Appendix E

Noise and Vibration Assessment

Noise and Vibration Assessment

ALMADEN VILLAS
1747 ALMADEN ROAD
NOISE AND VIBRATION ASSESSMENT

San José, California

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INTRODUCTION

A residential building consisting of 64 condominium units is proposed at 1747 Almaden Road in San José, California. The project proposes one level of ground-level parking, which would include 87 parking spaces using stacked parking lifts. Access to the project site would be provided along Almaden Road.

This report evaluates the project's potential to result in significant noise and vibration 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 groundborne 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 noise and land use compatibility utilizing 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 measures, where necessary, to mitigate the impacts of the project on sensitive receptors in the vicinity.

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* (L_{dn} or *DNL*) 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 DNL. Typically, the highest steady traffic noise level during the daytime is about equal to the DNL 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 to 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 to 62 dBA DNL with open windows and 65 to 70 dBA DNL if the windows are closed. Levels of 55 to 60 dBA are common along collector streets and secondary arterials, while 65 to 70 dBA is a typical value for a primary/major arterial. Levels of 75 to 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 DNL 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 DNL. At a DNL of about 60 dBA, approximately 12 percent of the population is highly annoyed. When the DNL increases to 70 dBA, the percentage of the population highly annoyed increases to about 25 to 30 percent of the population. There is, therefore, an increase of about 2 percent per dBA between a DNL of 60 to 70 dBA. Between a DNL of 70 to 80 dBA, each decibel increase increases by about 3 percent the percentage of the population highly annoyed. People appear to respond more adversely to aircraft noise. When the DNL is 60 dBA, approximately 30 to 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 sound 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 - Noise

The State of California, Santa Clara County, and the City of San José have established regulatory criteria that are applicable in this assessment. The State CEQA Guidelines, Appendix G, California Building Code, Santa Clara County Airport Land Use Commission Comprehensive Land Use Plan, and the City of San Jose General Plan are used to assess the potential significance of impacts. A summary of the applicable regulatory criteria is provided below.

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; or

(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.

Pursuant to recent court decisions, the impacts of site constraints, such as exposure of the proposed project to excessive levels of noise and vibration, are not included in the Impacts and Mitigation Section of this report. These items are discussed in a separate section addressing the project's consistency with the policies set forth in the City's General Plan.

CEQA does not define what noise level increase would be considered substantial. Typically, an increase in the DNL noise level resulting from the project at noise sensitive land uses of 3 dBA or greater would be considered a significant impact when projected noise levels would exceed those considered acceptable for the affected land use. An increase of 5 dBA DNL or greater would be considered a significant impact when projected noise levels would remain within those considered acceptable for the affected land use.

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

Santa Clara County Airport Land Use Commission Comprehensive Land Use Plan. The Comprehensive Land Use Plan adopted by the Santa Clara County Airport Land Use Commission contains standards for projects within the vicinity of San José International Airport, which are relevant to this project:

4.3.2.1 Noise Compatibility Policies

Policy N-3 Noise impacts shall be evaluated according to the Aircraft Noise Contours presented on Figure 5 (2022 Aircraft Noise Contours).

City of San José General Plan. The Environmental Leadership Chapter in the Envision San José 2040 General Plan sets forth policies with the goal of minimizing the impact of noise on people through noise reduction and suppression techniques, and through appropriate land use policies in the City of San José. The following policies are applicable to the proposed project:

EC-1.1 Locate new development in areas where noise levels are appropriate for the proposed uses. Consider federal, state, and City noise standards and guidelines as a part of new development review. Applicable standards and guidelines for land uses in San José include:

Interior Noise Levels

- The City's standard for interior noise levels in residences, hotels, motels, residential care facilities, and hospitals is 45 dBA DNL. Include appropriate site and building design, building construction and noise attenuation techniques in new development to meet this standard. For sites with exterior noise levels of 60 dBA DNL or more, an acoustical analysis following protocols in the City-adopted California Building Code is required to demonstrate that development projects can meet this standard. The acoustical analysis shall base required noise attenuation techniques on expected Envision General Plan traffic volumes to ensure land use compatibility and General Plan consistency over the life of this plan.

Exterior Noise Levels

- The City's acceptable exterior noise level objective is 60 dBA DNL or less for residential and most institutional land uses (Table EC-1). The acceptable exterior noise level objective is established for the City, except in the environs of the San José International Airport and the Downtown, as described below:

    - For new multi-family residential projects and for the residential component of mixed-use development, use a standard of 60 dBA DNL in usable outdoor activity areas, excluding balconies and residential stoops and porches facing existing roadways. Some common use areas that meet the 60 dBA DNL exterior standard will be available to all residents. Use noise attenuation techniques such as shielding by buildings and structures for outdoor common use areas. On sites subject to aircraft overflights or adjacent to elevated roadways, use noise attenuation techniques to achieve the 60 dBA DNL standard for noise from sources other than aircraft and elevated roadway segments.

Table EC-1: Land Use Compatibility Guidelines for Community Noise in San José

LAND USE CATEGORY	EXTERIOR NOISE EXPOSURE (DNL IN DECIBELS (DBA)) 55	60	65	70	75	80
1. Residential, Hotels and Motels, Hospitals and Residential Care[1]						
2. Outdoor Sports and Recreation, Neighborhood Parks and Playgrounds						
3. Schools, Libraries, Museums, Meeting Halls, Churches						
4. Office Buildings, Business Commercial, and Professional Offices						
5. Sports Arena, Outdoor Spectator Sports						
6. Public and Quasi-Public Auditoriums, Concert Halls, Amphitheaters						

[1]Noise mitigation to reduce interior noise levels pursuant to Policy EC-1.1 is required.

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.

Conditionally Acceptable:

- Specified land use may be permitted only after detailed analysis of the noise reduction requirements and needed noise insulation features included in the design.

Unacceptable:

- New construction or development should generally not be undertaken because mitigation is usually not feasible to comply with noise element policies.

EC-1.2 Minimize the noise impacts of new development on land uses sensitive to increased noise levels (Categories 1, 2, 3 and 6) by limiting noise generation and by requiring use of noise attenuation measures such as acoustical enclosures and sound barriers,

where feasible. The City considers significant noise impacts to occur if a project would:

- Cause the DNL at noise sensitive receptors to increase by five dBA DNL or more where the noise levels would remain "Normally Acceptable;" or

- Cause the DNL at noise sensitive receptors to increase by three dBA DNL or more where noise levels would equal or exceed the "Normally Acceptable" level.

EC-1.7 Require construction operations within San José to use best available noise suppression devices and techniques and limit construction hours near residential uses per the City's Municipal Code. The City considers significant construction noise impacts to occur if a project located within 500 feet of residential uses or 200 feet of commercial or office uses would:

- Involve substantial noise generating activities (such as building demolition, grading, excavation, pile driving, use of impact equipment, or building framing) continuing for more than 12 months.

For such large or complex projects, a construction noise logistics plan 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 to reduce noise impacts on neighboring residents and other uses.

EC-1.11 Require safe and compatible land uses within the Mineta San José International Airport noise zone (defined by the 65 CNEL contour as set forth in State law) and encourage aircraft operating procedures that minimize noise.

Regulatory Background – Vibration

City of San José General Plan. The Environmental Leadership Chapter in the Envision San José 2040 General Plan sets forth policies to achieve the goal of minimizing vibration impacts on people, residences, and business operations in the City of San José. The following policies are applicable to the proposed project:

EC-2.3 Require new development to minimize continuous vibration impacts to adjacent uses during demolition and construction. For sensitive historic structures, including ruins and ancient monuments or building that are documented to be structurally weakened, a continuous vibration limit of 0.08 in/sec PPV (peak particle velocity) will be used to minimize the potential for cosmetic damage to a building. A continuous vibration limit of 0.20 in/sec PPV will be used to minimize the potential for cosmetic damage at buildings of normal conventional construction. Equipment or activities typical of generating continuous vibration include but are not limited

to: excavation equipment; static compaction equipment; vibratory pile drivers; pile-extraction equipment; and vibratory compaction equipment. Avoid use of impact pile drivers within 125 feet of any buildings, and within 300 feet of historical buildings, or buildings in poor condition. On a project-specific basis, this distance of 300 feet may be reduced where warranted by a technical study by a qualified professional that verifies that there will be virtually no risk of cosmetic damage to sensitive buildings from the new development during demolition and construction. Transient vibration impacts may exceed a vibration limit of 0.08 in/sec PPV only when and where warranted by a technical study by a qualified professional that verifies that there will be virtually no risk of cosmetic damage to sensitive buildings from the new development during demolition and construction.

Existing Noise Environment

The project site is located at 1747 Almaden Road in San José, California. Existing single- and multi-family residences adjoin the site to the north and to the west. Multi-family residences are located to the east, opposite Almaden Road. Additionally, the property to the south is currently being developed with multi-family residential units, which are expected to be occupied prior to construction of the proposed project.

