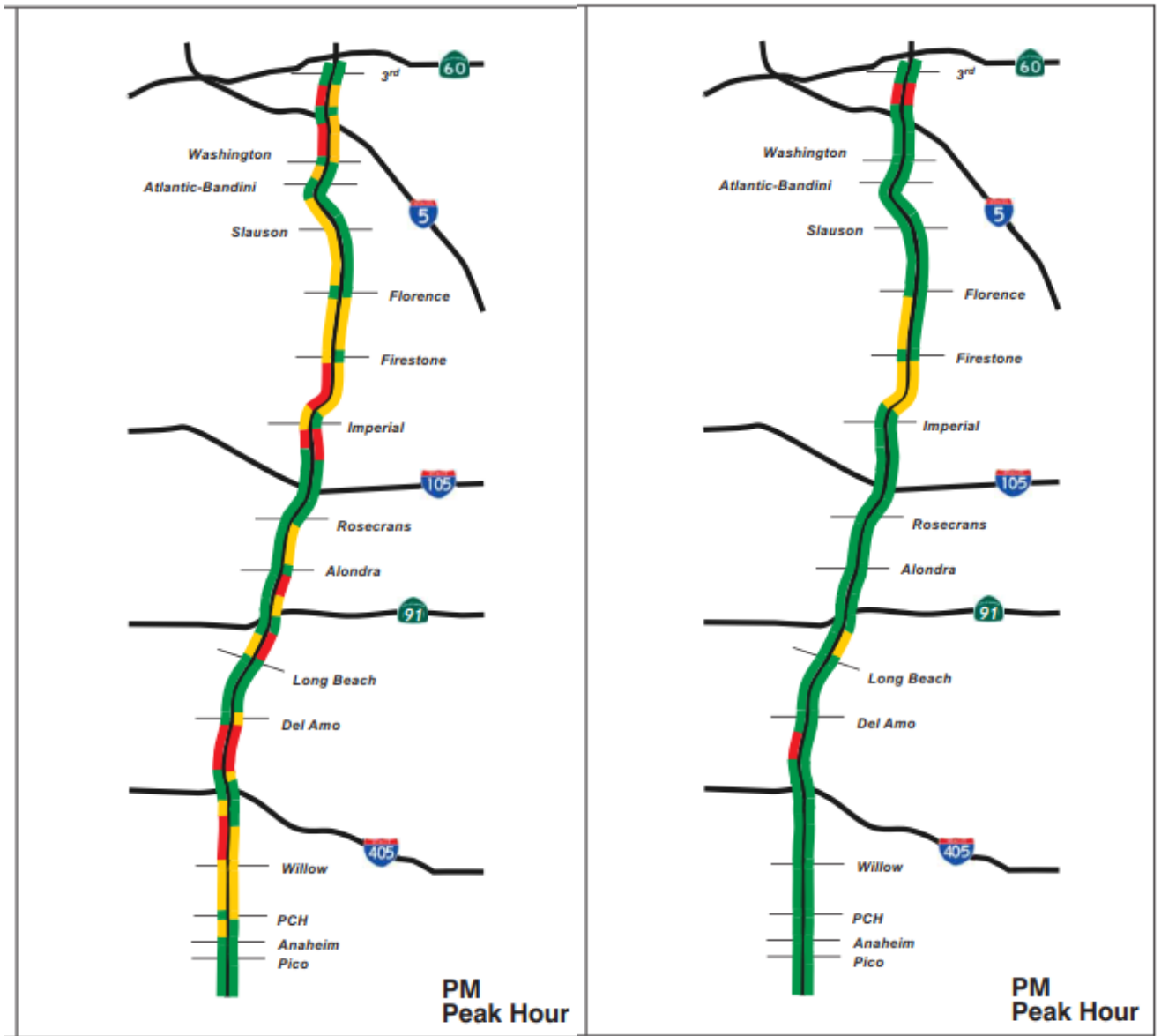
FIGURE 1b

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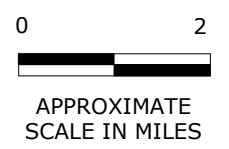
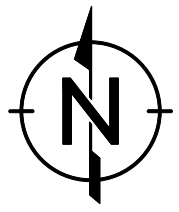
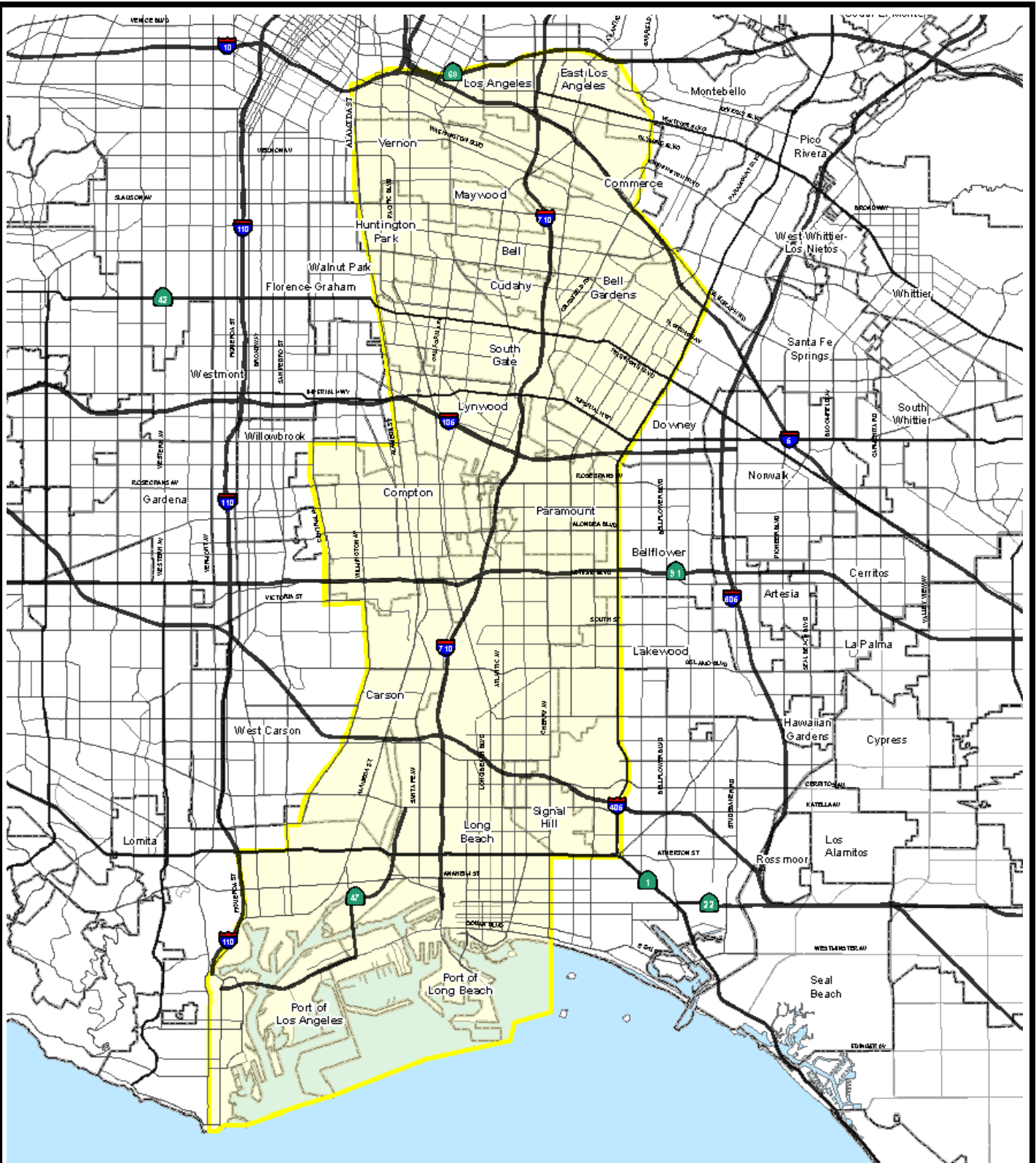
Level of Service
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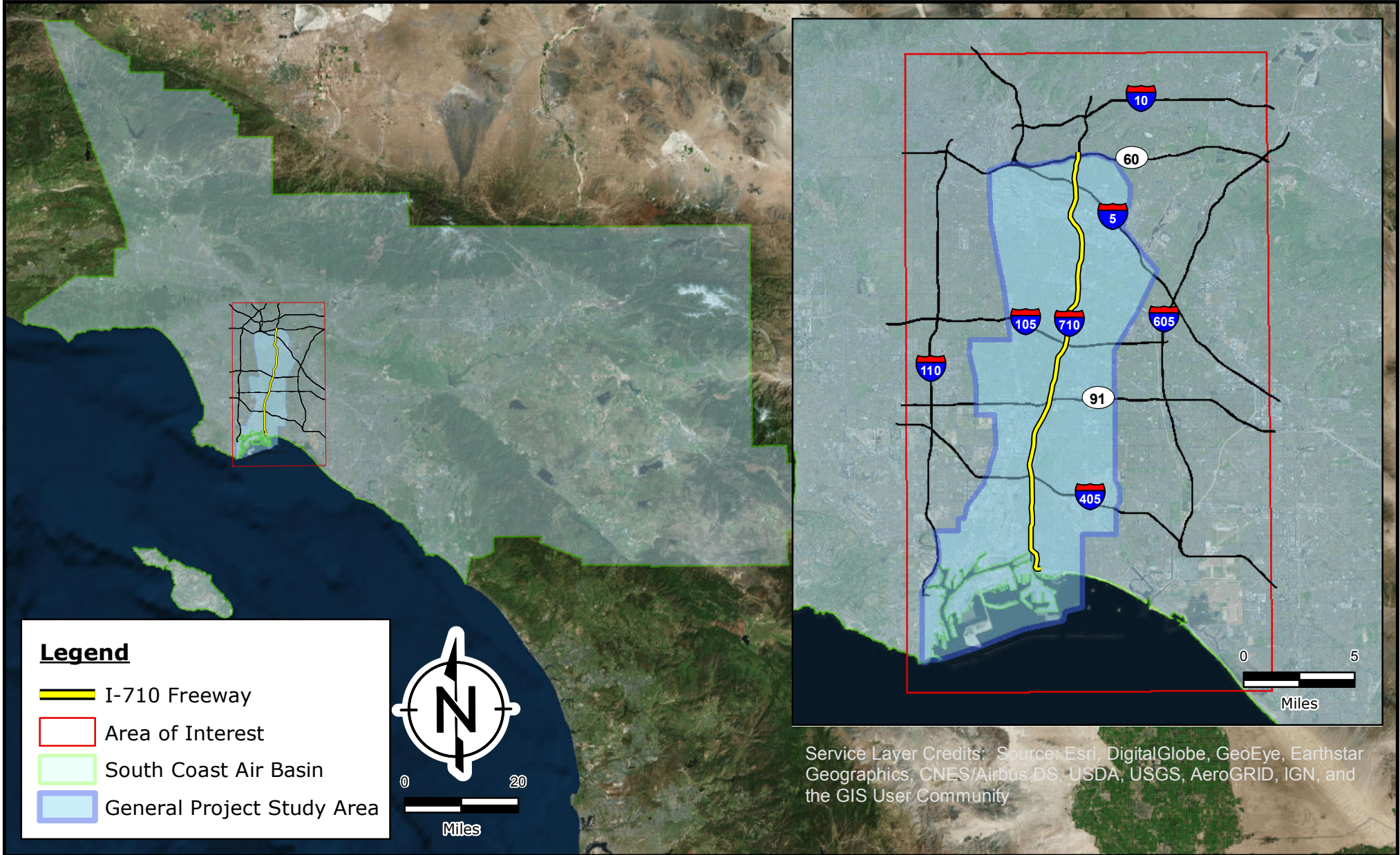
PM Peak Hour Levels of Service

**FIGURE
1c**

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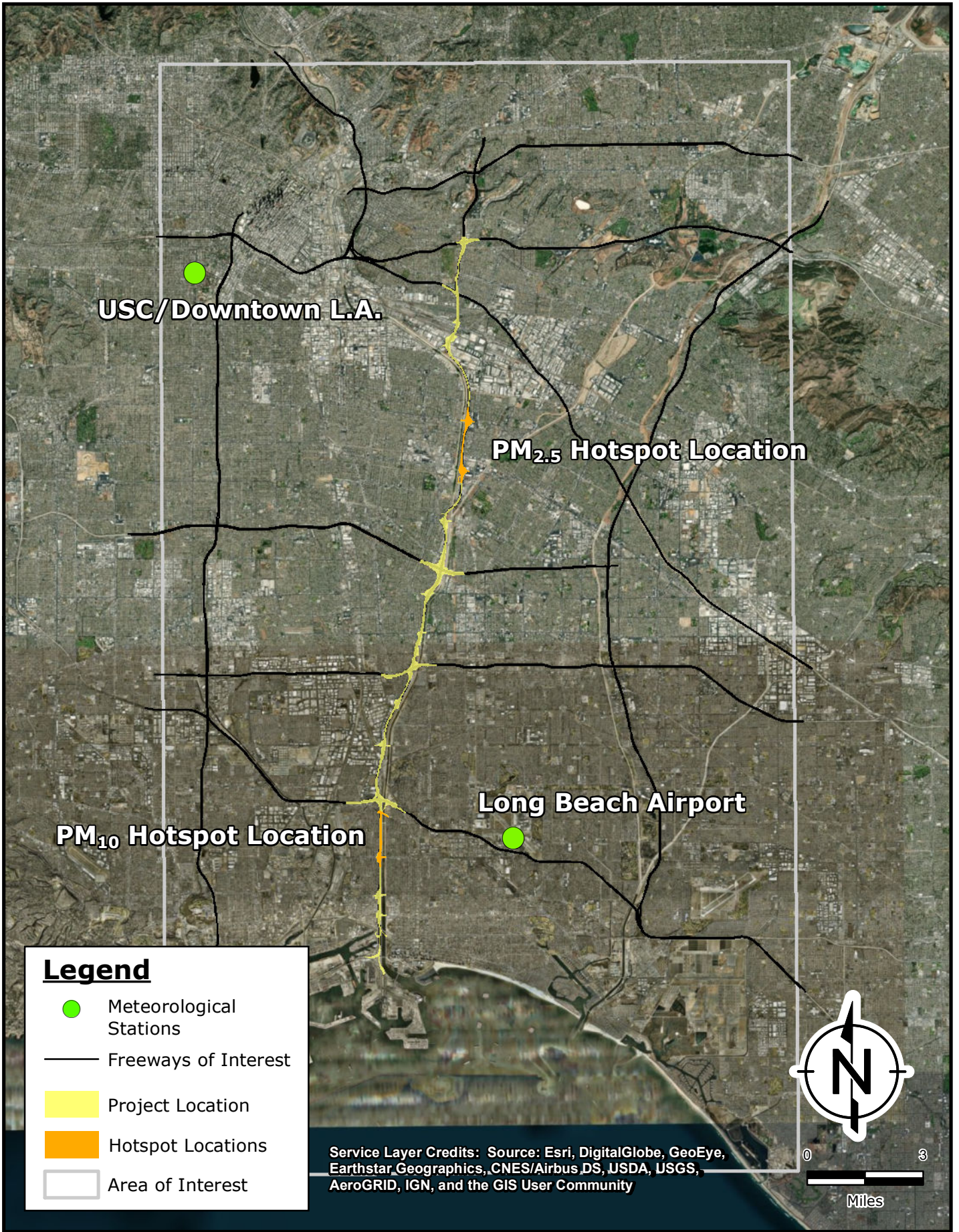
	<h1>General Project Study Area</h1>	<p>FIGURE 2</p> <p>PROJECT: 1690007615</p>
<p>DRAFTED BY: MG</p>	<p>DATE: 8/8/2018</p>	



Project Study Areas for Air Quality Analyses

FIGURE
3

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Legend

- Meteorological Stations
- Freeways of Interest
- Project Location
- Hotspot Locations
- Area of Interest

