FAIR OAKS OVERHEAD BRIDGE REHABILITATION PROJECT DRAFT AIR QUALITY AND GREENHOUSE GAS EMISSIONS ASSESSMENT SUNNYVALE, CALIFORNIA

June 2, 2014

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Introduction

The City of Sunnyvale (City) proposes to rehabilitate the Fair Oaks Overhead Bridge (bridge). The bridge is located on a portion of Fair Oaks Avenue between Kifer Road and Evelyn Avenue. The bridge crosses over both Hendy Avenue and the railroad tracks owned by the Peninsula Corridor Joint Powers Board (Caltrain). The project would rehabilitate the bridge to address the identified structural deficiencies while providing for expanding bicycle and pedestrian amenities. The rehabilitated bridge would maintain its current automobile capacity (two travel lanes in each direction).

This report addresses air quality and greenhouse gas (GHG) emissions impacts associated with the proposed bridge. The project would not increase traffic capacity and, as a bridge rehabilitation project, is exempt from State Implementation Plan (SIP) project-level conformity requirements per 40 CFR 93.126. Construction of the project would temporarily emit air pollutants and GHGs, which are analyzed in this report.

Setting

The project is located in the San Francisco Bay Area Air Basin. Ambient air quality standards have been established at both the State and Federal level. The Bay Area meets all ambient air quality standards with the exception of ground-level ozone, respirable particulate matter (PM_{10}) and fine particulate matter ($PM_{2.5}$).

High ozone levels are caused by the cumulative emissions of reactive organic gases (ROG) and nitrogen oxides (NOx). These precursor pollutants react under certain meteorological conditions to form high ozone levels. Controlling the emissions of these precursor pollutants is the focus of the Bay Area's attempts to reduce ozone levels. Highest ozone levels in the Bay Area occur in the eastern and southern inland valleys that are downwind of air pollutant sources. High ozone levels aggravate respiratory and cardiovascular diseases, reduced lung function, and increase coughing and chest discomfort.

Particulate matter is another problematic air pollutant in the Bay Area. Particulate matter is assessed and measured in terms of respirable particulate matter or particles that have a diameter of 10 micrometers or less (PM_{10}) and fine particulate matter where particles have a diameter of 2.5 micrometers or less ($PM_{2.5}$). Elevated concentrations of PM_{10} and $PM_{2.5}$ are the result of both region-wide (or cumulative) emissions and localized emissions. High particulate matter levels aggravate respiratory and cardiovascular diseases, reduce lung function, increase mortality (e.g., lung cancer), and result in reduced lung function growth in children.

The ambient air quality in a given area depends on the quantities of pollutants emitted within the area, transport of pollutants to and from surrounding areas, local and regional meteorological conditions, as well as the surrounding topography of the air basin. Air quality is described by the concentration of various pollutants in the atmosphere. Units of concentration are generally expressed in parts per million (ppm) or micrograms per cubic meter ($\mu g/m^3$). Sunnyvale is located in the northern portion of the Santa Clara Valley sub-region. The northwest-southeast oriented Santa Clara Valley is bounded by the Santa Cruz Mountains to the west, the Diablo Range to the east, the San Francisco Bay to the north and the convergence of the Gabilan Range and the Diablo Range to the south. Temperatures are warm in summer, under mostly clear skies, although a relatively large diurnal range results in cool nights. Winter temperatures are mild, except for very cool but generally frostless mornings. At the northern end of the Santa Clara Valley, the San Jose Airport mean maximum temperatures range from the high 70's to the low 80's during the summer to the high 50's-low 60's during the winter, and mean minimum temperatures range from the high 50's during the summer to the low 40's during the winter. Sunnyvale's annual average rainfall is about 15 inches per year.[1] The wind patterns in the Valley are influenced greatly by the terrain, resulting in a prevailing flow roughly parallel to the Valley's northwest-southeast axis with a north-northwesterly sea breeze extending up the valley during the afternoon and early evening and a light south-southeasterly drainage flow occurring during the late evening and early morning.

The air pollution potential of the Santa Clara Valley is high. The valley has a large population and the largest complex of mobile sources in the Bay Area making it a major source of carbon monoxide, particulate and photochemical air pollution. In addition, photochemical precursors from San Francisco, San Mateo and Alameda counties can be carried along by the prevailing winds to the Santa Clara Valley making it also a major ozone receptor.

National and State Ambient Air Quality Standards

The ambient air quality in a given area depends on the quantities of pollutants emitted within the area, transport of pollutants to and from surrounding areas, local and regional meteorological conditions, as well as the surrounding topography of the air basin. Air quality is described by the concentration of various pollutants in the atmosphere. Units of concentration are generally expressed in parts per million (ppm) or micrograms per cubic meter *(*$\mu g/m^3$).

As required by the Federal Clean Air Act, National Ambient Air Quality Standards (NAAQS) have been established for six major air pollutants: carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), particulate matter, including respirable particulate matter (PM_{10}) and fine particulate matter ($PM_{2.5}$), sulfur oxides, and lead. Pursuant to the California Clean Air Act, the State of California has established the California Ambient Air Quality Standards (CAAQS). Relevant State and Federal standards are summarized in Table 1. The "primary" standards have been established to protect the public health. The "secondary" standards are intended to protect the nation's welfare and account for air pollutant effects on soil, water, visibility, materials, vegetation and other aspects of the general welfare. CAAQS are generally the same or more stringent than NAAQS.

[1] Western Region Climate Center (WRCC), 2014. Available online: http://www.wrcc.dri.edu. Accessed: May 30, 2014.

Attainment status

Areas with air quality that exceed adopted air quality standards are designated as "nonattainment" areas for the relevant air pollutants. Nonattainment areas are sometimes further classified by degree (marginal, moderate, serious, severe, and extreme for ozone, and moderate and serious for carbon monoxide and PM_{10}) or status ("nonattainment-transitional"). Areas that comply with air quality standards are designated as "attainment" areas for the relevant air pollutants. "Unclassified" areas are those with insufficient air quality monitoring data to support a designation of attainment or nonattainment, but are generally presumed to comply with the ambient air quality standard. State Implementation Plans must be prepared by States for areas designated as federal nonattainment areas to demonstrate how the area will come into attainment of the exceeded federal ambient air quality standard.

The Bay Area as a whole is considered by U.S. EPA as nonattainment for the 8-hour ozone and 24-hour $PM_{2.5}$ NAAQS. The area is nonattainment or unclassified for all other pollutants under the NAAQS, including carbon monoxide and PM_{10}. At the State level, the region is designated as nonattainment for ozone, PM_{10} and $PM_{2.5}$. The region is attainment for all other pollutants regulated under the CAAQS.

Sensitive Receptors and Toxic Air Contaminants

There are groups of people more affected by air pollution than others. CARB has identified the following persons who are most likely to be affected by air pollution: children under 14, the elderly over 65, athletes, and people with cardiovascular and chronic respiratory diseases. These groups are classified as sensitive receptors. Locations that may contain a high concentration of these sensitive population groups include residential areas, hospitals, daycare facilities, elder care facilities, elementary schools, and parks. The closest sensitive receptors are existing residences located north of the bridge, adjacent to Kifer Road and east of Fair Oaks Avenue. There are also residences adjacent to both sides of the bridge just south of Caltrain tracks in the Heritage Park apartment community.

Toxic air contaminants (TAC) are a broad class of compounds known to cause morbidity or mortality (usually because they cause cancer) and include, but are not limited to, the criteria air pollutants listed above. TACs are found in ambient air, especially in urban areas, and are caused by industry, agriculture, fuel combustion, and commercial operations (e.g., dry cleaners). TACs are typically found in low concentrations, even near their source (e.g., diesel particulate matter near a freeway). Because chronic exposure can result in adverse health effects, TACs are regulated at the regional, state, and Federal level.

