APOLLO MIXED-USE PROJECT NOISE AND VIBRATION ASSESSMENT

San José, California

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INTRODUCTION

A 20-story mixed-use building is proposed at 32 and 60 Stockton Avenue in San José, California. The proposed building would include a total of 471 residential units and 7,661 square feet of retail. As part of the proposed project, the existing carwash and auto body shop structures currently occupying the site would be demolished.

This report evaluates the project's potential to result in significant 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 ambient noise conditions in the project vicinity; 2) the Plan Consistency Analysis section discusses noise and land use compatibility utilizing policies in the City's General Plan and compatibility with groundborne vibration from the adjacent rail line; 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.

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

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

Effects of Noise

Sleep and Speech Interference

The thresholds for speech interference indoors are about 45 dBA if the noise is steady and above 55 dBA if the noise is fluctuating. Outdoors the thresholds are about 15 dBA higher. Steady noises of sufficient intensity (above 35 dBA) and fluctuating noise levels above about 45 dBA have been shown to affect sleep. Interior residential standards for multi-family dwellings are set by the State of California at 45 dBA DNL. Typically, the highest steady traffic noise level during the daytime is about equal to the DNL and nighttime levels are 10 dBA lower. The standard is designed for sleep and speech protection and most jurisdictions apply the same criterion for all residential uses. Typical structural attenuation is 12 to 17 dBA with open windows. With closed windows in good condition, the noise attenuation factor is around 20 dBA for an older structure and 25 dBA for a newer dwelling. Sleep and speech interference is therefore possible when exterior noise levels are about 57 to 62 dBA DNL with open windows and 65 to 70 dBA DNL if the windows are closed. Levels of 55 to 60 dBA are common along collector streets and secondary arterials, while 65 to 70 dBA is a typical value for a primary/major arterial. Levels of 75 to 80 dBA are normal noise levels at the first row of development outside a freeway right-of-way. In order to achieve an acceptable interior noise environment, bedrooms facing secondary roadways need to be able to have their windows closed, those facing major roadways and freeways typically need special glass windows.

Annoyance

Attitude surveys are used for measuring the annoyance felt in a community for noises intruding into homes or affecting outdoor activity areas. In these surveys, it was determined that the causes for annoyance include interference with speech, radio and television, house vibrations, and interference with sleep and rest. The DNL as a measure of noise has been found to provide a valid correlation of noise level and the percentage of people annoyed. People have been asked to judge the annoyance caused by aircraft noise and ground transportation noise. There continues to be disagreement about the relative annoyance of these different sources. When measuring the percentage of the population highly annoyed, the threshold for ground vehicle noise is about 50 dBA DNL. At a DNL of about 60 dBA, approximately 12 percent of the population is highly annoyed. When the DNL increases to 70 dBA, the percentage of the population highly annoyed increases to about 25 to 30 percent of the population. There is, therefore, an increase of about 2 percent per dBA between a DNL of 60 to 70 dBA. Between a DNL of 70 to 80 dBA, each decibel increase increases by about 3 percent the percentage of the population highly annoyed. People appear to respond more adversely to aircraft noise. When the DNL is 60 dBA, approximately 30 to 35 percent of the population is believed to be highly annoyed. Each decibel increase to 70 dBA adds about 3 percentage points to the number of people highly annoyed. Above 70 dBA, each decibel increase results in about a 4 percent increase in the percentage of the population highly annoyed.

TABLE 1 Definition of Acoustical Terms Used in this Report

Term	Definition
Decibel, dB	A unit describing, the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for air is 20 micro Pascals.
Sound Pressure Level	Sound pressure is the sound force per unit area, usually expressed in micro Pascals (or 20 micro Newtons per square meter), where 1 Pascal is the pressure resulting from a force of 1 Newton exerted over an area of 1 square meter. The sound pressure level is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressures exerted by the sound to a reference sound pressure (e. g., 20 micro Pascals). Sound pressure level is the quantity that is directly measured by a sound level meter.
Frequency, Hz	The number of complete pressure fluctuations per second above and below atmospheric pressure. Normal human hearing is between 20 Hz and 20,000 Hz. Infrasonic sound are below 20 Hz and Ultrasonic sounds are above 20,000 Hz.
A-Weighted Sound Level, dBA	The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise.
Equivalent Noise Level, L_{eq}	The average A-weighted noise level during the measurement period.
L_{max}, L_{min}	The maximum and minimum A-weighted noise level during the measurement period.
L_{01}, L_{10}, L_{50}, L_{90}	The A-weighted noise levels that are exceeded 1%, 10%, 50%, and 90% of the time during the measurement period.
Day/Night Noise Level, L_{dn} or DNL	The average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels to levels measured in the night between 10:00 pm and 7:00 am.
Community Noise Equivalent Level, CNEL	The average A-weighted noise level during a 24-hour day, obtained after addition of 5 decibels in the evening from 7:00 pm to 10:00 pm and after addition of 10 decibels to sound levels measured in the night between 10:00 pm and 7:00 am.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Intrusive	That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level.

Source: Handbook of Acoustical Measurements and Noise Control, Harris, 1998.

TABLE 2 Typical Noise Levels in the Environment

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	110 dBA	Rock band
Jet fly-over at 1,000 feet		
	100 dBA	
Gas lawn mower at 3 feet		
	90 dBA	
Diesel truck at 50 feet at 50 mph		Food blender at 3 feet
	80 dBA	Garbage disposal at 3 feet
Noisy urban area, daytime		
Gas lawn mower, 100 feet	70 dBA	Vacuum cleaner at 10 feet
Commercial area		Normal speech at 3 feet
Heavy traffic at 300 feet	60 dBA	
		Large business office
Quiet urban daytime	50 dBA	Dishwasher in next room
Quiet urban nighttime	40 dBA	Theater, large conference room
Quiet suburban nighttime		
	30 dBA	Library
Quiet rural nighttime		Bedroom at night, concert hall (background)
	20 dBA	
		Broadcast/recording studio
	10 dBA	
	0 dBA	

Source: Technical Noise Supplement (TeNS), California Department of Transportation, September 2013.

Fundamentals of Groundborne Vibration

Ground vibration consists of rapidly fluctuating motions or waves with an average motion of zero. Several different methods are typically used to quantify vibration amplitude. One method is the Peak Particle Velocity (PPV). The PPV is defined as the maximum instantaneous positive or negative peak of the vibration wave. In this report, a PPV descriptor with units of mm/sec or in/sec is used to evaluate construction generated vibration for building damage and human complaints. Table 3 displays the reactions of people and the effects on buildings that continuous or frequent intermittent vibration levels produce. The guidelines in Table 3 represent syntheses of vibration criteria for human response and potential damage to buildings resulting from construction vibration.

Construction activities can cause vibration that varies in intensity depending on several factors. The use of pile driving and vibratory compaction equipment typically generates the highest construction related groundborne vibration levels. Because of the impulsive nature of such activities, the use of the PPV descriptor has been routinely used to measure and assess groundborne vibration and almost exclusively to assess the potential of vibration to 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.

Federal Government

Federal Transit Administration. The Federal Transit Administration (FTA) has identified construction noise thresholds in the *Transit Noise and Vibration Impact Assessment Manual*,[1] which limit daytime construction noise to 80 dBA L_{eq} at residential land uses and to 90 dBA L_{eq} at commercial and industrial land uses.

1 Federal Transit Administration, *Transit Noise and Vibration Impact Assessment Manual*, FTA Report No. 0123, September 2018.

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.