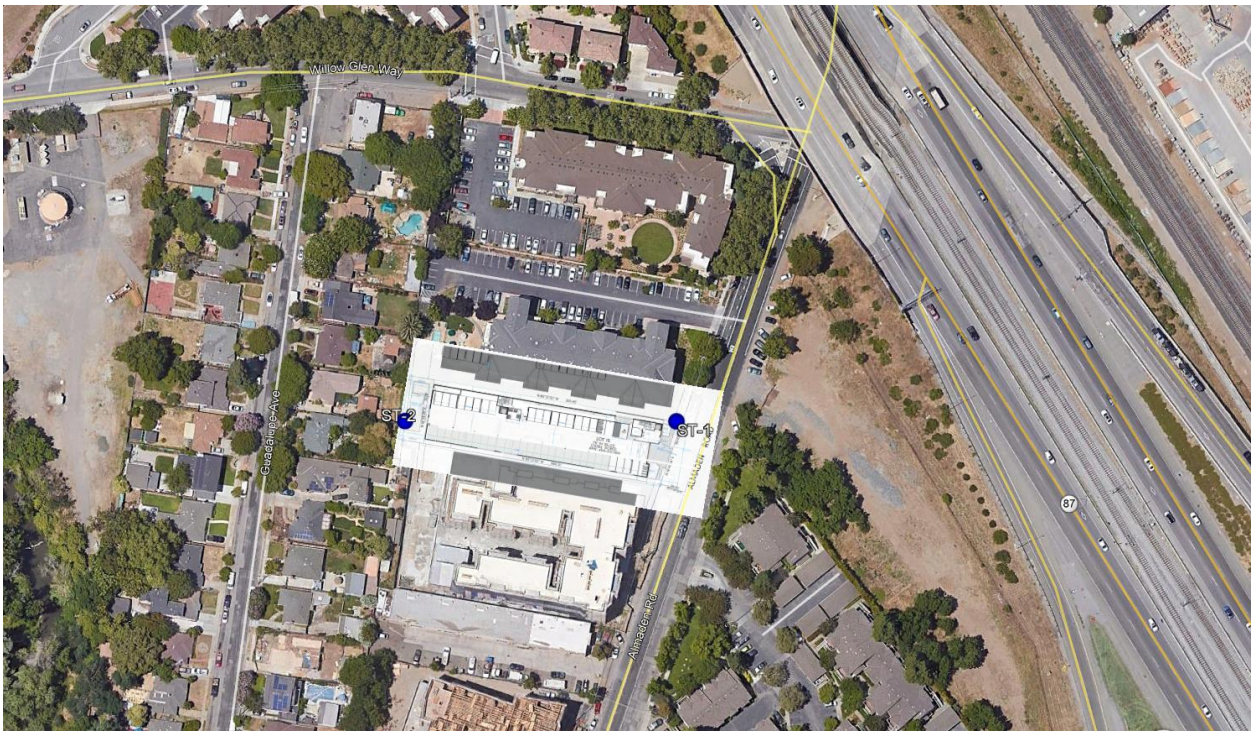
Due to ongoing construction at the adjoining site to the south, as well as construction along Almaden Road, long-term noise measurements could not be made at the site or the surrounding area. Short-term noise measurements were made on Friday, October 25, 2019, following the construction workday. This noise monitoring survey included two measurement locations (ST-1 and ST-2), which are shown in Figure 1. Short-term noise measurements were made over 10-minute periods between 4:20 p.m. and 4:50 p.m. All short-term measurement results are summarized in Table 4.

In the absence of local construction noise, the existing noise environment at the project site results primarily from vehicular traffic along State Route 87 (SR 87). Traffic along Almaden Road and aircraft associated with Mineta San José International Airport operations also affect the ambient noise environment.

Noise measurement ST-1 was made in the northeastern corner of the site, approximately 30 feet west of the centerline of Almaden Road. Seventy-nine (79) cars, generating noise levels ranging from 64 to 76 dBA, and two heavy trucks, generating noise levels ranging from 73 to 75 dBA, passed along Almaden Road during the ST-1 measurement. Additionally, two overhead jets generated noise levels or 63 to 65 dBA at ST-1. The 10-minute average noise level measured at ST-1 was 66 dBA $L_{eq(10\text{-}min)}$.

Noise measurement ST-2 was made at the back of the project site, more than 330 feet from the centerline of Almaden Road. Car pass-bys produced noise levels at ST-2 that ranged from 50 to 52 dBA, and a noisy motorcycle along SR 87 generated noise levels of 55 dBA. One jet flew overhead during the ST-2 measurement, producing noise levels of 59 dBA. The maximum noise level measured in this time period was from people talking near the microphone (63 dBA). The 10-minute average noise level measured at ST-2 was 53 dBA $L_{eq(10\text{-}min)}$.

FIGURE 1 Noise Measurement Locations



Source: Google Earth 2020.

TABLE 4 Summary of Short-Term Noise Measurements (dBA)

Noise Measurement Location (Date, Time)	L_{max}	$L_{(1)}$	$L_{(10)}$	$L_{(50)}$	$L_{(90)}$	$L_{eq(10\text{-}min)}$
ST-1: ~30 feet west of the centerline of Almaden Road (10/25/2019, 4:20-4:30 p.m.)	78	76	69	63	59	66
ST-2: Back of 1747 Almaden Road project site (10/25/2019, 4:40-4:50 p.m.)	64	59	55	53	51	53

PLAN CONSISTENCY ANALYSIS

Noise and Land Use Compatibility

The future noise environment at the project site would continue to result primarily from vehicular traffic along SR 87 and Almaden Road. Since existing long-term ambient noise levels could not be measured at the site due to on-going construction in the area, an acoustical model of the project site and the surrounding area was created to estimate the future noise environment. The model was developed using the Federal Highway Administration's (FHWA) Traffic Noise Model, version 2.5 (TNM). Model inputs included existing and future buildings that would exist under future 2035 conditions, existing sound walls or privacy fences that would remain under project conditions, and peak hour traffic volumes estimated for the year 2035. While a traffic study was completed for the

proposed project, [1] future traffic volumes were not included in the study. Peak hour traffic volumes for SR 87 were obtained from the California Department of Transportation (Caltrans) website for the year 2017.[2] To model the worst hour scenario in TNM, it was assumed that an increase of 1 to 2% in traffic volumes could occur along SR 87 and Almaden Road each year through 2035. These projections assume a standard rate of growth in the City but are conservative for built-out areas where substantial growth is not forecasted to occur. According to the Caltrans 2016 Daily Truck Traffic spreadsheet,[3] medium trucks make up about 1.24% of the total volume of traffic along this segment of SR 87 and heavy trucks make up 1.32% of the total volume of traffic along this segment of SR 87.

Future Exterior Noise Environment

The exterior noise threshold established in the City's General Plan for new residential buildings is 60 dBA DNL at common use outdoor activity areas, not including private decks or balconies.

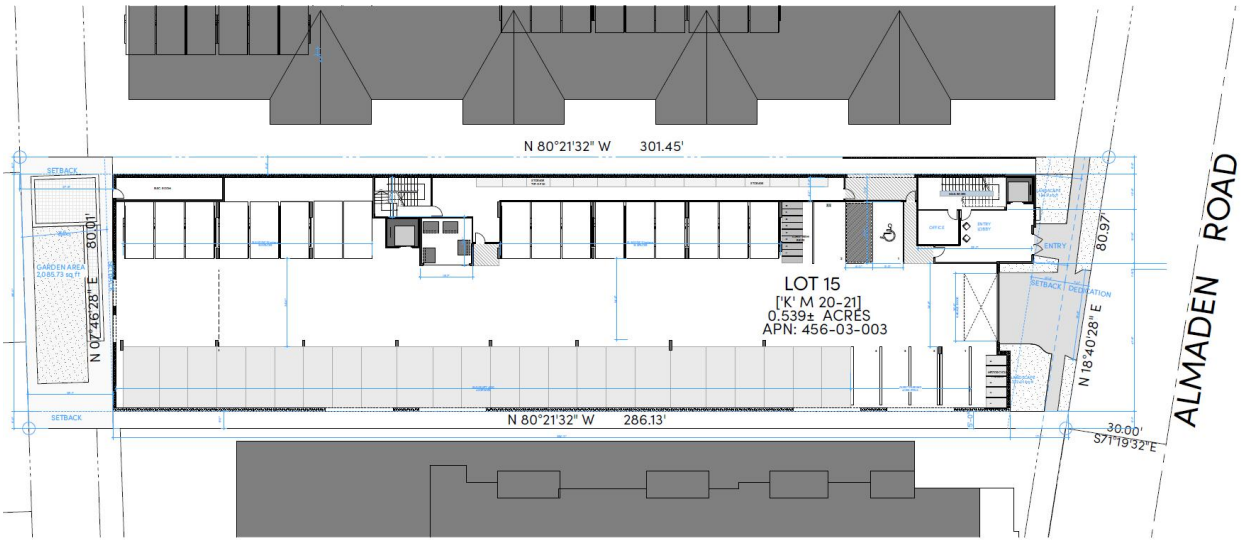
According to the site plan, four common use outdoor activity areas are proposed as part of the project: 1) a ground-level garden area, which is located at the back of the project site (see Figure 2); 2) a second-floor community deck area, which is located along the northern building façade and would be surrounded by the proposed building on three sides (see Figure 3); 3) an amenity deck, which is proposed near the northeastern corner of the roof of the proposed building (see Figure 4); and 4) a yoga/exercise deck at the western portion of the roof of the proposed building (see Figure 4).

Garden Area

Due to the proposed building and existing buildings adjoining the site, the ground-level garden area, which is shown to the west of the proposed building in Figure 2, would be adequately shielded from traffic along SR 87 and Almaden Road. The future exterior noise levels at these outdoor use areas would be below 60 dBA DNL.

[1] Hexagon Transportation Consultants, Inc., "1747 Almaden Road Residential Development Transportation Analysis," March 18, 2020.
[2] Caltrans, https://dot.ca.gov/programs/traffic-operations/census/traffic-volumes/2017/route-87-91.
[3] Caltrans, https://dot.ca.gov/-/media/dot-media/programs/traffic-operations/documents/f0017681-2016-aadt-truck-a11y.pdf.

FIGURE 2 Ground-Level Site Plan



Community Deck Area

The second-floor community deck area, which is shown in the northwest corner of the building in Figure 3, would be mostly shielded on three sides; however, the northern edge of the outdoor use area would have some exposure to SR 87. At the center of this space, the future exterior noise levels would be below 60 dBA DNL, while along the north edge, the future exterior noise levels would be 65 dBA DNL.

