sierra research
A Trinity Consultants Company
1801 J Street
Sacramento, CA 95811
Tel: (916) 444-6666
Fax: (916) 444-8373
Ann Arbor, MI
Tel: (734) 761-6666
Fax: (734) 761-6755

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Memo to: City of Davis

From: Allan Daly and Gary Rubenstein

Subject: Qualitative Assessment of Near-Roadway Air Quality Impacts on the Plaza 2555 Project, Davis, California

Introduction

The Plaza 2555 project is a proposed residential development within the City of Davis, California, consisting of approximately 200 apartments. The project also contains a small café, a leasing and community facilities building, bike barns, parking, and open spaces. The project is situated on a 6.5-acre site immediately adjacent to and south of Interstate 80 (I-80), east of the Pole Line Road overpass. The Project proposes a 10-foot wide vegetative barrier between I-80 and the project. Vegetative barriers have been shown to provide benefits for the dispersion of roadway air pollutants.

We have been asked to consider the potential for exposure of future occupants of the Project to significant health hazards from I-80, assess whether future project occupants would potentially be exposed to significant hazards from I-80 and, if so, whether the impacts may be mitigated to a level of insignificance. This assessment reflects potential exposures to a variety of roadway emission sources, including combustion emissions and fugitive emissions from tire and brake wear. See Public Resources Code Section 21155.1(a)(4).

As explained below, the potential for exposure of future occupants of the project to significant health hazards from I-80 is below the screening cancer level risk threshold. In other words, the near-roadway health risk experienced by the Plaza 2555 project is not expected to be significant. Implementation of the proposed Project design features would further reduce the already less-than-significant impacts.

Background

There has been public concern over near-road air quality as an environmental issue, resulting from a body of health studies linking adverse health effects to near-roadway exposures in some situations. *See, e.g.*, California Air Resources Board's "Land Use Handbook."[1] These effects are attributed to increased exposure to particulate matter, gaseous criteria pollutants, and air toxics that can be emitted by vehicle activity.

[1] https://www.arb.ca.gov/ch/handbook.pdf.

This memo evaluates the issue of near-roadway air quality and the potential for exposure of future occupants of the Project to significant health hazards from I-80 using generally accepted methods employed by lead agencies under CEQA for projects adjacent to freeways and high-traffic roadways. These methods are based on the following guidance documents, which are discussed in greater detail below:

- California Air Resources Board's "Land Use Handbook" (2005)
- Sacramento Metropolitan Air Quality Management "Roadway Protocol" (2011)
- USEPA/CARB Emission Standards for 2007 and Later Heavy-Duty Engines and Vehicles and CARB Truck & Bus Rule
- USEPA's Recommendations for Constructing Roadside Vegetation Barriers to Improve Near-Road Air Quality (2016)
- CARB's Technical Advisory: Strategies to Reduce Air Pollution Exposure near High-Volume Roadways (2017)

Potential mitigation for near-roadway air quality impacts is also discussed within the context of each guidance document.

In summary, while the Plaza 2555 Project would be located near a freeway:

- The project would not result in an increased health risk to residents of a magnitude that would warrant a site-specific health risk assessment (HRA).

- The potential health risk to project residents is lower than that presumed in the analyses underlying existing guidance because vehicle emission standards have become more stringent since those analyses were initially prepared, resulting in significantly lower emission rates of toxic air contaminants from mobile sources.

Analysis

The Plaza 2555 project is located within the Yolo-Solano Air Quality Management District (YSAQMD). YSAQMD published its Handbook for Assessing and Mitigating Air Quality Impacts in July 2007 (YSAQMD CEQA Handbook).[2] YSAQMD's CEQA Handbook does not identify nor require assessment of near-roadway air quality impacts. Therefore, it does not provide a protocol for analyzing the potential for exposure of future occupants of Plaza 2555 to significant health hazards from I-80.

