280 MCEVOY STREET
NOISE AND VIBRATION ASSESSMENT

San José, California

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INTRODUCTION

The project proposes to demolish existing structures and construct a single garage podium with two residential towers. The eastern tower (Building 1) would include 11 stories over a one-story podium with a total of 132 residential units for family housing. The western tower (Building 2) would include a total of 244 residential units for workforce housing. The 1.13-acre site located at 280 McEvoy Street, north of West San Carlos Street and west of Dupont Street in San Jose, California. The project is planned to be completed in phases over approximately 30 months.

This report evaluates the project's potential to result in significant environmental noise or 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 land use compatibility utilizing noise and vibration-related 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 to a less-than-significant level.

SETTING

Fundamentals of Environmental Noise

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

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

There are several methods of characterizing sound. The most common in California is the *A-weighted sound level (dBA).* This scale gives greater weight to the frequencies of sound to which the human ear is most sensitive. Representative outdoor and indoor noise levels in units of dBA are shown in Table 2. Because sound levels can vary markedly over a short period of time, a method for describing either the average character of the sound or the statistical behavior of the variations must be utilized. Most commonly, environmental sounds are described in terms of an average level that has the same acoustical energy as the summation of all the time-varying events. This *energy-equivalent sound/noise descriptor* is called L_{eq}. The most common averaging period is hourly, but L_{eq} can describe any series of noise events of arbitrary duration.

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

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

Effects of Noise

Sleep and Speech Interference

The thresholds for speech interference indoors are about 45 dBA if the noise is steady and above 55 dBA if the noise is fluctuating. Outdoors the thresholds are about 15 dBA higher. Steady noises of sufficient intensity (above 35 dBA) and fluctuating noise levels above about 45 dBA have been shown to affect sleep. Interior residential standards for multi-family dwellings are set by the State of California at 45 dBA 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 25-30 percent of the population. There is, therefore, an increase of about 2 percent per dBA between a DNL of 60-70 dBA. Between a DNL of 70-80 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 30-35 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.

Railroad and light-rail operations are potential sources of substantial ground vibration depending on distance, the type and the speed of trains, and the type of railroad track. People’s response to ground vibration from rail vehicles has been correlated best with the average, root mean square (RMS) velocity of the ground. The velocity of the ground is expressed on the decibel scale. The reference velocity is 1 x 10-6 in/sec RMS, which equals 0 VdB, and 1 in/sec equals 120 VdB. Although not a universally accepted notation, the abbreviation “VdB” is used in this document for vibration decibels to reduce the potential for confusion with sound decibels.

Typical background vibration levels in residential areas are usually 50 VdB or lower, well below the threshold of perception for most humans. Perceptible vibration levels inside residences are attributed to the operation of heating and air conditioning systems, door slams and foot traffic. Construction activities, train operations, and street traffic are some of the most common external sources of vibration that can be perceptible inside residences. Table 4 illustrates some common sources of vibration and the association to human perception or the potential for 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.

TABLE 4 Typical Levels of Groundborne Vibration

Human/Structural Response	Velocity Level, VdB	Typical Events (50-foot setback)
Threshold, minor cosmetic damage	100	Blasting, pile driving, vibratory compaction equipment
		Heavy tracked vehicles (Bulldozers, cranes, drill rigs)
Difficulty with tasks such as reading a video or computer screen	90	
		Commuter rail, upper range
Residential annoyance, infrequent events	80	Rapid transit, upper range
Residential annoyance, occasional events		Commuter rail, typical Bus or truck over bump or on rough roads
Residential annoyance, frequent events	70	Rapid transit, typical
Approximate human threshold of perception to vibration		Buses, trucks and heavy street traffic
	60	
		Background vibration in residential settings in the absence of activity
Lower limit for equipment ultra-sensitive to vibration	50	

Source: Transit Noise and Vibration Impact Assessment, US Department of Transportation Federal Transit Administration, September 2018.

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, 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 CEQA Guidelines. The 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) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies;

(b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels;

(c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project;

(d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project;

(e) For a project located within 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;

(f) For a project within the vicinity of a private airstrip, if the project would expose people residing or working in the project area to excessive noise levels.

The impacts of site constraints such as exposure of the proposed project to excessive levels of noise are not assessed under CEQA, but rather are described within the General Plan Consistency Analysis Section of the report. The significant effects of the project on the environment are addressed within the Impacts and Mitigation Section of the report, which follows CEQA EIR criteria.

2016 California Building Code, Title 24, Part 2. The current version of the California Building Code (CBC) requires interior noise levels in any new multi-family residential, residential care, or transit lodging, attributable to exterior environmental noise sources, 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 (CLUP) 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). [Note: The figure references the CLUP and the updated contours are for the year 2027.]

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.)

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: Normally Acceptable	Conditionally Acceptable	Unacceptable
1. Residential, Hotels and Motels, Hospitals and Residential Care[1]	up to 60	60–75	above 75
2. Outdoor Sports and Recreation, Neighborhood Parks and Playgrounds	up to 65	65–80	above 80
3. Schools, Libraries, Museums, Meeting Halls, Churches	up to 60	60–75	above 75
4. Office Buildings, Business Commercial, and Professional Offices	up to 70	70–80	above 80
5. Sports Arena, Outdoor Spectator Sports	up to 70	70–80	above 80
6. Public and Quasi-Public Auditoriums, Concert Halls, Amphitheaters		up to 70	above 70

[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-1.3 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.

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-1.9 Require noise studies for land use proposals where known or suspected loud intermittent noise sources occur which may impact adjacent existing or planned land uses. For new residential development affected by noise from heavy rail, light rail, BART or other single-event noise sources, implement mitigation so that recurring maximum instantaneous noise levels do not exceed 50 dBA L_{max} in bedrooms and 55 dBA L_{max} in other rooms.

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.

City of San José Municipal Code. The City's Municipal Code contains a Zoning Ordinance that limits noise levels at adjacent properties. Chapter 20.30.700 states that sound pressure levels generated by any use or combination of uses on a property shall not exceed 55 dBA at any property line shared with land zoned for residential use, except upon issuance and in compliance with a Conditional Use Permit. Chapter 20.40.600 states the sound pressure level generated by any use or combination of uses shall not exceed 60 dBA at any property line shared with land zoned for commercial/industrial uses, except upon issuance and in compliance with a Conditional Use Permit. This code is not explicit in terms of the acoustical descriptor associated with the noise level limit. Consistent with General Plan policy E.C.-1.3, a reasonable interpretation of this standard would identify the ambient base noise level criteria as the day/night noise level (DNL).

Chapter 20.100.450 of the Municipal Code establishes allowable hours of construction within 500 feet of a residential unit 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.

Chapter 20.40.500 of the Municipal Code prohibits outdoor activity, including loading, sweeping, landscaping or maintenance, which occurs within 150 feet of any residentially zoned property, between the hours of 12:00 a.m. midnight and 6:00 a.m.

Regulatory Background – Vibration

The City of San José has established vibration guidelines applicable to this analysis.

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-2.1 Near light and heavy rail lines or other sources of ground-borne vibration, minimize vibration impacts on people, residences, and businesses through the use of setbacks and/or structural design features that reduce vibration to levels at or below the guidelines of the Federal Transit Administration. Require new development within 100 feet of rail lines to demonstrate prior to project approval that vibration experienced by residents and vibration sensitive uses would not exceed these guidelines.

EC-2.3 Require new development to minimize vibration impacts to adjacent uses during demolition and construction. For sensitive historic structures, a 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 vibration limit of 0.20 in/sec PPV will be used to minimize the potential for cosmetic damage at buildings of normal conventional construction.