FIGURE 3 Second-Floor Site Plan

Amenity Deck Area

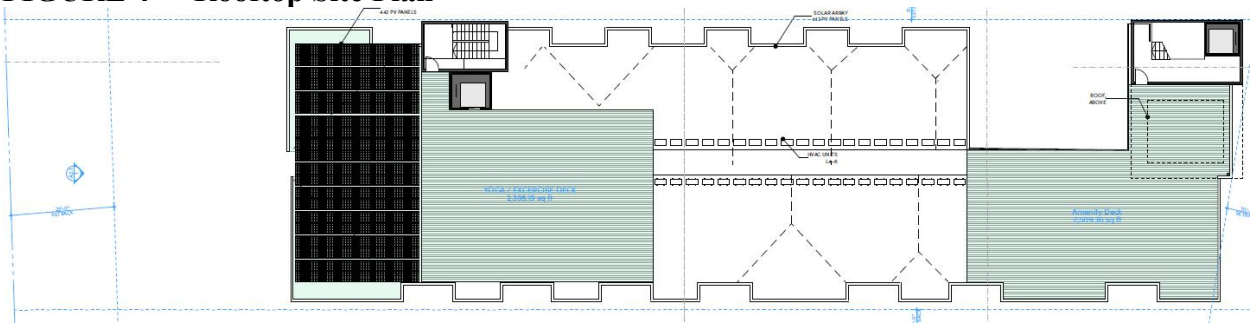
The amenity deck, which is shown on the eastern façade of the rooftop in Figure 4, would be elevated approximately 66 feet above the ground level; therefore, the building would provide partial shielding from Almaden Road traffic. However, SR 87 is an elevated highway, and the shielding provided by the eight-foot barrier located along the edge of SR 87 would be reduced. The future exterior noise levels at the center of the amenity deck, which is located along the eastern portion of the rooftop, would be 68 dBA DNL, while noise levels would be up to 73 dBA DNL at the edge of the roof deck.

Yoga/Exercise Deck Area

The yoga/exercise deck would also be elevated approximately 66 feet above the ground level and would be partially shielded from Almaden Road traffic by the proposed building. As with the

amenity deck area, however, the eight-foot barrier along the edge of the elevated SR 87 would provide less attenuation. The yoga/exercise deck, which would be located along the western portion of the rooftop, as shown in Figure 4, would have future exterior noise levels of 62 dBA DNL at the center.

FIGURE 4 Rooftop Site Plan



The ground-level and second-level outdoor use areas associated with the proposed residential building are not expected to experience noise levels that would exceed the City's exterior noise level limits at the centers of each of these spaces. While the northern edge of second-floor community deck would be 65 dBA DNL, noise levels at the center of this outdoor space would be below 60 dBA DNL. The rooftop decks would have direct exposure to SR 87. Future noise levels at both roof decks would exceed the 60 dBA DNL threshold by up to 8 dBA DNL at the center of the amenity deck and by up to 2 dBA DNL at the yoga/exercise deck. This would require that measures be implemented to reduce noise levels.

Recommended Measures to Reduce Exterior Noise Levels

Methods available to reduce exterior noise levels at the roof deck facing SR 87 include site planning alternatives (e.g., increased setbacks and using the proposed buildings as noise barriers), the construction of traditional noise barriers, or a combination of the above. For the proposed project, relocating the roof decks would not be adequate to meet the City's 60 dBA DNL due to the elevation of the outdoor use areas relative to the elevation of SR 87. Therefore, construction of noise barriers or specially-designed fences along the perimeters of the amenity deck and the yoga/exercise deck would be the optimal measure.

The barriers would be located around the perimeter of the roof decks, as shown in Figures 5 (for the amenity deck) and 6 (for yoga/exercise deck). Each barrier shall be continuous from grade to top, with no cracks or gaps, and be constructed from materials having a minimum surface density of three lbs/ft^2. A clear barrier would be optimal in order to maintain aesthetic appeal (e.g., ½-inch laminated glass). Details for each specific barrier are discussed below.

<u>Amenity Deck Area</u>

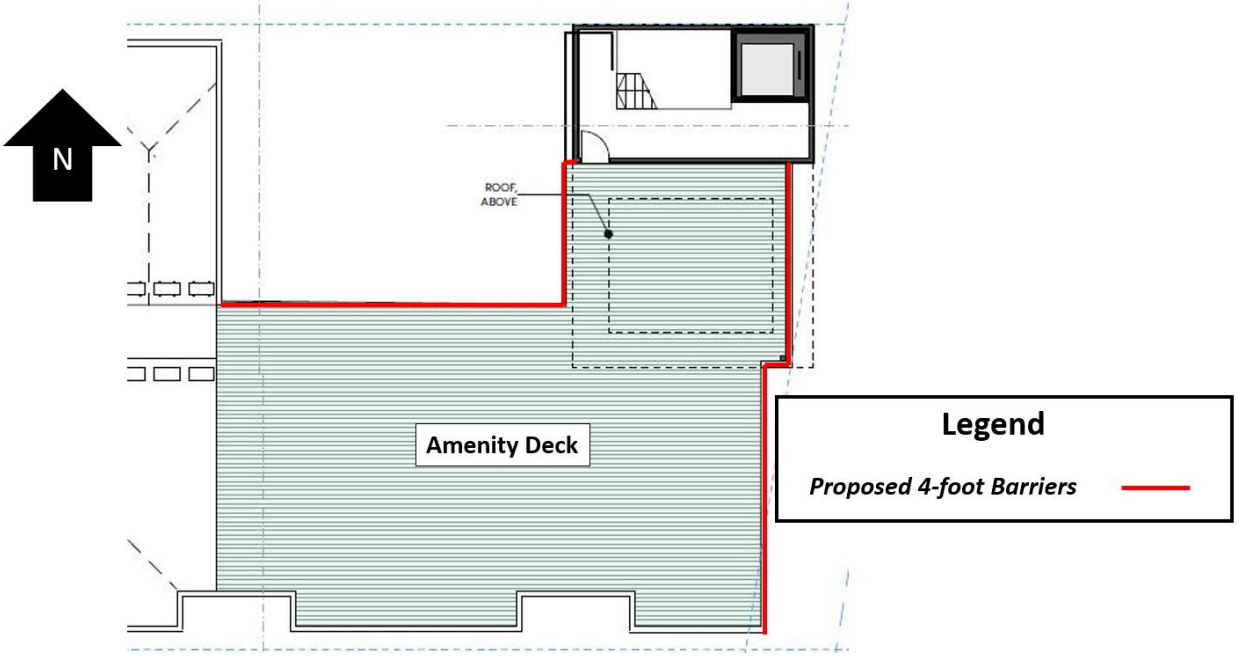
To meet the City's 60 dBA DNL threshold, a barrier height of eight feet would be required along the western and northern edges of the amenity deck. However, the City of San José does not support an eight-foot noise barrier to meet the "normally acceptable" noise level threshold. A four-foot tall noise barrier would reduce exterior noise levels to 65 dBA DNL at the center of the amenity deck proposed nearest to SR 87. Exterior noise levels at the edge of the amenity deck

would still reach 73 dBA DNL, as the four-foot barrier would not shield a five-foot receptor that can look over the noise barrier. If the City does not support the higher barrier required to meet the "normally acceptable" noise level threshold, then the modified threshold of 65 dBA DNL should be considered to reduce noise levels as low as feasible and reasonable.

A future exterior noise level of 65 dBA DNL would be well within the range of "conditionally acceptable" noise levels, particularly for multi-family housing proposed within an urban noise environment. This modified threshold recognizes that those choosing to live in an urban environment and near transit are not normally as sensitive to environmental noise as compared to those who choose to live in rural or suburban environments. The 60 dBA DNL "normally acceptable" threshold in the General Plan best fits the expectations of those in suburban areas. Other communities in the Bay Area (e.g., Walnut Creek) allow noise levels up to 65 dBA DNL at multi-family projects for the same reasons. In the City of Fremont, a DNL of 65 dBA may be permitted when the City determines that providing an outdoor DNL of 60 dBA or lower cannot be achieved after the application of appropriate mitigations.

The location of the proposed noise barrier is shown in Figure 5 for the amenity deck.

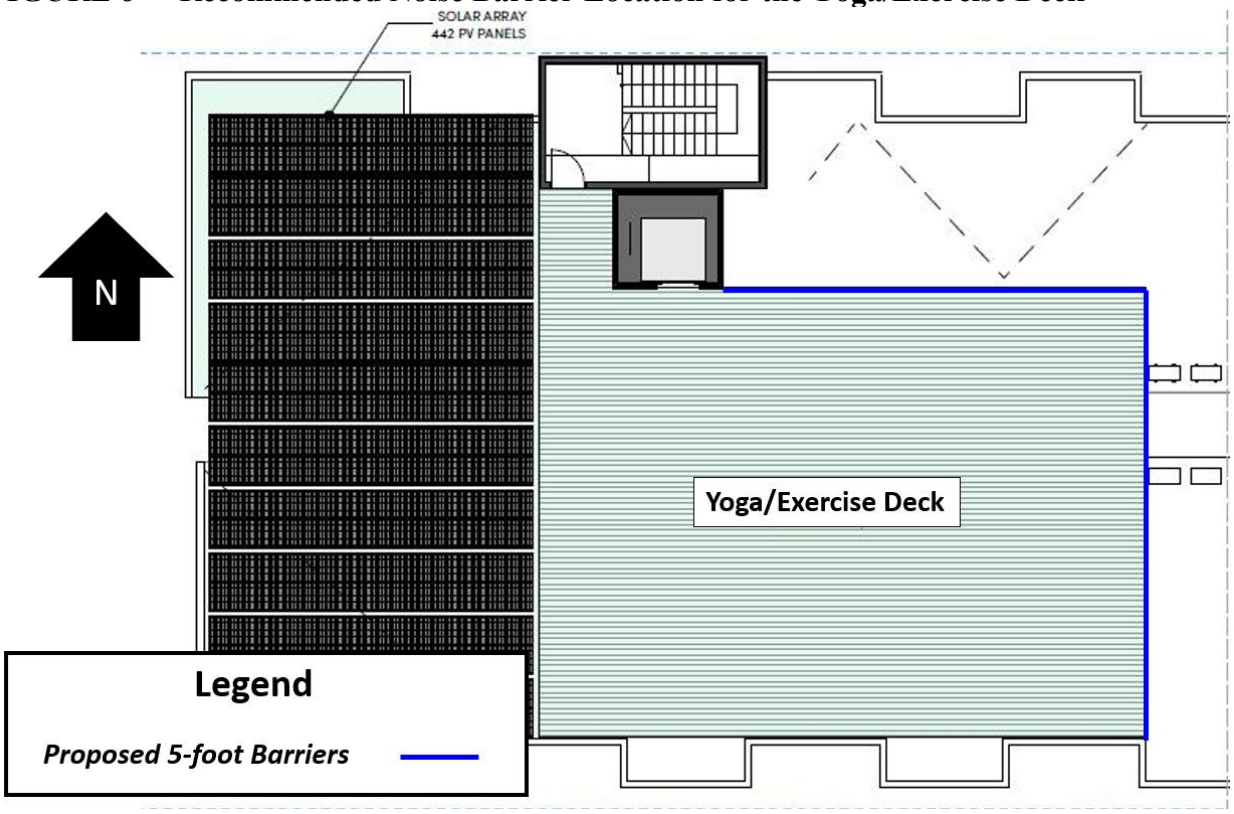
FIGURE 5 Recommended Noise Barrier Location for the Amenity Deck



