APPENDIX F

Noise and Vibration Assessment

PENINSULA HEIGHTS
NOISE AND VIBRATION ASSESSMENT

San Mateo, California

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Prepared for:

Mike Campbell, AICP, CPSWQ
David J. Powers & Associates, Inc.
1871 The Alameda, Suite 200
San José, CA 95126

Prepared by:

Steve J. Deines
Dana M. Lodico, PE, INCE Bd. Cert.

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality
429 E. Cotati Avenue
Cotati, CA 94931
(707) 794-0400

I&R Project: 20-104

INTRODUCTION

The Peninsula Heights Project plans to redevelop an existing and underused 26-acre office park located on a hillside between California State Route 92 (SR 92) and the Peninsula Golf and Country Club in San Mateo, California. Four of the existing six offices would be demolished to allow for construction of a 290-unit residential development consisting of three-story and four-story townhomes, stacked flats, single-family residences, 6 "pocket" parks, and a series of paths and landscaping to connect the development to the surrounding neighborhood.

This report evaluates the Project's potential to result in significant noise impacts with respect to applicable California Environmental Quality Act (CEQA) guidelines. The report is divided into three sections: 1) the Setting Section provides a brief description of the fundamentals of environmental noise and vibration, summarizes applicable regulatory criteria, and discusses the results of the ambient noise monitoring survey completed to document existing noise conditions; 2) the General Plan Consistency section discusses land use compatibility utilizing noise policies in the City's General Plan; and, 3) the Impacts and Mitigation Measures Section describes the significance criteria used to evaluate project impacts, provides a discussion of each project impact, and presents mitigation measures, where necessary, to reduce the impacts to less than significant.

SETTING

Fundamentals of Environmental Noise

Noise may be defined as unwanted sound. Noise is usually objectionable because it is disturbing or annoying. The objectionable nature of sound could be caused by its *pitch* or its *loudness*. *Pitch* is the height or depth of a tone or sound, depending on the relative rapidity (*frequency*) of the vibrations by which it is produced. Higher pitched signals sound louder to humans than sounds with a lower pitch. *Loudness* is intensity of sound waves combined with the reception characteristics of the ear. Intensity may be compared with the height of an ocean wave in that it is a measure of the amplitude of the sound wave.

In addition to the concepts of pitch and loudness, there are several noise measurement scales which are used to describe noise in a particular location. A *decibel (dB)* is a unit of measurement which indicates the relative amplitude of a sound. The zero on the decibel scale is based on the lowest sound level that the healthy, unimpaired human ear can detect. Sound levels in decibels are calculated on a logarithmic basis. An increase of 10 decibels represents a ten-fold increase in acoustic energy, while 20 decibels is 100 times more intense, 30 decibels is 1,000 times more intense, etc. There is a relationship between the subjective noisiness or loudness of a sound and its intensity. Each 10 decibel increase in sound level is perceived as approximately a doubling of loudness over a fairly wide range of intensities. Technical terms are defined in Table 1.

There are several methods of characterizing sound. The most common in California is the *A-weighted sound level (dBA).* This scale gives greater weight to the frequencies of sound to which the human ear is most sensitive. Representative outdoor and indoor noise levels in units of dBA are shown in Table 2. Because sound levels can vary markedly over a short period of time, a method for describing either the average character of the sound or the statistical behavior of the variations must be utilized. Most commonly, environmental sounds are described in terms of an

average level that has the same acoustical energy as the summation of all the time-varying events. This *energy-equivalent sound/noise descriptor* is called L_{eq}. The most common averaging period is hourly, but L_{eq} can describe any series of noise events of arbitrary duration.

The scientific instrument used to measure noise is the sound level meter. Sound level meters can accurately measure environmental noise levels to within about plus or minus 1 dBA. Various computer models are used to predict environmental noise levels from sources, such as roadways and airports. The accuracy of the predicted models depends upon the distance the receptor is from the noise source. Close to the noise source, the models are accurate to within about plus or minus 1 to 2 dBA.

Since the sensitivity to noise increases during the evening and at night -- because excessive noise interferes with the ability to sleep -- 24-hour descriptors have been developed that incorporate artificial noise penalties added to quiet-time noise events. The *Community Noise Equivalent Level* (*CNEL*) is a measure of the cumulative noise exposure in a community, with a 5 dB penalty added to evening (7:00 pm - 10:00 pm) and a 10 dB addition to nocturnal (10:00 pm - 7:00 am) noise levels. The *Day/Night Average Sound Level* (*DNL* or L_{dn}) is essentially the same as CNEL, with the exception that the evening time period is dropped and all occurrences during this three-hour period are grouped into the daytime period.

