Appendix F

Noise & Vibration Assessment

BELMONT VILLAGE ASSISTED LIVING FACILITY ENVIRONMENTAL NOISE AND VIBRATION ASSESSMENT

San José, California

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INTRODUCTION

The project proposes to construct a 198-bed, 152-unit assisted living and memory care facility at the northwest of intersection of Union Avenue and Los Gatos Almaden Road in the City of San José, California. Proposed amenities include courtyards, dining rooms, a bistro, town hall rooms, a salon, a screening room, and garden. The facility will employ 47 full-time equivalent employees. Vehicular access to the facility will be provided from the driveway on Union Avenue and 162 parking spaces will be provided on a parking lot west of proposed building.

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 mitigation measures, where necessary, to provide a compatible project in relation to adjacent noise sources and land uses.

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 to 17 dBA with open windows. With closed windows in good condition, the noise attenuation factor is around 20 dBA for an older structure and 25 dBA for a newer dwelling. Sleep and speech interference is therefore possible when exterior noise levels are about 57 to 62 dBA DNL with open windows and 65 to 70 dBA DNL if the windows are closed. Levels of 55 to 60 dBA are common along collector streets and secondary arterials, while 65 to 70 dBA is a typical value for a primary/major arterial. Levels of 75 to 80 dBA are normal noise levels at the first row of development outside a freeway right-of-way. In order to achieve an acceptable interior noise environment, bedrooms facing secondary roadways need to be able to have their windows closed, and those facing major roadways and freeways typically need special glass windows.

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.

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 induce structural 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 much 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 dwellings
0.5	Severe - Vibrations considered unpleasant	Threshold at which there is a risk of damage to new residential and modern commercial/industrial structures

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

Regulatory Background – Noise

The State of California 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 California Environmental Quality Act (CEQA) contains guidelines to evaluate the significance of effects of environmental noise attributable to a proposed project. Under CEQA, noise impacts would be considered significant if the project would result in:

(a) Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies;

(b) Generation of excessive groundborne vibration or groundborne noise levels;

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

Checklist items (a) and (b) are applicable to the proposed project. The project is not located within two miles of a public airport or in the vicinity of a private airstrip and would not expose people residing or working in the project area to excessive aircraft noise levels; therefore, item (c) is not carried further in this analysis.

2016 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.

2016 California Green Building Standards Code (Cal Green Code). The State of California established exterior sound transmission control standards for new non-residential buildings as set forth in the 2016 California Green Building Standards Code (Section 5.507.4.1 and 5.507.4.2). Section 5.507 states that either the prescriptive (Section 5.507.4.1) or the performance method (Section 5.507.4.2) shall be used to determine environmental control at indoor areas. The prescriptive method is very conservative and not practical in most cases; however, the performance method can be quantitatively verified using exterior-to-interior calculations. For the purposes of this report, the performance method is utilized to determine consistency with the Cal Green Code. The sections that pertain to this project are as follows:

> **5.507.4.1 Exterior noise transmission, prescriptive method.** Wall and roof-ceiling assemblies exposed to the noise source making up the building envelope shall meet a composite STC rating of at least 50 or a composite OITC rating of no less than 40, with exterior windows of a minimum STC of 40 or OITC of 30 when the building falls within the 65 dBA L_{dn} noise contour of a freeway or expressway, railroad, industrial source or fixed-guideway noise source, as determined by the local general plan noise element.
>
> **5.507.4.2 Performance method.** For buildings located, as defined by Section 5.507.4.1, wall and roof-ceiling assemblies exposed to the noise source making up the building envelope shall be constructed to provide an interior noise environment attributable to exterior sources that does not exceed an hourly equivalent noise level ($L_{eq\ (1\text{-}hr)}$) of 50 dBA in occupied areas during any hour of operation.

The performance method, which establishes the acceptable interior noise level, is the method typically used when applying these standards.

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 such as schools, 65 dBA DNL for playground and outdoor spaces, and 70 dBA DNL for commercial uses (Table EC-1). The acceptable exterior noise level objective is established for the City, except in the environs of the San José International Airport and the Downtown, as described below:

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

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

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

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

Normally Acceptable:

- Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.

Conditionally Acceptable:

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

Unacceptable:

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

EC-1.2 Minimize the noise impacts of new development on land uses sensitive to increased noise levels (Categories 1, 2, 3 and 6) by limiting noise generation and by requiring use of noise attenuation measures such as acoustical enclosures and sound barriers, where feasible. The City considers significant noise impacts to occur if a project would:

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

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

EC-1.3 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-1.7 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.