The Sacramento Metropolitan Air Quality Management District (SMAQMD), which is adjacent to and deals with similar air quality management issues to YSAQMD, has developed a protocol for considering and addressing near-roadway air quality impacts.[3]

SMAQMD's Recommended Protocol for Evaluating the Location of Sensitive Land Uses Adjacent to Major Roadways (Roadway Protocol) provides a three-step procedure, described below, for evaluating health risks from vehicle exhaust within 500 feet of

[2] http://yolosolanoair.wpengine.com/wp-content/uploads/2016/06/CEQAHandbook2007.pdf
[3] YSAQMD has adopted certain of SMAQMD's protocols for use in YSAQMD, including SMAQMD's Roadway Construction Emissions Model, demonstrating the applicability of such models across district boundaries.

freeways and major roadways. If an acceptable level of risk can be demonstrated, the sensitive land use is approvable within 500 feet of the freeway or roadway.

Step 1—The first step of the Roadway Protocol is to determine whether the project is within 500 feet of a freeway, urban roadway with a traffic volume greater than 100,000 vehicles/day, or a rural roadway with a traffic volume of greater than 50,000 vehicles/day.

As previously stated, the project site lies immediately adjacent to the south of I-80, east of the Pole Line Road overpass, and thus is within 500 feet of a freeway.

Step 2—The second step of the Roadway Protocol is to apply screening tables, which estimate the health risk at a receptor based on the distance from the nearest travel lane and the peak hour traffic volume, and whether the receptor is upwind or downwind of the roadway. Separate screening tables have been developed for roadways oriented east-west and those oriented north-south (reflecting predominant wind patterns in the greater Sacramento area).

The appropriate screening table for I-80—an east-west freeway—is included as Table 1. Plaza 2555 is south of I-80, and is therefore upwind of the roadway. In other words, the wind predominantly blows from the roadway away from the project site.

Table 1:
Diesel PM Cancer Risk (Potential Incremental Cancer Chances per Million People)
Projects South (Upwind) of an East-West Roadway

Peak Hour Traffic (veh/hr)	Receptor Distance from Edge of Nearest Travel Lane (feet)							
	10	**25**	**50**	**100**	**200**	**300**	**400**	**500**
4,000	102	86	67	48	32	22	19	16
8,000	27	172	137	99	64	48	38	32
12,000	305	254	200	143	92	70	54	48
16,000	423	353	277	200	127	95	76	64
20,000	531	442	347	248	159	121	95	80
24,000	636	531	417	299	191	143	114	9

A screening cancer risk level of 276 in a million is deemed an acceptable risk at or below which the sensitive land use is approvable.[4] This risk level is based on a 70 percent reduction in the worst-case health risk. The worst case would occur downwind (east) of a north-south roadway, which SMAQMD determined to be 919 in a million.

To apply the above screening table to the project, the peak hour traffic data must be determined from Caltrans data. Data for the most recent calendar year (2015) were obtained from the Caltrans Census Program.[5] The "ahead peak hour" traffic volume for

[4] Roadway Protocol, p. 7.
[5] Available at *www.dot.ca.gov/trafficops/census/*.

"Davis, Olive Avenue" (representing the two-way traffic measured to the east of the exit) was determined to be 12,200 vehicles per hour. The SMAQMD Roadway Protocol specifies that traffic volumes be rounded up to the next row of the screening table, which in this case is the 16,000 vehicles per hour row in Table 1.

The distance of the nearest receptor to the edge of the nearest travel lane was determined from the easement lines and from aerial photography. The site plan shows that an easement lies adjacent to the freeway and the nearest buildings could be no closer than approximately 75 feet from the northernmost property line (See Figure 1). Aerial photography shows that the property line (indicated by the existing fencing running parallel to the freeway) is approximately 52 feet from the edge of the nearest travel lane, as indicated by the white line on I-80 (See Figure 2), resulting in a total setback distance of approximately 127 feet.