Diesel exhaust is the predominant TAC in urban air and is estimated to represent about three-quarters of the cancer risk from TACs (based on the Bay Area average). According to the California Air Resources Board (CARB), diesel exhaust is a complex mixture of gases, vapors and fine particles. This complexity makes the evaluation of health effects of diesel exhaust a complex scientific issue. Some of the chemicals in diesel exhaust, such as benzene and formaldehyde, have been previously identified as TACs by the CARB, and are listed as carcinogens either under the state's Proposition 65 or under the Federal Hazardous Air Pollutants programs.

Table 1. Relevant California and National Ambient Air Quality Standards and Attainment Status

Pollutant	Averaging Time	California Standards [a]		National Standards [b]	
		Concentration	Attainment Status	Concentration	Attainment Status
Carbon Monoxide (CO)	8-Hour	9 ppm ($10 mg/m^3$)	Attainment	9 ppm ($10 mg/m^3$)	Attainment [f]
	1-Hour	20 ppm ($23 mg/m^3$)	Attainment	35 ppm ($40 mg/m^3$)	Attainment
Nitrogen Dioxide (NO_2)	Annual Mean	0.030 ppm ($57 mg/m^3$)	Attainment	0.053 ppm ($100 \mu g/m^3$)	Attainment
	1-Hour	0.18 ppm ($338 \mu g/m^3$)	Attainment	0.100 ppm [j]	Unclassified
Ozone (O_3)	8-Hour	0.07 ppm ($137 \mu g/m^3$)	Nonattainment [h]	0.075 ppm	Nonattainment [d]
	1-Hour	0.09 ppm ($180 \mu g/m^3$)	Nonattainment	Not Applicable	Not Applicable [e]
Suspended Particulate Matter (PM_{10})	Annual Mean	$20 \mu g/m^3$	Nonattainment [g]	Not Applicable	Not Applicable
	24-Hour	$50 \mu g/m^3$	Nonattainment	$150 \mu g/m^3$	Unclassified
Suspended Particulate Matter ($PM_{2.5}$)	Annual Mean	$12 \mu g/m^3$	Nonattainment[g]	$12 \mu g/m^3$	Attainment
	24-Hour	Not Applicable	Not Applicable	$35 \mu g/m^3$ See footnote [i]	Nonattainment
Sulfur Dioxide (SO_2) [k]	Annual Mean	Not Applicable	Not Applicable	$80 \mu g/m^3$ (0.03 ppm)	Attainment
	24-Hour	0.04 ppm ($105 \mu g/m^3$)	Attainment	$365 \mu g/m^3$ (0.14 ppm)	Attainment
	1-Hour	0.25 ppm ($655 \mu g/m^3$)	Attainment	0.075 ppm ($196 \mu g/m^3$)	Attainment

[a] California standards for ozone, carbon monoxide (except Lake Tahoe), sulfur dioxide (1-hour and 24-hour), nitrogen dioxide, suspended particulate matter - PM_{10}, and visibility reducing particles are values that are not to be exceeded. The standards for sulfates, Lake Tahoe carbon monoxide, lead, hydrogen sulfide, and vinyl chloride are not to be equaled or exceeded. If the standard is for a 1-hour, 8-hour or 24-hour average (i.e., all standards except for lead and the PM_{10} annual standard), then some measurements may be excluded. In particular, measurements are excluded that CARB determines would occur less than once per year on the average.

[b] National standards shown are the "primary standards" designed to protect public health. National standards other than for ozone, particulates and those based on annual averages are not to be exceeded more than once a year. The 1-hour ozone standard is attained if, during the most recent three-year period, the average number of days per year with maximum hourly

concentrations above the standard is equal to or less than one. The 8-hour ozone standard is attained when the 3-year average of the 4th highest daily concentrations is 0.075 ppm (75 ppb) or less. The 24-hour PM_{10} standard is attained when the 3-year average of the 99th percentile of monitored concentrations is less than 150 μg/m^3. The 24-hour $PM_{2.5}$ standard is attained when the 3-year average of 98^{th} percentiles is less than 35 μg/m^3.

Except for the national particulate standards, annual standards are met if the annual average falls below the standard at every site. The national annual particulate standard for PM_{10} is met if the 3-year average falls below the standard at every site. The annual $PM_{2.5}$ standard is met if the 3-year average of annual averages spatially-averaged across officially designed clusters of sites falls below the standard.

[c] National air quality standards are set by EPA at levels determined to be protective of public health with an adequate margin of safety.

[d] On September 22, 2011, the EPA announced it will implement the current 8-hour ozone standard of 75 ppb. The EPA expects to finalize initial area designations for the 2008 8-hour ozone standard by mid-2012.

[e] The national 1-hour ozone standard was revoked by EPA on June 15, 2005.

[f] In April 1998, the Bay Area was redesignated to attainment for the national 8-hour carbon monoxide standard.

[g] In June 2002, CARB established new annual standards for $PM_{2.5}$ and PM_{10}. Statewide VRP Standard (except Lake Tahoe Air Basin): Particles in sufficient amount to produce an extinction coefficient of 0.23 per kilometer when the relative humidity is less than 70 percent. This standard is intended to limit the frequency and severity of visibility impairment due to regional haze and is equivalent to a 10-mile nominal visual range.

[h] The 8-hour CA ozone standard was approved by the CARB on April 28, 2005 and became effective on May 17, 2006.

[i] EPA lowered the 24-hour $PM_{2.5}$ standard from 65 μg/m^3 to 35 μg/m^3 in 2006. EPA designated the Bay Area as nonattainment of the $PM_{2.5}$ standard on October 8, 2009. The effective date of the designation is December 14, 2009, and the Air District has three years to develop a SIP that demonstrates the Bay Area will achieve the revised standard by December 14, 2014. The SIP for the new $PM_{2.5}$ standard must be submitted to the EPA by December 14, 2012.

[j] To attain this standard, the 3-year average of the 98^{th} percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 0.100ppm (effective January 22, 2010).

[k] On June 2, 2010, the EPA established a new 1-hour SO_2 standard, effective August 23, 2010, which is based on the 3-year average of the annual 99^{th} percentile of 1-hour daily maximum concentrations. The existing 0.030 ppm annual and 0.14 ppm 24-hour SO_2 NAAQS however must continue to be used until one year following EPA initial designations of the new 1-hour SO_2 NAAQS. EPA expects to designate areas by June 2012.

Lead (Pb) is not listed in the above table because it has been in attainment since the 1980s.
ppm = parts per million
mg/m^3 = milligrams per cubic meter
μg/m^3 = micrograms per cubic meter

Source: Bay Area Air Quality Management District, 2014, EPA, 2014.

CARB has adopted and implemented a number of regulations for stationary and mobile sources to reduce emissions of DPM. Several of these regulatory programs affect medium and heavy duty diesel trucks that represent the bulk of DPM emissions from California highways. These regulations include the solid waste collection vehicle (SWCV) rule, in-use public and utility fleets, and the heavy-duty diesel truck and bus regulations. In 2008, CARB approved a new regulation to reduce emissions of DPM and nitrogen oxides from existing on-road heavy-duty diesel fueled vehicles[2]. The regulation requires affected vehicles to meet specific performance requirements between 2014 and 2023, with all affected diesel vehicles required to have 2010 model-year engines or equivalent by 2023. These requirements are phased in over the compliance period and depend on the model year of the vehicle.

The BAAQMD is the regional agency tasked with managing air quality in the region. At the State level, CARB (a part of the California Environmental Protection Agency) oversees regional air district activities and regulates air quality at the State level. The BAAQMD published CEQA

[2] Available online: http://www.arb.ca.gov/msprog/onrdiesel/onrdiesel.htm. Accessed: July 9, 2012.