Yoga/Exercise Deck Area

To achieve 60 dBA DNL or below at the center of the yoga/exercise deck, a five-foot barrier would be required along the western and northern perimeters of the yoga/exercise deck, as shown in Figure 6. A five-foot barrier is assumed to be adequate for the City. Due to the nature of yoga activities, a quiet environment would be ideal so incorporating a noise barrier taller than that recommended at the amenity deck could be justified to ensure the "normally acceptable" threshold of 60 dBA DNL is met at the center of the area where most of the extended use would occur.

FIGURE 6 Recommended Noise Barrier Location for the Yoga/Exercise Deck



With the implementation of a four-foot barrier at the amenity deck, a conditionally acceptable exterior noise threshold of 65 dBA DNL would be achieved at the center of the outdoor use space. With the implementation of a five-foot barrier at the yoga/exercise deck, the City's normally acceptable threshold of 60 dBA DNL for residential uses would be achieved at the center of outdoor use area. The final recommendations shall be confirmed when detailed site plans and grading plans are available.

Conditions of Approval

Prior to the issuance of any building permit, the project applicant shall ensure all outdoor use areas achieve future exterior noise levels at or below the City's "normally acceptable" threshold of 60 dBA DNL at the center of the spaces where reasonably achievable. For common outdoor use areas where 60 dBA DNL is not reasonably achievable, such as the rooftop along the eastern portion of the building, measures should be incorporated to achieve reasonable "conditionally acceptable" noise levels at the centers of the outdoor use spaces.

The project applicant shall retain a qualified acoustical consultant to review the final site plan in order to determine specific noise reduction measures to meet the City's requirements. Noise reduction measures could include increased setbacks, using the proposed building façades as noise barriers, the construction of traditional noise barriers, or a combination of these methods. The applicant's retained qualified acoustical consultant shall prepare a detailed acoustical study during final building design to evaluate the land use compatibility of the proposed common use outdoor spaces with the future noise environment at the site and to identify the necessary noise controls

that are included in the design to meet the City's requirements. The study shall be submitted to the Director of Planning, Building and Code Enforcement or the Director's designee prior to issuance of any building permit.

Future Interior Noise Environment

The City requires that interior noise levels be maintained at 45 dBA DNL or less for residential land uses.

Standard residential construction 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 DNL, the inclusion of adequate forced-air mechanical ventilation is often the method selected to reduce interior noise levels to acceptable levels by closing the windows to control noise. Where noise levels exceed 65 dBA DNL, forced-air mechanical ventilation systems and sound-rated construction methods are normally required. Such methods or materials may include a combination of smaller window and door sizes as a percentage of the total building façade facing the noise source, sound-rated windows and doors, sound rated exterior wall assemblies, and mechanical ventilation so windows may be kept closed at the occupant's discretion.

Eastern Building Façade

The residential units located along the eastern building façade nearest Almaden Road would be set back from the centerline of the roadway by approximately 45 feet. At this distance, the units facing Almaden Road would be exposed to future exterior noise levels ranging from 72 dBA DNL on the second floor to 74 dBA DNL on the sixth floor.

Northern and Southern Building Façades

Units along the northern and southern façades would receive additional shielding from traffic noise by the existing and future residential building adjoining the site. With setbacks ranging from 45 to 270 feet, the units along the northern and southern façades would be exposed to future exterior noise levels ranging from below 60 to 72 dBA DNL on the second floor and from 66 to 74 dBA DNL on the sixth floor.

Western Building Façade

Units along the western façade would be shielded from traffic noise along SR 87 and Almaden Road. These units would be exposed to future exterior noise levels from below 60 dBA DNL on the second floor to 64 dBA DNL on the sixth floor.

Table 5 summarizes the future noise levels at the exterior façades, as well as within the residential interiors along each building façade, assuming windows to be partially open for ventilation. Assuming windows to be partially open for ventilation, the future interior noise levels for the proposed project would exceed the City's interior noise threshold of 45 dBA DNL within residential units located along the eastern, northern, and southern façades. Noise insulation features would be required to reduce interior noise levels to at or below 45 dBA DNL.

TABLE 5 Summary of Future Exterior and Interior Noise Levels Along Each Building Façade

Building Façade	Future Exterior Noise Levels, DNL (dBA)	Future Interior Noise Levels, DNL (dBA)	Minimum STC Ratings
Eastern Façade	72 to 74	57 to 59	31 STC
Northern and Southern Façades	Below 60 to 74	Below 45 to 59	28 to 31 STC
Western Façade	Below 60	Below 45	Standard construction

Noise Insulation Features to Reduce Future Interior Noise Levels

The following noise insulation features shall be incorporated into the proposed project to reduce interior noise levels to 45 dBA DNL or less:

- Preliminary calculations indicate that residential units nearest to Almaden Road along the eastern façade would require windows and doors with a minimum rating of 31 STC with adequate forced-air mechanical ventilation to meet the interior noise threshold of 45 dBA DNL.

- Residential units located along the northern and southern façades within approximately 120 feet of the centerline of Almaden Road would require windows and doors with minimum STC ratings of 30 to 31 with the incorporation of suitable forced-air mechanical ventilation to meet the City's 45 dBA DNL threshold. Beyond 120 feet, windows and doors would require a minimum STC rating of 28.

- Provide a suitable form of forced-air mechanical ventilation, as determined by the local building official, for all residential units on the project site, so that windows can be kept closed at the occupant's discretion to control interior noise and achieve the interior noise standards.

The implementation of these noise insulation features would reduce interior noise levels to 45 dBA DNL or less.

Conditions of Approval

A qualified acoustical specialist shall prepare a detailed analysis of interior residential noise levels resulting from all exterior sources during the design phase pursuant to requirements set forth in the State Building Code. The study will also establish appropriate criteria for noise levels inside the commercial spaces affected by environmental noise. The study will review the final site plan, building elevations, and floor plans prior to construction and recommend building treatments to reduce residential interior noise levels to 45 dBA DNL or lower. Treatments would include, but are not limited to, sound-rated windows and doors, sound-rated wall and window constructions, acoustical caulking, protected ventilation openings, etc. The specific determination of what noise insulation treatments are necessary shall be conducted on a unit-by-unit basis during final design

of the project. Results of the analysis, including the description of the necessary noise control treatments, shall be submitted to the City, along with the building plans and approved design, prior to issuance of a building permit.

NOISE IMPACTS AND MITIGATION MEASURES

Significance Criteria

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

- A significant noise impact would be identified if the project would generate a substantial temporary or permanent noise level increase over ambient noise levels at existing noise-sensitive receptors surrounding the project site.
    - A significant noise impact would be identified if construction-related noise would temporarily increase ambient noise levels at sensitive receptors. The City of San José considers large or complex projects involving substantial noise-generating activities and lasting more than 12 months significant when within 500 feet of residential land uses or within 200 feet of commercial land uses or offices.
    - A significant permanent noise level increase would occur if project-generated traffic would result in: a) a noise level increase of 5 dBA DNL or greater, with a future noise level of less than 60 dBA DNL, or b) a noise level increase of 3 dBA DNL or greater, with a future noise level of 60 dBA DNL or greater.
    - A significant noise impact would be identified if the project would expose persons to or generate noise levels that would exceed applicable noise standards presented in the General Plan.
- A significant impact would be identified if the construction of the project would generate excessive vibration levels surrounding receptors. Groundborne vibration levels exceeding 0.2 in/sec PPV would have the potential to result in cosmetic damage to normal buildings.
- A significant noise impact would be identified if the project would expose people residing or working in the project area to excessive aircraft noise levels.

Impact 1a: **Temporary Construction Noise.** Existing noise-sensitive land uses would be exposed to a temporary increase in ambient noise levels due to project construction activities. The incorporation of construction best management practices as project conditions of approval would result in a **less-than-significant** temporary noise impact.

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.

Policy EC-1.7 of the City's General Plan requires that all construction operations within the City to use best available noise suppression devices and techniques and to limit construction hours near residential uses per the Municipal Code allowable hours, which are between the hours of 7:00 a.m. and 7:00 p.m. Monday through Friday when construction occurs within 500 feet of a residential land use. Further, the City considers significant construction noise impacts to occur if a project located within 500 feet of residential uses or 200 feet of commercial or office uses would involve substantial noise-generating activities (such as building demolition, grading, excavation, pile driving, use of impact equipment, or building framing) continuing for more than 12 months.

Existing residences are located along Almaden Road would be represented by ST-1, which had daytime noise levels of 66 dBA L_{eq}, while residences located to the west of the project would have ambient daytime noise levels of 53 dBA L_{eq}, as measured at ST-2.