Figure 1
Distance from Fence line to Easement Line

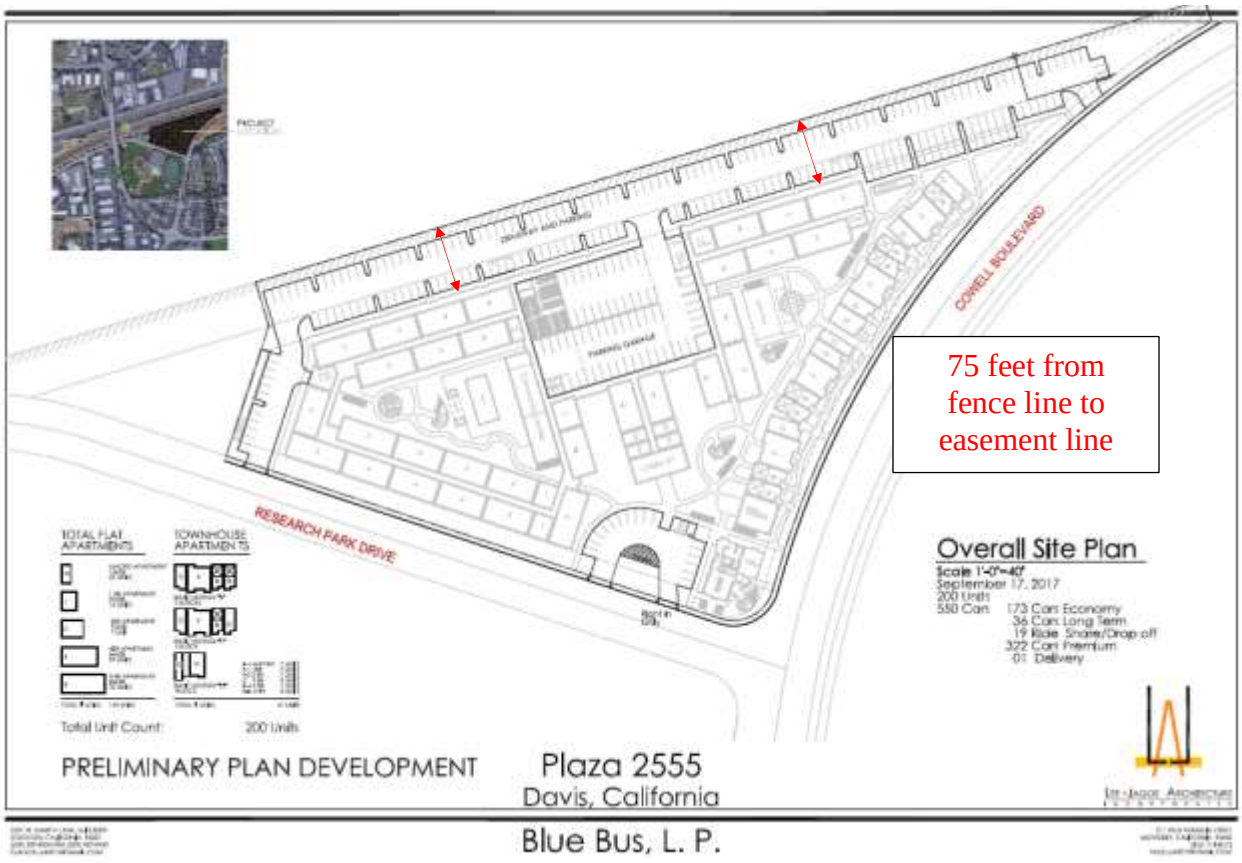

Figure 2
Distance from Fence Line to the Edge of the Nearest Travel Lane

Table 1 does not specify a receptor distance of 127 feet and SMAQMD does not provide specific guidance with regard to rounding or interpolating the receptor distance. Using the more conservative column for a receptor distance of 100 feet shows that the potential incremental risk would be 200 in a million. This conservative estimate is well below the cancer screening risk level threshold of 276 in a million. Because the receptors (residents) would live even farther from the roadway, the actual cancer screening risk level would be lower.

Step 3—Where cancer screening risk levels are above the threshold of 276 in a million, the SMAQMD protocol requires a site-specific health risk assessment using a dispersion model such as CAL3QHCR.

Because an acceptable risk level can be shown using the screening tables, a site-specific health risk assessment is not required for Plaza 2555.

Policy Context

The SMAQMD Roadway Protocol can be best understood in the context of evolving policies regarding land uses in proximity to roadways. The following history of applicable policies shows the ongoing refinement of policy in response to improvements in research and continuing emissions reductions.

The California Air Resources Board (CARB) initially articulated a concern about siting new sensitive land uses near freeways and roads, distribution centers, rail yards, ports,

refineries, chrome plating facilities, dry cleaners, and large gasoline-dispensing facilities. These concerns were outlined in CARB's Air Quality and Land Use Handbook: A Community Health Perspective (Land Use Handbook). These source types were selected based on CARB's jurisdiction to regulate mobile sources of air toxics as well as certain other stationary sources of toxic air contaminants. CARB's Land Use Handbook provides limited guidance with regard to mitigation, and no guidance with regard to new or modified freeway/road projects or mitigation measures that may reduce the health risk from these sources.

