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

STATE ROUTE 210 MIXED FLOW LANE ADDITION FROM HIGHLAND AVENUE TO SAN BERNARDINO AVENUE

CITIES OF HIGHLAND, SAN BERNARDINO, AND REDLANDS
SAN BERNARDINO COUNTY, CALIFORNIA
DISTRICT 8–SBD–210 (PM R25.0/R33.2)

EA 0C700 / PN 0812000164

RTP ID: 4M01005 / FTIP ID: 20111625

Prepared by

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in coordination with the San Bernardino Associated Governments

June 2014

Table of Contents

PAGE

Introduction 1

Project Description 2

Hot-Spot Analysis 6

APPENDIX A

EPA PM2.5 and PM10 Monitoring Values Data

EMFAC2011 Output Sheets

AP-42 Re-entrained Road Dust Calculation Worksheets

Traffic Data

Emissions Source Parameter Development Worksheets

AERMOD Output Sheets

Tables

PAGE

1 24-Hour PM10 Design Value Calculation .....

2 24-Hour PM2.5 Design Value Calculation .....

3 Annual PM2.5 Design Value Calculation .....

Figures

PAGE

1 Regional Vicinity Map 3

2 Project Location Map 4

3 Wind Rose 9

4 Monitoring Station Location 10

Acronyms and Abbreviations

µg/m^3	micrograms per cubic meter
AADT	Annual Average Daily Traffic
CAA	Clean Air Act
California CAA	California Clean Air Act
Caltrans	California Department of Transportation
CARB	California Air Resources Board
CFR	Code of Federal Regulations
DOT	U.S. Department of Transportation
EPA	U.S. Environmental Protection Agency
FHWA	Federal Highway Administration
FR	Federal Register
FTIP	Federal Transportation Improvement Program
Guidance	Transportation Conformity Guidance for Quantitative Hot-Spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas
HOV	high-occupancy vehicle
IAC	interagency consultation
LOS	Level-of-Service
NAAQS	National Ambient Air Quality Standards
$PM_{2.5}$	particulate matter less than or equal to 2.5 microns in diameter
PM_{10}	particulate matter less than or equal to 10 microns in diameter
POAQC	Project of Air Quality Concern
RTP	Regional Transportation Plan
SANBAG	San Bernardino Associated Governments
SCAB	South Coast Air Basin
SCAG	Southern California Association of Governments
SCAQMD	South Coast Air Quality Management District
SR-210	State Route 210
SR-330	State Route 330
VMT	vehicle miles travelled

Project Description and Location

The California Department of Transportation (Caltrans), in coordination with San Bernardino Associated Governments (SANBAG), proposes to widen SR-210 from Sterling Avenue to San Bernardino Avenue in the cities of Highland, San Bernardino and Redlands and the County of San Bernardino, California. The widening would occur between post miles (PM) Route (R) 26.3 and R32.4, for a distance of 6.1 miles. The total length of the proposed project limits is approximately 8.2 miles, from PM R25.0 to R33.2, which includes transition striping and signage. This segment of SR-210 currently has two mixed flow lanes in each direction with three mixed flow lanes in each direction existing to the west and four mixed flow lanes in each direction existing to the east. The reduction in lanes within this segment of the freeway restricts capacity and creates poor operating conditions. All work would occur within the existing Caltrans right-of-way. Figure 1 and Figure 2 show the regional vicinity map and the project location map, respectively.

BUILD ALTERNATIVE

The proposed Build Alternative would include the following design features and elements:

- The existing segment of SR-210 from Sterling Avenue to San Bernardino Avenue would be widened from four mixed flow lanes (two lanes in each direction) to six mixed flow lanes (three lanes in each direction) with the addition of one mixed flow lane in each direction. The third lane would be added within the existing SR-210 median. Each of the six resulting mainline lanes would be 12 feet in width. Both directions (eastbound and westbound) would have 10-foot-wide left and right shoulders.

- An auxiliary lane would be created in each direction between the Base Line and 5th Street interchanges.

- A deceleration lane would be constructed on eastbound SR-210 from Sterling Avenue undercrossing to the proposed two-lane exit at Highland Avenue. Proposed permanent striping would start from Del Rosa Avenue in the eastbound direction.

- A new acceleration lane would be added at the 5th Street eastbound on-ramp.

