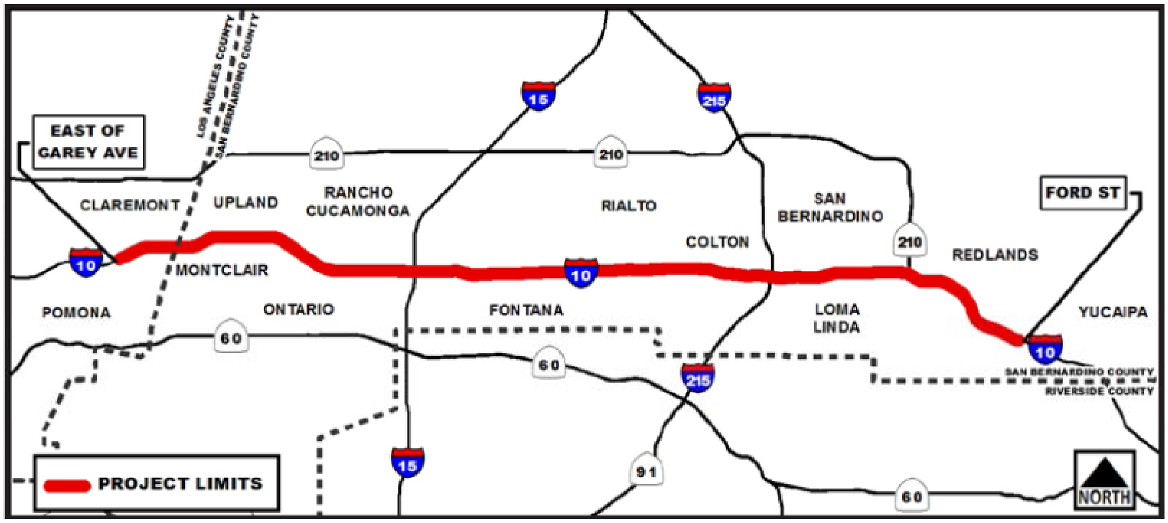
Interagency Consultation for

Interstate 10 Corridor Project

San Bernardino, CA



Prepared by

Terry A. Hayes Associates Inc.

For the
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1. Introduction

The California Department of Transportation (Caltrans), in cooperation with the San Bernardino Associated Governments (SANBAG), proposes to add freeway lanes through all or a portion of the 33-mile stretch of Interstate 10 (I-10) from the Los Angeles/San Bernardino (LA/SB) County Line to Ford Street in San Bernardino County. The project limits, including transition areas, extend from approximately 0.4 miles west of White Avenue in the City of Pomona to Live Oak Canyon Road in the City of Yucaipa. The project is currently expected to be open to traffic in year 2025 with a design year of 2045.

The proposed project has been identified as a Project of Air Quality Concern and Caltrans is preparing a hot-spot analysis related to Transportation Conformity pursuant to the United States Environmental Protection Agency (USEPA) *Transportation Conformity Guidance for Quantitative Hot-Spot Analyses in Nonattainment Areas and Maintenance Areas*. The following discussion presents the methodology for completing the hot-spot analysis.

The Protocol is organized as follows:

Chapter 2 - Project Description
Chapter 3 – Covered Geographic Area
Chapter 4 - Methodology

2. Project Description

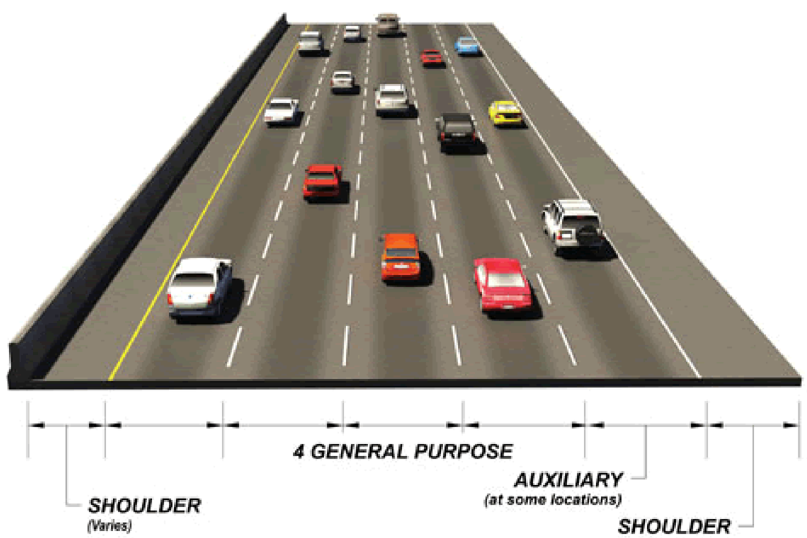
The I-10 Corridor Project considers addition of managed lanes and other freeway improvements from approximately two miles west of the Los Angeles/San Bernardino County line in the City of Pomona to Ford Street in the City of Redlands. Depending on the alternative selected, the length of the improvements will be 25 to 35 miles. The estimated construction cost is between $500 million to over $1 billion, depending on the alternative selected.

I-10 is a major east-west freeway used for intraregional, interregional and interstate travel and shipping that currently experiences heavy congestion in the east and west bound directions in the peak periods. I-10 is heavily used by travelers between Los Angeles and San Bernardino counties, and it is also a major truck route between southern California and the rest of the nation. Currently, I-10 is at capacity for many hours of the day, and that condition is expected to worsen significantly during the coming years if more capacity is not added.

Along the proposed project alignment, surrounding land use and traffic generators vary widely. The corridor includes areas of substantial residential, retail and other commercial, and industrial land uses as well as Ontario International Airport and the Union Pacific Railroad's main east-west trunk line. Substantial tracts of undeveloped land also lie along the corridor. Major warehousing, industrial, mining, and truck service and maintenance facilities are located along the corridor. These industrial land uses, the rail facilities, and the airport contribute to truck traffic on I-10.