CARB's guidance with regard to freeways/roadways was generally to "avoid siting new sensitive land uses within 500 feet of a freeway, urban roads with 100,000 vehicles/day, or rural roads with 50,000 vehicles/day." CARB justified these setback distances based on data showing that exposure is "greatly reduced at approximately 300 feet," and that "health risk attributable to the proximity effect was strongest within 1,000 feet."

The CARB Guidance did not address potential risks from a project that might be sited within 500 feet of a freeway.

Subsequently, SMAQMD recognized that policy changes after the CARB Guidance was released would significantly reduce toxic air contaminant emissions from heavy-duty vehicles (discussed later in this memo). Moreover, SMAQMD recognized that strict adherence to CARB's Land Use Handbook guidance could effectively prohibit any new residence, school, daycare center, playground, or medical facility from being located near freeways in urbanized areas. This policy would be at odds with the air quality objectives of existing land use policy to promote high-density, mixed-use, and urban infill projects in close proximity to job centers. These changes in emissions and in policy prompted SMAQMD to adopt its Recommended Protocol for Evaluating the Location of Sensitive Land Uses Adjacent to Major Roadways (Roadway Protocol), as outlined and applied above.

Since SMAQMD adopted its Roadway Protocol, additional policy and emissions changes have occurred.

The risk values in SMAQMD's screening tables are based on the 2007 version of CARB's EMFAC model—the approved model for evaluating emissions from California's on-road vehicles. The EMFAC model was updated in 2011 and 2014 to incorporate the effects of new on-highway engine emission standards and current traffic volumes and fleet composition.

On December 21, 2000, the U.S. Environmental Protection Agency (USEPA) signed emission standards for model year 2007 and later heavy-duty highway engines, which were adopted by CARB thereafter. The new emission standards lowered the allowable emission rate for diesel particulate matter from 0.1 grams/brake horsepower-hour (applicable to 2004–2006 model year engines) to 0.01 grams/brake horsepower-hour (applicable to 2007+ model year engines)—a decrease of 90 percent—for all heavy-duty diesel vehicles with a gross vehicle weight rating (GVWR) of 8,500 lbs or greater. Diesel particulate emissions are often used as a surrogate for mobile source air toxic emissions (MSATs) from diesel vehicles.

Additionally, in December 2008, CARB adopted its Regulation to Reduce Emissions of Diesel Particulate Matter, Oxides of Nitrogen and Other Criteria Pollutants from In-Use Heavy-Duty Diesel-Fueled Vehicles,[6] commonly referred to as the "Truck and Bus Rule." The Truck & Bus Rule requires that all in-use heavy-duty diesel trucks with a GVWR >26,000 lbs be equipped with either factory or retrofit diesel particulate filters equivalent to the 2007+ MY standards, with limited exceptions.[7] Heavy-duty vehicles with a GVWR of 14,001 to 26,000 lbs must be phased out over time on a model-year basis.

As a result of these standards and regulations, the California fleet of heavy-duty diesel vehicles (the largest contributor of near-roadway health risk) is being modernized by accelerated turnover and retrofits. The corresponding health risk attributable to freeways and high-traffic roadways has decreased sharply over time, and will continue to do so.

This significant reduction in health risk is not factored into the studies on which CARB's Land Use Handbook were based, which represented mobile source fleet data from 1997 to 2004, and therefore reflect a mobile source fleet that was subject to much less stringent standards at the time. Likewise, the health risk assessment on which SMAQMD's Roadway Protocol is based reflects a much older fleet of higher-emitting vehicles. As such, even with regional increases in VMT, the near-roadway health risk experienced by the Plaza 2555 project is not expected to be significant.