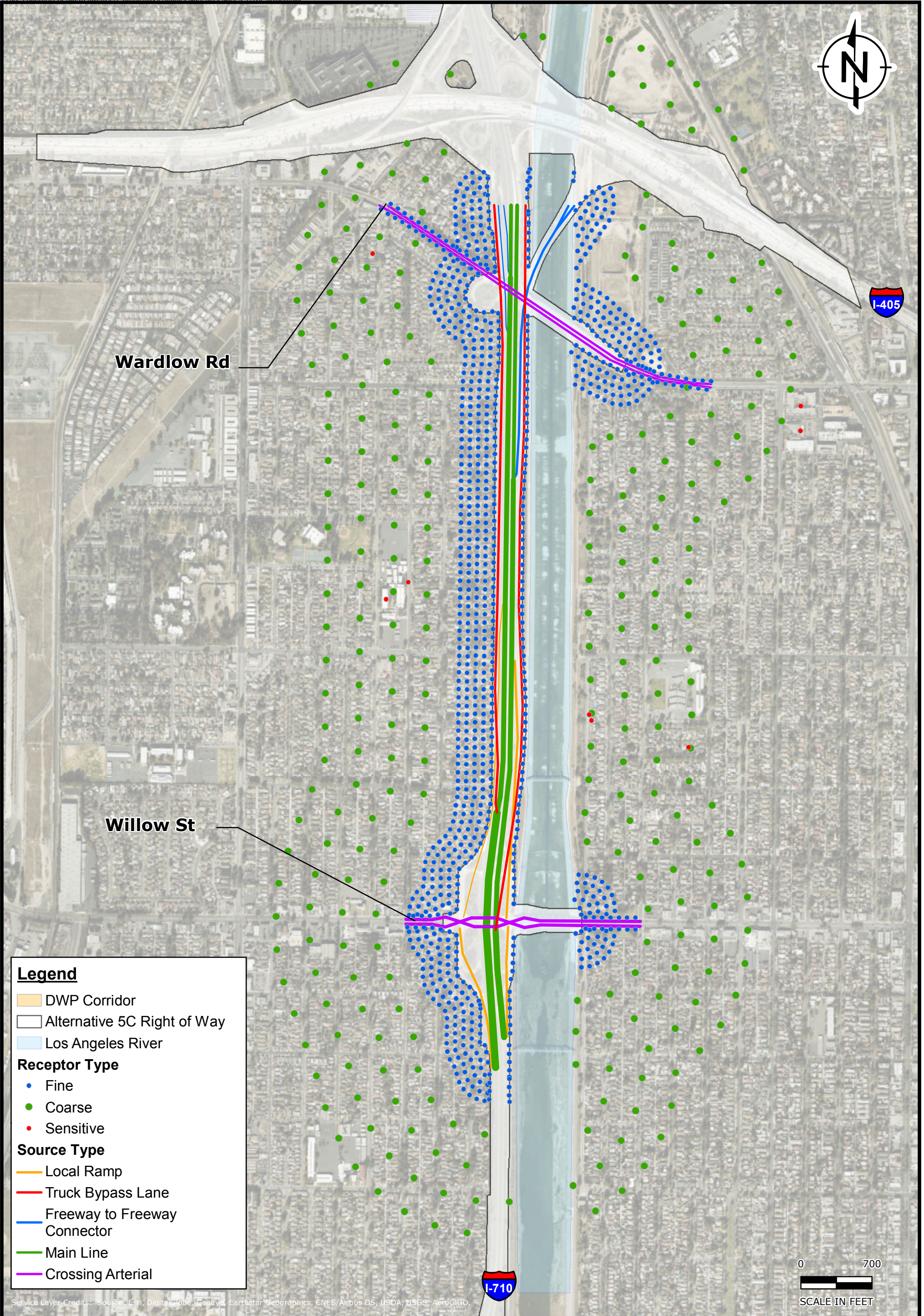
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar, Geographics, CNES/Airbus_DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

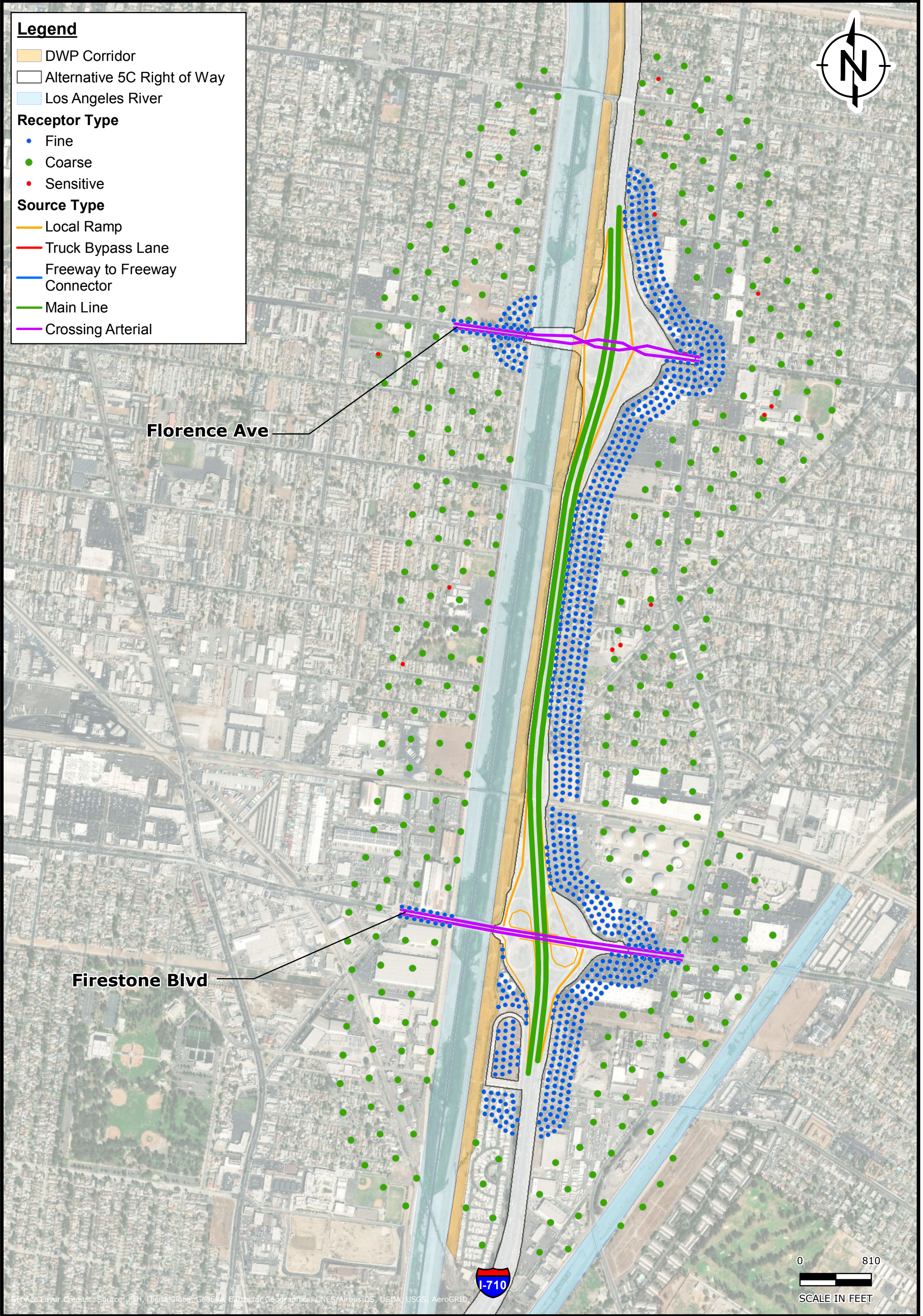
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Meteorological Station Locations

FIGURE 4

PROJECT: 1690007615





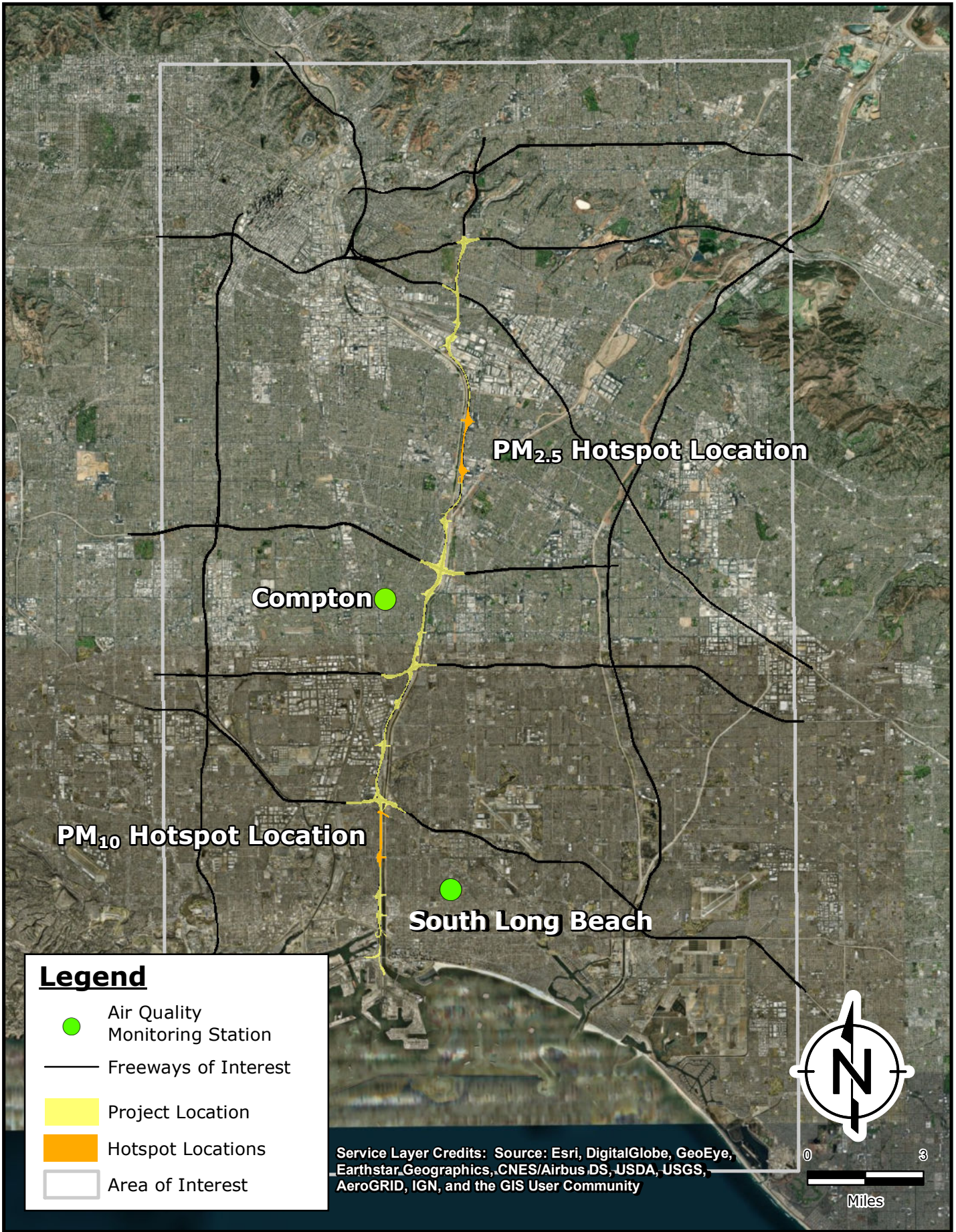
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**PM_{2.5} Hot-Spot Modeling
Source-Receptor Setup**

**FIGURE
6**

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DRAFTED BY: MG DATE: 8/1/2018

Ambient Air Monitoring Stations

FIGURE 7

PROJECT: 1690007615

APPENDIX A
I-710 CORRIDOR PROJECT: MODELING
LOCATION SELECTION FOR QUANTITATIVE
PM HOT-SPOT ANALYSES



White Paper August 2018

I-710 Corridor Project: Modeling Location Selection for Quantitative PM Hot-spot Analyses

Transportation project-level PM₁₀/PM_{2.5} conformity analysis requires dispersion modeling consistent with 40 CFR 93.123. As stated in 40 CFR 93.123(c)(2), hot-spot analyses must include the entire transportation project, but modeling of a worst-case location can be sufficient if it is demonstrated that other areas would have lower impacts (and thus, if the worst-case location demonstrates conformity, all other areas would also). Near-roadway concentrations can be affected by a number of factors, including (but not limited to):

- Annual average daily trips under the Build condition (Alternative 5C) relative to the No Build;
- Magnitude of the vehicle exhaust, tire/brake wear, and entrained road dust emissions released by vehicles travelling on the roadway. These emissions are a function of vehicle miles travelled and emission factors which vary with vehicle type, vehicle age, vehicle weight, and vehicle speed; and
- The “density” of emissions along a roadway (e.g., the emissions from a particular number of vehicles travelling in 3 lanes will produce a more concentrated emissions source for modeling as compared to the same number of vehicles travelling in 4 lanes).

Additionally, the distance from the edge of the roadway to areas accessible by the public (i.e., width of non-public right-of-way) affects how close to the roadway the near-roadway concentrations matter.

The next sections of the memorandum analyze these factors along the entire project and, taken together, justify the selection of the following sections of the freeway for detailed hot-spot modeling analysis:

- Between Willow and Wardlow for PM₁₀ hot-spot analysis; and
- Between Firestone and north of Florence for PM_{2.5} hot-spot analysis.

Note, for purposes of this memorandum “I-710 Freeway” or “I-710” refers to the portion of the I-710 freeway that represent the Project as described under Section 2 of the Protocol.

TRAFFIC ANALYSIS

As a preliminary step, both total traffic and heavy-duty truck traffic along the I-710 corridor were reviewed to determine areas with the highest traffic increases. Table 1 presents the annual average daily traffic volumes on those major segments of the I-710 corridor where traffic is highest under Alternative 5C. For 2035 Alternative 5C, the maximum total annual average daily traffic (AADT) for all vehicle types is seen between I-105 and Alondra, with the most heavy-duty trucks traveling between Long Beach and Del Amo. However, the maximum increase in total AADT for 2035 Alternative 5C as

compared to 2035 No Build is seen between Atlantic-Bandini and Florence, while the maximum increase in heavy-duty truck AADT occurs at a different location on the I-710 freeway - between Willow and Pacific Coast Highway- followed closely by I-405 to Willow. Heavy-duty trucks are the primary driver for particulate matter emissions, hence heavy-duty truck AADT are generally considered more important while choosing the location for the quantitative PM hot-spot analysis. The review of the traffic increases on I-710 provides a strong indicator for the key areas likely to result in the highest concentrations of particulate matter in the I-710 corridor. See the following section on Emissions Analysis for supporting analyses.

Segment Description	2035 Alternative 5C AADT Volumes		Increase in AADT Volumes as Compared to 2035 No Build	
	Total	Heavy-Duty Trucks	Total	Heavy-Duty Trucks
I-10/SR-60	181,898	20,822	4,211	1,549
SR-60/I-5	229,838	34,602	38,127	5,843
Atlantic-Bandini/Florence	267,962	42,378	41,959	6,253
Florence/Firestone	272,854	43,315	38,018	5,822
Firestone/North of I-105	274,645	43,423	33,379	5,392
South of I-105/Alondra	285,595	55,786	17,967	1,934
Alondra/SR-91	253,697	54,011	1,505	1,146
SR-91/Long Beach	248,990	59,868	33,192	4,627
Long Beach/Del Amo	236,698	60,002	28,478	5,211
Del Amo/I-405	226,104	58,826	20,269	5,145
I-405/Willow	216,076	58,458	40,209	6,854
Willow/PCH	195,914	58,306	33,323	6,886
South of Pico	53,877	41,395	4,726	2,584

EMISSIONS ANALYSIS – MAGNITUDE AND DENSITY

Modeled air quality concentrations will be dependent on the magnitude of the emissions as well as the “density” of emissions at the release point (i.e., the emissions from a smaller cross-section of roadway will yield a higher local concentration than the same emissions from a wider roadway). Therefore, emissions and emission densities per square mile were assessed along one-mile sections of the I-710 freeway.