The typical range of maximum instantaneous noise levels for the proposed project would be 70 to 90 dBA L_{max} at a distance of 50 feet (see Table 6) from the equipment. Table 7 shows the average noise level ranges, by construction phase. Hourly average noise levels generated by construction are about 65 to 88 dBA L_{eq} for a residential development measured at a distance of 50 feet from the center of a busy construction site. 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 often result in lower construction noise levels at distant receptors.

Project construction is expected to start in mid-April 2021 and take about 18 months to complete. A detailed list of equipment expected to be used during each phase of construction was provided and is summarized in Table 8. Federal Highway Administration's (FHWA's) Roadway Construction Noise Model (RCNM) was used to calculate the hourly average noise levels for each phase of construction, assuming every piece of equipment would operate simultaneously, which would represent the worst-case scenario. This construction noise model includes representative sound levels for the most common types of construction equipment and the approximate usage factors of such equipment that were developed based on an extensive database of information gathered during the construction of the Central Artery/Tunnel Project in Boston, Massachusetts (CA/T Project or "Big Dig"). The usage factors represent the percentage of time that the equipment would be operating at full power.

For each phase, the worst-case hourly average noise level, as estimated at the property line of each surrounding land use, is also shown in Table 8. For overall construction noise levels, multiple pieces of equipment used simultaneously would add together creating a collective noise source. While every piece of equipment per phase would likely be scattered throughout the site, the noise-sensitive receptors surrounding the site would be subject to the collective noise source generated by all equipment operating at once. Therefore, to assess construction noise impacts at the receiving property lines of noise-sensitive receptors, the collective worst-case hourly average noise level for each phase was centered at the geometrical center of the site and propagated to the nearest property line of the surrounding land uses. These noise level estimates are also shown in Table 8. In addition

to the construction equipment in Table 8, cement trucks would be accessing the site throughout the building structure/exterior phase. Up to 145 total truck trips are expected during this phase; however, at any given time, no more than 5 trucks would be anticipated. In Table 8, the range in construction noise levels for this phase represents when no trucks are present on site and when up to 5 trucks are on site. At any instance, this would be the worst-case scenario. Noise levels in Table 8 do not assume reductions due to intervening buildings or existing barriers.

As shown in Table 8, ambient levels at the surrounding uses would potentially be exceeded by 5 dBA L_{eq} or more at various times throughout construction. Since project construction would last for a period of more than one year and considering that the project site is within 500 feet of existing residences, the proposed project would be considered a significant temporary noise impact.

TABLE 6 Construction Equipment 50-Foot Noise Emission Limits

Equipment Category	L_{max} Level (dBA)[1,2]	Impact/Continuous
Arc Welder	73	Continuous
Auger Drill Rig	85	Continuous
Backhoe	80	Continuous
Bar Bender	80	Continuous
Boring Jack Power Unit	80	Continuous
Chain Saw	85	Continuous
Compressor[3]	70	Continuous
Compressor (other)	80	Continuous
Concrete Mixer	85	Continuous
Concrete Pump	82	Continuous
Concrete Saw	90	Continuous
Concrete Vibrator	80	Continuous
Crane	85	Continuous
Dozer	85	Continuous
Excavator	85	Continuous
Front End Loader	80	Continuous
Generator	82	Continuous
Generator (25 KVA or less)	70	Continuous
Gradall	85	Continuous
Grader	85	Continuous
Grinder Saw	85	Continuous
Horizontal Boring Hydro Jack	80	Continuous
Hydra Break Ram	90	Impact
Impact Pile Driver	105	Impact
Insitu Soil Sampling Rig	84	Continuous
Jackhammer	85	Impact
Mounted Impact Hammer (hoe ram)	90	Impact
Paver	85	Continuous
Pneumatic Tools	85	Continuous
Pumps	77	Continuous
Rock Drill	85	Continuous
Scraper	85	Continuous
Slurry Trenching Machine	82	Continuous
Soil Mix Drill Rig	80	Continuous
Street Sweeper	80	Continuous

Equipment Category	L_{max} Level (dBA)[1,2]	Impact/Continuous
Tractor	84	Continuous
Truck (dump, delivery)	84	Continuous
Vacuum Excavator Truck (vac-truck)	85	Continuous
Vibratory Compactor	80	Continuous
Vibratory Pile Driver	95	Continuous
All other equipment with engines larger than 5 HP	85	Continuous

Notes:

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

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

[3] Portable Air Compressor rated at 75 cfm or greater and that operates at greater than 50 psi.

TABLE 7 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 8 Estimated Construction Noise Levels at Nearby Land Uses

Phase of Construction	Time Duration	Construction Equipment (Quantity)	Calculated Hourly Average Noise Levels, L_{eq} (dBA)							
			Ambient Noise Levels = 66 dBA L_{eq}						Ambient Noise Levels = 53 dBA L_{eq}	
			North Res. (55ft)		South Res. (30ft)		East Res. (220ft)		West Res. (160ft)	
			Level, dBA	Exceeds Ambient by 5 dBA or more?	Level, dBA	Exceeds Ambient by 5 dBA or more?	Level, dBA	Exceeds Ambient by 5 dBA or more?	Level, dBA	Exceeds Ambient by 5 dBA or more?
Demolition	25 days	Concrete/Industrial Saw (1) Excavator (1)	83	Yes	88	Yes	71	Yes	74	Yes
Site Preparation	5 days	Grader (1) Rubber-Tired Dozer (1) Tractor/Loader/Backhoe (1)	84	Yes	89	Yes	72	Yes	74	Yes
Grading/ Excavating	30 days	Scraper (1) Excavator (1) Tractor/Loader/Backhoe (1)	84	Yes	89	Yes	72	Yes	74	Yes
Trenching/ Ground Improvement	21 days	Tractor/Loader/Backhoe (1) Excavator (1)	81	Yes	86	Yes	69	No	72	Yes
Building Exterior	250 days	Crane (1) Forklift (1) Generator Set (1) Tractor/Loader/Backhoe (1) Welder (1)	82-85[a]	Yes	87-90[a]	Yes	70-73[a]	Yes	73-75[a]	Yes
Building Interior/ Architectural Coating	47 days	Air Compressor (3) Aerial Lift (2) Man Lift (1)	79	Yes	84	Yes	67	No	69	Yes

[a] Range in hourly average noise levels reflects when no cement trucks are present at the construction site and when up to 5 trucks are operating on site.

Mitigation Measure 1a:

Reasonable regulation of the hours of construction, as well as regulation of the arrival and operation of heavy equipment and the delivery of construction material, are necessary to protect the health and safety of persons, promote the general welfare of the community, and maintain the quality of life. The Municipal Code requires that reasonable noise reduction measures be incorporated into the construction plan and implemented during all phases of construction activity. In accordance with Policy EC-1.7, a construction noise logistics plan should be developed for the proposed project.

The potential short-term noise impacts associated with construction of the project would be mitigated by the implementation of General Plan Policy EC-1.7. This policy states:

> Construction operations within the City will be required to use available noise suppression devices and techniques and continue to limit construction hours near residential uses per the City's Municipal Code. The City considers significant construction noise impacts to occur if a project located within 500 feet of residential uses or 200 feet of commercial or office uses would:
>
> - Involve substantial noise generating activities (such as building demolition, grading, excavation, pile driving, use of impact equipment, or building framing) continuing for more than 12 months.
>
> For such large or complex projects, a construction noise logistics plan 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 to reduce noise impacts on neighboring residents and other uses.

The following standard noise control measures shall be implemented:

- Construction will be limited to the hours of 7:00 a.m. to 7:00 p.m. Monday through Friday for any on-site or off-site work within 500 feet of any residential unit. Construction outside of these hours may be approved through a development permit based on a site-specific "construction noise mitigation plan" and a finding by the Director of Planning, Building and Code Enforcement that the construction noise mitigation plan is adequate to prevent noise disturbance of affected residential uses.

- The contractor shall use "new technology" power construction equipment with state-of-the-art noise shielding and muffling devices. All internal combustion engines used on the project site shall be equipped with adequate mufflers and shall be in good mechanical condition to minimize noise created by faulty or poorly maintained engines or other components.

- The unnecessary idling of internal combustion engines shall be prohibited.

- Staging areas and stationary noise-generating equipment shall be located as far as possible from noise-sensitive receptors, such as residential uses (a minimum of 200 feet).

- The surrounding neighborhood shall be notified early and frequently of the construction activities.

- A "noise disturbance coordinator" shall be designated to respond to any local complaints about construction noise. The disturbance coordinator would determine the cause of the noise complaints (e.g., beginning work too early, bad muffler, etc.) and institute reasonable measures warranted to correct the problem. A telephone number for the disturbance coordinator would be conspicuously posted at the construction site.

A "construction noise logistics plan," in accordance with Policy EC-1.7, would be required. Typical construction noise logistics plan would include, but not be limited to, the following measures to reduce construction noise levels as low as practical:

- Utilize 'quiet' models of air compressors and other stationary noise sources where technology exists.

- Equip all internal combustion engine-driven equipment with mufflers, which are in good condition and appropriate for the equipment.

- Construct temporary noise barriers, where feasible, to screen stationary noise-generating equipment when located within 200 feet of adjoining sensitive land uses. Temporary noise barrier fences would provide a 5 dBA noise reduction if the noise barrier interrupts the line-of-sight between the noise source and receptor and if the barrier is constructed in a manner that eliminates any cracks or gaps.

- If stationary noise-generating equipment must be located near receptors, adequate muffling (with enclosures where feasible and appropriate) shall be used. Any enclosure openings or venting shall face away from sensitive receptors.

- Ensure that generators, compressors, and pumps are housed in acoustical enclosures.

- Locate cranes as far from adjoining noise-sensitive receptors as possible.

- During final grading, substitute graders for bulldozers, where feasible. Wheeled heavy equipment are quieter than track equipment and should be used where feasible.

- Substitute nail guns for manual hammering, where feasible.

