ACOUSTICS

Acoustical & Audiovisual Consultants

CEQA NOISE AND VIBRATION ASSESSMENT FOR:

480 EAST 4TH AVENUE & 400 EAST 5TH AVENUE

SAN MATEO, CA

RGD Project #: 19-039

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1. Introduction

The proposed project features a 7-story residential building with 5-stories of wood frame construction over a 2-story concrete podium with 225 residential units. The project also includes a 5-story parking garage in a separate building. The project site is located at 480 East 4th Avenue and 400 East 5th Avenue in San Mateo with railroad tracks located to the south. The major noise sources affecting the project site are commuter and freight train using the adjacent railroad corridor.

This report quantifies the existing noise and vibration environment at the site, determines future noise and vibration levels associated with the construction and operation of the project and cumulative growth. Potential noise and vibration impacts are assessed, and where necessary, mitigation measures are presented. The noise standards of the City of San Mateo and the State of California are considered. To address the NEPA analysis, the noise standards of the US Department of Housing and Urban Development (HUD) are considered.

2. Environmental Noise Fundamentals

Noise can be defined as unwanted sound. It is commonly measured with an instrument called a sound level meter. The sound level meter captures the sound with a microphone and converts it into a number called a sound level. Sound levels are expressed in units of decibels. To correlate the microphone signal to a level that corresponds to the way humans perceive noise, the A-weighting filter is used. A-weighting de-emphasizes low-frequency and very high-frequency sound in a manner similar to human hearing. The use of A-weighting is required by most local General Plans as well as federal and state noise regulations (e.g. Caltrans, EPA, OSHA and HUD). The abbreviation dBA is sometimes used when the A-weighted sound level is reported.

Because of the time-varying nature of environmental sound, there are many descriptors that are used to quantify the sound level. Although one individual descriptor alone does not fully describe a particular noise environment, taken together, they can more accurately represent the noise environment. The maximum instantaneous noise level (L_{max}) is often used to identify the loudness of a single event such as a car passby or airplane flyover. To express the average noise level the L_{eq} (equivalent noise level) is used. The L_{eq} can be measured over any length of time but is typically reported for periods of 15 minutes to 1 hour. The background noise level (or residual noise level) is the sound level during the quietest moments. It is usually generated by steady sources such as distant freeway traffic. It can be quantified with a descriptor called the L_{90} which is the sound level exceeded 90 percent of the time.

Type of Noise or Environment	Decibels
Recording studio	20
Soft whisper; quiet bedroom	30
Busy open-plan office	55
Normal conversation	60–65
Automobile *at 20 mph 25 ft. away*	65
Vacuum cleaner *10 ft. away*	70
Dump truck *at 50 mph 50 ft. away*	90
Gas leaf blower *at 25 ft. away*	100
Helicopter *200 ft. away*	100
Train horn *100 ft. away*	105
Claw hammer; jet takeoff *200 ft. away*	120
Shotgun *at shooter's ear*	140

To quantify the noise level over a 24-hour period, the Day/Night Average Sound Level (DNL or L_{dn}) or Community Noise Equivalent Level (CNEL) is used. These descriptors are averages like the L_{eq} except they include a 10 dB penalty during nighttime hours (and a 5 dB penalty during evening hours in the CNEL) to account for peoples increased sensitivity during these hours. The CNEL and DNL are typically within one decibel of each other.

Community Response to changes in noise levels: The potential for adverse community response tends to increase as an intrusive noise becomes more noticeable above existing background noise levels. For example, if an intrusive noise has an average level that is comparable to existing average ambient noise levels, then the intrusive sound would tend to blend in with the ambient noise. However, if the intrusive sound is significantly greater than the ambient noise then the intrusive sound would be more noticeable and potentially more annoying as it can interfere with rest, working efficiency, social interaction and general tranquility.

In environmental noise, a change in noise level of 3 dB is considered a just noticeable difference. A 5 dB change is clearly noticeable, but not dramatic. A 10 dB change is perceived as a halving or doubling in loudness (Cowen, *Handbook of Environmental Acoustics*, 1994).

Vibration is an oscillatory motion which can be described in terms of the displacement, velocity, or acceleration. Because the motion is oscillatory, there is no net movement. Displacement is the easiest descriptor to understand. For a vibrating floor, the displacement is simply the distance that a point on the floor moves away from its static position. The velocity represents the instantaneous speed of the floor movement.

The peak particle velocity (PPV) is the descriptor used in monitoring of construction vibration since it is related to the stresses that are experienced by buildings. Although

PPV is appropriate for evaluating the potential of building damage, it is not always suitable for evaluating human response. It takes some time for the human body to respond to vibration signals and a time averaged vibration descriptor correlates better with human response. For this reason, criteria for transit vibration is presented in terms of the root-mean-square (rms) vibration velocity and is typically shown in units of decibels referenced to 1 micro-inch per second (with the abbreviation “VdB" to reduce the potential for confusion with sound decibels).

3. Regulatory Background

3.1. State of California

3.1.1. California Environmental Quality Act (CEQA)

3.1.1.1. CEQA Guidelines

In accordance with Appendix G of the CEQA Guidelines *(CEQA Environmental Checklist)*, a proposed project could have a significant environmental impact if it would result in:

a. Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies;
b. Generation of excessive ground-borne vibration or ground-borne noise levels;
c. For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels

3.1.1.2. Increase in Noise

The CEQA checklist does not specify a quantitative method for determining whether or not a project would cause a permanent significant noise increase. Therefore, for the purposes of assessing impact due to the proposed project, this report uses thresholds of significance based on a FAA Draft Policy discussing screening and impact thresholds for increases in aircraft noise.

The project will cause a significant adverse noise impact if it will:

- raise the L_{dn} by more than 5 dBA and the future L_{dn} is less than 60 dBA, OR

- raise the L_{dn} by more than 3 dBA and future L_{dn} is 60 dBA or greater and less than 65 dBA,

  OR
- raise the L_{dn} by more than 1.5 dBA and the future L_{dn} is 65 dBA or greater

3.1.2. California Building Code

Section 1206.4 of the 2019 California Building Code has exterior noise transmission requirements for multi-family residential dwelling units. The code states that allowable interior noise levels attributable to exterior sources shall not exceed an L_{dn} of 45 dB in any habitable room.

3.1.3. California Green Building Standards Code

Section 5.507 of the 2019 State of California Green Building Standards Code has exterior noise transmission requirements for new nonresidential buildings. If the building will be exposed to an hourly L_{eq} of 65 dB or more, the building envelope shall be constructed to achieve an interior hourly equivalent noise level (L_{eq}) of 50 dBA in the occupied areas during any hour of operation. The aforementioned performance standard is an alternative to use of the prescriptive standard which tends to be much more restrictive for buildings exposed to normal exterior noise levels.

3.2. City of San Mateo

3.2.1. General Plan

The Noise Element of the City of San Mateo General Plan has policies and actions to assure the compatibility of new development with the noise environment of San Mateo. The applicable goals and policies are below:

GOAL 1: Protect “noise sensitive” land uses from excessive noise levels.

- POLICY N 1.1: Interior Noise Level Standard. Require submittal of an acoustical analysis and interior noise insulation for all “noise sensitive” land uses listed in Table N-1 that have an exterior noise level of 60 dB (L_{dn}) or above, as shown on Figure N-1. The maximum interior noise level shall not exceed 45 dB (L_{dn}) in any habitable rooms.

- POLICY N 1.2: Exterior Noise Level Standard. Require an acoustical analysis for new parks, play areas, and multi-family common open space (intended for the use and the enjoyment of residents) that have an exterior noise level of 60 dB (L_{dn}) or above, as shown on Figure N-1. Require an acoustical analysis that uses peak hour L_{eq} for new parks and play areas. Require a feasibility analysis of noise reduction measures for public parks and play areas. Incorporate necessary mitigation measures into residential project design to minimize common open space noise levels. Maximum exterior noise should not exceed 67 dB (L_{dn}) for residential uses and should not exceed 65 dB (L_{eq}) during the noisiest hour for public park uses.

Figure 1: City of San Mateo General Plan Noise-Land Use Compatibility Guidelines

TABLE N-1
NOISE SENSITIVE LAND-USE COMPATIBILITY GUIDELINES FOR COMMUNITY NOISE ENVIRONMENTS[1]
Day-Night Average Sound Level (L_{dn}), Decibels

Land-Use Category	Normally Acceptable[2]	Conditionally Acceptable[3]	Normally Unacceptable[4]
Single-Family Residential	50 to 59	60 to 70	Greater than 70
Multi-Family Residential	50 to 59	60 to 70	Greater than 70
Hotels, Motels, and Other Lodging Houses	50 to 59	60 to 70	Greater than 70
Long-Term Care Facilities	50 to 59	60 to 70	Greater than 70
Hospitals	50 to 59	60 to 70	Greater than 70
Schools	50 to 59	60 to 70	Greater than 70
Multi-Family Common Open Space Intended for the Use and Enjoyment of Residents	50 to 67	--	Greater than 67

TABLE N-2
NOISE GUIDELINES FOR OUTDOOR ACTIVITIES
Average Sound Level (L_{eq}), Decibels

Land Use Category	Normally Acceptable[2]	Conditionally Acceptable[3]	Normally Unacceptable[4]
Parks, Playgrounds	50 to 65*	--	Greater than 65*

[1] These guidelines are derived from the California Department of Health Services, Guidelines for the Preparation and Content of the Noise Element of the General Plan, 2003. The State Guidelines have been modified to reflect San Mateo's preference for distinct noise compatibility categories and to better reflect local land-use and noise conditions. It is intended that these guidelines be utilized to evaluate the suitability of land-use changes only and not to determine cumulative noise impacts. Land uses other than those classified as being "noise sensitive" are exempt from these compatibility guidelines.
[2] Normally Acceptable – Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.
[3] Conditionally Acceptable – New construction should be undertaken only after a detailed analysis of the noise reduction requirement is conducted and needed noise insulation features included in the design.
[4] Normally Unacceptable – New construction should be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.

* Average Sound Level (L_{eq}) for peak hour.

GOAL 2: Minimize unnecessary, annoying, or unhealthful noise.

- POLICY N 2.1: Noise Ordinance. Continue implementation and enforcement of the City's existing noise control ordinance: a) which prohibits noise that is annoying or injurious to neighbors of normal sensitivity, making such activity a public nuisance, and b) restricts the hours of construction to minimize noise impact.
- POLICY N 2.2: Minimize Noise Impact. Protect all "noise-sensitive" land uses listed in Tables N-1 and N-2 from adverse impacts caused by the noise generated on-site by new developments. Incorporate necessary mitigation measures into development design to minimize noise impacts. Prohibit long-term exposure increases of 3 dB (L_{dn}) or greater at the common property line, or new uses which generate noise levels of 60 dB (L_{dn}) or greater at the property line, excluding existing ambient noise levels.
- POLICY N 2.3: Minimize Commercial Noise. Protect land uses other than those listed as "noise sensitive" in Table N-1 from adverse impacts caused by the on-site noise generated by new developments. Incorporate necessary mitigation measures into development design to minimize noise impacts. Prohibit new uses that generate noise levels of 65 dB (L_{dn}) or above at the property line, excluding existing ambient noise levels.

3.2.2. Municipal Code

The City's Municipal Code Section 7.30.040 contains maximum permissible sound levels noise level limits to protect the inhabitants of the City with some exceptions and special provisions such as construction noises.

(a) It is unlawful for any person to operate or cause to be operated any source of sound at any location within the City or allow the creation of any noise on property owned, leased, occupied or otherwise controlled by such person, which causes the noise level when measured on any other property to exceed:

(1) The noise level standard for that property as specified in Table 7.30.040 [Table 1] for a cumulative period of more than 30 minutes in any hour;
(2) The noise level standard plus five dB for a cumulative period of more than 15 minutes in any hour;
(3) The noise level standard plus 10 dB for a cumulative period of more than five minutes in any hour;
(4) The noise level standard plus 15 dB for a cumulative period of more than one minute in any hour; or
(5) The noise level standard or the maximum measured ambient level, plus 20 dB for any period of time.

