NOISE AND VIBRATION ASSESSMENT

THE MARK RESIDENTIAL TOWER
459 & 475 SOUTH 4TH STREET
San José, California

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Prepared for:

Fiona Phung
Project Manager
David J. Powers & Associates, Inc.
1871 The Alameda, Suite 200
San José, CA 95126

Prepared by:

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

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INTRODUCTION

The project proposes to construct a 23-story all student focused multifamily residential building at 459 & 475 South 4th Street in San José, California. The 0.45-acre project site, located on four parcels, is currently developed with an apartment complex, a single-family residence and associated parking areas. The proposed project would demolish the existing buildings and parking areas and construct a multifamily residential building with up to 240 with parking for the project provided both on and off-site. The project will consist of roughly 335,000 gross square feet of construction. Project amenities will include study rooms, a gym, gathering areas on each floor and an amenity deck on the roof.

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, 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.

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.

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.

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.

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 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 12-17 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 DNL with open windows and 65-70 dBA DNL 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 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 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, Cal. Dept. of Transportation, Sept. 2013.

REGULATORY BACKGROUND – NOISE

The State of California and the City of San José have established regulatory criteria that are applicable in this assessment. The State of California Environmental Quality Act (CEQA) Guidelines, Appendix G, are used to assess the potential significance of impacts pursuant to local General Plan policies, Municipal Code standards, or the applicable standards of other agencies. A summary of the applicable regulatory criteria is provided below.

State of California

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 DNL/CNEL in any habitable room.

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.

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.

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-1.3 Mitigate noise generation of new nonresidential land uses to 55 dBA DNL at the property line when located adjacent to existing or planned noise-sensitive residential and public/quasi-public land uses.

EC-1.6 Regulate the effects of operational noise from existing and new industrial and commercial development on adjacent uses through noise standards in the City's Municipal Code.

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-1.7 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.

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:

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

Policy N-4 No residential or transient lodging construction shall be permitted within the 65 dB CNEL contour boundary unless it can be demonstrated that the resulting interior sound levels will be less than 45 dB CNEL and there are no outdoor patios or outdoor activity areas associated with the residential portion of a mixed use residential project or a multi-unit residential project. (Sound wall noise mitigation measures are not effective in reducing noise generated by aircraft flying overhead.)

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.

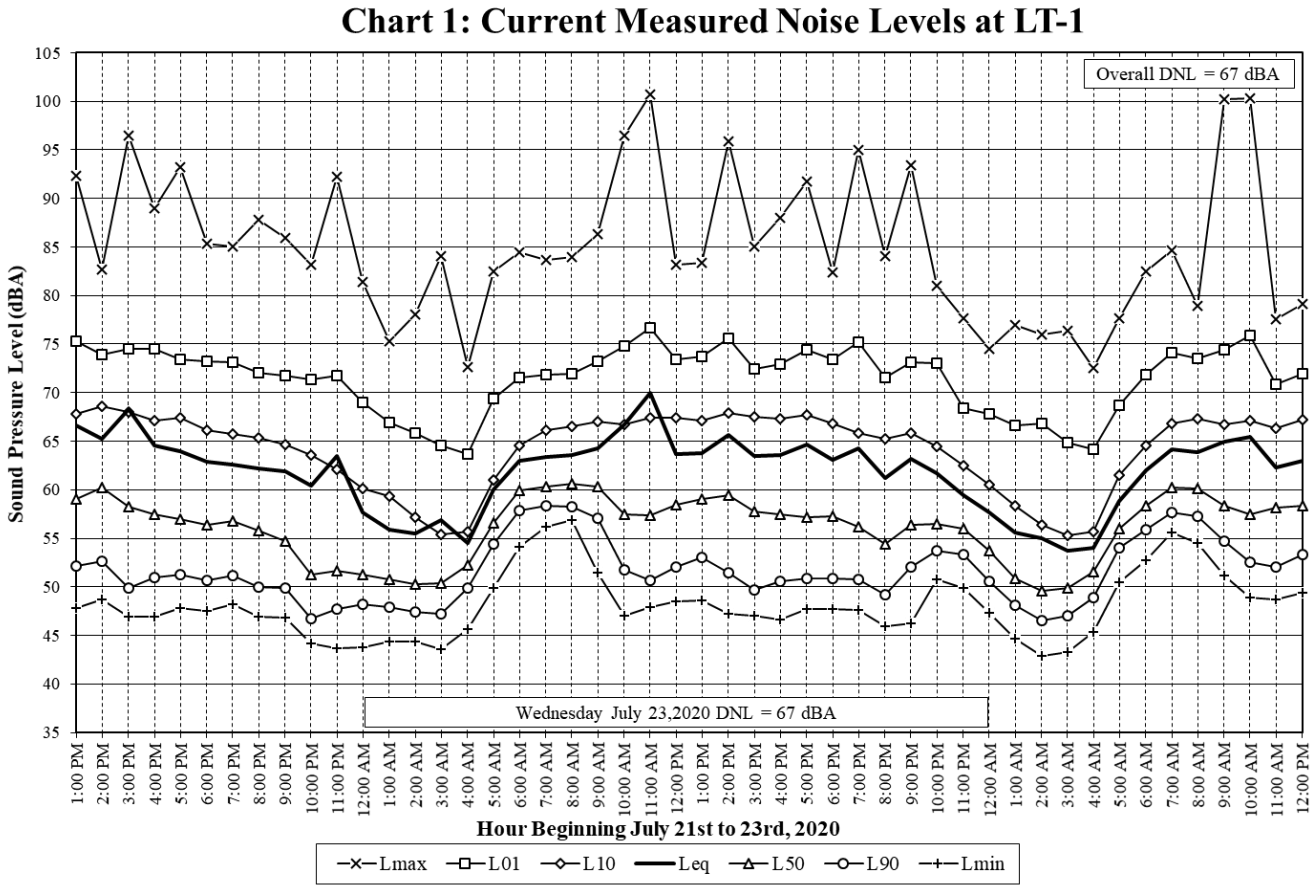
EXISTING NOISE ENVIRONMENT

The project site is located on the west side of South 4th Street between East San Salvador Street and East William Street in San José, California. The project site is in the vicinity of San José State University. Adjacent to the property to the north, east and west are existing residential land uses. The land uses to the south are mix of commercial and residential land uses. Interstate 280 (I-280) is located approximately 1,100 feet to the south of the project site.

