# APPENDIX H
# Noise Assessment

# *1655 BERRYESSA MIXED-USE DEVELOPMENT ENVIRONMENTAL NOISE AND VIBRATION ASSESSMENT*

## *San José, California*

**March 11, 2022**

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## INTRODUCTION

This report evaluates the project's potential to result in significant 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 and groundborne vibration, summarizes applicable regulatory criteria, and discusses existing noise and vibration conditions; 2) the Plan Consistency Analysis section discusses noise/vibration 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 mitigate project impacts to a less-than-significant level.

## PROJECT DESCRIPTION

The 13-acre project site is within the boundaries of the 270-acre Berryessa BART Urban Village (BBUV) Plan area. The project site currently contains three industrial buildings and ancillary structures, an associated parking lot, a vegetated pond, and trees. The northern portion of the site has been cleared and graded. The project proposes to demolish the existing uses and construct up to 850 residential units, 480,000 square feet (sf) of commercial space, and a 0.9-acre open space park at the project site. The residences would be located in the northeastern and central areas, and along the northern and western perimeter of the site. The proposed commercial space would be located in the southern area of the site, fronting Berryessa Road, and the open space park would be located on the northwestern corner of the site.

The 850 residential units would include 614 market rate multi-family, 189 affordable multi-family, 23 townhouse, and 24 single-family units. The single-family and townhouse units would be two-stories, the market rate multi-family buildings would be nine stories, and the affordable multi-family would be 10 stories. The proposed commercial building would be 10 stories containing 465,000-sf of medical office space and 15,000-sf of retail/restaurant space. The project would provide two levels of underground parking in residential buildings and three levels of underground parking in the commercial building for a total of 2,105 parking stalls.

## 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*) 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.

**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, 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 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 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, April 2020.

**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**

This section describes the relevant guidelines, policies, and standards established by State Agencies, Santa Clara County, and the City of San José. 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 of California**

***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.

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

***2019 California Building Cal Green Code.*** The State of California established exterior sound transmission control standards for new non-residential buildings as set forth in the 2019 California Green Building Standards Code (Section 5.507.4.1 and 5.507.4.2). 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 DNL 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.

**<u>Santa Clara County</u>**

***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;

<u>4.3.2.1 Noise Compatibility Policies</u>

N-1 The Community Noise Equivalent Level (CNEL) method of representing noise levels shall be used to determine if a specific land use is consistent with the CLUP.

N-2 In addition to the other policies herein, the Noise Compatibility Policies presented in Table 4-1 shall be used to determine if a specific land use is consistent with this CLUP.

N-3 Noise impacts shall be evaluated according to the Aircraft Noise Contours presented on Figure 5 (not shown in this report).

N-6 Noise level compatibility standards for other types of land uses shall be applied in the same manner as the above residential noise level criteria. Table 4-1 presents acceptable noise levels for other land uses in the vicinity of the Airport.

Table 4 - 1

**NOISE COMPATIBILITY POLICIES**

| LAND USE CATEGORY | CNEL | | | | | |
|---|---|---|---|---|---|---|
| | 55-60 | 60-65 | 65-70 | 70-75 | 75-80 | 80-85 |
| Residential – low density Single-family, duplex, mobile homes | * | ** | *** | **** | **** | **** |
| Residential – multi-family, condominiums, townhouses | * | ** | *** | **** | **** | **** |
| Transient lodging - motels, hotels | * | * | ** | **** | **** | **** |
| Schools, libraries, indoor religious assemblies, hospitals, nursing homes | * | *** | **** | **** | **** | **** |
| Auditoriums, concert halls, amphitheaters | * | *** | *** | **** | **** | **** |
| Sports arena, outdoor spectator sports, parking | * | * | * | ** | *** | **** |
| Playgrounds, neighborhood parks | * | * | *** | **** | **** | **** |
| Golf courses, riding stables, water recreation, cemeteries | * | * | * | ** | *** | **** |
| Office buildings, business commercial and professional, retail | * | * | ** | *** | **** | **** |
| Industrial, manufacturing, utilities, agriculture | * | * | * | *** | *** | **** |
| * Generally 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. Mobile homes may not be acceptable in these areas. Some outdoor activities might be adversely affected. | | | | | |
| ** Conditionally Acceptable | New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design. Outdoor activities may be adversely affected.<br>Residential: Conventional construction, but with closed windows and fresh air supply systems or air conditioning will normally suffice. | | | | | |
| *** Generally Unacceptable | New construction or development should be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design. Outdoor activities are likely to be adversely affected. | | | | | |
| **** Unacceptable | New construction or development shall not be undertaken. | | | | | |

Source: Based on General Plan Guidelines, Appendix C (2003), Figure 2 and Santa Clara County ALUC 1992 Land Use Plan, Table 1

Source: Comprehensive Land Use Plan Santa Clara County, Norman Y Mineta San José International Airport, May 25, 2011, Amended May 23, 2019.

## City of San José

***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 | 55–60 | 60–65 | 65–70 | 70–75 | 75–80 | 80+ |
|---|---|---|---|---|---|---|---|
| 1. Residential, Hotels and Motels, Hospitals and Residential Care[1] | Normally Acceptable | Normally Acceptable | Conditionally Acceptable | Conditionally Acceptable | Conditionally Acceptable | Unacceptable | Unacceptable |
| 2. Outdoor Sports and Recreation, Neighborhood Parks and Playgrounds | Normally Acceptable | Normally Acceptable | Normally Acceptable | Conditionally Acceptable | Conditionally Acceptable | Conditionally Acceptable | Unacceptable |
| 3. Schools, Libraries, Museums, Meeting Halls, Churches | Normally Acceptable | Normally Acceptable | Conditionally Acceptable | Conditionally Acceptable | Conditionally Acceptable | Unacceptable | Unacceptable |
| 4. Office Buildings, Business Commercial, and Professional Offices | Normally Acceptable | Normally Acceptable | Normally Acceptable | Normally Acceptable | Conditionally Acceptable | Conditionally Acceptable | Unacceptable |
| 5. Sports Arena, Outdoor Spectator Sports | Normally Acceptable | Normally Acceptable | Normally Acceptable | Normally Acceptable | Conditionally Acceptable | Conditionally Acceptable | Unacceptable |
| 6. Public and Quasi-Public Auditoriums, Concert Halls, Amphitheaters | Conditionally Acceptable | Conditionally Acceptable | Conditionally Acceptable | Conditionally Acceptable | Unacceptable | Unacceptable | Unacceptable |

[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.

Source: Envision San José 2040 General Plan, Adopted November 1, 2011, As Amended on May 16, 2019.

**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-1.14** Require acoustical analyses for proposed sensitive land uses in areas with exterior noise levels exceeding the City's noise and land use compatibility standards to base noise attenuation techniques on expected Envision General Plan traffic volumes to ensure land use compatibility and General Plan consistency.

**Regulatory Background – Vibration**

**<u>Federal Government</u>**

***Federal Transit Administration.*** The Federal Transit Administration (FTA) has identified vibration impact criteria for sensitive buildings, residences, and institutional land uses near rail transit and railroads. These criteria are shown in Table 5. The thresholds for residences and buildings where people normally sleep (e.g., nearby residences) are 72 VdB for frequent events (more than 70 events of the same source per day), 75 VdB for occasional events (30 to 70 vibration events of the same source per day), and 80 VdB for infrequent events (less than 30 vibration events of the same source per day).

**TABLE 5 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.

**City of San José**

***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 continuous vibration impacts to adjacent uses during demolition and construction. For sensitive historic structures, including ruins and ancient monuments or building that are documented to be structurally weakened, a continuous vibration limit of 0.08 in/sec PPV (peak particle velocity) will be used to minimize the potential for cosmetic damage to a building. A continuous vibration limit of 0.20 in/sec PPV will be used to minimize the potential for cosmetic damage at buildings of normal conventional construction. Equipment or activities typical of generating continuous vibration include but are not limited to: excavation equipment; static compaction equipment; vibratory pile drivers; pile-extraction equipment; and vibratory compaction equipment. Avoid use of impact pile drivers within 125 feet of any buildings, and within 300 feet of historical buildings, or buildings in poor condition. On a project-specific basis, this distance of 300 feet may be reduced where warranted by a technical study by a qualified professional that verifies that there will be virtually no risk of cosmetic damage to sensitive buildings from the new development during demolition and construction. Transient vibration impacts may exceed a vibration limit of 0.08 in/sec PPV only when and where warranted by a technical study by a qualified professional that verifies that there will be virtually no risk of cosmetic damage to sensitive buildings from the new development during demolition and construction.