(b) If the measured ambient level for any area is higher than the standard set in Table 7.30.040 [Table 1], then the ambient shall be the base noise level standard for purposes of subsection (a)(1) of this section. In such cases, the noise levels for purposes of subsections (a)(2) through (a)(5) of this section shall be increased in five dB increments above the ambient.

Table 1: City of San Mateo Noise Level Standards (Table 7.30.040)

Noise Zone	Time Period	Noise Level (dB)
Noise Zone 1 - All property in any single family residential zone (including adjacent parks and open space) as designated on the City's zoning map	10 p.m. – 7 a.m.	50
	7 a.m. – 10 p.m.	60
Noise Zone 2 - All property in any commercial/mixed residential, multi-family residential, specific plan district or PUD as designated on the City's zoning map	10 p.m. – 7 a.m.	55
	7 a.m. – 10 p.m.	60
Noise Zone 3 - All property in any commercial or central business district as designated on the City's zoning map	10 p.m. – 7 a.m.	60
	7 a.m. – 10 p.m.	65
Noise Zone 4 - All property in any manufacturing or industrial zone as designated on the City's zoning map	Anytime	70

Section 7.30.060.e includes special provisions for construction generated noise. The specific language is repeated below.

(e) Construction. Construction, alteration, repair or land development activities which are authorized by a valid city permit shall be allowed on weekdays between the hours of seven a.m. and seven p.m., on Saturdays between the hours of nine a.m. and five p.m., and on Sundays and holidays between the hours of noon and four p.m., or at such other hours as may be authorized or restricted by the permit, if they meet at least one of the following noise limitations:

(1) No individual piece of equipment shall produce a noise level exceeding 90 dB at a distance of 25 feet. If the device is housed within a structure or trailer on the property, the measurement shall be made outside the structure at a distance as close to 25 feet from the equipment as possible.

(2) The noise level at any point outside of the property plane of the project shall not exceed 90 dB.
(3) The operation of leaf blowers shall additionally comply with Chapter 10.80, Operation of Leaf Blowers. (Ord. 2013-13 § 9; Ord. 2004-16 § 1)

3.3. San Mateo County Airport Land Use Commission (ALUC)

The City/County Association of Governments of San Mateo County (C/CAG), acting as the Airport Land Use Commission, has adopted Comprehensive Land Use Plans (ALUCPs) for San Francisco International Airport, Half Moon Bay Airport, and San Carlos Airport. The ALUCP includes airport noise exposure information and land use policies. The project site is located within the Airport Influence Area A of the ALUCPs for San Francisco International Airport and the San Carlos Airport. The relevant policies are repeated below.

San Francisco International Airport ALUCP (2012)

Policy IP-1 Airport Influence Area A – Real Estate Disclosure Area. Within Area A, the real estate disclosure requirements of state law apply. Section 11010 of the Business and Professions Code requires people offering subdivided property for sale or lease to disclose the presence of all existing and planned airports within two miles of the property. The law requires that, if the property is within an "airport influence area" designated by the airport land use commission, the following statement must be included in the notice of intention to offer the property for sale:

Notice of Airport in Vicinity

This property is presently located in the vicinity of an airport, within what is known as an airport influence area. For that reason, the property may be subject to some of the annoyances or inconveniences associated with proximity to airport operations (for example: noise, vibration, or odors). Individual sensitivities to those annoyances can vary from person to person. You may wish to consider what airport annoyances, if any, are associated with the property before you complete your purchase and determine whether they are acceptable to you.

Policy NP-1 Noise Compatibility Zones. For the purposes of this ALUCP, the projected 2020 CNEL noise contour map from the Draft Environmental Assessment for the Proposed Runway Safety Area Program shall define the boundaries within which noise compatibility policies described in this Section shall apply. Exhibit IV-5 depicts the noise compatibility zones. More detailed is provided in Exhibit IV-6. The zones are defined by the CNEL 65, 70 and 75 dB contours.

Policy NP-2 Airport Noise/Land Use Compatibility Criteria. The compatibility of proposed land uses located in the Airport noise compatibility zones shall be determined according to the noise/land use compatibility criteria shown in Table IV-1. The criteria indicate the maximum acceptable airport noise levels, described in terms of Community Noise Equivalent Level (CNEL), for the indicated land uses. The compatibility criteria indicate whether a proposed land use is "compatible," "conditionally compatible," or "not compatible" within each zone, designated by the identified CNEL ranges.

- "Compatible" means that the proposed land use is compatible with the CNEL level indicated in the table and may be permitted without any special requirements related to the attenuation of aircraft noise.
- "Conditionally compatible" means that the proposed land use is compatible if the conditions described in Table IV-1 are met.
- "Not compatible" means that the proposed land use is incompatible with aircraft noise at the indicated CNEL level.

Figure 2: ALUC Noise Compatibility Policies

Table IV-1 Noise/Land Use Compatibility Criteria

LAND USE	COMMUNITY NOISE EQUIVALENT LEVEL (CNEL) BELOW 65 dB	65-70 dB	70-75 dB	75 dB AND OVER
Residential				
Residential, single family detached	Y	C	N *(a)*	N
Residential, multi-family and single family attached	Y	C	N *(a)*	N
Transient lodgings	Y	C	C	N
Public/Institutional				
Public and Private Schools	Y	C	N	N
Hospitals and nursing homes	Y	C	N	N
Places of public assembly, including places of worship	Y	C	N	N
Auditoriums, and concert halls	Y	C	C	N
Libraries	Y	C	C	N
Outdoor music shells, amphitheaters	Y	N	N	N
Recreational				
Outdoor sports arenas and spectator sports	Y	Y	Y	N
Nature exhibits and zoos	Y	Y	N	N
Amusements, parks, resorts and camps	Y	Y	Y	N
Golf courses, riding stables, and water recreation	Y	Y	Y	Y
Commercial				
Offices, business and professional, general retail	Y	Y	Y	Y
Wholesale; retail building materials, hardware, farm equipment	Y	Y	Y	Y
Industrial and Production				
Manufacturing	Y	Y	Y	Y
Utilities	Y	Y	Y	Y
Agriculture and forestry	Y	Y *(b)*	Y *(c)*	Y *(c)*
Mining and fishing, resource production and extraction	Y	Y	Y	Y

Figure 2: ALUC Noise Compatibility Policies (cont.)

Notes:

CNEL = Community Noise Equivalent Level, in A-weighted decibels.

Y (Yes) = Land use and related structures compatible without restrictions.

C (conditionally compatible) = Land use and related structures are permitted, provided that sound insulation is provided to reduce interior noise levels from exterior sources to CNEL 45 dB or lower and that an avigation easement is granted to the City and County of San Francisco as operator of SFO. See Policy NP-3.

N (No) = Land use and related structures are not compatible.

(a) Use is conditionally compatible only on an existing lot of record zoned only for residential use as of the effective date of the ALUCP. Use must be sound-insulated to achieve an indoor noise level of CNEL 45 dB or less from exterior sources. The property owners shall grant an avigation easement to the City and County of San Francisco prior to issuance of a building permit for the proposed building or structure. If the proposed development is not built, then, upon notice by the local permitting authority, SFO shall record a notice of termination of the avigation easement.

(b) Residential buildings must be sound-insulated to achieve an indoor noise level of CNEL 45 dB or less from exterior sources.

(c) Accessory dwelling units are not compatible.

SOURCES: Jacobs Consultancy Team 2010. Based on State of California General Plan Guidelines for noise elements of general plans; California Code of Regulations, Title 21, Division 2.5, Chapter 6, Section 5006; and 14 CFR Part 150, Appendix A, Table 1.

PREPARED BY: Ricondo & Associates, Inc., June 2012.

San Carlos Airport ALUCP (2015)

Overflight Policy 1 – Real Estate Transfer Disclosure. Effective as of January 1, 2004, California state statues (Business and Professional Code Section 11010 and Civil Code Sections 1102.6, 1103.4, and 1353) mandate that sellers or lessors of real property must disclose information regarding whether their property is situated within an airport influence area.

a. These state requirements apply to the sale or lease of subdivided lands and condominium conversions and to the sale of certain existing residential property.

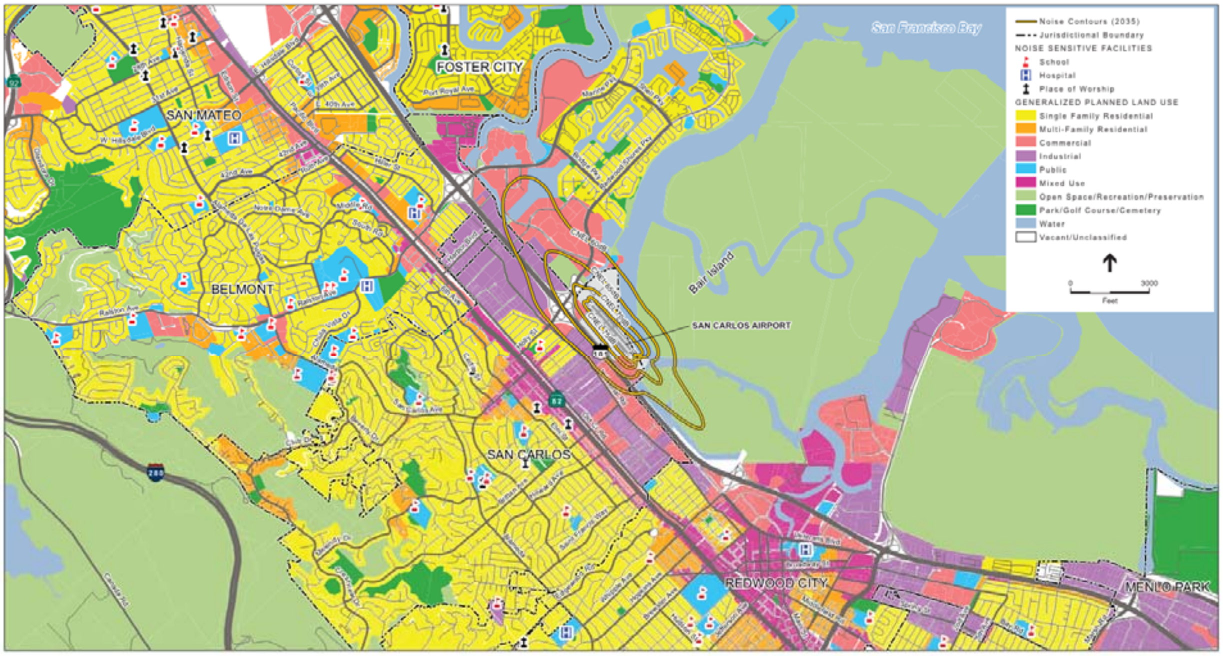
b. Where disclosure is required, the state statutes dictate that the following statement shall be provided:

> *NOTICE OF AIRPORT IN VICINITY*
>
> *This property is presently located in the vicinity of an airport, within what is known as an airport influence area. For that reason, the property may be subject to some of the annoyances or inconveniences associated with proximity to airport operations (for example: noise, vibration, or odors). Individual sensitivities to those annoyances can vary from person to person. You may wish to consider what airport annoyances, if any, are associated with the property before you complete your purchase and determine whether they are acceptable to you.*

c. Although not mandated by state law, the recommendation of this ALUCP is that the airport proximity disclosure should be provided as part of all real estate transactions involving private property (both new and existing) within the airport influence area.

Noise Policy 1 – Noise Impact Area. The threshold for evaluation is the projected CNEL 60 dB contour depicted in Exhibit 4-2. This contour defines the noise impact area of the Airport. All land uses located outside this contour are consistent with the noise compatibility policies of this ALUCP.