Effects of Noise

Sleep and Speech Interference

The thresholds for speech interference indoors are about 45 dBA if the noise is steady and above 55 dBA if the noise is fluctuating. Outdoors the thresholds are about 15 dBA higher. Steady noises of sufficient intensity (above 35 dBA) and fluctuating noise levels above about 45 dBA have been shown to affect sleep. Interior residential standards for multi-family dwellings are set by the State of California at 45 dBA L_{dn}. Typically, the highest steady traffic noise level during the daytime is about equal to the L_{dn} and nighttime levels are 10 dBA lower. The standard is designed for sleep and speech protection and most jurisdictions apply the same criterion for all residential uses. Typical structural attenuation is 12-17 dBA with open windows. With closed windows in good condition, the noise attenuation factor is around 20 dBA for an older structure and 25 dBA for a newer dwelling. Sleep and speech interference is therefore possible when exterior noise levels are about 57-62 dBA L_{dn} with open windows and 65-70 dBA L_{dn} if the windows are closed. Levels of 55-60 dBA are common along collector streets and secondary arterials, while 65-70 dBA is a typical value for a primary/major arterial. Levels of 75-80 dBA are normal noise levels at the first row of development outside a freeway right-of-way. In order to achieve an acceptable interior noise environment, bedrooms facing secondary roadways need to be able to have their windows closed, those facing major roadways and freeways typically need special glass windows.

Annoyance

Attitude surveys are used for measuring the annoyance felt in a community for noises intruding into homes or affecting outdoor activity areas. In these surveys, it was determined that the causes for annoyance include interference with speech, radio and television, house vibrations, and

interference with sleep and rest. The L_{dn} as a measure of noise has been found to provide a valid correlation of noise level and the percentage of people annoyed. People have been asked to judge the annoyance caused by aircraft noise and ground transportation noise. There continues to be disagreement about the relative annoyance of these different sources. When measuring the percentage of the population highly annoyed, the threshold for ground vehicle noise is about 50 dBA L_{dn}. At a L_{dn} of about 60 dBA, approximately 12 percent of the population is highly annoyed. When the L_{dn} increases to 70 dBA, the percentage of the population highly annoyed increases to about 25-30 percent of the population. There is, therefore, an increase of about 2 percent per dBA between a L_{dn} of 60-70 dBA. Between a L_{dn} of 70-80 dBA, each additional decibel increases the percentage of the population highly annoyed by about 3 percent. People appear to respond more adversely to aircraft noise. When the L_{dn} is 60 dBA, approximately 30-35 percent of the population is believed to be highly annoyed. Each decibel increase to 70 dBA adds about 3 percentage points to the number of people highly annoyed. Above 70 dBA, each decibel increase results in about a 4 percent increase in the percentage of the population highly annoyed.

Fundamentals of Groundborne Vibration

Ground vibration consists of rapidly fluctuating motions or waves with an average motion of zero. Several different methods are typically used to quantify vibration amplitude. One method is the Peak Particle Velocity (PPV). The PPV is defined as the maximum instantaneous positive or negative peak of the vibration wave. In this report, a PPV descriptor with units of mm/sec or in/sec is used to evaluate construction generated vibration for building damage and human complaints. Table 3 displays the reactions of people and the effects on buildings that continuous or frequent intermittent vibration levels produce. The guidelines in Table 3 represent syntheses of vibration criteria for human response and potential damage to buildings resulting from construction vibration.

Construction activities can cause vibration that varies in intensity depending on several factors. The use of pile driving and vibratory compaction equipment typically generates the highest construction related groundborne vibration levels. Because of the impulsive nature of such activities, the use of the PPV descriptor has been routinely used to measure and assess groundborne vibration and almost exclusively to assess the potential of vibration to cause damage and the degree of annoyance for humans.

The two primary concerns with construction-induced vibration, the potential to damage a structure and the potential to interfere with the enjoyment of life, are evaluated against different vibration limits. Human perception to vibration varies with the individual and is a function of physical setting and the type of vibration. Persons exposed to elevated ambient vibration levels, such as people in an urban environment, may tolerate a higher vibration level.

Structural damage can be classified as cosmetic only, such as paint flaking or minimal extension of cracks in building surfaces; minor, including limited surface cracking; or major, that may threaten the structural integrity of the building. Safe vibration limits that can be applied to assess the potential for damaging a structure vary by researcher. The damage criteria presented in Table 3 include several categories for ancient, fragile, and historic structures, the types of structures most at risk to damage. Most buildings are included within the categories ranging from “Historic and

some old buildings" to "Modern industrial/commercial buildings". Construction-induced vibration that can be detrimental to the building is very rare and has only been observed in instances where the structure is at a high state of disrepair and the construction activity occurs immediately adjacent to the structure.

The annoyance levels shown in Table 3 should be interpreted with care since vibration may be found to be annoying at lower levels than those shown, depending on the level of activity or the sensitivity of the individual. To sensitive individuals, vibrations approaching the threshold of perception can be annoying. Low-level vibrations frequently cause irritating secondary vibration, such as a slight rattling of windows, doors, or stacked dishes. The rattling sound can give rise to exaggerated vibration complaints, even though there is very little risk of actual structural damage.