- Substitute electrically-powered tools for noisier pneumatic tools, where feasible.

- The Construction Noise Logistic Plan, inclusive of the above shall be signed by a qualified acoustical specialist verifying that the implementation measures included in this Plan meets the reduction to noise levels as required by this mitigation measure.

With the implementation of GP Policy EC-1.7, Municipal Code requirements, and the above measures, the temporary construction noise impact would be reduced to a **less-than-significant** level.

Impact 1b: **Permanent Noise Level Increase.** The proposed project is not expected to cause a substantial permanent noise level increase at the existing residential land uses in the project vicinity. **This is a less-than-significant impact.**

According to Policy EC-1.2 of the City's General Plan, a significant permanent noise increase would occur if the project would increase noise levels at noise-sensitive receptors by 3 dBA DNL or more where ambient noise levels exceed the "normally acceptable" noise level standard. Where ambient noise levels are at or below the "normally acceptable" noise level standard, noise level increases of 5 dBA DNL or more would be considered significant. The City's General Plan defines the "normally acceptable" outdoor noise level standard for the residential land uses to be 60 dBA DNL. Existing ambient levels for residential uses along Almaden Road near SR 87 would exceed 60 dBA DNL; therefore, a significant impact would occur if traffic due to the proposed project would permanently increase ambient levels by 3 dBA DNL at these residences. For reference, a 3 dBA DNL noise increase would be expected if the project would double existing traffic volumes along a roadway.

The traffic study included peak hour turning movements for the existing traffic volumes at three intersections along Almaden Road, including one at the future access driveway of the project site. The traffic study also included peak hour project trips, which when added to the existing volumes provided existing plus project peak hour turning movements. By comparing the existing plus project traffic scenario to the existing scenario, the project's contribution to the overall noise level increase was determined to be less than 1 dBA DNL. Therefore, the project would not result in a permanent noise increase of 3 dBA DNL or more at noise-sensitive receptors in the project vicinity. This is a less-than-significant impact.

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

Impact 1c: **Noise Levels in Excess of Standards.** The proposed project would not generate noise in excess of standards established in the City's General Plan at the nearby sensitive receptors. However, the project could potentially exceed the City's Municipal Code threshold of 55 dBA DNL. Implementation of measures as a project condition of approval would ensure noise levels to be below 55 dBA DNL. **This is a less-than-significant impact.**

The City's General Plan does not include policies specifically addressing mechanical noise generated by residential land uses. However, the residential mechanical noise should be addressed with respect to the City's Municipal Code threshold of 55 dBA DNL to minimize disturbance to the existing and future residences surrounding the project site.

The site plan of the proposed project shows rooftop mechanical equipment, including heating, ventilation, and air conditioning systems (HVAC units) and solar panel arrays. Details pertaining to the number, size, type, and manufacturer-provided noise level information of such equipment were not available at the time of this study.

Typical noise levels produced residential HVAC units would range from 53 to 63 dBA at 3 feet during operation. These types of units typically cycle on and off continuously during daytime and nighttime hours. Therefore, multiple units clustered in the same general vicinity are usually operating simultaneously at any given time. Assuming up to eight units would operate simultaneously at any given time, the estimated day-night average noise level at 3 feet would be up to 78 dBA DNL. The HVAC units are shown to be set back approximately 30 feet from the southern property line, approximately 35 feet from northern property line, and approximately 150 feet from the western property line. The day-night average noise level would be 58 and 57 dBA DNL at the shared property planes to the south and north, respectively, assuming eight units operating simultaneously and no shielding. At the western property plane, the day-night average noise levels would be below 55 dBA DNL, assuming eight units operating simultaneously and no shielding. The estimated operational noise levels are summarized in Table 9.

TABLE 9 Estimated Operational Noise Levels for Eight HVAC Units Operating Simultaneously

Receptor	Distance from Noise Source	Hourly Average Noise Level	Day-Night Average Noise Level
Northern Residential Property Plane	35 feet	41 to 51 dBA L_{eq}	57 dBA DNL
Southern Residential Property Plane	30 feet	42 to 52 dBA L_{eq}	58 dBA DNL
Western Residential Property Plane	150 feet	28 to 38 dBA L_{eq}	45 dBA DNL
Eastern Residential Property Plane	160 feet	27 to 37 dBA L_{eq}	44 dBA DNL

The off-site residential buildings to the north and to the south are close to the shared property lines. Both of these residential buildings would be approximately 40 feet from the nearest rooftop HVAC units; however, the existing building to the north is four stories and the residential units located on the fourth floor would be partially shielded from the HVAC units on the rooftop of the proposed building. The existing building to the south is expected to be a six-floor building once completed. Therefore, the residential units on the sixth floor would have little to no attenuation. The day-night average noise levels at the exterior façades of the residential buildings to the north and to the south would be below 55 and 56 dBA DNL, respectively.

The nearest single-family residence to the west would be approximately 210 feet from the HVAC units, with the center of the backyard approximately 180 feet from the HVAC units. The residences along Guadalupe Avenue are single-story buildings with ground-level backyards. Therefore, the height of the proposed building would provide some shielding. The day-night average noise level at the backyard would be about 43 dBA DNL, while the day-night average noise level at the residential façade would be 42 dBA DNL. The multi-family residential building east of Almaden Road is a two-story building located approximately 180 feet from the nearest HVAC units. Due to the height of the proposed building, these residences would also be partially shielded. The day-night average noise level at the nearest façade would be 43 dBA DNL.

Noise levels generated by solar panels, which are shown to be located along the edges of the proposed building's rooftop, are low and would be inaudible at the shared residential property lines. The Municipal Code limit of 55 dBA DNL would not be exceeded at the property lines by noise generated by the solar panels.

Since the City's General Plan does not include policies specifically addressing mechanical noise generated by residential land uses, no General Plan policies would be violated by noise levels generated by the HVAC units, and this would be considered a less-than-significant impact. However, it is expected that mechanical equipment noise generated from the rooftop of the proposed building could potentially exceed the City's Municipal Code thresholds.

Prior to the issuance of any building permit, the project applicant shall ensure all mechanical equipment and/or noise barriers are selected and designed to reduce noise impacts on surrounding uses by meeting the City's 55 dBA DNL noise limit requirements at the shared property line. The project applicant shall retain a qualified acoustical consultant to review mechanical noise as the equipment systems are selected in order to determine specific noise reduction measures to meet the City's requirements. Noise reduction measures could include, but are not limited to, selection of equipment that emits low noise levels and/or installation of noise barriers such as enclosures and parapet walls to block the line-of-sight between the noise source and the nearest receptors. The applicant's retained qualified acoustical consultant shall prepare a detailed acoustical study during final building design to evaluate the potential noise generated by building mechanical equipment and to identify the necessary noise controls that are included in the design to meet the City's requirements. The study shall be submitted to the Director of Planning, Building and Code Enforcement or the Director's designee prior to issuance of any building permit.

Mitigation Measure 1c: None required.

Impact 2: Exposure to Excessive Groundborne Vibration due to Construction. Construction-related vibration levels resulting from activities could potentially exceed 0.2 in/sec PPV at the surrounding sensitive land uses. **This is a significant impact.**

The construction of the project may generate perceptible vibration when heavy equipment or impact tools (e.g. jackhammers, hoe rams) are used. Construction activities would include site preparation work, foundation work, and new building framing and finishing. Pile driving equipment, which can cause excessive vibration, is not expected to be required for the proposed project.

According to Policy EC-2.3 of the City of San Jose General Plan, a vibration limit of 0.08 in/sec PPV shall be used to minimize the potential for cosmetic damage to sensitive historical structures, and a vibration limit of 0.20 in/sec PPV shall be used to minimize damage at buildings of normal conventional construction.

Table 10 presents typical vibration levels that could be expected from construction equipment at a distance of 25 feet. Project construction activities, such as drilling, the use of jackhammers, rock drills and other high-power or vibratory tools, and rolling stock equipment (tracked vehicles,

compactors, etc.), may generate substantial vibration in the immediate vicinity. Jackhammers typically generate vibration levels of 0.035 in/sec PPV, and drilling typically generates vibration levels of 0.09 in/sec PPV at a distance of 25 feet. Vibration levels would vary depending on soil conditions, construction methods, and equipment used. Table 10 also summarizes the distances to the 0.08 in/sec PPV threshold for historical buildings and to the 0.2 in/sec PPV threshold for all other buildings.

TABLE 10 Vibration Source Levels for Construction Equipment

Equipment		PPV at 25 ft. (in/sec)	Minimum Distance to Meet 0.08 in/sec PPV (feet)	Minimum Distance to Meet 0.2 in/sec PPV (feet)
Clam shovel drop		0.202	58	26
Hydromill (slurry wall)	in soil	0.008	3	1
	in rock	0.017	6	2
Vibratory Roller		0.210	60	27
Hoe Ram		0.089	28	12
Large bulldozer		0.089	28	12
Caisson drilling		0.089	28	12
Loaded trucks		0.076	24	10
Jackhammer		0.035	12	5
Small bulldozer		0.003	1	<1

Source: Transit Noise and Vibration Impact Assessment Manual, Federal Transit Administration, Office of Planning and Environment, U.S. Department of Transportation, FTA Report No. 0123, September 2018, as modified by Illingworth & Rodkin, Inc., November 2019.

Based on the inventory of historically documented buildings in the City of San José,[4] there are no historical structures located within 200 feet of the project boundary. Therefore, vibration levels exceeding 0.2 in/sec PPV at the surrounding buildings would be considered a significant impact.

Table 11 summarizes the vibration levels at the nearest building façade to the north, to the south, to the east, and to the west of the project site. While construction noise levels increase based on the cumulative equipment in use simultaneously, construction vibration levels would be dependent on the location of individual pieces of equipment. That is, equipment scattered throughout the site would not generate a collective vibration level, but a vibratory roller, for instance, operating near the project site boundary would generate the worst-case vibration levels for the receptor sharing that property line. Further, construction vibration impacts are assessed based on damage to buildings on receiving land uses, not receptors at the nearest property lines. Therefore, the distances used to propagate construction vibration levels (as shown in Table 11), which are different than the distances used to propagate construction noise levels (as shown in Table 8), were estimated under the assumption that each piece of equipment from Table 10 was operating along the nearest boundary of the project site, which would represent the worst-case scenario.