Air Quality Guidelines that are used in this assessment to evaluate construction air quality impacts of the project.[3]

Greenhouse Gases

Global temperatures are affected by naturally occurring and anthropogenic (generated by humankind) atmospheric gases, such as water vapor, carbon dioxide, methane, and nitrous oxide. Gases that trap heat in the atmosphere are called greenhouse gases (GHG). Solar radiation enters the earth's atmosphere from space, and a portion of the radiation is absorbed at the surface. The earth emits this radiation back toward space as infrared radiation. Greenhouse gases, which are mostly transparent to incoming solar radiation, are effective in absorbing infrared radiation and redirecting some of this back to the earth's surface. As a result, this radiation that otherwise would have escaped back into space is now retained, resulting in a warming of the atmosphere. This is known as the greenhouse effect. The greenhouse effect helps maintain a habitable climate. Emissions of GHGs from human activities, such as electricity production, motor vehicle use and agriculture, are elevating the concentration of GHGs in the atmosphere, and are reported to have led to a trend of unnatural warming of the earth's natural climate, known as global warming or global climate change. The term "global climate change" is often used interchangeably with the term "global warming," but "global climate change" is preferred because it implies that there are other consequences to the global climate in addition to rising temperatures. Other than water vapor, the primary GHGs contributing to global climate change include the following gases:

- Carbon dioxide (CO_2), primarily a byproduct of fuel combustion;
- Nitrous oxide (N_2O), a byproduct of fuel combustion; also associated with agricultural operations such as the fertilization of crops;
- Methane (CH_4), commonly created by off-gassing from agricultural practices (e.g. livestock), wastewater treatment and landfill operations;
- Chlorofluorocarbons (CFCs) were used as refrigerants, propellants and cleaning solvents, but their production has been mostly prohibited by international treaty;
- Hydrofluorocarbons (HFCs) are now widely used as a substitute for chlorofluorocarbons in refrigeration and cooling; and
- Perfluorocarbons (PFCs) and sulfur hexafluoride (SF_6) emissions are commonly created by industries such as aluminum production and semiconductor manufacturing.

These gases vary considerably in terms of Global Warming Potential (GWP), a term developed to compare the propensity of each GHG to trap heat in the atmosphere relative to another GHG. GWP is based on several factors, including the relative effectiveness of a gas to absorb infrared radiation and the length of time of gas remains in the atmosphere. The GWP of each GHG is measured relative to CO_2. Accordingly, GHG emissions are typically measured and reported in terms of CO_2 equivalent (CO_2e). For instance, SF_6 is 22,800 times more intense in terms of global climate change contribution than CO_2.

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[3] Bay Area Air Quality Management District, 2011. *CEQA Air Quality Guidelines*. May.

Significance Thresholds

In June 2010, BAAQMD adopted thresholds of significance to assist in the review of projects under CEQA. These Thresholds were designed to establish the level at which BAAQMD believed air pollution emissions would cause significant environmental impacts under CEQA and were posted on BAAQMD's website and included in the Air District's updated CEQA Guidelines (updated May 2011).

BAAQMD's adoption of significance thresholds contained in the 2011 CEQA Air Quality Guidelines was called into question by an order issued March 5, 2012, in California Building Industry Association (CBIA) v. BAAQMD (Alameda Superior Court Case No. RGI0548693). The order requires BAAQMD to set aside its approval of the thresholds until it has conducted environmental review under CEQA. The ruling made in the case concerned the environmental impacts of adopting the thresholds and how the thresholds would indirectly affect land use development patterns. In August 2013, the Appellate Court struck down the lower court's order to set aside the thresholds. However, this litigation remains pending as the California Supreme Court recently accepted a portion of CBIA's petition to review the appellate court's decision to uphold BAAQMD's adoption of the thresholds. The specific portion of the argument to be considered is in regard to whether CEQA requires consideration of the effects of the environment on a project (as contrasted to the effects of a proposed project on the environment). Therefore, the significance thresholds contained in the 2011 CEQA Air Quality Guidelines are applied to this project. The significance thresholds identified by BAAQMD and used in this analysis are summarized in Table 2.

Table 2 Air Quality Significance Thresholds

Pollutant	Construction Thresholds	Operational Thresholds	
	Average Daily Emissions (lbs./day)	Average Daily Emissions (lbs./day)	Annual Average Emissions (tons/year)
Criteria Air Pollutants			
ROG	54	54	10
NO_x	54	54	10
PM_{10}	82	82	15
$PM_{2.5}$	54	54	10
CO	Not Applicable	9.0 ppm (8-hour avg.) or 20.0 ppm (1-hour avg.)	
Fugitive Dust	Best Management Practices	Not Applicable	
Health Risks and Hazards for New Sources			
Excess Cancer Risk	10 per one million	10 per one million	
Hazard Index	1.0	1.0	
Incremental annual	0.3 µg/m^3	0.3 µg/m^3	

average $PM_{2.5}$		
Health Risks and Hazards for Sensitive Receptors (Cumulative from all sources within 1,000 foot zone of influence) and Cumulative Thresholds for New Sources		
Excess Cancer Risk	100 per one million	
Chronic Hazard Index	10.0	
Annual Average $PM_{2.5}$	0.8 µg/m^3	
Greenhouse Gas Emissions		
GHG Annual Emissions	1,100 metric tons or 4.6 metric tons per capita	
Note: ROG = reactive organic gases, NOx = nitrogen oxides, PM_{10} = course particulate matter or particulates with an aerodynamic diameter of 10 micrometers (µm) or less, $PM_{2.5}$ = fine particulate matter or particulates with an aerodynamic diameter of 2.5µm or less; and GHG = greenhouse gas.		

Impact 1: Conflict with or obstruct implementation of the applicable air quality plan? ***No Impact***

The most recent clean air plan is the *Bay Area 2010 Clean Air Plan* that was adopted by BAAQMD in September 2010. The proposed project would not conflict with the latest Clean Air planning efforts since (1) the project would have emissions well below the BAAQMD thresholds (see Impact 2), and (2) the project has been planned as a transportation improvement project that is included in the City's Capital Improvement Plan. The project would not increase traffic capacity and, as a bridge rehabilitation project, is exempt from air quality SIP project-level conformity requirements per 40 CFR 93.126.

Impact 2: Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable Federal or State ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)? ***Less than significant***

The Bay Area is considered a non-attainment area for ground-level ozone and fine particulate matter ($PM_{2.5}$) under both the Federal Clean Air Act and the California Clean Air Act. The area is also considered non-attainment for respirable particulates or particulate matter with a diameter of less than 10 micrometers (PM_{10}) under the California Clean Air Act, but not the Federal act. The area has attained both State and Federal ambient air quality standards for carbon monoxide.

Construction Period Emissions

The California Emissions Estimator Model (CalEEMod) Version 2013.2.2 was used to predict annual emissions for construction, as recommended by BAAQMD. CalEEMod provides emission estimates for both on-site and off-site construction activities. On-site activities are primarily made up of construction equipment emissions, while off-site activity includes worker, vendor and haul truck traffic. A construction build-out scenario, including equipment list and phasing schedule was provided by the project applicant. Construction is anticipated to occur over a period of approximately 14 months (308 construction days, assuming an average of 22 workdays per month). Estimated cement truck trips, soil and demolition hauling volumes were also provided by the project applicant and input to the model. *Attachment 1* includes the CalEEMod input and output values for construction emissions, as well as the applicant construction schedule and equipment proposed for use.

Construction activities, particularly during site preparation and grading would temporarily generate fugitive dust in the form of PM_{10} and $PM_{2.5}$. Sources of fugitive dust would include disturbed soils at the construction site and trucks carrying uncovered loads of soils. Unless properly controlled, vehicles leaving the site would deposit mud on local streets, which could be an additional source of airborne dust after it dries. Fugitive dust emissions would vary from day to day, depending on the nature and magnitude of construction activity and local weather conditions. Fugitive dust emissions would also depend on soil moisture, silt content of soil, wind speed, and the amount of equipment operating. Larger dust particles would settle near the source, while fine particles would be dispersed over greater distances from the construction site. The BAAQMD CEQA Air Quality Guidelines consider these impacts to be less than significant if best management practices are employed to reduce these emissions. *Mitigation Measure 1 would implement BAAQMD-required best management practices*.