A noise monitoring survey was performed in the vicinity of the project site beginning on Tuesday July 21st and Thursday July 23rd, 2020 to document existing noise levels in the project area and update measurement results from a prior noise measurement survey conducted for the site immediately north of the project site in September of 2015. Limited access to the project site and equipment security concerns at the time of the monitoring survey prevented long term noise measurements from being made on the site, therefore our long-term monitoring survey was conducted in the same location as was previously monitored in 2015. In this way, we were able to compare changes in noise levels in the site vicinity over the past 5 years and through a review of the relative hourly noise levels determine the relative effect of traffic and activity changes due to the current, ongoing, COVID-19 pandemic on area noise levels. The monitoring survey also included a short term, multi-elevation, noise measurement at the site frontage on South 4th Street. The measurement locations are shown in Figure 1. The noise environment at the site and in the surrounding areas results primarily from vehicular traffic along South 4th Street, East Salvador Street, and East William Street. Traffic noise from I-280 would also affect the noise environment in the vicinity of the project site. Occasional overhead aircraft associated with the San José International Airport also affect the noise environment.

Figure 1: Project Site and Noise Measurement Locations

Noise measurement LT-1 was made in the same tree as in 2015 at a height of approximately 12 feet above grade in front of the façade of the existing apartment building at 405 South 4th Street at a distance of approximately 50 feet from the roadway centerline. The measured noise levels at this location, including the energy equivalent noise level (L_{eq}), maximum (L_{max}), minimum (L_{min}), and the noise levels exceeded 10, 50 and 90 percent of the time (indicated as L_{10}, L_{50} and L_{90}) are shown on Chart 1.



A review of Chart 1 indicates that the noise levels at LT-1 followed a diurnal pattern characteristic of traffic noise, with an hourly average noise level of 64 dBA, which ranged from 61 to 70 dBA L_{eq} during the day, and the hourly average nighttime noise level was 58 dBA, and ranged from 54 to 62 dBA L_{eq}. The day-night average noise level over the entire (48 hour) measurement period and for Wednesday July 22, 2020 was 67 dBA DNL.

For reference we have also include the results of the measurement survey I&R conducted at this same location in September of 2015. The measured noise levels at this location in 2015, including the energy equivalent noise level (L_{eq}), maximum (L_{max}), minimum (L_{min}), and the noise levels exceeded 10, 50 and 90 percent of the time (indicated as L_{10}, L_{50} and L_{90}) are shown on Chart 2.

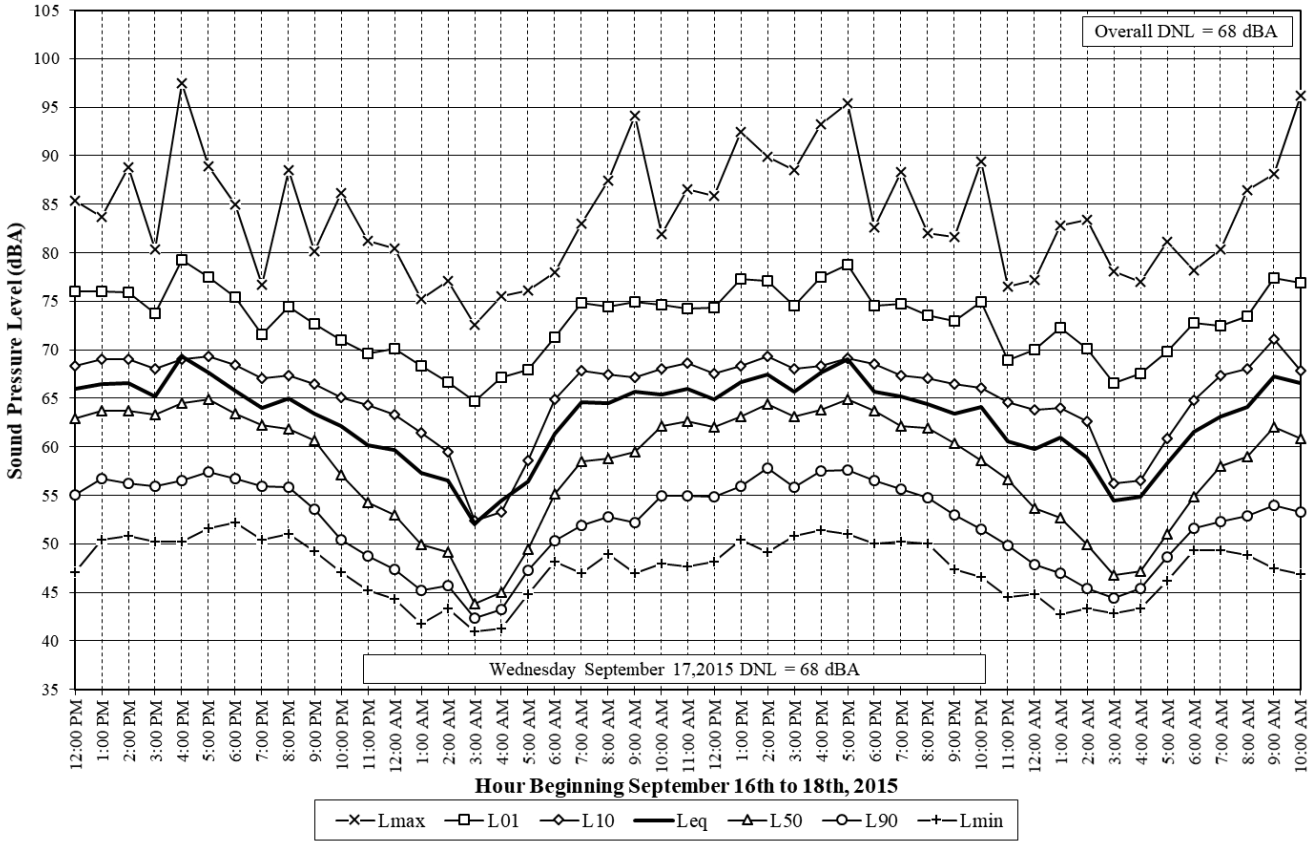
A review of Chart 2 indicates that the noise levels at LT-1 in 2015 also followed a diurnal pattern characteristic of traffic noise, with an hourly average noise level of 66 dBA and ranged from 63 to 69 dBA L_{eq} during the day, and the hourly average nighttime noise level was 58 dBA and ranged from 52 to 64 dBA L_{eq}. The day-night average noise level over the entire (47 hour) measurement period and on Thursday September 17, 2015 was 68 dBA DNL.