Existing Noise Environment

The project site is located at 280 McEvoy Street in San Jose, California. The site is surrounded by existing residential and commercial land uses. The eastern property line of the site is located as close as 80 feet from the Valley Transit Authority (VTA) light-rail line (Mountain View to Winchester route), with Union Pacific Railroad (UPRR) lines located further to the east. The frequency of VTA trains on weekdays is one every 15 to 20 minutes in northbound and southbound directions between 5 a.m. and 8 p.m. Trains are less frequent after 8 p.m. and on weekends.

A noise monitoring survey was performed between Monday, May 14, 2018 and Wednesday, May 16, 2018 to quantify and characterize ambient noise levels at the site and in the project vicinity. The monitoring survey included two long-term noise measurements (LT-1 and LT-2) and three short-term noise measurements (ST-1 through ST-3), as shown in Figure 1. The noise environment at the site and at the nearby land uses results primarily from vehicular traffic along West San Carlos Street. Secondary noise sources affecting the noise environment include aircraft activity associated with Mineta San José International Airport and intermittent VTA light-rail train passbys. Some operational and construction noise was audible at the measurement locations did not contribute towards the overall noise levels at any of the measurement locations.

Long-term noise measurement LT-1 was made east of the site, approximately 25 feet from the centerline of Dupont Street. This location was selected to quantify noise levels due to traffic along Dupont Street and train passbys along the adjacent VTA line. Maximum noise level at this location ranged from 65 to 82 dBA L_{max} during the day and 50 to 72 dBA L_{max} during night. Occasionally, maximum noise levels of 85 to 92 dBA L_{max} were recorded. Hourly average noise levels at this location ranged from 57 to 64 dBA L_{eq} during the day and from 42 to 57 dBA L_{eq} at night. The day-night average noise level on Tuesday, May 15, 2018 was 63 dBA DNL. The daily trend in noise levels at LT-1 is shown in Figure 2.

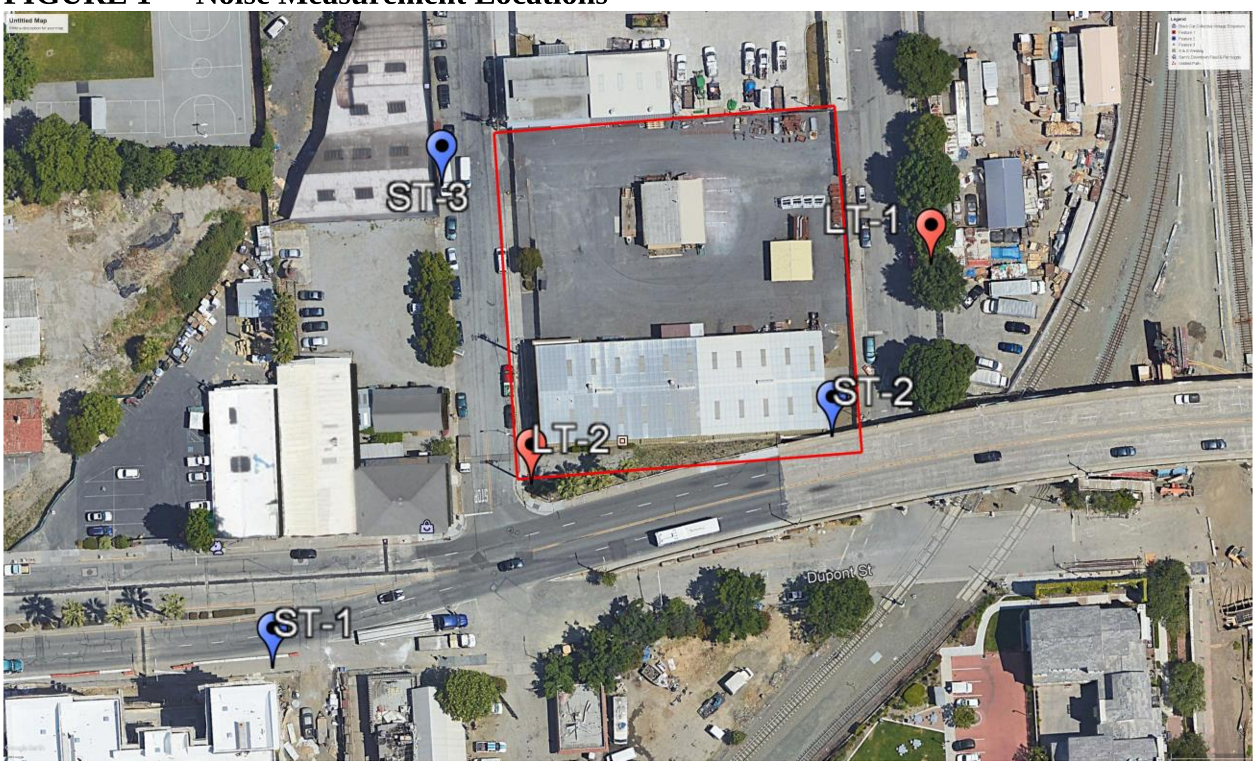
Long-term noise measurement LT-2 was made on the corner of West San Carlos Street and McEvoy Street. This location was selected to quantify noise levels due to traffic along West San Carlos Street and McEvoy Street. Hourly average noise levels at this location ranged from 68 to 74 dBA L_{eq} during the day and from 56 to 70 dBA L_{eq} at night. The day-night average noise level on Tuesday, May 15, 2018 was 73 dBA DNL. The daily trend in noise levels at LT-2 is shown in Figure 3.

Short-term noise measurements ST-1 through ST-3 were conducted on Wednesday, May 16, 2018 in ten-minute intervals starting at 11:10 a.m. and concluding at 12:00 p.m. ST-1 was made across from 759 West San Carlos Street, 40 feet south of the center of West San Carlos Street. This location was selected to quantify ambient noise levels at nearby residential receptors. The 10-minute average noise level measured at this location was 73 dBA L_{eq}. Short-term noise measurement ST-2 was made on the West San Carlos Street overpass at the southeast corner of the property line. This location was selected to quantify noise levels from West San Carlos Street that will affect the future south façade of the building. The 10-minute average noise level measured at this location was also 73 dBA L_{eq}. Short-term noise measurement ST-3 was made on the northwest corner of the project site, approximately 15 feet west of McEvoy Street. This location was selected to quantify noise levels at the nearby commercial land uses. The 10-minute average noise level measured at this location was 56 dBA L_{eq}. Table 5 summarizes the results of the short-term measurements.

TABLE 5 Summary of Short-Term Noise Measurement Data (dBA)

ID	Location (Start Time)	Measured Noise Levels, dBA					Primary noise source
		L_{10}	L_{50}	L_{90}	L_{eq}	L_{dn}	
ST-1	759 West San Carlos Street, 40 feet from centerline of West San Carlos Street (5/16/18, 11:10 a.m. to 11:20 a.m.)	75	68	61	73	75	Traffic on West San Carlos Street
ST-2	Southeast corner of the site, close to overpass, 27 feet from centerline of West San Carlos Street (5/16/18, 11:30 a.m. to 11:40 a.m.)	77	70	57	73	75	Traffic on West San Carlos Street
ST-3	In front of Aisel Design (5/16/18, 11:50 a.m. to 12:00 p.m.)	59	54	50	56	58	Distant traffic noise