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 that sound pressure levels generated by any use or combination of uses on a property shall not exceed 60 dBA at any property line shared with land zoned for commercial or other non-residential purposes, 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.

Regulatory Background – Vibration

The City of San Jos**é** 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-2.3 Require new development to minimize vibration impacts to adjacent uses during demolition and construction. 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 5175 Union Avenue in San José, California. Residential uses surround the site to the north, east, and west. The Union School District Office is located south of the project site. A noise monitoring survey was performed beginning on Tuesday, February 19, 2019 and concluding on Thursday, February 21, 2019. The survey included one long-term and two short-term noise measurements, as shown in Figure 1. Table 4 summarizes the results of the short-term measurements. The results of the long-term noise measurement at LT-1 are shown in Figure 2.

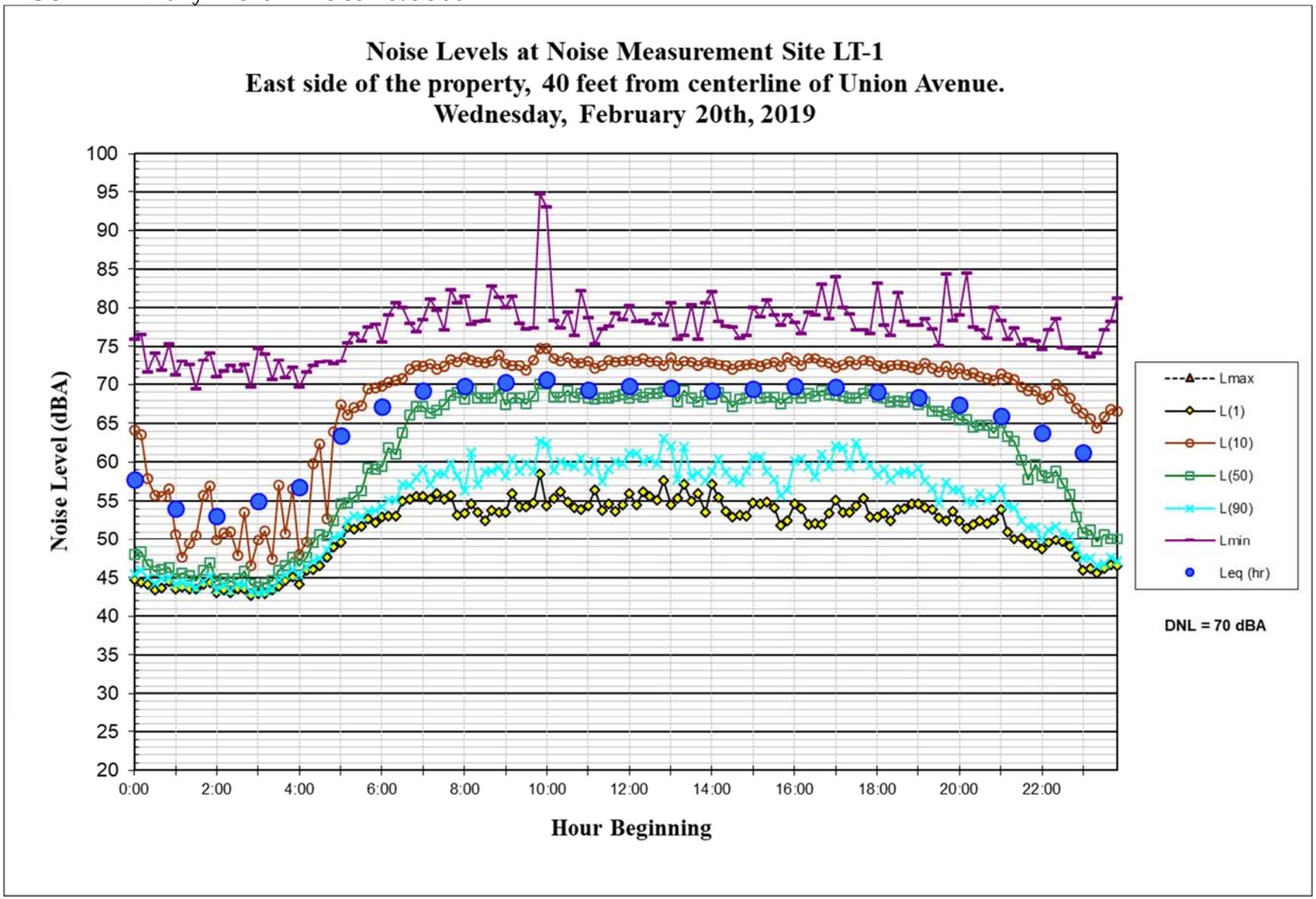
Long-term noise measurement LT-1 was made approximately 40 feet from the centerline of Union Avenue. The primary noise source at this location was vehicular traffic along Union Avenue. Hourly average noise levels at LT-1 ranged from 66 to 71 dBA L_{eq} during daytime hours and from 53 to 67 dBA L_{eq} at night. The day-night average noise level on Wednesday, February 20, 2019 was 70 dBA DNL.