To the north and to the south, the multi-family residential buildings would be approximately 15 feet from the project's respective boundaries. At 15 feet, the residential buildings would be exposed to vibration levels up to 0.37 in/sec PPV, which would exceed the City's 0.2 in/sec PPV threshold. The single-family residences to the west would be 20 feet or more from the project's

[4] http://www.sanjoseca.gov/DocumentCenter/View/35475

western boundary, which would expose these structures to levels up to 0.27 in/sec PPV when construction activities occur near the shared property line.

The nearest residential structures opposite Almaden Road to the east would be 85 feet or more from the project's nearest boundary. At this distance, vibration levels would be at or below 0.06 in/sec PPV.

The City's threshold of 0.2 in/sec PPV for non-historical buildings would potentially be exceeded at residences to the north, to the south, and to the west when construction activities at the project site occur along these shared boundaries.

TABLE 11 Vibration Source Levels for Construction Equipment

Equipment		PPV (in/sec)			
		North Res. (15ft)	South Res. (15ft)	East Res. (85ft)	West Res. (20ft)
Clam shovel drop		**0.354**	**0.354**	0.053	**0.258**
Hydromill (slurry wall)	in soil	0.014	0.014	0.002	0.010
	in rock	0.030	0.030	0.004	0.022
Vibratory Roller		**0.368**	**0.368**	0.055	**0.268**
Hoe Ram		0.156	0.156	0.023	0.114
Large bulldozer		0.156	0.156	0.023	0.114
Caisson drilling		0.156	0.156	0.023	0.114
Loaded trucks		0.133	0.133	0.020	0.097
Jackhammer		0.061	0.061	0.009	0.045
Small bulldozer		0.005	0.005	0.001	0.004

Source: Transit Noise and Vibration Impact Assessment Manual, Federal Transit Administration, Office of Planning and Environment, U.S. Department of Transportation, FTA Report No. 0123, September 2018, as modified by Illingworth & Rodkin, Inc., November 2019.

A study completed by the US Bureau of Mines analyzed the effects of blast-induced vibration on buildings in USBM RI 8507.[5] The findings of this study have been applied to buildings affected by construction-generated vibrations.[6] As reported in USBM RI 8507[5] and reproduced by Dowding,[6] Figure 7 presents the damage probability, in terms of "threshold damage," "minor damage," and "major damage," at varying vibration levels. Threshold damage, which is described as cosmetic damage in this report, would entail hairline cracking in plaster, the opening of old cracks, the loosening of paint or the dislodging of loose objects. Minor damage would include hairline cracking in masonry or the loosening of plaster, and major structural damage would include wide cracking or shifting of foundation or bearing walls. As shown in Figure 7, maximum vibration levels of 0.4 in/sec PPV would result in a less than 5% chance of threshold damage or cosmetic damage, while no minor or major damage would be expected.

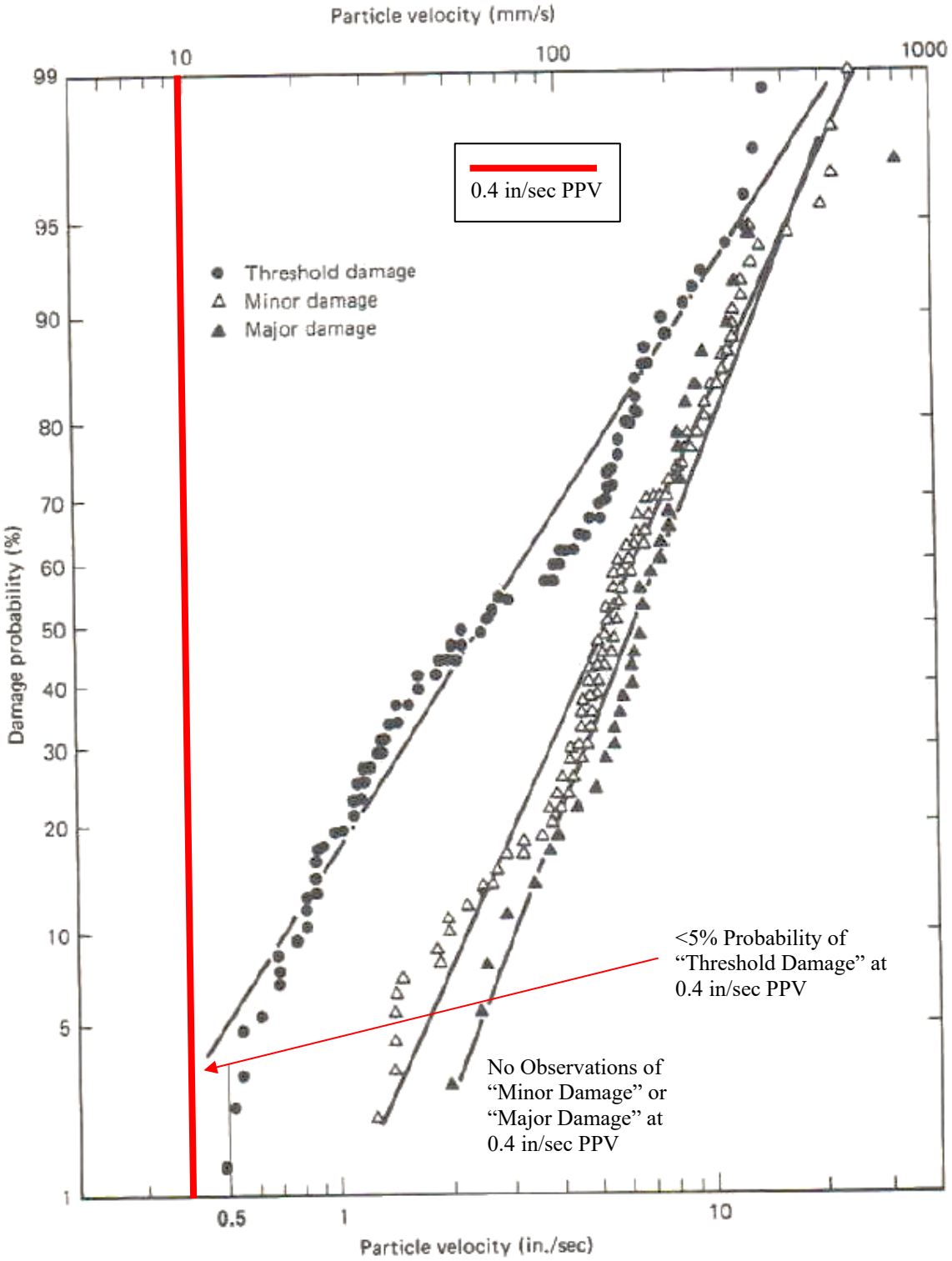
Typical construction equipment, as shown in Table 11, would have the potential to produce vibration levels of 0.2 in/sec PPV or more at the non-historical buildings surrounding the site.

[5] Siskind, D.E., M.S. Stagg, J.W. Kopp, and C.H. Dowding, Structure Response and Damage Produced by Ground Vibration form Surface Mine Blasting, RI 8507, Bureau of Mines Report of Investigations, U.S. Department of the Interior Bureau of Mines, Washington, D.C., 1980.
[6] Dowding, C.H., Construction Vibrations, Prentice Hall, Upper Saddle River, 1996.

While no minor or major damage would occur at these conventional buildings, there is the potential to generate threshold or cosmetic damage at the surrounding buildings. This is a significant impact.

At these locations, and in other surrounding areas within 200 feet, vibration levels would potentially be perceptible. By use of administrative controls, such as notifying neighbors of scheduled construction activities and scheduling construction activities with the highest potential to produce perceptible vibration during less sensitive hours, perceptible vibration can be kept to a minimum.

FIGURE 7 Probability of Cracking and Fatigue from Repetitive Loading



Source: Dowding, C.H., Construction Vibrations, Prentice Hall, Upper Saddle River, 1996, as modified by Illingworth & Rodkin, Inc., November 2019.

Mitigation Measure 2:

The project shall implement the following measures, in addition to the best practices specified in Mitigation Measure 1a of this report, to minimize the impacts of groundborne vibration.

Construction Vibration Monitoring, Treatment, and Reporting Plan: The project proponent shall implement a construction vibration monitoring plan to document conditions prior to, during, and after vibration generating construction activities. All plan tasks shall be undertaken under the direction of a licensed Professional Structural Engineer in the State of California and be in accordance with industry-accepted standard methods. The construction vibration monitoring plan shall include, but not be limited to, the following measures:

- The report shall include a description of measurement methods, equipment used, calibration certificates, and graphics as required to clearly identify vibration-monitoring locations.

- A list of all heavy construction equipment to be used for this project and the anticipated time duration of using the equipment that is known to produce high vibration levels (clam shovel drops, vibratory rollers, hoe rams, large bulldozers, caisson drillings, loaded trucks, jackhammers, etc.) shall be submitted to the Director of Planning or Director's designee of the Department of Planning, Building and Code Enforcement by the contractor. This list shall be used to identify equipment and activities that would potentially generate substantial vibration and to define the level of effort required for continuous vibration monitoring. Phase demolition, earth-moving, and ground impacting operations so as not to occur during the same time period.

- Where possible, use of the heavy vibration-generating construction equipment shall be prohibited within 20 feet of any adjacent building.

- Document conditions at all structures located within 30 feet of construction prior to, during, and after vibration-generating construction activities. All plan tasks shall be undertaken under the direction of a licensed Professional Structural Engineer in the State of California and be in accordance with industry-accepted standard methods. Specifically:

    - Vibration limits shall be applied to vibration-sensitive structures located within 30 feet of all construction activities identified as sources of high vibration levels.