Table 2 presents the average daily emissions of particulate matter smaller than 10 microns in diameter (PM₁₀) and PM₁₀ emission densities along one-mile sections of the I-710 freeway. Average daily PM₁₀ emissions and incremental average daily PM₁₀ emissions for 2035 Alternative 5C are highest between Willow and Wardlow. Daily PM₁₀ emissions per square mile for Alternative 5C are highest along the section of the I-710 freeway between south of Florence and north of Florence. Incremental

PM₁₀ emission density (per square mile) are highest on the section of the freeway between Willow and Wardlow, and the section of the freeway between south of Florence and north of Florence.

Table 3 presents average daily particulate matter smaller than 2.5 microns in diameter (PM_{2.5}) emissions and emission densities along one-mile sections of the I-710 freeway. Average daily PM_{2.5} emissions for 2035 Alternative 5C are highest between north of Florence and Slauson. Incremental average daily PM_{2.5} emissions are highest on the section of the freeway between south of Florence and north of Florence. Daily PM_{2.5} emissions per square mile and incremental PM_{2.5} emission density (per square mile) are also highest in the location surrounding Florence.

Based on the emission densities presented in Tables 2 and 3, we would expect receptors located in the vicinity of the I-710 freeway located between Willow and Wardlow to have the maximum PM₁₀ impacts and the receptors located near the I-710 freeway between south of Florence to north of Florence to have the maximum PM_{2.5} impacts. The next section includes a discussion how the non-conformity PM modeling results and information on the distance from the edge of the roadway to publicly-accessible areas may further inform our selection of location(s) for hot-spot modeling.

Table 2. Average Daily PM₁₀ Emissions Along the I-710 Freeway

General Location	Width of Roadway (feet)	Emissions per Mile (lb/day)		Emissions per Square Mile (lb/day/mile ²)	
		Alternative 5C Total PM ₁₀ (Annual Average)	Incremental PM ₁₀ (Annual Average) Alternative 5C vs. No Build	Alternative 5C Total PM ₁₀ (Annual Average)	Incremental PM ₁₀ (Annual Average) Alternative 5C vs. No Build
Third St to SR60	120	32	3	1,398	139
I-5 to Third St	160	91	18	2,999	606
Atlantic Blvd/Bandini Blvd to I-5	160	81	-8	2,665	-251
Slauson Ave to Atlantic Blvd/Bandini Blvd	160	94	3	3,103	84
North of Florence Ave to Slauson Ave	160	147	47	4,842	1,555
South of Florence Ave to North of Florence Ave	150	145	50	5,108	1,762
Firestone Blvd to South of Florence Ave	150	115	17	4,058	586
Imperial Highway to Firestone Blvd	180	121	16	3,547	474
I-105 to Imperial Highway	120	97	-4	4,270	-162
Rosecrans to I-105	130	94	9	3,832	355
Alondra to Rosecrans	180	127	0	3,721	11
SR 91 to Alondra	160	114	-9	3,761	-284
Long Beach Blvd to SR 91	150	122	13	4,300	451
Del Amo Blvd to Long Beach Blvd	180	136	13	3,982	384
I-405 to Del Amo Blvd	230	128	6	2,948	142
Wardlow Rd to I-405	260	113	16	2,287	317
Willow St to Wardlow Rd.	240	218	105	4,804	2,300
Pacific Coast Highway to Willow St	170	154	44	4,787	1,367
9th Street to Pacific Coast Highway	150	85	-14	2,982	-484
Long Beach Terminus to 9th Street	130	71	3	2,867	121

Table 3. Average Daily PM_{2.5} Emissions Along the I-710 Freeway

General Location	Width of Roadway (feet)	Emissions per Mile (lb/day)		Emissions per Square Mile (lb/day/mile ²)	
		Alternative 5C Total PM _{2.5} (Annual Average)	Incremental PM _{2.5} (Annual Average) Alternative 5C vs. No Build	Alternative 5C Total PM _{2.5} (Annual Average)	Incremental PM _{2.5} (Annual Average) Alternative 5C vs. No Build
Third St to SR60	120	7	0.7	325	32
I-5 to Third St	160	20	4.0	673	133
Atlantic Blvd/Bandini Blvd to I-5	160	18	-1.8	601	-60
Slauson Ave to Atlantic Blvd/Bandini Blvd	160	21	0.7	698	24
North of Florence Ave to Slauson Ave	160	33	10.5	1,077	346
South of Florence Ave to North of Florence Ave	150	32	11.1	1,129	392
Firestone Blvd to South of Florence Ave	150	25	3.7	896	129
Imperial Highway to Firestone Blvd	180	27	3.6	784	105
I-105 to Imperial Highway	120	21	-1.2	922	-51
Rosecrans to I-105	130	20	1.9	824	75
Alondra to Rosecrans	180	27	0.2	799	5
SR 91 to Alondra	160	24	-2.1	789	-70
Long Beach Blvd to SR 91	150	25	2.8	895	99
Del Amo Blvd to Long Beach Blvd	180	28	2.9	829	84
I-405 to Del Amo Blvd	230	17	-8.4	389	-193
Wardlow Rd to I-405	260	9	-10.6	181	-215
Willow St to Wardlow Rd.	240	16	-7.5	346	-165
Pacific Coast Highway to Willow St	170	23	0.6	711	18
9th Street to Pacific Coast Highway	150	17	-3.1	582	-108
Long Beach Terminus to 9th Street	130	13	0.7	544	28

AQ/HRA MODELING AND DISTANCE TO ACCESSIBLE AREAS

The air dispersion modeling performed to support the analyses in the RDEIR/SDEIS was setup using volume sources to represent roadway emissions and a freeway following receptor grid that extended from a distance of 50 meters to 3,000 meters from the edge of the right of way.¹ The RDEIR/SDEIS air dispersion modeling was based on its own Protocol, reviewed by multiple agencies, including USEPA, CARB, SCAQMD, FHWA, SCAG and others, and is consistent with HRA and CEQA/NEPA analyses done for major transportation and goods movement projects/sites in Southern California. Although that modeling was not completely consistent with the PM hot-spot modeling guidance (ex., nearest receptors are placed at 50 meters instead of 5 meters from the source), its results can be used as a supporting analysis to assess where the maximum impacts would likely occur for a PM hot-spot analysis. Results of this modeling are shown in Figures 1 through 5.

PM₁₀ Air Quality Dispersion Modeling Results

Figure 1 displays air quality dispersion modeling results for 24-hour average PM₁₀ for 2035 Alternative 5C. (Larger copies of Figures 1-5 are also included in Attachment 1). Locations where the 24-hour PM₁₀ concentrations are greatest ($\geq 25 \mu\text{g}/\text{m}^3$, represented by orange dots) are in the areas between Willow and I-405, and areas east of the I-710 Freeway between Alondra and Rosecrans. The higher impacts seen on the east of the I-710 Freeway between Alondra and Rosecrans are located on the Los Angeles River and are thus in accessible to the public. This confirms that the section of the I-710 Freeway between Willow and I-405 would be the most appropriate for the PM₁₀ hot-spot analysis.

¹ Caltrans and Metro. I-710 Corridor Project Recirculated Draft Environmental Impact Report/Supplemental Draft Environmental Impact Statement and Section 4(f) Evaluation. 2017. Available at: <http://www.dot.ca.gov/d7/env-docs/docs/710corr-eir/>. Accessed: January 2018.

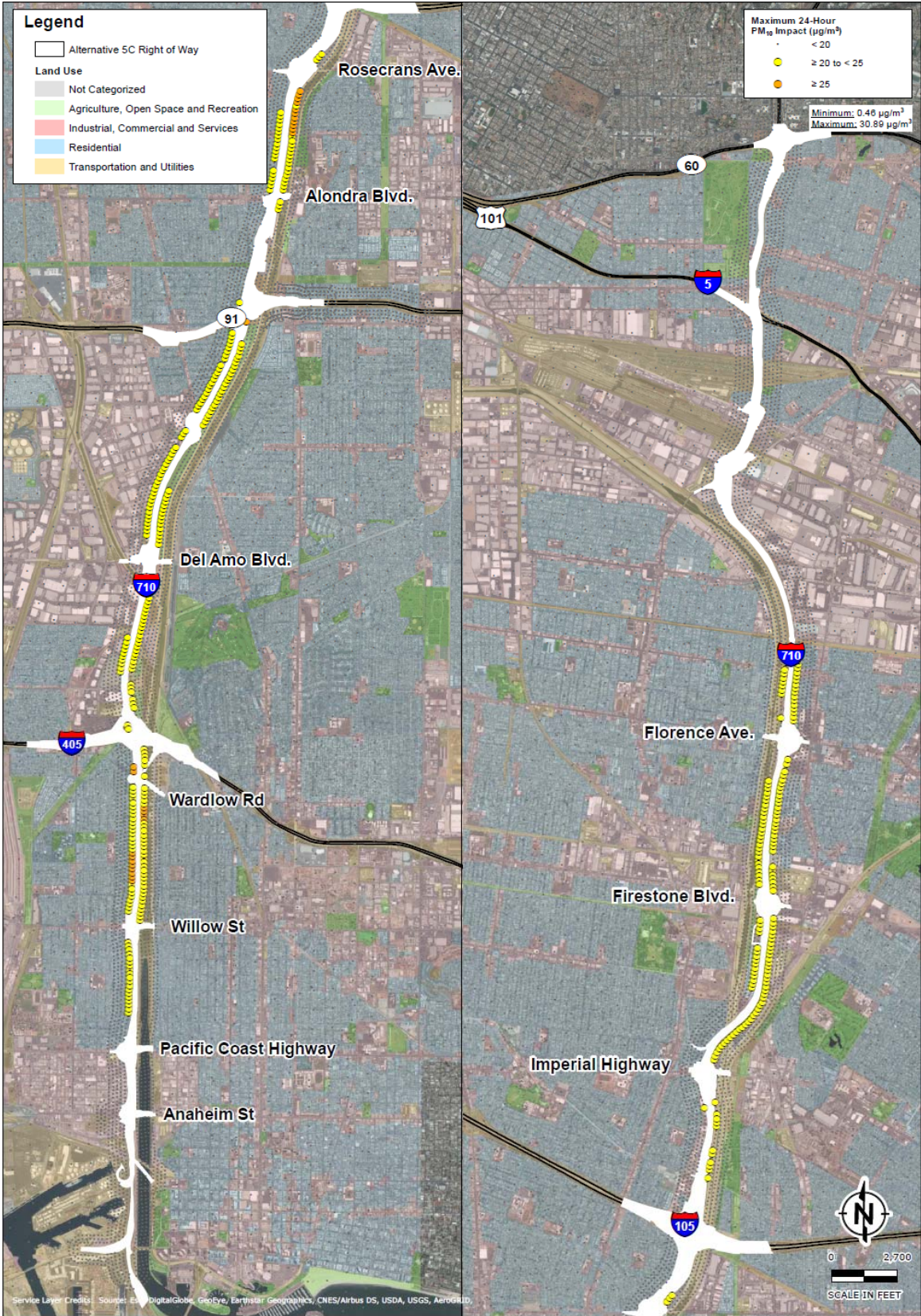


Figure 1. 2035 Alternative 5C PM₁₀ 24-hour Maximum Impacts

PM_{2.5} Air Quality Dispersion Modeling Results

Figures 2 and 3 show the 24-hour and annual average modeling results for PM_{2.5} for 2035 Alternative 5C. (Larger copies of Figures 1-5 are also included in Attachment 1). Locations where the 24-hour PM_{2.5} concentrations are greatest ($\geq 5 \mu\text{g}/\text{m}^3$, represented by orange dots) are in areas between Willow and Wardlow, Alondra and Rosecrans, and Imperial and north of Florence. The greatest annual average PM_{2.5} impacts ($\geq 3 \mu\text{g}/\text{m}^3$, represented by orange lines) are also seen at the same locations.

Since the background concentrations for 24-hour and annual PM_{2.5} are close to the NAAQS, we would most likely have to do a build/no-build analysis. Hence, we reviewed the incremental PM_{2.5} modeling results for 2035 Alternative 5C as compared to 2035 No Build (Figure 4 and Figure 5). (Larger copies of Figures 1-5 are also included in Attachment 1). These results show similar trends, with additional impacts near I-405, where the truck lanes will be constructed in Alternative 5C. A closer look at the areas where the greatest incremental impacts ($\geq 1 \mu\text{g}/\text{m}^3$ for 24-hour represented by orange dots and $\geq 0.5 \mu\text{g}/\text{m}^3$ for annual represented by orange lines) occur reveal that the following locations of maximum incremental impacts are not accessible to the public as they fall on the Los Angeles River:

- east side of the I-710 Freeway between Willow and Wardlow,
- east of the I-710 Freeway near Imperial Highway, and
- west of I-710 Freeway between Firestone and Florence.

However, the areas of maximum incremental impacts seen on the east of the I-710 Freeway, between Firestone and north of Florence are located on residential areas. This confirms that the location between Firestone and north of Florence would be the most appropriate for the PM_{2.5} hot-spot modeling.