In order to compute average daily emissions, the total emissions output from CalEEMod were divided by the entire construction period (assumed 308 days). Average daily emissions are compared against BAAQMD thresholds. Table 3 provides a summary of the total annual and average daily criteria pollutant emissions from project construction activities, along with a comparison to the BAAQMD significance thresholds. As shown in Table 3, emissions of all pollutants are below the BAAQMD significance thresholds.

Table 3. Construction Period Emissions

Scenario	ROG	NOx	PM_{10} (Exhaust)	$PM_{2.5}$ (Exhaust)
2015 Annual Emissions (tons per year)	0.16	1.27	0.08	0.08
2016 Annual Emissions (tons per year)	0.09	0.76	0.04	0.04
BAAQMD Thresholds (tons per year)	*10*	*10*	*15*	*10*
Exceed Threshold?	***No***	***No***	***No***	***No***
Average Daily Emissions (pounds per day)[1]	1.6	13.2	<1.0	<1.0
BAAQMD Thresholds (pounds per day)	*54*	*54*	*82*	*54*
Exceed Threshold?	***No***	***No***	***No***	***No***

Note: [1]Based on 308 construction workdays.

<u>Operational Period Emissions</u>

The proposed project would not generate new vehicular trips or increase roadway capacity. As a result, operational air pollutant emissions would not result in a significant impact. As stated above, the project is exempt from SIP project-level conformity requirements per 40 CFR 93.126. The project does not qualify as a project of air quality concern (POAQC) under EPA guidelines for particulate matter.

Mitigation Measure AQ-1: Include measures to control dust and exhaust during construction.

During demolition or any construction ground disturbance, implement measures to control dust and exhaust. Implementation of the measures recommended by BAAQMD and listed below would reduce the air quality impacts associated with grading and new construction to a less than significant. The contractor shall implement the following Best Management Practices that are required of all projects:

1. All exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) shall be watered two times per day.

2. All haul trucks transporting soil, sand, or other loose material off-site shall be covered.

3. All visible mud or dirt track-out onto adjacent public roads shall be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweeping is prohibited.

4. All vehicle speeds on unpaved roads shall be limited to 15 mph.

5. All roadways, driveways, and sidewalks to be paved shall be completed as soon as possible. Building pads shall be laid as soon as possible after grading unless seeding or soil binders are used.

6. Idling times shall be minimized either by shutting equipment off when not in use or reducing the maximum idling time to 5 minutes (as required by the California airborne toxics control measure Title 13, Section 2485 of California Code of Regulations [CCR]). Clear signage shall be provided for construction workers at all access points.

7. All construction equipment shall be maintained and properly tuned in accordance with manufacturer’s specifications. All equipment shall be checked by a certified mechanic and determined to be running in proper condition prior to operation.

8. Post a publicly visible sign with the telephone number and person to contact at the Lead Agency regarding dust complaints. This person shall respond and take corrective action within 48 hours. The Air District’s phone number shall also be visible to ensure compliance with applicable regulations.

Impact 3: Violate any air quality standard or contribute substantially to an existing or projected air quality violation? *Less than significant*

As discussed under Impact 2, the project would have emissions that would be below significance thresholds adopted by BAAQMD for evaluating impacts to ozone and particulate matter. Therefore, the project would not contribute substantially to existing or projected violations of those standards. Carbon monoxide emissions from traffic generated by projects are the pollutant of greatest concern at the local level. Congested intersections with a large volume of traffic have the greatest potential to cause high-localized concentrations of carbon monoxide. Air pollutant monitoring data indicate that carbon monoxide levels have been at healthy levels (i.e., below State and Federal standards) in the Bay Area since the early 1990s. As a result, the region has been designated as attainment for the standard. There is an ambient air quality monitoring station in San José that measures carbon monoxide concentrations. The highest measured level over any 8-hour averaging period during the last 3 years is less than 2 parts per million (ppm), compared to the ambient air quality standard of 9.0 ppm. Recognizing the relatively low CO concentrations experienced in the Bay Area, the BAAQMD's CEQA Air Quality Guidelines state that a project would have a less-than-significant impact if it would not increase traffic volumes at affected intersections to more than 44,000 vehicles per hour. The intersections affected by the proposed project have much lower traffic volumes (less than 10,000 vehicles per hour). Therefore, the change in traffic caused by the proposed project would be minimal and the project would not cause or contribute to a violation of an ambient air quality standard.

Additionally, as a bridge rehabilitation project, and as stated above, the project is exempt from project-level conformity requirements per 40 CFR 93.126. The California Department of Transportation has developed a Transportation Project-Level Carbon Monoxide Protocol (Protocol) for assessing CO impacts of transportation projects.[4] The project is except from CO hotspot and emissions analysis based on Table 1 of the Protocol.

Impact 4: Expose sensitive receptors to substantial pollutant concentrations? ***Less-than- significant with construction period mitigation measures***

Construction is anticipated to occur over a period of approximately 14 months.

Construction Period TAC Impacts

The primary community risk impact issues associated with construction emissions are cancer risk and exposure to $PM_{2.5}$. Exposure to construction equipment and truck exhaust can cause increase cancer risks and other adverse non-cancer health effects. There are existing residences located north of the Fair Oaks Overhead Bridge (bridge) adjacent to Kifer Road and east of Fair Oaks Avenue. There are also residences adjacent to both sides of the bridge just south of Caltrain tracks in the Heritage Park apartment community. Since existing residences are located near the where project construction would occur a refined health risk assessment of the construction activity was conducted that evaluated emissions of diesel particulate matter (DPM) and $PM_{2.5}$. Emissions and dispersion modeling was conducted to predict the off-site concentrations resulting from project construction, so that lifetime cancer risks and non-cancer health effects could be evaluated. Figure 1 shows the local project area, locations of the construction modeling sources, and sensitive receptor locations

[4] California Department of Transportation, 1997. *Transportation Project-Level Carbon Monoxide Protocol*. December.

(residences) used in the air quality dispersion modeling analysis where potential health impacts were evaluated.

Construction Emissions

Construction activity is anticipated to include earth work, trenching, construction, and paving. Construction period emissions were modeled using the California Emissions Estimator Model, Version 2013.2.2 (CalEEMod) along with projected construction activity. The number and types of construction equipment and diesel vehicles, along with the anticipated length of their use for different phases of construction were based on site-specific construction activity schedules. The project would be constructed in five stages beginning in March 2015 and completed in May 2016.

The CalEEMod model provided total annual $PM_{2.5}$ exhaust emissions (assumed to be diesel particulate matter) for the off-road construction equipment and for exhaust emissions from on-road vehicles, with total emissions from all construction stages of 0.122 tons (244 pounds). The on-road emissions are a result of worker and truck travel, and vendor deliveries. A trip length of 0.3 miles was used to represent vehicle travel while at or near the construction site. It was assumed that these emissions from on-road vehicles traveling at or near the site would occur at the construction site. Fugitive $PM_{2.5}$ dust emissions were calculated by CalEEMod as 0.5 pounds for the construction period. The project emission calculations are provided in *Attachment 1*.

Dispersion Modeling

The U.S. EPA ISCST3 dispersion model was used to predict concentrations of DPM and $PM_{2.5}$ concentrations at existing sensitive receptors (residences) in the vicinity of the project construction areas. The ISCST3 modeling utilized area sources to represent the on-site construction emissions in different construction areas of the project site. Seven area sources were used to model DPM exhaust emissions and seven area sources were used for fugitive $PM_{2.5}$ dust emissions. To represent the construction equipment exhaust emissions, an emission release height of six meters was used for the area sources. The elevated source height reflects the height of the equipment exhaust pipes and buoyancy of the exhaust plume. For modeling fugitive $PM_{2.5}$ emissions, a near ground level release height of two meters was used for modeling the area sources. Emissions from vehicle travel on- and off-site were distributed throughout the modeled area sources. Construction emissions were modeled as occurring daily between 7 a.m. - 4 p.m. when a majority of the construction activity involving equipment usage would occur.