Figure 3: San Carlos Airport Future Aircraft Noise Contours (ALUCP Exhibit 4-2)



SOURCE: Belmont, 1982; San Mateo County, 1986; Foster City, 1993; Menlo Park, 1994; San Carlos, 2009; City of San Mateo, 2010; Redwood City, 2010; ESRI, 2014; ESA Airports, 2016

San Carlos Airport ALUCP . 130753
Exhibit 4-2
Future Conditions (2035) Aircraft Noise Contours

3.4. U.S. Department of Housing and Urban Development (HUD)

HUD Site Acceptability Standards are contained in 24CFR51 and are summarized below in Table 1. According to the HUD regulations, development in Normally Unacceptable Noise Zones require a minimum of 5 decibels additional sound attenuation for buildings having noise-sensitive uses if the L_{dn} is greater than 65 dBA but does not exceed 70 dBA, or a minimum of 10 dBA additional sound attenuation if the L_{dn} is greater than 70 dBA but does not exceed 75 dBA. Noise attenuation measures in Unacceptable Noise Zones require the approval of the Assistant Secretary for Community Planning and Development, or the Certifying Officer for activities subject to 24 CFR part 58.

HUD's regulations do not contain standards for interior noise levels. Rather a goal of DNL 45 dBA is set forth and the attenuation requirements are geared towards achieving that goal. It is assumed that with standard construction any building will provide sufficient attenuation so that if the exterior level is 65 dBA or less, the interior DNL will be 45 dBA or less.

Table 2: HUD Site Acceptability Standards

Noise Zone	Day-night average sound level (L_{dn}) (in decibels)	Special approvals and requirements
Acceptable	Not exceeding 65 dB(1)	None.
Normally Unacceptable	Above 65 dB but not exceeding 75 dB	Special Approvals (2) Environmental Review (3). Attenuation (4).
Unacceptable	Above 75 dB	Special Approvals (2). Environmental Review (3). Attenuation (5).

Notes: (1) Acceptable threshold may be shifted to 70 dB in special circumstances pursuant to § 51.105(a).
(2) See § 51.104(b) for requirements.
(3) See § 51.104(b) for requirements.
(4) 5 dB additional attenuation required for sites above 65 dB but not exceeding 70 dB and 10 dB additional attenuation required for sites above 70 dB but not exceeding 75 dB. (See § 51.104(a).)
(5) Attenuation measures to be submitted to the Assistant Secretary for CPD for approval on a case-by-case basis.

3.5. Ground-borne Vibration

3.5.1. Railroad Vibration

Ground-borne vibration generated by train passbys can propagate into nearby buildings and cause perceptible vibration in the floors and walls of residential units. This perceptible vibration can cause annoyance to the residents. Neither CEQA nor the State specifies acceptable vibration levels from construction activities. For the purposes of this assessment, the methodology described by the Federal Transit Administration (FTA) is used[1].

The FTA vibration impact criteria were developed for assessing new transit systems near existing land use. Table 3 lists the impact levels for various land uses depending on how often the events occur. The FTA considers an impact to occur when the vibration velocity level inside a residence from frequent events (70 or more events per day) exceeds 72 VdB[2]. The impact levels are less stringent for less sensitive land uses or for fewer events per day. The threshold for “occasional events” (30 – 70 events per day) is 75 VdB and the threshold for “infrequent events” (fewer than 30 events per day) is 80 VdB. Since the criteria

[1] *Transit Noise and Vibration Impact Assessment*, Federal Transit Administration, September 2018
[2] *VdB – The vibration velocity level expressed in decibel re one micro-inch per second.*

were developed for assessing new transit systems the number of events per day are correlated with typical project types such as "rapid transit" and "commuter rail". The FTA also provides Table 4 to help understand the human response to different levels of ground-borne vibration.

Table 3: FTA Ground-borne Vibration Impact Levels

Land Use Category	GBV Impact Levels (VdB re 1 micro-inch /sec)		
	Frequent Events	Occasional Events	Infrequent Events
Category 1: Buildings where vibration would interfere with interior operations.	65 VdB*	65 VdB*	65 VdB*
Category 2: Residences and buildings where people normally sleep.	72 VdB	75 VdB	80 VdB
Category 3: Institutional land uses with primarily daytime use.	75 VdB	78 VdB	83 VdB

Category	Definition	Typical Project Types
Frequent Events	More than 70 events per day	Most rapid transit
Occasional Events	30–70 events per day	Most commuter trunk lines
Infrequent Events	Fewer than 30 events per day	Most commuter rail branch lines

Table 4: Human Response to Different Levels of Ground-borne Vibration

Ground-borne Vibration Level	Human Response
65 VdB	Approximate threshold of perception for many humans.
75 VdB	Approximate dividing line between barely perceptible and distinctly perceptible. Many people find transit vibration at this level annoying.
85 VdB	Vibration acceptable only if there are an infrequent number of events per day.

3.5.2. Construction Vibration

Tables 5 and 6 show the criteria for building damage and human annoyance recommended by Caltrans for construction vibration. The criteria are in terms of the peak particle velocity (PPV) expressed in inches per second.[3]

Table 5: Construction Vibration Damage Potential Threshold

Structure and Condition	Maximum PPV (in/sec)	
	Transient Sources	Continuous/Frequent Intermittent Sources
Extremely fragile historic buildings, ruins, ancient monuments	0.12	0.08
Fragile buildings	0.2	0.1
Historic and some old buildings	0.5	0.25
Older residential structures	0.5	0.3
New residential structures	1.0	0.5
Modern industrial/commercial buildings	2.0	0.5

Note: Transient sources create a single isolated vibration event, such as blasting or drop balls. Continuous/frequent intermittent sources include impact pile drivers, pogo-stick compactors, crack-and-seat equipment, vibratory pile drivers, and vibratory compaction equipment.

Table 6: Construction Vibration Annoyance Potential Criteria

Human Response	Maximum PPV (in/sec)	
	Transient Sources	Continuous/Frequent Intermittent Sources
Barely perceptible	0.04	0.01
Distinctly perceptible	0.25	0.04
Strongly perceptible	0.9	0.10
Severe	2.0	0.4

4. Noise and Vibration Environment

4.1. Noise Measurements

Existing noise levels were quantified by two long-term, 2-day, measurements (LT-1 and LT-2) and four short-term, 15-minute, attended noise measurements (ST-1 to ST-4). The measurement locations are shown in Figure 4.

The dominant noise sources at the project site are train passbys and the at-grade crossing bells. Other noise sources include traffic, construction activities across 4th Avenue and occasionally operating mechanical equipment to the south of Railroad Avenue.

Figures 5 to 6 show the long-term measurement results and Table 7 shows the short-term measurement results. The noise levels shown in the charts are in terms of the hourly L_{eq}, L_1, L_{90}, and L_{max}. At locations ST-1 and ST-2, near the proposed building façade closest to the train tracks, the noise from passing

[3] Caltrans, *Transportation and Construction Vibration Guidance Manual, September 2013.*

trains generated a typical maximum instantaneous noise level between 91 to 100 dBA during the short-term noise measurements.

Figure 7 shows a histogram of the measured noise events at Location LT-1 with a maximum noise level (L_{max}) of 73 dBA or greater. Most of the noise events in the histogram are due to train passbys (e.g. horns, crossing bells). Since the residential project site is in between two at-grade roadway crossings (4th and 5th Avenues), trains are required to sound their horn as they pass the site. The sound of train horns were the loudest events (with a typical L_{max} of about 103 dBA at Location LT-1). The crossing bells generated a maximum instantaneous noise level of approximately 77 dBA at Location LT-1.