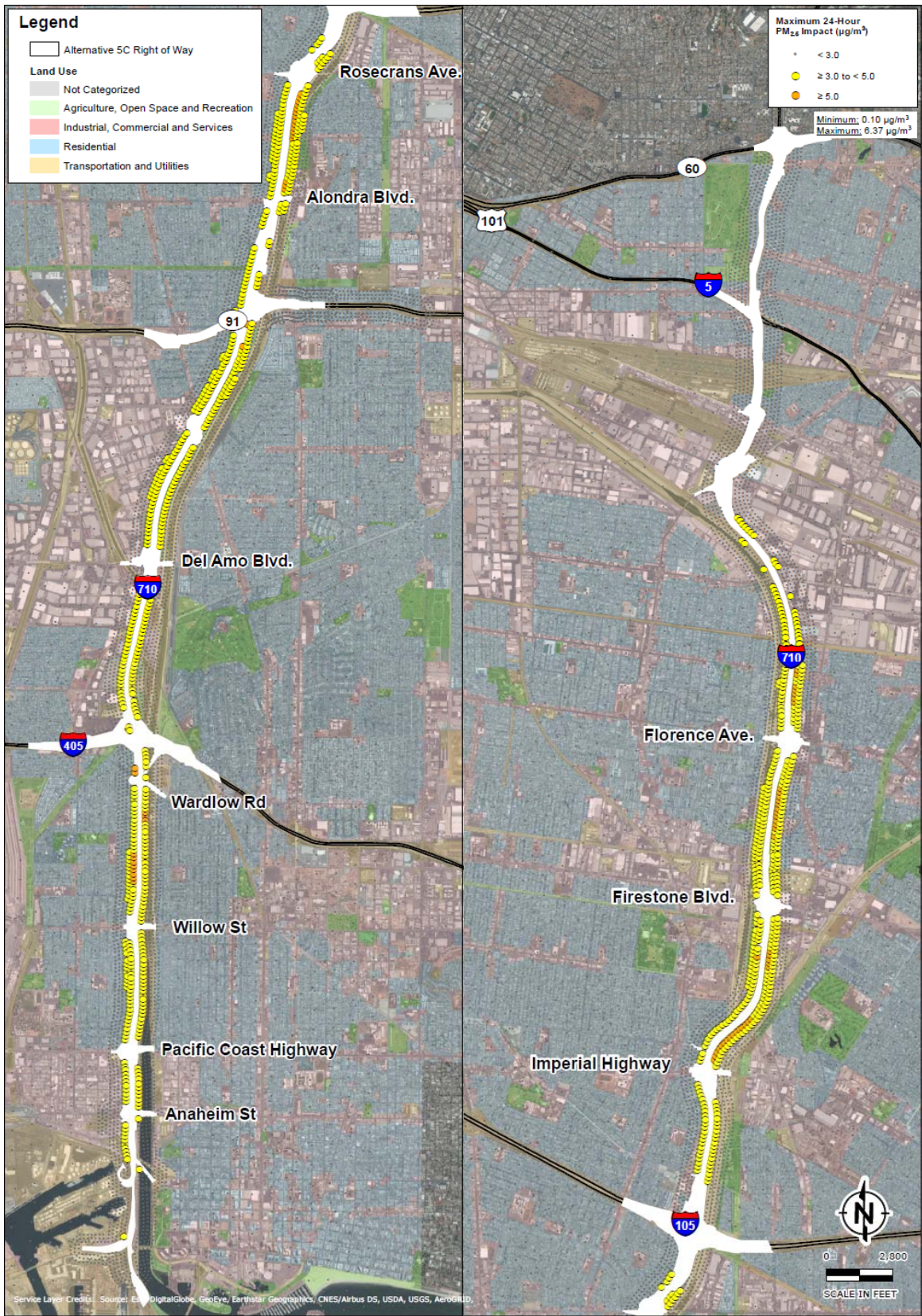


Figure 2. 2035 Alternative 5C PM_{2.5} 24-hour Maximum Impacts

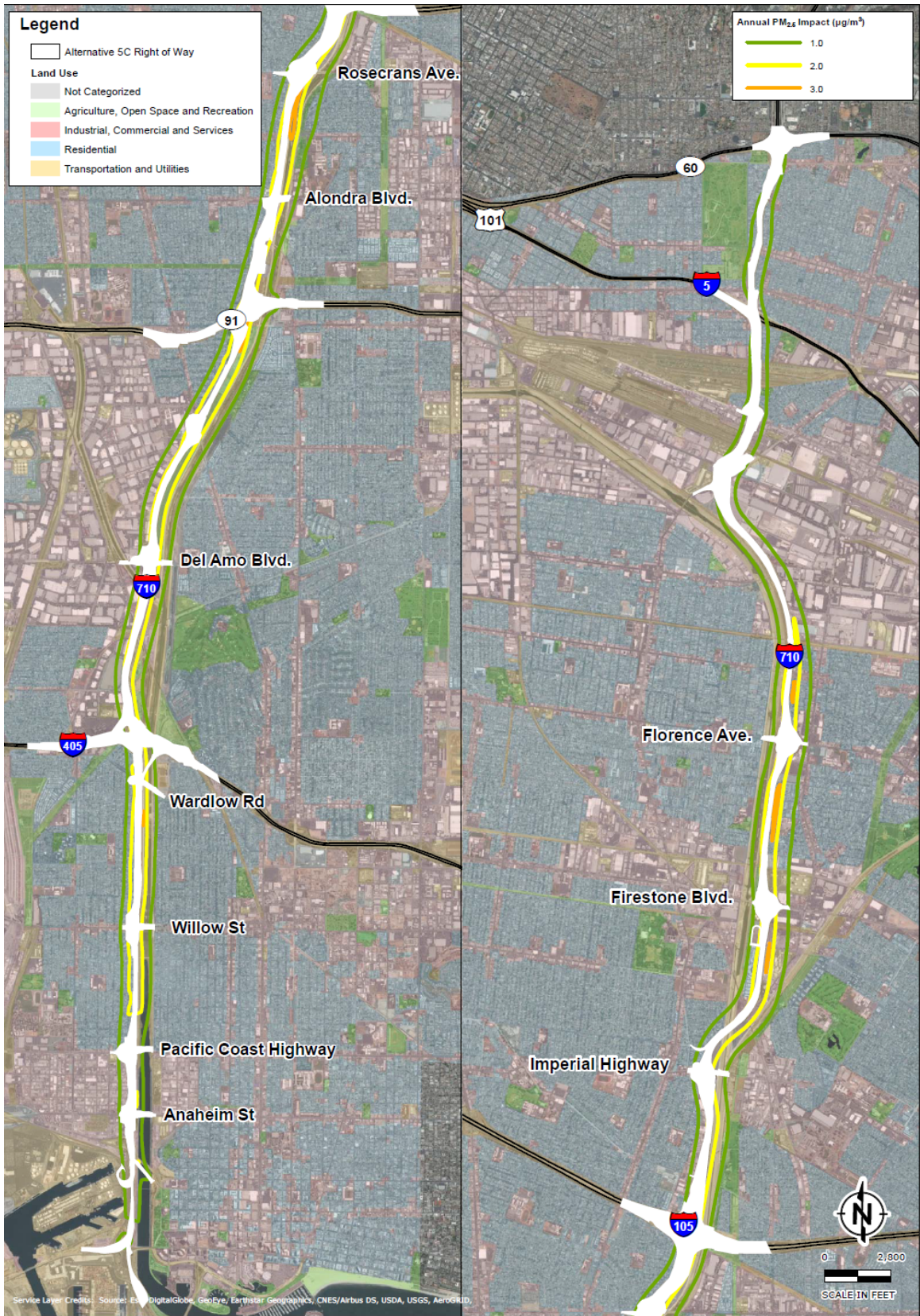


Figure 3. 2035 Alternative 5C PM_{2.5} Annual Impacts

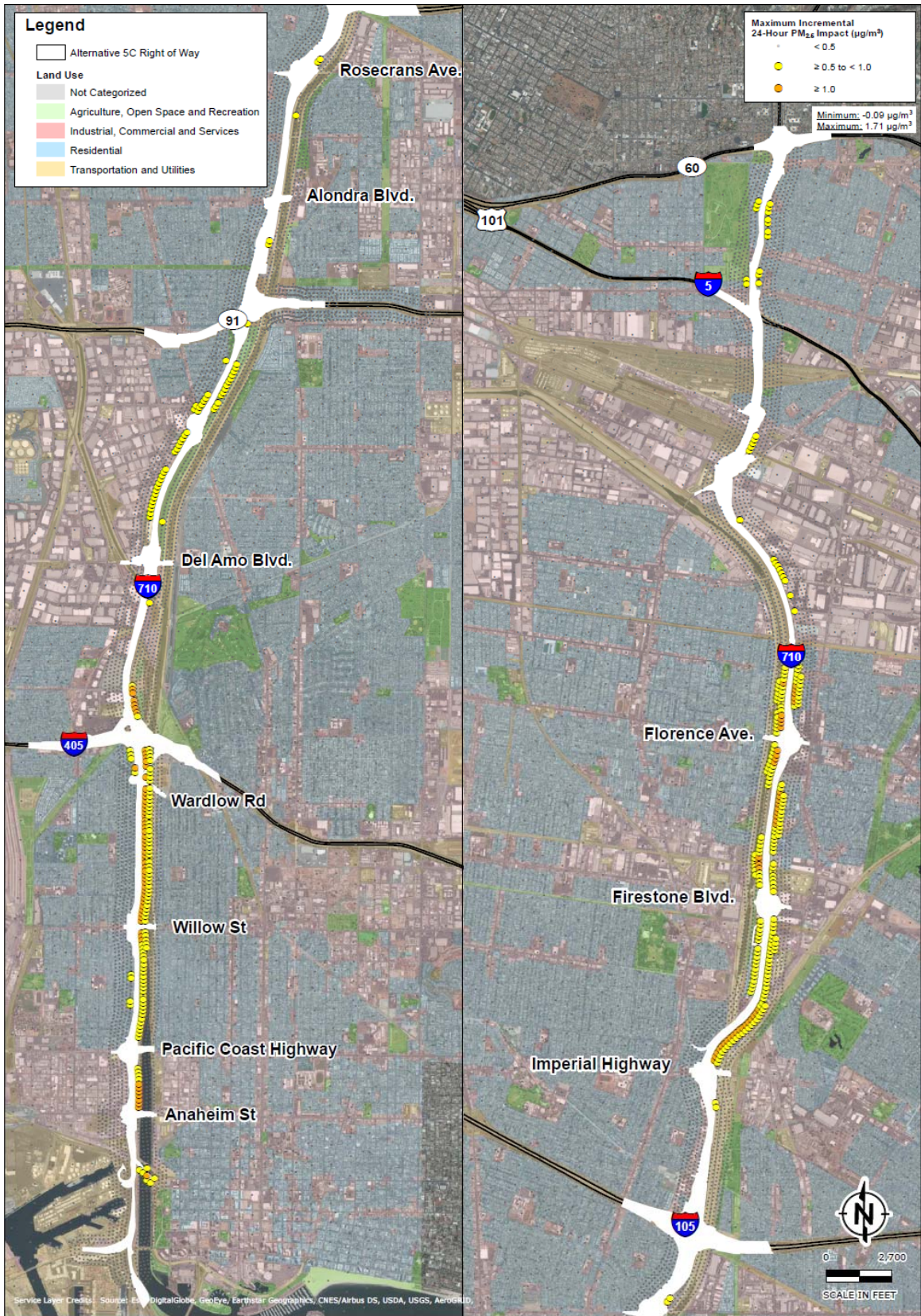


Figure 4. 2035 Alternative 5C vs. 2035 Alternative 1 PM_{2.5} 24-hour Maximum Impacts

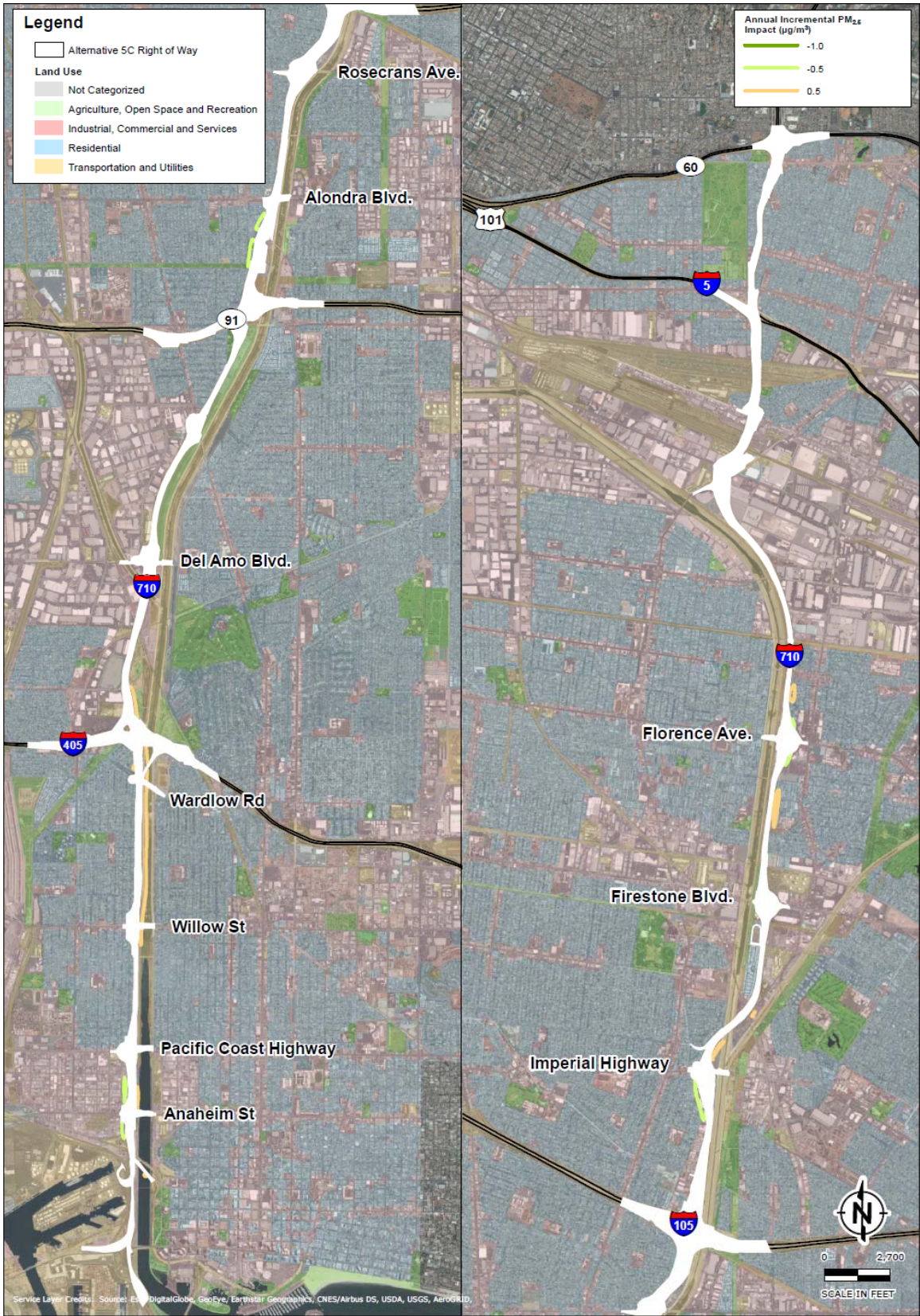


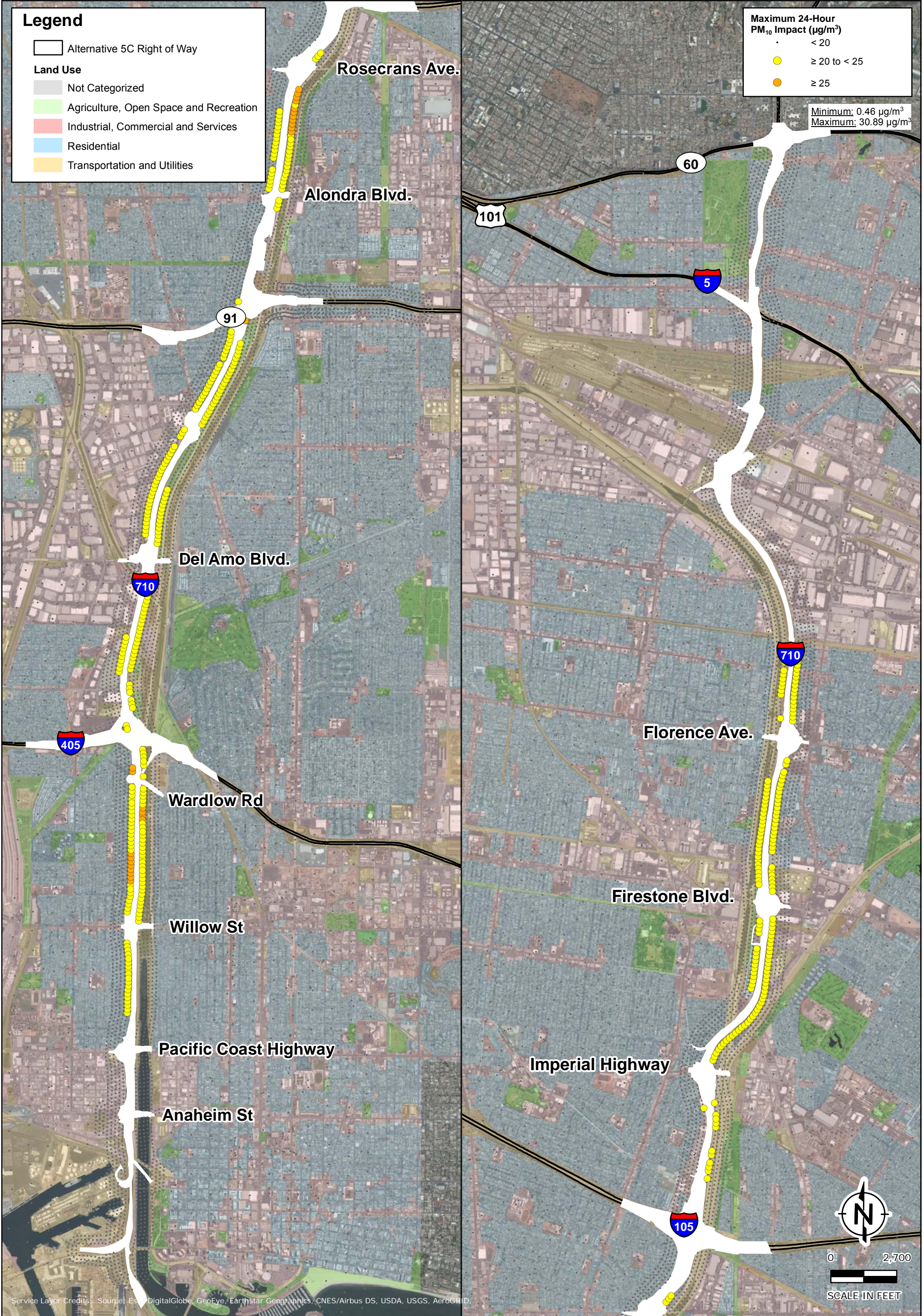
Figure 5. 2035 Alternative 5C vs. 2035 Alternative 1 PM_{2.5} Annual Impacts

CONCLUSION

We evaluated traffic volumes on the I-710 freeway, emissions trends on one-mile sections of the I-710 Freeway, and the RDEIR/SDEIS air quality modeling results (PM concentrations) in this white paper. Taken together, we conclude that the results of these evaluations demonstrate that the following sections of the freeway are most appropriate for the PM hot-spot modeling:

- Between Willow and Wardlow for PM₁₀ hot-spot analysis; and
- Between Firestone and north of Florence for PM_{2.5} hot-spot analysis.