**Existing Noise Environment**

The project site is located north of Berryessa Road and the Bay Area Rapid Transit (BART) Berryessa Station and west of the BART/Union Pacific Railroad (UPRR) rail line in San José, California. The site is bordered to the west by multi-family and single family residences and to the north by single family residences. The project site currently contains three industrial buildings and ancillary structures, and an associated parking lot.

Illingworth & Rodkin, Inc. performed a noise monitoring survey beginning on Wednesday, June 2, 2021 and concluding on Friday, June 4, 2021. The survey consisted of one long-term noise measurement (LT-1) and three short-term noise measurements (ST-1, ST-2, and ST-3). The existing noise environment at the site results primarily from vehicular traffic along Berryessa Road and passbys of BART. UPRR trains (2/day), aircraft associated with the Norman Y. Mineta San José International Airport, and local residential traffic/activities occasionally contribute to the noise environment. Measurement locations relative to the project site are shown in Figure 1.

All short-term measurements were conducted on Wednesday, June 2, 2021 and were each 10 minutes in duration. Short-term noise measurement ST-1 was conducted beginning at 10:40 a.m. at southern end of Krebs Court near the northern property line of the project site. The ten-minute average noise level measured at this location was 43 dBA $L_{eq}$. BART train passbys and aircraft flyovers were the primary noise sources at this location. Measurement ST-2 was conducted beginning at 11:00 a.m. at the eastern end of Mercado Way near the western property line of the project site. The ten-minute average noise level measured at ST-2 was 48 dBA $L_{eq}$. The primary sources of noise at this location were BART train passbys, aircraft flyovers, and vehicular traffic on local residential streets. Measurement ST-3 was conducted beginning at 11:20 a.m. near the southwestern corner of the project site along Berryessa Road. The ten-minute average noise level measured at ST-3 was 70 dBA $L_{eq}$. The primary noise source at this location was vehicular traffic along Berryessa Road. During the measurement, a southbound BART train passed by but was inaudible above the noise resulting from traffic. Short-term measurement data is summarized in Table 6.

Long-term measurement LT-1 measured noise levels between Wednesday, June 2, 2021 and Friday, June 4, 2021. Measurement LT-1 was located north of the project site at the eastern end of Valley Crest Court. The sound level meter was mounted in a tree at a height of approximately 12 feet and located about 30 feet from the centerline of the BART/UPRR rail line. The measurement served to quantify noise resulting from BART and UPRR rail activity. Maximum noise levels measured during train passbys typically ranged from 74 to 75 dBA $L_{max}$. Daytime hourly average noise levels at LT-1 ranged between 51 and 58 dBA $L_{eq}$ and nighttime hourly average noise levels ranged between 39 and 56 dBA $L_{eq}$. The day-night average noise level on Thursday, June 6, 2021 was 58 dBA DNL.

**TABLE 6 Summary of Short-Term Noise Measurement Data (dBA)**

| Location, Date, and Time | | $L_{max}$ | $L_{(1)}$ | $L_{(10)}$ | $L_{(50)}$ | $L_{(90)}$ | $L_{eq}$ |
|---|---|---|---|---|---|---|---|
| ST-1: Southern End of Krebs Court Wednesday, June 2, 2021 | 10:40 – 10:50 a.m. | 54 | 52 | 46 | 40 | 39 | 43 |
| ST-2: Eastern End of Mercado Way Wednesday, June 2, 2021 | 11:00 – 11:10 a.m. | 63 | 56 | 51 | 44 | 42 | 48 |
| ST-3: Southeastern Corner of Project Site Near Berryessa Road Wednesday, June 2, 2021 | 11:20 – 11:30 a.m. | 81 | 79 | 75 | 66 | 57 | 70 |