TABLE 4 Summary of Short-Term Noise Measurement Data, February 19, 2019

ID	Location (Start Time)	Measured Noise Levels, dBA				Calculated DNL	Primary noise source
		L_{10}	L_{50}	L_{90}	L_{eq}		
ST-1	East side of the site, 40 feet from centerline of Union Avenue (12:30 pm to 12:40 pm)	73	68	58	70	70	Traffic on Union Avenue
ST-2	West side of the site (12:50 p.m. to 1:00 p.m.)	49	46	44	47	48	Distant Traffic

FIGURE 1 Noise Measurement Locations

FIGURE 2 Daily Trend in Noise Levels at LT-1



GENERAL PLAN CONSISTENCY ANALYSIS

Noise and Land Use Compatibility

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 the proposed residential uses (Table EC-1).

- The City's acceptable exterior noise level objective is 70 dBA DNL for the proposed office and commercial uses (Table EC-1).

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

- The California Green Building Code limits interior noise levels within new non-residential land uses to an hourly equivalent noise level ($L_{eq\ (1\text{-}hr)}$) of 50 dBA in occupied areas during any hour of operation.

Future Exterior Noise Environment

Exterior use areas would include a memory care garden, a main courtyard and two smaller courtyards, and a restaurant patio, all on the ground level. Based on proposed project's transportation analysis[1], future traffic noise levels along Union Avenue are not anticipated to change substantially from existing levels. As a result, future traffic noise levels at the site were calculated based on measurements made during the noise monitoring survey.

The main courtyard and memory care garden would be well shielded from the traffic on Union Avenue by the proposed building and would be exposed to up to 53 dBA DNL. These noise levels would meet the City's residential exterior noise level objective of 60 dBA DNL or less. The restaurant patio overlooking Union Avenue would be exposed to up to 67 dBA DNL, and the restaurant courtyards to the south of the proposed building would be exposed to up to 64 dBA DNL. These noise levels would meet the City's commercial exterior noise level objective of 70 dBA DNL or less.

Future Interior Noise Environment

The City of San José requires that interior noise levels be maintained at 45 dBA DNL or less for residences, consistent with the California Building Code. Exterior noise levels would be as high as 67 dBA DNL at building façades facing east, 65 dBA DNL at north facing façades, 63 dBA

[1] Belmont Village Assisted Living Facility Transportation Analysis, *Hexagon Transportation Consultants*, February 15, 2019.

DNL at south facing façades, and up to 53 dBA DNL at façades facing the memory care garden and main courtyard.

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 new construction with the windows closed provides approximately 25 dBA of noise reduction in interior spaces. Where exterior noise levels range from 60 to 70 dBA DNL, the inclusion of adequate forced-air mechanical ventilation can reduce interior noise levels to acceptable levels by allowing occupants the option of closing the windows to control noise.

Based on preliminary calculations, residential units with east and north fronting façades would achieve the 45 dBA DNL interior standard with the inclusion of forced-air mechanical ventilation to allow occupants the option of keeping windows closed to control noise. All other residential units would achieve the 45 dBA DNL interior limit with standard construction and windows in the open or closed position. Forced air mechanical ventilation with windows in the closed positions would also be sufficient for restaurant and other amenity use areas to comply with the Cal Green Code standard of 50 dBA $L_{eq\ (1\text{-}hr)}$ in occupied non-residential areas during any hour of operation.

Recommended Conditions of Approval

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

- A suitable form of forced-air mechanical ventilation, as determined by the local building official, shall be provided for all occupied areas of the proposed building with east and north fronting façades, so that windows can be kept closed to control noise.

NOISE IMPACTS AND MITIGATION MEASURES

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

Significance Criteria

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

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

    a. Operational Noise in Excess of Standards. A significant noise impact would be identified if on-site project operations (i.e., mechanical equipment or parking) would generate noise levels that would exceed 55 dBA DNL at adjacent residential property lines or 60 dBA DNL at adjacent commercial property lines.

    b. Permanent Noise Increase. A significant permanent noise increase would occur if project traffic resulted in an increase of 3 dBA DNL or greater at noise-sensitive land uses where existing or projected noise levels would equal or exceed the noise level considered satisfactory for the affected land use (60 dBA DNL for single-family residential areas) and/or an increase of 5 dBA DNL or greater at noise-sensitive land uses where noise levels would continue to be below those considered satisfactory for the affected land use.

    c. Temporary Noise Increase. A significant temporary noise impact would be identified if construction-related noise would occur outside of the hours specified in the Municipal Code or if construction noise levels were to exceed the City's construction noise limits at adjacent noise sensitive land uses.