The 1 dBA reduction in the measured DNL at the LT-1 measurement location, the 2 dBA reduction in average daytime and no change in average nighttime noise levels at LT-1 between 2015 and 2020 may be a result from the absence of students in the area (San Jose State was in session in September of 2015 and any summer courses are now being administered remotely, without the

need for students to visit campus) or could be a result of traffic and activity reduction due to the current, ongoing, COVID-19 pandemic.

However, based on a consideration of the noise level increase for the Central/Downtown section of the City estimated in the noise assessment conducted for the Envision San José 2040 General Plan Comprehensive Update[1], which showed noise levels in the area increasing by 1 dB in the area by 2035, we would not expect a reduction of environmental noise in the project vicinity with SJSU in session under non-Pandemic conditions. In view of this, and to conduct a conservative analysis of environmental noise at the project site, this report considers the non-pandemic existing noise levels at LT-1 to be equal to, or up to 1 dBA higher, than those measured at this location in 2015. Thus, we expect the current, but non- Pandemic noise levels at LT-1 to up a DNL of 69 dBA.

Chart 2: Measured Noise Levels in 2015 at LT-1



Simultaneous ten minute duration short-term noise measurements (ST-1 and ST-2 in Figure 1) on the project site frontage at a distance of approximately 50 feet from the roadway centerline at elevations of 5 and 16 feet above the current site grade were made simultaneously with measurements at long term position LT-1 (indicated as ST-3 in Figure 1 and Table 3), between 1:50 and 2:00 pm on Friday July 24th to determine the noise levels of the residential facades residences to South 4th Street. The average day-night noise level (DNL) at short-term measurements ST-1 and ST-2 was calculated by correlating the short-term measurement data to the data gathered during the corresponding time period at the long-term site. The measurement results

[1] Illingworth and Rodkin, Inc., "Envision San José 2040 General Plan Comprehensive Update Environmental Noise Assessment", December 2010.

and calculated DNL levels at these locations under measured and estimated non-pandemic noise conditions are shown in Table 4, following.

TABLE 4: Summary of Short-Term Noise Measurement Data, dBA

Noise Measurement Location	L_{max}	$L_{(01)}$	$L_{(10)}$	$L_{(eq)}$	$L_{(50)}$	$L_{(90)}$	DNL	
							Measured Level	Non-Pandemic Levels (est.)
ST-1: 5 ft. above grade at 4th St. Site Frontage	75	72	66	62	58	49	65	67
ST-2: 16 ft. above grade at 4th St. Site Frontage	78	72	68	64	60	51	67	69
ST-3: 12 ft. above grade at position LT-1	*77*	*73*	*68*	*64*	*60*	*52*	*67*	*69*

Note: DNL is approximated by correlation to the corresponding measurement period at the long-term sites.

PLAN CONSISTENCY ANALYSIS

Noise and Land Use Compatibility

The proposed mixed-use project consists of lobby, equipment rooms and parking on the basement and first floor levels, lobby, office, amenity space, equipment rooms and parking on the mezzanine level, two outdoor courtyards, exercise rooms, amenity spaces, and residential uses are on the second floor, and residential and amenity uses are on floors three through twenty. Outdoor decks and an indoor lounge are provided on the rooftop. The primary access to the proposed development would be from South 4th Street.

Future Exterior Noise Environment

Based on the results of the site noise measurement survey, a review of area land uses, that the site is outside of the San Jose International Airport Master Plan 2037 60 dBA CNEL noise contour, and that the site is between about 1,100 and 1,250 feet of Interstate 280, transportation related noise from South 4th Street and other area roadways is expected to be the primary noise-generating uses affecting the project at the lower floors, while a combination of noise from these area roadways and I-280 traffic is expected to contribute to the environmental noise exposure of the project building at the upper floor levels.

As discussed above, future noise levels in the project vicinity are estimated to increase by 1 dBA by 2035, which would result in the project's 1st and 2nd level building facades facing South 4th Street being exposed to DNL levels of 68 and 70 dBA, respectively. Additionally, where there is a clear line of site to I-280 traffic, noise from this roadway would contribute to the exterior noise exposure at the proposed building. Based on a review of the noise contours contained in the noise assessment conducted for the Envision San José 2040 General Plan Comprehensive Update, in these conditions, the building façade at level and with a clear view of the freeway, would be exposed to noise levels of between 66 and 67 dBA DNL.

Based on this future noise exposure and considering the attenuation of traffic noise sources with distance[2] and the barrier effect provided by the building itself at facades not directly facing area

2 Traffic noise levels typically attenuate at a rate of 3 decibel (dB) per doubling of the distance from the source to the receiver.

roadways or the freeway, the DNL at various floor levels of the eastern, southern, western, and northern building façades have been calculated. The results of this analysis are given in Table 5.

Table 5: Calculated Exterior Noise Levels at Building Facades, DNL, dBA

FACADE	BUILDING FLOOR LEVELS					
	1	2	3	4-6	7-11	12-20
Eastern	68	70	71	71	70	69
Southern	62	64	65	68	68	67
Western	>60	>60	64	67	67	67
Northern	62	62	60	>60	>60	>60

The project will includes three 2nd level courtyards over the 1st building level. Two of these courtyards will be positioned at the approximate mid-section of the northern and southern facades and the third will be on the eastern edge of the project site. Considering the elevation of these courtyards with respect to that of surrounding buildings and the project building itself, these areas will be acoustically shielded from West 4th Street and I-280 traffic noise, such that they will be exposed to a DNL of less than 60 dBA. The project also includes outdoor roof decks. Considering the elevation of roof relative to surrounding roadways and these areas will be acoustically shielded by the building edge from these ground level sources, such that they will also be exposed to a DNL of less than 60 dBA.