Figure 4: Noise Measurement Locations

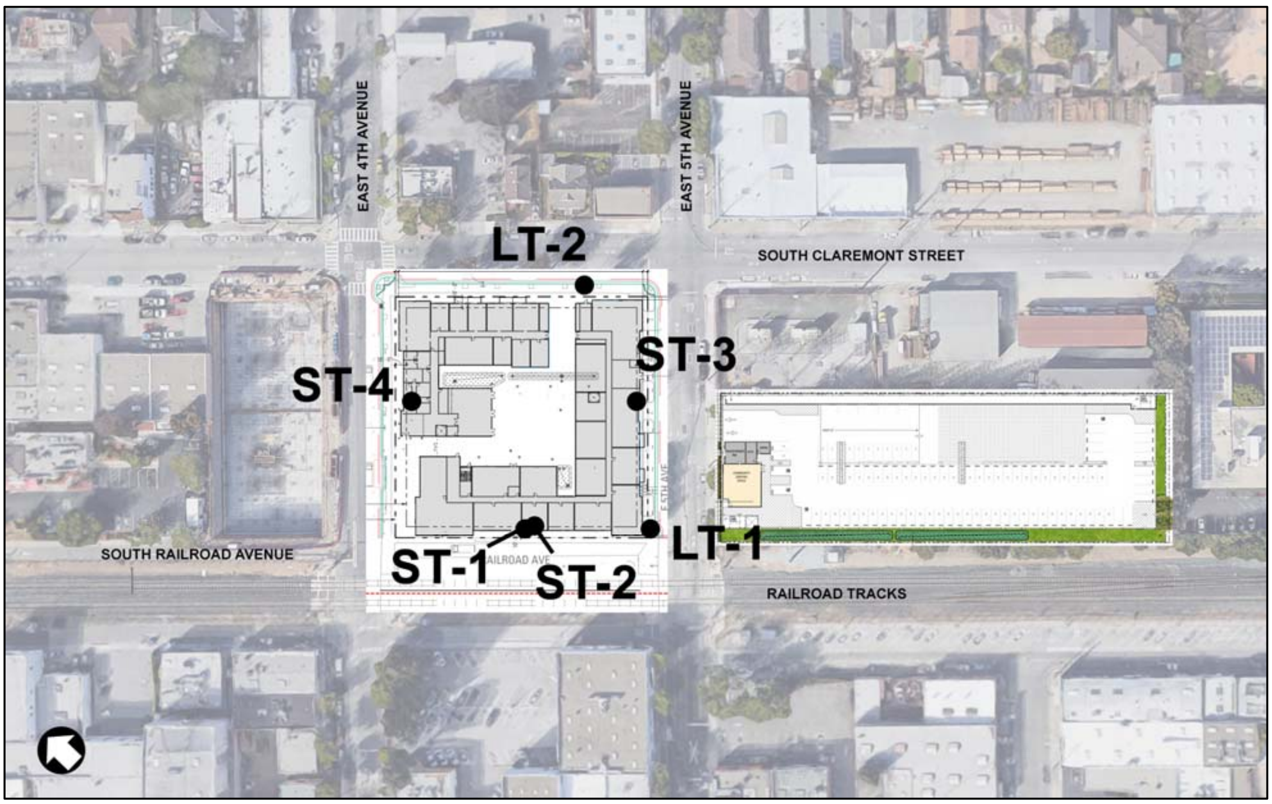


Figure 5: Long-Term Noise Measurement Results - Location LT-1
L_{dn} 83 dBA

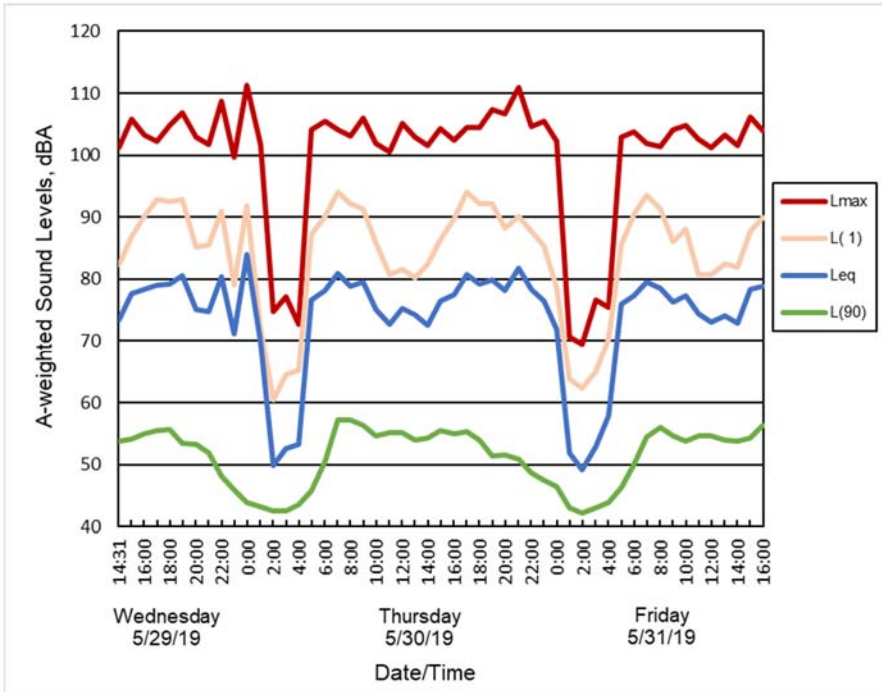


Figure 6: Long-Term Noise Measurement Results - Location LT-2
L_{dn} 73 dBA

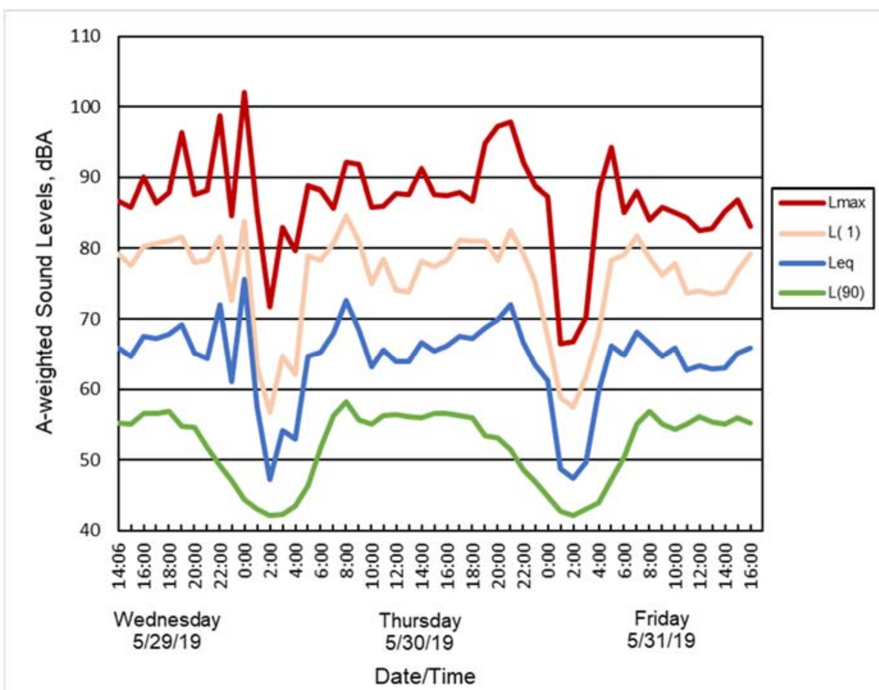
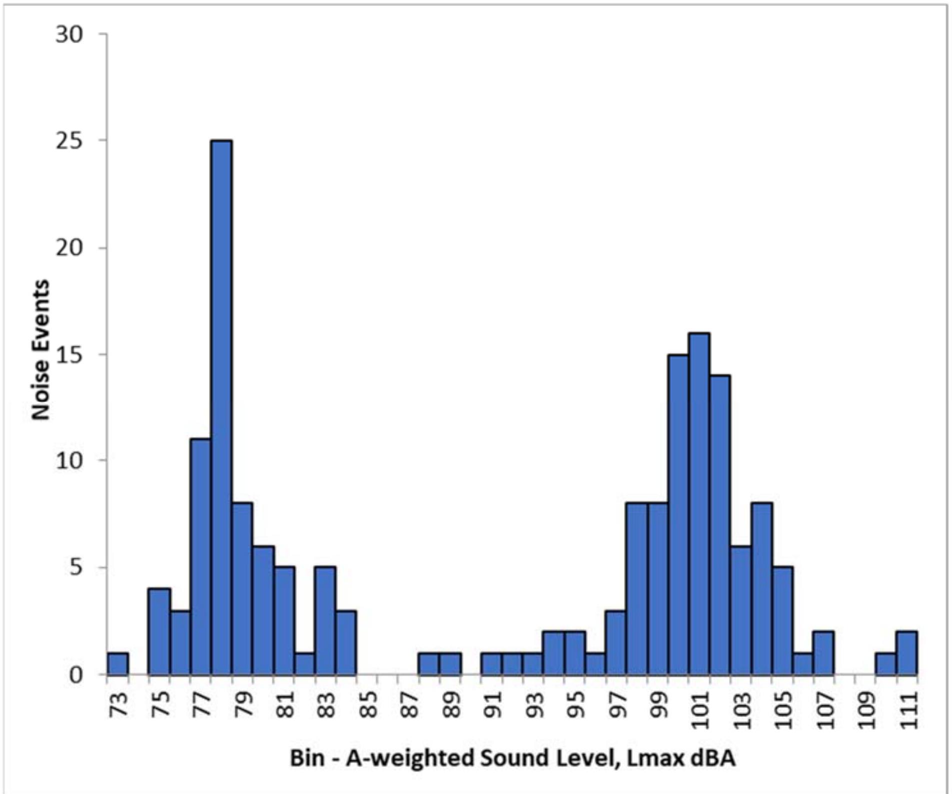


Table 7: Short Term Noise Measurements

Location	Height Above Ground	Date/Time	A-weighted Sound Level, dBA				L_{max} (dBA)
			L_{eq}	L_{50}	L_{90}	L_{dn}*	
ST-1 Approximately 12 feet from the west property line (facing Railroad Avenue)	24 feet	30 May 2019 3:09 PM – 3:25 PM	79	59	56	81	Train Engine: 83 Rail Passenger: 76 Train Horn: 100, 94, 94
ST-2 Approximately 12 feet from the west property line (facing Railroad Avenue)	12 feet	31 May 2019 4:14 PM – 4:36 PM	74	58	55	79	Train Horn: 97, 91, 96 Crossing Bells: 76
ST-3 Setback of project residential building from 5th Avenue	5 feet	30 May 2019 3:35 PM – 3:50 PM	64	58	53	74	Traffic: 63, 68, 73 Train Horn: 84
ST-4 Approximately 44 feet from the 4th Avenue roadway centerline	5 feet	30 May 2019 3:53 PM – 4:08 PM	64	57	53	71	Traffic: 65, 70 Heavy Truck: 65 Crossing Bells: 61 Train Horn: 85

*L_{dn} values based on correlation with simultaneous measurement at Long-term monitor locations.

Figure 7: Histogram of Noise Events with L_{max} 73 dBA or Greater in One day – 30 May 2019



4.2. Future Noise Levels due to Roadway Traffic

The project's traffic study indicates an increase in traffic volumes in the "cumulative + project" condition compared to the existing condition. The "cumulative + project" condition includes traffic increase due to the project as well as growth in the area in the future. Traffic volumes for the roadways surrounding the project site show an expected traffic volume increase of 20% along 4th Avenue, 27% along 5th Avenue, and 23% along Claremont Street. Based on a standard rate of 3 dB per doubling for line sources, traffic noise is calculated to increase by approximately 1 dBA in the "cumulative + project" condition.

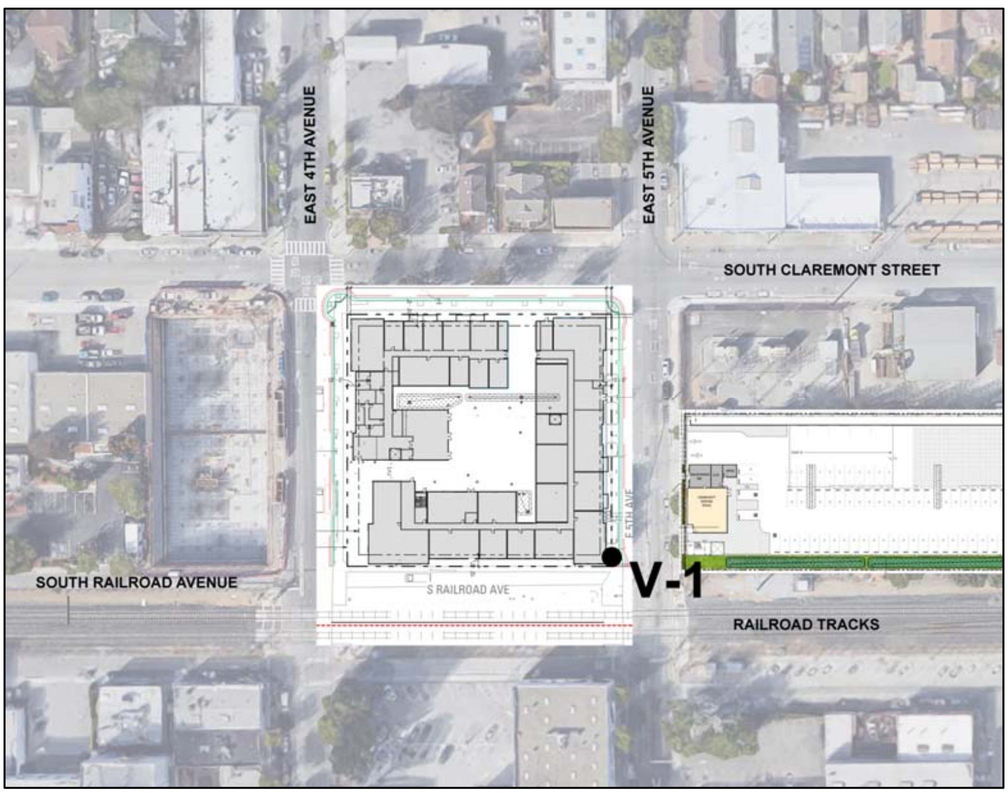
4.3. Future Noise Levels due to Railroad Activities

Caltrain is planning for the electrification of the Caltrain line between San Francisco and San Jose. Although the trains themselves will be somewhat quieter due to the electric propulsion, the train noise is dominated by the train horns required because of the nearby at-grade crossings. The train horn noise is not expected to change. According to the Peninsula Corridor Electrification Project FEIR (Appendix C), the number of total daily trains will increase from 92 to 114 trains per day with the electrification project,. There will be 23 additional trains during the daytime hours (7 AM to 10 PM) and one fewer train during the nighttime (10 PM to 7 AM). This change in number of trains corresponds to an increase in L_{dn} of less than 1 dBA.

4.4. Ground Vibration Measurements

Ground vibration measurements were made at Location V-1 from May 30, 2019 to May 31, 2019 (1 day) to document the vibration levels generated by trains. Location V-1 is approximately 6 feet from the property line. Figure 8 shows the vibration measurement location. The proposed building is 6 feet from the property line except at the corners of the building which are as close as about 2 feet from the property line. There are two tracks in the railroad right-of-way. The centerline of the tracks are 41 feet and 60 feet from the property line. Therefore, the track centerlines are approximately 43 to 62 feet from the nearest edge of proposed building.