    - Performance of a photo survey, elevation survey, and crack monitoring survey for each structure of normal construction within 30 feet of all construction activities identified as sources of high vibration levels. Surveys shall be performed prior to any construction activity, in regular intervals during construction, and after project completion, and shall include internal and external crack monitoring in structures, settlement, and distress, and shall document the condition of foundations, walls and other structural elements in the interior and exterior of said structures.

- Develop a vibration monitoring and construction contingency plan to identify structures where monitoring would be conducted, set up a vibration monitoring schedule, define structure-specific vibration limits, and address the need to conduct photo, elevation, and crack surveys

to document before and after construction conditions. Construction contingencies shall be identified for when vibration levels approached the limits.

- At a minimum, vibration monitoring shall be conducted during demolition and excavation activities.

- If vibration levels approach limits, suspend construction and implement contingency measures to either lower vibration levels or secure the affected structures.

- Designate a person responsible for registering and investigating claims of excessive vibration. The contact information of such person shall be clearly posted on the construction site.

- Conduct a post-construction survey on structures where either monitoring has indicated high vibration levels or complaints of damage has been made. Make appropriate repairs or compensation where damage has occurred as a result of construction activities.

The implementation of these measures would reduce the impact to a less-than-significant level.

Impact 3: **Excessive Aircraft Noise.** The project site is located more than three miles from a public airport or public use airport and would not expose people residing or working in the project area to excessive aircraft noise levels with the implementation of forced-air mechanical ventilation. **This is a less-than-significant impact.**

Norman Y. Mineta San José International Airport is a public-use airport located approximately 3.85 miles northwest of the project site. According to the City's new Airport Master Plan Environmental Impact Report,[7] the project site lies outside the 60 dBA CNEL/DNL contour line (see Figure 8). According to Policy EC-1.11 of the City's General Plan, the required safe and compatible threshold for exterior noise levels would be at or below 65 dBA CNEL/DNL for aircrafts. Therefore, the proposed project would be compatible with the City's exterior noise standards for aircraft noise.

Assuming standard construction materials for aircraft noise below 60 dBA DNL, the future interior noise levels resulting from aircraft would below 45 dBA DNL. Therefore, future interior noise at the proposed building would be compatible with aircraft noise. This would be a less-than-significant impact.

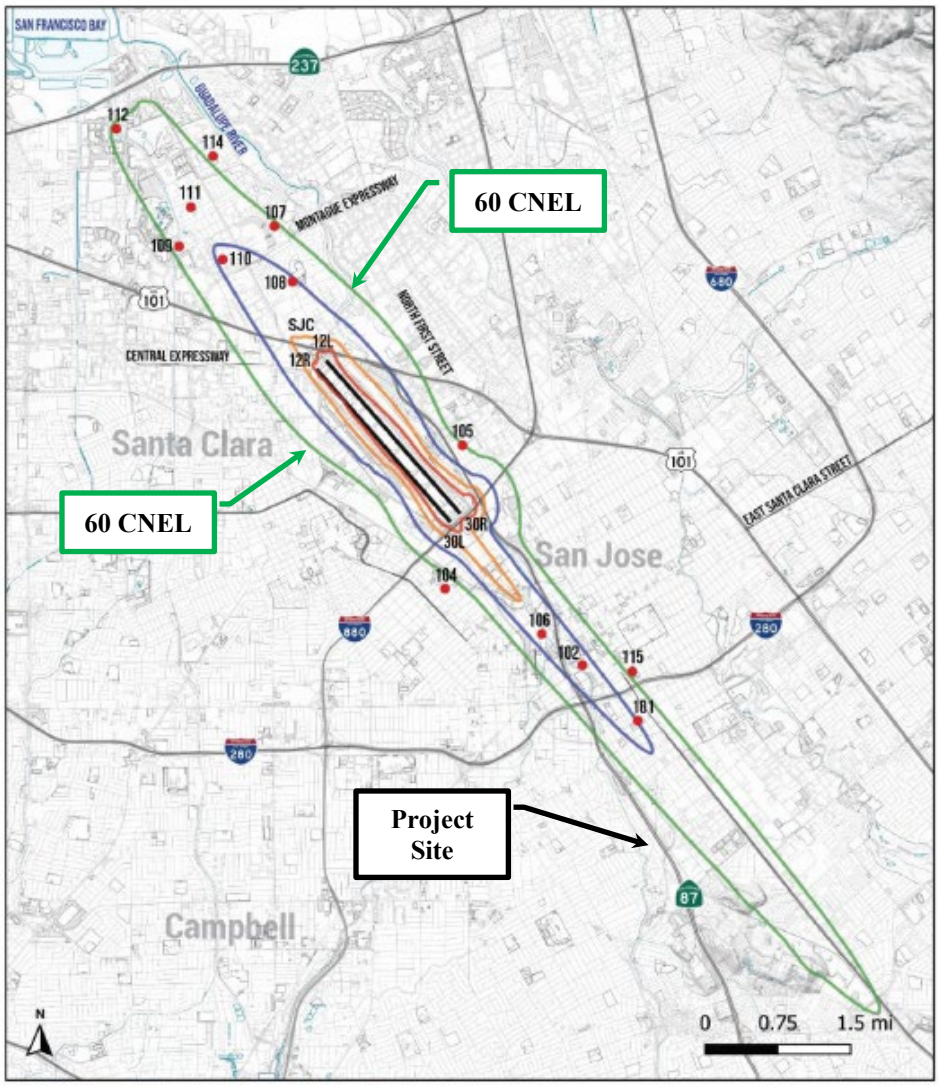
Mitigation Measure 3: **None required.**

[7] David J. Powers & Associates, Inc., Integrated Final Environmental Impact Report, Amendment to Norman Y. Mineta San Jose International Airport Master Plan, April 2020.

FIGURE 8 2027 CNEL Noise Contours for SJIA Relative to Project Site

Figure 5
Scenario 2: With Project 2037 Noise Contour Map

SAN JOSE INTERNATIONAL AIRPORT | Environmental Impact Report FINAL | October 2019



NORMAN Y. MINETA SAN JOSE INTERNATIONAL AIRPORT

- Noise Monitoring Station
- 101 Site ID
- Runway
- 75 dBA and Greater CNEL Contour
- 70 dBA and Greater CNEL Contour
- 65 dBA and Greater CNEL Contour
- 60 dBA and Greater CNEL Contour

Figure 5 Scenario 2: With Project 2037 Noise Contour Map

Source: BridgeNet International 2019

Addendum Letter to the

Noise and Vibration Assessment

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April 20, 2021

Ms. Leianne Humble
Senior Planner
Denise Duffy & Associates, Inc.
947 Cass Street, Suite 5
Monterey, CA 93940

Via email: **lhumble@ddaplanning.com**

Subject: **1747 Almaden Road, San José, CA –**
Addendum Letter to the Noise and Vibration Assessment

Dear Leianne:

The original noise assessment for the proposed residential building at 1747 Almaden Road in San José, California, was completed in September 2020.[1] In that report, four common use outdoor areas were evaluated as part of the proposed building: 1) a ground-level garden area; 2) a second-floor community deck area; 3) a rooftop amenity deck area; and 4) a rooftop yoga/exercise deck area. An updated site plan, dated March 23, 2021, includes the ground-level garden and second-floor community deck; however, the outdoor use areas located on the rooftop have been eliminated from the project. This addendum letter discusses how the updated site plan would change the results of the previous noise study.

Noise and Land Use Compatibility

The ground-level garden and second-floor community deck, which were analyzed in the previous noise report, are expected to result in exterior noise levels at or below the City's 60 dBA DNL threshold and would not require additional measures to reduce noise levels.

The building setbacks from Almaden Road and nearby SR 87 are consistent with previous noise report. The future interior noise levels estimated in the previous noise report would be consistent with the updated site plan. The same noise insulation features recommended in the previous noise report would be recommended for the updated site plan.

[1] Illingworth & Rodkin, Inc., "Almaden Villas 1747 Almaden Road Noise and Vibration Assessment," September 3, 2020.

Noise Impacts and Mitigation Measures

The updated site plan would not result in changes to the impact discussions and recommended mitigation measures for construction noise and vibration, permanent traffic noise, or aircraft noise.

The same type of HVAC units would be assumed for the updated site plan, and the units would continue to be located at the center of the rooftop; however, the two rows of units would stretch farther west then previously studied. The distances from the HVAC units to the northern, southern, and eastern residential property planes would not change, but the nearest HVAC units would be approximately 100 feet from the nearest residential property plane to the west of the site, which would be reduced from the setback distance previously studied. Based on the updated locations for the HVAC units, hourly average noise levels at the nearest residential property plane to the west would range from 32 to 42 dBA L_{eq}, and the day-night average noise level would be 48 dBA DNL. This would be below the City's 55 dBA threshold. Since the distances to the northern, southern, and eastern residences would not change and the new setback to the west would not result in noise levels in excess of the Municipal Code thresholds, no new results or mitigation measures would result from the updated site plan.

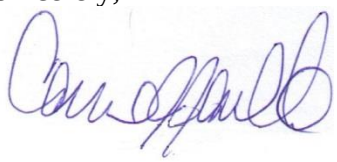
The garden area and community deck would not generate measurable noise levels at the neighboring property lines. Both outdoor use area is expected to have fewer than 15 people at any given time, and such activities would potentially include normal levels of conversation, which are not considered noise-generating sources. These types of activities are considered background ambient noise.

The updated site plan would not result in exterior noise levels at common outdoor use areas exceeding the City's threshold of 60 dBA DNL. Future interior noise levels within the residential units would not change with the updated site plan. No new impacts would result from the updated site plan, and no additional mitigation measures would be required.

♦ ♦ ♦

Please feel free to contact us with any questions on the analysis or if we can be of further assistance.

Sincerely,



Carrie J. Janello
Senior Consultant
Illingworth & Rodkin, Inc.

(19-166)