TABLE 1 Definition of Acoustical Terms Used in this Report

Term	Definition
Decibel, dB	A unit describing, the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for air is 20 micro Pascals.
Sound Pressure Level	Sound pressure is the sound force per unit area, usually expressed in micro Pascals (or 20 micro Newtons per square meter), where 1 Pascal is the pressure resulting from a force of 1 Newton exerted over an area of 1 square meter. The sound pressure level is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressures exerted by the sound to a reference sound pressure (e. g., 20 micro Pascals). Sound pressure level is the quantity that is directly measured by a sound level meter.
Frequency, Hz	The number of complete pressure fluctuations per second above and below atmospheric pressure. Normal human hearing is between 20 Hz and 20,000 Hz. Infrasonic sounds are below 20 Hz and Ultrasonic sounds are above 20,000 Hz.
A-Weighted Sound Level, dBA	The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise.
Equivalent Noise Level, L_{eq}	The average A-weighted noise level during the measurement period.
L_{max}, L_{min}	The maximum and minimum A-weighted noise level during the measurement period.
L_{01}, L_{10}, L_{50}, L_{90}	The A-weighted noise levels that are exceeded 1%, 10%, 50%, and 90% of the time during the measurement period.
Day/Night Noise Level, L_{dn} or DNL	The average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels to levels measured in the night between 10:00 pm and 7:00 am.
Community Noise Equivalent Level, CNEL	The average A-weighted noise level during a 24-hour day, obtained after addition of 5 decibels in the evening from 7:00 pm to 10:00 pm and after addition of 10 decibels to sound levels measured in the night between 10:00 pm and 7:00 am.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Intrusive	That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level.

Source: Handbook of Acoustical Measurements and Noise Control, Harris, 1998.

TABLE 2 Typical Noise Levels in the Environment

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	110 dBA	Rock band
Jet fly-over at 1,000 feet		
	100 dBA	
Gas lawn mower at 3 feet		
	90 dBA	
Diesel truck at 50 feet at 50 mph		Food blender at 3 feet
	80 dBA	Garbage disposal at 3 feet
Noisy urban area, daytime		
Gas lawn mower, 100 feet	70 dBA	Vacuum cleaner at 10 feet
Commercial area		Normal speech at 3 feet
Heavy traffic at 300 feet	60 dBA	
		Large business office
Quiet urban daytime	50 dBA	Dishwasher in next room
Quiet urban nighttime	40 dBA	Theater, large conference room
Quiet suburban nighttime		
	30 dBA	Library
Quiet rural nighttime		Bedroom at night, concert hall (background)
	20 dBA	
		Broadcast/recording studio
	10 dBA	
	0 dBA	

Source: Technical Noise Supplement (TeNS), California Department of Transportation, September 2013.

TABLE 3 Reaction of People and Damage to Buildings from Continuous or Frequent Intermittent Vibration Levels

Velocity Level, PPV (in/sec)	Human Reaction	Effect on Buildings
0.01	Barely perceptible	No effect
0.04	Distinctly perceptible	Vibration unlikely to cause damage of any type to any structure
0.08	Distinctly perceptible to strongly perceptible	Recommended upper level of the vibration to which ruins and ancient monuments should be subjected
0.1	Strongly perceptible	Threshold at which there is a risk of damage to fragile buildings with no risk of damage to most buildings
0.25	Strongly perceptible to severe	Threshold at which there is a risk of damage to historic and some old buildings.
0.3	Strongly perceptible to severe	Threshold at which there is a risk of damage to older residential structures
0.5	Severe - Vibrations considered unpleasant	Threshold at which there is a risk of damage to new residential and modern commercial/industrial structures

Source: Transportation and Construction Vibration Guidance Manual, California Department of Transportation, September 2013.

Regulatory Background

The project would be subject to noise-related regulations, plans and policies established by the State of California and the City of San Mateo. Applicable planning documents include Appendix G of the CEQA Guidelines, the San Mateo General Plan, and the San Mateo Municipal Code. Regulations, plans, and policies presented within these documents form the basis of the significance criteria used to assess project impacts.

State CEQA Guidelines. CEQA contains guidelines to evaluate the significance of effects of environmental noise attributable to a proposed project. Under CEQA, noise impacts would be considered significant if the project 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 groundborne vibration or groundborne 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, if the project would expose people residing or working in the project area to excessive noise levels.

Of these guidelines, items (a) and (b) are applicable to the proposed project. The project is not located in the vicinity of a public airport or private airstrip; therefore, checklist item (c) is not carried forward in this analysis.

2019 California Building Code, Title 24, Part 2. The current version of the California Building Code (CBC) requires interior noise levels attributable to exterior environmental noise sources to be limited to a level not exceeding 45 dBA L_{dn}/CNEL in any habitable room.

City of San Mateo General Plan: The Noise Element of the City of San Mateo General Plan sets forth goals and policies to control environmental noise and protect citizens from excessive noise exposure. The goals and policies relevant to this project are summarized below:

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

POLICIES:

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.

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.

GOAL 2: Minimize unnecessary, annoying and unhealthful noise.

POLICIES:

N 2.1: Noise Ordinance. Continue implementation and enforcement of 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.

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 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, excluding existing ambient noise levels.

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.

N 2.4: Traffic Noise. Recognize projected increases in ambient noise levels resulting from traffic increases. Promote the installation of noise barriers along highways where "noise-sensitive" land uses listed in Table N-1 are adversely impacted by unacceptable noise levels [60 dB (L_{dn}) or above]. Require adequate noise mitigation to be incorporated into the widening of SR 92 and US 101. Accept noise increases on El Camino Real at existing development, and require new multi-family development to provide common open space having a maximum exterior noise level of 67 dB (L_{dn}).

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 (Leq) for peak hour.

City of San Mateo Municipal Code: The Noise Regulations of the San Mateo Municipal Code, Chapter 7.30 are set forth to protect the inhabitants of the City against all forms of nuisances.