Figure 8: Vibration Measurement Location

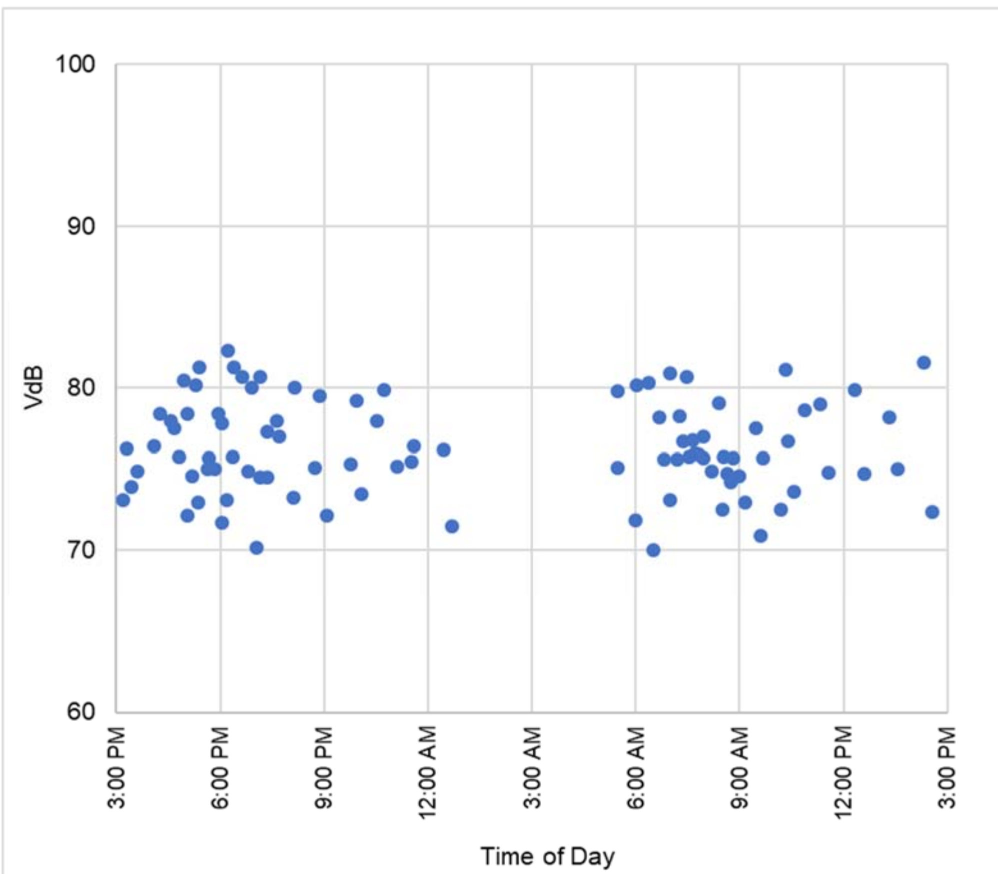


According to the Caltrain schedule (Effective April 1, 2019), there are a total of 92 Caltrains that passby the San Mateo Station (and the project site) throughout the day with 70 stopping at the San Mateo Station. According to information from the City website, Caltrain service operates within the City of San Mateo from approximately 5:00 AM to 1:00 AM on weekdays and approximately 8:00 AM to 1:00 AM on weekends. The Caltrain passby duration is about 15 seconds.

Union Pacific service operates from approximately 7:30 PM to 4:00 AM. During the monitoring period, we identified three freight train passbys on May 30, 2019 at 7:37 PM, 9:55 PM, and 10:31 PM. Two of the freight trains had a passby duration of 20 to 26 seconds and one of them had a passby duration of approximately 1 minute. All of the trains we observed traveled at relatively slow speeds, about 30 mph.

Measured ground vibration levels generated by passing trains ranged from 70 VdB to 82 VdB. Figure 9 shows a chart of the measured vibration events in a 24-hour time period. Section 5 provides detailed information on vibration levels that would be experienced inside the building for comparison with FTA impact criteria.

Figure 9: Measured Vibration Events in 24-Hour Period – 30-31 May 2019 Location V1



4.5. Future Vibration Levels due to Railroad

According to the Peninsula Corridor Electrification Project EIR, "Although the exact unsprung weight of the EMU (electric multiple unit) vehicles isn't known at this time, it would not be significantly greater than the weight of the existing Caltrain vehicles. Therefore, the EMU vehicles would not result in greater vibration levels than the existing train. Furthermore, because there would be no diesel locomotives associated with EMU trains, vibration caused by existing locomotives would be reduced."

Since the amount of the potential vibration reduction is not stated in the EIR, no adjustment is made to the measured vibration levels for the analysis of the compatibility of the subject project.

5. Land Use Compatibility

Based on the analysis, the future noise exposure at the project building will be up to a L_{dn} 83 dBA at the façade facing the railroad tracks. According to the City's Land Use Compatibility Guidelines, a noise exposure greater than L_{dn} 70 dBA is considered "normally unacceptable" for multi-family residential and "should be discouraged". If new development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.

In the following excerpt, the General Plan acknowledges that new residential development that border the railway line are exposed to very high noise levels but does not preclude development as long as interior noise levels are adequately reduced.

> *A few of San Mateo's residential neighborhoods that border highways, El Camino Real (SR 82), and the railway line are subject to sound levels exceeding 70 dB (L_{dn}), which is in the "normally unacceptable" range for "noise-sensitive" uses. Rather than precluding new residential development in these areas, the City will require that building construction techniques be utilized that reduce interior sound to 45 dB (L_{dn}) or less.*

5.1. Indoor Noise at Residential Units

Achieving the City and State interior residential noise standard of L_{dn} 45 dBA or less would require the use of sound-rated windows (and/or exterior doors) and would likely also require acoustical upgrades to the exterior wall assembly. This interior standard is consistent with the HUD's interior noise goal of L_{dn} 45 dBA.

Based on preliminary analysis of a standard bedroom (revised conceptual plans dated 12/20/2019), windows with a sound rating of up to STC 42 and exterior wall assemblies up to STC 55 are likely to be required to meet the interior noise standard of L_{dn} 45 dBA.

Any balcony doors should also achieve the same sound ratings as the windows. Corner units and units with a larger percentage of window area would require higher STC ratings.

The window sound ratings are preliminary estimates that are intended to indicate the feasibility of meeting the interior noise level requirements. The window and balcony door sound ratings along with the final exterior wall construction that are included in the construction documents should be determined by an acoustical consultant during the detailed architectural design phase and the final STC ratings may differ from those presented herein.

It is also helpful to consider the maximum instantaneous noise levels (L_{max}) generated by trains in dwelling units because of the potential for interference with sleep and other activities. Although the City of San Mateo and the State of California do not have maximum instantaneous noise level criteria for single-events such as train passbys, it should be noted that meeting the minimum interior noise standard of L_{dn} 45 dBA would result in typical maximum instantaneous noise levels of approximately L_{max} 65 dBA at units closest to the rail line. An L_{max} of 65 dBA could interfere with daily activities such as watching TV and disrupt sleep for some building occupants.

Required Noise Control Measure #1:

A detailed analysis should be prepared by a qualified acoustical consultant to determine the noise insulation requirements on a unit-by-unit basis to meet the interior noise level requirement of an L_{dn} of 45 dBA or less at the dwelling units.

The windows and balcony doors in the dwelling units will need to be in the closed position to meet the required interior noise level. This closed window condition will need to be considered by the Mechanical Engineer in their determination of the outdoor air ventilation requirements for the dwelling units. The ventilation system must not compromise the noise reduction provided by the window and wall assembly.

Recommended Noise Control Measure #1:

Some cities have a standard for maximum instantaneous noise level from single events such as railroad passbys. Although there are no code requirements for single event noise applicable to this project, the applicant should consider the potential for sleep and activity interference due to single-event noise in the design of the project building. Achieving a single event noise goal would likely require window and exterior wall constructions with higher sound-ratings than needed to meet the code requirement. In addition, the nighttime train and whistle noise should be disclosed to project residents.

5.2. Indoor Noise at Non-Residential Units

Meeting the California Green Building Code (CalGreen) performance standard of interior hourly L_{eq} 50 dBA at the non-residential portions of the building will generally require less noise insulation than at the residential portion of the building. The proposed building would be exposed to a peak-hour L_{eq} of up to 81 dBA on the ground floor along South Railroad Avenue. Therefore, the occupied non-residential spaces of the building (e.g. offices, meeting rooms) would need to provide a noise reduction of 31 decibels.

Required Noise Control Measure #2:

Analysis of the noise insulation requirements should be made for the non-residential spaces such that the interior noise levels would meet the CalGreen requirement of hourly L_{eq} of 50 dBA. The noise insulation requirements in the detailed analysis must be incorporated into the building design.

5.3. Exterior Noise at Outdoor Space

The project includes exterior residential balconies and a primary common outdoor use space. Based on the ambient noise measurements, the exterior residential balconies will be noisy with noise exposure levels up to L_{dn} 82 dBA along the railroad facing façade, L_{dn} 71 dBA along the 4th Avenue facing façade, and L_{dn} 74 dBA along the 5th Avenue facing facade. The balconies facing South Claremont Street would be exposed to L_{dn} 65 dBA.

According to the City's General Plan Policy N1.2, maximum exterior noise should not exceed L_{dn} 67 dBA for residential uses and the project should incorporate necessary mitigation measures into residential project designs to minimize common open space noise levels. Since the balconies are not common outdoor space, they are not subject to the City's outdoor common noise standard. However, the balconies facing the railroad and along 4th and 5th Avenues would be exposed to noise levels greater than the HUD "Acceptable" noise level of L_{dn} 65 dBA.

The project's primary common use area is a courtyard in the center of the residential building. This space benefits from the acoustical shielding from traffic and trains provided by project building. Based on our computer model analysis (SoundPlan) which included a factor for acoustical reflections, geometric spreading, and the acoustical barrier effect provided by the project building, the outdoor use space would generally be exposed to an L_{dn} of 65 dBA or less from ambient noise sources.

Therefore, the project's primary common use area would generally meet the City's exterior noise level goal of L_{dn} 67 dBA for multi-family common open space and the HUD "Acceptable" noise exposure of an L_{dn} of 65 dBA or less.

5.4. Exposure *to Groundborne Vibration from Railroad*

The FTA's guidance manual provides a methodology to estimate future vibration levels in a building from rail vibration sources. Factors accounted for by this methodology include building structure type, building foundations type, attenuation and dispersion of vibration energy as it propagates through a building (i.e. upper floor typically experience lower vibration levels that lower floors), and amplification due to resonances of floors, walls and ceilings. These factors were applied to the measured railroad ground vibration levels to calculate the interior vibration levels in the project building. An increase of 0.8 VdB was included to account for the closer distance of the building corners to the railroad tracks than the measurement location (V-1). The calculation of this offset is based on the FTA's guidance manual data for vibration attenuation due to distance from the tracks.

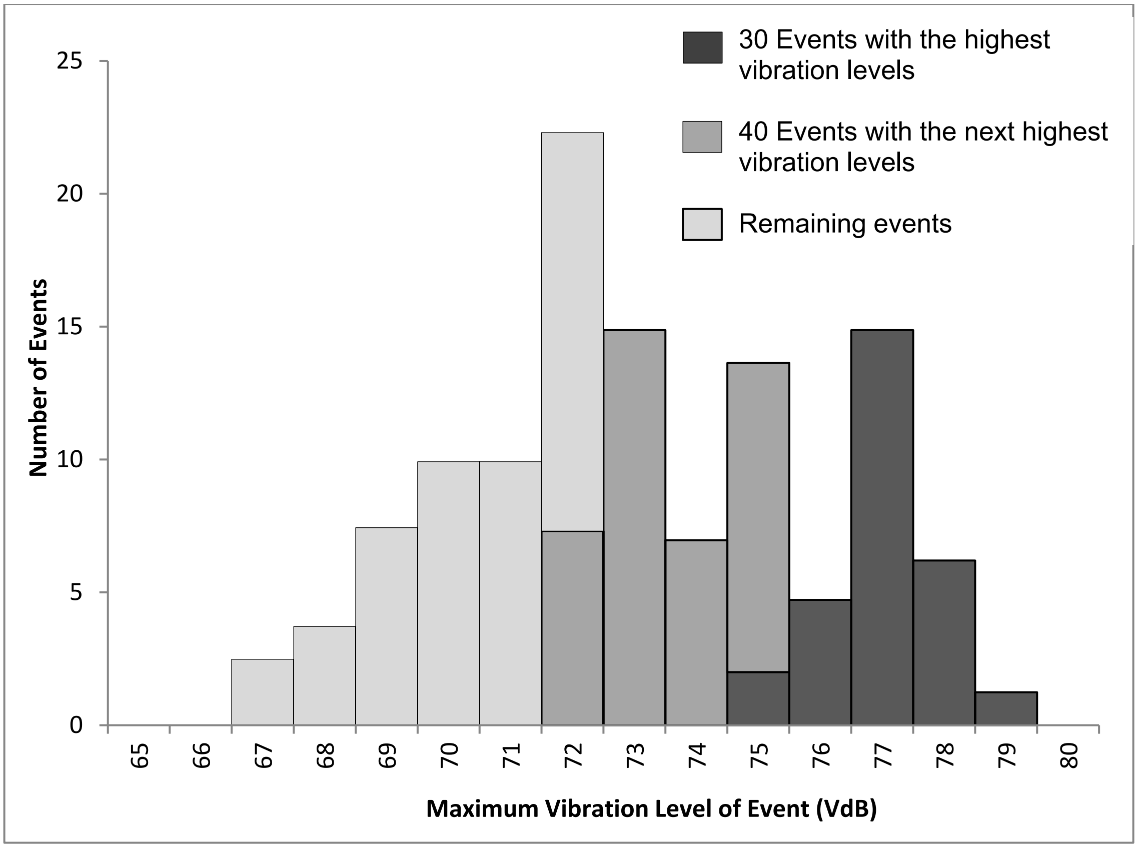
Table 8 summarizes the factors that were used and indicates that the vibration levels expected in the 2nd floor residential units along the side of the building closest to the tracks. The overall adjustment is -3.7 VdB between the measured ground vibration levels and units on the second floor. Units on other floors are expected to have an equal or greater (more reduction) overall adjustment.