2. **Generation of Excessive Groundborne Vibration:** 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.

Impact 1: **Temporary or Permanent Noise Increases in Excess of Standards.** Project traffic would not result in substantial permanent noise level increase at existing noise-sensitive uses in the project vicinity. Existing noise sensitive land uses would not be exposed to operational and construction noise levels in excess of applicable noise thresholds. This is a **less-than-significant impact**.

a. Permanent Noise from On-Site Operations

Noise generating on-site operational components of the project would include mechanical equipment and parking lot activities. Operational noise levels are limited to 55 dBA DNL at adjacent residential property lines or 60 dBA DNL at adjacent commercial property lines.

Parking Lot Noise

Parking will be provided in a parking lot located to the west of proposed building. Access to the parking lot would be provided from Union Avenue, north of the proposed building. Noise sources associated with the use of the parking lot would include vehicular circulation, louder engines, car alarms, squealing tires, door slams, and human voices. The typical sound of a passing car at 15 mph would be about 50 to 60 dBA L_{max} at a distance of 50 feet. The noise of an engine start is similar. Door slams typically produce noise levels lower than engine starts. The hourly average noise level resulting from all these noise-generating activities in a small parking lot would reach 40 dBA L_{eq} at a distance of 50 feet from the parking area.

The nearest residential land uses are located 25 feet south and 100 feet north of the parking lot. Residences to the south would be anticipated to experience hourly average noise levels as high as 46 dBA L_{eq} and residences to the north would experience up to 34 dBA L_{eq} from parking activities. Noise levels would be considerably lower on a DNL basis and would not exceed the City's 55 dBA DNL limit at residences or 60 dBA DNL limit at the school office building located to the south. This is a **less-than-significant** impact.

Mechanical Equipment

The proposed project would include mechanical equipment such as heating, ventilation and air conditioning systems (HVAC). The site plans[2], dated February 9, 2018, indicate that mechanical equipment would be installed in a generator and mechanical equipment room inside the southern portion of the proposed building. Equipment housed inside would not be audible at off-site locations and would not contribute to the ambient noise at sensitive receptors near the project area. This is a **less-than-significant** impact.

b. Permanent Noise Increases from Project Traffic

A significant permanent noise increase would be identified if traffic noise generated by the project would result in a noise level increase of 5 dBA DNL or greater, with a future noise level of less than 60 dBA DNL, or 3 dBA DNL or greater, with a future noise level of 60 dBA DNL or greater. For reference, a doubling in traffic volumes would result in a noise level increase of 3 dBA.

2 Belmont Village Union Avenue – Full Resubmittal Set, *HKIT Architects*, February 9, 2018.

The Transportation Analysis provided by Hexagon Transportation Consultants, Inc[1] was reviewed to calculate potential traffic noise level increases attributable to the project. To calculate the traffic noise level increases attributable to project-generated traffic at nearby noise sensitive areas, project trip traffic volumes 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 less than 1 dBA L_{eq} at existing noise-sensitive land uses. Day-night average (DNL) noise level increases would be anticipated to be similar. Project attributed traffic noise increases would be less than 3 dBA DNL. This is a **less-than-significant impact**.

c. Temporary Noise Increases from Project Construction

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. Policy EC-1.7 of the City's General Plan states that for large or complex projects within 500 feet of residential land uses or within 200 feet of commercial land uses or offices involving substantial noise-generating activities lasting more than 12 months, 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.

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.

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 construction noise levels at a distance of 50 feet are shown in Tables 5 and 6. Table 5 shows the average noise level ranges, by construction phase and Table 6 shows the maximum noise level ranges for different construction equipment. Typical hourly average construction-generated noise levels for residential buildings are about 81 to 88 dBA L_{eq} at a distance of 50 feet from the center of the site during busy non-pile driving construction periods (e.g., earth moving equipment, impact tools, etc.). Pile driving would not be used as a method of construction. Construction-generated noise levels drop off at a rate of about 6 dBA per doubling of the distance between the source and receptor.

TABLE 5 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 6 Construction Equipment 50-Foot Noise Emission Limits

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

Project construction is anticipated to take 15 to 17 months. 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 within stages, based on the amount of equipment in operation and the location at which the equipment is operating. The noisiest periods of construction would include demolition and site work (site preparation, excavation, and grading). Building construction generally results in much lower noise levels.