Section 7.30.040 Maximum Permissible Sound Levels. 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 for a cumulative period of more than thirty minutes in any hour;
(2) The noise level standard plus five dB for a cumulative period of more than fifteen minutes in any hour;
(3) The noise level standard plus ten dB for a cumulative period of more than five minutes in any hour;
(4) The noise level standard plus fifteen 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 twenty dB for any period of time.

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

Table 7.30.040: Noise Level Standards

Noise Zone	Time Period	Noise Level, dBA
Noise Zone 1	10 p.m.--7 a.m.	50
	7 a.m.--10 p.m.	60
Noise Zone 2	10 p.m.--7 a.m.	55
	7 a.m.--10 p.m.	60
Noise Zone 3	10 p.m.--7 a.m.	60
	7 a.m.--10 p.m.	65
Noise Zone 4	Anytime	70

Section 7.30.060 Special Provisions. Construction, alteration, repair, or land development activities authorized by a valid city permit shall be allowed at the following times:

- Weekdays: between 7:00 a.m. and 7:00 p.m.
- Saturdays: between 9:00 a.m. and 5:00 p.m.
- Sundays and Holidays: between 12:00 p.m. and 4:00 p.m.
- Or at other such hours as authorized or restricted by the permit, so long as they meet the following conditions:

    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 on the property, the measurement shall be made outside the structure at a distance as close to 25 feet as possible.

2. The noise level outside of any point outside the property plane of the project shall not exceed 90 dBA.

Existing Noise Environment

The project site, shown in Figure 1, is located on a hillside east of SR 92, west of the Peninsula Golf and Country Club, and is bisected by Campus Drive. The site plan is divided into two northern and two southern parcels. Existing uses in the vicinity of the project include office buildings bordering the site to the east and west, commercial uses to the south, single-family residences to the north, and more distant single-family residences to the east.

Due to the COVID-19 pandemic, a current noise monitoring survey to characterize the noise environment of the site was unable to be conducted for this study. The existing noise environment was determined through noise modeling and review of traffic noise contours provided in the Draft Environmental Impact Report completed for the City of San Mateo General Plan (DEIR)[1]. The DEIR identifies distances to traffic noise contours of 276 feet for the 70 dBA L_{dn} contour and 1,283 feet for the 60 dBA L_{dn} contour for the segment of SR 92 nearest the site. These contour distances assume an at-grade roadway alignment with no intervening shielding.

Traffic volumes for segments of SR 92 in the vicinity of the project site were obtained from Caltrans via the Traffic Census Program[2] and traffic volumes for Campus Drive were obtained from the project's traffic study, completed by Kittelson & Associates. These volumes were used to model traffic noise at the site and were validated using the contour distances specified in the DEIR. Traffic noise was modeled using Federal Highway Administration Traffic Noise Model 2.5 implemented in SoundPLAN 8.2. Sound PLAN is a three-dimensional noise modeling software that considers site geometry, the characteristics of noise sources, and shielding from structures, barriers, and terrain.

Based on review of General Plan contours and SoundPLAN noise modeling, the existing noise environment at the project site is characterized primarily by vehicular traffic along SR 92 and Campus Drive. The northern and southern halves of the site are located approximately 330 feet and 875 feet east of the centerline of SR 92, respectively. As the site is located on a hilltop east of SR 92, the intervening terrain between the highway and the site provides a substantial reduction in traffic noise. Noise reduction provided by intervening terrain and buildings was not accounted for in DEIR noise contour calculations, and therefore the project site experiences lower noise levels than what would otherwise be estimated based on distance attenuation alone. Results of the noise model created for the project indicate that existing noise levels at the site vary with proximity to SR 92 and Campus Drive, reaching 46 to 58 dBA L_{dn}. The highest calculated noise levels at the site are located along Campus Drive and along the western property line of the northern half of the site nearest SR 92.

[1] City of San Mateo, *General Plan Update Draft Environmental Impact Report*, July 2009, https://www.cityofsanmateo.org/DocumentCenter/View/5216/4_6-Noise

[2] Caltrans, *Traffic Census Program: 2017 Traffic Volumes: Route 92-98*, Accessed 9/3/2020, Available: https://dot.ca.gov/programs/traffic-operations/census/traffic-volumes/2017/route-92-98

FIGURE 1 Location of Project Site

Source: Google Earth, 2020.

GENERAL PLAN CONSISTENCY ANALYSIS

Noise and Land Use Compatibility Thresholds

The Noise Element of the City of San Mateo General Plan sets forth goals and policies to control environmental noise and protect citizens from excessive noise exposure. The applicable policies were presented in detail in the Regulatory Background section and are summarized below for the proposed project:

- The City of San Mateo's "Normally Acceptable" exterior noise level objective is 59 dBA L_{dn} or less for residential land uses. Maximum exterior noise in multi-family outdoor activity areas intended for the use of residents should not exceed 67 dBA L_{dn}.

- The City of San Mateo's interior noise level limit is 45 dBA L_{dn} or less for residential land uses consistent with the requirements of the California Building Code.

Future Exterior Noise Environment

The future exterior noise environment at the project site would continue to be characterized by vehicular traffic along SR 92 and Campus Drive. The noise environment at the site would vary depending on the proximity to these roadways and shielding provided by intervening structures. Open space outdoor areas for residents are proposed throughout the project site.