FIGURE 1 Noise Measurement Locations



Source: Google Earth

FIGURE 2 Daily Trend in Noise Levels at LT-1

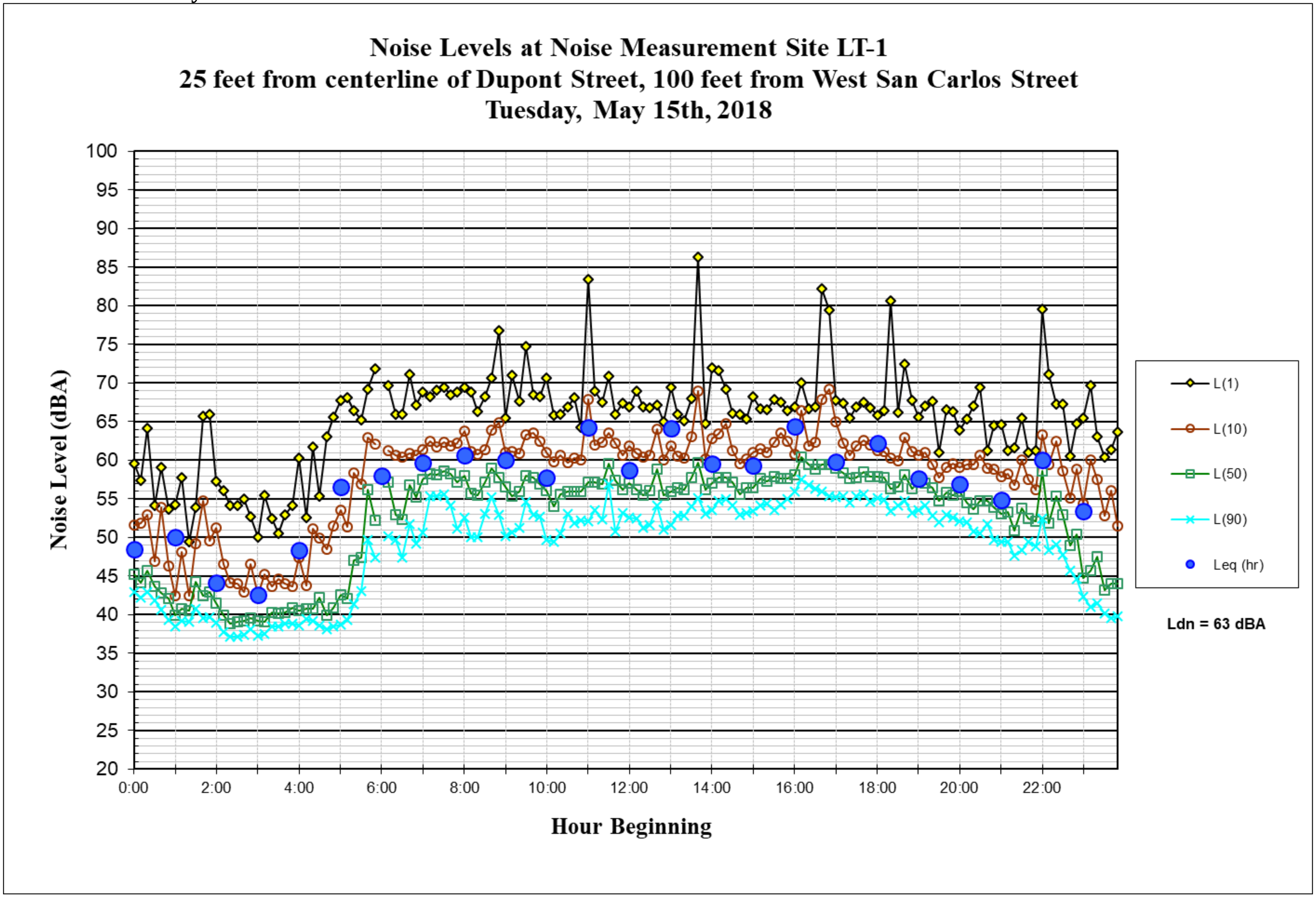
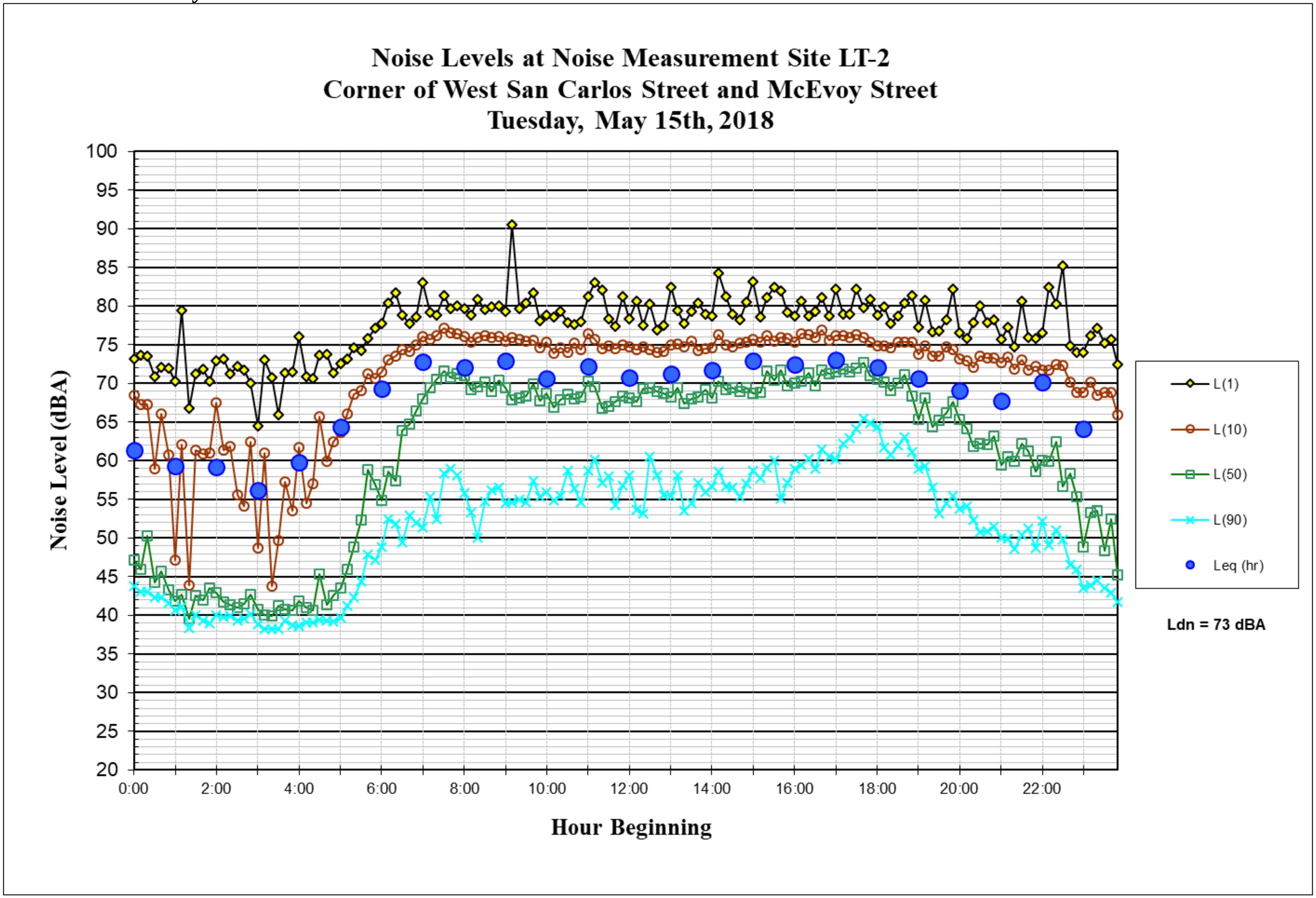


FIGURE 3 Daily Trend in Noise Levels at LT-2



GENERAL PLAN CONSISTENCY ANALYSIS

Noise and Land Use Compatibility Thresholds

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 applicable General Plan policies were presented in detail in the Regulatory Background section and are summarized below for the proposed project:

- The City's acceptable exterior noise level objective is 60 dBA DNL or less for specified outdoor areas at the proposed residential uses (Table EC-1).

- The City's standard for interior noise levels in residences is 45 dBA DNL.