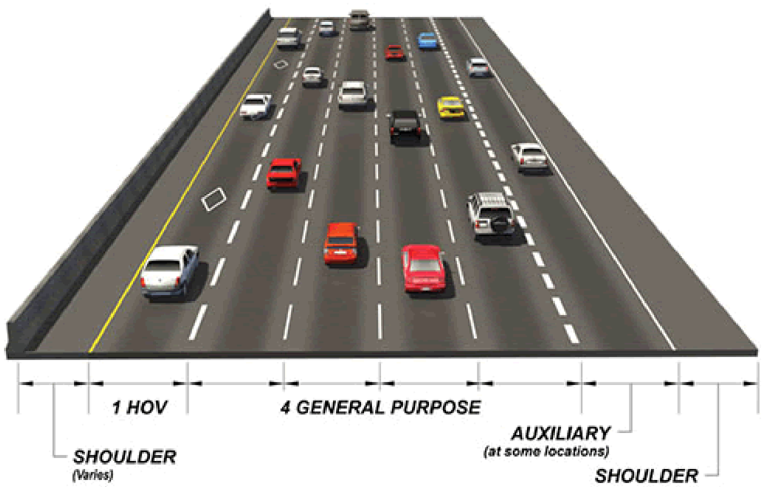
Figure 1 and **Figures 2A** through **2F** shows the project vicinity and project location maps, respectively. The I-10 Corridor Project includes one “no build” and two “build” alternatives as follows:

Alternative 1/No Build Alternative: Under the No Build Alternative, the I-10 corridor and associated bridge and ramp improvements within the I-10 project area would not be constructed. The existing lane configuration would be maintained, as shown below.

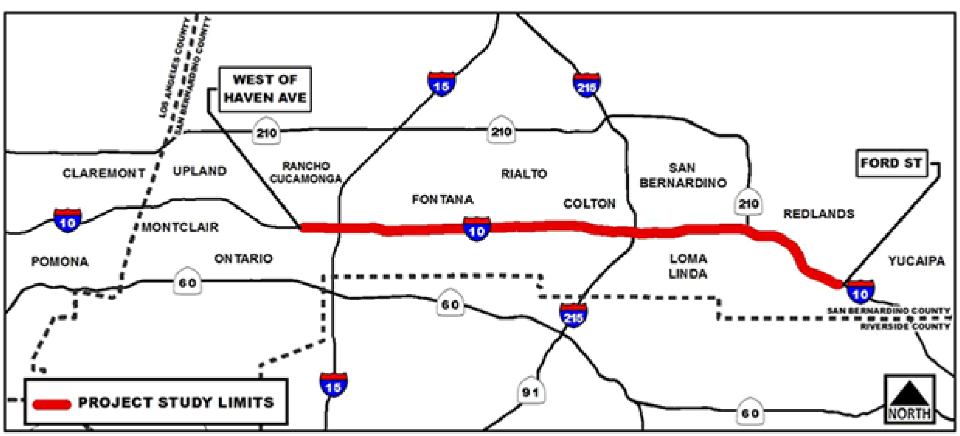


SCHEMATIC OF THE FREEWAY LANES – NO BUILD ALTERNATIVE

Alternative 2/One High Occupancy Vehicle Lane (HOV) in Each Direction: The HOV Alternative includes extending an existing HOV lane that would allow access to vehicles with multiple passengers. Improvements for this alternative would begin from where the existing HOV lanes end approximately 0.2-mile west of Haven Avenue in the City of Ontario to Ford Street in the City of Redlands, a distance of approximately 25 miles. The main features of this alternative include widening of the I-10 corridor through the addition of a HOV lane modified in each direction, auxiliary lanes, and inside and outside shoulders, as shown below. This alternative would also upgrade standards of roadway features. Within the project area, approximately 57 existing bridges and 102 ramp facilities would be modified and additional right-of-way would be required.

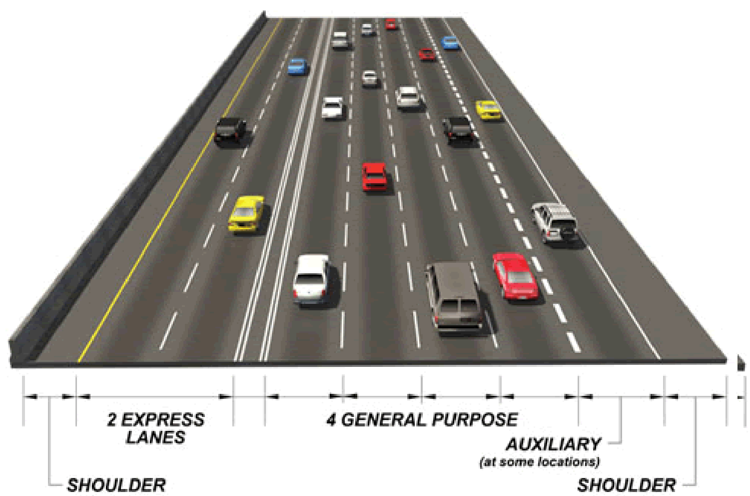


SCHEMATIC OF THE FREEWAY LANES WITH HOV LANES- ALTERNATIVE 2



HOV LANE ALTERNATIVE PROJECT LIMITS- ALTERNATIVE 2

Alternative 3/Two Express Lanes in Each Direction: The Express Lanes Alternative would add two Express Lanes, also known as high occupancy toll (HOT) lanes. Express Lanes allow vehicles carrying multiple passengers to access the lanes and other vehicles, including single passenger vehicles to access the lane by paying a toll. This alternative would begin from approximately two miles west of the San Bernardino/Los Angeles County line, in the City of Pomona and end at Ford Street in the City of Redlands, a total distance of approximately 35 miles. Restriping of the existing HOV lanes into transitional lanes for the Express Lanes would begin in Los Angeles County near Garey Avenue and continue east for approximately two miles. At the Los Angeles/San Bernardino County line, an Express lane would be added in each direction from the Los Angeles/San Bernardino County line to 0.2 miles west of Haven Avenue. The existing HOV lane and the new Express lane would be managed jointly as an Express facility with two lanes in each direction. Two Express Lanes in each direction would be added from 0.2 miles west of Haven Avenue to the I-10/SR-210 interchange. From SR-210 to Ford Street, a single express lane would be added in each direction. The Express Lanes Alternative would require modifications of approximately 81 bridge structures and 140 ramp facilities. This alternative would require additional right-of-way.