Fugitive Dust from Tire and Brake Wear

The friction of tires against the road surface, and between brake pads and discs or drums on wheels, results in particulate emissions which can contain traces of the metals (and other components) used in the manufacture of these materials. Because these PM emissions are mechanically created, the particles tend to generally be coarser (large) in size than combustion-generated particulates.[8] Some researchers have found the same trace metals in analyses of ultrafine particles (UFPs) in studies near roadways, and have associated these metals with a variety of health effects.[9]

Regardless of whether tire and brake wear emissions are included within PM_{10}/$PM_{2.5}$ concentrations, or as much smaller ultrafine particles, the metals these emissions contain can be harmful to health. Particles within this size range will typically behave in a manner similar to gases, and will be transported by winds. Some deposition of these particles will occur closer to emission sources (in this case, a roadway), while some of the particles may be transported longer distances. Any project design features that are intended to address other sources of roadway particulate emissions (such as combustion emissions) will also be effective in addressing potential impacts of tire and brake wear emissions.

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[6] 13 CCR § 2025.

[7] The Truck and Bus Rule provides limited exemptions where heavy-duty trucks not meeting the 2010+ MY standards may operate in California, such as the "low-use vehicle" exemption under which heavy-duty trucks that operate <1,000 miles/year in 2023 are not subject to the rule requirements.

[8] EMFAC 2014 Volume III – Technical Documentation. California Air Resources Board. May 12, 2015. p. 18

[9] *Very Fine and UltraFine Metals and Ischemic Heart Disease in the California Central Valley 1: 2003-2007.* Cahill, Barnes, et al. Aerosol Science and Technology. May 12, 2011.

Policy Recommendations to Improve Near-Road Air Quality

Recently, the US Environmental Protection Agency (USEPA) and CARB have both recommended certain design features that improve air quality near roadways.

In July 2016, USEPA published its Recommendations for Constructing Roadside Vegetation Barriers to Improve Near-Road Air Quality. The report recognizes the public health concerns related to near-road air quality and sets forth measures for near-term actions that can be taken to reduce impacts to be implemented in conjunction with longer-term vehicle emission reductions achieved through vehicle exhaust standards.

The near-term actions recommended in the report include the preservation and planting of roadside vegetation) for urban developers and facilities already subject to high pollution levels near roads. These mitigation methods complement existing pollution control programs and regulations, as well as provide measures to reduce impacts from sources that are difficult to control. Vegetative barriers have been shown to provide benefits.[10] This is the approach being adopted by the Project.

According to the report, roadside vegetation has been shown to reduce exposure to air pollution through the interception of airborne particles and/or through the uptake of gaseous air pollutants by leaf stomata as well as improvements to air pollutant dispersion.

Vegetation type, height, and thickness can all influence the extent of mixing and pollutant deposition experienced at the site. The USEPA report identifies species with the following characteristics:

- Minimal seasonal effects (no deciduous plants);
- Low allergen, low BVOC-producing, non-poisonous;
- Urban hardy;
- Low maintenance;
- Drought tolerant;
- Preferably native; and
- Non-invasive.

With regard to physical characteristics of vegetation barriers, the USEPA report identifies, among other things, the following:

- Height (preferably 5 meters or higher);
- Thickness (preferably 10 meters or greater, for vegetative barriers);
- Allowance for some air flow-through (porosity of 0.5 to 0.9, for vegetative barriers);
- No gaps in vegetation; and
- Vegetation extending from the ground to the top of the canopy;

[10] See: https://www.arb.ca.gov/research/single-project.php?row_id=65195

On April 24, 2017, CARB issued the publication "Technical Advisory: Strategies to Reduce Air Pollution Exposure near High-Volume Roadways."[11] The Technical Advisory is a supplement to the 2005 Land Use Handbook and includes guidelines for infill development near freeways and other high traffic locations.

Many of the strategies relate to the design of roadways. Other measures are aimed at designing urban buildings with varying shapes, heights, and articulations to improve air dispersion.

Similar to the USEPA guidance previously cited, CARB's Technical Advisory identifies the use of vegetative barriers for pollutant dispersion as an available mitigation measure for roadside air impacts.

And finally, CARB's Technical Advisory identifies the use of particle filtration systems and devices, and specifically high-efficiency filtration with mechanical ventilation or portable high efficiency air cleaners. CARB states that these measures can be highly effective for reducing indoor pollution concentrations and can remove between 50 to 99 percent of particles in the air.

[11] Available at *www.arb.ca.gov/ch/landuse.htm.*