- The existing SR-210 median would be re-graded and generally remain unpaved.

- The following existing bridges would be widened to accommodate the new mixed flow lanes: Highland Avenue/Arden Avenue, Sand Creek, Victoria Avenue, 5th Street/ Greenspot Road, City Creek, Plunge Creek, Access Road, Santa Ana River, and Pioneer Avenue.

- The proposed project would not require the acquisition of new permanent right-of-way. Temporary Construction Easements (TCE) would likely be needed during the construction period for construction of sound walls and construction access.

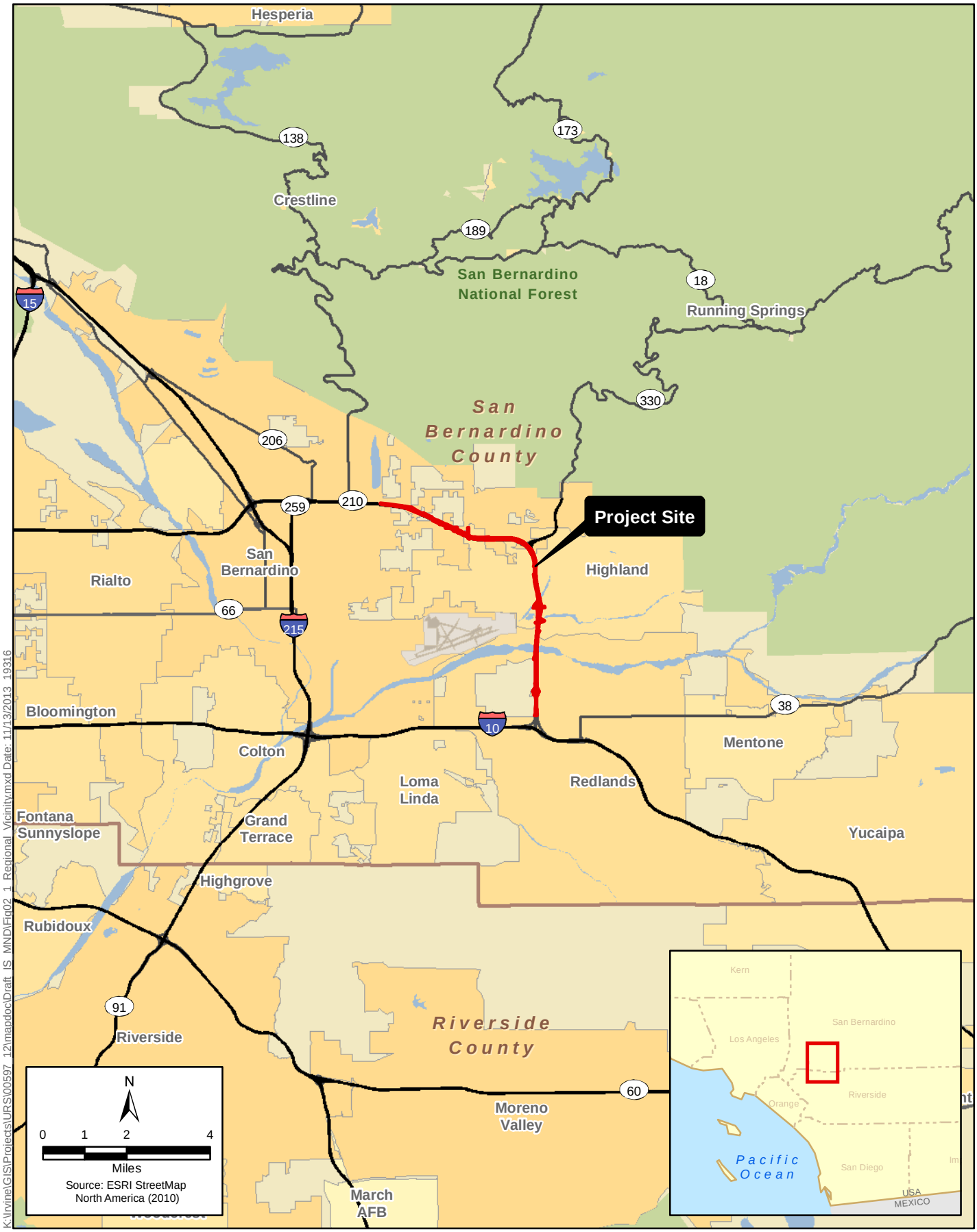

Figure 1
Regional Vicinity Map
State Route 210 Mixed Flow Lane Addition from Highland Avenue to San Bernardino Avenue

Figure 2
Project Location Map
State Route 210 Mixed Flow Lane Addition from Highland Avenue to San Bernardino Avenue

- Scour and pier protection would be installed at the drainages as needed to protect bridge foundations.