SCHEMATIC OF THE FREEWAY LANES WITH EXPRESS LANES- ALTERNATIVE 3

EXPRESS LANES ALTERNATIVE PROJECT LIMITS - ALTERNATIVE 3

The purpose of the proposed I-10 Corridor Project is to improve traffic operations on the I-10 freeway in San Bernardino County in order to reduce congestion, increase throughput and enhance trip reliability for the planning design year of 2045.

The objectives of the project are to:

- Reduce volume-to-capacity (v/c) ratios along the corridor;
- Improve travel times within the corridor;
- Provide a facility that is compatible with transit and other modal options;
- Provide consistency with the SCAG Regional Transportation Plan;
- Provide a cost effective project solution; and
- Minimize environmental impacts and right of way acquisition.

The I-10 corridor within the project limits is currently experiencing congestion and traffic delays during the peak hours due to demand exceeding capacity, resulting from local, regional, and interregional traffic demand. In addition, forecasted local and regional traffic demand is expected to increase, resulting in the need to improve the I-10 corridor.

Deficiencies of I-10 within the project limits are summarized below:

- Substantial portions of the I-10 mainline General Pupose lanes peak-period traffic demand currently exceeds capacity;

- Nearly all of the I-10 mainline GP lanes are projected to exceed capacity in the future years; and
- The I-10 existing mainline HOV lanes operation is degraded during the peak periods.

Potential traffic diversion effects of congestion relief are minor. In the design year (2045) under Alternative 3 which adds the most new capacity along I-10, daily VMT reductions on parallel freeways SR-210 and SR-60 are approximately 3% and 0%, respectively; VHT reductions are approximately 5% and 1%, respectively. VMT and VHT reductions on 644 miles of arterials in the corridor are approximately 1% and 0%, respectively.

3. Covered Geographic Area

I-10 is an eight–lane facility in the County of San Bernardino at the Los Angeles County Line and moving easterly, it traverses the cities of Montclair, Upland, Ontario, Rancho Cucamonga, Fontana, Rialto, Colton, San Bernardino and Loma Linda. I-10 transitions to six lanes in the City of Redlands, and passes through the City of Yucaipa and into the County of Riverside. I-10 continues through the City of Calimesa to Beaumont where it transitions to eight lanes and traverses the cities of Banning, Palm Springs, Cathedral City and Rancho Mirage.

The goal in designing the I-10 route is to maintain a minimum level of service (LOS) “E” during peak periods in the urbanized and urbanizing areas and LOS “C” in the rural areas. The rationale for maintaining LOS “E” and “C” is to achieve a reasonable balance between desired levels of mobility and forecasted traffic with consideration of development abutting rights of way and constrained financial transportation resources.

The growing population and relatively affordable housing market in San Bernardino Counties, along with increasing employment opportunities in the Greater Los Angeles, Orange, and San Diego counties areas, and increasing goods movement and recreational traffic have increased demand on the corridor in the last decade and are expected to continue into the future.

The proposed project under jurisdiction of the County of San Bernardino is located within the South Coast Air Basin (Basin) (**Figure 3**).. The area includes the southern two-thirds of Los Angeles County, all of Orange County, and the western urbanized portions of Riverside and San Bernardino counties. The regional climate within the Basin is considered semi-arid and is characterized by warm summers, mild winters, infrequent seasonal rainfall, moderate daytime onshore breezes, and moderate humidity.

The South Coast region generally forms a lowland coastal plain, bounded by the Pacific Ocean on the west and by mountains on the other three sides. The Basin is home to over 40 percent of the total State population, or about 16 million people, and over 10 million vehicles. Fifty thousand heavy duty diesel trucks travel nearly 10 million miles through the region annually, and well over 50,000 diesel engines are used to move goods and power construction and mining equipment.

The South Coast region experiences more days of sunlight than any other major urban area in the nation except Phoenix. However, the climate does vary, from mild near the coast to more extreme at inland locations. The coastal area benefits from the marine influence. This influence moderates temperatures, and the daily onshore/offshore circulation pattern tends to disperse pollutants, which keeps pollutant concentrations low.

Average temperatures in the coastal area vary from lows in the mid-50s to highs in the mid-70s degree Fahrenheit, with annual precipitation ranging from 12 to 15 inches. Further inland, temperatures increase and precipitation decreases. Average highs during the summertime can reach the mid- to high-90s, with maximum daily temperatures over 100 degrees Fahrenheit common in many inland areas. In contrast to the low elevation inland areas, the surrounding inland mountains reach elevations of more than 10,000 feet. These areas see temperatures below freezing in the winter and precipitation in the form of snow.

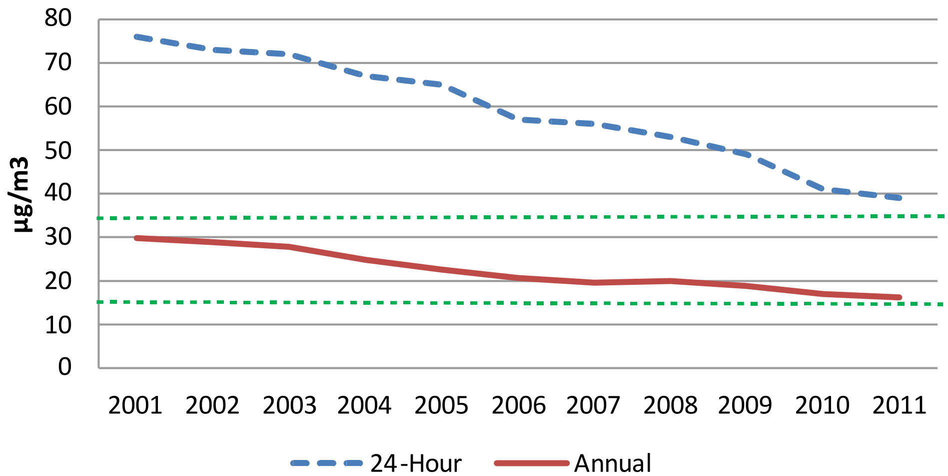
In contrast to a very steady pattern of temperature, rainfall is seasonally and annually highly variable. Almost all rain falls from November through April. Summer rainfall is normally restricted to widely scattered thundershowers near the coast with slightly heavier shower activity in the east and over the mountains. Rainfall in some areas averages less than 10 inches per year.