Table 8: Interior Vibration Level Factors

Factor Affecting Vibration	**Adjustment**
Coupling to building foundation:	- 8.5 VdB
Floor-to-floor attenuation: Second Floor residential units	- 2 VdB per floor
Amplification due to resonances of floors	+ 6 VdB
Increase due to distance (building corners are closer to the tracks than measurement location (V1)	+ 0.8 VdB
Total Adjustment	- 3.7 VdB

The adjustments shown in Table 8 are applied to the ground vibration measurements to determine the expected interior vibration levels from trains at the project. Figure 10 shows a histogram of the predicted interior vibration levels expected in a 24-hour period. The histogram is annotated to group the vibration events by their frequency of occurrence.

Figure 9: Histogram of Predicted Indoor Vibration Levels in a 24-hour Period



The FTA vibration impact assessment methodology was developed to assess *new* transit projects affecting *existing* vibration receptors (e.g. residences) and does not strictly apply to the project that is the subject of this report: *new* residential vibration receptors (proposed project) near an *existing* rail corridor. Therefore, this report *adapts* the FTA vibration impact criteria to assess the compatibility of the proposed residential project while also considering the wide range of measured vibration levels during a 24-hour period.

For example, when using FTA methodology, vibration predictions for a new transit facility result in a single vibration level to assess the transit facility's impact at each receptor. That vibration level is assumed to occur each time a train passes by the vibration receptor and is simply compared to the FTA threshold that corresponds to the frequency of the expected passbys.

In contrast, our measurements of actual train passbys show that there is a relatively wide distribution of vibration levels and this requires some interpretation when applying the FTA criteria. The most conservative approach would be to count the number of passbys in a day and if that number is greater than 70 (as it is in this case) then apply the “frequent” threshold of 72 VdB. This approach would identify a vibration impact for this project. However, this approach would ignore the fact that fewer than 70 trains per day exceed the criterion for “frequent” events of 72 VdB. Likewise, fewer than 30 trains per day exceed the criterion for “occasional” events of 75 VdB and no trains exceed the criterion for “infrequent” events of 80 VdB. Therefore, this report *adapts* the FTA vibration impact criteria to consider this distribution of vibration levels from the passbys.

Table 9 compares the distribution of interior vibration levels to the FTA impact criteria thresholds for frequent, occasional and infrequent events (including the future addition of 22 trains with the electrification project). The vibration events (passbys) are categorized as shown in Figure 9; the 30 passbys with the highest vibration levels are considered “infrequent events”, the 40 passbys with the next highest vibration levels are considered “occasional” events and the remaining passbys are considered “frequent” events. The interior vibration levels are calculated for the areas of the building on the second floor closest to the railroad tracks. The vibration levels will be less on other floors or those farther from the railroad tracks.

Table 9 indicates that the predicted indoor vibration levels do not exceed the FTA impact criteria.

Table 9: Predicted Indoor Vibration Level Compared to FTA Impact Criteria

Impact Criterion Category	Range of Predicted Vibration Levels (VdB)	Impact Criterion Vibration Level (VdB)	Exceeds Impact Criterion
Frequent Events (more than 70 events per day)	72 or less	72	No
Occasional Events (30 – 70 events per day)	72 – 75	75	No
Infrequent Events (fewer than 30 events per day)	75 - 79	80	No

It should be noted that the 24-hour measurement period included three identified freight train passbys. The FTA criteria were developed for transit trains which have a relatively brief passby duration, the FTA suggests that when assessing vibration from a typical freight train "which lasts approximately two minutes" it is appropriate to assess the locomotive passby separately from the long duration of the railcar passby.

Table 10 shows a summary of the predicted interior freight train vibration levels based on the identified freight train passbys during the measurements. According to the FTA it is more appropriate to use the "frequent events" criterion of 72 VdB for the long duration of the passby of freight train railcars. The data shows that two of the freight train passby durations are similar to that of a Caltrain passby and the other passby had a longer duration of about a minute. These freight train passby durations are considerably shorter than the duration of "approximately two minutes" used by the FTA for "frequent" events.

Table 10 also shows the duration expected to exceed an interior vibration level of 72 VdB. Since this information indicates relatively brief vibration events from the freight trains, we conclude that it is reasonable to assess the freight train vibration levels along with the commuter vibration levels as per Table 9.

Table 10: Summary of Predicted Indoor Vibration Level from Freight Train

Date	Time of Day	Total Passby Duration	Seconds Above Interior 72 VdB	Maximum Vibration Level, VdB
5/30/2019	7:37 PM	26 seconds	12 seconds	74
	9:55 PM	56 seconds	16 seconds	76
	10:31 PM	20 seconds	10 seconds	74

Vibration Abatement Recommendation #1

Since the project will be exposed to feelable ground vibration from passing commuter and freight trains, the following recommendations are provided to reduce the potential for annoyance from vibration:

- The project sponsor should prepare a design level analysis of the railroad induced vibration levels in the project building. The study shall consider structural design features such as stiffening the floor constructions to avoid resonant frequencies below 25 Hz. If the study indicates that the FTA criteria will be exceeded the study should identify the areas of the building that are potentially affected.

- The owners shall disclose the potential vibration effects to residents that may be affected by train passbys.

6. CEQA Impact Analysis

This section evaluates the significance of environmental impact resulting from the project with respect to Appendix G of the CEQA Guidelines.

a) Would the project result in generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?

Land Use Compatibility

Based on a recent Supreme Court decision (CBIA v BAAQMD, issued December 17, 2015), evaluation of land use compatibility is not required in a CEQA study. Therefore, land use compatibility is addressed in the previous section and not in this CEQA Impact Analysis section.

Project-Generated Traffic Noise

Traffic data from the project's traffic study were used to calculate the increase in traffic noise due to the project. The traffic study data included turning movement counts for the existing condition, the existing plus project condition, the cumulative no project condition, and the cumulative plus project conditions for the surrounding intersections. Roadway traffic volumes were calculated using these turning movement counts and compared to the existing condition. As discussed in the previous section, traffic noise is calculated to increase by less than 1 dBA in the future along East 4th, East 5th and South Claremont Avenue.

Table 11 shows the increase in traffic noise due to the project by comparing the "existing" condition and the "existing plus project" condition. The increases due to the project are less than 1 dBA.

Table 11: Traffic Noise Increase

Roadway		Traffic Noise at 35 feet from Roadway Centerline (L_{dn}, dBA)		
		Existing	Existing + Project	Increase
3rd Avenue				
	west of El Camino Real	61.6	61.6	0.0
	El Camino Real to B St	60.9	60.8	-0.1
	B St to Claremont St	61.2	61.3	0.1
	Claremont St to Delaware St	61.5	61.7	0.2
	Delaware St to Fremont St	62.4	62.4	0.0
	Fremont St to Humboldt St	63.6	64.5	0.9
	Humboldt St to Norfolk St	67.1	67.4	0.3
	east of Norfolk St	66.7	66.7	0.0
4th Avenue				
	west of El Camino Real	59.8	59.8	0.0
	El Camino Real to B St	63.4	63.4	0.0
	B St to Claremont St	63.5	63.4	-0.1
	Claremont St to Delaware St	63.8	63.8	0.0
	Delaware St to Fremont St	65.4	65.5	0.1
	Fremont St to Humboldt St	66.5	66.6	0.1
	east of Humboldt St	67.9	68.0	0.1
5th Avenue				
	west of El Camino Real	60.5	60.5	0.0
	El Camino Real to San Mateo Dr	61.7	62.1	0.4
	San Mateo Dr to Ellsworth Ave	61.7	62.1	0.4
	Ellsworth Ave to B St	61.1	61.6	0.5
	B St to Claremont St	61.3	61.9	0.6
	Claremont St to Delaware St	61.2	61.7	0.5
	Delaware St to Fremont St	59.2	59.4	0.2
	Fremont St to Humboldt St	57.0	57.4	0.4
	east of Humboldt St	54.1	54.6	0.5
9th Avenue				
	El Camino Real to B St	60.3	60.3	0.0
	B St to Claremont St	62.5	62.5	0.0
	Claremont St to Delaware St	61.5	61.5	0.0
	Delaware St to Humboldt St	59.4	59.4	0.0
	east of Humboldt St	53.1	53.1	0.0
El Camino Real				

Roadway		Traffic Noise at 35 feet from Roadway Centerline (L_{dn}, dBA)		
		Existing	**Existing + Project**	**Increase**
	north of 3rd Ave	71.4	71.5	0.1
	3rd Ave to 4th Ave	71.6	71.6	0.0
	4th Ave to 5th Ave	71.6	71.6	0.0
	5th Ave to 9th Ave	71.8	71.9	0.1
	south of 9th Ave	71.9	71.9	0.0
San Mateo Drive				
	north of 5th Ave	59.2	59.2	0.0
Ellsworth Avenue				
	north of 5th Ave	56.4	56.4	0.0
B Street				
	north of 3rd Ave	59.8	59.8	0.0
	3rd Ave to 4th Ave	59.6	59.8	0.2
	4th Ave to 5th Ave	58.6	58.9	0.3
	5th Ave to 9th Ave	59.5	59.5	0.0
	south of 9th Ave	60.1	60.1	0.0
Claremont Street				
	north of 3rd Ave	58.2	58.2	0.0
	3rd Ave to 4th Ave	58.4	58.6	0.2
	4th Ave to 5th Ave	58.2	58.5	0.3
	5th Ave to 9th Ave	57.7	57.7	0.0
	south of 9th Ave	58.3	58.3	0.0
Delaware Street				
	north of 3rd Ave	62.8	62.9	0.1
	3rd Ave to 4th Ave	64.0	64.0	0.0
	4th Ave to 5th Ave	62.8	62.9	0.1
	5th Ave to 9th Ave	62.1	62.3	0.2
	south of 9th Ave	62.3	62.4	0.1
Fremont Street				
	north of 3rd Ave	61.2	61.2	0.0
	3rd Ave to 4th Ave	59.1	59.1	0.0
	4th Ave to 5th Ave	58.1	58.1	0.0
	south of 5th Ave	55.6	55.6	0.0
Humboldt Street				
	north of 3rd Ave	61.6	62.5	0.9

Roadway	Traffic Noise at 35 feet from Roadway Centerline (L_{dn}, dBA)		
	Existing	Existing + Project	Increase
3rd Ave to 4th Ave	60.6	60.7	0.1
4th Ave to 5th Ave	60.6	60.6	0.0
5th Ave to 9th Ave	58.4	58.4	0.0
south of 9th Ave	51.1	51.1	0.0

In the future, traffic will increase due to general growth in the area that is not directly related to the project. Table 12 shows the traffic noise levels under the “existing” condition, “cumulative no project” condition, and the “cumulative plus project” condition. Table 12 also shows the increase in traffic noise under the “cumulative plus project” condition relative to the “existing” condition as well as the project’s contribution to the increase.