ATTACHMENT 1: FIGURES



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID,

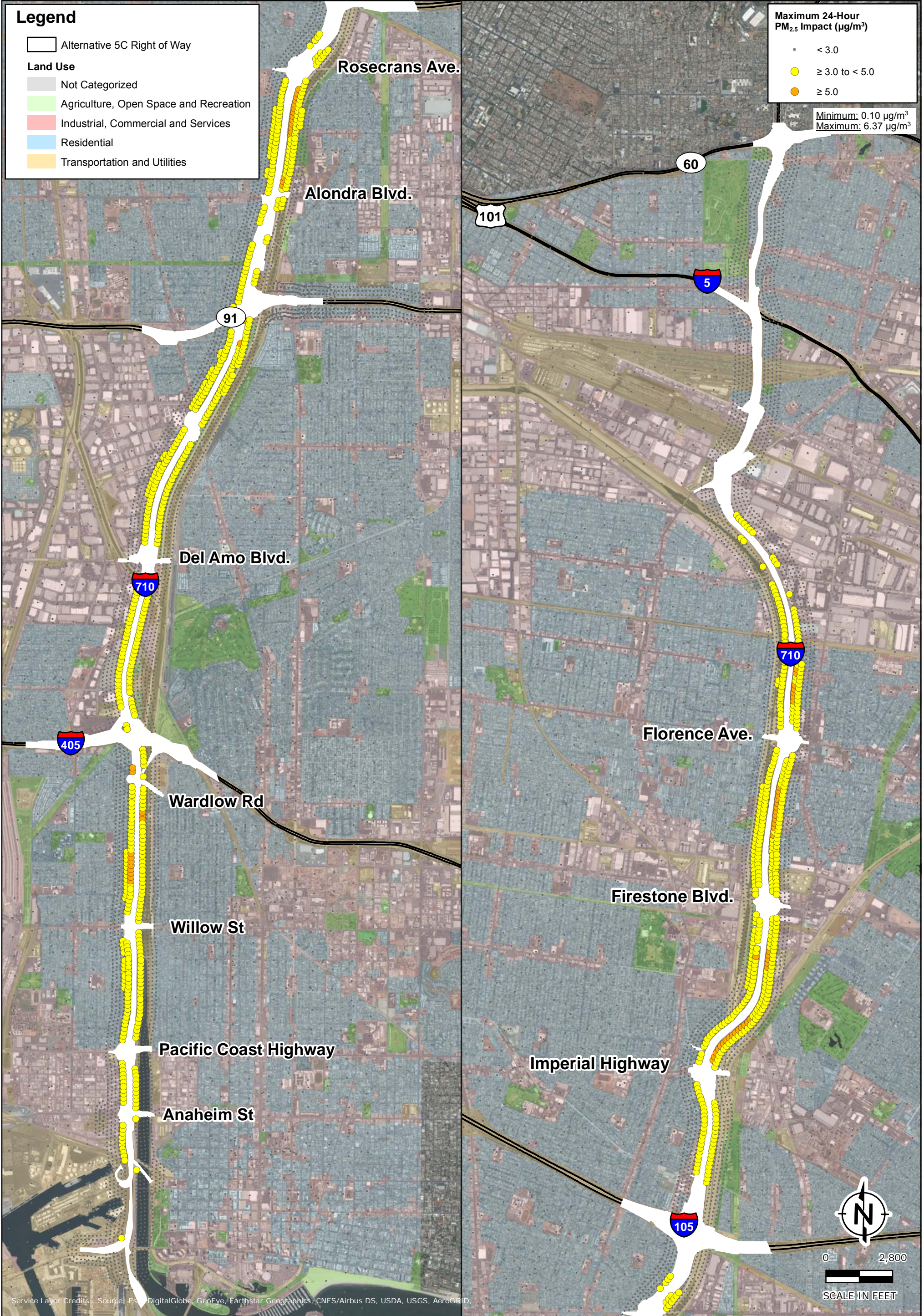
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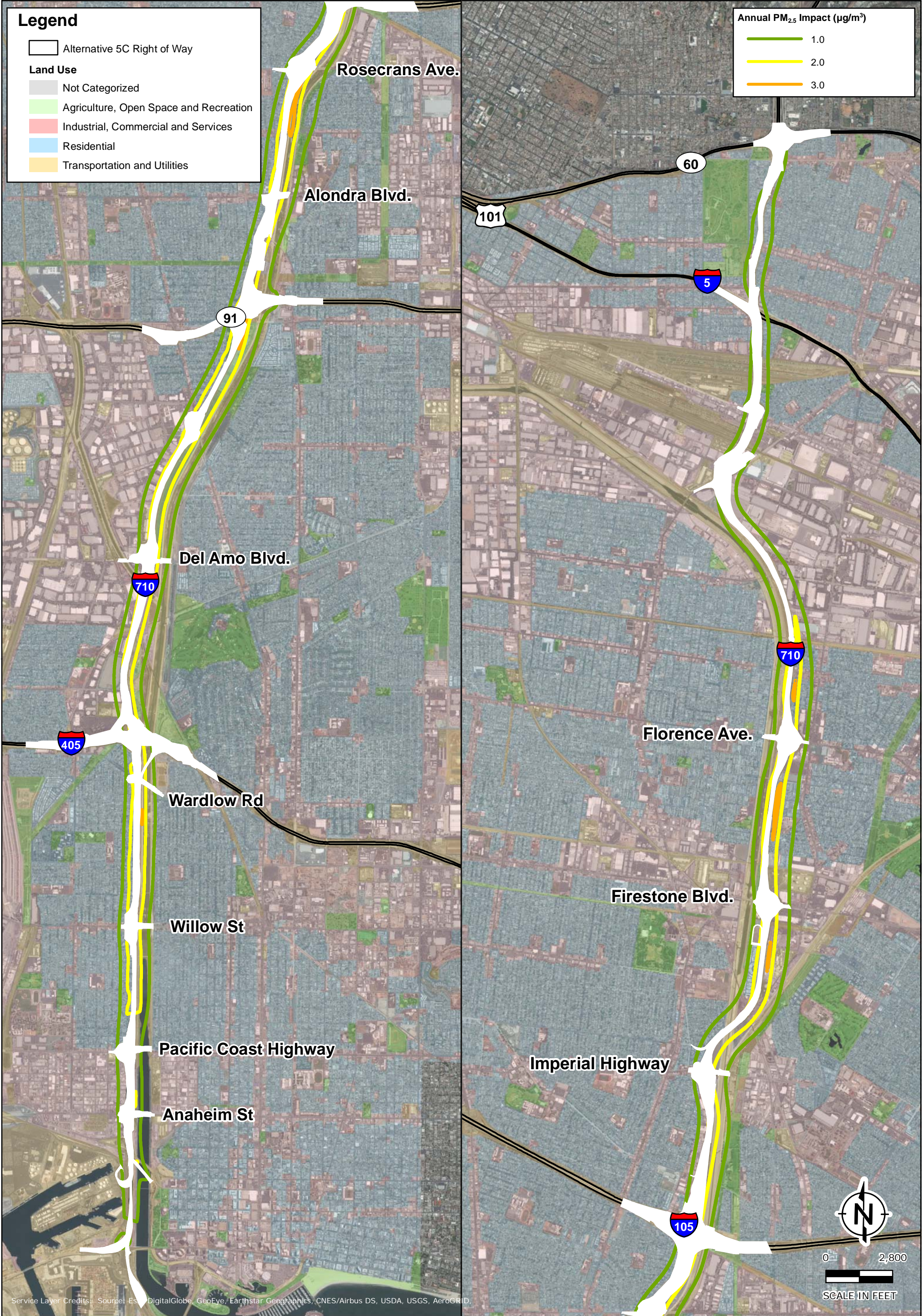
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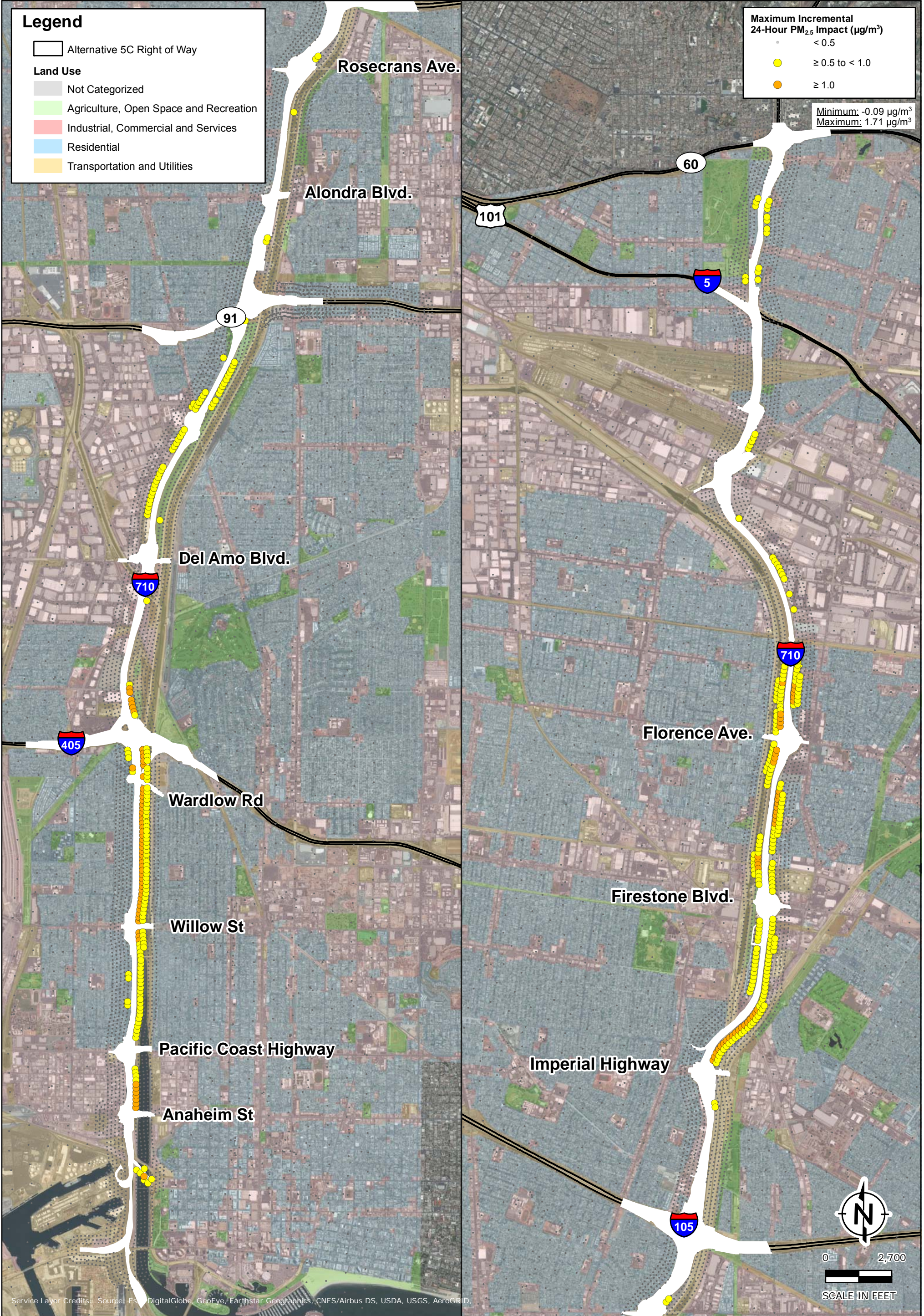
**2035 Alternative 5C PM₁₀
24-hour Maximum Impacts**

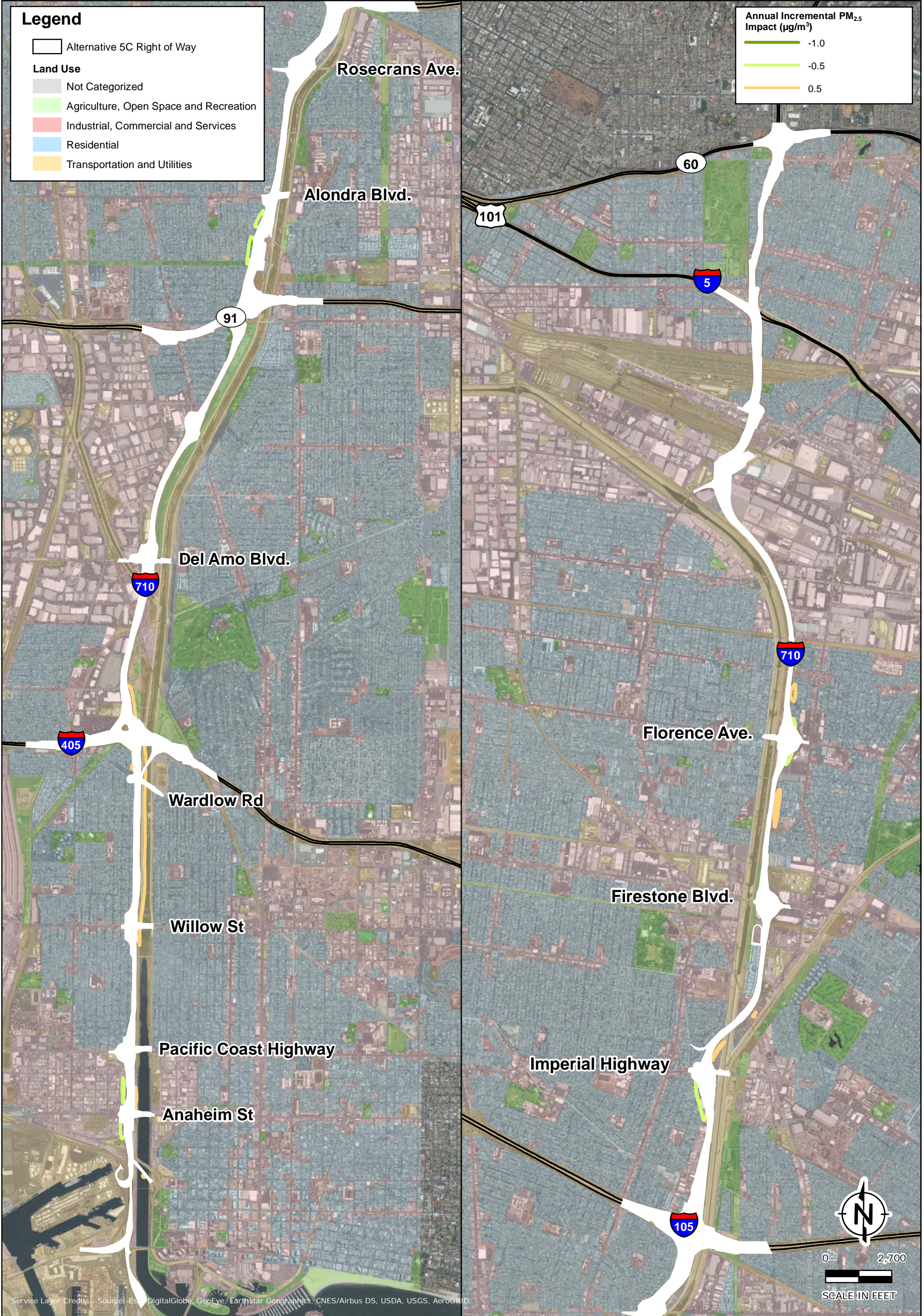
**FIGURE
1**

PROJECT: 1690007615









APPENDIX B
I-710 CORRIDOR PROJECT: SELECTION OF
ANALYSIS YEAR FOR QUANTITATIVE PM
HOT-SPOT ANALYSES



White Paper August 2018

I-710 Corridor Project: Selection of Analysis Year for Quantitative PM Hot-spot Analyses

The quantitative particulate matter (PM) conformity guidance¹ states that the analysis year(s) chosen for the hot-spot analysis should be the year(s) within the transportation plan or regional emissions analysis, as appropriate, during which:

- Peak emissions from the project are expected; and
- A new national ambient air quality standard (NAAQS) violation or worsening of an existing violation would most likely occur due to the cumulative impacts of the project and background concentrations in the project area.