Wind patterns across the south coastal region are characterized by westerly and southwesterly onshore winds during the day and easterly or northeasterly breezes at night. Wind speed is somewhat greater during the dry summer months than during the rainy winter season. Between periods of wind, periods of air stagnation may occur, both in the morning and evening hours. Air stagnation is one of the critical determinants of air quality conditions on any given day. During the winter and fall months, surface high-pressure systems over the Basin, combined with other meteorological conditions, can result in very strong, downslope Santa Ana winds. These winds normally continue a few days before predominant meteorological conditions are reestablished. The mountain ranges surrounding the Basin affect the transport and diffusion of pollutants by inhibiting the eastward transport of pollutants. The entire region experiences heavy concentrations of air pollutants during prolonged periods of stable atmospheric conditions.

Temperature inversions are common in the region throughout the year. Since the inversion is often lower than the height of the surrounding mountain ranges, the region effectively becomes a bowl capped with a lid that traps emissions near the surface. When horizontal dispersion (transport flow) and vertical dispersion (rising air) are minimized, PM_{10} and $PM_{2.5}$ concentrations can build quickly, especially in the winter. These naturally occurring meteorological conditions have the net effect of spatially concentrating direct $PM_{2.5}$ and PM_{10} concentrations near their sources; promoting the formation and regional buildup of secondary species, particularly ammonium nitrate.

Complex terrain and weather patterns make the region a natural sink for the accumulation of emissions and sustained high pollution levels. Along the coastal area, better air quality prevails because of the relatively mild climate, cooler temperatures, and a pattern of onshore airflow. However, in the inland portion of the air basin, a combination of abundant sunshine, warm temperatures, and poor vertical air mixing is conducive to the formation of ozone, commonly referred to as "smog." The problem is further aggravated by the surrounding mountains that act together with the weather and air pollutant emissions.

The Basin is classified nonattainment for the federal standard for $PM_{2.5}$. As shown in the following figure, the trend in the Basin 24-hour $PM_{2.5}$ design values, determined from routinely monitored Federal Reference Monitoring (FRM), from 2001 through 2011 depicts sharp reductions in concentrations over the period. The 24-hour $PM_{2.5}$ design value for 2001 was 76 $\mu g/m^3$ while the 2008 design value (based on data from 2006, 2007 and 2008) is 53 $\mu g/m^3$. Furthermore, the most current design value computed for 2011 has been reduced to 38 $\mu g/m^3$. The annual $PM_{2.5}$ design value has demonstrated a reduction of 13.6 µg/m[3] over the 10-year period from 2001 through 2011. In each case, the trend in $PM_{2.5}$ is steadily moving in the direction of air quality improvements.



SOUTH COAST AIR BASIN 24-HOUR AVERAGE AND ANNUAL $PM_{2.5}$ DESIGN VALUES

According to the USEPA's Green Book website, the proposed project site is located in a part of the Basin that is listed as maintenance area for PM_{10}[1].

One of the general processes that significantly contributes to formation of secondary $PM_{2.5}$ is the formation of particulates from precursors such SOx. There are eleven stationary source facilities with SOx emissions greater than 100 tons per year in the South Coast.[2] All eleven facilities are located in Los Angeles County and most are related to petroleum processing and transportation. Together, these facilities represent 84% of the total stationary source component of the South Coast SOx inventory. The map in **Figure 4** shows the locations of the large SOx facilities. Seven of the facilities are located relatively close to one another, near the Port of Long Beach, south of the City of Los Angeles. The remaining four are scattered around the southern and central portions of the County and not close to the project site.

[1] The USEPA's Green Book Maintenance Areas, http://www.epa.gov/oaqps001/greenbk/pmp.html, accessed June 25, 2014.

[2] Five Factor Analysis for California Air Basin, Appendix 1, California Air Resources Board, http://www.arb.ca.gov/desig/so2a1.pdf, accessed July 9, 2014.

4. Methodology

The project-level hot-spot analysis will be completed using the *Transportation Conformity Guidance for Quantitative Hot-Spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas* and the related information presented in the three-day training course titled *Completing Quantitative PM Hot-Spot Analyses in California*. The methodology is briefly summarized below and explained in detail within this section of the Protocol.

- The Build Alternatives American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) input emission rates will be calculated using project-specific traffic data, including truck/non-truck percentages, and the emissions rates obtained from EMFAC2011-PL.
- The surface and profile meteorological data will be obtained from San Bernardino- East 4^{th} Street meteorological station.
- Adjacent volume sources will be generated for each lane using ArcGIS. As detailed below, each source will be assigned the appropriate release height, initial horizontal dispersion coefficient, and initial vertical dispersion coefficient.
- Receptors will initially be placed in a coarse grid as a screening methodology; to identify areas of exceedance. Where the coarse grid either identifies an exceedance or an area near the applicable standard, a fine grid will be used to identify each affected receptor. The interpretation of the model run outputs will be performed as described briefly below:
    - If design values for the Build Alternatives are less than or equal to the relevant NAAQS, project meets the conformity rule's hotspot requirements.
    - If design values for the Build Alternatives are greater than the NAAQS, the No-Build Alternative will be modeled using the existing alignment and the same methodology described above, although the Build Alternative traffic data will be replaced with No-Build Alternative traffic data.