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 the project specific construction equipment list. Vehicles and equipment anticipated during each phase of construction were input into RCNM to calculate noise levels at distances representative of the nearest noise sensitive uses. Levels calculated in RCNM represent an upper bound of possible construction noise. Construction noise levels would typically range 5 to 10 dBA below these upper bound levels. Table 7 presents the construction noise levels calculated for each major construction phase of the project using RCNM.

TABLE 7 Noise Levels by Construction Phase at Representative Distances

Construction Phase	Maximum Noise Level (L_{max}, dBA)			Hourly Average Noise Level ($L_{eq[h]}$, dBA)		
	50 ft.	80 ft.	150 ft.	50 ft.	80 ft.	150 ft.
Demolition	90	86	81	85	81	76
Site Preparation	85	81	76	83	79	74
Grading Excavation	85	81	76	84	80	75
Trenching	81	77	72	78	74	69
Building Exterior	81	77	72	78	74	69
Building Interior	78	74	69	75	71	62
Paving	80	76	71	84	80	76

The closest noise sensitive receptors would include residences located 50 feet to the south, 150 feet to the north and 125 feet to the east, and the School District Office Building located 125 feet to the south. At a distance of 50 feet, hourly average noise levels would typically range from 78 to 90 dBA L_{eq}. At a distance of 150 feet, hourly average noise levels would typically range from 69 to 81 dBA L_{eq}.

Construction would be located within 500 feet of residential land uses and within 200 feet of commercial land uses for a period of more than 12 months. However, the noisiest periods of construction would occur over a combined period of 10 to 11 months, with building construction occurring during the middle period of construction. This is a **less-than-significant impact**, assuming the following best management practices are used:

- 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.

- 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. Construct temporary noise barriers to screen stationary noise-generating equipment when located near adjoining sensitive land uses. Temporary noise barriers could reduce construction noise levels by 5 dBA.

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

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

- 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 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.

Mitigation Measure 1: None required.

Impact 2: Exposure to Excessive Groundborne Vibration due to Construction. Construction-related vibration levels would not exceed the 0.2 in/sec PPV threshold at nearby structures. This is a **less-than-significant** impact.

According to the City of San José Historic Resources Inventory[3], there are no historical buildings within 170 feet of the project site. Therefore, Policy EC-2.3 of the City of San José General Plan limits construction vibration to 0.2 in/sec PPV at buildings of normal conventional construction.

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, excavation, grading, trenching, building construction, paving, and architectural coating. Pile driving is not anticipated as a method of construction.

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

Table 8 presents typical vibration levels that could be expected from construction equipment at a distance of 25 feet, as given by FTA, and at distances of 50, 80, 100, and 125 feet, representative of the nearest structures. Project construction activities, such as 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. Vibration levels would vary depending on soil conditions, construction methods, and equipment used.

TABLE 8 Vibration Source Levels for Construction Equipment

Equipment		**PPV at 25 ft. (in/sec)**	**PPV at 50 ft. (in/sec)**	**PPV at 80 ft. (in/sec)**	**PPV at 100 ft. (in/sec)**	**PPV at 125 ft. (in/sec)**
Clam shovel drop		0.202	0.094	0.056	0.044	0.034
Hydromill (slurry wall)	in soil	0.008	0.004	0.002	0.002	0.001
	in rock	0.017	0.008	0.005	0.004	0.003
Vibratory Roller		0.210	0.098	0.058	0.046	0.036
Hoe Ram		0.089	0.042	0.025	0.019	0.015
Large bulldozer		0.089	0.042	0.025	0.019	0.015
Caisson drilling		0.089	0.042	0.025	0.019	0.015
Loaded trucks		0.076	0.035	0.021	0.017	0.013
Jackhammer		0.035	0.016	0.010	0.008	0.006
Small bulldozer		0.003	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, May 2006 as modified by Illingworth & Rodkin, Inc., February 2019.

Structures are located as close as 50 feet from construction. As indicated in Table 8, 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 within 25 feet of construction. There are no structures located within 25 feet of project construction. At distances of 50 feet vibration levels from construction are anticipated to be 0.09 or less. Vibration levels may be perceptible to occupants but would be below the 0.3 in/sec PPV vibration limit. Construction vibration would not be anticipated to cause architectural or structural damage to the nearest buildings and would not be considered excessive. As construction moves away from the shared property lines, vibration levels would be even lower. This is a **less-than-significant** impact.

Mitigation Measure 2: None required.