**FIGURE 1 Noise Measurement Locations**

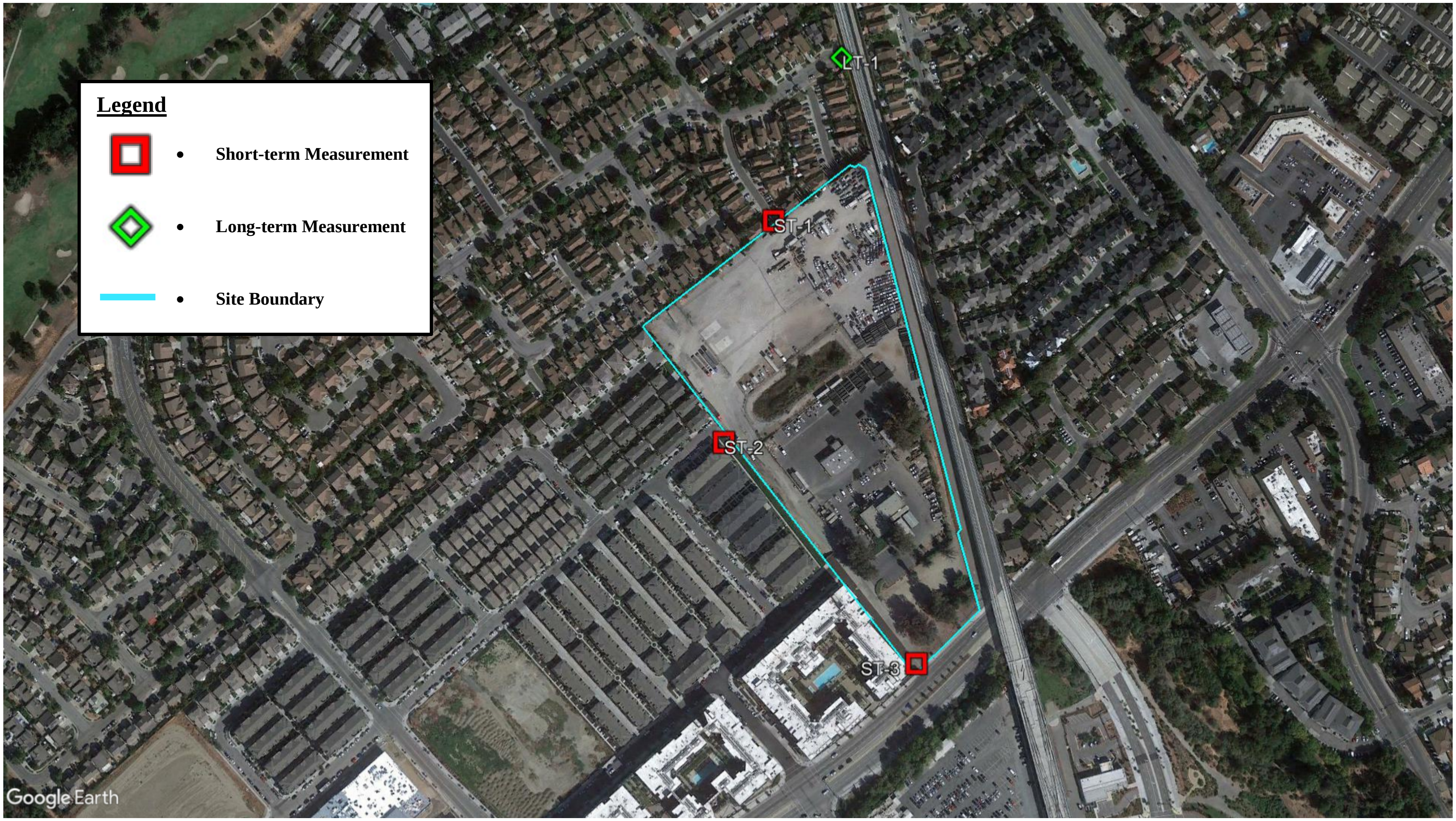


**FIGURE 2 Daily Trend in Noise Levels at Measurement Location LT-1 on Wednesday, June 2, 2021**

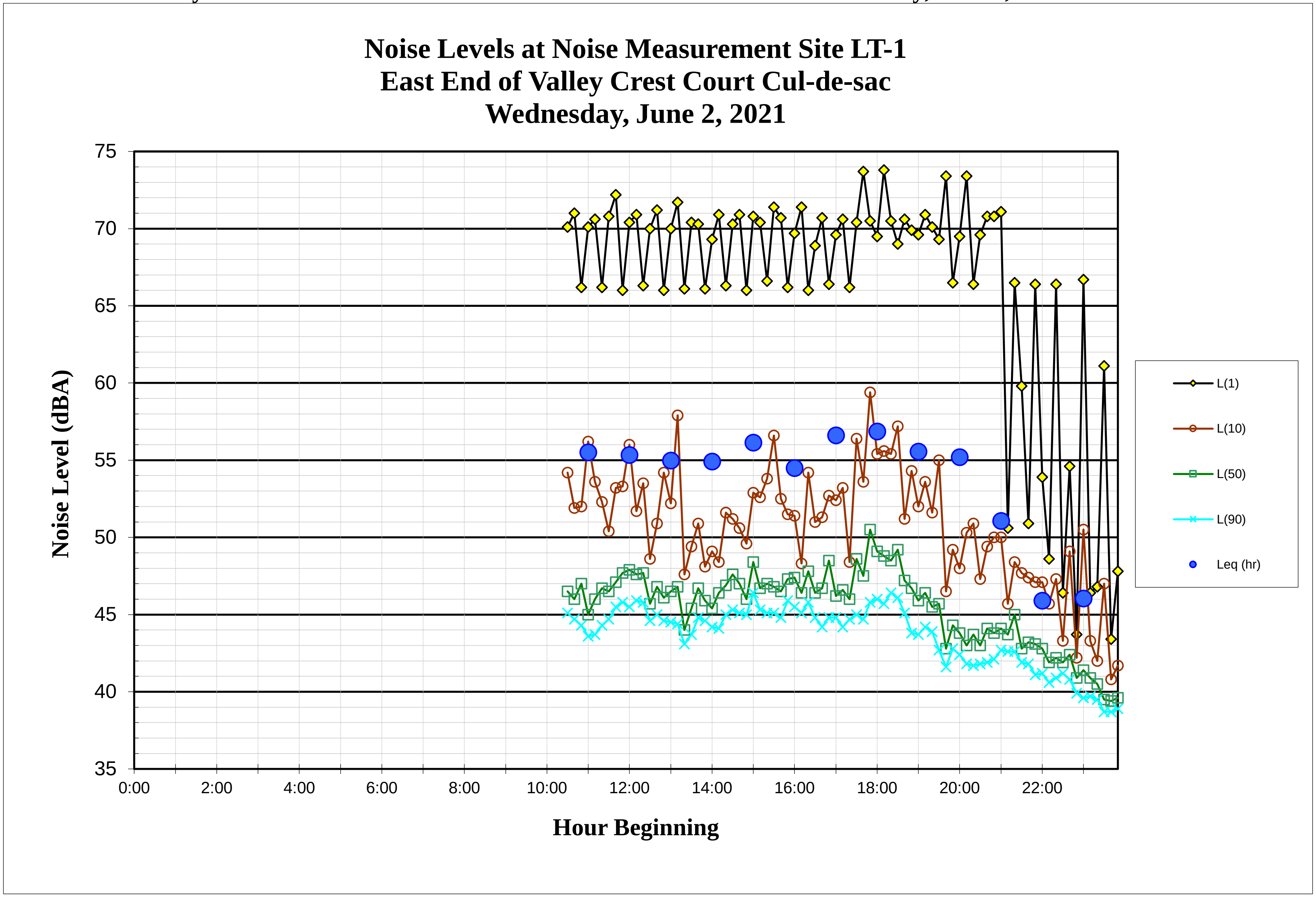


**FIGURE 3 Daily Trend in Noise Levels at Measurement Location LT-1 on Thursday, June 3, 2021**

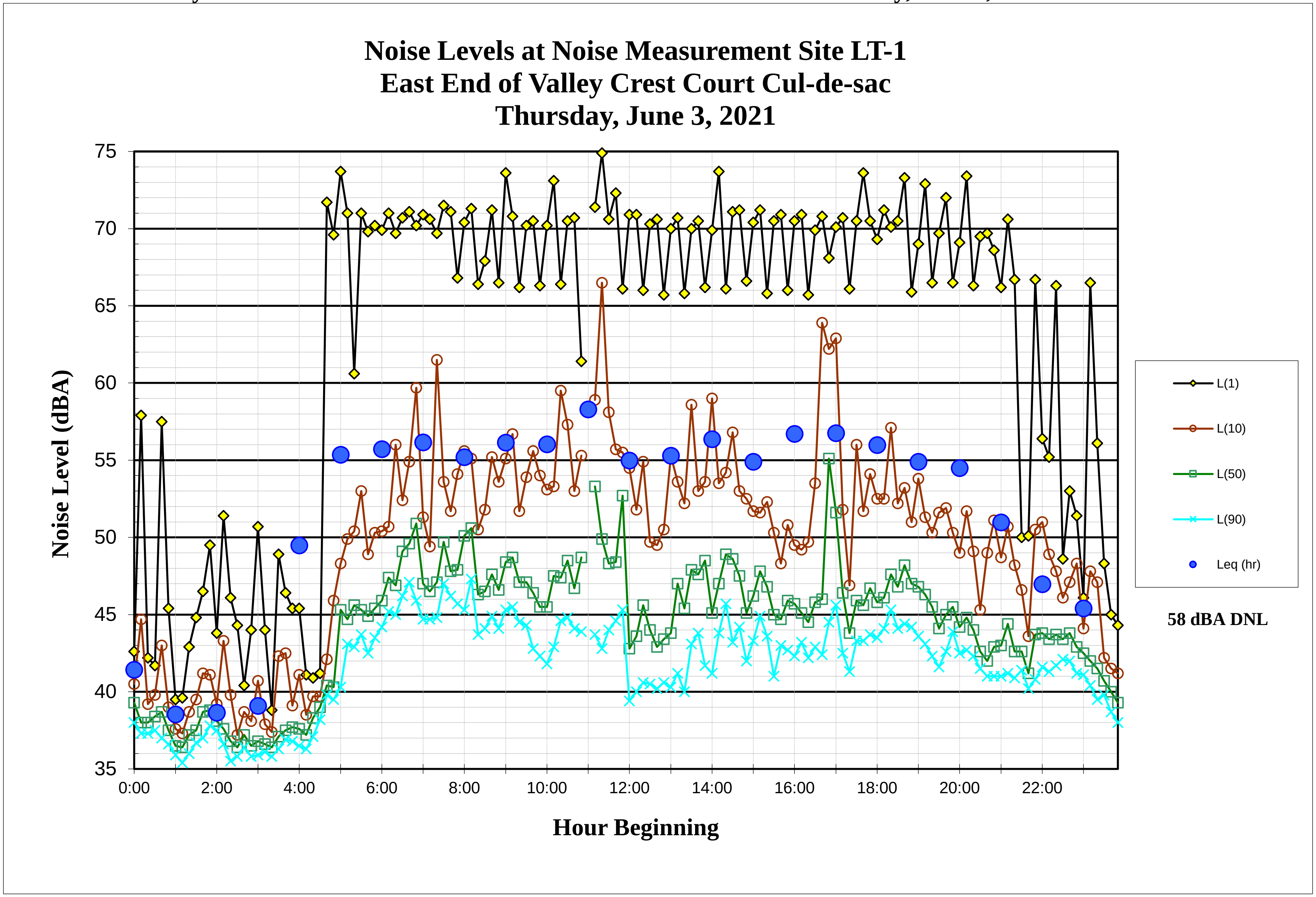
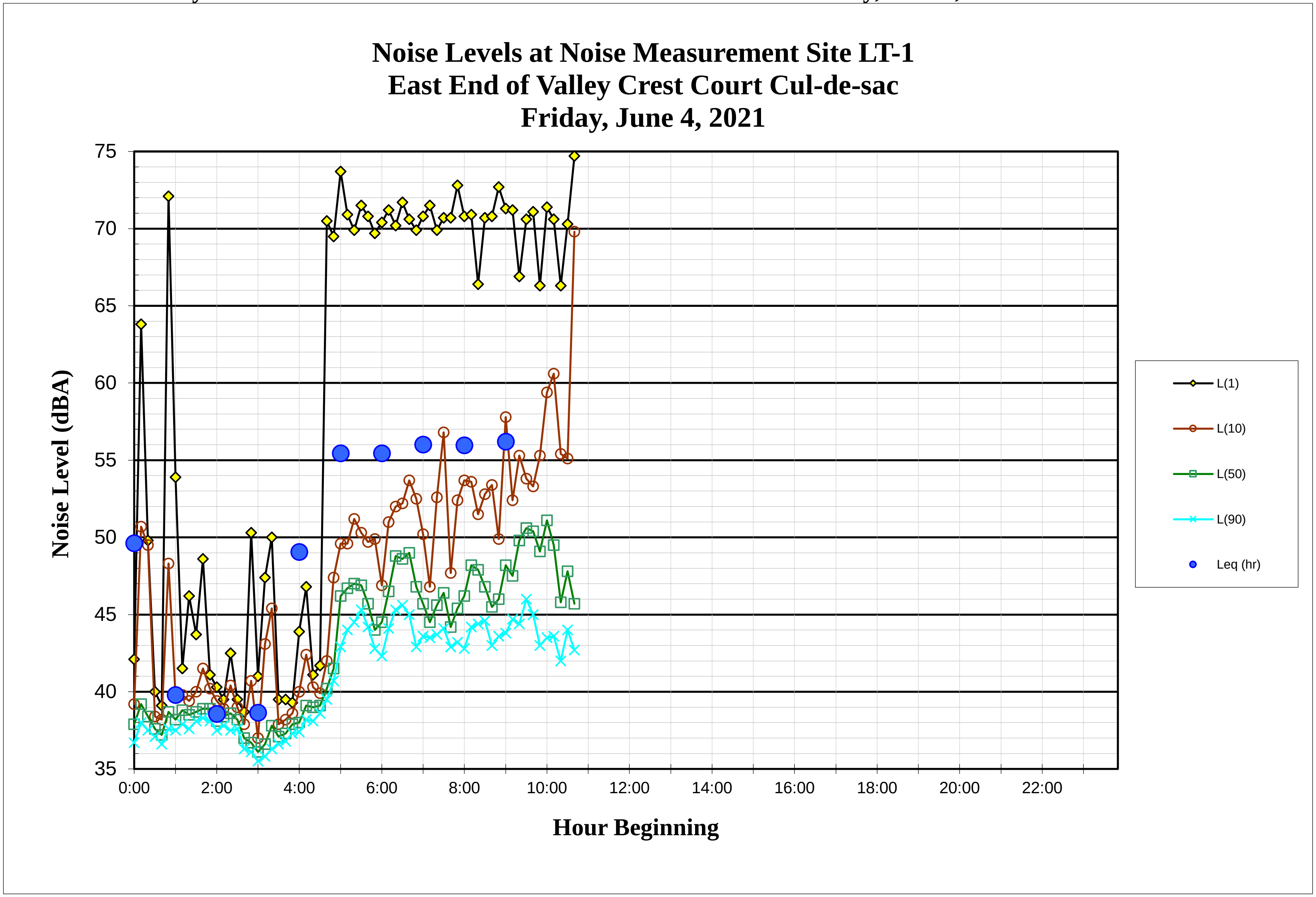