4.1 Emissions Inventory

EMFAC2011 will be utilized to estimate $PM_{2.5}$ and PM_{10} emissions from exhaust, brake wear, and tire wear. Re-entrained road dust is also a significant contributor to regional $PM_{2.5}$ and PM_{10} emissions, and emissions will be estimated using the AP-42 Compilation of Air Pollutant Emission Factors.[3]

The Project Level (PL) EMFAC2011 (EMFAC-PL) uses activity data from EMFAC2011-SG module (EMFAC-LDV and EMFAC-HD modules) to calculate emission rates consistent with the default fleet distributions in the region, including running, idling, and start exhaust emissions, and PM tire and brake wear. This project does not meet the following criteria needed to complete the detailed EMFAC2011-PL approach, and the analysis will utilize the USEPA-approved simplified approach.

1) Regional temperature and/or relative humidity profiles differ from EMFAC default, or
2) Vehicle age distributions different from EMFAC defaults; or
3) Project involves vehicle start and idling emissions.

It is anticipated that two EMFAC-PL runs, one for year 2025 and one for year 2045, will be needed to obtain annual emission rates for the Build and No-Build Scenarios. Since PM emission rates do not vary with temperature and humidity in EMFAC2011-PL, it is not necessary to run multiple EMFAC2011 scenarios to capture seasonal variation in emission rates. The output will contain emission rates calculated for truck and non-truck vehicles for the speed range of 5-65 miles per hour.

The analysis will include mainline and ramp links. It is not anticipated that the proposed project would directly or significantly increase volumes on surface streets near I-10. **Table 1** and **Table 2** show percent increase in average daily traffic (ADT) volumes for the Alternatives 2 and 3 compared to Alternative 1 for four selected segments. The traffic data indicates that the proposed project would result in significant traffic increase in Truck and Non-Truck numbers for the years 2025 and 2045. For a detailed list of segments and traffic data see **Appendix A**.

[3] USEPA, AP-42, Fifth Edition, Volume I, Chapter 13: Miscellaneous Sources, Section 13.2.1, Fugitive Dust Sources, Paved Roads.

TABLE 1. ADT AND TRUCK ADT PERCENT INCREASE: ALTERNATIVE 2 COMPARED TO ALTERNATIVE 1 (NO BUILD)

Segment	2025		2045	
	Bi-Direction		Bi-Direction	
	ADT	Truck ADT	ADT	Truck ADT
LA County Line to I-15	5%	5%	3%	3%
I-15 to I-215	7%	8%	6%	5%
I-215 to SR-210	12%	12%	10%	10%
SR-210 to Ford Street	12%	11%	5%	5%

TABLE 2. ADT AND TRUCK ADT PERCENT INCREASE: ALTERNATIVE 3 COMPARED TO ALTERNATIVE 1 (NO BUILD)

Segment	2025		2045	
	Bi-Direction		Bi-Direction	
	ADT	Truck ADT	ADT	Truck ADT
LA County Line to I-15	17%	17%	18%	18%
I-15 to I-215	16%	17%	17%	16%
I-215 to SR-210	20%	20%	17%	16%
SR-210 to Ford Street	17%	16%	8%	8%

Detailed traffic is currently being prepared, including volumes, speeds, and vehicle speciation for peak and off-peak hours. The traffic data will be based on the regional travel demand forecasting model that is the basis for air quality conformity determinations. The data splits will be for four time periods:

- 3-Hour AM Peak Period (6:00 a.m. – 9:00 a.m.)
- 6-Hour High Off-Peak Period (9:00 a.m. – 3:00 p.m.)
- 4-Hour PM Peak Period (3:00 p.m. – 7:00 p.m.)
- 11-Hour Low Off-Peak Period (7:00 p.m. – 6:00 a.m.)

These data will be used to estimate emissions for highway and ramp links. Each link will represent a change in volumes and/or alignment. Link emissions will be estimated based on truck and non-truck emission rates, volumes, and speeds. Hourly truck percentage averages were calculated using the hourly truck and total traffic hourly volumes for the traffic links and are reported adjacent to the average hourly truck volume for each time period in the tables. Subsequently, four emission rates associated with each peak and off-peak period will be estimated for each link.

Traffic data has been provided for End Construction/Open to Traffic (2025) and Design Year (2045). Two factors determine the amount of the project future years emissions: fleet emission rates and traffic volumes. More efficient engines and better emission control technologies will lower vehicular exhaust emission rates while the traffic volumes will grow and increase overall emissions.

An analysis will be completed using project-specific traffic data, EMFAC-PL emission rates, and the AP-42 re-entrained road dust methodology to determine if more emissions are anticipated in 2025 or 2045. EMFAC-PL generates emission rates up to 2035. Emission rates from 2035 will be used to estimate 2045 emissions. The analysis will be based on the year with the highest emissions.

The construction phase would not last more than five years, therefore, the construction emissions will not be included in this analysis.

4.2 Dispersion Modeling

The hot-spot analysis will be completed using AERMOD version 14134, which was published on May 14, 2014. Concentrations will be determined by consecutive AERMOD runs accompanied by the FASTALL option. The analysis can be completed using the unaltered version of AERMOD available on the EPA website. However, due to the 33-mile alignment and the associated number of emission sources and receptors, Caltrans is requesting approval to use Lakes Environmental AERMOD MPI version 14134.

4.2.1 Modeling Domains

According to the Guidance, a hot-spot analysis must include the entire transportation project. For large projects such as the current I-10 project, the available modeling technology cannot allow modeling of the the entire project length of 33 miles in a single run. However, it is possible to divide the project into multiple domains, and then set up a separate run for each model. If conformity is shown in the domains, it can be concluded that conformity is met for the entire project area. This is the methodology that was followed for the modeling of the High Desert Corridor Project (Caltrans, District 7, Project ID: 1C0404, LA962212, LA0G665, and SB20061702).