A review of peak hour traffic turning movements for the four intersections surrounding the project site due to the project and the existing and background traffic volumes on these roadways shows that the peak hour project trips would result in a less than 1 dB increase over the peak hour traffic volumes under the existing and background conditions. Therefore, the same project-generated traffic noise increase would occur under 2035 cumulative conditions. The total cumulative plus project noise level increase at the project site by the year 2035 would be 1 dB.

Future Interior Noise Environment

The City of San José requires that interior noise levels be maintained at 45 dBA DNL or less for residences. As shown in Table 5, above, the project building facades would be exposed to levels of less than 60 dBA to up to 71 dBA DNL.

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 typically provides approximately 12 to 15 dBA of exterior-to-interior noise reduction with windows partially open for ventilation. However, with closed windows standard construction provides approximately 20 to 25 dBA of noise reduction in interior spaces. For the proposed project, interior noise levels of residences in the most noise exposed areas may be up to 51 dBA DNL standard construction and closed windows, which would exceed the City's threshold for interior noise.

Therefore, in areas where exterior noise levels range from 57 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 may be required. Such methods or materials may include a combination of smaller window and exterior 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.

Noise Insulation Features to Reduce Future Interior Noise Levels
The following noise insulation features should be incorporated into the proposed project to reduce interior noise levels to 45 dBA DNL or less:

Based on a review of the residential building floor plans and elevations provided at the time of this analysis, preliminary calculations indicate that;

- Residences on the eastern building façade and upper floor residences on the southern and western facades may be require windows and doors with a minimum STC[3] rating of 28 to 32 to meet the City and State interior noise threshold.
- Lower floor residences along the southern and western façades may require windows and doors with a minimum STC rating of 26 to 28 to meet the City and State interior noise threshold.
- Standard construction materials with the incorporation of forced-air mechanical ventilation would be adequate for the remainder of the residences
- Provide a suitable form of forced-air mechanical ventilation, as determined by the local building official, for all residences on the project site, so that windows can be kept closed to control noise.
- A qualified acoustical consultant shall review the final site plan, building elevations, and floor plans prior to construction and recommend building treatments to reduce 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.

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

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

[3] **Sound Transmission Class (STC)** A single figure rating designed to give an estimate of the sound insulation properties of a partition. Numerically, STC represents the number of decibels of speech sound reduction from one side of the partition to the other. The STC is intended for use when speech and office noise constitute the principal noise problem.

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: **Construction Noise.** Existing noise-sensitive land uses would be exposed to construction noise levels in excess of the significance thresholds for a period of more than one year. **This is a significant 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 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.

For the residences located in the project vicinity the ambient noise levels would be represented by the results of our noise measurement survey, which ranged from 61 to 70 dBA L_{eq} during daytime hours. Construction activities generate considerable amounts of noise, especially during earth-moving activities when heavy equipment is used. The construction of the proposed project would involve demolition of existing structures and pavement, substantial excavation to create the below-grade parking garage and to lay foundations, building erection, paving, and landscaping. The hauling of excavated materials and construction materials would generate truck trips on local roadways, as well. For the proposed project augercast piles will be drilled and poured and impact pile driving is not proposed. Construction activities for individual projects are typically 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 6 and 7. Table 6 shows the average noise level ranges, by construction phase, and Table 7 shows the maximum noise level ranges for different construction equipment. Most demolition and construction noise falls with the range of 80 to 90 dBA at a distance of 50 feet from the source.

The highest noise levels would be generated during grading, excavation, and foundation construction. The erection of large buildings from steel structures could also cause considerable noise for fairly long durations. At 50 feet, maximum noise levels generated would typically range from 85 to 95 dBA L_{max}. 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.

Based on the construction equipment list provided for the proposed project, hourly average construction noise levels were estimated at the property lines of the surrounding receptors. Table 8 summarizes the equipment expected to be used during each phase of construction, as well as the time duration of each phase and the estimated noise levels at the receptors. On any day, various combinations of equipment would be used simultaneously. For purposes of this analysis, worst-case conditions are assumed, which would include each piece of equipment per phase operating simultaneously. Assuming the center of the proposed building as the center of the active construction site, the distances for each hourly average noise level shown in Table 8 were measured from the center of the proposed building to nearest property line of the surrounding receptors. Shielding due to intervening buildings or other barriers is not assumed in this study.

The surrounding noise-sensitive receptors range from 65 to 150 feet from the project site. At these distances, noise levels due to construction activities would exceed 60 dBA L_{eq} and would exceed ambient levels by more than 5 dBA L_{eq} over short-term durations. At the time of this study, the projected time duration for the construction of the proposed project was estimated to be approximately 24 months. This is considered a significant impact.

TABLE 6 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 7 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
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.

Source: Mitigation of Nighttime Construction Noise, Vibrations and Other Nuisances, National Cooperative Highway Research Program, 1999.

TABLE 8 Estimated Construction Noise Levels at Nearby Land Uses

Phase	Time Duration	Construction Equipment (Quantity)	Calculated Hourly Average L_{eq}, dBA			
			Res. & Comm. - South (70ft)	Res. & Comm. - East (150ft)	Res. North (70ft)	Res. & Comm. - West (65ft)
Demolition/Site Preparation	6/16/2021-7/15/2021	Concrete/Industrial Saws (1), Excavator (1), Rubber-Tired Dozers (1), Rollers(2), Tractor/Loader/Backhoe (2)	84	77	84	84
Shoring Grading/ Excavation	7/15/2021-11/23/2021	Excavator (1), Tractor/Loader/Backhoe (3), Augercast Pile Drill Rig (2), Skid Steer Loader (2)	83	76	83	84
Below Slab Utilities	11/23/2021-12/23/2021	Tractor/Loader/Backhoe (2)	78	71	78	79
Foundation/Structure	12/23/2021-1/16/2023	Tractor/Loader/Backhoe (3), Concrete Pumper (2), Crane (1), Welder (1)	81	74	81	81
Building-Exterior	9/23/2022-5/3/2023	Crane (1), Forklift (4), Tractor/Loader/Backhoe (2) Welder (4)	81	74	81	81
Building – Interior/ Architectural Coating	4/22/2022-6/27/2023	Air Compressor (3), Aerial Lift (5)	77	70	77	78

According to the estimated construction noise levels summarized 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 and future residences, the construction of the proposed project would cause a significant temporary noise impact.