**FIGURE 4 Daily Trend in Noise Levels at Measurement Location LT-1 on Friday, June 4, 2021**



## Existing Vibration Environment

The BART Silicon Valley Phase 1 Extension was designed with vibration mitigation measures in place to reduce impacts at nearby sensitive receptors to not exceed the FTA's 72 VdB threshold for residences and buildings where people usually sleep and frequent groundborne vibration events occur.

## 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 standard is 60 dBA DNL or less for the proposed residential land uses.
- The City's acceptable interior noise level standard is 45 dBA DNL or less for the proposed residential land uses.
- The City requires mitigation to reduce recurring maximum instantaneous noise levels resulting from heavy rail, light rail, or BART to not exceed 50 dBA $L_{max}$ in bedrooms or 55 dBA $L_{max}$ in other rooms of residential land uses.
- The City's acceptable exterior noise level standard is 70 dBA DNL or less for the proposed commercial land uses.
- The Cal Green Code standards specify an interior noise environment attributable to exterior sources not to exceed an hourly equivalent noise level ($L_{eq\ (1\text{-}hr)}$) of 50 dBA in occupied areas of nonresidential uses during any hour of operation.

*Future Exterior Noise Environment*

The future noise environment at the site would continue to result primarily from vehicular traffic along Berryessa Road and BART. Based on the project's traffic study, year 2040 peak hour traffic noise levels along Berryessa Road are expected to increase by about 3 to 4 dBA $L_{eq}$ over existing conditions. Peak hour noise levels measured at location LT-1 and at other locations near the site were approximately equal to the measured day-night level. Therefore, calculated peak hour noise levels are assumed to also represent the day-night level.

The existing and future noise exposure of the site was calculated using SoundPLAN, a three-dimensional noise modeling software that considers site geometry, the characteristics of the noise sources, and shielding from structures. The existing model was validated to noise levels measured in the noise monitoring survey (see Setting Section). Future noise levels were modeled for traffic conditions under both the Berryessa Interchange Network and Mabury Interchange Network scenarios. Noise levels at the site were slightly higher under the Mabury Interchange Network scenario and were used in this analysis to represent the worst case future noise environment. Calculated exterior noise levels at the proposed park and residential use open spaces are shown in Table 7.

**TABLE 7 Calculated Exterior Noise Levels at Proposed Outdoor Use Areas**

| Location | Calculated Noise Levels (dBA DNL) |
|---|---|
| Courtyard D | 46 |
| Courtyard F | 37 |
| Courtyard G | 47 to 54 |
| Courtyard H | 56 to 60 |
| Parcel E Park | 48 to 51 |

Noise levels at proposed outdoor use areas would not exceed the 60 dBA DNL San José General Plan standard for residential spaces or the 65 dBA DNL standard for neighborhood parks.

*Future Interior Noise Environment*

Interior noise levels would vary depending upon the design of the buildings (relative window area to wall area) and the selected construction materials and methods. Standard residential construction 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 20 to 25 dBA of noise reduction in interior spaces. The façade elements which contribute to the composite sound isolation of the assembly are the exterior wall assemblies themselves, along with significant openings/penetrations to the wall assembly, such as windows or exterior doors. For residential buildings, a minimum noise reduction of 20 dBA is assumed for the purpose of this analysis. For commercial buildings, a minimum noise reduction of 25 dBA is assumed.

Both the City of San José and the California Building Code require that interior noise levels be maintained at 45 dBA DNL or less for residences. The Cal Green Code limits noise levels inside occupied non-residential spaces to 50 dBA $L_{eq(1\text{-}hr)}$ during any hours of operation. Table 8 lists calculated exterior noise levels at building façades representative of the worst case noise exposure, and interior noise levels assuming a noise reduction of 20 dBA resulting from new construction with windows in a closed position. Highlighted in yellow are locations where noise levels could exceed 45 dBA DNL within residences with windows partially open.

**TABLE 8 Calculated Exterior Noise Levels at Building Façades and Interior Noise Levels Within Buildings (Peak Hour dBA $L_{eq}$/DNL)**

| Building | Floor | Calculated Exterior Noise Level | | | | Calculated Interior Noise Level | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | North | South | East | West | North | South | East | West |
| Parcel A Single Family Residential | 1 | 45 to 53 | 45 to 57 | 57 | 43 | 25 to 33 | 25 to 37 | 37 | 23 |
| | 2 | 46 to 53 | 45 to 59 | 59 | 42 | 26 to 33 | 25 to 39 | 39 | 22 |
| Parcel B Single Family Residential | 1 | 52 | 45 | 45 to 46 | 44 | 32 | 25 | 25 to 26 | 24 |
| | 2 | 53 | 45 | 45 to 46 | 44 | 33 | 25 | 25 to 26 | 24 |
| Parcel C Townhomes | 1 | 43 | 56 | 41 to 47 | 48 | 23 | 36 | 21 to 27 | 28 |
| | 2 | 44 | 56 | 43 to 48 | 48 | 24 | 36 | 23 to 28 | 28 |
| Parcel D Market-rate Multi-family Residential | 1 | 50 to 52 | 52 to 56 | 57 to 59 | 46 | 30 to 32 | 32 to 36 | 37 to 39 | 26 |
| | 2 | 51 to 54 | 53 to 58 | 60 to 61 | 46 | 31 to 34 | 33 to 28 | 40 to 41 | 26 |
| | 3 | 54 to 56 | 54 to 59 | 61 to 62 | 47 | 34 to 36 | 34 to 39 | 41 to 42 | 27 |
| | 4 | 54 to 55 | 55 to 60 | 61 to 62 | 47 | 34 to 35 | 35 to 40 | 41 to 42 | 27 |
| | 5 | 52 to 55 | 55 to 60 | 61 to 62 | 48 | 32 to 35 | 35 to 40 | 41 to 42 | 28 |
| | 6 | 52 to 55 | 56 to 60 | 62 to 63 | 48 | 32 to 35 | 36 to 40 | 42 to 43 | 28 |
| | 7 | 51 to 55 | 56 to 60 | 62 to 63 | 49 | 31 to 35 | 36 to 40 | 42 to 43 | 29 |
| | 8 | 51 to 55 | 56 to 60 | 61 to 62 | 50 | 31 to 35 | 36 to 40 | 41 to 42 | 30 |
| | 9 | 52 to 55 | 56 to 60 | 61 to 62 | 50 | 32 to 35 | 36 to 40 | 41 to 42 | 30 |