The guidance recommends that the following factors (among others) be considered when selecting the year(s) of peak emissions:

- Changes in vehicle fleets;
- Changes in traffic volumes, speeds, and vehicle miles traveled (VMT); and
- Expected trends in background concentrations, including any nearby sources that are affected by the project.

The Preferred Alternative (Build Alternative 5C) is expected to begin freeway-related construction in the 2022-2024 time-period and be completed by the horizon year 2035. This white paper describes the methodology used to determine if any interim years (between the start of construction and the horizon year) could produce greater emissions than the 2035 horizon year and thus possibly represent peak year emissions. Note, for purposes of this memorandum "I-710 Freeway" or "I-710" refers to the portion of the I-710 freeway in the Project Study Area, as described under Section 2 of the Protocol.

In summary, there will be no appreciable reductions from improvements in truck and car vehicle technologies because the fleet will contain almost entirely the best certified engines before major construction begins on the Preferred Alternative, general truck and passenger vehicle VMT will continue to increase with population increases shown in the 2016 Air Quality Management Plan (AQMP) and, most importantly for the I-710 itself, port truck traffic will increase significantly until

¹ 2015. United States Environmental Protection Agency. Transportation Conformity Guidance for Quantitative Hot-spot Analyses in PM_{2.5} and PM₁₀ Nonattainment and Maintenance Areas. EPA-420-B-15-081. November. Available at: <https://www.epa.gov/state-and-local-transportation/project-level-conformity-and-hot-spot-analyses#pmguidance>. Accessed: January 2018.

2035 as the port capacity is met. Based on analysis of the trends in these key metrics, detailed below, no interim years between the start of construction and 2035 would be the peak emissions year.

CHANGES IN VEHICLE FLEETS

The greatest change in vehicle fleets is from the implementation of the Ports Clean Air Action Plan [CAAP]² and California Air Resources Board [CARB] Truck and Bus Rule³. Thus, almost 100% of heavy-duty trucks will be Model Year (MY) 2010 trucks or newer by 2023. These MY2010+ trucks have significantly lower exhaust PM emissions. As shown in Figure 1, EMFAC2014⁴ emission factors demonstrate that the effect of better truck engine technology and almost complete turnover in the truck fleet dramatically reduces running exhaust emission factors (grams/mile or gm/mi) from 2012 through 2023 and stays relatively constant after that through 2035 (emissions may slightly increase after 2024 due to fleet aging). Note that Figure 1 is PM₁₀ emissions, but would be similar for PM_{2.5}, as most exhaust is PM_{2.5}-size or smaller.

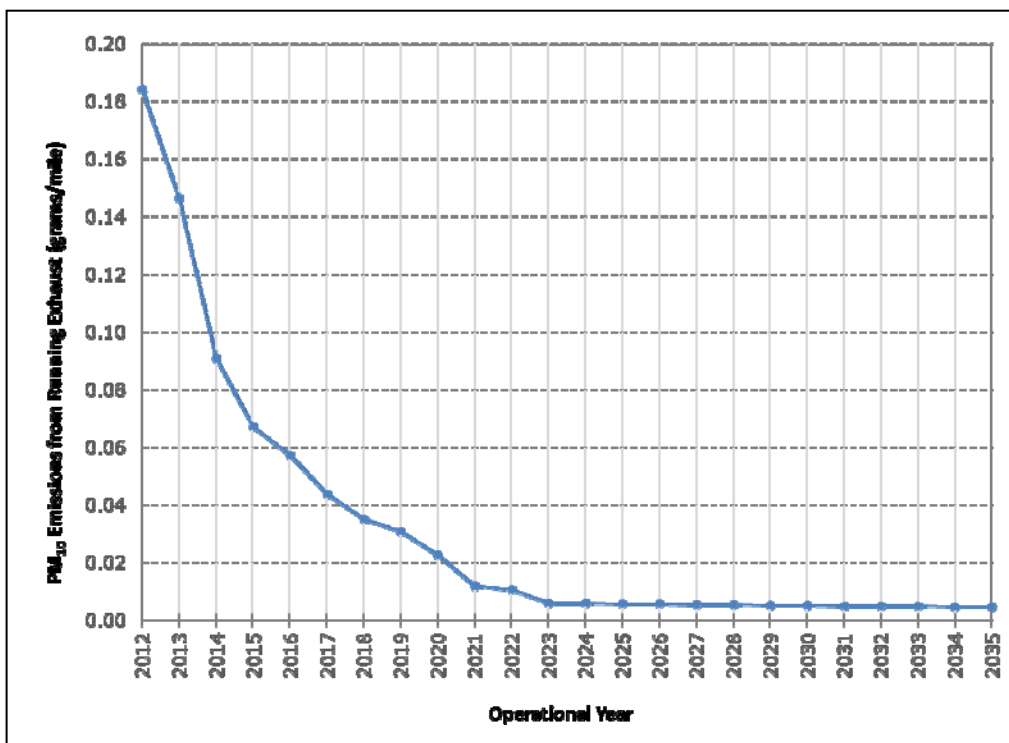


Figure 1. Heavy-Duty Truck Emission Rates (EMFAC2014, Los Angeles County Fleet)

² San Pedro Bay Ports Clean Air Action Plan. Available at: <http://www.cleanairactionplan.org/>. Accessed: April 2018.

³ California Air Resources Board. Truck and Bus Regulation. Available at: <https://www.arb.ca.gov/msprog/onrdiesel/onrdiesel.htm>. Accessed: April 2018.

⁴ EMFAC2014 is the most recently federally approved emissions factor model, however, CARB has released EMFAC2017, which is undergoing federal review. EMFAC2017 represents CARB's current understanding of motor vehicle travel activities and their associated emission levels. The trends and conclusions in this analysis using EMFAC2014 would not change if EMFAC2017 was used, as shown in Figure 5.1-5 of the EMFAC2017 Technical Documentation. Available at: <https://www.arb.ca.gov/msei/downloads/emfac2017-volume-iii-technical-documentation.pdf>. Accessed: June 2018.

Thus, we would expect that after the start of freeway-related construction (2022-2024 time frame), the trend in any exhaust-related truck emissions will be related to changes in VMT (and to a lesser extent, speed) from then until 2035. As we see in the next section, emissions increase monotonically from the start of construction through 2035 as truck VMT increases during this time period.

Vehicle turnover of the light-duty vehicle fleet (i.e., passenger cars/trucks) also reduces fleet emission rates, but the change in exhaust emission rates from 2012 through 2023 is not as pronounced as seen for heavy-duty trucks. The next section discusses the changes in emissions (resulting from changes in traffic volumes, speeds and VMT) during the project lifetime.

CHANGES IN EMISSIONS FROM CHANGES IN TRAFFIC VOLUMES, SPEEDS AND VMT

Overall VMT: A majority of the population uses light-duty automobiles and SUVs (light trucks) for day-to-day travel. Table III-2-3 of the 2016 AQMP provides estimated population and VMT projections in the South Coast Air Basin (SCAB). The population rises monotonically from 15.9 million in 2012 to 17.9 million in 2031, an increase of 12% over 20 years. Daily VMT rises monotonically from 380 million in 2012 to 409 million in 2031, an increase of 8%. Attachment D to Appendix III the 2016 AQMP provides the annual average on-road mobile source emission inventories for the base year and future years and includes VMT estimates. Based on Attachment D, light and medium duty vehicle VMT was projected to increase by 5% from 2012 to 2017, and then remain relatively constant through 2031.

Heavy-duty vehicle VMT trends in SCAB, which include port trucks, can also be assessed from Attachment D of the 2016 AQMP. Based on this analysis, heavy-duty vehicle VMT is expected to increase from a total of 21,837 miles in 2012 to 31,636 miles in 2031, an increase of 45%.

Port truck VMT projections are dependent on activity at the ports. Estimated container volumes in twenty-foot equivalent units (TEUs) are expected to triple from 14.1 million in 2012 to 41.4 million in 2035.⁵ Port truck VMT is expected to follow a similar trend to the TEUs.

Overall emission trends: Exhaust emissions are directly proportional to VMT, but can be affected by traffic volumes and speed also. The following chart shows that exhaust/brake and tire wear PM_{2.5} emissions in Los Angeles County increase monotonically from 2023 through 2035 (EMFAC2014 and Los Angeles County vehicle fleet). The exhaust-only portion does continue a slow decrease from 2023 and beyond, but VMT-related increases in brake and tire wear during that time period predominate and result in total non-entrained vehicle PM_{2.5} increasing. This would also be true for PM₁₀, as the exhaust portion of vehicle PM₁₀ is overwhelmingly PM_{2.5}.

⁵ Los Angeles County Metropolitan Transportation Authority. 2017. Technical Memorandum – I-710 Corridor Project RDEIR/SDEIS Travel Demand Modeling Methodology. June.

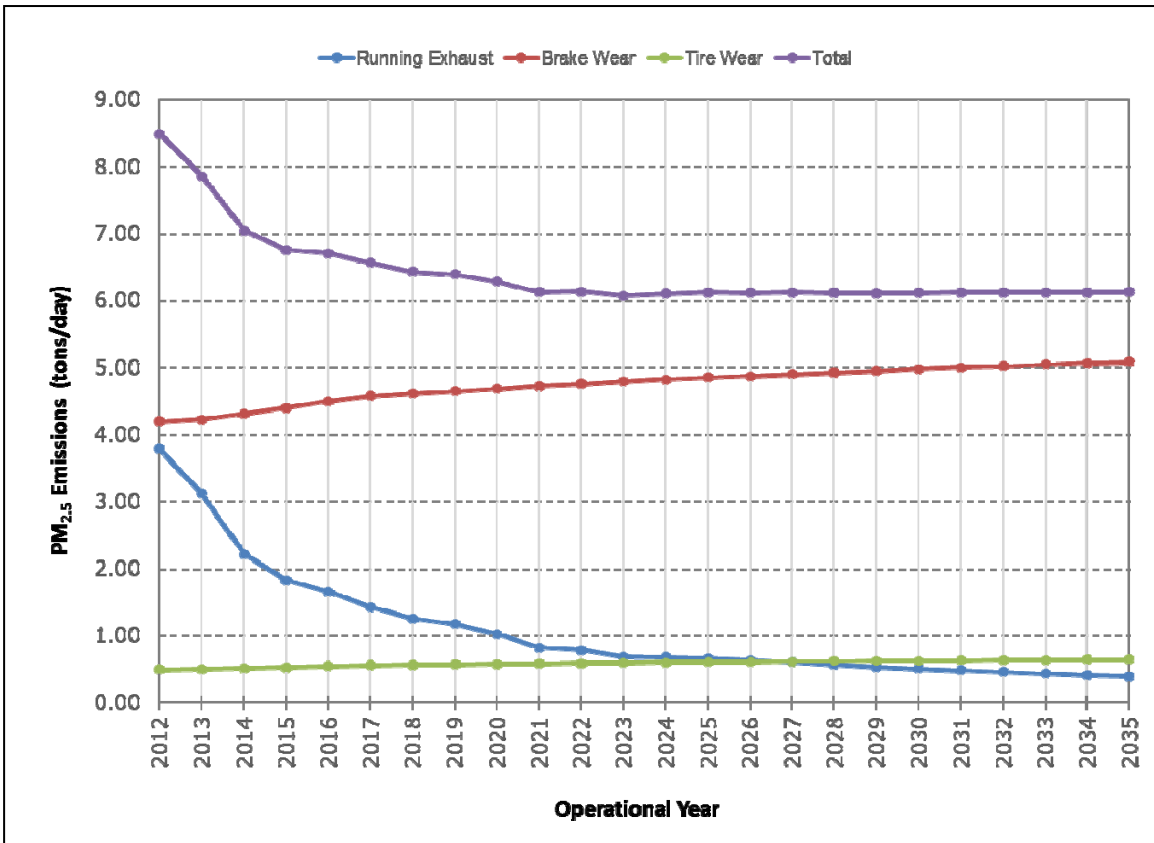


Figure 2. PM_{2.5} Emissions from Mobile Sources in Los Angeles County (EMFAC2014)

Entrained road dust is a direct function of VMT, which increases monotonically throughout the time period, as discussed above.

I-710 VMT and trends: The traffic analysis for the I-710 Corridor Project follows similar trends to the 2016 AQMP and TEU projections for the SCAB, with greater increases in truck VMT due to the proximity to the ports and related goods movement operations. Table 1 shows that for the Preferred Alternative (Alternative 5C) compared to the 2012 Baseline, VMT on the I-710 Freeway is expected to increase by 10% for drive alone and shared ride vehicles, 61% for heavy-duty truck (LHDT, MHDT, and HHDT) vehicles, and by 70% for port trucks (based on post-processed traffic model results used in the AQ/HRA analyses).

Scenario	Drive Alone/ Shared Ride	LHDT	MHDT	HHDT	Port Truck	Total
2012 Baseline	2,936,462	49,796	38,349	165,241	282,511	3,472,360
2035 Alternative 5C	3,230,547	64,878	47,910	295,790	480,860	4,119,985
% Change from 2012 Baseline	10%	30%	25%	79%	70%	19%

Based on the data provided in the 2016 AQMP and the expected activity at the ports, VMT in interim years between 2012 and 2035 will not be greater than the projected VMT in 2035. Hence emission estimates of entrained road dust, tire wear, and brake wear (which are directly proportional to VMT) for the I-710 Freeway will be higher in 2035 as compared to any of the interim years between 2012 and 2035.

It is also important to note that entrained road dust, tire wear, and brake wear account for a majority of the total particulate matter emissions from the I-710 Freeway (Figure 3).