- Drainage system improvements would be constructed to carry runoff away from the traveled lanes and into traditional drainage courses.

- Stormwater treatment best management practice (BMP) features would be included at select locations where identified benefits outweigh impacts. To the fullest extent possible, roadside swales and bio-filtration strips would be used to convey both stormwater quantity flows and peak flows.

- A new fiber optic backbone system would be constructed within the existing median with branch connections linking the backbone system to existing traffic management system elements along the corridor, including wireless vehicle detection stations, ramp metering systems, and a changeable message sign.

- Ramp metering systems would be installed on the existing on-ramps at the 5th Street/Greenspot Road interchange.

- An existing weigh-in-motion system located approximately one-half mile north of San Bernardino Avenue would be reconstructed to accommodate the additional lanes on the freeway.

- Utilities would be relocated, as needed, to accommodate the widened facility. Retaining walls would be constructed as needed by changes in elevation that cannot be accommodated by regrading.

- An existing sound wall between Base Line and 5th Street in the eastbound direction will be reconstructed to accommodate the proposed auxiliary lane. Additional sound walls would be constructed where noise abatement is required and where they are considered feasible and reasonable.

The ultimate corridor for SR-210 within the project limits is an eight-lane freeway facility (six mixed flow lanes and two high occupancy vehicle lanes). Improving the facility to six mixed flow lanes would be compatible with the Route Concept Fact Sheet planning and would not preclude future improvements or make these future improvements more costly to implement.

NO-BUILD ALTERNATIVE

Under the No -Build Alternative no additional lanes would be constructed along SR-210 between Sterling Avenue and San Bernardino Avenue. This alternative, however, does not preclude the construction of future improvements. The No-Build Alternative provides a baseline for comparing impacts with the Build Alternative. It is used to compare the relative impacts and benefits of the proposed project improvements.

PM2.5 and PM10 Hot Spot Analysis

The project is located within the San Bernardino County portion of the South Coast Air Basin (SCAB or Basin), which is designated as nonattainment for the federal 24-hour PM_{10} and $PM_{2.5}$ standards. A quantitative hot-spot analysis for $PM_{2.5}$ and PM_{10} is therefore deemed necessary to satisfactorily meet project-level conformity requirements in accordance with EPA's final rule and the Guidance.

A hot-spot analysis is defined in the 40CFR93.101 as an estimation of likely future localized pollutant concentrations and a comparison of those concentrations to the relevant air quality standards. A project-level hot-spot analysis assesses the air quality impacts on a scale smaller than an entire nonattainment or maintenance area, such as a congested freeway corridor. Such an analysis is a means of demonstrating that a transportation project would meet Clean Air Act (CAA) conformity requirements to support state and local air quality goals with respect to potential localized air quality impacts.

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

According to the Guidance, a hot-spot analysis must include the entire transportation project. As such, the entire project length was modeled.

TYPES OF EMISSIONS CONSIDERED

In accordance with the Guidance, this Analysis considers the following PM_{10} and $PM_{2.5}$ emissions: (1) direct exhaist, (2) brake wear and tire wear, and (3) re-entrained road dust. Precursors of PM_{10} and $PM_{2.5}$ and secondary particles are not considered in this project-level Analysis.[1] According to the project schedules, construction duration will not exceed 5 years (2017 – 2019). As such, short-term construction-period emissions are considered temporary as defined in 40 CFR 93.123(c)(5); and are not included in this Analysis. This project will comply with the South Coast Air Quality Management District (SCAQMD) Rule 403 (Fugitive Dust). Rule 403 is intended to reduce the amount of particulate matter in the ambient air resulting from anthropogenic fugitive dust sources by requiring projects to prevent, reduce, or mitigate fugitive dust emissions. All construction activity sources of fugitive dust are required to implement the best available control measures indicated in Rule 403, provided in Appendix A. In addition, the project is required to comply with all state, federal, and/or local rules and regulations developed as a result of implementing control and mitigation measures proposed as part of the State Implimentation Plan (SIP).