Santa Clara County

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

4.3.2.1 Noise Compatibility Policies

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

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

Normally Acceptable:

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

Conditionally Acceptable:

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

Unacceptable:

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

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-1.7 Require construction operations within San José to use best available noise suppression devices and techniques and limit construction hours near residential uses per the City's Municipal Code. The City considers significant construction

noise impacts to occur if a project located within 500 feet of residential uses or 200 feet of commercial or office uses would:

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

For such large or complex projects, a construction noise logistics plan that specifies hours of construction, noise and vibration minimization measures, posting or notification of construction schedules, and designation of a noise disturbance coordinator who would respond to neighborhood complaints will be required to be in place prior to the start of construction and implemented during construction to reduce noise impacts on neighboring residents and other uses.

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

Regulatory Background – Vibration

Federal Government

Federal Transit Administration. The 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 at 32 and 60 Stockton Avenue in San José, California. Adjoining the site to the north is a residential mixed-use building. Commercial retail uses are located to the west, opposite Stockton Avenue, and to the southwest, opposite West Santa Clara Street. To the east, opposite UPRR train tracks, is the SAP Center and associated parking lots.

The existing noise environment at the site results primarily from vehicular traffic along West Santa Clara Street/The Alameda and train activity along the adjacent tracks. Nearby State Route 87 (SR 87) traffic noise and aircraft associated with Norman Y. Mineta San José International Airport also contribute to the noise environment.

A noise monitoring survey consisting of two long-term (LT-1 and LT-2) and four short-term (ST-1 through ST-4) noise measurements was made at the site between Tuesday, February 22, 2022, and Friday, February 25, 2022. Noise measurement locations are shown in Figure 1.

Long-term noise measurement LT-1 was made along Stockton Avenue, approximately 50 feet east of the centerline. This measurement quantifies the traffic noise along Stockton Avenue and West Santa Clara Street during typical daytime and nighttime activities, as well as during a home San José Sharks hockey game at the SAP Center, which occurred on Thursday, February 24, 2022. Hourly average noise levels at LT-1 typically ranged from 61 to 71 dBA L_{eq} during daytime hours (7:00 a.m. and 10:00 p.m.) and from 50 to 66 dBA L_{eq} during nighttime hours (10:00 p.m. and 7:00 a.m.). The day-night average noise level on Wednesday, February 23, 2022 was 69 dBA DNL. On gameday, daytime hourly average noise levels ranged from 64 to 71 dBA L_{eq}, and nighttime hourly average noise levels ranged from 63 to 65 dBA L_{eq}. The day-night average noise level on Thursday, February 24, 2022 was 70 dBA DNL. The daily trend in noise levels at LT-1 is shown in Figures A1 through A4 of Appendix A.

LT-2 was made along the train tracks at 250 Stockton Avenue, approximately 40 feet west of the nearest set of tracks. This measurement could not be made at the project site due to logistical concerns with safely installing the meter. This location was selected as an alternative measurement

location. Hourly average noise levels at LT-2 typically ranged from 62 to 70 dBA L_{eq} during daytime hours on non-game days and from 56 to 71 dBA L_{eq} during nighttime hours on non-games days. The day-night average noise level on Wednesday, February 23, 2022 was 72 dBA DNL. On gameday, daytime hourly average noise levels ranged from 64 to 70 dBA L_{eq}, and nighttime hourly average noise levels from 10:00 p.m. to 1:00 a.m., which are the nighttime hours when the gameday traffic would be exiting the parking lot, ranged from 70 to 74 dBA L_{eq}. The day-night average noise level on Thursday, February 24, 2022 was 75 dBA DNL. The daily trend in noise levels at LT-2 is shown in Figures A5 through A8 of Appendix A.

Short-term noise measurements ST-1 and ST-2 were made on Tuesday, February 22, 2022, between 12:20 p.m. and 12:50 p.m. in 10-minute intervals, and ST-3 and ST-4 were made on Friday, February 25, 2022, between 10:40 a.m. and 11:30 a.m. Results of the measurements are summarized in Table 6.

ST-1 was made along the UPRR tracks near the existing carwash. The major noise sources measured at ST-1 included carwash operations, which ranged from 58 to 67 dBA; train horns, which ranged from 80 to 83 dBA; and aircraft flyovers, which ranged from 66 to 68 dBA. Additionally, a car starting in the parking was measured to be about 64 dBA at ST-1. In the absence of all these noise sources, ambient levels ranged from 52 to 54 dBA at ST-1. The 10-minute L_{eq} measured at ST-1 was 67 dBA.

ST-2 was also made along the UPRR tracks, towards the northern section of the project site. The major noise contributors at ST-2 included carwash operations, which ranged from 49 to 50 dBA; train horns from pass-by events, which ranged from 76 to 83 dBA; and aircraft flyovers, which ranged from 66 to 68 dBA. Typical ambient noise levels at ST-2 ranged from 54 to 56 dBA. The 10-minute L_{eq} measured at ST-2 was 61 dBA.

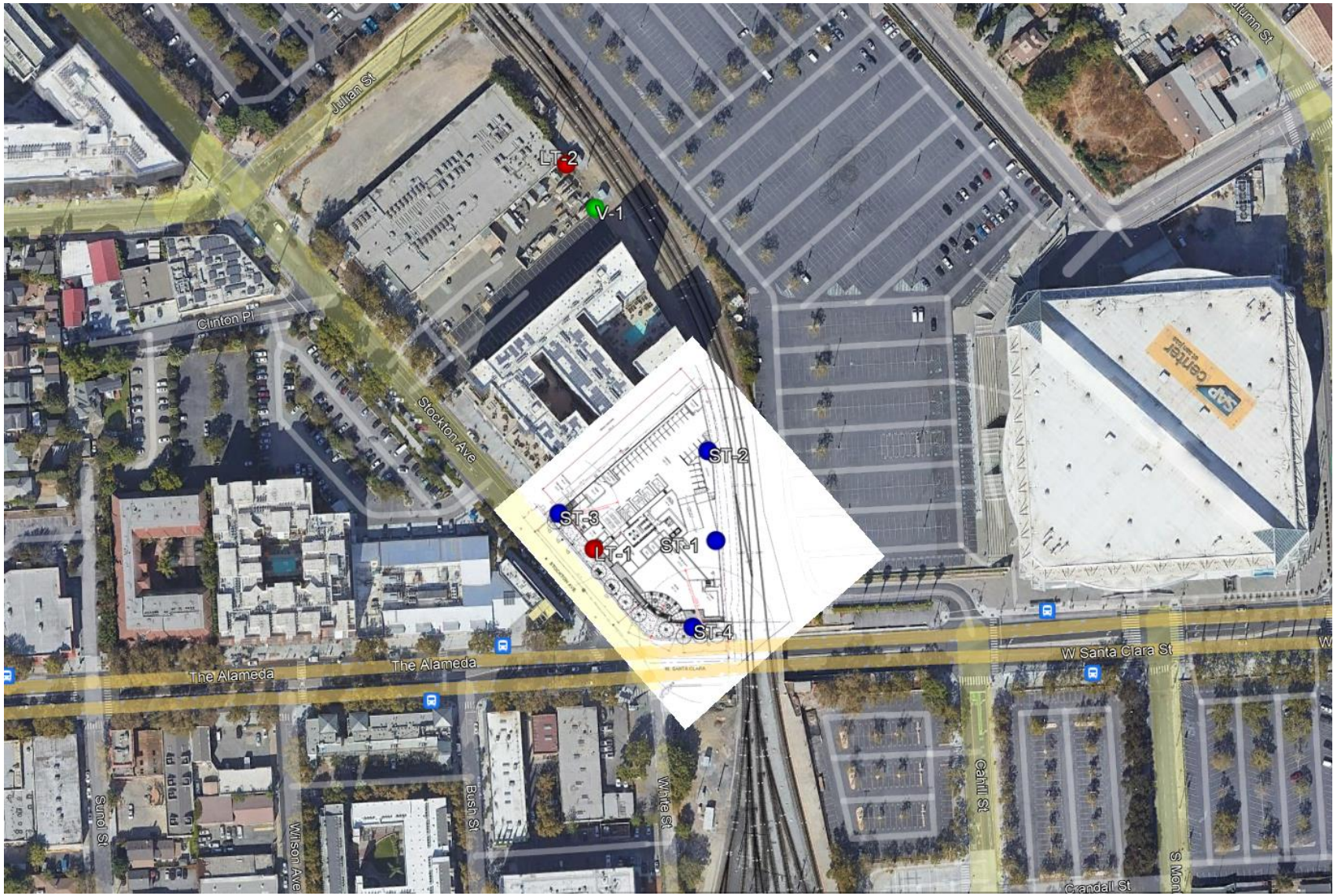
ST-3 was made approximately 45 feet east of the centerline of Stockton Avenue, in the northwestern corner of the project site. Major noise contributors at ST-3 included traffic noise along Stockton Avenue, which consisted mostly of passenger cars with noise levels ranging from 62 to 64 dBA. Typical background ambient noise levels ranged from 56 to 58 dBA. A jet flying overhead generated noise levels of 72 dBA, and train horns generated noise levels ranging from 74 to 75 dBA. The 10-minute L_{eq} measured at ST-3 was 62 dBA.