Noise and Land Use Compatibility

The project proposes to demolish existing industrial warehouses on a 1.13-acre land north of West San Carlos Street bridge ramp, between McEvoy Street and Dupont Street, and construct two 11-story towers over a single podium. The towers will include 381 affordable residential units, ranging from studios to three-bedroom units. East-side tower (Building 1) will have family housing units and west-side (Building 2) will have workforce housing units. Parking will be provided on the first floor and on one below grade level. Exterior areas would include a podium on level one and potential balconies. Amenity areas would be located on level one of the towers. Levels two through twelve would have residential units.

Future Exterior Noise Environment

The future noise environment at the project site would continue to result primarily from traffic along West San Carlos Street. Secondary noise sources would include vehicle traffic along McEvoy Street and Dupont Street and trains along the VTA light-rail line to the east. Calculations based on future projected traffic volumes provided by Hexagon Transportation Consultants indicate an increase in traffic related noise of up to 1 dBA on West San Carlos Street and an increase of 3 to 4 dBA on McEvoy Street. Traffic on West San Carlos Street would continue to dominate the noise environment.

Light rail and heavy rail train activity is not anticipated to substantially increase and train activity associated with the potential California High Speed Rail project is speculative at this time. For the purposes of this assessment, future train noise levels are assumed to reach up to 64 dBA DNL along the easternmost site boundary based on the noise measured made at LT-1. Maximum instantaneous noise levels due to light rail would be expected to remain similar to existing conditions, typically in the range of 70 to 80 dBA L_{max}.

Mineta San José International Airport is a public-use airport located approximately 1.8 miles northwest of the project site. The project area lies outside the 60 dBA CNEL 2027 noise contour of the airport, according to the Mineta San José International Airport Master Plan Update Project[1] report published in February 2010 as an addendum to the Environmental Impact Report. Although aircraft-related noise would occasionally be audible at the project site, noise from aircraft would not substantially contribute to ambient noise levels.

The calculated noise level at the southern part of the courtyard on level one is up to 73 dBA DNL and would reduce substantially in the interior area of the courtyard due to shielding provided by the towers. The project has the potential to include balconies. Balconies are not typically considered sensitive to exterior noise levels. Residential land uses are considered "normally acceptable" in exterior noise exposures up to 60 dBA DNL. Where the exterior noise exposure is between 60 dBA and 75 dBA DNL, residential land uses are considered "conditionally acceptable", such that the specified land use may be permitted only after detailed analysis of the noise reduction requirements and needed noise insulation features included in the design. The majority of the exterior use area is calculated to experience noise levels above 60 dBA DNL. At these levels, the land use would be considered "conditionally acceptable" for outdoor use. Building shielding and mitigation measures such as noise barriers would be necessary to reduce noise levels to 60 dBA DNL. An eight feet barrier on the southern side of the courtyard would be required to achieve 60 dBA DNL threshold over the entire courtyard area. Alternatively, a modification to the site plan to provide more shielding using the building structure itself, would reduce the noise exposure to less than 60 dBA DNL.

Future Interior Noise Environment

The City of San José requires that interior noise levels be maintained at 45 dBA DNL or less for residences. Policy EC-1.9 requires noise studies for land use proposals where known or suspected loud intermittent noise sources occur which may impact adjacent existing or planned land uses. For new residential development affected by noise from heavy rail, light rail, BART or other single-event noise sources, policy EC-1.9 also requires mitigation so that recurring maximum instantaneous noise levels do not exceed 50 dBA L_{max} in bedrooms and 55 dBA L_{max} in other rooms.

The calculated exterior noise level exposures of building façades are summarized in Table 6, based on the results of the noise monitoring survey and future increase in traffic noise levels.

[2] City of San José, "Norman Y. Mineta San José International Airport Master Plan Update Project: Eighth Addendum to the Environmental Impact Report," City of San José Public Project File No. PP 10-024, February 10, 2010.

TABLE 6 Predicted Exterior Noise Levels at Building Façades

Building façade	Predicted Noise Levels at Façades (dBA DNL)			Minimum Recommended Sound Rated Construction[2] for 45 dBA DNL threshold
	Levels 2 - 4	Levels 5 - 8	Levels 9 - 12	
East façade facing Dupont Street	66	63	59	Forced-air only
Southern façade of Building 1 (east tower)	70	66	63	STC 28[1]
Southern façade of Building 2 (west tower)	72	69	66	STC 28 to 30
Western façade facing McEvoy Street	66	65	64	Forced-air only

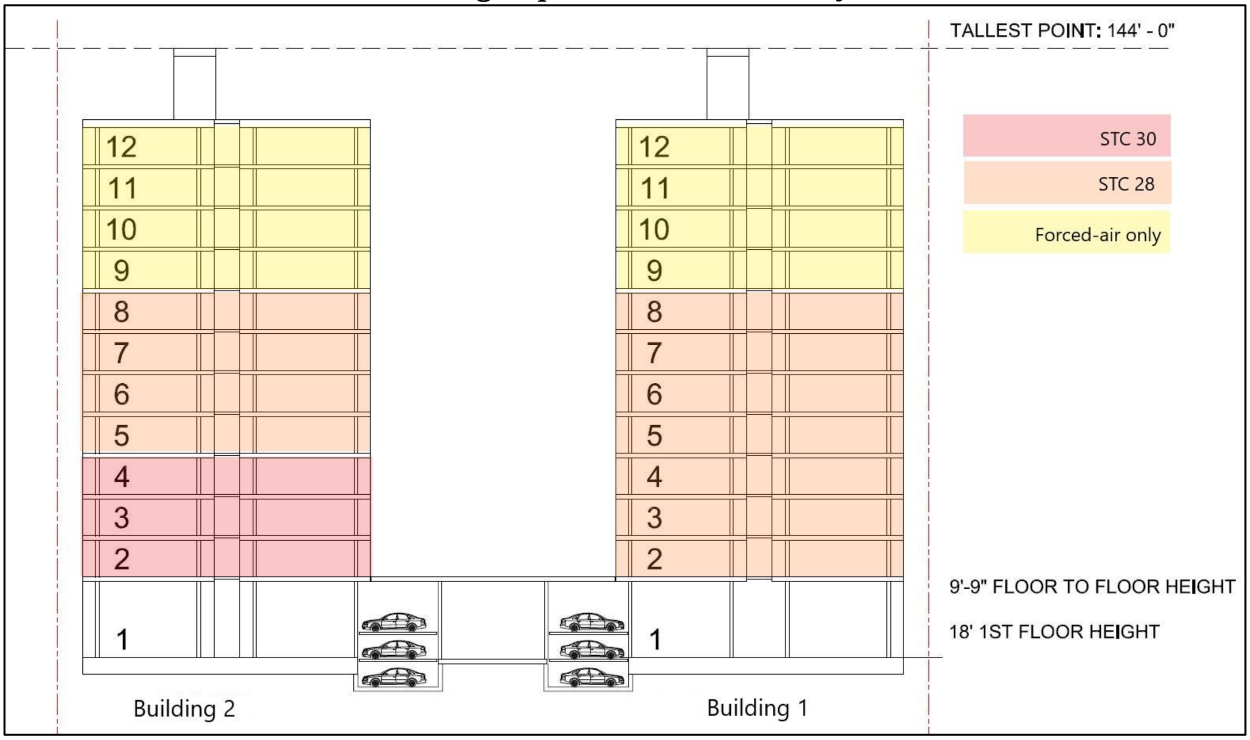
[1] Assumes forced-air mechanical ventilation is provided to allow occupants the option of keeping windows closed to control noise.
[2] Analysis assumes window area to be 40% of the façade area or less and wood stud wall with cavity of STC 39 rating.

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 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 providing a habitable interior environment and 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.