[1] Precurser emissions are considered as part of the regional emission analysis prepared for the conforming RTP and FTIP

EMISSIONS AND DISPERSION MODELS USED

The Guidance requires use of the latest emissions model in hot-spot analyses. This Analysis has been prepared based on the latest EPA-approved emissions model for use in California, EMFAC2011. As recommended by the Guidance, this Analysis applied the simplified approach using the Project-Level Assessment tool, EMFAC2011-PL, to generate emission rates for traffic volumes forecasted within the San Bernardino County portion of the SCAB for years of 2020 (Opening Year) and 2040 (Horizon Year).

The Guidance recommends that hot-spot analyses be developed consistent with the EPA's current recommended model under Appendix W to 40 CFR Part 51. The American Meteorological Society/EPA Regulatory Model (AERMOD) is the EPA's recommended near-field dispersion model. The latest version of AERMOD (version 14134) was used in this Analysis, using the BEE-LINE Software BEEST version 10.13 software graphical user interface to facilitate modeling inputs.

NATIONAL AMBIENT AIR QUALITY STANDARDS

The CAA and transportation conformity regulations require that conformity be met for all transportation-related NAAQS for which an area has been designated nonattainment or maintenance. Therefore, a project-level conformity determination must address all applicable NAAQS for a given pollutant.[2]

Accordingly, results from a quantitative hot-spot analysis will need to be compared to all relevant PM_{10} and $PM_{2.5}$ NAAQS in effect. For this proposed project, this includes the following:

- PM_{10}
  - 150 micrograms per cubic meter ($\mu g/m^3$) 24-hour standard

- $PM_{2.5}$
  - 35 $\mu g/m^3$ 24-hour standard
  - 12.0 $\mu g/m^3$ annual standard

METEOROLOGY AND CLIMATE

The project site is located within the San Bernardino County portion of the SCAB, which is an approximately 6,745-square-mile area bounded by the Pacific Ocean to the west and the San Gabriel, San Bernardino, and San Jacinto Mountains to the north and east. The SCAB includes all of Orange County and the non-desert portions of Los Angeles, Riverside, and San Bernardino Counties in addition to the San Gorgonio Pass area in Riverside County. The terrain and geographical location determine the distinctive climate of the SCAB, which is a coastal plain with connecting broad valleys and low hills.

[2] See EPA's March 2006 final rule (71 FR 12468-12511).

AERMOD-ready meteorological data for San Bernardino (474.76 km E; 3,773.82 km N; 305 m elevation) for years 2007 through 2011, inclusive, was provided by the SCAQMD.[3] This data represents the most recent 5-year data set that meets the EPA's requirement for 90% completeness by quarter for wind direction, wind speed, and temperature. The meteorological data was processed with AERMET Version 14134, using upper air data data from the San Diego Miramar Naval Air Station. The threshold wind speed used was 0.5 meters per second, as recommended by EPA. A wind rose depicting the 5-year meteorological data set is provided in Figure 3.

BACKGROUND CONCENTRATION

The nearest air quality monitoring station in the vicinity of the project area is the San Bernardino-4th Street monitoring station, which is located approximately 2.5 miles south of the east-west SR-210 alignment and approcimately 4.2 miles west of the north-south SR-210 alignment (see Figure 7).

PM_{10} and $PM_{2.5}$ background concentrations were developed consistent with the methodology detailed in the Guidance using the "single monitor" approach, as the San Bernardino-4th Street monitoring station discussed above and depicted in Figure 4 meets all EPA requirements for (1) simularily of characteristics between monitor location and project area, (2) distance of monitor from project area, and (3) wind patterns between the monitor and project area.[4]

24-Hour PM_{10}

For 24-hour PM_{10}, the appropriate background concentration is simply the highest recorded 24-hour concentration from the previous 3-year period that meets all applicable EPA monitoring requirements, such as data completeness. Per the EPA Monitor Value Reports (see Appendix), which represent the best and most recent information available to EPA from state agencies, the highest 24-hour PM_{10} concentration recorded at the San Bernatdino-4th Street station during the 2011 – 2013 period was ***102 µg/m^3***.