| Building | Floor | Calculated Exterior Noise Level | | | | Calculated Interior Noise Level | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | North | South | East | West | North | South | East | West |
| Parcel F/G Market-rate Multi-family Residential | 1 | 47 | 50 to 57 | 51 to 57 | 45 to 49 | 27 | 30 to 37 | 31 to 37 | 25 to 29 |
| | 2 | 46 | 51 to 57 | 51 to 58 | 45 to 49 | 26 | 31 to 37 | 31 to 38 | 25 to 29 |
| | 3 | 48 | 52 to 58 | 52 to 59 | 47 to 50 | 28 | 32 to 38 | 32 to 39 | 27 to 30 |
| | 4 | 49 | 53 to 60 | 53 to 61 | 49 to 51 | 29 | 33 to 40 | 33 to 41 | 29 to 31 |
| | 5 | 49 | 55 to 61 | 54 to 62 | 50 to 51 | 29 | 35 to 41 | 34 to 42 | 30 to 31 |
| | 6 | 50 | 57 to 61 | 54 to 62 | 51 | 30 | 37 to 41 | 34 to 42 | 31 |
| | 7 | 49 | 57 to 61 | 55 to 62 | 50 to 52 | 29 | 37 to 41 | 35 to 42 | 30 to 21 |
| | 8 | 49 | 57 to 61 | 55 to 62 | 49 to 51 | 29 | 37 to 41 | 35 to 42 | 29 to 31 |
| | 9 | 49 | 57 to 61 | 55 to 62 | 50 to 51 | 29 | 37 to 41 | 35 to 42 | 30 to 31 |
| Parcel H Affordable Multi-family Residential | 1 | 52 | 57 | 57 to 59 | 53 | 32 | 37 | 37 to 39 | 33 |
| | 2 | 53 | 58 | 59 to 61 | 53 | 33 | 38 | 39 to 41 | 33 |
| | 3 | 55 | 60 | 61 to 62 | 53 | 35 | 40 | 41 to 42 | 33 |
| | 4 | 56 | 61 | 62 to 63 | 54 | 36 | 41 | 42 to 43 | 34 |
| | 5 | 56 | 62 | 63 | 55 | 36 | 42 | 43 | 35 |
| | 6 | 56 | 62 | 63 | 56 | 36 | 42 | 43 | 36 |
| | 7 | 56 | 62 | 62 to 63 | 56 | 36 | 42 | 42 to 43 | 36 |
| | 8 | 56 | 62 | 62 to 63 | 56 | 36 | 42 | 42 to 43 | 36 |
| | 9 | 56 | 62 | 62 to 63 | 56 | 36 | 42 | 42 to 43 | 36 |
| | 10 | 56 | 62 | 62 to 63 | 56 | 36 | 42 | 42 to 43 | 36 |

| Building | Floor | Calculated Exterior Noise Level | | | | Calculated Interior Noise Level | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | North | South | East | West | North | South | East | West |
| Parcel I Commercial | 1 | 52 to 53 | 68 to 72 | 64 | 61 | 27 to 28 | 43 to 47 | 39 | 36 |
| | 2 | 52 to 54 | 68 to 72 | 64 | 61 | 27 to 29 | 43 to 47 | 39 | 36 |
| | 3 | 53 to 54 | 68 to 71 | 64 | 61 | 28 to 29 | 43 to 46 | 39 | 36 |
| | 4 | 54 to 56 | 68 to 71 | 66 | 61 | 29 to 31 | 43 to 46 | 41 | 36 |
| | 5 | 53 to 58 | 68 to 71 | 67 | 61 | 28 to 33 | 43 to 46 | 42 | 36 |
| | 6 | 54 to 58 | 69 to 70 | 67 | 61 | 29 to 33 | 44 to 45 | 42 | 36 |
| | 7 | 54 to 58 | 69 to 70 | 67 | 60 | 29 to 33 | 44 to 45 | 42 | 35 |
| | 8 | 54 to 58 | 69 to 70 | 67 | 59 | 29 to 33 | 44 to 45 | 42 | 34 |
| | 9 | 54 to 58 | 68 to 69 | 67 | 59 | 29 to 33 | 43 to 44 | 42 | 34 |
| | 10 | 54 to 58 | 68 to 69 | 67 | 59 | 29 to 33 | 43 to 44 | 42 | 34 |

Interior noise levels within residences would not exceed 45 dBA DNL with windows closed. Noise levels would exceed 45 dBA DNL within residences located along floors 2 through 9 of the eastern sides of the Parcel D multi-family residential building, along floors 4 through 9 of the eastern side of the Parcel F/G multi-family residential building, along floors 5 through 9 of the southern side of the Parcel F/G multi-family residential building, along floors 2 through 10 of the east side of the Parcel H multi-family residential building, and along floors 4 through 10 of the south side of the Parcel H multi-family residential building. These locations are identified in Figure 5. An adequate forced-air mechanical ventilation system would be required at units located along these segments to allow residents the option of closing windows for the purpose of noise control.

During the noise monitoring survey, long-term measurement LT-1 measured maximum instantaneous noise levels resulting from BART train passbys at a distance of about 30 feet from the centerline of the rail line and about 25 feet from the centerline of the nearest track. These intermittent noises typically reached levels of about 74 to 75 dBA $L_{max}$. The nearest residential building façade proposed as a part of the project would be located about 85 feet from the centerline of the nearest BART track. At this distance, BART train passbys would produce noise levels of about 69 to 70 dBA $L_{max}$. Assuming a 20 dBA exterior-to-interior noise reduction resulting from standard modern construction with windows in a closed position, intermittent noise from train passbys would reach 49 to 50 dBA $L_{max}$ and would not exceed the 50 dBA $L_{max}$ limit established in the City's General Plan Policy EC-1.9 for bedrooms.

Interior noise levels within the Parcel I commercial building would not exceed the Cal Green Code standard of 50 dBA $L_{eq(1\text{-}hr)}$.

*Recommended Condition of Approval*

For consistency with the General Plan and Cal Green Code the following Condition of Approval are recommended for consideration by the City:

> Provide forced-air mechanical ventilation to residential units at locations identified in Figure 5 to allow residents the opportunity of closing windows for the purpose of noise control. These include residences located along floors 2 through 9 of the eastern sides of the Parcel D multi-family residential building, along floors 4 through 9 of the eastern side of the Parcel F/G multi-family residential building, along floors 5 through 9 of the southern side of the Parcel F/G multi-family residential building, along floors 2 through 10 of the east side of the Parcel H multi-family residential building, and along floors 4 through 10 of the south side of the Parcel H multi-family residential building.

*Future Vibration Environment*

Groundborne vibration would continue to be adequately mitigated by design measures incorporated into the construction of the BART Silicon Valley Phase I Extension. Potential groundborne vibration impacts at receivers along the Phase 1 alignment were assessed in section 4.13 of the BART Silicon Valley 2nd Supplemental EIR.[1] Via the 8-Hz floating slab track design,

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1 Valley Transportation Authority, "BART Silicon Valley 2nd Supplemental EIR," 2011, https://www.vta.org/sites/default/files/documents/4.13_noise_and_vibration.pdf

vibration is mitigated to levels not exceeding 72 VdB at single family residences located on the opposite side of the rail line from the project site and as close as approximately 20 feet from the centerline of the nearest track. As the proposed project buildings would be located approximately 70 feet or greater from the centerline of the nearest track, vibration levels would not exceed 72 VdB at any of the proposed buildings.

**FIGURE 5 Locations Where Noise Abatement Measures are Recommended**

## 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:

- **Temporary or Permanent Noise Increases in Excess of Established Standards.** A significant noise impact would be identified if the project would generate a substantial temporary or permanent noise level increase over ambient noise levels at existing noise-sensitive receptors surrounding the project site and that would exceed applicable noise standards presented in the General Plan or Municipal Code at existing noise-sensitive receptors surrounding the project site.
    - Temporary Noise Increase. The City of San José 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.
    - Permanent Noise Increase. A significant permanent noise level increase would occur if project-generated traffic would result in: a) a noise level increase of 5 dBA DNL or greater, with a future noise level of less than 60 dBA DNL, or b) a noise level increase of 3 dBA DNL or greater, with a future noise level of 60 dBA DNL or greater.
    - Operational Noise 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.
- **Generation of Excessive Groundborne Vibration.** A significant impact would be identified if the construction of the project would generate excessive vibration levels surrounding receptors. For sensitive historic structures, including ruins and ancient monuments or building that are documented to be structurally weakened, a continuous vibration limit of 0.08 in/sec PPV (peak particle velocity) will be used to minimize the potential for cosmetic damage to a building. A continuous vibration limit of 0.20 in/sec PPV will be used to minimize the potential for cosmetic damage at buildings of normal conventional construction.
- **Excessive Aircraft Noise.** A significant noise impact would be identified if the project would expose people residing or working in the project area to excessive aircraft noise levels.

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

Chapter 20.100.450 of the City of San José'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 of San José's General Plan requires that all construction operations within the City use best available noise suppression devices and techniques and to limit construction hours near residential uses per the Municipal Code allowable hours. Further, the City of San José 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.