For the proposed project, the southern façade of Building 1 and Building 2 would be exposed to up to 70 dBA and 72 dBA DNL respectively. The eastern façade facing Dupont Street and western façade facing McEvoy Street would be exposed to 66 dBA DNL at levels 2 through 4. Interior noise levels with standard construction and open windows would exceed the City's 45 dBA DNL threshold in all residential units. The inclusion of forced air mechanical ventilation and windows with STC 28 rating or higher would be required on for residences with southern façade on levels 2 through 4 of Building 1. The residences with southern façade in Building 2 would require windows with STC[2] 30 rating or higher on levels 2 through 4, STC 28 or higher on floors 5 to 8. The calculations for minimum required STC ratings were made assuming window area to be 40 % of the wall area and the walls were assumed to be constructed with wood material of STC 39 sound rating. Figure 4 shows the southern elevation view of the two towers from West San Carlos Street indicating the minimum STC ratings required for windows on each level.

Forced air ventilation with closed windows would be sufficient to reduce the interior noise levels to 45 dBA DNL or less, in residences with exterior noise level up to 65 to 69 dBA DNL, which would be applicable to residences with façades facing Dupont Street or McEvoy Street and southern façade of Building 1 on levels 9 through 12.

FIGURE 4 Minimum STC rating required for southern façades



Exterior intermittent maximum noise levels expected at the easternmost portion of the project site would typically range from 70 to 80 dBA L_{max} due to nearby train activity. With the incorporation of sound rated windows and doors as specified above, noise levels would not be expected to result in sleep disturbance and activity interference within residences facing the railroad. At the worst-case affected residential units, units facing the eastern property line, intermittent maximum interior noise levels are not expected to exceed the 50 dBA L_{max} recommendation in bedrooms.

Vibration and Land Use Compatibility

The U.S. Department of Transportation, Federal Transit Administration's (FTA) vibration impact assessment criteria[2] were used to evaluate vibration levels produced by trains at the project site. The FTA vibration impact criteria are based on maximum overall levels for a single event. The impact criteria for groundborne vibration are shown in Table 7. Note that there are criteria for frequent events (more than 70 events of the same source per day), occasional events (30 to 70 vibration events of the same source per day), and infrequent events (less than 30 vibration events of the same source per day).

Based on previous train vibration measurements made by Illingworth & Rodkin, Inc. in the San Jose Diridon Station area on February 23, 2018, heavy rail train events produced vibration levels up to 79 VdB at a distance of 85 feet from the tracks while light rail train events produced vibration levels up to 67 VdB at a distance of 30 feet from the tracks. The current project site exists up to 220 feet from the nearest heavy rail track and up to 70 feet from the nearest light rail track. The

[2]U.S. Department of Transportation, Federal Transit Administration, Transit Noise and Vibration Impact Assessment, September 2018, FTA-VA-90-1003-06.

heavy rail train vibration levels at project site are calculated to be up to 73 VdB at a distance of 220 feet, and light rail train vibrations are calculated to be 61 VdB at 70 feet. At these distances, neither heavy rail nor light rail train events would be anticipated to exceed the Federal Transit Administration vibration impact guidelines for Category 2 (residential) land use.

TABLE 7 Groundborne Vibration Impact Criteria

Land Use Category	Groundborne Vibration Impact Levels (VdB re 1 µinch/sec, RMS)		
	Frequent Events[1]	**Occasional Events[2]**	**Infrequent Events[3]**
Category 1 Buildings where vibration would interfere with interior operations.	65 VdB[4]	65 VdB[4]	65 VdB[4]
Category 2 Residences and buildings where people normally sleep.	72 VdB	75 VdB	80 VdB
Category 3 Institutional land uses with primarily daytime use.	75 VdB	78 VdB	83 VdB

Notes:
1.“Frequent Events” is defined as more than 70 vibration events of the same source per day. Most rapid transit projects fall into this category.
2.“Occasional Events” is defined as between 30 and 70 vibration events of the same source per day. Most commuter trunk lines have this many operations.
3.“Infrequent Events” is defined as fewer than 30 vibration events of the same kind per day. This category includes most commuter rail branch lines.
4.This criterion limit is based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes. Vibration sensitive manufacturing or research should always require detailed evaluation to define the acceptable vibration levels. Ensuring low vibration levels in a building requires special design of HVAC systems and stiffened floors.

Measures to Consider to Ensure General Plan Consistency

For consistency with the General Plan the following Conditions of Approval are recommended for consideration by the City:

- When refining the project’s site plan, locate common outdoor areas away from adjacent noise sources and continue to shield noise-sensitive outdoor spaces with buildings or noise barriers where feasible.

- Acoustical analyses shall be conducted during the final design phase of the project to confirm that interior noise levels in residences will be reduced to 45 dBA DNL or lower. Special building techniques (e.g., sound-rated windows and building facade treatments) will likely be required to maintain interior noise levels at or below acceptable levels. These treatments would include, but are not limited to, sound rated windows and doors, sound rated wall constructions, acoustical caulking, protected ventilation openings, etc. The specific determination of what treatments are necessary will be conducted on a unit-by-unit basis during the final design phase of the project. Results of the analysis, including the description of the necessary noise control treatments, will be submitted to the City along with the building plans and approved prior to issuance of a building permit.

All building units shall be provided forced-air mechanical ventilation to allow windows to be kept closed at the occupant's discretion to control noise.

NOISE AND VIBRATION IMPACTS AND MITIGATION MEASURES

Significance Criteria

Paraphrasing from Appendix G of the CEQA Guidelines, a project would normally result in significant noise impacts if noise levels generated by the project conflict with adopted environmental standards or plans, if the project would generate excessive groundborne vibration levels, or if ambient noise levels at sensitive receivers would be substantially increased over a permanent, temporary, or periodic basis. The following criteria were used to evaluate the significance of environmental noise resulting from the project:

- **Noise Levels in Excess of Standards:** 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 or Municipal Code.

- **Groundborne Vibration from Construction:** A significant impact would be identified if the construction of the project would expose persons to excessive vibration levels. Groundborne vibration levels exceeding 0.2 in/sec PPV would have the potential to result in cosmetic damage to normal buildings. Groundborne vibration levels exceeding 0.08 in/sec PPV would have the potential to result in cosmetic damage to sensitive historic structures.

- **Project-Generated Traffic Noise Increases:** A significant impact would be identified if traffic generated by the project would substantially increase noise levels at sensitive receivers 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.

- **Construction Noise:** A significant noise impact would be identified if construction-related noise would temporarily increase ambient noise levels at sensitive receptors. Hourly average noise levels exceeding 60 dBA L_{eq} at the property lines shared with residential land uses, and the ambient by at least 5 dBA L_{eq}, for a period of more than one year would constitute a significant temporary noise increase at adjacent residential land uses. Hourly average noise levels exceeding 70 dBA L_{eq} at the property lines shared with commercial land uses, and the ambient by at least 5 dBA L_{eq}, for a period of more than one year would also constitute a significant temporary noise.

Impact 1: **Noise Levels in Excess of Standards.** The proposed project could generate noise levels in excess of standards established in the City's General Plan and Municipal Code at the nearby sensitive receptors. **This is a potentially significant impact.**

Construction Noise

Chapter 20.100.450 of the City's Municipal Code establishes allowable hours of construction within 500 feet of a residential unit 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. This analysis assumes that construction activities will occur only during the allowable hours. Project construction will be consistent with the code limits and the impact is **less-than-significant**.

Mechanical Equipment Noise

High density residential buildings typically require various mechanical equipment, such as air conditioners, exhaust fans, and air handling equipment for ventilation of the buildings. This equipment has the potential to generate noise that would be received at nearby noise-sensitive receptors. The "McEvoy Project Conceptual Residential Apartments" plans, dated August 23rd, 2018, do not include detailed information about the location or types of mechanical equipment. No specifications of the mechanical equipment were available for this analysis. Therefore, the following analysis is based on generic mechanical equipment information and locations for similar type projects that represent a worst-case scenario.