24-Hour $PM_{2.5}$

For 24-hour $PM_{2.5}$, the Guidance provides two analysis options, or tiers, to determine the appropriate background concentration. This analysis uses the tier one approach, which is conservative, but less intensive to develop.[5] Under the tier one approach, the background concentration is developed by averaging the measured 98th percentile 24-hour concentrations from the previous 3-year period that meets all applicable EPA monitoring requirements, such as data completeness. Per the EPA Monitor Value Reports (see Appendix), which represent the best and most recent information available to EPA from state agencies, the average 98th percentile 24-hour $PM_{2.5}$ concentration recorded at the San Bernatdino-4th Street station during the 2011 – 2013 period was ***31.67 µg/m^3***.

[3] Available: http://www.aqmd.gov/home/library/air-quality-data-studies/meteorological-data/data-for-aermod
[4] See Guidance, page 119.
[5] *Ibid*, page 134.

Figure 3: San Bernardino Station Wind Rose

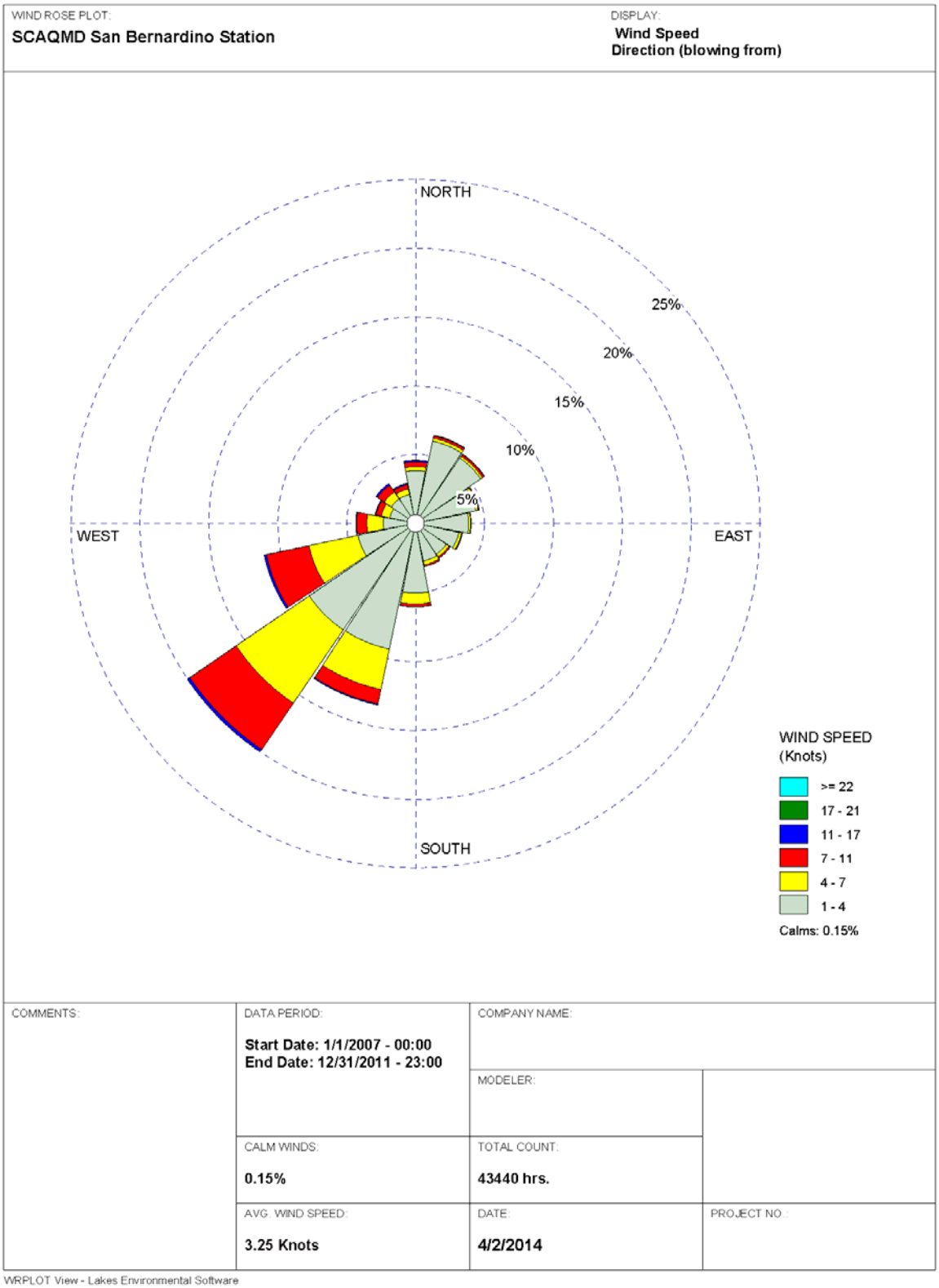

Figure 3
Monitoring Station Location
State Route 210 Mixed Flow Lane Addition from Highland Avenue to San Bernardino Avenue