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.

Construction Noise Logistics Plan: Prior to the issuance of any grading or demolition permits, the project proponent shall submit and implement a construction noise logistics plan that specifies hours of construction, noise and vibration minimization measures, posting and notification of construction schedules, equipment to be used, and designation of a noise disturbance coordinator. The noise disturbance coordinator shall respond to neighborhood complaints and shall be in place prior to the start of construction and implemented during construction to reduce noise impacts on neighboring residents and other uses. The noise logistic plan shall be submitted to the Director of Planning or Director's designee of the Department of Planning, Building and Code Enforcement prior to the issuance of any grading or demolition permits.

As a part of the noise logistic plan, construction activities for the proposed project shall include, but should not be limited to, the following best management practices:

- In accordance with Policy EC-1.7 of the City's General Plan, utilize the best available noise suppression devices and techniques during construction activities.
- Construction activities shall be limited to the hours between 7:00 AM and 7:00 PM, Monday through Friday, unless permission is granted with a development permit or other planning approval. No construction activities are permitted on the weekends at sites within 500 feet of a residence (San José Municipal Code Section 20.100.450).
- Construct temporary noise barriers, where feasible, around the perimeter of the construction site. The temporary noise barrier fences provide noise reduction if the noise barrier interrupts the line-of-sight between the noise source and receiver and if the barrier is constructed in a manner that eliminates any cracks or gaps.
- 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 shall be strictly prohibited.
- Locate stationary noise-generating equipment such as air compressors or portable power generators as far as possible from sensitive receptors. Construct temporary noise barriers to screen stationary noise-generating equipment when located near adjoining sensitive land uses.
- Utilize "quiet" air compressors and other stationary noise sources where technology exists.
- Construction staging areas shall be established at locations that would create the greatest distance between the construction-related noise source and noise-sensitive receptors nearest the project site during all project construction.
- A temporary noise control blanket barrier shall be erected, if necessary, along building facades facing construction sites. This mitigation would only be necessary if conflicts occurred which were irresolvable by proper scheduling.
- Locate material stockpiles, as well as maintenance/equipment staging and parking areas, as far as feasible from residential receptors.
- Control noise from construction workers' radios to a point where they are not audible at existing residences bordering the project site.
- The project applicant shall prepare a detailed construction 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.
- Notify all adjacent business, residences, and other noise-sensitive land uses of the construction schedule, in writing, and provide a written schedule of "noisy" construction activities to the adjacent land uses and nearby residences.
- Designate a "disturbance coordinator" who shall be responsible for responding to any complaints about construction noise. The disturbance coordinator shall determine the cause of the noise complaint (e.g., bad muffler, etc.) and 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.

The potential short-term noise impacts associated with project construction activities would be mitigated by the reasonable noise reduction measures identified above, incorporated into the construction plan and implemented during all phases of construction activity. Construction noise would be minimized to the extent feasible, reducing the noise exposure of neighboring properties to a less-than-significant level.

Impact 1b: **Permanent Noise Level Increase.** The proposed project would not result in a permanent noise level increase at the existing residential land uses due to project-generated traffic. **This is a less-than-significant impact.**

A significant impact would result if traffic generated by the project would substantially increase noise levels at sensitive receptors in the vicinity. A substantial increase would occur if: a) the noise level increase is 5 dBA DNL or greater, with a future noise level of less than 60 dBA DNL, or b) the noise level increase is 3 dBA DNL or greater, with a future noise level of 60 dBA DNL or greater. Residences surrounding the project site have existing noise levels of 64 dBA DNL or greater; therefore, a significant impact would occur if project-generated traffic would permanently increase noise levels by 3 dBA DNL. For reference, a 3 dBA DNL noise increase would be expected if the project would double existing traffic volumes along a roadway.

For the proposed project, peak hour turning movements were provided for the four intersections in the project vicinity. Project trips were added to the existing volumes to calculate the existing plus project scenario, and the existing plus project traffic volumes were compared to existing volumes to determine the project's contribution to the permanent noise level increase. Upon comparison of these traffic conditions, a traffic noise increase of less than 1 dBA was estimated for each roadway segment included in the traffic study. The project would neither result in a doubling of traffic nor result in a permanent noise increase of 3 dBA DNL or more. This is a less-than-significant impact.

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

Impact 1c: **Noise Levels in Excess of Standards.** The proposed project is not expected to generate noise levels in excess of standards established in the City's General Plan at the nearby sensitive receptors. However, project conditions of approval shall be implemented to reduce generator noise at surrounding residential land uses to meet the City's Municipal Code threshold of 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 mixed-use land uses. However, the mechanical noise should be addressed with respect to the City's Municipal Code threshold of 55 dBA DNL to minimize disturbance to the existing residences surrounding the project site.

Mechanical Equipment

The proposed project would include mechanical equipment, such as heating, ventilation, and air conditioning systems (HVAC), as well as emergency generators, pumps, condensers, etc. The site plan available at the time of this study showed fire pump, electrical, water utility and storm water treatment rooms on the basement level; transformer and trash termination (collection) rooms on

the ground level; an elevator machine, electrical, boiler and generator rooms on the lower roof; and a mechanical well on the upper roof.

Noise level information for the specific equipment proposed, as well as quantity of equipment and size of equipment, was unavailable at the time of this study. However, most of the equipment operating on a daily basis would be located within rooms in the parking garage or on the rooftop. Typically, these types of equipment, which would include heat pumps, HVAC units, condensers, etc. would have noise levels ranging from 56 to 66 dBA at a distance of 3 feet. The ground-level equipment would receive a minimum noise level reduction of 20 dBA from the building façades. Equipment located within rooms on the rooftop would be further reduced due to the elevation of the noise source. Therefore, mechanical equipment noise due to daily operations are expected to be below 55 dBA DNL at the nearby residential property lines.