Temporary noise increases resulting from construction vary depending upon the noise levels generated by various pieces of construction equipment, the timing and duration of noise-generating activities, the distance between construction noise sources and noise-sensitive areas, and the presence of intervening shielding features such as buildings or terrain. 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 for individual projects are typically carried out in stages. During each stage of construction, there would be a different mix of equipment operating, and noise levels would vary by stage and vary within stages, based on the amount of equipment in operation and the location at which the equipment is operating. Typical construction noise levels at a distance of 50 feet are shown in Tables 9 and 10. Table 9 shows average and maximum noise levels for different construction equipment. Table 10 shows average noise level ranges by construction phase. Most demolition and construction noise falls with the range of 80 to 90 dBA at a distance of 50 feet from the source.

**TABLE 9 Construction Equipment 50-foot Noise Emission Levels (dBA)**

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

Notes: [1] Measured at 50 feet from the construction equipment, with a "slow" (1 sec.) time constant.
[2] Noise levels apply to total noise emitted from equipment and associated components operating at full power while engaged in its intended operation.
[3] Equipment without average ($L_{eq}$) noise levels are non-stationary and best represented only by maximum instantaneous noise level ($L_{max}$).
Source: Project 25-49 Data, National Cooperative Highway Research Program, https://apps.trb.org/cmsfeed/trbnetprojectdisplay.asp?projectid=3889, October 2018

**TABLE 10 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.<br>**II** - Minimum required equipment present at site. | | | | | | | | |

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

Project construction is anticipated to begin in 2023 and last for a period of about 4 years. A detailed list of construction equipment to be used by phase was not available at the time of this writing. Noise-sensitive uses surrounding the site include single family residences to the north, northwest, and east, and multi-family residences to the east, west, and southwest. The project’s northwestern and southwestern property lines are shared with those of single and multi-family residences. Backyards of single family residences adjoin the project’s northwestern property line. Façades of multifamily residential buildings are located as near as 5 feet from the southwestern property line. Single family homes located to the east of the BART train line are located approximately 90 feet from the project’s western boundary. These residences would be partially shielded from most direct construction noise exposure by the BART train line structure and existing noise barriers constructed along it. Depending on the degree of shielding provided, noise levels at these residences would be reduced by about 5 to 10 dBA.

Based on the typical construction noise levels shown in Table 10, project construction is expected to generate noise levels at a distance of 50 feet ranging from 72 to 88 dBA $L_{eq}$ during construction of residential buildings and ranging from 75 to 89 dBA $L_{eq}$ during construction of the commercial building. It is not currently known if pile driving, which has the potential to generate excessive noise, would be a necessary method of construction. If pile driving is used, average noise levels at a distance of 50 feet of 99 dBA $L_{eq}$ would be expected. Noise levels will vary throughout construction depending on intensity of construction activity and primary location of construction work being performed. Noise levels will be higher when construction activity is located near shared property lines.

Project construction would involve substantial noise generating activities occurring for a period of greater than 12 months and would be located within 500 feet of residential uses. Based on City of San José General Plan Policy EC-1.7, this is a **significant** impact. 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.

**Mitigation Measure 1a:**

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

> Construction operations within the City will be required to use best available noise suppression devices and techniques and continue to limit construction hours near residential uses per the City's Municipal Code.
>
> For such large or complex projects, a construction noise logistics plan that specifies hours of construction, noise and vibration minimization measures, posting or notification of construction schedules, and designation of a noise disturbance coordinator who would respond to neighborhood complaints will be required to be in place prior to the start of construction and implemented during construction to reduce noise impacts on neighboring residents and other uses.

The following standard noise control measures shall be implemented:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

- Substitute nail guns for manual hammering, where feasible.

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

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

With the implementation of GP Policy EC-1.7, Municipal Code requirements, and the above measures, overall construction noise levels would be reduced by 5 to 10 dBA at nearby noise-sensitive receptors, and the temporary construction noise impact would be reduced to a **less-than-significant** level.

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

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

AM and PM peak hour traffic volumes provided by *Hexagon Transportation Consultants, Inc.* (dated May 21, 2021) were reviewed to calculate potential traffic noise level increases attributable to the project expected along roadways serving the site.

Roadway link traffic volumes with and without the project under cumulative 2040 conditions with construction of either the Berryessa or Mabury Interchange Networks were compared to calculate the traffic noise increase attributable to the project during AM and PM peak hour conditions. A 3 dBA $L_{eq}$ noise level increase was calculated to occur along a segment of Oakland Road north of US Route 101 during the AM peak hour under the Berryessa Interchange condition. However, the project would reduce noise levels under this condition during the PM peak hour by about 1 dBA $L_{eq}$. Additionally, the traffic volumes along Oakland Road are substantially lower than those along US Route 101 which serves as the primary noise source in the vicinity. Because of this, it is not anticipated that this 3 dBA $L_{eq}$ AM peak hour increase would also result in a 3 dBA DNL increase at the nearest noise-sensitive use, an RV park located approximately 900 feet to the north. This is a **less-than-significant** impact.

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

**Impact 1c: Noise Levels in Excess of Standards.** The proposed project would have the potential to generate noise in excess of standards established in the City's General Plan at the nearby sensitive receptors during emergency backup generator testing. **This is a less-than-significant impact** with mitigation.

General Plan Policy EC-1.3 implements the City's Municipal Code limits on noise generation of new nonresidential land uses to 55 dBA DNL when located adjacent to existing or planned noise-sensitive residential and public/quasi-public land uses. General Plan Policy EC-1.2 prohibits new development from increasing noise levels at noise-sensitive land uses to less than 5 dBA DNL where noise levels would remain "Normally Acceptable" or less than 3 dBA DNL where noise levels would equal or exceed the "Normally Acceptable" level

Operational noise sources introduced by similar projects include mechanical equipment, parking lots, emergency backup generators, and residential activities such as use of parks and open spaces. Specific locations of mechanical equipment including heating, ventilation, and air conditioning (HVAC) equipment were not available as of this writing. Typically, these are located on rooftops of larger buildings or in side yards of single family residences or townhomes. No large, surface-level parking lots would be included with the project, as most parking would be located in basement levels below each building. Noise from parking is not anticipated to be a substantial source of noise associated with the project.

Park Use

Use of the park at Parcel E could occasionally result in observable noise levels at the nearby residences. Noise sources associated with park use include conversations, children playing, and small gatherings. The greatest noise levels resulting from use of the park would be expected from groups of children playing, which can result in noise levels ranging from 59 to 67 dBA $L_{eq}$ at a distance of 50 feet. The noise-sensitive uses nearest the park are single family residential backyards located approximately 200 feet from the center of the park. At this distance and when accounting for shielding provided by the Parcel A homes, noise levels from park use could reach up to 50 dBA $L_{eq}$ at the nearest residential backyard. As these noise levels would not be expected to extend over a long period of time, the use of the park would not exceed 55 dBA DNL at any nearby noise-sensitive use.

Mechanical Equipment

The nearest noise-sensitive receptors are single and multi-family residences located along the northwestern and southwestern borders of the project site. Noise levels produced by HVAC equipment typical for the large, multifamily buildings proposed would reach about 66 dBA at a distance of 3 feet during operation. Noise sources representing HVAC equipment placed at credible worst-case locations near the outer perimeter of the of rooftops of the buildings at Parcels D, F, G, H, and I, and in between the Parcel C townhomes were implemented in the SoundPLAN model and noise levels were calculated at receivers representative of the nearby noise-sensitive residences. An emergency backup generator would also be included with the project. Its exact specifications, location, and noise data were not available as of this writing. Based on experience with similar projects, it is assumed that there will be one 1,000 kW generator located at the Parcel

I commercial building. Often, generators will be located on rooftops or in ground-level enclosures. Testing at full load of a typical 1,000 kW generator unequipped with any sound attenuation can be expected to result in noise levels of up to 102 dBA $L_{eq}$ at a distance of 23 feet (7 meters). A noise source representing this worst-case generator and placed at the northern corner on top of the commercial building, nearest the residences to the west, was added to the noise model. Table 11 below lists calculated noise levels from HVAC noise assuming continuous, 24-hour operation and the same HVAC noise with a simultaneous two hour generator test.

**TABLE 11 Calculated Noise Levels Resulting from Operation of Mechanical Equipment**

| Location | HVAC Only | | HVAC and Generator Testing | |
|---|---|---|---|---|
| | **Peak Hour (dBA Leq)** | **Day-night Level (dBA DNL)** | **Peak Hour (dBA Leq)** | **Day-night Level (dBA DNL)** |
| Residences to East and Northeast | 23 to 38 | 29 to 44 | 85 to 89 | 74 to 78 |
| Residences to Northwest | 32 | 38 to 39 | 65 to 67 | 54 to 56 |
| Residences to Southwest | 36 to 37 | 43 | 74 to 79 | 63 to 68 |

As seen above in Table 11, noise levels resulting from operation of HVAC equipment alone would not result in noise levels exceeding General Plan or Municipal Code standards. However, with a worst-case, two hour test of a 1,000 kW generator, the 55 dBA DNL criterion would be exceeded at multiple residences near the project site. This is a **potentially significant** impact.