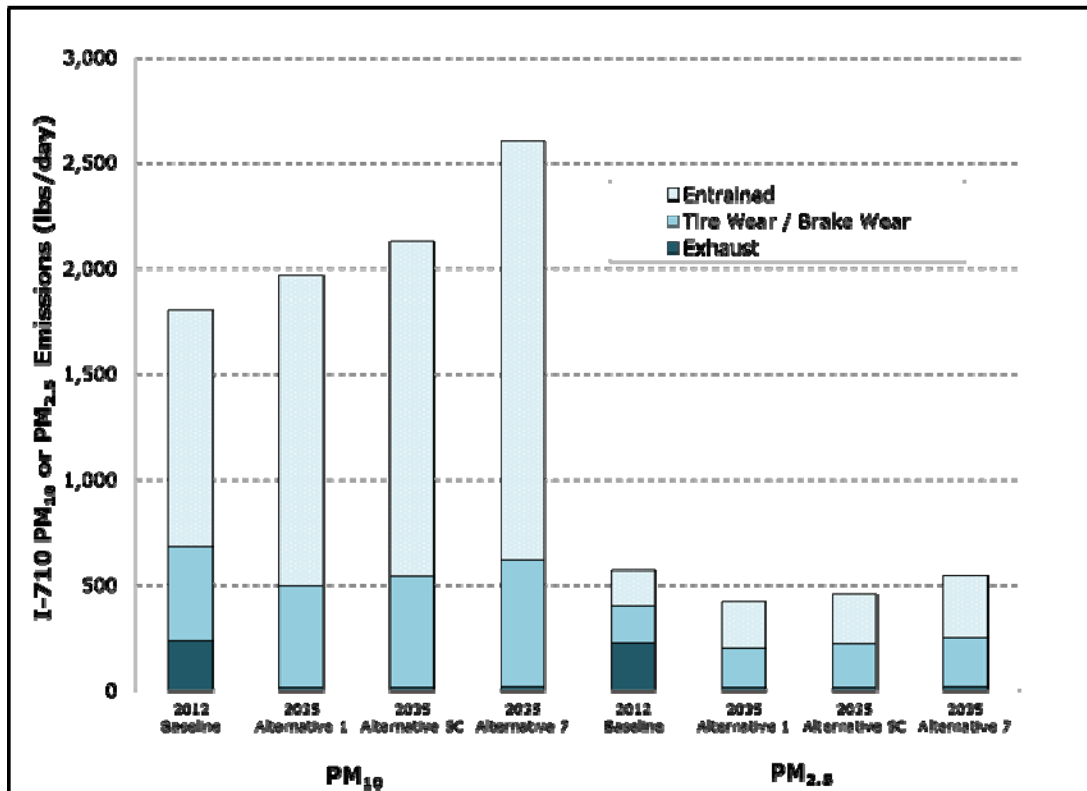


Figure 3. Particulate Matter Contributions

As demonstrated above, exhaust-only emissions are a small fraction of non-entrained PM and are essentially the same from 2022 on (see Figure 2 above). Thus, the distribution of emissions from 2022 on will generally be consistent with that seen in 2035 (Figure 3). Total PM₁₀ and PM_{2.5} emissions will be driven by entrained road dust and brake/tire emissions, which will increase monotonically as VMT monotonically increases during that 2022-2035 time period. Therefore, the trends for total PM emissions (includes exhaust emissions) will follow the same trends as that for entrained road dust, tire wear and brake wear. ***As a result, we can conclude there would be higher total PM emissions from the I-710 Freeway in 2035 than for any interim year during the major construction period between 2022 and 2035.***

EXPECTED TRENDS IN BACKGROUND CONCENTRATIONS

The 2016 AQMP demonstrates that annual average PM_{2.5} is the controlling PM standard (the area is in attainment of the PM₁₀ standard and expected to attain the 24-hour average PM_{2.5} standard in 2019). From Chapter 5 of the 2016 AQMP:

The Basin was designated a “moderate” nonattainment area for the 2012 annual PM_{2.5} standard of 12 µg/m³ on April 15, 2015. This designation sets an attainment deadline of December 31, 2021. Despite the recent drought, the Basin shows continued improvement in annual PM_{2.5} design values. The base year annual PM_{2.5} design values at Mira Loma are lower than the previous 1997 standard of 15 µg/m³, but do not yet meet the new 2012 standard of 12 µg/m³ (Figure 5-11), indicating that additional reductions may be needed to meet the more stringent standard. Acknowledging the challenges in meeting the standard, including the feasibility of proposed measures, uncertainties in drought conditions, and the potential inability to credit all ozone strategy reductions towards PM_{2.5} attainment if approved under CAA Section 182(e)(5), SCAQMD will request a voluntary bump-up to the “serious” classification, with a new attainment date of 2025.

The 2012 and 2015 modeling projections below (Figures 4 and 5), show that annual average PM_{2.5} levels in the I-710 Corridor (including the ports and downtown rail yard area) decrease slightly from 2012 to the attainment year of 2025.

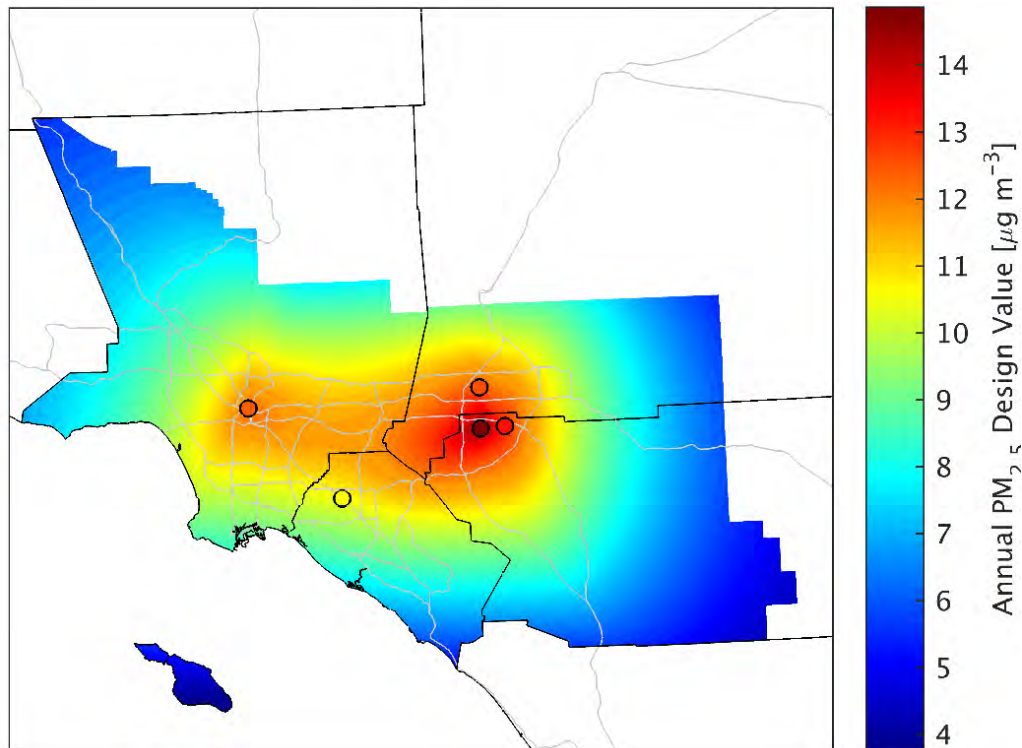


Figure 4. 5-Year Weighted Annual PM_{2.5} Design Values (µg/m³) for 2012 (2016 AQMP, Figure 5-13)

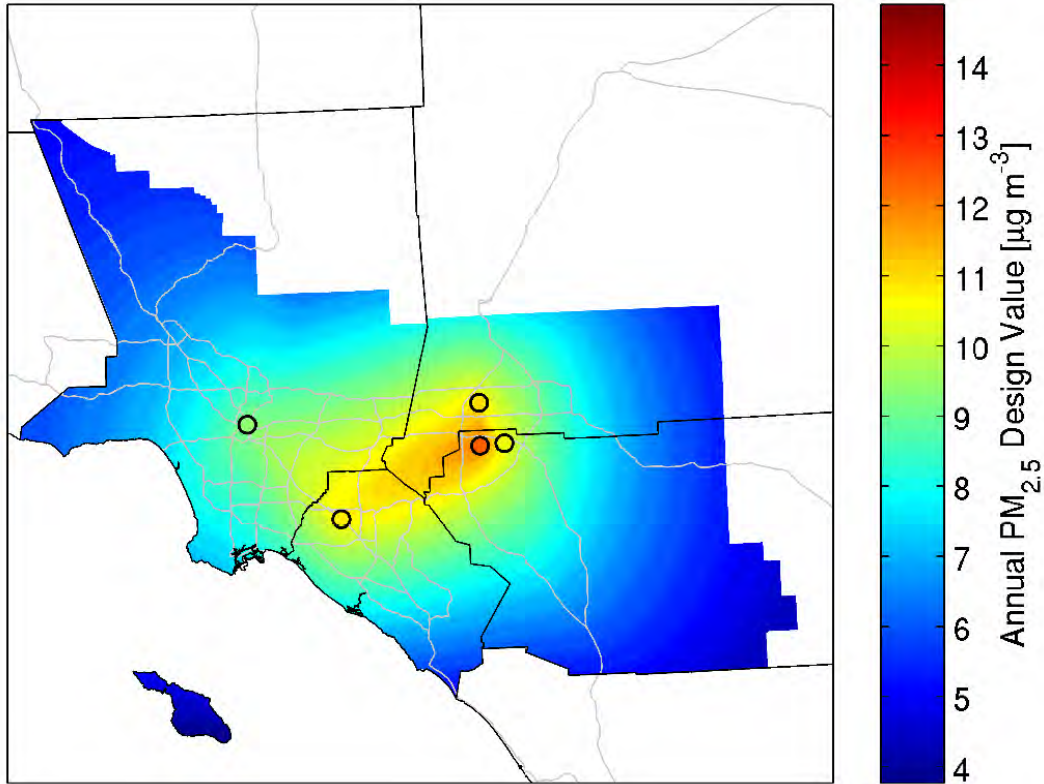


Figure 5. Annual PM_{2.5} Concentrations (µg/m³) with 2025 Baseline Emissions (2016 AQMP, Figure 5-15)

The region would be required to stay in attainment after 2025, but we note that no post-2025 primary PM control measures are currently in the AQMP and future PM maintenance plans will likely depend on NO_x-reduction strategies needed for ozone attainment (reducing inland ammonium nitrate and sulfate concentrations). On-road mobile sources are expected to increase monotonically from 2023 through 2035, as described above, and the growth in cargo to the ports and related goods movement activities is incorporated in the 2016 AQMP emission projections (including off-road ship and train emissions). Primary PM emissions are essentially flat from 2023 through 2031 (see Figure 6 – entrained road dust is considered an area source).

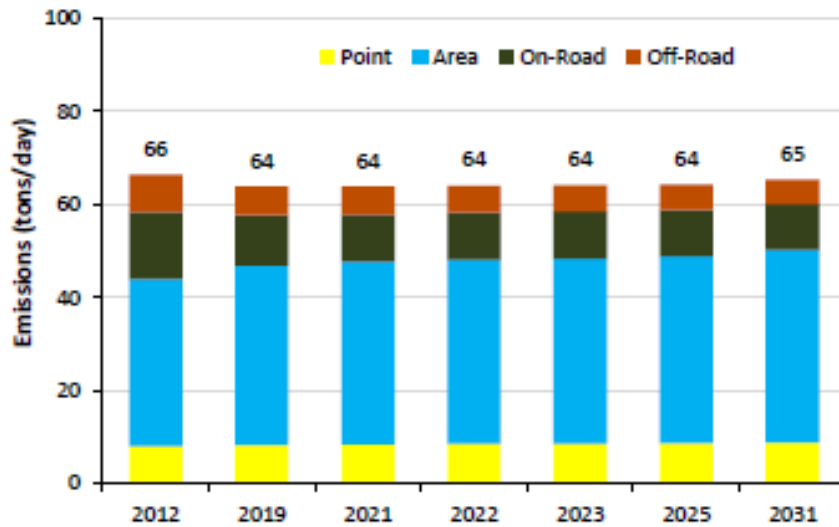


Figure 6. PM_{2.5} Emission Trend by Source Category – Average Annual Day (2016 AQMP, Figure III-2-18)

Thus, we would expect background PM concentrations in central Los Angeles County through the major construction period (2022/24 through 2035) to be generally consistent with the 2016 AQMP's future projections (2019/2025), as overall primary PM emissions will be constant during that time-period and coastal area NO_x reductions would affect Inland Empire, rather than local, aerosol PM levels.

APPENDIX C
I-710 CORRIDOR PROJECT:
EMISSION CALCULATION DETAILS

CONTENTS

1.	DIRECTLY EMITTED PM EMISSION FACTORS FOR MOTOR VEHICLES	1
1.1	EMFAC2014 Run for Vehicle Miles Traveled and Population Data	3
1.1.1	EMFAC2014 Run for Natural Gas Vehicle VMT and Population Data	3
1.2	EMFAC2014 Run for Emission Rates	4
1.3	Estimating On-Road Emission Factors	4
2.	PM EMISSION ESTIMATIONS FOR RE-ENTRAINED ROAD DUST	6

TABLES

Table 1:	Vehicle Classes
Table 2:	Silt Loading Values
Table 3:	Average Vehicle Weight

ACRONYMS AND ABBREVIATIONS

µg/m ³ :	micrograms per cubic meter
AOI:	Area of Interest
AQMP:	Air Quality Management Plan
BNSF:	Burlington Northern Santa Fe Railway Company
CAIRP	California International Registration Plan Truck
CARB:	California Air Resources Board
CFR:	code of federal regulations
CSI:	Cambridge Systematics Incorporated
DA	Drive alone
DA_SR	Drive alone and shared ride vehicles
EIR:	Environmental Impact Report
EIS:	Environmental Impact Statement
EMFAC:	EMission FACtors model
FCAA:	Federal Clean Air Act
FRATIS:	freight advanced traveler information systems
FTIP:	Federal Transportation Improvement Program
g/mi	gram per mile
g/m ²	gram per square meter
GP:	general purpose
HDT:	heavy-duty trucks
HOV	High-occupancy vehicle
I-105:	Interstate-105
I-405:	Interstate-405
I-5:	Interstate-5
I-710:	Interstate-710
ITS:	Intelligent Transportation Systems
LADWP:	Los Angeles Department of Water and Power
LAJ:	Los Angeles Junction
MHDT	medium heavy-duty trucks

ACRONYMS AND ABBREVIATIONS *(CONTINUED)*

NAAQS:	National Ambient Air Quality Standards
NNOOS:	Non-Neighboring Out-of-state
NONHOV:	Non-high-occupancy vehicle
NOOS:	Neighboring Out-of-state
NZE:	near zero emission
OBUS	Other buses
PCH:	Pacific Coast Highway
PM:	particulate matter
PM ₁₀ :	particulate matter less than 10 microns in diameter
PM _{2.5} :	particulate matter less than 2.5 microns in diameter
POLA:	Port of Los Angeles
POLB:	Port of Long Beach
RDEIR:	Recirculated Draft Environmental Impact Report
RTP:	Regional Transportation Plan
RTP/SCS:	Regional Transportation Plan/Sustainable Communities Strategy
SBUS:	School buses
SCAB:	South Coast Air Basin
SCAG:	Southern California Association of Governments
SCAQMD:	South Coast Air Quality Management District
SCE:	Southern California Edison
SDEIS:	Supplemental Draft Environmental Impact Statement
SIP:	state implementation plan
SR-60:	State Route 60
SR-91:	State Route-91
SWCV	Solid waste collection vehicle
TCWG:	Transportation Conformity Working Group
TDM:	Transportation Demand Management
TSM:	Transportation Systems Management
UBUS	Urban buses
UP:	Union Pacific
USEPA:	United States Environmental Protection Agency

ACRONYMS AND ABBREVIATIONS *(CONTINUED)*

VMT:	vehicle miles traveled
WBAN:	Weather Bureau Army Navy
ZE:	zero emission

1. DIRECTLY EMITTED PM EMISSION FACTORS FOR MOTOR VEHICLES

Directly emitted PM₁₀ and PM_{2.5} emissions from the freeway traffic at the selected hot-spot location will be estimated using traffic activity data and on-road emission factors. PM₁₀ and PM_{2.5} emission factors for on-road vehicles in analysis year (2035) will be estimated using EMFAC2014, the latest USEPA-approved emissions model for use in California, as recommended in the 2015 USEPA Guidance.^{1, 2} The following types of emission factors will be estimated for the direct PM₁₀ and PM_{2.5} vehicular emissions in the PM hot-spot analyses:

- Running Exhaust (grams per mile [g/mi]): On-road vehicles are typically fueled by gasoline, diesel, or natural gas. PM₁₀ and PM_{2.5} emissions generated by the combustion of these fuels during the vehicle movement are released from the vehicle's tail pipe and referred to as running exhaust emissions.
- Tire Wear (g/mi) and Brake Wear (g/mi): On-road vehicles generate PM₁₀ and PM_{2.5} emissions due to the operational wear of tires and brakes.

Ramboll will use CARB's EMFAC2014 model to generate the annual average emission factors for running exhaust, tire wear, and brake wear from on-road vehicles operating Los Angeles (LA) County. EMFAC (short for EMISSION FACTOR) is a computer model developed by CARB and can be used for estimating emission rates for on-road mobile sources operating in California in calendar years 2000 to 2050. EMFAC2014 was released on December 30, 2014 and subsequently approved in December 2015 by USEPA for use in the conformity determinations. CARB recently released an updated version of the model called EMFAC2017 on December 22, 2017. This version has not yet been approved by USEPA for use in conformity analysis. Hence, Ramboll will use EMFAC2014.

EMFAC2014 classifies on-road vehicles into 39 different vehicle classes, whereas the traffic model used to estimate the vehicle activity for this project classifies on-road vehicles into 15 different vehicle classes. In order to develop emission inventories, Ramboll mapped the EMFAC2014 vehicle classes to the I-710 Traffic Model³ vehicle classes and developed project-specific consolidated vehicle classes as shown in Table 1.

¹ CARB. Mobile Source Emission Inventory – Categories - On-Road Motor Vehicles - EMFAC2014. Available at: <http://www.arb.ca.gov/msei/categories.htm>. Accessed: June 2018.