The proposed I-10 corridor was thus divided into two domains of approximately 16 miles in length along with connecting facilities. A model will be set up and run independently for each domain. Approximate limits along the proposed I-10 project as established in each of the Domains are as follows:

The analysis indicated that the following segments would emit the most PM mass and therefore used as the select numerical domains:

- Domain 1: From Sierra Avenue in the City of Fontana to Monte Vista Avenue in the City of Mont Clair
- Domain 2: From Sierra Avenue in the City of Fontana to Ford Street in the City of Redlands

Figure 2A-F illustrate the extent of the modeling in Domains 1 and 2, respectively.

4.2.2 Sources

The ESRI ArcGIS geographic information system will be utilized for modeling of the sources and receptors. Volume sources will be created for each traffic link, which will be identified by a change in traffic volumes, speeds, or highway alignment. **Figure 2A-F** show the extent of the analysis. Each volume source, or lane, will have a lateral dimension of 12 feet. Volume source variables will be estimated as follows:

- Release Height = % Trucks × 3.4 + % Non-Trucks × 1.3
- Initial Lateral Dispersion Coefficient = Length of Side / 2.15
- Initial Vertical Dimension = % Trucks × 6.8 meters + % Non-Trucks × 2.6 meters
- Initial Vertical Dispersion Coefficient = Initial Vertical Dimension / 2.15

The volume sources representing the ramps will be assumed to be an additional lane that extends parallel to the highway main lanes and gradually merges with the rest of the lanes. The volume sources associated with the links will be manually hard-coded in the AERMOD input file using LOCATION and SCRPARAM in the SO section.

The urban source group will have a surface roughness of 0.338 meters in accordance with data presented in Section 4.3.

4.2.3 Receptors

Receptors will be placed in order to estimate the highest concentrations of $PM_{2.5}$ and PM_{10} to determine any possible violations of the NAAQS. A coarse screening grid with a general receptor spacing of 50 meters up to 250 meters from the right-of-way line will be used along the alignment for modeling of all the alternatives. A line of receptors will be placed at the right-of-way line for conformity analysis.

In subsequent runs, a detailed 10-meter receptor grid (fine grid) will be used to refine the analysis in areas where the Design Value exceeds NAAQS levels. In addition, a fine grid will be placed where concentrations approach the Design Value to assess instances where the highest concentrations occur between receptors in the coarse grid. In summary, each exceedance location will be identified and receptors will be precisely placed on potentially impacted land uses.

The spacing will vary slightly along the alignment as receptors will be excluded based on limitations to public access or where a member of the public would normally be present only for a very short period of time. No receptors have been placed in the volume source exclusion zone, which is defined as the Initial Lateral Dispersion Coefficient × 2.15 + 0.99. Receptors have been given a height of 1.8 meters.

4.3 Meteorological Data

California Air Resource Board (CARB) and South Coast Air Quality Management District (SCAQMD) maintain a network of air quality monitoring stations located throughout the Basin to characterize the air quality environment in the Basin by measuring and recording pollutant concentrations in the local ambient air. The Basin is divided into 38 source/receptor areas (SRAs). The proposed project corridor extends along 33 miles of I-10, which passes through SRAs 32 (Upland), 33 (Ontario), 34 (San Bernardino, Fontana), and 35 (Redlands) and along the border of SRAs 23 (Riverside, Rubidoux) and 24 (Perris). The monitoring stations near the project corridor include the following:

Pomona – 500 North Dearborn Street Station, located approximately 2.6 miles south west of the western terminus of the project corridor in SRA 10. Five years of meteorological data from this location is available for download on the SCAQMD’s website. O_3, PM_{10}, Wind Direction, Horizontal Wind Speed are monitored at this station.

Upland – 1350 San Bernardino Road Station, located approximately 1.3 miles north of project corridor in SRA 32. Five years of meteorological data from this location is available for download on the SCAQMD’s website. The station monitors Outdoor Temperature, Relative Humidity, Wind Direction, Horizontal Wind Speed, Barometric Pressure, Solar Radiation, CO, NO_2, O_3, $BAMPM_{10}$, $BAMPM_{2.5}$, TSP.

Fontana – 14360 Arrow Highway Street, located approximately 2.5 miles north of project corridor in SRA 34. Five years of meteorological data from this location is available for download on the SCAQMD’s website. The station monitors Outdoor Temperature, Relative Humidity, Wind Direction, Horizontal Wind Speed, Barometric Pressure, CO, SO_2, NO_2, O_3, PM_{10}, $PM_{2.5}$, and TSP.

San Bernardino – 24302 East 4^{th} Street Station, located approximately 2.9 miles north of project corridor in SRA 34. Five years of meteorological data from this location is available for download on the SCAQMD’s website. The station monitors Relative Humidity, Wind Direction, Horizontal Wind Speed, NO_2, O_3, PM_{10}, $TEOMPM_{10}$, $PM_{2.5}$, and TSP.

Redlands – 500 North Dearborn Street Station, located approximately 0.9 miles north east of the eastern terminus of the project corridor in SRA 34. Five years of meteorological data from this location is available for download on the SCAQMD’s website. O_3, PM_{10}, Wind Direction, Horizontal Wind Speed are monitored at this station.

Figure 5A shows an overview of the location of the air monitoring stations in relation to the location of the proposed project. It also includes overlays of the wind roses plotted for the cities of Pomona, Upland, Fontana, San Bernardino, and Redlands along the alignment.

Figures 5-B through 5-F represent the same individual wind roses. Wind in cities of Upland, Fontana, and San Bernardino blows mostly from southwest. The portion of the alignment between these cities constitutes approximately 80% of the length of the corridor. Going towards the east, in the City of Redland wind changes direction due to the contour of the lands and blows equally northwesterly/southeasterly parallel to the direction of I-10 outside of the project limits towards east. This is not similar meteorological conditions as opposed to the rest of the project area as shown in **Figure 5A**. Similarly, on the west side, prevailing wind in the City of Pomona blows easterly-northeasterly.