Existing noise levels at the site range from 46 to 58 dBA L_{dn}. Based on the project's traffic study, future traffic levels along Campus Drive would decrease slightly following project construction. Therefore, there would be no expected future traffic noise increase along Campus Drive. According to the Traffic Operations Report for the State Route 92/El Camino Real Interchange PA/ED completed in 2013[3], future 2038 traffic volumes along SR 92 near the site are anticipated to increase and would result in an increase in traffic noise of approximately 2 dBA L_{dn}. However, due to the intervening terrain between the site and SR 92, the noise environment of the site would remain mostly unaffected.

Overall, the future noise environment at the site will remain mostly unchanged from existing conditions. Noise levels throughout the site are anticipated to continue to range between 46 and 58 dBA L_{dn}. These noise levels are within the "Normally Acceptable" ranges for single- and multi-family residential uses and the "Normally Acceptable" range for multi-family common open space as defined in Table N-1 of the City of San Mateo General Plan.

Future Interior Noise Environment

Interior noise levels would vary depending upon the design of the buildings (relative window area to wall area) and the selected construction materials and methods. Standard residential construction

[3] Fehr & Peers, *Traffic Operations Report for the State Route 92 (SR92)/El Camino Real (SR82) Interchange PA/ED*, October 2013, https://www.cityofsanmateo.org/DocumentCenter/View/46134/Traffic-Operations-Report

provides approximately 15 dBA of exterior-to-interior noise reduction, assuming the windows are partially open for ventilation. Standard construction with the windows closed provides approximately 20 to 25 dBA of noise reduction in interior spaces. Where exterior noise levels range from 60 to 65 dBA L_{dn}, the inclusion of adequate forced-air mechanical ventilation can reduce interior noise levels to acceptable levels by allowing occupants the option of closing the windows to control noise. Where noise levels exceed 65 dBA L_{dn}, forced-air mechanical ventilation systems and sound-rated construction methods are normally required. Such methods or materials may include a combination of sound-rated windows and doors, sound-rated exterior wall assemblies, and mechanical ventilation so windows may be kept closed at the occupant's discretion. Attaining the necessary noise reduction from exterior to interior spaces is readily achievable in noise environments less than 75 dBA L_{dn} with proper wall construction techniques, the selections of proper windows and doors, and the incorporation of forced-air mechanical ventilation systems.

Both the City of San Mateo and the California Building Code require that interior noise levels be maintained at 45 dBA L_{dn} or less for residences. The highest residential façade noise exposures are anticipated to reach approximately 57 dBA L_{dn} at the northwesternmost residences. Assuming a noise reduction of 15 dBA resulting from standard construction with windows partially open for ventilation, interior noise levels within residences would reach up to 42 dBA L_{dn}. Project plans indicate forced-air mechanical ventilation is to be provided for all proposed residential units. This would allow for residents to control ventilation with windows in a closed position, resulting in a greater reduction in interior noise. Future interior noise levels would not exceed 45 dBA L_{dn} and would be consistent with the City of San Mateo General Plan and the California Building Code.

NOISE IMPACTS AND MITIGATION MEASURES

This section describes the significance criteria used to evaluate project impacts under CEQA, provides a discussion of each project impact, and presents mitigation measures, where necessary, to provide a compatible project in relation to adjacent land uses.

Significance Criteria

The following criteria were used to evaluate the significance of environmental noise resulting from the project:

1. **Temporary or Permanent Noise Increases in Excess of Established Standards.** A significant impact would be identified if project construction or operations would result in a substantial temporary or permanent increase in ambient noise levels at sensitive receivers in excess of the local noise standards contained in the San Mateo General Plan or Municipal Code, as follows:

    a. Operational Noise in Excess of Standards. A significant noise impact would be identified if the project operations would generate noise levels that would exceed applicable noise standards presented in the San Mateo General Plan or Municipal Code.

    b. Permanent Noise Increase. A significant permanent noise increase would be identified if traffic generated by the project or project improvements/operations would substantially increase noise levels at sensitive receivers in the vicinity. The City of San Mateo defines a substantial increase to occur if the noise level increase is 3 dBA L_{dn} or greater. (Policy N-2.2)

    c. Temporary Noise Increase. A significant temporary noise increase would be identified if construction-related noise would result in noise levels exceeding the applicable noise standards presented in the San Mateo Municipal Code.

2. **Generation of Excessive Groundborne Vibration.** A significant impact would be identified if the construction of the project would generate excessive vibration levels. Groundborne vibration levels exceeding 0.3 in/sec PPV would have the potential to result in cosmetic damage to normal buildings (see Table 3).

Impact 1a: **Operational Noise in Excess of Established Standards.** Mechanical equipment operation would have the potential to exceed the applicable noise thresholds at existing noise-sensitive land uses in the project vicinity. **This is a potentially significant impact.**

Operational noise is limited to the levels specified in Table 7.30.040, adjusted for ambient conditions. Noise-sensitive uses in the site vicinity include single-family residences to the north and east and office buildings along the eastern and western property lines. Maximum permissible sound levels for residences would be that of Zone 1: 50 dBA between 10:00 p.m. and 7 a.m. and 60 dBA between 7:00 a.m. and 10:00 p.m. Maximum permissible sound levels for offices would be that of Zone 2: 55 dBA between 10:00 p.m. and 7 a.m. and 60 dBA between 7:00 a.m. and 10:00 p.m.