The modeling used a five-year data set (1991 - 1995) of hourly meteorological data from the San Jose Airport available from the BAAQMD. Annual DPM and $PM_{2.5}$ concentrations from construction activities in 2015 and 2016 were calculated using the model. DPM and $PM_{2.5}$ concentrations were calculated at nearby residential locations. Receptor heights of 1.5 meters (4.9 feet) and 4.5 meters (14.8 feet) were used in the modeling to represent the first and second story levels of nearby multi-story apartments and other residences.

The maximum-modeled DPM and $PM_{2.5}$ concentrations from project construction occurred at an apartment unit located in the northwest corner of the Heritage Park apartment community on eastern side of the Fair Oaks Overhead Bridge. The location of this receptor is identified on Figure 1.

Predicted Cancer Risk and Hazards

Increased lifetime cancer risks were calculated using the maximum modeled annual DPM concentrations and BAAQMD recommended risk assessment methods for both a child exposure (3rd trimester through 2 years of age) and for an adult exposure.[5] The cancer risk calculations were based on applying the BAAQMD recommended age sensitivity factors to the TAC concentrations. Age-sensitivity factors reflect the greater sensitivity of infants and small children to cancer causing TACs. Since the modeling was conducted under the assumption that emissions occurred daily for a full year during each construction year, the default BAAQMD exposure period of 350 days per year was used.[6] Infant and child exposures were assumed to occur at all residences through the entire construction period.

Results of the assessment for project construction indicate the maximum incremental child cancer risk at the maximally exposed individual (MEI) receptor would be 16.0 in one million and the adult incremental cancer risk would be 0.8 in one million. While the adult cancer risk would be lower than the BAAQMD significance threshold of a cancer risk of 10 in one million or greater, the increased child cancer risk would be greater than the significance threshold. *This would be considered a significant impact.*

The maximum annual $PM_{2.5}$ concentration was 0.11 micrograms per cubic meter ($\mu g/m^3$) occurring at the same location where maximum cancer risk would occur. This $PM_{2.5}$ concentration is below the BAAQMD threshold of 0.3 $\mu g/m^3$ used to judge the significance of health impacts from $PM_{2.5}$.

Potential non-cancer health effects due to chronic exposure to DPM were also evaluated. Non-cancer health hazards from TAC exposure are expressed in terms of a hazard index (HI), which is the ratio of the TAC concentration to a reference exposure level (REL). California's Office of Environmental Health and Hazards (OEHHA) has defined acceptable concentration levels for contaminants that pose non-cancer health hazards. TAC concentrations below the REL are not expected to cause adverse health impacts, even for sensitive individuals. The chronic inhalation reference exposure level (REL) for DPM is 5 $\mu g/m^3$. The maximum modeled annual DPM concentration was 0.11 $\mu g/m^3$, which is much lower than the REL. The maximum computed hazard index based on this DPM concentration is 0.022. This hazard index is much lower than the BAAQMD significance criterion of a hazard index greater than 1.0.

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[5] Bay Area Air Quality Management District (BAAQMD), 2012, *Recommended Methods for Screening and Modeling Local Risks and Hazards*, May.

[6] Bay Area Air Quality Management District (BAAQMD), 2010, *Air Toxics NSR Program Health Risk Screening Analysis Guidelines*, January.

Attachment 2 includes the emission calculations used for the area source modeling and the cancer risk calculations.

The project would have a *significant impact* with respect to community risk caused by construction activities. *Implementation of Mitigation Measure AQ-1 and AQ-2 would reduce this impact to a level of less than significant.*

Mitigation Measure AQ-2: Diesel-Powered Construction Equipment Selection

Implement the following measures to minimize emissions from diesel equipment:

1. All diesel-powered off-road equipment larger than 50 horsepower and operating at the site for more than two days continuously shall meet U.S. EPA particulate matter emissions standards for Tier 2 engines or equivalent;

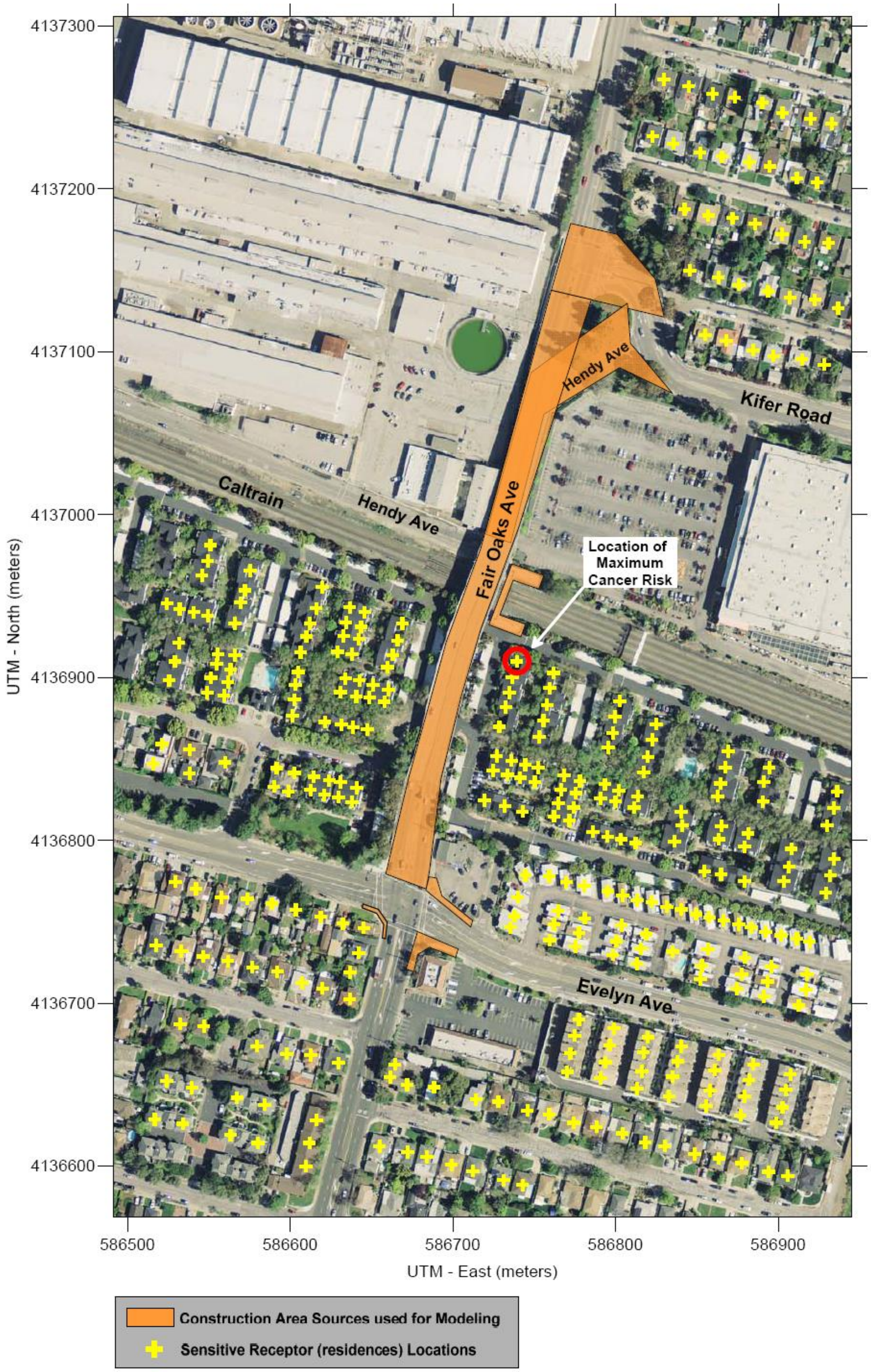
2. All stationary pieces of construction equipment shall use best available control technology to reduce particulate matter or shall be gasoline- or alternative energy-powered;