In accordance with the hot-spot guidance, 5 year of processed AERMOD meteorological data were obtained from the SCAQMD's website.[4] The meteorological data are compatible with the latest version of AERMOD (version 14134) and are developed using site specific surface characteristics (i.e., surface albedo, surface roughness, and Bowen ratio) obtained using AERSURFACE. **Table 3** summarizes the surface characteristics of the meteorological sites.

TABLE 3. STATUS SUMMARY OF METEOROLOGICAL DATA- PROCESSED BY SCAQMD FOR AERMOD VERSION 14134

Meteorological Station	Average Wind Speed (m/s)	% Calm Wind	% Data Availability	Years	Surface Albedo	Surface Roughness (m)	Bowen Ratio
Fontana	2.47	0.04%	98.70%	2008-12	0.19	0.240	1.0
Pomona	1.38	0.79%	98.99%	2008-12	0.18	0.470	1.0
San Bernardino	1.69	0.08%	99.22%	2007-11	0.18	0.315	1.0
Redlands	1.23	0.01%	99.01%	2008-12	0.20	0.331	1.0
Upland	1.73	0.02%	98.49%	2008-12	0.18	0.334	1.0
Source: SCAQMD, 2014.							

In this analysis, data from the San Bernardino meteorological station will be used. The representativeness of the meteorological data in any air quality modeling study depends on the proximity of the meteorological monitoring site to the project location and applicability of data to project site. As shown in the following table, San Bernardino has the smallest average wind speed of 1.67 m/s among the cities of Fontana, Upland, and San Bernardino which could lead to the highest concentrations at the receptors. Therefore, San Bernardino meteorological station is the most conservative choice. The San Bernardino meteorological station is also close at a distance of 2.9 miles.

The albedo is a dimensionless quantity which represents the average reflectivity of the surface. Typical values of albedo can range from 0.1 (10% reflection) for darkly

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[4] SCAQMD website, Meteorological Sites, http://www.aqmd.gov/home/library/air-quality-data-studies/meteorological-data/aermod-table-1, accessed July 1, 2014.

colored surfaces to 0.9 (90% reflection) for white/other bright surfaces. The Bowen ratio is a dimensionless quantity which represents the relationship of the sensible heat flux to the latent heat flux. The amount of soil moisture available for evaporation drives the value of the Bowen ratio, typically ranging from 0.3 for water surfaces to 10 or more for very dry, desert surfaces.[5] The surface roughness length is typically expressed in centimeters or meters and represents the average height of obstructions to wind flow. The values for surface roughness range from 0.001 meter for water surfaces to 1 meter or more for urban areas. As shown in **Table 3** and according to the data obtained from the SCAQMD's website, the albedo within the project site varies between 0.18 to 0.20. Also according to the SCAQMD, Bowen ratios for all the air monitoring sites are 1.0.

Based on the available surface meteorological data, Surface Roughness within the project site ranges between 0.24 and 0.47. The project site passes through areas with a mixture of residential, business, and industrial land uses. These areas also have similar Surface Roughness. Therefore, an average surface roughness of 0.338 meter will be used in this analysis.

The San Bernardino Station is 2.9 miles to the north of the project site and best represents the conditions along the alignment. This conclusion is based on the distance, prevailing winds patterns, and surface characteristics.

4.4 Monitoring Activity and Background Concentrations

4.4.1 Monitoring Activity

The Guidance requires that the background concentration be determined based on available measurements for twelve consecutive quarters. Three years of the most recent PM2.5 and PM10 measurements data were obtained through EPA's AirData website (http://www.epa.gov/airdata/) for the five air monitoring stations closest the project site. **Figure 5A** illustrates the locations of the closest monitoring stations relative to the proposed project site.

Based on a review of the monitoring stations available in the vicinity of the proposed project, the Fontana- Arrow Highway Street air monitoring station monitoring was

[5] Chapin III, F. S., Chapin, M. C., Matson, P. A., & Vitousek, P. (2011). Page 76, Principles of terrestrial ecosystem ecology. Springer.

selected as the most representative background concentrations for this Analysis. The site is approximately 2.5 miles away from the project site.

Table 4 summarizes background 24-hr and Annual $PM_{2.5}$ and 24-hr PM_{10} measurements at these locations. The background concentrations for 24-hr and Annual $PM_{2.5}$ and 24-hr PM_{10} based on the daily $PM_{2.5}$ and PM_{10} concentrations obtained from EPA website are calculated according to the Transportation Conformity Guidance for PM Hotspot Analysis. Data completeness varies between 16% and 17%, depending on the averaging period and the year used. As shown, background 98^{th} percentile 24-hr $PM_{2.5}$ concentrations for the 1^{st}, 2^{nd}, and 3^{rd} year of the $PM_{2.5}$ were calculated as 32.7, 28.2, and 27.7 μg/m^3, respectively, while the annual $PM_{2.5}$ background concentration averaged 12.2 μg/m^3. The maximum 24-hr PM_{10} is 90 μg/m^3.

TABLE 4. BACKGROUND CONCENTRATIONS

Pollutant	**Data Availability**	**Background Conc. (μg/m3)**
24-hr $PM_{2.5}$	Daily Mean 1/1/2011-12/31/2013 (3 years)	1st year: 32.7 2nd Year 2: 28.2 3rd Year 3: 27.7 (98th percentiles)
Annual $PM_{2.5}$	Daily Mean 1/1/2011-12/31/2013 (3 years)	12.2 (3-yr average)
24-hr PM_{10}	Daily Mean 1/1/2011-12/31/2013	90 (max 24-hr)
Source: USEPA Air Data website and TAHA 2014.		

The Fontana-Arrow Highway air monitoring station is described in the SCAQMD 2014 Annual Air Monitoring Network Plan as located in the central part of the Basin with mountains to the north. South-East-West air flow is virtually unobstructed. The Fontana-Arrow Highway monitoring station is operated by the SCAQMD and collection of $PM_{2.5}$ samples started in 1981. The site monitors meteorology, ozone (SLAMS), $PM_{2.5}$ (BAM FEM, SLAMS, Met One SASS, Andersen RAAS $PM_{2.5}$), PM_{10} (TEOM, SLAMS, GMW 1200 SSI), CO (FRM, SLAMS) SO_2 (FEM, SLAMS), and NO_2 (FRM, SLAMS). The $PM_{2.5}$ and PM_{10} are collected at heights of 2.4 and 2.9 meters above the ground, respectively. The purpose of this site is to measure background urban concentrations (SCAQMD, 2008).[6] SCAQMD in the same document adds that this air monitoring station is further away from the influence of the I-10.