The proposed project would include mechanical equipment, such as heating, ventilation, and air conditioning (HVAC) systems. Information regarding the type and size of the mechanical equipment units to be used in the project was not available at the time of this study. A review of project site plans shows HVAC equipment will be located on rooftops and partially shielded by parapet walls. Typical air conditioning units and heat pumps for multi-level residential buildings range from about 50 to 60 dBA L_{eq} at a distance of 50 feet. The nearest sensitive receptors would be single-family residences located approximately 25 feet from HVAC equipment on the roof of the northernmost proposed residential building and 75 feet from HVAC equipment on the roof of residences along the western property line of the site's southern half. At a distance of 25 feet, the unmitigated HVAC equipment noise would reach 56 to 66 dBA $L_{eq.}$ At a distance of 75 feet, the unmitigated HVAC equipment noise would reach 46 to 56 dBA L_{eq}. If parapet walls along the perimeters of the proposed buildings are constructed without any gaps or cracks and have a minimum surface weight of 3 pounds per square foot (such as 1-inch-thick wood, ½-inch laminated glass, masonry block, concrete, or metal one-inch), they can be expected to provide a reduction in noise of about 10 to 15 dBA, resulting in noise levels at the nearest residences of approximately 41 to 56 dBA and at the nearest office of 31 to 46 dBA. Noise from HVAC equipment could exceed the daytime and nighttime hourly noise thresholds at adjacent uses. This is a **potentially significant impact**.

Mitigation Measure 1a:

Mechanical equipment shall be selected and designed to reduce impacts on surrounding uses to meet the City's noise level requirements. A qualified acoustical consultant shall be retained to review mechanical noise as these systems are selected to determine specific noise reduction measures necessary, if any, to reduce noise to comply with the City's noise level requirements. Noise reduction measures could include, but are not limited to, selection of equipment that emits low noise levels and the installation of noise barriers, such as enclosures or parapet walls to block the line-of-sight between the noise source and the nearest receptors.

Impact 1b: **Permanent Noise Level Increase.** Project-generated traffic would not cause a permanent noise level increase at existing noise-sensitive land uses in the project vicinity. **This is a less-than-significant impact.**

A significant noise impact would occur if traffic generated by the project would increase noise levels at sensitive receptors by 3 dBA L_{dn} or more. For reference, existing traffic volumes would have to double for noise levels to increase by 3 dBA L_{dn}. Traffic volumes for future cumulative scenarios with and without the project were analyzed to determine the project's potential to result in traffic noise increases. The project would result in an overall decrease in future traffic volumes, and therefore would not increase traffic noise. This is a **less-than-significant impact**.

Mitigation Measure 1b: **None required.**

Impact 1c: **Temporary Construction Noise.** Existing noise-sensitive land uses would be exposed to construction noise levels in excess of the significance thresholds. **This is a potentially significant impact**.

Section 7.30.060 of the City of San Mateo's Municipal Code limits construction to weekdays between 7:00 a.m. and 7:00 p.m., Saturdays between 9:00 a.m. and 5:00 p.m., and Sundays and holidays between 12:00 p.m. and 4:00 p.m. Additionally, the City specifies that no individual piece of equipment shall produce a noise level exceeding 90 dBA at a distance of 25 feet and that the noise level outside any point outside the property plane of the project shall not exceed 90 dBA.

Noise impacts resulting from construction depend upon the noise generated by various pieces of construction equipment, the timing and duration of noise-generating activities, and the distance between construction noise sources and noise-sensitive areas. Construction noise impacts primarily result when construction activities occur during noise-sensitive times of the day (e.g., early morning, evening, or nighttime hours), the construction occurs in areas immediately adjoining noise-sensitive land uses, or when construction lasts over extended periods of time.

Project construction is anticipated to occur over a period of about 18 to 24 months and would include demolition of existing structures and pavement, site preparation, grading and excavation, trenching and foundations, building erection, and paving. The hauling of excavated materials and construction materials would generate truck trips on local roadways. Pile driving would not be used as a means of construction.

Construction activities would be carried out in stages. During each stage of construction, there would be a different mix of equipment operating, and noise levels would vary by stage and vary within stages, based on the amount of equipment in operation and the location at which the equipment is operating. Typical construction noise levels at a distance of 50 feet are shown in Tables 4 and 5. Table 4 shows the average noise level ranges by construction phase and Table 5 shows the average and maximum noise level ranges for different construction equipment. Most demolition and construction noise falls with the range of 80 to 90 dBA at 50 feet from the source. Construction-generated noise levels drop off at a rate of about 6 dBA per doubling of the distance

between the source and receptor. Shielding by buildings or terrain can provide an additional 5 to 10 dBA noise reduction at distant receptors.