In general, most of roadways would experience an increase of 1 dBA or less in the future with some sections of the roadways experiencing an increase of more than 1 dBA but less than 2 dBA. Additionally, the project’s contribution to the increase in future roadway noise levels are less than 1 dBA at all the roadways in the study.

This a less than significant impact.

Table 12: Cumulative Traffic Noise Increase

Roadway		Traffic Noise at 35 feet from Roadway Centerline (L_{dn}, dBA)				
		Existing	Cumulative no Project	Cumulative + Project	Increase: Existing to Cumulative with Project	Project Contribution to Increase
3rd Avenue						
	west of El Camino Real	61.6	61.9	61.9	0.3	0.0
	El Camino Real to B St	60.9	61.8	61.7	0.8	-0.1
	B St to Claremont St	61.2	61.9	62.0	0.8	0.1
	Claremont St to Delaware St	61.5	62.5	62.6	1.1	0.1
	Delaware St to Fremont St	62.4	63.1	63.2	0.8	0.1
	Fremont St to Humboldt St	63.6	65.1	65.1	1.5	0.0
	Humboldt St to Norfolk St	67.1	67.8	67.8	0.7	0.0
	east of Norfolk St	66.7	66.8	66.8	0.1	0.0
4th Avenue						
	west of El Camino Real	59.8	60.0	60.0	0.2	0.0
	El Camino Real to B St	63.4	64.4	64.4	1.0	0.0
	B St to Claremont St	63.5	64.3	64.3	0.8	0.0
	Claremont St to Delaware St	63.8	64.7	64.7	0.9	0.0
	Delaware St to Fremont St	65.4	66.0	66.1	0.7	0.1
	Fremont St to Humboldt St	66.5	67.0	67.1	0.6	0.1
	east of Humboldt St	67.9	68.5	68.6	0.7	0.1
5th Avenue						
	west of El Camino Real	60.5	61.0	61.0	0.5	0.0
	El Camino Real to San Mateo Dr	61.7	62.0	62.4	0.7	0.4
	San Mateo Dr to Ellsworth Ave	61.7	61.8	62.2	0.5	0.4
	Ellsworth Ave to B St	61.1	61.3	61.7	0.6	0.4
	B St to Claremont St	61.3	61.7	62.3	1.0	0.6
	Claremont St to Delaware St	61.2	61.6	62.1	0.9	0.5
	Delaware St to Fremont St	59.2	59.6	59.8	0.6	0.2
	Fremont St to Humboldt St	57.0	57.7	58.1	1.1	0.4
	east of Humboldt St	54.1	55.2	55.6	1.5	0.4
9th Avenue						
	El Camino Real to B St	60.3	61.4	61.4	1.1	0.0
	B St to Claremont St	62.5	63.6	63.6	1.1	0.0
	Claremont St to Delaware St	61.5	62.3	62.3	0.8	0.0
	Delaware St to Humboldt St	59.4	60.4	60.4	1.0	0.0

Roadway		Traffic Noise at 35 feet from Roadway Centerline (L_{dn}, dBA)				
		Existing	Cumulative no Project	Cumulative + Project	Increase: Existing to Cumulative with Project	Project Contribution to Increase
	east of Humboldt St	53.1	53.5	53.5	0.4	0.0
El Camino Real						
	north of 3rd Ave	71.4	71.5	71.6	0.2	0.1
	3rd Ave to 4th Ave	71.6	71.8	71.9	0.3	0.1
	4th Ave to 5th Ave	71.6	72.1	72.1	0.5	0.0
	5th Ave to 9th Ave	71.8	72.3	72.4	0.6	0.1
	south of 9th Ave	71.9	72.4	72.4	0.5	0.0
San Mateo Drive						
	north of 5th Ave	59.2	59.6	59.6	0.4	0.0
Ellsworth Avenue						
	north of 5th Ave	56.4	57.0	57.0	0.6	0.0
B Street						
	north of 3rd Ave	59.8	60.6	60.6	0.8	0.0
	3rd Ave to 4th Ave	59.6	60.0	60.1	0.5	0.1
	4th Ave to 5th Ave	58.6	59.5	59.6	1.0	0.1
	5th Ave to 9th Ave	59.5	60.8	60.8	1.3	0.0
	south of 9th Ave	60.1	61.4	61.4	1.3	0.0
Claremont Street						
	north of 3rd Ave	58.2	58.7	58.7	0.5	0.0
	3rd Ave to 4th Ave	58.4	59.6	59.7	1.3	0.1
	4th Ave to 5th Ave	58.2	58.8	59.1	0.9	0.3
	5th Ave to 9th Ave	57.7	58.5	58.5	0.8	0.0
	south of 9th Ave	58.3	59.0	59.0	0.7	0.0
Delaware Street						
	north of 3rd Ave	62.8	63.1	63.2	0.4	0.1
	3rd Ave to 4th Ave	64.0	64.5	64.5	0.5	0.0
	4th Ave to 5th Ave	62.8	63.3	63.4	0.6	0.1
	5th Ave to 9th Ave	62.1	62.9	63.0	0.9	0.1
	south of 9th Ave	62.3	63.2	63.4	1.1	0.2
Fremont Street						
	north of 3rd Ave	61.2	62.0	62.0	0.8	0.0
	3rd Ave to 4th Ave	59.1	59.8	59.8	0.7	0.0

Roadway		Traffic Noise at 35 feet from Roadway Centerline (L_{dn}, dBA)				
		Existing	Cumulative no Project	Cumulative + Project	Increase: Existing to Cumulative with Project	Project Contribution to Increase
Humboldt Street	*4th Ave to 5th Ave*	58.1	58.7	58.7	0.6	0.0
	south of 5th Ave	55.6	56.0	56.0	0.4	0.0
	north of 3rd Ave	61.6	62.7	62.8	1.2	0.1
	3rd Ave to 4th Ave	60.6	61.7	61.8	1.2	0.1
	4th Ave to 5th Ave	60.6	62.2	62.3	1.7	0.1
	5th Ave to 9th Ave	58.4	60.1	60.1	1.7	0.0
	south of 9th Ave	51.1	52.4	52.4	1.3	0.0

To determine the noise from the proposed parking lot, we constructed a 3D computer model using the noise modeling software SoundPLAN. The model considered factors including maximum number of parking spaces, acoustical reflections and distance to receivers. Based on the calculation results for a parking event (arriving or leaving a parking space) at all of the parking spots per hour, traffic noise in the parking lot would generate a L_{eq} of 42 to 44 dBA at the commercial lumber building, 50 dBA at the office to the southeast at 5 feet above ground (53 dBA at 15 feet above ground), and 52 dBA at the buildings to the southwest across the railroad tracks. Parking lot noise is expected to generate a less than 1 dBA increase in the existing L_{dn} at the surrounding buildings. In addition, for the adjacent commercial lumber building and the office building, the garage structure would provide some acoustical shielding from railroad noise.

According to the 2018 San Mateo Zoning Map, the nearest zones to the parking lot are commercial and noise levels from the parking lot are within the City's noise level standards identified in Section 7.30.040 of the municipal code.

This is considered a less than significant impact.

Project-Generated Operational Noise

The proposed project building is expected to have mechanical equipment generally associated with building ventilation/air-conditioning units but could also include an emergency engine-generator. The equipment would likely be located on the rooftops of the proposed buildings, or at-grade next to the buildings. At the time of this report, the details and locations of the mechanical equipment are not known and therefore, calculations of specific noise levels at surrounding uses cannot be made.

The large commercial systems that are often used in this type of building can generate high noise levels and therefore, they would have the potential to increase the noise levels at nearby noise sensitive receptors. Therefore, noise from mechanical equipment is considered a potentially significant impact. However, with the implementation of Mitigation Measure NO-1, this impact would be reduced to a less than significant level. This is a less than significant impact with mitigation.

With the implementation of Mitigation Measure NO-1, this is considered less than significant with mitigation.

Mitigation Measure NO-1

Analysis of noise from the project's mechanical equipment must be conducted to determine the noise reduction measures needed, if any, to meet the City of San Mateo Municipal Code Zoning Ordinance Noise Standards (Table 1 of this report).

Temporary Construction Noise

Construction will consist of Phase 1 (Garage Construction) and Phase 2 (Residential Building Construction). Phase 1 and Phase 2 construction are expected to be completed in 12.5 months and 17 months, respectively, with an overall construction period of 30.5 months.

Construction equipment will likely include excavators, backhoes, cranes, graders, trenchers, dump trucks, loaders, compactors, bulldozers, pavers, concrete trucks, air compressors, pneumatic equipment, roller compaction equipment, hand compaction equipment and other heavy machinery.

Table 13 presents typical construction equipment noise levels at a reference distance of 50 feet expected to be used for the project. Table 13 also shows the calculated noise levels at a distance of 25 feet using a standard rate for point sources of 6 dB per halving of distance. The noisier activities tend to occur during the demolition, grading and foundation phases of construction. The later construction phases of the residential building would generally generate lower noise levels when the construction activities occur indoors.

Table 13: Typical Construction Equipment Noise Levels

Equipment	Ref. Noise Level at 50 feet, dBA*	Adjustments for Distance at 25 feet	Noise Level at 25 feet, dBA
Backhoe	78	6	84
Compressor	78	6	84
Concrete Saw	90	6	**96**
Dozer	85	6	**91**
Dump Truck	76	6	82
Gradall	83	6	89
Flat Bed Trucks	74	6	80
Excavator	81	6	87
Vacuum Street Sweeper	82	6	88
Tractor	84	6	90
Front End Loader	79	6	85
Compactor (ground)	83	6	89
Scraper	84	6	90
Auger Drill Rig	84	6	90
Slurry Trenching Machine	80	6	86
Gradall	83	6	89
Generator	81	6	87
Pneumatic Tools	85	6	**91**
Welder/Torch	74	6	80
Pump	81	6	87
Crane	81	6	87
Concrete Mixer Truck	79	6	85
Man-lift	75	6	81
Roller	80	6	86
Paver	77	6	83

*Federal Transit Administration Manual, Construction Equipment Noise Emission Levels, 2006

According to the Municipal Code, the City allows construction to take place if the construction activities (authorized by a valid city permit) take place on weekdays between the hours of 7 AM and 7 PM, or on Saturdays between the hours of 9 AM and 5 PM, or on Sundays/Holidays between the hours of noon and 4 PM or other authorized hours by permit, provided the construction activities meet at least one of the following noise limitations:

1) No individual piece of equipment shall produce a noise level exceeding 90 dBA at a distance of 25 feet. If the device is housed within a structure or trailer on the property, the measurement shall be made outside the structure at a distance as close to 25 feet from the equipment as possible, or
2) The noise level at any point outside of the property plane of the project shall not exceed 90 dBA.
3) The operation of leaf blowers shall additionally comply with Chapter 10.80, Operation of Leaf Blowers.

Equipment such as a dozer, pneumatic tool and concrete saws would likely exceed 90 dBA at a distance of 25 feet. However, the aforementioned equipment are expected to be primarily used at distances of more than 50 feet from the property plane. At distances of 50 feet or more from the property plane, the equipment would not exceed 90 dBA. There may be times when the equipment could be used close to the property line. The loudest of the three, the concrete saw, is expected to be only used during the demolition phase for Phase 1 and Phase 2. Since there is a chance that the concrete saw and pneumatic tools could be used close to the perimeter of the site, they could exceed the property plane noise limit of 90 dBA and this would be a significant impact.

With the implementation of Mitigation Measure NO-2, this is considered less than significant with mitigation.

Mitigation Measure NO-2

In order to minimize disruption and potential annoyance during construction, the following is recommended:

- A construction noise logistics plan should be prepared that specifies hours of construction, noise and vibration minimization measures, posting or notification of construction schedules, and designation of a noise disturbance coordinator who would respond to neighborhood complaints will be required to be in place prior to the start of construction and implemented during construction.