ST-4 was made approximately 50 feet north of the centerline of West Santa Clara Street/The Alameda. Major noise contributors at ST-4 included traffic noise along West Santa Clara Street/The Alameda, which consisted of passenger cars with noise levels ranging from 68 to 70 dBA, heavy trucks with noise levels ranging from 79 to 82 dBA, and buses with noise levels ranging from 76 to 80 dBA. Typical background ambient noise levels ranged from 60 to 62 dBA. Aircraft flyovers generated noise levels of 66 to 68 dBA, and a train horn generated noise levels of 74 dBA. Other noise contributors included carwash operations with noise levels of 64 dBA, and a noisy vehicle, which reached levels up to 83 dBA. The 10-minute L_{eq} measured at ST-4 was 69 dBA.

TABLE 6 Summary of Short-Term Noise Measurements (dBA)

Noise Measurement Location	Date, Time	Measured Noise Level, dBA					
		L_{max}	$L_{(1)}$	$L_{(10)}$	$L_{(50)}$	$L_{(90)}$	L_{eq}
ST-1: adjacent to UPRR tracks, center of the project site	2/22/2022, 12:20-12:30	83	81	67	57	52	67
ST-2: adjacent to UPRR tracks, northern portion of the project site	2/22/2022, 12:40-12:50	83	73	60	51	49	61
ST-3: ~45 feet east of the centerline of Stockton Avenue	2/25/2022, 10:40-10:50	75	72	65	59	54	62
ST-4: ~50 feet north of the centerline of West Santa Clara Street/The Alameda	2/25/2022, 11:10-11:20	83	79	72	66	59	69

FIGURE 1 Aerial Image of the Project Site and Surrounding Area with Long- and Short-Term Measurement Locations Identified



Source: Google Earth, 2022.

Existing Vibration Environment

Vibration measurements were made near LT-2 at 250 Stockton Avenue. As shown in Figure 1, V-1 was made approximately 40 feet from the edge of the nearest set of UPRR tracks. At this location, the vibration sensor was at-grade with the tracks, whereas the train tracks are elevated approximately six feet above grade at the Apollo project site.

Sixteen observed and recorded vibration measurements of individual train activity were conducted on Tuesday, February 22, 2022, between 10:55 a.m. and 1:20 p.m. The instrumentation used to conduct the measurements included a Roland model R-05 solid state recorder and seismic grade, low noise accelerometers firmly fixed to the ground. This system was capable of accurately measuring very low vibration levels. Vibration levels were measured at ground level at a setback distance of 40 feet from the edge of the nearest set of UPRR tracks.

All measurements were made in the corner parking lot of 250 Stockton Avenue. While the track elevation may vary from the Apollo project site, vibration levels at the site would be equal to or less than the measurements made at 250 Stockton Avenue. Vibration levels ranged from 67 to 72 VdB, and the average was 69 VdB. Table 7 summarizes each of the 16 measurements made at V-1. Vibration levels were measured in the vertical axis because ground vibration is typically most dominant on this axis. Vibration levels measured at V-1 during each of the train pass-by events can be seen in Figure A9 of Appendix A.

TABLE 7 Summary of Train Pass-by Vibration Measurements Made at V-1

Date, Time	Train Information							Vibration Level
	Type of Train	No. of Engines	No. of Cars	Track	Distance from V-1	Direction of Travel	Speed	
2/22/2022, 10:55 a.m.	CalTrain	1	5	Center	55 feet	NB	15 mph	70 VdB
2/22/2022, 11:05 a.m.	CalTrain	1	4	Center	55 feet	NB	15 mph	70 VdB
2/22/2022, 11:16 a.m.	CalTrain	1	5	Center	55 feet	SB	15 mph	70 VdB
2/22/2022, 11:29 a.m.	CalTrain	1	5	Center	55 feet	SB	15 mph	70 VdB
2/22/2022, 11:33 a.m.	CalTrain	1	5	Center	55 feet	SB	15 mph	72 VdB
2/22/2022, 11:44 a.m.	CalTrain	1	5	Center	55 feet	NB	15 mph	71 VdB
2/22/2022, 11:48 a.m.	CalTrain	1	5	Center	55 feet	NB	20 mph	70 VdB
2/22/2022, 11:55 a.m.	CalTrain	1	5	Center	55 feet	NB	20 mph	72 VdB
2/22/2022, 12:09 p.m.	Amtrack	1	4	Far	70 feet	SB	15 mph	67 VdB
2/22/2022, 12:19 p.m.	CalTrain	1	5	Center	55 feet	SB	15 mph	69 VdB
2/22/2022, 12:26 p.m.	CalTrain	1	5	Center	55 feet	SB	10 mph	68 VdB
2/22/2022, 12:31 p.m.	CalTrain	1	5	Center	55 feet	SB	15 mph	70 VdB
2/22/2022, 12:44 p.m.	CalTrain	1	5	Center	55 feet	NB	15 mph	70 VdB
2/22/2022, 12:49 p.m.	CalTrain	1	5	Center	55 feet	NB	15 mph	68 VdB
2/22/2022, 12:56 p.m.	CalTrain	1	5	Center	55 feet	NB	20 mph	70 VdB
2/22/2022, 13:19 p.m.	CalTrain	1	5	Center	55 feet	SB	20 mph	68 VdB

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'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.

The future noise environment at the site would continue to result primarily from vehicular traffic along West Santa Clara Street/The Alameda, train pass-bys along the UPRR tracks, and aircraft associated with the Norman Y. Mineta San José International Airport. It is assumed that noise levels at the site from train and aircraft activity would not change in the future since train and aircraft activity would not change.