TABLE 4 Typical Ranges of Construction Noise Levels at 50 Feet, L_{eq} (dBA)

	Domestic Housing		Office Building, Hotel, Hospital, School, Public Works		Industrial Parking Garage, Religious Amusement & Recreations, Store, Service Station		Public Works Roads & Highways, Sewers, and Trenches	
	I	II	I	II	I	II	I	II
Ground Clearing	83	83	84	84	84	83	84	84
Excavation	88	75	89	79	89	71	88	78
Foundations	81	81	78	78	77	77	88	88
Erection	81	65	87	75	84	72	79	78
Finishing	88	72	89	75	89	74	84	84

I - All pertinent equipment present at site.
II - Minimum required equipment present at site.

♦ Source: U.S.E.P.A., Legal Compilation on Noise, Vol. 1, p. 2-104, 1973.

TABLE 5 Construction Equipment 50-foot Noise Emission Levels (dBA)

Equipment Category	$L_{eq}^{1,2,3}$	$L_{max}^{1,2}$	Equipment Category	$L_{eq}^{1,2,3}$	$L_{max}^{1,2}$
Air Hose	93	100	Horizontal Bore Drill	87	88
Air-Operated Post Driver	83	85	Impact Pile Driver	99	105
Asphalt Distributor Truck (Asphalt Sprayer)	-	70	Impact Wrench	68	72
Auger Drill	88	101	Jackhammer	91	95
Backhoe	76	84	Jig Saw	92	95
Bar Bender	66	75	Joint Sealer	-	74
Blasting (Abrasive)	100	103	Man Lift	72	73
Blasting (Explosive)	83	93	Movement Alarm	79	80
Chainsaw	79	83	Mud Recycler	73	74
Chip Spreader	-	77	Nail Gun	70	74
Chipping Gun	95	100	Pavement Scarifier (Milling Machine)	-	84
Circular Saw	73	76	Paving – Asphalt (Paver, Dump Truck)	-	82
Compactor (Plate)	-	75	Paving – Asphalt (Paver, MTV, Dump Truck)	-	83
Compactor (Roller)	82	83	Paving – Concrete (Placer, Slipform Paver)	87	91
Compressor	66	67	Paving – Concrete (Texturing/Curing Machine)	73	74
Concrete Batch Plant	87	90	Paving – Concrete (Triple Roller Tube Paver)	85	88
Concrete Grinder	-	97	Power Unit (Power Pack)	81	82
Concrete Mixer Truck	81	82	Pump	73	74
Concrete Pump Truck	84	88	Reciprocating Saw	64	66
Concrete Saw	85	88	Rivet Buster	100	107
Crane	74	76	Rock Drill	92	95
Directional Drill Rig	68	80	Rumble Strip Grinding	-	87
Drum Mixer	66	71	Sander	65	68
Dump Truck (Cyclical)	82	92	Scraper	-	92
Dump Truck (Passby)	-	73	Shot Crete Pump/Spray	78	87
Excavator	76	87	Street Sweeper	-	81
Flatbed Truck	-	74	Telescopic Handler (Forklift)	-	88
Front End Loader (Cyclical)	72	81	Vacuum Excavator (Vac-Truck)	86	87
Front End Loader (Passby)	-	71	Ventilation Fan	62	63
Generator	67	68	Vibratory Concrete Consolidator	78	80
Grader (Passby)	-	79	Vibratory Pile Driver	99	105
Grinder	68	71	Warning Horn (Air Horn)	94	99
Hammer Drill	72	75	Water Spray Truck	-	72
Hoe Ram	92	99	Welding Machine	71	72

Notes: [1] Measured at 50 feet from the construction equipment, with a “slow” (1 sec.) time constant.

[2] Noise levels apply to total noise emitted from equipment and associated components operating at full power while engaged in its intended operation.

[3] Equipment without average (L_{eq}) noise levels are non-stationary and best represented only by maximum instantaneous noise level (L_{max}).

Source: Project 25-49 Data, National Cooperative Highway Research Program, https://apps.trb.org/cmsfeed/trbnetprojectdisplay.asp?projectid=3889, October 2018

As shown in Tables 4 and 5, construction activities generate considerable amounts of noise, especially during demolition and earth-moving activities when heavy equipment is used. Project-specific equipment lists were not available for this analysis. Based on the typical construction noise levels in Tables 4 and 5, average noise levels generated by project construction equipment are anticipated to range from 72 to 88 dBA L_{eq} at 50 feet from the noise source and from 78 to 94 dBA L_{eq} at 25 feet. Individual pieces of construction equipment, such as jackhammers and dump trucks, would have the potential to generate hourly average noise levels greater than 90 dBA L_{eq} at a distance of 25 feet.

Construction along property lines would occur within 20 feet of residential land uses to the northwest and within 75 feet of office uses to the west. The approximate center of construction of the northern half of the project site is about 250 feet from the nearest residence to the northwest. The approximate center of construction of the southern half of the project site is about 250 feet from the nearest office use to the west. Average noise levels from project construction would reach 58 to 74 dBA L_{eq} at the nearest residential and office buildings. Hourly average construction noise levels from construction activities could potentially exceed 90 dBA L_{eq} at the nearest residential and office buildings when construction is located within 35 feet of shared property lines. Ambient noise levels, as described in the above sections, range between 48 and 62 dBA L_{dn} at the project site and similar levels would be expected at adjacent uses.

It is assumed that construction activities would occur within the time periods allowed by the Municipal Code as described below. Noise levels would be anticipated to exceed 90 dBA L_{eq} at the project boundary when construction within 35 feet of shared property lines during some periods of heavy construction. This is a **potentially significant** temporary impact.