The nearest noise-sensitive uses to the project site include the multi-family residences to the south as well as commercial uses that surround the project area. Chapter 20.30.700 of the City's Municipal Code states that sound pressure levels generated by any use or combination of uses on a property shall not exceed 55 dBA at any property line shared with land zoned for residential use, except upon issuance and in compliance with a Conditional Use Permit. Chapter 20.40.600 states the sound pressure level generated by any use or combination of uses shall not exceed 60 dBA at any property line shared with land zoned for commercial/industrial uses, except upon issuance and in compliance with a Conditional Use Permit.

Typical air conditioning units and heat pumps for multi-story residential projects produce noise levels ranging from 70 to 75 dBA at a distance of 3 feet. This analysis assumes, in a worst-case scenario, that rooftop mechanical equipment could be located near the edges of the building and be as close as approximately 120 feet (direct line of site) from the shared commercial property lines. At this distance, not taking shielding from the rooftop or any potential mechanical screens or parapets walls into account, noise levels from the mechanical equipment would be above the City's threshold. Locating the equipment in a more centralized rooftop location or the incorporation of solid rooftop parapet walls and/or mechanical screening would be anticipated to provide at least 15 dBA of acoustic shielding, resulting in levels that would be below they City's threshold. Due to the number of variables inherent in the mechanical equipment needs of the project (number and type of units, locations, size, housing or enclosures, etc.), the impacts of mechanical equipment noise on adjacent noise-sensitive uses are conservatively identified as a **potentially significant** impact and shall be assessed during the final stage of project design.

Parking and Circulation Noise

Intermittent noise from vehicles accessing parking garages must meet the project generated noise threshold established in the City's Municipal Code. Current project site plans indicate parking associated with the project will be completely enclosed and exist on the 1st and 2nd level of the building. Parking activities would be completely shielded from nearby noise sensitive receptors and would not result in audible noise levels at off-site receptor locations. This is a **less-than-significant** impact.

Mitigation Measure 1:

The following mitigation measures shall be included in the project to reduce the impact to a less-than-significant level:

- Prior to the issuance of building permits, mechanical equipment shall be selected and designed to reduce impacts on surrounding uses to meet the City's requirements. A qualified acoustical consultant shall be retained by the project applicant to review mechanical noise as the equipment systems are selected in order to determine specific noise reduction measures necessary to reduce noise to comply with the City's 55 dBA L_{eq} residential and 60 dBA L_{eq} commercial noise limit at the shared property line. 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.

Impact 2: **Exposure to Excessive Groundborne Vibration due to Construction.** Construction-related vibration levels would exceed the 0.2 in/sec PPV threshold at nearby commercial buildings. **This is a potentially 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 demolition, site preparation work, grading and excavation, trenching, paving, and new building framing and finishing. This analysis assumes that under the worst-case scenario, there could be pile driving, which can cause excessive vibration.

According to Policy EC-2.3 of the City of San José 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 0.2 in/sec PPV shall be used to minimize damage at buildings of normal conventional construction.

Table 7 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 7 Vibration Source Levels for Construction Equipment

Equipment		PPV at 15 ft. (in/sec)	PPV at 55 ft. (in/sec)	PPV at 75 ft. (in/sec)	PPV at 100 ft. (in/sec)	PPV at 125 ft. (in/sec)
Pile Driver (Impact)	upper range	2.031	0.486	0.346	0.252	0.197
	typical	1.130	0.271	0.192	0.140	0.110
Pile Driver (Sonic)	upper range	1.287	0.308	0.219	0.160	0.125
	typical	0.298	0.071	0.051	0.037	0.029
Clam shovel drop		0.354	0.085	0.060	0.044	0.034
Hydromill (slurry wall)	in soil	0.014	0.003	0.002	0.002	0.001
	in rock	0.030	0.007	0.005	0.004	0.003
Vibratory Roller		0.368	0.088	0.063	0.046	0.036
Hoe Ram		0.156	0.037	0.027	0.019	0.015
Large bulldozer		0.156	0.037	0.027	0.019	0.015
Caisson drilling		0.156	0.037	0.027	0.019	0.015
Loaded trucks		0.133	0.032	0.023	0.017	0.013
Jackhammer		0.061	0.015	0.010	0.008	0.006
Small bulldozer		0.005	0.001	0.001	0.001	0.001

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

Impact pile driving would have the potential to produce typical vibration levels of 0.08 in/sec PPV or more at historical buildings within 170 feet of the project site. According to the City of San José Historic Resources Inventory,[3] there are no historical buildings within 170 feet of the project site.

Impact pile driving would have the potential to produce typical vibration levels of 0.2 in/sec PPV or more at conventional, non-historical buildings located within 125 feet of the project site. Conventional buildings located with 125 feet of the site include an industrial building at 254 McEvoy Street, 15 feet north of project site, 751 West San Carlos Street, 55 feet to the southwest, Asiel Design building, 75 feet to the northwest, and 205 Dupont Street, 100 feet to the north. All of the above-mentioned receptors are commercial or industrial use buildings.

As indicated in Table 7, at a distance of 15 feet, 'upper range' impact pile driving would be anticipated to generate vibration levels as high as 2.031 in/sec PPV, with 'typical' levels anticipated to be approximately 1.130 in/sec PPV. "Upper range' impact pile driving would have the potential to produce vibration levels of 0.2 in/sec PPV or more at buildings within 125 feet, with 'typical' impact pile driving generating levels producing vibration levels of 0.2 in/sec PPV or more at buildings within 75 feet. Other heavy vibration generating construction equipment, including 'typical' vibratory pile driving, vibratory rollers, or clam shovel drops, would have the potential to produce vibration levels of 0.2 in/sec PPV or more within about 25 feet of construction. 'Upper range' vibratory pile driving would have the potential to produce vibration levels of 0.2 in/sec PPV or more within about 80 feet of construction.

[3] "City of San José Historic Resources Inventory." City of San José, February 8, 2016, www.sanjoseca.gov/DocumentCenter/View/35475 .

The US Bureau of Mines has analyzed the effects of blast-induced vibration on buildings in USBM RI 8507[4], and these findings have been applied to vibrations emanating from construction equipment on buildings[5]. As shown on Figure 5, these studies indicate an approximate 40% probability of "threshold damage" (referred to as cosmetic damage elsewhere in this report) and 8% probability of "minor damage" at vibration levels of 2.0 in/sec PPV or less with no observations of "major damage". At vibration levels of 1.1 in/sec PPV or less, studies indicate an approximate 20% probability of "threshold damage" with no observations of "minor damage" or "major damage". Figure 5 presents the damage probability as reported in USBM RI 8507 and reproduced by Dowding assuming a maximum vibration level of 1.1 and 2.0 in/sec PPV. Based on these data, cosmetic or threshold damage would be manifested in the form of hairline cracking in plaster, the opening of old cracks, the loosening of paint or the dislodging of loose objects. Minor damage (e.g., hairline cracking in masonry or the loosening of plaster) could occur assuming a maximum vibration level of 2.0 in/sec PPV if impact pile driving is used as a form of construction. Major structural damage (e.g., wide cracking or shifting of foundation or bearing walls) to adjacent structures would not be anticipated to occur assuming a maximum vibration level of 2.0 in/sec PPV.