3. Minimize the number of hours that equipment will operate, including the use of idling restrictions; and

4. Avoid staging equipment within 100 feet of adjacent residences.

Implementation of Mitigation Measure AQ-1 is considered to reduce exhaust emissions and corresponding health risks by 5 percent. Implementation of Mitigation Measure AQ-2 would substantially reduce on-site diesel exhaust emissions. The computed maximum excess child cancer risk with implementation of Mitigation Measure AQ-1 and AQ-2 would be 9.1 per million and the $PM_{2.5}$ concentration would be 0.06 $\mu g/m^3$. *As a result, the project with mitigation measures would have a less-than-significant impact with respect to community risk caused by construction activities.*

Figure 1 – Project Construction Site, Residential Receptor Locations, and Location of Maximum Cancer Risk



Best management practices are necessary during demolition, trenching and grading activities to avoid generation of dust that may affect nearby sensitive receptors. Best management practices for controlling construction period air pollutant emissions are identified as *Mitigation Measure AQ-1* above.

Operational Period Impacts

Operation of the proposed project would not increase emissions of mobile sources of TACs or Mobile Source Air Toxins (MSATs). Emissions of TACs and $PM_{2.5}$ are predicted by the EMFAC2011 model to decrease substantially in the future. Because the project would not increase traffic capacity or roadway volumes and because emissions of TACs would decrease in future years, operation of the project would not cause significant exposures to TACs or $PM_{2.5}$.

Impact 5: Create objectionable odors affecting a substantial number of people? *Less than Significant*

Construction activities may cause localized odors that would be temporary and are not anticipated to result in frequent odor complaints. Operation of the proposed project would not generate odors that would result in confirmed odor complaints.

Impact 6: Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment? *Less than significant*

As described under Impact 2, emissions from construction and operation of the proposed project were modeled using proposed construction equipment and anticipated phasing information provided by the project applicant. CalEEMod also provides emissions of CO_2e.

The results of modeling indicate that GHG emissions from project demolition, construction and hauling activities would be 263 MT of CO_2e over the course of the entire construction period. Neither the City of Sunnyvale, BAAQMD, nor Caltrans have quantified thresholds for construction activities. However, the emissions would be below the lowest threshold considered by BAAQMD.

Operational Period Emissions

The proposed project would not generate new vehicular trips or increase roadway capacity. As a result, operational GHG emissions would not result in a significant impact.

Impact 7: Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of greenhouse gases? ***No Impact.***

The project would be subject to new requirements under rule making developed at the State and local level regarding greenhouse gas emissions and be subject to local policies that may affect emissions of greenhouse gases. The project would not interfere with any plan or regulation intended to reduce GHG emissions.

Attachment 1: CalEEMod Input and Output Worksheets

Attachment 2: Construction Health Risk Modeling Emissions and Risk Calculations

Fair Oaks Bridge - Construction Activity Schedule and Emissions

Unmitigated Emissions

				2015		2016		Total	
Stage	**Activity**	**Start Date**	**End Date**	**DPM**	**PM2.5**	**DPM**	**PM2.5**	**DPM**	**PM2.5**
1	Bridge Stage 1 Construction	3/30/2015	4/24/2015	6.35E-03	1.00E-05	0	0	6.35E-03	1.00E-05
2	Bridge Stage 2 Construction	4/27/2015	9/4/2015	0.0334	4.00E-05	0	0	3.34E-02	4.00E-05
3	Bridge Stage 3 Construction	9/7/2015	4/29/2016	0.0322	4.00E-05	0.0295	4.00E-05	6.17E-02	8.00E-05
1 & 2	Bent 2 - 5 & 10 Footings per Bent	3/30/2015	5/8/2015	1.88E-03	1.00E-05	0	0	1.88E-03	1.00E-05
1 & 2	Bent 6 Footing and Infill Wall	4/16/2015	5/8/2015	2.24E-03	1.00E-05	0	0	2.24E-03	1.00E-05
1 & 2	Bent 7 - 9 Footings 7 Columns per Bent	4/20/2015	6/26/2015	2.89E-03	2.00E-05	0	0	2.89E-03	2.00E-05
4	Bridge Stage 4 Construction	1/25/2016	3/11/2016	0	0	6.85E-03	3.00E-05	6.85E-03	3.00E-05
4	Roadway Stage 4 Construction	1/25/2016	3/11/2016	0	0	3.91E-03	3.00E-05	3.91E-03	3.00E-05
5	Roadway Stage 5 Construction	4/4/2016	5/6/2016	0	0	2.80E-03	2.00E-05	2.80E-03	2.00E-05
			Total	***7.90E-02***	***1.30E-04***	***4.31E-02***	***1.20E-04***	***1.22E-01***	***2.50E-04***

Mitigated Emissions

				2015		2016		Total	
Stage	**Activity**	**Start Date**	**End Date**	**DPM**	**PM2.5**	**DPM**	**PM2.5**	**DPM**	**PM2.5**
1	Bridge Stage 1 Construction	3/30/2015	4/24/2015	3.45E-03	1.00E-05	0	0	3.45E-03	1.00E-05
2	Bridge Stage 2 Construction	4/27/2015	9/4/2015	0.0191	4.00E-05	0	0	1.91E-02	4.00E-05
3	Bridge Stage 3 Construction	9/7/2015	4/29/2016	0.018	4.00E-05	0.0184	4.00E-05	3.64E-02	8.00E-05
1 & 2	Bent 2 - 5 & 10 Footings per Bent	3/30/2015	5/8/2015	9.10E-04	1.00E-05	0	0	9.10E-04	1.00E-05
1 & 2	Bent 6 Footing and Infill Wall	4/16/2015	5/8/2015	1.11E-03	1.00E-05	0	0	1.11E-03	1.00E-05
1 & 2	Bent 7 - 9 Footings 7 Columns per Bent	4/20/2015	6/26/2015	1.36E-03	2.00E-05	0	0	1.36E-03	2.00E-05
4	Bridge Stage 4 Construction	1/25/2016	3/11/2016	0	0	3.49E-03	3.00E-05	3.49E-03	3.00E-05
4	Roadway Stage 4 Construction	1/25/2016	3/11/2016	0	0	2.28E-03	2.00E-05	2.28E-03	2.00E-05
5	Roadway Stage 5 Construction	4/4/2016	5/6/2016	0	0	1.28E-03	2.00E-05	1.28E-03	2.00E-05
			Total	***4.39E-02***	***1.30E-04***	***2.55E-02***	***1.10E-04***	***6.94E-02***	***2.40E-04***

Fair Oaks Bridge, Sunnyvale, CA

DPM Construction Emissions and Modeling Emission Rates - Unmitigated

Construction Year	Activity Area	DPM (ton/year)	Area Source	DPM Emissions (lb/yr)	(lb/hr)	(g/s)	Modeled Area (m^2)	DPM Emission Rate ($g/s/m^2$)
2015	Fair Oaks Bridge	0.0531	FOB_DPM	106.2	0.03233	4.07E-03	7,704	5.29E-07
	Hendy Area	0.0246	HEN_DPM	49.3	0.01500	1.89E-03	3,575	5.29E-07
	Evelyn NE Area	0.0012	EVNE_DPM	2.5	0.00076	9.56E-05	181	5.29E-07
		0.0790					11,460	
2016	Evelyn SE Area	0.0036	EVSE_DPM	7.1	0.00217	2.74E-04	259	1.06E-06
	Ped Bridge Area	0.0063	PEDB_DPM	12.6	0.00382	4.82E-04	456	1.06E-06
	Kifer Area	0.0324	KIFR_DPM	64.7	0.01971	2.48E-03	2,352	1.06E-06
	Evelyn SW Area	0.0009	EVSW_DPM	1.8	0.00054	6.81E-05	65	1.06E-06
		0.0431					3,132	
Total		***0.1221***		***244***	***0.0743***	***0.0094***		