Mitigation Measure 1c: Modification, placement, and operation of construction equipment are possible means for minimizing the impact of construction noise on existing sensitive receptors. Construction equipment should be well-maintained and used judiciously to be as quiet as possible. Additionally, construction activities for the proposed project should include the following best management practices to reduce noise from construction activities near sensitive land uses:

- Construction activities, including truck traffic coming to and from the construction site for any purpose, shall be limited to the hours between 7:00 a.m. and 7:00 p.m., Monday through Friday, Saturdays between 9:00 a.m. and 5:00 p.m., and Sundays and Holidays between 12:00 p.m. and 4:00 p.m., in accordance with the City's Municipal Code, unless permission is granted with a development permit or other planning approval.

- Construction staging areas shall be established at locations that will create the greatest distance between the construction-related noise sources and noise-sensitive receptors nearest the project site during all project construction.

- Use of exceptionally loud equipment such as jackhammers and concrete saws within 35 feet of shared property lines shall be limited, as feasible.

- Equip all internal combustion engine-driven equipment with intake and exhaust mufflers that are in good condition and appropriate for the equipment.

- Unnecessary idling of internal combustion engines should be strictly prohibited.

- Locate stationary noise-generating equipment, such as air compressors or portable power generators, as far as possible from sensitive receptors and property lines. If they must be located within 35 feet of receptors and property lines, adequate muffling (with barriers or enclosures where feasible and appropriate) shall be used to reduce noise levels at the adjacent sensitive receptors.

- Utilize "quiet" air compressors and other stationary noise sources where technology exists.

- Control noise from construction workers' radios to a point where they are not audible at existing residences bordering the project site.

- The contractor shall prepare a detailed construction plana identifying the schedule for major noise-generating construction activities. The construction plan shall identify a procedure for coordination with adjacent residential land uses so that construction activities can be scheduled to minimize noise disturbance.

- Designate a "disturbance coordinator" who would be responsible for responding to any complaints about construction noise. The disturbance coordinator will determine the cause of the noise complaint (e.g. bad muffler, etc.) and will require that reasonable measures be implemented to correct the problem. Conspicuously post a telephone number for the disturbance coordinator at the construction site and include it in the notice sent to neighbors regarding the construction schedule.

Implementation of the above best management practices would reduce construction noise levels emanating from the site, limit construction hours, and minimize disruption and annoyance. With the implementation of these measures and recognizing that noise generated by construction activities would occur over a temporary period, the impact would be **less-than-significant**.

Impact 2: Exposure to Excessive Groundborne Vibration due to Construction. Groundborne vibration from project construction is not anticipated to result in structural of cosmetic damage to nearby structures. **This is a less-than-significant impact.**

The City of San Mateo does not specify a construction vibration limit. For structural damage, the California Department of Transportation recommends a vibration limit of 0.25 in/sec PPV for historic and old buildings, 0.3 in/sec PPV for older residential structures, and 0.5 in/sec PPV for new residential and modern commercial/industrial structures (see Table 3). There are no historic or ancient structures in the project vicinity. The 0.3 in/sec PPV vibration limit would be applicable to properties in the vicinity of the project.

Construction of the project may generate perceptible vibration when heavy equipment or impact tools (jackhammers, hoe rams) are used. Construction activities would include demolition, site preparation, grading and excavation, trenching and foundation, building (exterior), interior/architectural coating, and paving. Pile driving, which can result in higher groundborne vibration levels, is not anticipated as a method of construction.

Table 6 presents vibration levels from construction equipment at the reference distance of 25 feet and levels calculated at distances representing the nearest adjacent residential and office structures. Vibration levels are highest close to the source, and then attenuate with increasing distance at the rate $(D_{ref}/D)^{1.1}$, where D is the distance from the source in feet and D_{ref} is the reference distance of 25 feet.

TABLE 6 Vibration Levels for Construction Equipment at Various Distances

Equipment		PPV at 25 ft. (in/sec)	PPV at 20 ft. (in/sec)	PPV at 75 ft. (in/sec)
Clam shovel drop		0.202	0.258	0.060
Hydromill (slurry wall)	in soil	0.008	0.010	0.007
	in rock	0.017	0.022	0.000
Vibratory Roller		0.210	0.268	0.001
Hoe Ram		0.089	0.114	0.007
Large bulldozer		0.089	0.114	0.003
Caisson drilling		0.089	0.114	0.003
Loaded trucks		0.076	0.097	0.003
Jackhammer		0.035	0.045	0.001
Small bulldozer		0.003	0.004	0.000

Source: Transit Noise and Vibration Impact Assessment, United States Department of Transportation, Office of Planning and Environment, Federal Transit Administration, October 2018 as modified by Illingworth & Rodkin, Inc., September 2020.

The closest structures to the project site are residences located approximately 20 feet from the site to the northwest and the office building located at 2755 Campus Drive to the west. At these locations vibration levels are not expected to exceed the 0.3 in/sec PPV threshold and would not be anticipated to be impacted by project construction-generated vibration. Vibration levels may occasionally be perceptible at these and other structures in the vicinity, but structural and/or architectural damage to structures is not anticipated. This is a **less-than-significant** impact.

Mitigation Measure 2: None required.