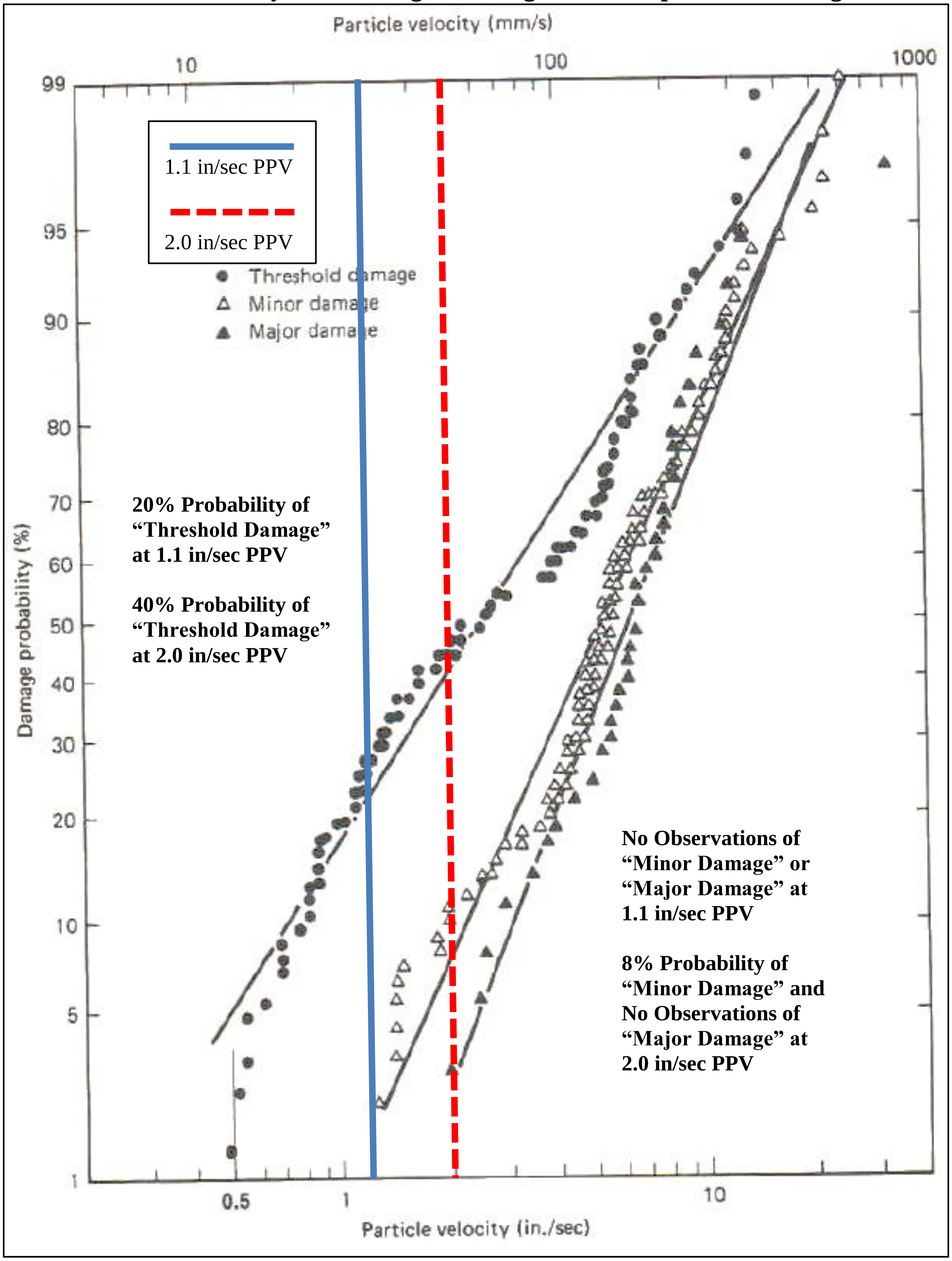
The use of impact pile driving could exceed 0.2 in/sec PPV when located within 125 feet of structures. Other heavy vibration generating construction equipment could exceed 0.2 in/sec PPV when located within 25 feet of structures. Such vibration levels could be capable of cosmetically damaging these buildings. For impact pile driving located within 15 feet of structures, "minor damage" to structures is also possible. This is a **potentially significant** impact.

In other surrounding areas where vibration would not be expected to cause structural 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 businesses, perceptible vibration can be kept to a minimum.

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 5 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., June 2018.

Mitigation Measure 2:

The following measures are recommended to reduce vibration impacts from construction activities:

- Avoid impact pile driving where possible. Drilled piers or rammed aggregate piers cause lower vibration levels where geological conditions permit their use.

- Where possible, prohibit operation of earth-moving equipment or other heavy vibration-generating equipment within distances of 25 feet of adjacent structures.

- Phase demolition, earth-moving, and ground impacting operations so as not to occur during the same time period.

- A list of all heavy construction equipment to be used for this project and anticipated time duration of using the equipment that is known to produce high vibration levels (clam shovel drops, vibratory rollers, tracked vehicles, vibratory compaction, jackhammers, hoe rams, etc.) shall be submitted to the City 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 for reducing vibration levels below the thresholds.

- Place operating equipment on the construction site as far as possible from vibration-sensitive receptors. Prohibit the use of heavy vibration-generating construction equipment, such as vibratory rollers or excavation using clam shell or chisel drops, within 30 feet of any adjacent building.

- Use smaller equipment to minimize vibration levels below the limits.

- Avoid using vibratory rollers and tampers near sensitive areas.

- Select demolition methods not involving impact tools.

- Modify/design or identify alternative construction methods to reduce vibration levels below the limits.

- Avoid dropping heavy objects or materials.

- If pile driving is required, notify neighbors within 500 feet of the construction site of the construction schedule and that there could be noticeable vibration levels resulting from pile driving.

- If pile driving is required, foundation pile holes shall be pre-drilled to minimize the number of impacts required to seat the pile.

- If pile driving is required, jet or partially jet piles into place to minimize the number of impacts required to seat the pile.

- A construction vibration monitoring plan shall be implemented to document conditions at all structures located within 125 feet of construction prior to, during, and after pile driving. 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 should be implemented to include the following tasks:

    - Identification of sensitivity to ground-borne vibration of nearby structures. Vibration limits should be applied to all vibration-sensitive structures located within 300 feet of any pile driving activities and 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 of structure of normal construction within 125 feet of pile driving activities and/or within 25 feet of other construction activities identified as sources if high vibration levels. Surveys shall be performed prior to any pile driving activity, in regular interval during pile driving, and after 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.

    - Development of 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 pile driving. Alternative construction methods would be identified for when vibration levels approach the limits.

    - At a minimum, vibration monitoring should be conducted during pavement demolition, excavation, and pile driving activities. Monitoring results may indicate the need for more or less intensive measurements.

    - If vibration levels approach limits (0.2 in/sec PPV), suspend construction and implement contingencies to either lower vibration levels or secure the affected structure.

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

    - The results of all vibration monitoring shall be summarized and submitted in a report shortly after substantial completion of each phase identified in the project schedule. The report will include a description of measurement methods, equipment used, calibration certificates, and graphics as required to clearly identify vibration-monitoring locations. An explanation of all events that exceeded vibration limits will be included together with proper documentation supporting any such claims.

- 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.

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

Impact 3: **Substantial Permanent Noise Increase due to Project-Generated Traffic.** Project-generated traffic would not cause a permanent noise level increase at existing noise-sensitive land uses in the project vicinity. **This is a less-than-significant impact.**

A significant noise impact would occur if traffic generated by the project would substantially increase noise levels at sensitive receptors in the project 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. Noise-sensitive land uses along Park Avenue and West San Carlos Street are exposed to noise levels greater than 60 dBA DNL; therefore, a significant impact would occur if project-generated traffic would permanently increase noise levels by 3 dBA DNL. For reference, a doubling in traffic volumes would result in a noise level increase of 3 dBA.