- Construction activities, including the maintenance and warming of equipment, shall be limited to Monday through Saturday between the hours of 7:00 AM and 7:00 PM, Saturdays between the hours of 9:00 AM and 5:00 PM, and on Sundays and holidays between the hours of 12:00 PM and 4:00 PM, except otherwise approved by the City.

- All construction equipment shall be equipped with mufflers and sound control devices (e.g., intake silencers and noise shrouds) that are in good condition and appropriate for the equipment.
- Maintain all construction equipment to minimize noise emissions.
- Stationary equipment shall be located on the site so as to maintain the greatest possible distance to the sensitive receptors.
- Unnecessary idling of internal combustion engines should be strictly prohibited.
- Residential uses within 500 feet and commercial or office uses within 200 feet of the project site shall be notified of the construction schedule in writing.
- The construction contractor shall provide the name and telephone number an on-site construction liaison. In the event that construction noise is intrusive to the community, the construction liaison shall investigate the source of the noise and require that reasonable measures be implemented to correct the problem

b) Generation of excessive ground-borne vibration or ground-borne noise levels

Temporary Construction Vibration

The construction of the project is expected to generate groundborne vibration that could potentially affect nearby land uses. Table 14 presents typical vibration levels generated by various construction equipment in terms of PPV and RMS at a distance of 25 feet. Vibration generating construction activities would include demolition, excavation, grading, site preparation, paving, and building construction. Pile driving is not expected for this project.

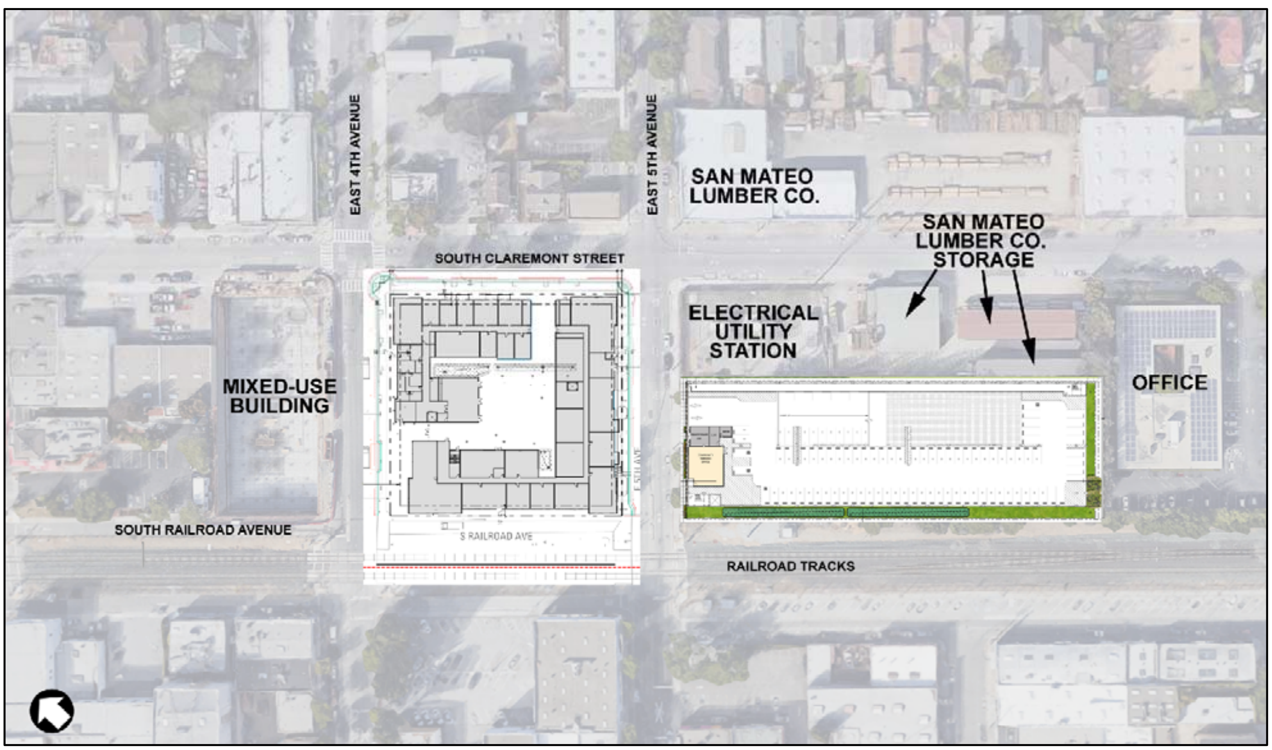
Vibration levels are dependent on the construction methods, soil conditions, equipment used and distance to the equipment. The nearest buildings from the project's residential building footprint are located at distances of 50 feet or more. For the construction of the garage building, the San Mateo Lumber Company has one building structure that is located near the project garage's north façade and two building structures located 35 feet or more from the project garage's north façade. To the east of the project garage, there is an office building that is approximately 23 feet from the project's east façade. Buildings across South Railroad Avenue are located at distances of 120 feet or more. Figure 11 shows the project buildings and the nearest surrounding structures.

Table 14: Vibration Source Levels for Construction Equipment

Equipment		PPV at 25 ft, in/sec	Approximate Lv* at 25 ft
Pile Driver (impact)	upper range	1.518	112
	typical	0.644	104
Pile Driver (sonic)	upper range	0.734	105
	typical	0.17	93
Clam shovel drop (slurry wall)		0.202	94
Hydromill (slurry wall)	in soil	0.008	66
	in rock	0.017	75
Vibratory Roller		0.21	94
Hoe Ram		0.089	87
Large bulldozer		0.089	87
Caisson drilling		0.089	87
Loaded trucks		0.076	86
Jackhammer		0.035	79
Small bulldozer		0.003	58

* RMS velocity in decibels, VdB re 1 micro-in/sec

Figure 11: Surrounding Land Uses



According to Caltrans' guideline criteria for building *damage* potential for modern industrial/commercial buildings and new residential structures, an appropriate threshold criterion for continuous/frequent intermittent vibration sources is 0.5 inches/second. The Caltrans' guideline for *annoyance* of 0.10 inches per second corresponds to "strongly perceptible". These thresholds are used to assess the potential for an impact due to building damage and annoyance from construction activities.

Based on the FTA's methodology for vibration propagation, Table 15 shows the predicted construction vibration levels from various equipment. The distances used in the calculation are the closest distance to the project buildings. For the San Mateo Lumber Company's storage structure located along the project garage's property line, a distance of 10 feet is used in the calculation.

Table 15 shows there is potential to exceed the construction vibration damage criteria at the storage structure nearest to the project garage which is potentially significant. Other nearest buildings are not expected to experience vibration levels exceeding the vibration damage potential. It should also be noted that for nearby occupied buildings (the office at 700 South Claremont Street) construction activities may, at times, generate vibration levels that could be annoying because they are calculated to exceed the threshold of 0.10 inches per second.

Table 15: Calculated Construction Vibration

	Mixed-use building across East 4th Avenue (under construction)	Electrical Utility Station	San Mateo Lumber Co. Storage	Closest San Mateo Lumber Co. Storage	Office – 700 South Claremont Street
Closest Distance to construction activities, feet	50	25	35	10	23
Construction Equipment	Peak Particle Velocity, inches/second				
Vibratory Roller	0.074	0.210	0.127	**0.830**	0.238
Hoe Ram	0.031	0.089	0.054	0.352	0.101
Large bulldozer	0.031	0.089	0.054	0.352	0.101
Caisson drilling	0.031	0.089	0.054	0.352	0.101
Loaded trucks	0.027	0.076	0.046	0.300	0.086
Jackhammer	0.012	0.035	0.021	0.138	0.040
Small Bulldozer	0.001	0.003	0.002	0.012	0.003
Damage Potential Threshold	0.5	0.5	0.5	0.5	0.5

With the implementation of Mitigation Measure NO-3, this is considered less than significant with mitigation.

Mitigation Measure NO-3

The project applicant shall submit a Construction Vibration Monitoring and Control Plan (Plan) prepared by an acoustical/vibration consultant, structural engineer or other appropriately qualified professional.

The Plan should identify protocols for project construction activities to maintain vibration levels at or below the potential for building damage threshold. The protocols could include continuous vibration monitoring during the phases of construction most likely to generate high vibration levels such as excavation and foundation phases.

A pre-construction survey of the storage building along the project garage's property line should also be conducted. The survey should include photo or video documentation. The Plan shall adopt a building damage vibration threshold of PPV 0.5 inches per second or identify an alternative threshold as appropriate based on the condition of the building and the actual construction equipment/activities.

Because the construction vibration analysis identifies the potential for construction vibration to cause annoyance at the adjacent existing office building at 700 S. Claremont St. (i.e. calculated PPV exceeds 0.10 inches per second), the Plan shall also identify project construction methods to maintain vibration levels below the annoyance threshold. If it is not feasible to limit construction vibration level to below the threshold, the Plan shall specify the expected periods that could result in annoyance and provide protocols for notifying the owner of the office building prior to those activities.

The Construction Vibration Monitoring and Control Plan (Plan) should be completed prior to grading or demolition activities.

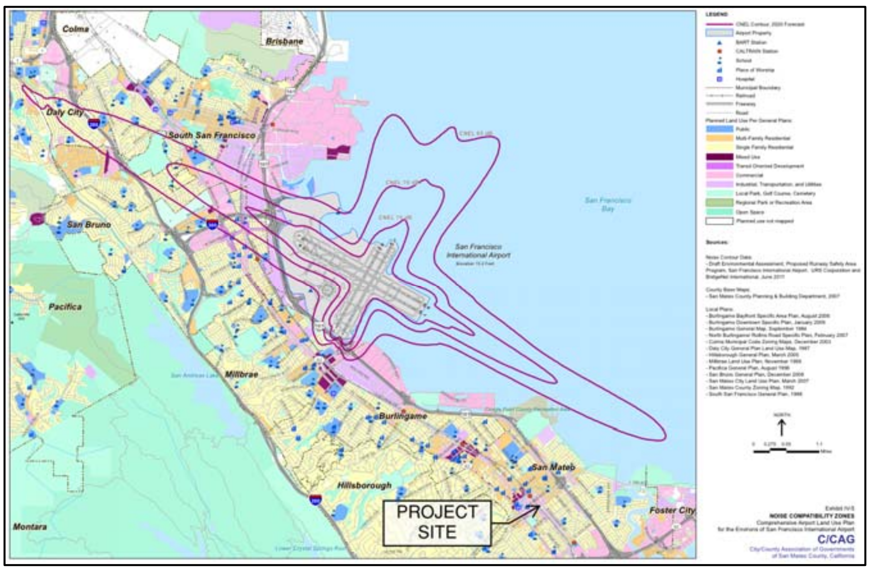
c) For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?

Less than Significant.

San Francisco International Airport

The 2012 Comprehensive Airport Land Use Compatibility Plan for the Environs of San Francisco International Airport (SFO ALUCP) has policies to ensure the appropriateness for proposed land uses. The project site is located within the Airport Influence Area A but outside the Airport Influence Area B. Per Policy IP-1, the project has real estate disclosure requirements. Policy NP-2 and Table IV-1 indicate that multi-family residential land use is considered compatible with aircraft noise below CNEL 65 dBA. Based on SFO ALUCP Exhibit IV-5 shown in Figure 12, the project is located outside the CNEL 65 dBA contour and therefore, the propose land use may be permitted without any special requirements related to the attenuation of aircraft noise.

Figure 12: San Francisco Airport Noise Contours



San Carlos Airport

The 2015 Comprehensive Airport Land Use Compatibility Plan for the Environs of San Carlos Airport (SQL ALUCP) has policies to ensure the appropriateness for proposed land uses. Based on SQL ALUCP Exhibit 4-2, the project site is located outside the future aircraft 60 dB noise contour. Per Noise Policy 1, the project's noise exposure to San Carlos Airport aircraft noise is considered consistent with the noise compatibility policies.

Private Airstrip

The project is not located within the vicinity of a private airstrip.

*   *   *