The USEPA guidance includes multiple factors to be considered when evaluating monitoring stations. These factors are addressed below.

Is the density and mix of emission sources around the monitor location similar to those around the project site?

The Fontana air monitoring station is located in an urban setting, north of the I-10. It is an urban area with a mix of residential, commercial, and industrial land uses. This is similar to the land uses along the alignment.

How well does the monitor capture the influence of nearby sources that are not affected by the project?

The 33-mile widening would occur from Ford Street in City of Redlands to Mills Avenue in the City of Claremont at Los Angeles/San Bernardino County line. The project traverses through cities of Montclaire, Upland, Fontana, Rialto, Bloomington, San Bernardino, and Redlands. The Fontana-Arrow Highway air monitoring station is located 5 miles downwind of the Ontario downtown in the same direction of the prevailing winds represents the typical background PM concentrations in the project area.

Is the monitor probe located at a similar height as the project (e.g., is the project at grade, but the monitor is on top of a high building)?

The monitor and the project are both at-grade.

What is the purpose of the monitor and what geographic scale of representation does the monitor have?

The purpose of the monitor is measurement of the urban background concentrations for Research Support (support for air pollution research studies) and Timely/Public (provide air pollution data to the general public in a timely

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[6] Development of two mobile measurement stations for ambient air toxic monitoring in local communities, SCAQMD, 2008. http://www.epa.gov/ ttnamti1/files/2012conference/ 3BPolidoriAmbient.pdf, accessed July 1, 2014.

manner). The monitor records at the neighborhood scale, which covers an area between 0.5 and 4.0 kilometers in range. This information is consistent with the requirements in the USEPA guidance document.

In conclusion, the Fontana-Arrow Highway air monitoring station accurately characterizes PM background concentrations along the alignment. Monitoring data from this station will be used in this hot-spot analysis.

4.4.2 Background Concentrations and Design Values

The design values necessary to complete the $PM_{2.5}$ and PM_{10} analysis will be calculated using results from AERMOD runs and background concentrations according the Transportation Conformity Guidance for PM Hotspot Analysis.

Design values will be estimated in accordance with the flow chart shown in **Figure 6** for PM_{10} and $PM_{2.5}$. AERMOD will provide the $PM_{2.5}$ and PM_{10} concentrations at each receptor. For the receptor with the maximum modeled concentration, the following steps will be used to determine the design value.

Calculation of Annual $PM_{2.5}$ Design Value

The attainment/nonattainment PM2.5 designation for the new 12.0 $\mu g/m^3$ is pending. In the absence of a formal designation, this PM2.5 hot-spot analysis will based on the 15.0 $\mu g/m^3$ standard. The following steps will estimate the build alternatives annual $PM_{2.5}$ design value at the highest receptor. If the design value is less than the annual $PM_{2.5}$ NAAQS (15.0 $\mu g/m^3$), the project conforms. For each receptor, calculate the average annual concentrations using AERMOD with the air quality modeling results for each quarter and year of meteorological data used (4 quarters and 5 years of meteorological data)

- Identify the receptor with the highest modeled average concentrations;
- Calculate annual average background concentrations;
- Add results from the receptor with highest concentration with the background concentrations; and
- Round to the nearest 0.1 $\mu g/m^3$.

If the calculated design value is more than the annual $PM_{2.5}$ NAAQS, the same calculations will be done for the No-Build Alternative using the receptors identified through the modeling of the No-Build Alternative. If the build alternative is less than or equal to the No-Build Alternative, the project conforms.

Calculation of 24-hr $PM_{2.5}$ Design Value

The following steps will estimate the Build Alternatives 24-hr $PM_{2.5}$ design value at the highest receptor. In order to calculate the 24-hr $PM_{2.5}$ design value, a MySQL script developed by EPA that is able to calculate the second tier design values will be used. The script simplifies calculation of 24-hr $PM_{2.5}$ design value. The steps involved in the calculations are listed below:

- Identify the receptors with highest average 24-hr contraptions (AERMOD can produce highest average 24-hr concentrations at each receptor);
- Calculate the average 98th percentile 24-hr background from the three most recent years of air quality modeling data;
- Count 24-hr background measurements in each year;
- For each year, rank the eight highest measurements from the highest to the lowest;
- Using a table that is provided in the guidance, the 98th percentile can be extracted from data;
- Add the concentration of the receptors with highest average 24-hr to the average 98th percentile background concentration;
- Round to the nearest whole $\mu g/m^3$ (design value); and
- If design value is less than NAAQS 24-hr $PM_{2.5}$, project conforms.

If the calculated design value is more than the 24-hr $PM_{2.5}$ NAAQS, the same calculations will be done for the No-Build Alternative using the receptors identified through the modeling of the No-Build Alternative. If the build alternative is less than or equal to the No-Build Alternative, the project conforms.

Calculation of 24-hr PM_{10} design value

The following steps will estimate the Build Alternatives 24-hr PM10 design value at the highest receptor:

- For each receptor, identify the 6th highest 24-hr concentration across five years of meteorological data (AERMOD)
- Identify the 6th highest of these values

- Identify the highest 24-hr background concentration from the three most recent years of monitoring data
- Add the highest calculated concentration to the highest 24-hr background concentration
- Round to the nearest 10 $\mu g/m^3$
- Identify all receptors with Build Alternative design values > 150 $\mu g/m^3$

If the calculated design value is more than the 24-hr PM_{10} NAAQS, the same calculations will be done for the No-Build Alternative. If the build alternative design values are less than or equal to the No-Build Alternative, the project conforms.