The traffic study completed for the proposed project included peak hour trips but did not include future cumulative traffic volumes. According to the traffic study completed for the *Downtown San José Strategy Plan 2040 EIR*,[2] the traffic noise level increase at the project site would be 3 dBA DNL above existing conditions under the worst-case 2040 cumulative buildout alternative. Based on the future traffic volumes along West Santa Clara Street/The Alameda, the project would not measurably contribute to the future traffic noise increase. Therefore, the total increase expected at the project site by the year 2040 would be 3 dBA DNL over existing measurements discussed above in the Setting Section.

Future Exterior Noise Environment

The site plan shows a common outdoor use deck on the fourth floor, which would include a pool, lawn, cocktail terrace, cabana deck, fitness area, and outdoor amenities. The fourth floor also shows an outdoor courtyard. Two sky decks would be located on the 18th floor. Each of these

[2] City of San José, "Downtown San José Strategy Plan 2040 Environmental Impact Report," December 2018.

outdoor use areas would be associated with the residential component of the proposed project and subject to the City's 60 dBA DNL exterior noise threshold.

The site plan also shows two small, shared balconies on multiple floors. Due to the size and intended short-term use of these outdoor areas, they would not be subject to the City's normally acceptable exterior noise thresholds, which are intended for extended outdoor use. Additionally, the site plan does not indicate any proposed outdoor areas associated with the retail component of the proposed project that would be intended for extended use.

The fourth-floor deck is mostly located along the western façade, with direct line-of-sight to Stockton Avenue; however, due to the orientation of the building, this outdoor use area would also have some direct exposure to West Santa Clara Street/The Alameda. The center of the fourth-floor deck would be set back approximately 105 feet from the centerline of Stockton Avenue and approximately 165 feet from the centerline of West Santa Clara Street/The Alameda. The approximate 35-foot elevation of the fourth floor and the surrounding building façades would provide partial shielding of more than 15 dBA from the traffic noise. With the partial shielding, future exterior noise levels due vehicular traffic noise would be below 60 dBA DNL. Note, aircraft noise exposure associated with the Norman Y. Mineta San José International Airport is discussed below in Impact 3 of this report.

The courtyard would be located behind the deck on the fourth floor and would be completely surrounded by the proposed building. This outdoor space would be adequately shielded by the surrounding building. The future exterior noise levels would be below 60 dBA DNL.

The sky decks on the 18th floor would be located at the end of the corridors, with one facing Stockton Avenue and the other facing West Santa Clara Street/The Alameda. The one facing Stockton Avenue would be located near the northwestern corner of the building, and the center of this sky deck would be set back approximately 65 feet from the centerline of the roadway. With the partial shielding from the sky deck elevation of 15 dBA or more, future exterior noise levels would be below 60 dBA DNL. The center of the 18th-floor sky deck in the southeastern corner of the building would be set back from the centerline of West Santa Clara Street/The Alameda by approximately 70 feet. With the partial shielding from the sky deck elevation of 15 dBA or more, future exterior noise levels would be below 60 dBA DNL.

The future noise levels at the centers of the outdoor use areas associated with the residential component of the proposed project would meet the City's normally acceptable threshold of 60 dBA DNL. Therefore, the proposed project would be compatible with the future noise environment at the project site.

Future Interior Noise Environment

Residential Uses

Standard residential construction provides approximately 15 dBA of exterior-to-interior noise reduction, assuming the windows are partially open for ventilation. Standard construction with the windows closed provides approximately 20 to 25 dBA of noise reduction in interior spaces. Where exterior noise levels range from 60 to 65 dBA DNL, the inclusion of adequate forced-air

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

Residential units are located on floors four through 19 of the proposed building. Units located along the southern façade nearest West Santa Clara Street/The Alameda would be set back from the centerline of the roadway by approximately 60 feet. At this distance, the units facing West Santa Clara Street/The Alameda would be exposed to future exterior noise levels up to 72 dBA DNL. Assuming windows to be partially open, future interior noise levels in these units would be up to 57 dBA DNL.

Residential units located along the western façade would be set back from the centerline of Stockton Avenue by approximately 50 feet. At this distance, the units nearest to Stockton Avenue would be exposed to future exterior noise levels up to 73 dBA DNL. Assuming windows to be partially open, future interior noise levels in these units would be up to 58 dBA DNL.

Units along the eastern façade would be exposed to train noise, with the tracks as close as 25 feet from the nearest building façade. At this distance, the units facing the UPRR rail tracks would be exposed to future exterior noise levels up to 77 dBA DNL. Assuming windows to be partially open, future interior noise levels in these units would range from 62 dBA DNL.

To meet the interior noise requirements set forth by the City of San José of 45 dBA DNL, implementation of noise insulation features would be required.

Commercial Land Uses

Ground-level commercial retail is proposed as part of the project. The setback from the centerline of West Santa Clara Street/The Alameda would be approximately 60 feet, and the setback from the centerline of Stockton Avenue would be approximately 50 feet. According to the site plan, the eastern façade of the retail use would not have direct exposure to the UPRR tracks, with the parking structure, a hallway, and staircase located between the retail use and the tracks. Daytime hourly average noise levels at the ground level of the building exterior would be up to 74 dBA L_{eq} at the building façade, with day-night average noise level up to 74 dBA DNL.

Standard construction materials for commercial uses would provide about 25 dBA of noise reduction in interior spaces. The inclusion of adequate forced-air mechanical ventilation systems is normally required so that windows may be kept closed at the occupant's discretion and would provide an additional 5 dBA reduction. The standard construction materials in combination with forced-air mechanical ventilation would satisfy the daytime threshold of 50 dBA $L_{eq(1\text{-}hr)}$.

Noise Insulation Features to Reduce Future Interior Noise Levels

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

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

- Preliminary calculations indicate that residential units along the southern and western building façades would require windows and doors with a minimum rating of 35 STC with adequate forced-air mechanical ventilation to meet the interior noise threshold of 45 dBA DNL.

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

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

Conditions of Approval

Interior Noise Standard for Residential Mixed-Use Development. The project applicant shall prepare final design plans that incorporate building design and acoustical treatments to ensure compliance with State Building Codes and City noise standards. A project-specific acoustical analysis shall be prepared to ensure that the design incorporates controls to reduce interior noise levels to 45 dBA DNL or lower within the residential unit and to 50 dBA $L_{eq(1\text{-}hr)}$ or lower within nonresidential interiors. The project applicant shall conform with any special building construction techniques requested by the City's Building Department, which may include sound-rated windows and doors, sound-rated wall constructions, and acoustical caulking.

Train Vibration 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 light rail vibration on people through appropriate land use policies in the City of San José. Policy EC-2.1 requires new development within 100 feet of light rail lines or other sources of groundborne vibration, to use setbacks and/or structural design features that reduce vibration to levels at or below the guidelines of the FTA.

The FTA vibration impact assessment criteria (summarized in Table 5) were used to evaluate vibration levels produced by trains passing the project area under future conditions. The FTA vibration impact criteria are based on maximum overall levels for a single event. The impact criteria in Table 5 provide thresholds based on the number of train pass-bys in a given day: frequent events (more than 70 events of the same source per day), occasional events (30 to 70 vibration events of the same source per day), and infrequent events (less than 30 vibration events of the same source per day).

Future Vibration Environment

As shown in Table 7, two full hours of train activity resulted in seven trains per hour from 11:00 a.m. through 1:00 p.m. Assuming this train pass-by frequency would be consistent for every daytime hour between 7:00 a.m. and 10:00 p.m. and fewer than seven train pass-bys each hour between 10:00 p.m. and 7:00 a.m., over 70 train pass-bys would occur in a given 24-hour period. This would fall into the frequent events category of the FTA vibration impact criteria, with a maximum vibration level of 72 VdB for mostly residential structures.