Annual $PM_{2.5}$

For annual $PM_{2.5}$, the background concentration is developed by averaging the annual concentrations from the previous 3-year period that meets all applicable EPA monitoring requirements, such as data completeness. Per the EPA Monitor Value Reports (see Appendix), which represent the best and most recent information available to EPA from state agencies, the average annual $PM_{2.5}$ concentration recorded at the San Bernatdino-4th Street station during the 2011 – 2013 period was ***11.83 µg/m³***.

ANALYSIS YEARS AND TRAFFIC DATA

According to the Guidance, if Build Alternative PM_{10} and $PM_{2.5}$ concentrations are less than the applicable NAAQS, then no additional analysis is required to demonstrate project-level conformity. If Build Alternative PM_{10} and/or $PM_{2.5}$ concentrations exceed an applicable NAAQS, then Build Alternative concentrations must be compared to, and not excced, No-Build Alternative concentrations in order to demonstrate project-level conformity. Build Alternative concentrations are determined by adding applicable modeled concentrations to the applicable background concentrations.

As discussed above, background concentrations have been developed for the 24-hour PM_{10}, 24-hour $PM_{2.5}$ and annual $PM_{2.5}$ averaging periods. "Modeled" concentrations are developed using: 1) Build Alternative-specific emissions factors that take into account evaluation year, fleet mix and travel speeds; and 2) Build Alternative-specific forecast traffic volumes for years during which peak emissions from the project are expected to occur (i.e., the period with highest traffic volumes). In other words, modeled concentrations reflect the period having the most potential for NAAQS violations to occur, taking into account the cumulative impacts of project concentrations and background concentrations.

This Analysis considers the Build Alternative forcast of traffic volumes anticipated to occur during the project opening year 2020 and horizon year 2040 using the latest available planning assumptions consistent with 40 CFR 93.110 and 40 CFR 93.123 requirements. The traffic data used in this Analysis was estimated by URS Corporation (provided in Appendix) under the direction of SANBAG and in conjunction with Caltrans District 8 using a travel demand model that was consistent with the SCAG regional model at the time the analysis began.

Build Alternative forecasts for 2020 and 2040 were used to develop 24-hour distributions for each roadway link, that were then used to develop emissions rates using the EMFAC 2011 and re-entrained road dust emissions factors described above. A summary of forecast traffic data used in the Analysis is provided in the Appendix.

DATA INPUTS AND RECEPTORS

The AERMOD model uses traffic data, emission factors, meteorological data, and topographical data to estimate ground-level concentrations of PM_{10} and $PM_{2.5}$ at receptor locations. AERMOD requires specific information for each traffic link and emission factors from each link for each

hour of the day. As mentioned above, the forecast traffic data was used to develop 24-hour traffic volumes for each roadway link. The forecast traffic data was then applied to appropriate emission factors to estimate emissions rates for each of the links along the proposed alignment within the project area. Emissions for tire and brake wear as well as re-entrained road dust were calculated and coded on the links according to their forecast travel activities. A summary of emissions (in pounds/hour) for links calculated based on the emission factors and forecast travel activity data is provided in the Appendix.

Receptors were placed in order to estimate the highest concentrations of PM_{10} and $PM_{2.5}$ to determine possible violations of the NAAQS. For this proposed project, a line of receptors was placed at the right-of-way (ROW) line for conformity analysis using 10 meter spacing. A 25-meter grid was placed from the ROW fenceline to 100 meters. And finally, a 50-meter grid was placed from 100 meters from ROW (end of 25-meter receptor grid) to 250 meters. Location and spacing of receptor placement was determined according to the Guidance.

CALCULATION OF DESIGN VALUES AND DETERMINATION OF CONFORMITY

To be included once dispersion modeling is completed.