As a project condition of approval, mechanical equipment and generators shall be selected and designed to reduce excessive noise levels at the surrounding uses to meet the City's 55 dBA DNL noise level requirement at the nearby noise-sensitive land uses. A qualified acoustical consultant shall be retained to review mechanical noise as these systems are selected to determine specific noise reduction measures necessary to reduce noise to comply with the City's Municipal Code noise level requirements. Noise reduction measures could include, but are not limited to, selection of equipment that emits low noise levels and installation of noise barriers, such as enclosures and parapet walls, to block the line-of-sight between the noise source and the nearest receptors. Other alternate measures may be optimal, such as locating equipment in less noise-sensitive areas, such as along the building façades farthest from adjacent neighbors, where feasible.

Implementation of the above conditions of approval based on General Plan Policies EC-1.2 and EC-1.3 would reduce the impact of noise from mechanical equipment to a **less-than-significant** level.

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

**Impact 2: Generation of Excessive Groundborne Vibration during Construction.** Construction-related vibration levels could likely exceed 0.2 in/sec PPV at adjacent buildings of normal conventional construction. **This is a less-than-significant impact** with mitigation.

The construction of the project would generate vibration when heavy equipment or impact tools are used. Construction activities would include the demolition of existing structures, site preparation work, excavation of the below-grade parking level, foundation work, and new building framing and finishing. It has not yet been determined if pile driving will be a necessary foundation construction technique.

Policy EC-2.3 of the City of San José General Plan establishes a vibration limit of 0.08 in/sec PPV to minimize the potential for cosmetic damage to sensitive historic structures, and a vibration limit of 0.2 in/sec PPV to minimize damage at buildings of normal conventional construction. The vibration limits contained in this policy are conservative and designed to provide the ultimate level of protection for existing buildings in San José. As discussed in detail below, vibration levels exceeding these thresholds would be capable of cosmetically damaging adjacent buildings. Cosmetic damage (also known as threshold damage) is defined as hairline cracking in plaster, the opening of old cracks, the loosening of paint or the dislodging of loose objects. Minor damage is defined as hairline cracking in masonry or the loosening of plaster. Major structural damage is defined as wide cracking or the shifting of foundation or bearing walls. Based on review of the City of San José Historic Resource Inventory,[2] there are no historic structures located within 500 feet of the project site. Therefore, the 0.2 in/sec PPV criterion for structures of normal conventional construction would apply.

Table 12 presents typical vibration levels from construction equipment at a reference distance of 25 feet and calculated vibration levels at distances representative of nearby structures to the project site. Some residential buildings along the southwest border of the project site would be about 10 feet from substantial construction activities including paving. Residences to the northwest are located as close as 10 to 15 feet from the project's northwestern property line where minor construction would occur. If pile driving is used as a method of construction for the larger buildings at Parcels D, F, G, H, or I, potential pile locations would be as close as about 50 feet from the multi-family residential building to the southwest located along Berryessa Road.

Jackhammers typically generate vibration levels of 0.035 in/sec PPV and drilling typically generates vibration levels of 0.09 in/sec PPV at 25 feet. Vibration levels would vary depending on soil conditions, construction methods, and equipment used. Vibration levels are highest close to the source, and then attenuate with increasing distance at the rate $(D_{ref}/D)^{1.1}$, where D is the distance from the source in feet and $D_{ref}$ is the reference distance of 25 feet.

2 City of San José Historic Resources Inventory, Accessed 8/25/2021, https://www.sanjoseca.gov/DocumentCenter/View/35475

**TABLE 12 Vibration Levels for Construction Equipment (in/sec PPV)**

| Equipment | | Reference Distance 25 feet | Residences to Northwest, Southwest 10 feet | Residences to Northwest 15 feet | Residences to Southwest 50 feet |
|---|---|---|---|---|---|
| Impact Pile Driver | Upper Range | 1.158 | **3.173** | **2.031** | **0.540** |
| | Lower Range | 0.664 | **1.764** | **1.130** | **0.300** |
| Sonic Pile Driver | Upper Range | 0.734 | **2.011** | **1.287** | **0.342** |
| | Lower Range | 0.170 | **0.466** | **0.298** | 0.079 |
| Clam shovel drop | | 0.202 | **0.553** | **0.354** | 0.094 |
| Hydromill (slurry wall) | in soil | 0.008 | 0.022 | 0.014 | 0.004 |
| | in rock | 0.017 | 0.047 | 0.030 | 0.008 |
| Vibratory Roller | | 0.210 | **0.575** | **0.368** | 0.098 |
| Hoe Ram | | 0.089 | **0.244** | 0.156 | 0.042 |
| Large bulldozer | | 0.089 | **0.244** | 0.156 | 0.042 |
| Caisson drilling | | 0.089 | **0.244** | 0.156 | 0.042 |
| Loaded trucks | | 0.076 | **0.208** | 0.133 | 0.035 |
| Jackhammer | | 0.035 | 0.096 | 0.061 | 0.016 |
| Small bulldozer | | 0.003 | 0.008 | 0.005 | 0.001 |

Source: Transit Noise and Vibration Impact Assessment, United States Department of Transportation, Office of Planning and Environment, Federal Transit Administration, October 2018 as modified by Illingworth & Rodkin, Inc., August 2021.

The US Bureau of Mines has analyzed the effects of blast-induced vibration on buildings in USBM RI 8507,[3] and these findings have been applied to vibrations emanating from construction equipment on buildings.[4] Figure 6 presents the damage probability, as reported in USBM RI 8507 and reproduced by Dowding assuming a maximum vibration level of 3.2 in/sec PPV. As shown on Figure 6, these studies indicate an approximate 60% probability of "threshold damage" (referred to as cosmetic damage elsewhere in this report), an approximate 20% probability of "minor damage", and an approximate 10% probability of "major damage" at vibration levels of 3.2 in/sec PPV or less. Other buildings of normal conventional construction are located approximately 15 feet from the project site. At this distance, vibration levels would be up to 2.0 in/sec PPV. As shown on Figure 6, studies indicate an approximate 45% probability of "threshold damage", an approximate 10% probability of "minor damage", and an approximate 3% probability of "major damage" at vibration levels of 2.0 in/sec PPV or less. Also shown on Figure 6, the studies indicate an approximate 5% chance of "threshold damage" at vibration levels of 0.500 or less.

As indicated in Table 8, vibration levels, particularly from pile driving, would have the potential to greatly exceed San José guidelines at residential uses in the site vicinity and could result in damage to nearby structures. This is a **potentially significant impact**.

**Mitigation Measure 2:** The following measures are recommended to reduce vibration impacts from construction activities to a less-than-significant impact:

3 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.

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

- Prohibit impact pile driving as a method of construction within 125 feet of any surrounding vibration-sensitive building. Prohibit vibratory pile driving as a method of construction within 85 feet of any surrounding vibration-sensitive building. As an alternative, drilled piles, which generate substantially lower levels of vibration, may be used.

- Limit the use of vibratory rollers, hoe rams, large bulldozers, and caisson drilling, and avoid clam shovel drops within 20 feet of the property lines shared with residences and commercial structures adjacent to the site.

- Place operating equipment on the construction site at least 30 feet from vibration-sensitive receptors.

- Use a smaller vibratory roller, such as the Caterpillar model CP433E vibratory compactor, when compacting materials within 30 feet of adjacent buildings. Only use the static compaction mode when compacting materials within 15 feet of buildings.

- Select demolition methods not involving impact tools.

- Avoid dropping heavy objects or materials within 30 feet of vibration sensitive locations.

- A list of all heavy construction equipment to be used for this project known to produce high vibration levels (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 required for continuous vibration monitoring.

- A construction vibration-monitoring plan shall be implemented to document conditions at the residences and commercial structures adjacent to the site prior to, during, and after vibration generating construction activities. All plan tasks shall be undertaken under the direction of a licensed Professional Structural Engineer in the State of California and be in accordance with industry accepted standard methods. The construction vibration monitoring plan should be implemented to include the following tasks:

    - Identification of sensitivity to ground-borne vibration of the residences and commercial structures adjacent to the site. A vibration survey (generally described below) would need to be performed.

    - Performance of a photo survey, elevation survey, and crack monitoring survey for the residences and commercial structures nearest to the site. Surveys shall be performed prior to and after completion of vibration generating construction activities located within 20 feet of the structure. This distance shall be extended to 80 feet for vibratory pile driving and 120 feet for impact pile driving. The surveys shall include internal and external crack monitoring in the structure, settlement, and distress, and shall document the condition of the foundation, walls and other structural elements in the interior and exterior of the structure.