Train pass-bys along the center and far tracks resulted in measured vibration levels of 67 to 72 VdB. Therefore, trains traveling on the nearest track could reach levels up to 75 VdB at the nearest building façade, which would be 25 feet from the edge of the nearest track. The proposed building includes below grade basement levels and up to 20 above-ground stories. According to the FTA Manual, vibration level exposure due to train activity would include adjustment factors applied to the measurements to account for coupling loss; amplification due to resonances of floors, walls, and ceilings; and floor-to-floor attenuation. At the ground-level, a minimum adjustment of 5 dB reduction would be applied to the proposed building, resulting in worst-case vibration level exposure of 70 VdB or below at the eastern building façade. Vibration levels at floors two through five would each include 1 dB of addition reduction, and all floors of six and up would include 2 dB of additional reduction. Vibration levels at the proposed building would not exceed the conservative 72 VdB threshold. The future residential development is expected to be compatible with the future vibration environment at the project site.

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 reduce project impacts to less-than-significant levels.

Significance Criteria

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

- A significant noise impact would be identified if the project would generate a substantial temporary or permanent noise level increase over ambient noise levels at existing noise-sensitive receptors surrounding the project site and that would exceed applicable noise standards presented in the General Plan at existing noise-sensitive receptors surrounding the project site.

    - A significant noise impact would be identified if temporary construction-related activities would substantially increase ambient noise levels at sensitive receptors. The City of San José considers large or complex projects involving substantial noise-generating activities and lasting more than 12 months significant when within 500 feet of residential land uses or within 200 feet of commercial land uses or offices. After a period of 12 months, a significant temporary noise impact would

occur if construction noise levels would exceed 80 dBA L_{eq} at residential land uses near the site or 90 dBA L_{eq} at commercial land uses near the site.

- A significant permanent noise level increase would occur if the project would result in: a) a noise level increase of 5 dBA DNL or greater, with a future noise level of less than 60 dBA DNL, or b) a noise level increase of 3 dBA DNL or greater, with a future noise level of 60 dBA DNL or greater.

- A significant noise impact would be identified if the project would expose persons to or generate noise levels that would exceed applicable noise standards presented in the General Plan.

- A significant impact would be identified if the construction of the project would generate excessive vibration levels at surrounding receptors. Groundborne vibration levels exceeding 0.08 in/sec PPV would have the potential to result in cosmetic damage to historic buildings, and groundborne vibration levels exceeding 0.2 in/sec PPV would have the potential to result in cosmetic damage to normal buildings.

- A significant noise impact would be identified if the project would expose people residing or working in the project area to excessive aircraft noise levels.

Impact 1a: **Temporary Construction Noise.** Existing noise-sensitive land uses would be exposed to a temporary increase in ambient noise levels due to project construction activities. With the implementation of mitigation measures included in the *Downtown Strategy Plan*, this would be considered a **less-than-significant** impact.

The project applicant proposes to demolish the existing buildings on the project site. The construction schedule assumed that the earliest possible start date would be the end of February 2024, and the project would be built out over a period of approximately 22 months. Construction phases would include demolition, site preparation, grading, trenching, building construction, and architectural coating. During each phase of construction, there would be a different mix of equipment operating, and noise levels would vary by phase and vary within phases, based on the amount of equipment in operation and the location at which the equipment is operating.

Noise impacts resulting from construction depend upon the noise generated by various pieces of construction equipment, the timing and duration of noise-generating activities, and the distance between construction noise sources and noise-sensitive areas. Construction noise impacts primarily result when construction activities occur during noise-sensitive times of the day (e.g., early morning, evening, or nighttime hours), the construction occurs in areas immediately adjoining noise-sensitive land uses, or when construction lasts over extended periods of time.

Policy EC-1.7 of the City's General Plan requires that all construction operations within the City to use best available noise suppression devices and techniques and to limit construction hours near residential uses per the Municipal Code allowable hours, which are between the hours of 7:00 a.m. and 7:00 p.m. Monday through Friday when construction occurs within 500 feet of a residential land use. Further, the City considers significant construction noise impacts to occur if a project

that is located within 500 feet of residential uses or 200 feet of commercial or office uses would involve substantial noise-generating activities (such as building demolition, grading, excavation, pile driving, use of impact equipment, or building framing) continuing for more than 12 months.

While the City of San José does not establish noise level thresholds for construction activities, this analysis uses the noise limits established by the Federal Transit Administration (FTA) to identify the potential for impacts due to substantial temporary construction noise. The FTA identifies construction noise limits in the *Transit Noise and Vibration Impact Assessment Manual*.[1] During daytime hours, an exterior threshold of 80 dBA L_{eq} shall be applied at residential land uses and 90 dBA L_{eq} shall be applied at commercial and industrial land uses.

Construction activities generate considerable amounts of noise, especially during earth-moving activities when heavy equipment is used. The hauling of excavated materials and construction materials would generate truck trips on local roadways, as well. For the proposed project, pile driving, which generates excessive noise levels, is not expected. The typical range of maximum instantaneous noise levels for the proposed project would be 70 to 90 dBA L_{max} at a distance of 50 feet (see Table 8) from the equipment. Table 9 shows the hourly average noise level ranges, by construction phase, typical for various types of projects. Hourly average noise levels generated by construction are about 72 to 88 dBA L_{eq} for residential mixed-use buildings, measured at a distance of 50 feet from the center of a busy construction site. Construction-generated noise levels drop off at a rate of about 6 dBA per doubling of the distance between the source and receptor. Shielding by buildings or terrain often result in lower construction noise levels at distant receptors.

TABLE 8 Construction Equipment 50-Foot Noise Emission Limits

Equipment Category	L_{max} Level (dBA)[1,2]	Impact/Continuous
Arc Welder	73	Continuous
Auger Drill Rig	85	Continuous
Backhoe	80	Continuous
Bar Bender	80	Continuous
Boring Jack Power Unit	80	Continuous
Chain Saw	85	Continuous
Compressor[3]	70	Continuous
Compressor (other)	80	Continuous
Concrete Mixer	85	Continuous
Concrete Pump	82	Continuous
Concrete Saw	90	Continuous
Concrete Vibrator	80	Continuous
Crane	85	Continuous
Dozer	85	Continuous
Excavator	85	Continuous
Front End Loader	80	Continuous
Generator	82	Continuous
Generator (25 KVA or less)	70	Continuous
Gradall	85	Continuous
Grader	85	Continuous
Grinder Saw	85	Continuous
Horizontal Boring Hydro Jack	80	Continuous
Hydra Break Ram	90	Impact

Equipment Category	L_{max} Level (dBA)[1,2]	Impact/Continuous
Impact Pile Driver	105	Impact
Insitu Soil Sampling Rig	84	Continuous
Jackhammer	85	Impact
Mounted Impact Hammer (hoe ram)	90	Impact
Paver	85	Continuous
Pneumatic Tools	85	Continuous
Pumps	77	Continuous
Rock Drill	85	Continuous
Scraper	85	Continuous
Slurry Trenching Machine	82	Continuous
Soil Mix Drill Rig	80	Continuous
Street Sweeper	80	Continuous
Tractor	84	Continuous
Truck (dump, delivery)	84	Continuous
Vacuum Excavator Truck (vac-truck)	85	Continuous
Vibratory Compactor	80	Continuous
Vibratory Pile Driver	95	Continuous
All other equipment with engines larger than 5 HP	85	Continuous

Notes:

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

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

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

TABLE 9 Typical Ranges of Construction Noise Levels at 50 Feet, L_{eq} (dBA)

	Domestic Housing		Office Building, Hotel, Hospital, School, Public Works		Industrial Parking Garage, Religious Amusement & Recreations, Store, Service Station		Public Works Roads & Highways, Sewers, and Trenches	
	I	II	I	II	I	II	I	II
Ground Clearing	83	83	84	84	84	83	84	84
Excavation	88	75	89	79	89	71	88	78
Foundations	81	81	78	78	77	77	88	88
Erection	81	65	87	75	84	72	79	78
Finishing	88	72	89	75	89	74	84	84

I - All pertinent equipment present at site.
II - Minimum required equipment present at site.