Additionally, the proposed building would include a 1000 kW emergency diesel generator in the lower roof generator room. Generators of this size can produce noise levels of up to 90 dBA at 23 feet if a weather enclosure is included or up to 80 dBA at 23 feet if a sound enclosure is included. During emergency situations, the noise produced by the operation of generators would be exempt from City noise restrictions; however, the generator is expected to be tested for a period of two hours every month. During this testing periods, ambient noise levels would temporarily increase and would be subject to the 55 dBA DNL threshold at nearby residential land uses. Assuming the emergency generator would run continuously during a two-hour period in a single day, the day-night average noise level at 23 feet would be up to 79 dBA DNL, assuming a weather enclosure, or up to 69 dBA DNL with a sound enclosure. With the location of the generator room on the low rooftop the nearest residential land uses would be about 200 feet from this room. At these distances and assuming a minimum reduction of 10 dBA from the intervening building structure, monthly testing of the emergency generator for 2 hours on a single day would result in noise levels up to 50 dBA DNL with a weather enclosure and up to 40 dBA DNL with a sound enclosure. Therefore, testing the emergency generator would not be expected to exceed the City's 55 dBA DNL threshold at the nearest residential property lines.

Since the City's General Plan does not include policies specifically addressing mechanical noise generated by residential mixed-use land uses, no General Plan policies would be violated, this would be considered a less-than-significant impact. However, as a project condition of approval, mechanical equipment shall be selected and designed to reduce excessive noise levels at the surrounding uses to meet the City's 55 dBA DNL noise level requirement at the nearby noise-sensitive land uses. A qualified acoustical consultant shall be retained to review mechanical noise as these systems are selected to determine specific noise reduction measures necessary to reduce noise to comply with the City's Municipal Code noise level requirements. Noise reduction measures could include, but are not limited to, selection of equipment that emits low noise levels and installation of noise barriers, such as enclosures and parapet walls, to block the line-of-sight between the noise source and the nearest receptors. Other alternate measures may be optimal, such as locating equipment in less noise-sensitive areas, where feasible.

Mitigation Measure 1c: None required.

Impact 2: **Exposure to Excessive Groundborne Vibration.** Residences and local businesses in the vicinity of the project site would be exposed to construction-related vibration, particularly during impact pile driving events. **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 demolition work, preparation work, excavation of below-grade levels, foundation work, and new building framing and finishing.

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. Figure 2 shows the project site and the historic properties (buildings that would be considered a San José City Landmark or would be eligible for the National Register or California Register for historic resources) within the immediate vicinity of the site (Buildings 7, 10, and 11). A significant impact at these buildings would occur if exposed to vibration levels exceeding 0.08 in/sec PPV threshold. For all other buildings in the immediate vicinity of the project site, a significant impact would occur if nearby buildings were exposed to vibration levels in excess of 0.20 in/sec PPV.

Figure 2: Nearby Buildings Surrounding the Project Site

Foundation piles for the project are proposed to be drilled and augercast and not impact driven. Project construction activities, such as drilling, the use of jackhammers, rock drills, other high-power or vibratory tools, and rolling stock equipment (tracked vehicles, compactors, etc.) may

generate substantial vibration in the immediate vicinity. Table 9 summarizes vibration levels generated by typical construction equipment at a distance of 25 feet. Vibration levels would vary depending on soil conditions, construction methods, and equipment used. Table 9 also presents estimated vibration levels calculated at the setback distances of the surrounding historic and non-historic buildings. Vibration levels are highest close to the source, and then attenuate with increasing distance at the rate $\left(\frac{D_{ref}}{D}\right)^{1.1}$, where *D* is the distance from the source (in feet) and D_{ref} is the reference distance of 25 feet.

The historical buildings adjacent to the project site along the western property lines (Buildings 11 and 12) are approximately 30 and 40 feet from the project site and the historic building to the south (Building 8) is approximately 50 feet from the project. Construction equipment such as clam shovel drops, hydromills in rock, vibratory rollers, hoe rams, large bulldozers, caisson drillings, loaded trucks, jackhammers, and small bulldozers would cause vibration levels ranging from 0.002 to 0.17 in/sec PPV at 30 feet, 0.002 to 0.13 in/sec PPV at 40 feet, and 0.001 to 0.9 in/sec PPV at 50 feet at these historical buildings as shown in Table 9. The use of these pieces of construction equipment would be in excess of the City's 0.08 in/sec PPV vibration threshold. Based our vibration level calculations, the use of the heaviest construction equipment will produce vibration levels in excess of the 0.08 in/sec PPV vibration threshold within 50 feet of historical Buildings.

The closest structure to the North, East and South are non-historically designated buildings (Buildings 2,3,4,5, and 7) at about 10 feet to the site perimeter to the North, 95 feet to the site perimeter to the East, and 5 feet to the site perimeter to the South. Construction equipment such as clam shovel drops, hydromills in rock, vibratory rollers, hoe rams, large bulldozers, caisson drillings, loaded trucks, jackhammers, and small bulldozers would cause vibration levels ranging from 0.01 to 0.6 in/sec PPV at the closest buildings to the North, 0.001 to 0.1 in/sec PPV at the closest buildings to the East, and 0.02 to 1.2 in/sec PPV at the closest buildings to the South as shown in Table 9.

TABLE 9 Vibration Source Levels for Construction Equipment at Building Façades Surrounding the Project Site

Equipment		PPV at 25 ft. (in/sec)	Vibration Levels at Nearest Buildings (in/sec PPV)						
			Historic Buildings			Non-Historical Buildings			
			Bldg. 8 South (50 ft.)	Bldg. 11 West (30 ft.)	Bldg. 12 West (40 ft.)	Nearest Bldg. East (95 ft)	Nearest Bldg. South (5 ft)	Nearest Bldg. North (10 ft)	Nearest Bldg. West (45 ft)
Clam shovel drop		0.202	0.09	0.17	0.12	0.05	1.2	0.6	0.11
Hydromill (slurry wall)	in soil	0.008	0.004	0.01	0.005	0.002	0.02	0.004	0.002
	in rock	0.017	0.008	0.01	0.01	0.004	0.05	0.01	0.004
Vibratory Roller		0.210	0.10	0.17	0.13	0.05	1.2	0.6	0.11
Hoe Ram		0.089	0.04	0.07	0.05	0.02	0.52	0.24	0.05
Large bulldozer		0.089	0.04	0.07	0.05	0.02	0.52	0.24	0.05
Caisson drilling		0.089	0.04	0.07	0.05	0.02	0.52	0.24	0.05
Loaded trucks		0.076	0.04	0.06	0.05	0.02	0.45	0.21	0.04
Jackhammer		0.035	0.02	0.03	0.02	0.01	0.21	0.10	0.02
Small bulldozer		0.003	0.001	0.002	0.002	0.001	0.02	0.01	0.002