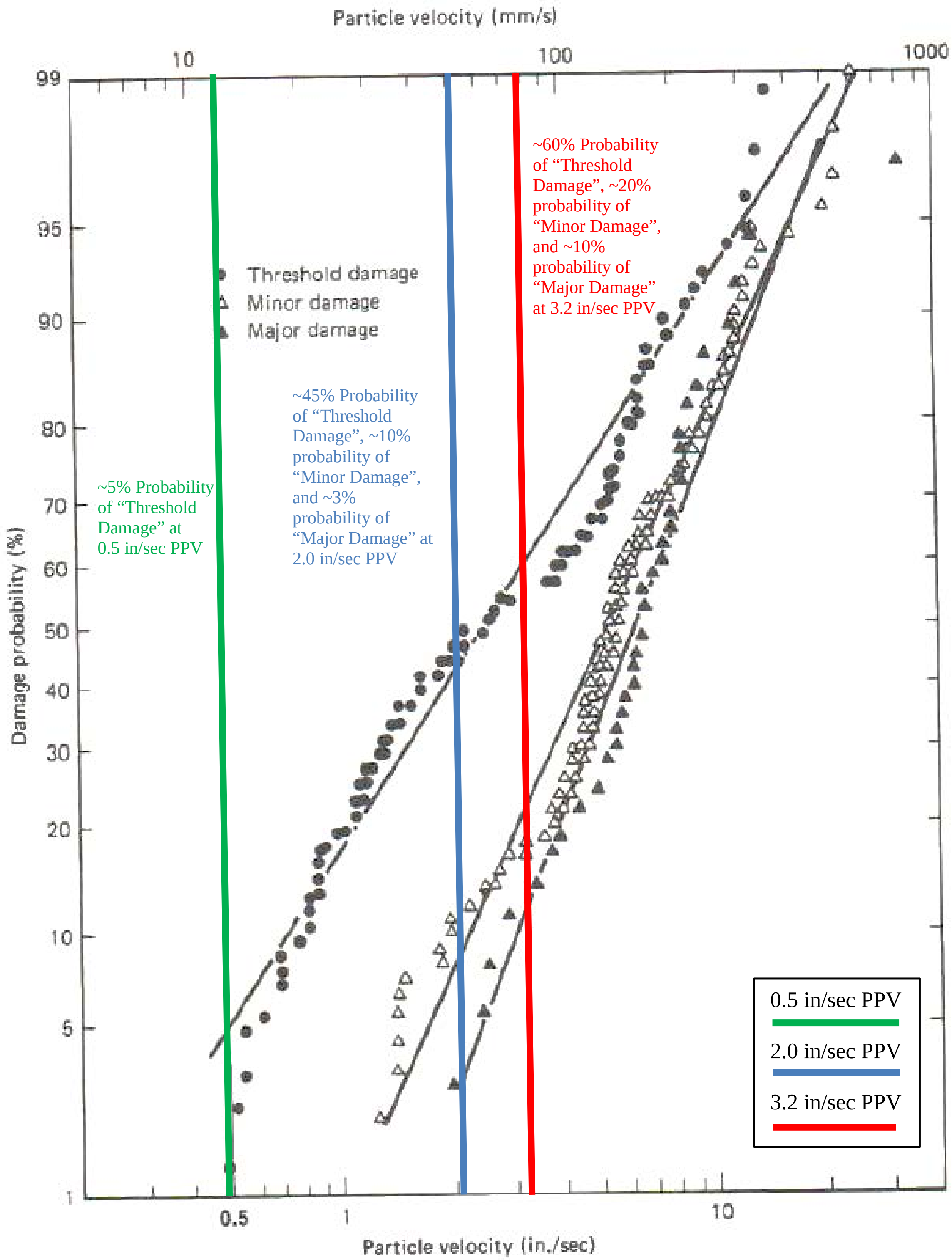
- Conduct a post-survey on the structure where either monitoring has indicated high levels or complaints of damage. Make appropriate repairs where damage has occurred as a result of construction activities.

- The results of any 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.

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

**FIGURE 6 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., August 2021.

**Impact 3:** **Excessive Aircraft Noise.** The project site is located approximately 2.3 miles from a public airport or public use airport and would not expose people residing or working in the project area to excessive aircraft noise. **This is a less-than-significant impact.**

Norman Y. Mineta San José International Airport is a public use airport located approximately 2.3 miles west of the project site. According to the City's Airport Master Plan Environmental Impact Report,[5] the project site lies outside the 60 dBA CNEL 2037 noise contour of the airport (see Figure 7). Future exterior noise levels due to aircraft from Norman Y. Mineta San José International Airport are compatible with the proposed use. This would be a **less-than-significant** impact.

**Mitigation Measure 3:** **None required.**

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

**FIGURE 7 2037 CNEL Noise Contours for San José International Airport Relative to Project Site**

Figure 5

Scenario 2: With Project 2037 Noise Contour Map

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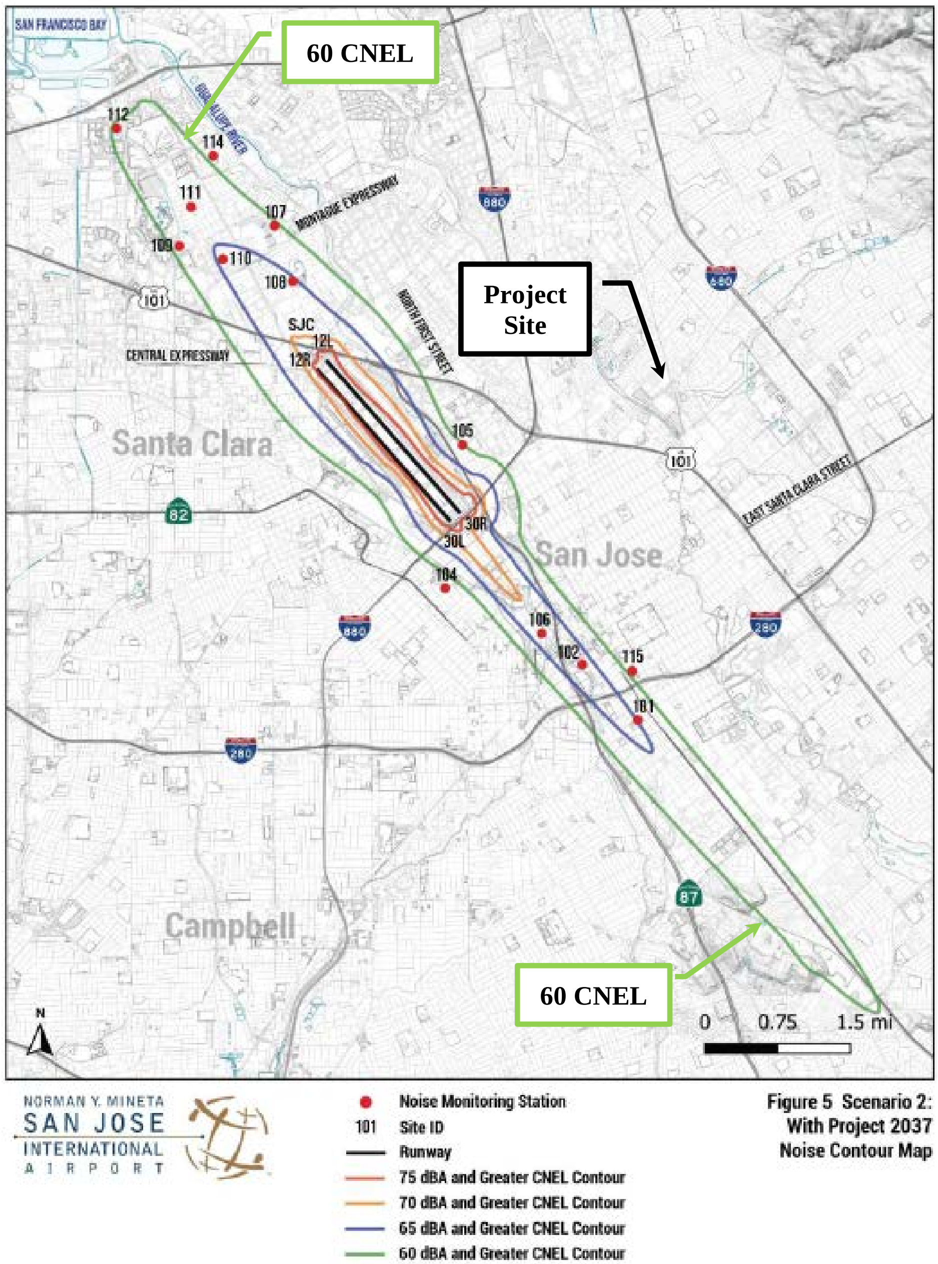


Source: BridgeNet International 2019