² See Section 3.3.6 of Transportation Conformity Guidance for Quantitative Hot-spot Analyses in PM_{2.5} and PM₁₀ Nonattainment and Maintenance Areas. See also 40 CFR 93.111. EMFAC2014 is the most recent EPA-approved mobile source emission factor model for use in California; see 80 Federal Register 239 (December 14, 2015, pp. 77337 – 77340).

³ Cambridge Systematics Incorporated (CSI), a member of the I-710 Project team, has run a more detailed version of the SCAG Regional Transportation Plan Travel Demand Model for the I-710 Study Area (hereafter referred to as the "I-710 Traffic Model") to estimate the traffic activity data for No Build, and preferred build alternative in the analysis year (2035).

Table 1. Vehicle Classes		
Consolidated Vehicle Classes used in this Analyses	I-710 Traffic Model Vehicle Class	EMFAC Vehicle Class¹
Drive Alone and Shared Ride Vehicles (DA_SR)	DA SR2 HOV SR2 NONHOV SR3 HOV SR3 NONHOV Port Autos	LDA LDT1 LDT2 MDV MCY MH SBUS UBUS OBUS All Other Buses Motor Coach
Light-Heavy-Duty Trucks (LHDT)	Light Trucks	LHD1 LHD2
Medium-Heavy-Duty Trucks (MHDT)	Medium Trucks	T6 Ag T6 TS T6 Public T6 Utility T6 CAIRP Heavy T6 CAIRP Small T6 Instate Construction Heavy T6 Instate Construction Small T6 Instate Heavy T6 Instate Small T6 OOS Heavy T6 OOS Small
Heavy-Heavy-Duty Trucks (HHDT)	Heavy Trucks Port Trans load Intermodal Domestic	T7 Ag T7 IS T7 Public T7 Utility T7 CAIRP T7 CAIRP construction T7 NNOOS T7 NOOS T7 Single T7 Single Construction T7 SWCV T7 Tractor T7 Tractor Construction
Port Trucks	Port Bobtail Port Chassis Port Container Port Non Container	T7 POLA
Notes: ¹ EMFAC2014 provides two class options: EMFAC2007 and EMFAC2011, these vehicle classes represent EMFAC2011 vehicle class option.		

Several EMFAC2014 model runs will be performed to generate the data needed to develop emission factors for these consolidated vehicle classes. The input data used for these EMFAC2014 model runs and the methodology used to generate these emissions factors are presented in the following sub-sections.

1.1 EMFAC2014 Run for Vehicle Miles Traveled and Population Data

Emission factors for the consolidated vehicle classes will be estimated using a weighted average approach using vehicle miles traveled (VMT) or vehicle population as the basis for weighting. In order to do this, VMT and population of EMFAC2014 vehicles operating in LA County will be obtained from EMFAC2014 model runs for the analysis year (2035). The following inputs will be used for these EMFAC2014 model runs.

- Run Mode: Emissions;
- Run Type: Default Activity;
- Sub-Area: Los Angeles (SC);
- Calendar Year: analysis year (2035);
- Season: Annual;
- Aggregation Level: Day;
- Vehicle Class: All EMFAC2011 Vehicle Classes;
- Model Year: Aggregated;
- Fuel: By Fuel;⁴
- Speed: Aggregated;
- Pollutants: None; and
- Activities: VMT and Population.

1.1.1 EMFAC2014 Run for Natural Gas Vehicle VMT and Population Data

EMFAC2014 model runs described above (Section 4.3.3) combine the VMT and vehicle population of natural gas vehicles with those of diesel vehicles and reports these values under the diesel subheading. Only two vehicle classes queried in these model runs, urban bus (UBUS) and heavy heavy-duty solid waste collection truck (T7 SWCV), are projected to have natural gas vehicles in their fleet and are therefore affected by this issue.

In order to determine the VMT and vehicle population split between natural gas and diesel vehicles for the UBUS and T7 SWCV vehicle classes, Ramboll will combine the EMFAC2014 assumption for natural gas fleet market penetration rates with VMT/population distribution of the UBUS and T7 SWCV vehicle classes by model year in the LA county for the analysis year (2035).

The VMT/population distribution of UBUS and T7 SWCV vehicle classes by model year LA County was obtained from EMFAC2014 model runs with the following inputs:

- Run Mode: Emissions;

⁴ Fuel types in EMFAC2014 include gasoline, diesel, natural gas, and electric. In the "Emissions" run mode EMFAC2014 groups the natural gas vehicles with diesel and reports them under the diesel sub-heading.

- Run Type: Default Activity;
- Sub-Area: Los Angeles (SC);
- Calendar Year: 2035;
- Season: Annual;
- Aggregation Level: Day;
- Vehicle Class: Two EMFAC2011 vehicle classes - UBUS and T7 SWCV;
- Model Year: By Model Year, all model years were chosen;
- Fuel: By Fuel;⁵
- Speed: Aggregated;
- Pollutants: None; and
- Activities: VMT and Population.

1.2 EMFAC2014 Run for Emission Rates

In order to obtain the running exhaust, tire wear, and brake wear emission rates (in grams per mile or grams per hours) of PM₁₀ and PM_{2.5}, for LA County in the analysis year (2035), EMFAC2014 will be run in the "Emissions Rate" mode using the following inputs:

- Run Mode: Emission Rates;
- Run Type: Project-Level Assessment (PL);
- Sub-Area: Los Angeles (SC);
- Calendar Year: 2035;
- Season: Annual;
- Vehicle Class: All EMFAC 2011 Vehicle Classes;
- Model Year: Aggregated;
- Fuel: By Fuel;⁶
- Speed: Speeds from 5 miles per hour (mph) to 70 mph;⁷
- Temperature and Relative Humidity: 63 °F and 47% (EMFAC2014 defaults for sub-area Los Angeles (SC); and
- Pollutants: PM₁₀, PM_{2.5}.

1.3 Estimating On-Road Emission Factors

Emission factors for the consolidated vehicle classes in SCAB and LA County for calendar year 2035 will be estimated by using a VMT-weighted approach for running exhaust, tire wear, and brake wear. Table 1 shows the EMFAC vehicle classes that are grouped under each consolidated vehicle class. VMT and population data used for the EMFAC vehicle classes in

⁵ Ibid.

⁶ Fuel types in EMFAC2014 include gasoline, diesel, natural gas, and electric. In the "Emission Rates" run mode EMFAC2014 outputs separate emission rates for each fuel type.

⁷ EMFAC2014 provides emission rates output at speeds that are multiples of 5 mph.

SCAB and LA County will be extracted from the EMFAC model to calculate the weighted average.

Analysis year (2035) emission factors for consolidated vehicle classes at all speeds will be used to calculate on-road emissions. The running exhaust emission factors in grams per mile at all speeds will be output in the EMFAC2014 model runs, which include speeds from 5 miles per hour (mph) to 70 mph at 5 mph increments. Tire wear and brake wear emission factors will be presented in grams per mile; they do not vary with speed.

Traffic activity data includes speeds ranging from 1 mph to 70 mph. As a result, emission factors will be estimated at all speeds in 1 mph increments. As described earlier, the EMFAC2014 output for running exhaust emission factors include speed from 5 mph to 70 mph in increments of 5 mph. Running exhaust emission factors at intermediate speeds will be estimated by interpolation. For speeds below 5 mph, the emission factor at 5 mph was used as per CARB's recommendation. The tire wear and brake wear emission factors generated by EMFAC2014 are in the units of g/mi. These do not vary with vehicle speed.

2. PM EMISSION ESTIMATIONS FOR RE-ENTRAINED ROAD DUST

Entrained road dust results from the re-suspension of loose particulate material from the surface of the road as a result of vehicle movement. According to the 2006 Final Rule, road dust emissions are to be considered for PM₁₀ hotspot analyses.⁸ For PM_{2.5}, road dust emissions are only to be considered in hot-spot analyses if the USEPA or the State air agency has made a finding that such emissions are a significant contributor to the PM_{2.5} air quality problem (40 CFR 93.102(b)(3)). The USEPA has published a guidance on the use of AP-42 for re-entrained road dust for SIP development and conformity (August 2007); therefore, re-entrained PM_{2.5} is considered in this analysis. PM₁₀ and PM_{2.5} emissions from the re-entrained road dust caused by the Project traffic at the selected hot-spot location will be estimated using CARB's methodology, which involves using the following equations in USEPA's Compilation of Air Pollutant Emission Factors (AP-42).^{9, 10}

$$\text{Maximum Daily } E_{i,j} = k \times sL^{0.91} \times W_{i,j}^{1.02}$$

.....Equation 1

$$\text{Annual Average } E_{i,j} = k \times sL^{0.91} \times W_{i,j}^{1.02} \times \left(1 - \frac{P}{4 \times N}\right)$$

.....Equation 2

Where,

- | | |
|------------------|--|
| i | Refers to a traffic link or section of a roadway in the project study area, for which emissions are estimated. |
| j | Refers to a particular time period. Traffic data will be provided for four different time periods: AM (6 AM to 9 AM), midday (9 AM to 3 PM), PM (3 PM to 7 PM), and night time (7 PM to 6 AM). Refer to Section 3 for further details on traffic data. |
| E _{i,j} | Represents the entrained road dust emission factor in lb/VMT for the i th traffic link during the j th time period. The maximum daily emission factor will be used to estimate the maximum daily mass emissions for the I-710 freeway and the 24-hour air quality impacts of the I-710 freeway. The annual average emission factor |

⁸ USEPA. 2006. Transportation Conformity Rule That Addresses Requirements for Project-level Conformity Determinations in PM_{2.5} and PM₁₀ Nonattainment and Maintenance Areas. March. Available at: <https://www.epa.gov/state-and-local-transportation/march-10-2006-transportation-conformity-rule-addresses-requirements>. Accessed: June 2018.

⁹ CARB. 2014. Miscellaneous Process Methodology 7.9 – Entrained Road Travel, Paved Road Dust. Available at: http://www.arb.ca.gov/ei/areasrc/fullpdf/full7-9_2014.pdf. Accessed: May 2015.

¹⁰ USEPA. 2011. AP-42 Compilation of Air Pollutant Emission Factors, Chapter 13.2.1 Miscellaneous Sources - Fugitive Dust Sources - Paved Roads. Available at: <http://www.epa.gov/ttn/chief/ap42/ch13/final/c13s0201.pdf>. Accessed: June 2018.

will be used to estimate the annual average air quality impacts of the I-710 freeway.

- k Represents the particle size multiplier, which is equal to 0.0022 lb/VMT for entrained PM₁₀ and 0.0022*(0.0686/0.4572) or 0.00033 lb/VMT for entrained PM_{2.5}. The particle size multiplier for entrained PM_{2.5} is estimated using the methodology described in CARB's April 2014 guidance document for estimating entrained road dust emissions from paved roads.¹¹
- sL Represents road surface silt loading value. Refer to Table 2 for further details.
- W_{ij} Average weight in tons of the vehicles traveling on the ith traffic link during the jth time period calculated using Equation 3.
- P Represents the number of wet days of precipitation with at least 0.1 inch of precipitation in the averaging period N. Based on Table 10 in CARB's April 2014 guidance document for estimating entrained road dust emissions from paved roads,¹² P for Los Angeles County is 34 days over an annual averaging period. Note: this precipitation correction term is used only for estimating the annual average air quality impacts of the I-710 freeway, which is located in Los Angeles County.
- N Represents number of days in the averaging period for precipitation. Since the averaging period is annual, N=365.

CARB provides silt loading values for California roadways in its April 2014 guidance document for estimating entrained road dust emissions from paved roads.¹³ These silt loading factors listed in Table 2 will be linked to the roadways in the I-710 Traffic Model in order to estimate the PM₁₀ and PM_{2.5} entrained road dust emission factors for this analysis. CARB revised the freeway silt loading to 0.015 g/m² in its 2016 guidance.¹⁴ The hot-spot modeling will use the April 2014 guidance value unless USEPA and the Transportation Conformity Working Group (TCWG) agree that the new 0.015 g/m² value can be used.

Table 2. Silt Loading Values		
CARB Road Type	I-710 Traffic Model Road Type	Silt Loading¹ (g/m²)
Freeway	Freeway, HOV, Expressway/Parkway, Ramps, Truck lanes	0.02
Major	Principal Arterial, Minor Arterial	0.013

¹¹ Ibid.

¹² Ibid.

¹³ Ibid.

¹⁴ CARB. 2016. Miscellaneous Process Methodology 7.9: Entrained Road Travel, Paved Road Dust. Available at: https://www.arb.ca.gov/ei/areasrc/fullpdf/full7-9_2016.pdf. Accessed: June 2018.

Table 2. Silt Loading Values		
CARB Road Type	I-710 Traffic Model Road Type	Silt Loading¹ (g/m²)
Collector	Major Collector	0.013
Local	Minor Collector	0.135
Notes: ¹ Silt loading factors for Los Angeles County based on CARB's April 2014 guidance for estimating entrained road dust emissions from paved roads.		

The average vehicle weight (Table 3) used for estimating entrained road dust emission factors will be calculated for every traffic link using a VMT-weighted average method. This method follows the procedure stated in USEPA's AP-42 methodology for calculation of entrained road dust emissions from paved roads.¹⁵

$$W_{i,j} = \frac{\sum_l W_l \times VMT_{l,i,j}}{VMT_{i,j}}$$

.....Equation 3

Where,

- i Refers to a traffic link or section of a roadway in the project study area, for which emissions are estimated.
- j Refers to a particular time period. Traffic data will be provided for four different time periods: AM (6 AM to 9 AM), midday (9 AM to 3 PM), PM (3 PM to 7 PM), and night time (7 PM to 6 AM). Refer to Section 4.3.6 for further details on traffic data.
- W_{i,j} Represents the average vehicle weight on the ith traffic link during the jth time period.
- l Refers to a particular vehicle class. Vehicle classes used in this analysis include DA_SR, LHDT, MHDT, HHDT, and port trucks (Table 1).
- W_l Represents the average vehicle weight for the lth vehicle class. The average weight for the consolidated vehicle classes shown in Table 3 were determined based on the gross vehicle weight ratings for the EMFAC vehicle classes¹⁶ and USEPA's vehicle weight classification.¹⁷

¹⁵ USEPA. 2011. AP-42 Compilation of Air Pollutant Emission Factors, Chapter 13.2.1 Miscellaneous Sources - Fugitive Dust Sources - Paved Roads.

¹⁶ CARB. 2011. EMFAC2011 Vehicle Category Descriptions. Available at: <http://www.arb.ca.gov/msei/vehicle-categories.xlsx>. Accessed: June 2018.

¹⁷ USEPA. 2017. Vehicle Weight Classification. Available at: <https://www.epa.gov/emission-standards-reference-guide/vehicle-weight-classifications-emission-standards-reference-guide>. Accessed: June 2018.

- $VMT_{i,j}$ Represents the total vehicle miles traveled by the i th vehicle class traveling on the i th traffic link during the j th time period. This is calculated as a product of the length of i th traffic link and traffic volume of the i th vehicle class traveling on the i th traffic link during the j th time period.
- $VMT_{i,j}$ Represents the total vehicle miles traveled on the i th traffic link during the j th time period. This is calculated as a sum of the vehicle miles traveled by all vehicle classes on the i th traffic link during the j th time period.

Table 3. Average Vehicle Weights	
Consolidated Vehicle Class Used in this Analyses	Average Vehicle Weight^{1,2} (tons)
Drive Alone and Shared Ride Vehicles (DA_SR)	2.13
Light-Heavy-Duty Trucks (LHDT)	5.63
Medium-Heavy-Duty Trucks (MHDT)	11.75
Heavy-Heavy-Duty Trucks (HHDT)	23.25
Port Trucks (all HHDT)	23.25
Notes:	
¹ CARB. 2011. EMFAC2011 Vehicle Category Descriptions. Available at: http://www.arb.ca.gov/msei/vehicle-categories.xlsx . Accessed: June 2018.	
² USEPA. 2015. Vehicle Weight Classification. Available at: https://www.epa.gov/emission-standards-reference-guide/vehicle-weight-classifications-emission-standards-reference-guide . Accessed: June 2018.	