Source: Transit Noise and Vibration Impact Assessment, United States Department of Transportation, Office of Planning and Environment, Federal Transit Administration, May 2006

A study completed by the US Bureau of Mines analyzed the effects of blast-induced vibration on buildings in USBM RI 8507.[4] The findings of this study have been applied to buildings effected by construction-generated vibrations.[5] As reported in USBM RI 8507[5] and reproduced by Dowding,[6] Figure 3 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 3, maximum vibration levels of 1.2 in/sec PPV would result in approximately 20% of threshold damage or cosmetic damage, while no minor or major damage was observed with maximum vibration levels of 1.2 in/sec PPV.

Based on these findings, heavy vibration-generating construction equipment, such as vibratory rollers or clam shovel drops, would have the potential to produce vibration levels of 0.2 in/sec PPV or more at buildings of normal conventional construction located within 25 feet of the project site (i.e., adjacent non-historical buildings to the north and south). Project-generated vibration levels would fall below the General Plan threshold of 0.2 in/sec PPV at other surrounding conventional buildings located 30 feet or more from the project site. Neither cosmetic, minor, or major damage would occur at conventional buildings located 30 feet or more from the project site.

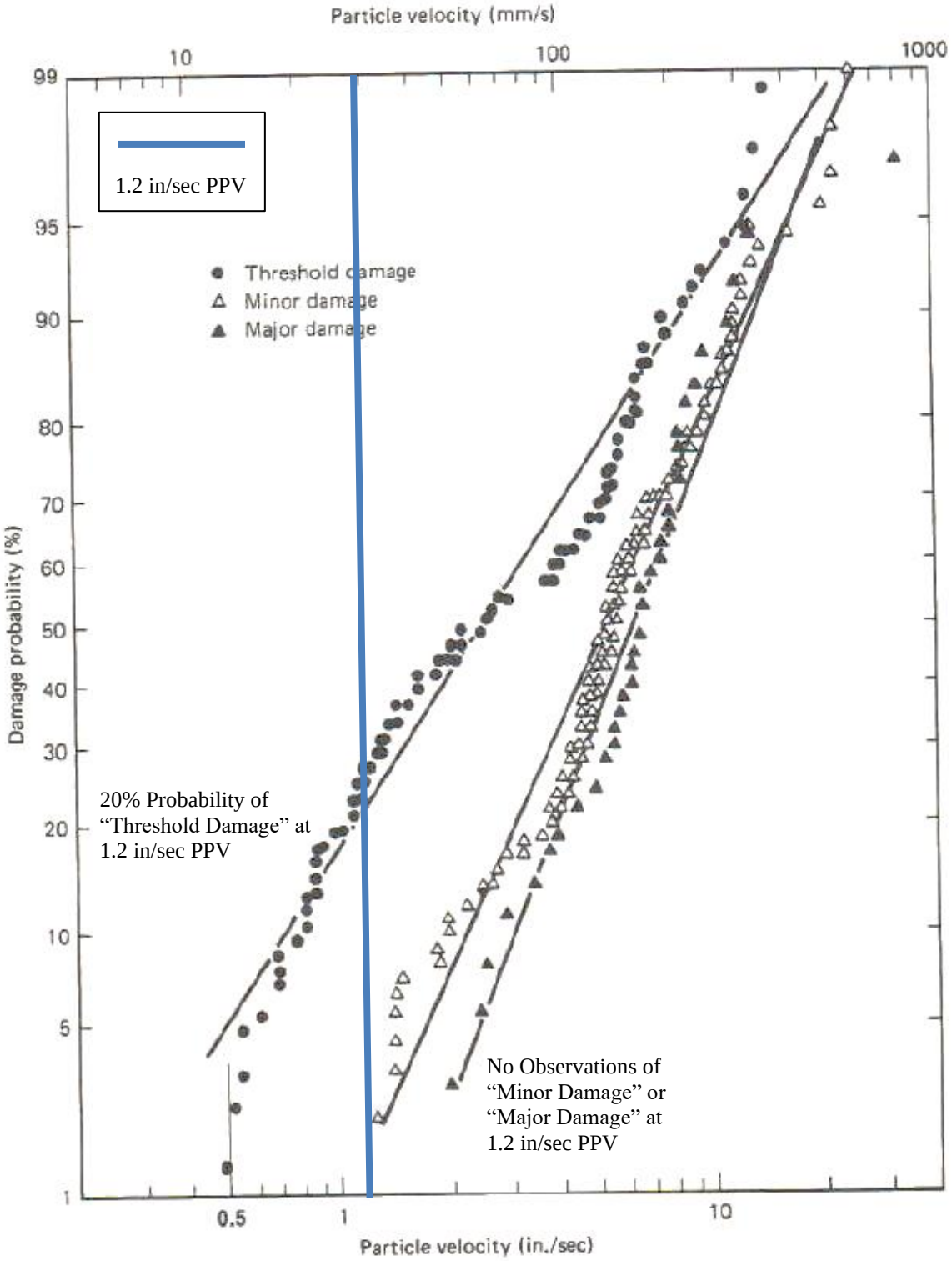
At these locations, and in other surrounding areas where vibration would not be expected to cause cosmetic damage, vibration levels may still be perceptible. However, as with any type of construction, this would be anticipated and would not be considered significant, given the intermittent and short duration of the phases that have the highest potential of producing vibration (use of jackhammers and other high-power tools). 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 hours with the least potential to affect nearby residences and businesses, perceptible vibration can be kept to a minimum.

In summary, the construction of the project would generate vibration levels exceeding the General Plan threshold of 0.08 in/sec PPV or more at historical buildings within 50 feet of the project site and of 0.2 in/sec PPV or more at buildings of normal conventional construction located within 25 feet of the project site. This is a significant impact.