Notes:

Emissions assumed to be evenly distributed over each construction area

hr/day =	9	(7am - 4pm)
days/yr =	365	
hours/year =	3285	

PM2.5 Fugitive Dust Construction Emissions for Modeling - Unmitigated

Construction Year	Activity	Area Source	PM2.5 Emissions (ton/year)	(lb/yr)	(lb/hr)	(g/s)	Modeled Area (m^2)	DPM Emission Rate $g/s/m^2$
2015	Fair Oaks Bridge	FOB_FUG	0.0001	0.2	0.00005	6.70E-06	7,704	8.70E-10
	Hendy Area	HEN_FUG	0.0000	0.1	0.00002	3.11E-06	3,575	8.70E-10
	Evelyn NE Area	EVNE_FUG	0.0000	0.0	0.00000	1.57E-07	181	8.70E-10
			0.0001				11,460	
2016	Evelyn SE Area	EVSE_FUG	0.0000	0.0	0.00001	7.62E-07	259	2.94E-09
	Ped Bridge Area	PEDB_FUG	0.0000	0.0	0.00001	1.34E-06	456	2.94E-09
	Kifer Area	KIFR_FUG	0.0001	0.2	0.00005	6.91E-06	2,352	2.94E-09
	Evelyn SW Area	EVSW_FUG	0.0000	0.0	0.00000	1.90E-07	65	2.94E-09
			0.0001				3,132	
Total			***0.0003***	***0.5***	***0.0002***	***0.0000***		

Notes:

Emissions assumed to be evenly distributed over each construction area

hr/day =	9	(7am - 4pm)
days/yr =	365	
hours/year =	3285	

DPM Construction Emissions and Modeling Emission Rates - With Mitigation

Construction Year	Activity Area	DPM (ton/year)	Area Source	DPM Emissions (lb/yr)	(lb/hr)	(g/s)	Modeled Area (m^2)	DPM Emission Rate ($g/s/m^2$)
2015	Fair Oaks Bridge	0.0295	FOB_DPM	59.0	0.01797	2.26E-03	7,704	2.94E-07
	Hendy Area	0.0137	HEN_DPM	27.4	0.00834	1.05E-03	3,575	2.94E-07
	Evelyn NE Area	0.0007	EVNE_DPM	1.4	0.00042	5.31E-05	181	2.94E-07
		0.0439					11,460	
2016	Evelyn SE Area	0.0021	EVSE_DPM	4.2	0.00128	1.62E-04	259	6.25E-07
	Ped Bridge Area	0.0037	PEDB_DPM	7.4	0.00226	2.85E-04	456	6.25E-07
	Kifer Area	0.0192	KIFR_DPM	38.3	0.01166	1.47E-03	2,352	6.25E-07
	Evelyn SW Area	0.0005	EVSW_DPM	1.1	0.00032	4.03E-05	65	6.25E-07
		0.0255					3,132	
Total		***0.0694***		***139***	***0.0423***	***0.0053***		

Notes:

Emissions assumed to be evenly distributed over each construction area

hr/day =	9	(7am - 4pm)
days/yr =	365	
hours/year =	3285	

PM2.5 Fugitive Dust Construction Emissions for Modeling - With Mitigation

Construction Year	Activity	Area Source	PM2.5 Emissions (ton/year)	(lb/yr)	(lb/hr)	(g/s)	Modeled Area (m^2)	DPM Emission Rate $g/s/m^2$
2015	Fair Oaks Bridge	FOB_FUG	0.0001	0.2	0.00005	6.70E-06	7,704	8.70E-10
	Hendy Area	HEN_FUG	0.0000	0.1	0.00002	3.11E-06	3,575	8.70E-10
	Evelyn NE Area	EVNE_FUG	0.0000	0.0	0.00000	1.57E-07	181	8.70E-10
			0.0001				11,460	
2016	Evelyn SE Area	EVSE_FUG	0.0000	0.0	0.00001	6.98E-07	259	2.69E-09
	Ped Bridge Area	PEDB_FUG	0.0000	0.0	0.00001	1.23E-06	456	2.69E-09
	Kifer Area	KIFR_FUG	0.0001	0.2	0.00005	6.34E-06	2,352	2.69E-09
	Evelyn SW Area	EVSW_FUG	0.0000	0.0	0.00000	1.74E-07	65	2.69E-09
			0.0001				3,132	
Total			***0.0002***	***0.5***	***0.0001***	***0.0000***		

Notes:

Emissions assumed to be evenly distributed over each construction area

hr/day =	9	(7am - 4pm)
days/yr =	365	
hours/year =	3285	

Fair Oaks Bridge, Sunnyvale, CA

Construction Health Impact Summary - Without Mitigation

Construction Year	Maximum Concentrations Exhaust PM2.5/DPM ($\mu g/m^3$)	Fugitive PM2.5 ($\mu g/m^3$)	Cancer Risk (per million) Child	Adult	Hazard Index (-)	Maximum Annual PM2.5 Concentration ($\mu g/m^3$)
2015	0.1095	0.0002	9.6	0.5	0.022	0.111
2016	0.0731	0.0003	6.4	0.3	0.015	0.066
Total	-	-	**16.0**	**0.8**	-	-
Maximum Annual	0.1095	0.0003	-	-	**0.022**	**0.111**

Construction Health Impact Summary - With Mitigation

Construction Year	Maximum Concentrations Exhaust PM2.5/DPM ($\mu g/m^3$)	Fugitive PM2.5 ($\mu g/m^3$)	Cancer Risk (per million) Child	Adult	Hazard Index (-)	Maximum Annual PM2.5 Concentration ($\mu g/m^3$)
2015	0.0608	0.0002	5.3	0.3	0.012	0.061
2016	0.0431	0.0002	3.8	0.2	0.009	0.043
Total	-	-	**9.1**	**0.5**	-	-
Maximum Annual	0.0608	0.0002	-	-	**0.012**	**0.061**

Fair Oaks Bridge, Sunnyvale, CA - Construction Impacts - Unmitigated Emissions
Maximum DPM Cancer Risk Calculations From Construction
Off-Site Residential Receptor Locations - 1.5 meters

Cancer Risk (per million) = CPF x Inhalation Dose x 1.0E6

Where: CPF = Cancer potency factor $(mg/kg\text{-}day)^{-1}$

Inhalation Dose = C_{air} x DBR x A x EF x ED x 10^{-6} / AT

Where: C_{air} = concentration in air ($\mu g/m^3$)
DBR = daily breathing rate (L/kg body weight-day)
A = Inhalation absorption factor
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
AT = Averaging time period over which exposure is averaged.
10^{-6} = Conversion factor

Values

Parameter	Child	Adult
CPF =	1.10E+00	1.10E+00
DBR =	581	302
A =	1	1
EF =	350	350
AT =	25,550	25,550