To determine traffic noise level increases at existing residential land uses due to project-generated traffic, net project trip traffic volumes from the project traffic study[6] were added to existing traffic volumes and then the existing + project volumes were compared to existing traffic volumes. Based on these calculations, roadways in the vicinity of the project are anticipated to result in noise increases attributable to the project of 0 to 1 dBA at existing noise-sensitive land uses. Project attributed traffic noise increases would be less than 3 dBA. This is a **less-than-significant** impact.

Mitigation Measure 3: **None required.**

Impact 4: **Substantial Temporary Noise Increase due to Construction.** 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 potentially 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.

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[6] 280 McEvoy Residential Development VMT Trip Generation Estimates, Hexagon Transportation Consultants, Inc., October 18, 2018.

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 and none on weekends when construction occurs within 500 feet of a residential land use. As described in Impact 1, construction would be conducted within allowable hours. 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.

While noise thresholds for temporary construction are not provided in the City's General Plan or Municipal Code, the Fundamentals section of this report provides a threshold of 45 dBA for speech interference indoors. Assuming a 15 dBA exterior-to-interior reduction for standard residential construction and a 25 dBA exterior-to-interior reduction for standard commercial construction, this would correlate to an exterior threshold of 60 dBA L_{eq} at residential land uses and 70 dBA L_{eq} at commercial land uses. Additionally, temporary construction would be annoying to surrounding land uses if the ambient noise environment increased by at least 5 dBA L_{eq} for an extended period of time. Therefore, the temporary construction noise impact would be considered significant if project construction activities exceeded 60 dBA L_{eq} at nearby residences or exceeded 70 dBA L_{eq} at nearby commercial land uses and exceeded the ambient noise environment by 5 dBA L_{eq} or more for a period longer than one year.

The commercial receptors to the north and east of the project site have existing daytime ambient noise levels in the range of 56 to 64 dBA L_{eq} (see LT-1 and ST-3). The commercial receptors to the west of the project site along with receptors to the south along San Carlos Street are exposed to daytime ambient noise levels in the range of 68 to 72 dBA L_{eq} (see LT-2).

Construction activities generate considerable amounts of noise, especially during earth-moving activities and during the construction of the building's foundation when heavy equipment is used. Typical hourly average construction-generated noise levels for residential buildings are about 81 to 88 dBA L_{eq} measured at a distance of 50 feet from the center of the site during busy construction periods (e.g., earth moving equipment, impact tools, etc.), as shown in Table 8. The typical range of maximum instantaneous noise levels would be 78 to 105 dBA L_{max} at a distance of 50 feet, as shown in Table 9.

TABLE 8 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 9 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.

Construction activities would include demolition, site preparation, excavation, grading, trenching, building construction, paving, and architectural coating. 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. The hauling of excavated materials and construction materials would generate truck trips on local roadways as well.

FHWA’s Roadway Construction Noise Model (RCNM) was used to calculate the maximum and average noise levels anticipated during each phase of construction based on a provided construction equipment list. 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. Vehicles and equipment anticipated during each phase of construction were input into RCNM to calculate noise levels at a reference distance of 50 feet. Levels calculated in RCNM represent an upper bound of possible construction noise. Construction noise levels would range 5-10 dBA below these upper bound levels. The typical hourly average noise levels were calculated considering the distance from the center of the construction site to the nearest receptors.

Hourly average noise levels due to construction activities during busy construction periods outdoors would typically range from about 75 to 88 dBA L_{eq} at a distance of 50 feet for all non pile driving activities. Pile driving noise levels typically range up to 105 dBA L_{eq} at a distance of 50 feet. Construction-generated noise levels drop off at a rate of about 6 dBA per doubling of the distance between the source and receptor. Table 10 presents the construction noise levels calculated for each major construction phase of the project using RCNM. The nearest noise-sensitive land uses are approximately 100 to 150 feet from the center of the project site. At these distances, hourly average noise levels during busy construction periods would range from 69 to 81 dBA L_{eq} at the nearest northern commercial use and from 65 to 77 dBA L_{eq} at the commercial uses to the west and east of the project site. Construction noise levels at commercial receptors on McEvoy Street and Dupont Street would be expected to exceed 70 dBA L_{eq} and the ambient noise environment by at least 5 dBA L_{eq} for a period exceeding one year. Other nearby noise-sensitive receptors to the south bordering West San Carlos Street include the 808 West apartments and Monte Vista Town Homes. These receptors have an ambient noise environment elevated by traffic noise on West San Carlos Street of 68 to 73 dBA L_{eq}. Noise levels at these receptors would not be expected to exceed both 60 dBA L_{eq} and ambient noise levels by 5 dBA L_{eq} due to typical construction activities.

TABLE 10 Noise Levels by Construction Phase at Distances from Site Center

Construction Phase	Maximum Noise Level (L_{max}, dBA)			Hourly Average Noise Level ($L_{eq[h]}$, dBA)		
	100 ft.	150 ft.	250 ft.	100 ft.	150 ft.	250 ft.
Demolition	84	80	76	82	78	74
Site Preparation	78	74	70	78	74	70
Pile driving	99	95	91	99	95	91
Grading Excavation	79	75	71	81	77	73
Trenching	78	74	70	76	72	68
Building Exterior	78	74	70	79	75	71
Building Interior	72	68	64	69	65	61
Paving	84	80	76	78	74	70

Typically, pile driving activities for a building can occur over a period of one week to several weeks in which hourly average noise levels would be substantially higher than average noise levels during other phases of construction. Noise levels from pile driving at a distance of 100 feet from the closest commercial receptors could reach 99 dBA L_{max}, and at the remaining nearby receptors would typically range from 91 to 95 dBA L_{max} during the pile driving phase. Pile driving activities would exceed noise thresholds at both nearby commercial and residential land uses.

Construction noise levels from the project site would be expected to exceed thresholds at nearby commercial receptors. In addition, assuming 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 and within 200 feet of existing commercial uses, Policy EC-1.7 of the City's General Plan would consider this temporary construction impact to be potentially significant.

Mitigation Measure 4:

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. Construction equipment should be well-maintained and used judiciously to be as quiet as possible. Additionally, construction activities for the proposed project should include the following best management practices to reduce noise from construction activities near sensitive land uses:

- Construction activities 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.

- Construct solid plywood fences around ground level construction sites adjacent to noise-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 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 should be strictly prohibited.

- Locate stationary noise-generating equipment, such as air compressors or portable power generators, as far as possible from sensitive receptors as feasible. If they must be located near receptors, adequate muffling (with enclosures where feasible and appropriate) or temporary barriers shall be used reduce noise levels at the adjacent sensitive receptors. Any enclosure openings or venting shall face away from sensitive receptors.

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

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

- If pile driving is found to be necessary, multiple-pile drivers shall be considered to expedite construction. Although noise levels generated by multiple pile drivers would be higher than the noise generated by a single pile driver, the total duration of pile driving activities would be reduced.

- Foundation pile holes shall be pre-drilled to minimize the number of impacts required to seat the pile. Pre-drilling foundation pile holes is a standard construction noise control technique because pre-drilling reduces the number of blows required to seat the pile.

- A temporary noise control blanket barrier could 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. Noise control blanket barriers can be rented and quickly erected.

- 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 contractor shall prepare a detailed construction plan identifying the schedule for major noise-generating construction activities and notify in writing all adjacent business, residences, and other noise-sensitive land uses of the construction schedule. The construction plan shall identify a procedure for coordination with adjacent residential land uses so that construction activities can be scheduled to minimize noise disturbance.

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

Implementation of the above measures would reduce construction noise levels emanating from the site, limit construction hours, and minimize disruption and annoyance. With the implementation of these measures, and recognizing that noise generated by construction activities would occur over a short-term period, the temporary increase in ambient noise levels would be less-than-significant.