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

Equipment expected to be used in each construction stage are summarized in Table 10, along with the quantity of each type of equipment and the reference noise level at 50 feet, assuming the operation of the two loudest pieces of construction equipment for each construction phase.

Federal Highway Administration's (FHWA's) Roadway Construction Noise Model (RCNM) was used to calculate the hourly average noise levels for each phase of construction, assuming the two loudest pieces of equipment would operate simultaneously, as recommended by the FTA for construction noise evaluations. This construction noise model includes representative sound levels for the most common types of construction equipment and the approximate usage factors of such equipment that were developed based on an extensive database of information gathered during the construction of the Central Artery/Tunnel Project in Boston, Massachusetts (CA/T Project or "Big Dig"). The usage factors represent the percentage of time that the equipment would be operating at full power. Table 10 also summarizes the construction noise levels for the two loudest pieces of equipment propagated to the surrounding receiving land uses.

To assess construction noise impacts at the receiving property lines of existing noise-sensitive receptors, the worst-case hourly average noise level, which would result in the noise levels summarized in Table 10, was propagated from the geometrical center of the project site to the nearest property lines or building façades of the surrounding land uses. These noise level estimates are shown in Table 11. Noise levels in Table 11 do not assume reductions due to intervening buildings or existing barriers.

TABLE 10 Estimated Construction Noise Levels for the Apollo Mixed-Use Building at a Distance of 50 feet

Phase of Construction	Total Workdays	Construction Equipment (Quantity)	Estimated Construction Noise Level at 50 feet
Demolition/Site Preparation	21 days	Concrete/Industrial Saw (1)[a] Excavator (1) Rubber-Tired Dozer (1) Tractor/Loader/Backhoe (2)[a]	86 dBA L_{eq}
Shoring/Grading/ Excavation	37 days	Excavator (1) Tractor/Loader/Backhoe (3)[a] Augercast Pile Drill Rig (2)[a] Skid Steer Loader (2) Roller (1)	86 dBA L_{eq}
Below Slab Utilities	22 days	Tractor/Loader/Backhoe (2)[a]	83 dBA L_{eq}
Foundation/ Basement/ Structure	180 days	Tractor/Loader/Backhoe (2)[a] Concrete Pumper (2)[a] Tractor/Loader/Backhoe (1)[a] Crane (1) Welder (1)	86 dBA L_{eq}
Building –Exterior	179 days	Crane (1)[a] Forklift (4) Tractor/Loader/Backhoe (1)[a] Welder (1)	81 dBA L_{eq}
Building – Interior/ Architectural Coating	287 days	Air Compressor (1)[a] Aerial Lift (2)[a]	76 dBA L_{eq}

[a] Denotes two loudest pieces of construction equipment per phase

TABLE 11 Estimated Construction Noise Levels at Nearby Land Uses

Phase of Construction	Calculated Hourly Average Noise Levels, L_{eq} (dBA)			
	North Residential & Offices (105ft)	**West Commercial (200ft)**	**Southwest Commercial (275ft)**	**East SAP Center (465ft)**
Demolition/Site Preparation	79 dBA L_{eq}	74 dBA L_{eq}	71 dBA L_{eq}	67 dBA L_{eq}
Shoring/Grading/ Excavation	80 dBA L_{eq}	74 dBA L_{eq}	71 dBA L_{eq}	67 dBA L_{eq}
Below Slab Utilities	77 dBA L_{eq}	71 dBA L_{eq}	68 dBA L_{eq}	64 dBA L_{eq}
Foundation/ Basement/ Structure	79 dBA L_{eq}	74 dBA L_{eq}	71 dBA L_{eq}	66 dBA L_{eq}
Building –Exterior	74 dBA L_{eq}	69 dBA L_{eq}	66 dBA L_{eq}	61 dBA L_{eq}
Building – Interior/ Architectural Coating	69 dBA L_{eq}	63 dBA L_{eq}	61 dBA L_{eq}	56 dBA L_{eq}

As shown in Table 11, construction noise levels would intermittently range from 56 to 80 dBA L_{eq} when focused near the center of the project site. These construction noise levels would not exceed the exterior threshold of 80 dBA L_{eq} at residential land uses. The 90 dBA L_{eq} threshold would not be exceeded at commercial land uses in the project vicinity during project construction. While specific construction activities would at times exceed these thresholds when work is conducted near shared property lines, construction would move throughout the project site during the planned 22-month period and thus would not constitute a significant temporary increase. Since project construction would last for a period of more than one year and considering that the project site is within 500 feet of existing residential uses and within 200 feet of existing commercial uses, this temporary construction impact would be considered significant in accordance with Policy EC-1.7 of the City's General Plan.

The proposed project falls within the *Downtown San José Strategy Plan 2040 EIR* plan area, which included mitigation measures to reduce temporary construction noise levels at noise-sensitive receptors. The *Downtown San José Strategy Plan 2040 EIR* would enforce Policy EC-1.7. Pursuant to this General Plan Policy, a construction noise logistics plan shall be prepared 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. Project construction operations shall use best available noise suppression devices and techniques including, but not limited to the following:

- Limit construction hours to between 7:00 a.m. and 7:00 p.m., 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. 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 PBCE that the construction noise mitigation plan is adequate to prevent noise disturbance of affected residential uses.

- Construct solid plywood fences around ground level construction sites adjacent to operational businesses, residences, or other noise-sensitive land uses. A temporary 8-foot noise barrier shall be constructed along the south property line of the project site to shield adjacent residential land uses from ground-level construction equipment and activities. The noise barrier shall be solid over the face and at the base of the barrier in order to provide a 5 dBA noise reduction.

- Equip all internal combustion engine-driven equipment with intake and exhaust mufflers that are in good condition and appropriate for the equipment.

- Prohibit unnecessary idling of internal combustion engines.

- Locate stationary noise-generating equipment such as air compressors or portable power generators as far as possible from sensitive receptors. Construct temporary noise barriers

to screen stationary noise-generating equipment when located near adjoining sensitive land uses.

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

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

- Notify all adjacent business, residences, and other noise-sensitive land uses of the construction schedule, in writing, and provide a written schedule of "noisy" construction activities to the adjacent land uses and nearby residences.

- If complaints are received or excessive noise levels cannot be reduced using the measures above, erect a temporary noise control blanket barrier along surrounding building facades that face the construction sites.

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

With the implementation of GP Policy EC-1.7, Zoning Code requirements, and the above measures provided in the *Downtown San José Strategy Plan 2040 EIR*, the temporary construction noise impact would be **less-than-significant**. No further mitigation would be required.

Mitigation Measure 1a: No further mitigation required.