Construction Cancer Risk by Year - Maximum Impact Receptor Location

		Child - Exposure Information			**Child**	**Adult - Exposure Information**			**Adult**		
	Exposure			**Exposure**	**Cancer**	**Modeled**		**Exposure**	**Cancer**		
Exposure	**Duration**	**DPM Conc (ug/m3)**		**Adjust**	**Risk**	**DPM Conc (ug/m3)**		**Adjust**	**Risk**	**Fugitive**	**Total**
Year	**(years)**	**Year**	**Annual**	**Factor**	**(per million)**	**Year**	**Annual**	**Factor**	**(per million)**	**PM2.5**	**PM2.5**
1	1	2015	0.1104	10	9.67	2015	0.1104	1	0.50	0.0002	0.111
2	1	2016	0.0657	10	5.75	2016	0.0657	1	0.30	0.0003	0.066
3	1		0.0000	4.75	0.00		0.0000	1	0.00		
4	1		0.0000	3	0.00		0.0000	1	0.00		
5	1		0.0000	3	0.00		0.0000	1	0.00		
6	1		0.0000	3	0.00		0.0000	1	0.00		
7	1		0.0000	3	0.00		0.0000	1	0.00		
8	1		0.0000	3	0.00		0.0000	1	0.00		
9	1		0.0000	3	0.00		0.0000	1	0.00		
10	1		0.0000	3	0.00		0.0000	1	0.00		
11	1		0.0000	3	0.00		0.0000	1	0.00		
12	1		0.0000	3	0.00		0.0000	1	0.00		
13	1		0.0000	3	0.00		0.0000	1	0.00		
14	1		0.0000	3	0.00		0.0000	1	0.00		
15	1		0.0000	3	0.00		0.0000	1	0.00		
16	1		0.0000	3	0.00		0.0000	1	0.00		
17	1		0.0000	1.5	0.00		0.0000	1	0.00		
18	1		0.0000	1	0.00		0.0000	1	0.00		
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65	1		0.0000	1	0.00		0.0000	1	0.00		
66	1		0.0000	1	0.00		0.0000	1	0.00		
67	1		0.0000	1	0.00		0.0000	1	0.00		
68	1		0.0000	1	0.00		0.0000	1	0.00		
69	1		0.0000	1	0.00		0.0000	1	0.00		
70	1		0.0000	1	0.00		0.0000	1	0.00		
Total Increased Cancer Risk					**15.42**				**0.80**		

Fair Oaks Bridge, Sunnyvale, CA - Construction Impacts - Unmitigated Emissions
Maximum DPM Cancer Risk Calculations From Construction
Off-Site Residential Receptor Locations - 4.5 meters

Cancer Risk (per million) = CPF x Inhalation Dose x 1.0E6

Where: CPF = Cancer potency factor $(mg/kg\text{-}day)^{-1}$

Inhalation Dose = C_{air} x DBR x A x EF x ED x 10^{-6} / AT

Where: C_{air} = concentration in air ($\mu g/m^3$)
DBR = daily breathing rate (L/kg body weight-day)
A = Inhalation absorption factor
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
AT = Averaging time period over which exposure is averaged.
10^{-6} = Conversion factor

Values

Parameter	Child	Adult
CPF =	1.10E+00	1.10E+00
DBR =	581	302
A =	1	1
EF =	350	350
AT =	25,550	25,550

Construction Cancer Risk by Year - Maximum Impact Receptor Location

		Child - Exposure Information			Child	Adult - Exposure Information			Adult		
	Exposure			Exposure	Cancer	Modeled		Exposure	Cancer		
Exposure	Duration	DPM Conc (ug/m3)		Adjust	Risk	DPM Conc (ug/m3)		Adjust	Risk	Fugitive	Total
Year	(years)	Year	Annual	Factor	(per million)	Year	Annual	Factor	(per million)	PM2.5	PM2.5
1	1	2015	0.1095	10	9.58	2015	0.1095	1	0.50	0.0002	0.110
2	1	2016	0.0731	10	6.40	2016	0.0731	1	0.33	0.0002	0.073
3	1		0.0000	4.75	0.00		0.0000	1	0.00		
4	1		0.0000	3	0.00		0.0000	1	0.00		
5	1		0.0000	3	0.00		0.0000	1	0.00		
6	1		0.0000	3	0.00		0.0000	1	0.00		
7	1		0.0000	3	0.00		0.0000	1	0.00		
8	1		0.0000	3	0.00		0.0000	1	0.00		
9	1		0.0000	3	0.00		0.0000	1	0.00		
10	1		0.0000	3	0.00		0.0000	1	0.00		
11	1		0.0000	3	0.00		0.0000	1	0.00		
12	1		0.0000	3	0.00		0.0000	1	0.00		
13	1		0.0000	3	0.00		0.0000	1	0.00		
14	1		0.0000	3	0.00		0.0000	1	0.00		
15	1		0.0000	3	0.00		0.0000	1	0.00		
16	1		0.0000	3	0.00		0.0000	1	0.00		
17	1		0.0000	1.5	0.00		0.0000	1	0.00		
18	1		0.0000	1	0.00		0.0000	1	0.00		
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65	1		0.0000	1	0.00		0.0000	1	0.00		
66	1		0.0000	1	0.00		0.0000	1	0.00		
67	1		0.0000	1	0.00		0.0000	1	0.00		
68	1		0.0000	1	0.00		0.0000	1	0.00		
69	1		0.0000	1	0.00		0.0000	1	0.00		
70	1		0.0000	1	0.00		0.0000	1	0.00		
Total Increased Cancer Risk					**15.98**				**0.83**		

Fair Oaks Bridge, Sunnyvale, CA - Construction Impacts - Mitigated Emissions
Maximum DPM Cancer Risk Calculations From Construction
Off-Site Residential Receptor Locations - 4.5 meters

Cancer Risk (per million) = CPF x Inhalation Dose x 1.0E6

Where: CPF = Cancer potency factor $(mg/kg\text{-}day)^{-1}$

Inhalation Dose = C_{air} x DBR x A x EF x ED x 10^{-6} / AT

Where: C_{air} = concentration in air ($\mu g/m^3$)
DBR = daily breathing rate (L/kg body weight-day)
A = Inhalation absorption factor
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
AT = Averaging time period over which exposure is averaged.
10^{-6} = Conversion factor

Values

Parameter	Child	Adult
CPF =	1.10E+00	1.10E+00
DBR =	581	302
A =	1	1
EF =	350	350
AT =	25,550	25,550

Construction Cancer Risk by Year - Maximum Impact Receptor Location

Exposure Year	Exposure Duration (years)	Child - Exposure Information: DPM Conc (ug/m3) Year	DPM Conc (ug/m3) Annual	Exposure Adjust Factor	Child Cancer Risk (per million)	Adult - Exposure Information: Modeled DPM Conc (ug/m3) Year	Annual	Exposure Adjust Factor	Adult Cancer Risk (per million)	Mitigated Fugitive PM2.5	Total PM2.5
1	1	2015	0.0608	10	5.33	2015	0.0608	1	0.28	0.0002	0.061
2	1	2016	0.0431	10	3.77	2016	0.0431	1	0.20	0.0002	0.043
3	1		0.0000	4.75	0.00		0.0000	1	0.00		
4	1		0.0000	3	0.00		0.0000	1	0.00		
5	1		0.0000	3	0.00		0.0000	1	0.00		
6	1		0.0000	3	0.00		0.0000	1	0.00		
7	1		0.0000	3	0.00		0.0000	1	0.00		
8	1		0.0000	3	0.00		0.0000	1	0.00		
9	1		0.0000	3	0.00		0.0000	1	0.00		
10	1		0.0000	3	0.00		0.0000	1	0.00		
11	1		0.0000	3	0.00		0.0000	1	0.00		
12	1		0.0000	3	0.00		0.0000	1	0.00		
13	1		0.0000	3	0.00		0.0000	1	0.00		
14	1		0.0000	3	0.00		0.0000	1	0.00		
15	1		0.0000	3	0.00		0.0000	1	0.00		
16	1		0.0000	3	0.00		0.0000	1	0.00		
17	1		0.0000	1.5	0.00		0.0000	1	0.00		
18	1		0.0000	1	0.00		0.0000	1	0.00		
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65	1		0.0000	1	0.00		0.0000	1	0.00		
66	1		0.0000	1	0.00		0.0000	1	0.00		
67	1		0.0000	1	0.00		0.0000	1	0.00		
68	1		0.0000	1	0.00		0.0000	1	0.00		
69	1		0.0000	1	0.00		0.0000	1	0.00		
70	1		0.0000	1	0.00		0.0000	1	0.00		
Total Increased Cancer Risk					**9.10**				**0.47**		