4 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.

5 Dowding, C.H., Construction Vibrations, Prentice Hall, Upper Saddle River, 1996.

FIGURE 3 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., May 2018.

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.
- 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 75 feet of other 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 construction activities identified as sources of high vibration levels and each historic structure within 75 feet of construction activities. 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 two 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 2.3 miles northwest of the project site. The project site lies outside of the 60 dBA CNEL 2037 noise contour of the airport, according to the Norman Y. Mineta San José International Airport Master Plan Contour Map (Amended 2/28/20). This means that future exterior noise levels due to aircraft from Norman Y. Mineta San José International Airport is not excepted to exceed 60 dBA CNEL/DNL. Therefore, the proposed project would be compatible with the City's exterior noise standards for aircraft noise. This would be a less-than-significant impact.

Mitigation Measure 3: **None required.**

Cumulative Impacts

Cumulative noise impacts would include temporary construction noise from cumulative construction projects. Cumulative traffic volumes were not provided for the proposed project, and therefore, cumulative noise increases could not be assessed here. However, due to full buildout in the project vicinity, a significant cumulative traffic noise increase would not be expected due to the proposed project.

Expected temporary construction projects in the immediate vicinity of the project site include South Fourth Street Mixed-Use project, located on two adjacent properties (439 and 451 South 4th Street) to the north of the project site. This planned project would include the construction of a 19-story mixed-use residential building. Potentially the South Fourth Street Mixed-Use development and the proposed project could have overlapping periods of construction or could be constructed consecutively. If this occurs residential and historic buildings located in the vicinity of these two projects would be exposed to direct construction activity from both of these projects. With the inclusion of Mitigation Measures 1a and 2 in this report and those provided in the Environmental Impact Report (EIR) for the South Fourth Street Mixed-Use project, noise and vibration impacts due to cumulative construction would be reduced. However, the South Fourth Street Mixed-Use would include pile driving activities which could produce substantial vibrations at surrounding buildings.

Considering the size of each project, the heavy noise- and vibration-generating equipment, and the total time of construction for each project, this would be a significant and unavoidable cumulative noise impact for the receptors in the immediate vicinity.

No other planned development projects are located in the immediate vicinity of the proposed project. No further cumulative impacts would be expected.

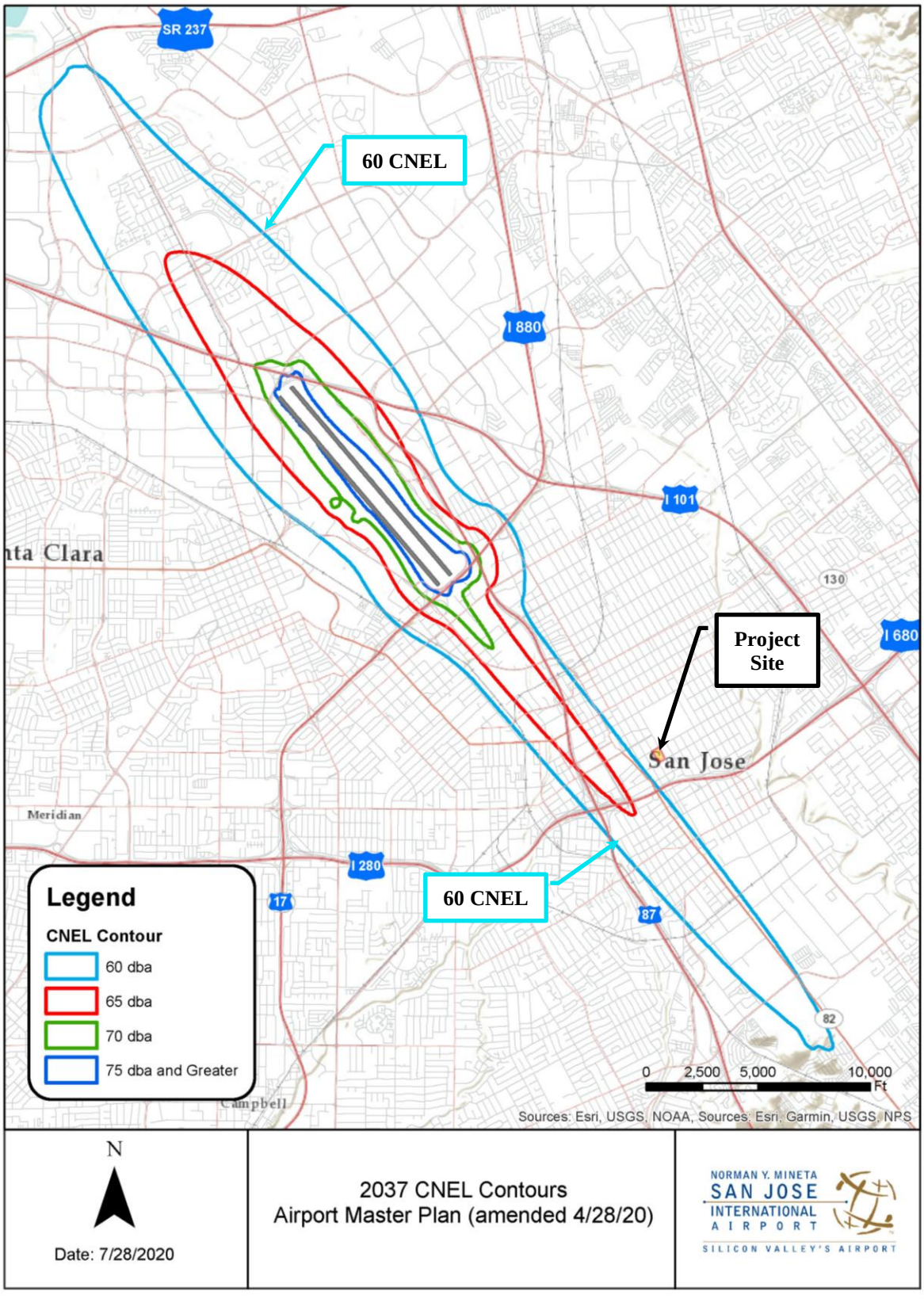


Figure 7: 2027 CNEL Noise Contours for SJIA Relative to Project Site