Impact 1b: Permanent Noise Level Increase/Exceed Applicable Standards. The proposed project would not result in a substantial permanent noise level increase at receptors in the project vicinity. With the incorporation of the City's Standard Permit Condition and measures included in the *Downtown San José Strategy Plan 2040 EIR,* operational noise levels due to mechanical equipment would not exceed applicable standards at the noise-sensitive receptors in the project vicinity. This is a **less-than-significant** impact with the incorporation of these measures.

According to Policy EC-1.2 of the City's General Plan, a significant permanent noise increase would occur if the project would substantially increase noise levels at existing sensitive receptors in the project vicinity. A substantial increase would occur if: a) the noise level increase is 5 dBA DNL or greater, with a future noise level of less than 60 dBA DNL at residences; or b) the noise level increase is 3 dBA DNL or greater, with a future noise level of 60 dBA DNL or greater at residences. Noise levels at sensitive land uses exceed 60 dBA DNL; therefore, a significant impact would occur if traffic or operational noise due to the proposed project would permanently increase ambient levels by 3 dBA DNL.

Under the City's Noise Element, noise levels from nonresidential building equipment shall not exceed a noise level of 55 dBA DNL at receiving noise-sensitive land uses. While the proposed project does include a residential component, the mixed-use building equipment would be used by both the residential and commercial uses; conservatively, Policies EC-1.3 and EC-1.6 shall be enforced for the proposed project.

The City's General Plan does not include thresholds for equipment noise generated at residential buildings; however, the Municipal Code requires mechanical equipment noise to be maintained at or below 55 dBA at receiving residential properties when operational noise is generated at residential uses. Additionally, Section 20.40.600 of the Municipal Code includes a noise limit of 60 dBA on receiving commercial uses.

Project Traffic Increase

The traffic study included peak hour turning movements for existing traffic volumes and two existing plus project traffic volume scenarios (full access and limited access) at six intersections in the vicinity of the project site. By comparing both existing plus project traffic scenarios to the existing scenario, the project's contribution to the overall noise level increase under the existing plus project (full access) scenario was determined to be 1 dBA DNL or less along each roadway segment in the project vicinity, and the project's contribution to the overall noise level increase under the existing plus project (full access) scenario was determined to be 2 dBA DNL or less. The calculated increases are summarized in Table 12. Therefore, the project would not result in a permanent noise increase of 3 dBA DNL or more at noise-sensitive receptors in the project vicinity.

TABLE 12 Estimated Noise Level Increases of Existing Plus Project Traffic Volumes (for Full Access and Limited Access Scenarios) Over Existing Volumes at Receptors in the Project Vicinity

Roadway	Segment	Estimated Noise Level Increase	
		Full Access Scenario	Limited Access Scenario
Stockton Avenue	North of Julian Street	0 dBA DNL	0 dBA DNL
	Julian Street to Project Driveway	1 dBA DNL	0 dBA DNL
	Project Driveway to West Santa Clara Street/The Alameda	0 dBA DNL	0 dBA DNL
	South of West Santa Clara Street/The Alameda	0 dBA DNL	0 dBA DNL
Julian Street	West of Stockton Avenue	0 dBA DNL	0 dBA DNL
	Stockton Avenue to Autumn Street	0 dBA DNL	0 dBA DNL
	East of Autumn Street	0 dBA DNL	0 dBA DNL
	West of Race Street	0 dBA DNL	0 dBA DNL

Roadway	Segment	Estimated Noise Level Increase	
		Full Access Scenario	Limited Access Scenario
West Santa Clara Street/The Alameda	Race Street to Stockton Avenue	0 dBA DNL	0 dBA DNL
	Stockton Avenue to Barack Obama Boulevard	0 dBA DNL	0 dBA DNL
	East of Barack Obama Boulevard	0 dBA DNL	0 dBA DNL
Race Street	North of West Santa Clara Street/The Alameda	0 dBA DNL	0 dBA DNL
	South of West Santa Clara Street/The Alameda	0 dBA DNL	0 dBA DNL
Barack Obama Boulevard	North of West Santa Clara Street/The Alameda	0 dBA DNL	0 dBA DNL
	South of West Santa Clara Street/The Alameda	0 dBA DNL	1 dBA DNL
Autumn Street	North of Julian Street	0 dBA DNL	0 dBA DNL
	South of Julian Street	0 dBA DNL	2 dBA DNL

Mechanical Equipment

The roof plan is identified as a green roof/solar ready and would include approximately 9,058 square feet of required green roof or solar ready space. Solar panels are quiet and would not generate measurable noise levels at the property lines.

Other rooftop equipment is not shown on the site plan; however, some type of heating, ventilation, and air conditioning (HVAC) equipment would be expected. These types of units typically cycle on and off continuously throughout a 24-hour period. This means that, at any given time, multiple units could be operating simultaneously in a relatively small vicinity of the rooftop. Typical heating pumps would generate noise ranging from 56 to 66 dBA at a distance of 3 feet. Assuming up to 10 heating pumps would run simultaneously at any given time, hourly average noise levels would range from 66 to 76 dBA L_{eq} at a distance of 3 feet. Additionally, air handling units for buildings of this size typically generate noise levels up to 62 dBA at a distance of 20 feet. Assuming up to 10 air handling units would operate simultaneously at any given time, noise levels generated by the air handling units would be up to 72 dBA L_{eq} at 20 feet. When combined with the heating pumps, hourly average noise levels for the worst-case scenario would be up to 89 dBA L_{eq} at 3 feet.

The mechanical equipment located on the rooftops would be over 198 feet above the ground. All buildings in the immediate vicinity of the project site would be seven stories or less. The elevation

of the rooftop equipment would provide at least 20 dBA reduction for all existing receptors. Additionally, the site plan shows parapet walls surrounding the rooftop. While the height of these parapet walls are not available, the total attenuation from the combination of the rooftop elevation and the parapet wall would provide a conservative 25 dBA reduction for all existing receptors.

Table 13 shows the estimated mechanical equipment noise propagated to the surrounding land uses, assuming the equipment would be set back 10 feet from the nearest building edge.

TABLE 13 Estimated Operational Noise Levels for the Rooftop Equipment

Receptor	Distance from Rooftop Equipment	Hourly L_{eq}, dBA	DNL, dBA	Noise Level Increase, dBA DNL
North Residential & Office Building	15 feet	50[a]	56[a]	0
West Commercial	110 feet	32[a]	39[a]	0
Southwest Commercial	170 feet	29[a]	35[a]	0
East SAP Center	395 feet	21[a]	28[a]	0

[a] A conservative 25 dBA reduction was applied to the noise levels due to the elevation of the rooftop equipment for existing receptors.

Based on the estimated noise levels in Table 13, mechanical equipment noise levels would potentially exceed the City's General Plan and Municipal Code threshold of 55 dBA DNL at the existing residential/office building adjoining the site to the north. For all existing receptors, the noise level increase due to mechanical equipment noise would not be measurable or detectable (0 dBA DNL increase).

Truck Loading and Unloading

The site plan shows ground-level loading zones within the parking structure. All surrounding residential and commercial land uses would be well shielded from truck loading activities. It is assumed that all deliveries and on-site maintenance activities would occur during daytime hours between 7:00 a.m. and 10:00 p.m. Truck deliveries occurring at the proposed project site would not be expected to generate levels exceeding the City's thresholds at the nearby noise-sensitive land uses. For all existing receptors, the noise level increase due to truck delivery noise would not be measurable or detectable (0 dBA DNL increase).

Total Combined Project-Generated Noise

The operational noise levels produced by the proposed project combined (i.e., traffic, mechanical equipment) would result in an increase of 2 dBA DNL or less at all existing noise-sensitive receptors in the project vicinity. Therefore, the proposed project would not result in a substantial increase over ambient noise levels in the project vicinity. However, operational noise levels due to mechanical equipment located on the rooftop of the proposed building could potentially exceed 55 dBA DNL at the nearest residential receptors to the north of the site.

The final design plans should be reviewed by a qualified acoustical consultant to address any potential conflicts with the General Plan or Municipal Code. The City's standard permit condition shall be implemented as condition of approval for the proposed project. The standard permit condition states the following:

> A detailed acoustical study shall be prepared during final building design to evaluate the potential noise generated by building mechanical equipment and demonstrate the necessary noise control to meet the City's 55 dBA DNL goal. Noise control features such as sound attenuators, baffles, and barriers shall be identified and evaluated to demonstrate that mechanical equipment noise would not exceed 55 dBA DNL at noise-sensitive locations around the project site. The noise control features identified by the study shall be incorporated into the project prior to issuance of a building permit.

Additionally for noise-generating land uses, the *Downtown San José Strategy Plan 2040 EIR* states the following:

> The implementation of General Plan Policies EC-1.2, EC-1.3, and EC-1.9 would reduce potential impacts associated with new noise-producing land uses facilitated by the plan to a less-than-significant level. Policy EC-1.2 limits noise generation by requiring use of noise attenuation measures, such as acoustical enclosures and sound barriers, where feasible, to avoid substantial increases to ambient noise. General Plan Policy EC-1.3 would be implemented and would require new projects to mitigate noise generation to 55 dBA DNL at the property line. Lastly, General Plan Policy EC-1.9 would be implemented and would require that studies be conducted to mitigate loud intermittent noise sources associated with new projects.

Mitigation Measure 1b: No further mitigation required.

Impact 2: Exposure to Excessive Groundborne Vibration. Construction-related vibration levels would potentially exceed applicable vibration thresholds at nearby sensitive land uses. **This is a potentially significant impact.**

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

According to the City's Historic Resource Inventory,[3] historical structures are identified at 120 and 138 Stockton Avenue, both of which are lots containing the existing residential/office building adjoining the site; however, this existing residential/office building is a relatively new construction and would not be considered a sensitive structure. It is likely that the historical inventory has not been updated to reflect the new construction. For purposes of this analysis, the residential/office building north of the project site is not treated as a historical building but would be considered a

[3] www.sanjoseca.gov/your-government/departments/planning-building-code-enforcement/planning-division/historic-preservation/historic-resources-inventory

building of normal conventional construction. The next nearest structure identified on the historical inventory is 734 The Alameda, which is approximately 200 feet southwest of the project site. No other historical buildings are located within 200 feet of the project site.

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

Table 14 presents typical vibration levels that could be expected from construction equipment at a distance of 25 feet. Project construction activities, such as drilling, the use of jackhammers, rock drills and other high-power or vibratory tools, and rolling stock equipment (tracked vehicles, compactors, etc.), may generate substantial vibration in the immediate vicinity. Jackhammers typically generate vibration levels of 0.035 in/sec PPV, and drilling typically generates vibration levels of 0.09 in/sec PPV at a distance of 25 feet.

Vibration levels would vary depending on soil conditions, construction methods, and equipment used. Table 14 also summarizes the distances to the 0.08 in/sec PPV threshold for historical buildings and to the 0.2 in/sec PPV threshold for all other buildings.

TABLE 14 Vibration Source Levels for Construction Equipment

Equipment		PPV at 25 ft. (in/sec)	Minimum Distance to Meet 0.08 in/sec PPV (feet)	Minimum Distance to Meet 0.2 in/sec PPV (feet)
Clam shovel drop		0.202	59	26
Hydromill (slurry wall)	in soil	0.008	4	2
	in rock	0.017	7	3
Vibratory Roller		0.210	61	27
Hoe Ram		0.089	28	13
Large bulldozer		0.089	28	13
Caisson drilling		0.089	28	13
Loaded trucks		0.076	24	11
Jackhammer		0.035	12	6
Small bulldozer		0.003	2	<1

Source: Transit Noise and Vibration Impact Assessment Manual, Federal Transit Administration, Office of Planning and Environment, U.S. Department of Transportation, September 2018, as modified by Illingworth & Rodkin, Inc., March 2022.

Table 15 summarizes the vibration levels at nearest surrounding buildings in the project vicinity, including the historical building at 734 The Alameda. Vibration levels are highest close to the source and then attenuate with increasing distance at the rate $\left({}^{D_{ref}}/_{D}\right)^{1.1}$, where *D* is the distance

from the source in feet and D_{ref} is the reference distance of 25 feet. While construction noise levels increase based on the cumulative equipment in use simultaneously, construction vibration levels would be dependent on the location of individual pieces of equipment. That is, equipment scattered throughout the site would not generate a collective vibration level, but a vibratory roller, for instance, operating near the project site boundary would generate the worst-case vibration levels for the receptor sharing that property line. Further, construction vibration impacts are assessed based on damage to buildings on receiving land uses, not receptors at the nearest property lines. Therefore, the distances used to propagate construction vibration levels (as shown in Table 15), which are different than the distances used to propagate construction noise levels (as shown in Table 11), were estimated under the assumption that each piece of equipment from Table 14 was operating along the nearest boundary of the project site, which would represent the worst-case scenario.

Project construction activities would potentially generate vibration levels up to 0.4 in/sec PPV at the residential/office building adjoining the project site to the north. A study completed by the US Bureau of Mines analyzed the effects of blast-induced vibration on buildings in USBM RI 8507.[4] The findings of this study have been applied to buildings affected by construction-generated vibrations.[5] As reported in USBM RI 8507[4] and reproduced by Dowding,[5] Figure 2 presents the damage probability, in terms of "threshold damage" (described above as cosmetic damage), "minor damage," and "major damage," at varying vibration levels. Threshold damage, or cosmetic damage, would entail hairline cracking in plaster, the opening of old cracks, the loosening of paint or the dislodging of loose objects. Minor damage would include hairline cracking in masonry or the loosening of plaster, and major structural damage would include wide cracking or shifting of foundation or bearing walls.

As shown in Figure 2, maximum vibration levels of 0.2 in/sec PPV or lower would result in virtually no measurable damage, while maximum vibration levels of 0.4 in/sec PPV would result in less than 5% chance of cosmetic damage. No minor or major damage would be expected at the buildings immediately adjoining the project site.

Neither cosmetic, minor, or major damage would occur at historical or conventional buildings located 60 feet or more from the project site. At these locations, and in other surrounding areas where vibration would not be expected to cause cosmetic damage, vibration levels may still be perceptible. However, as with any type of construction, this would be anticipated and would not be considered significant, given the intermittent and short duration of the phases that have the highest potential of producing vibration (use of jackhammers and other high-power tools). By use of administrative controls, such as notifying neighbors of scheduled construction activities and scheduling construction activities with the highest potential to produce perceptible vibration during hours with the least potential to affect nearby businesses, perceptible vibration can be kept to a minimum.

[4] Siskind, D.E., M.S. Stagg, J.W. Kopp, and C.H. Dowding, Structure Response and Damage Produced by Ground Vibration form Surface Mine Blasting, RI 8507, Bureau of Mines Report of Investigations, U.S. Department of the Interior Bureau of Mines, Washington, D.C., 1980.

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

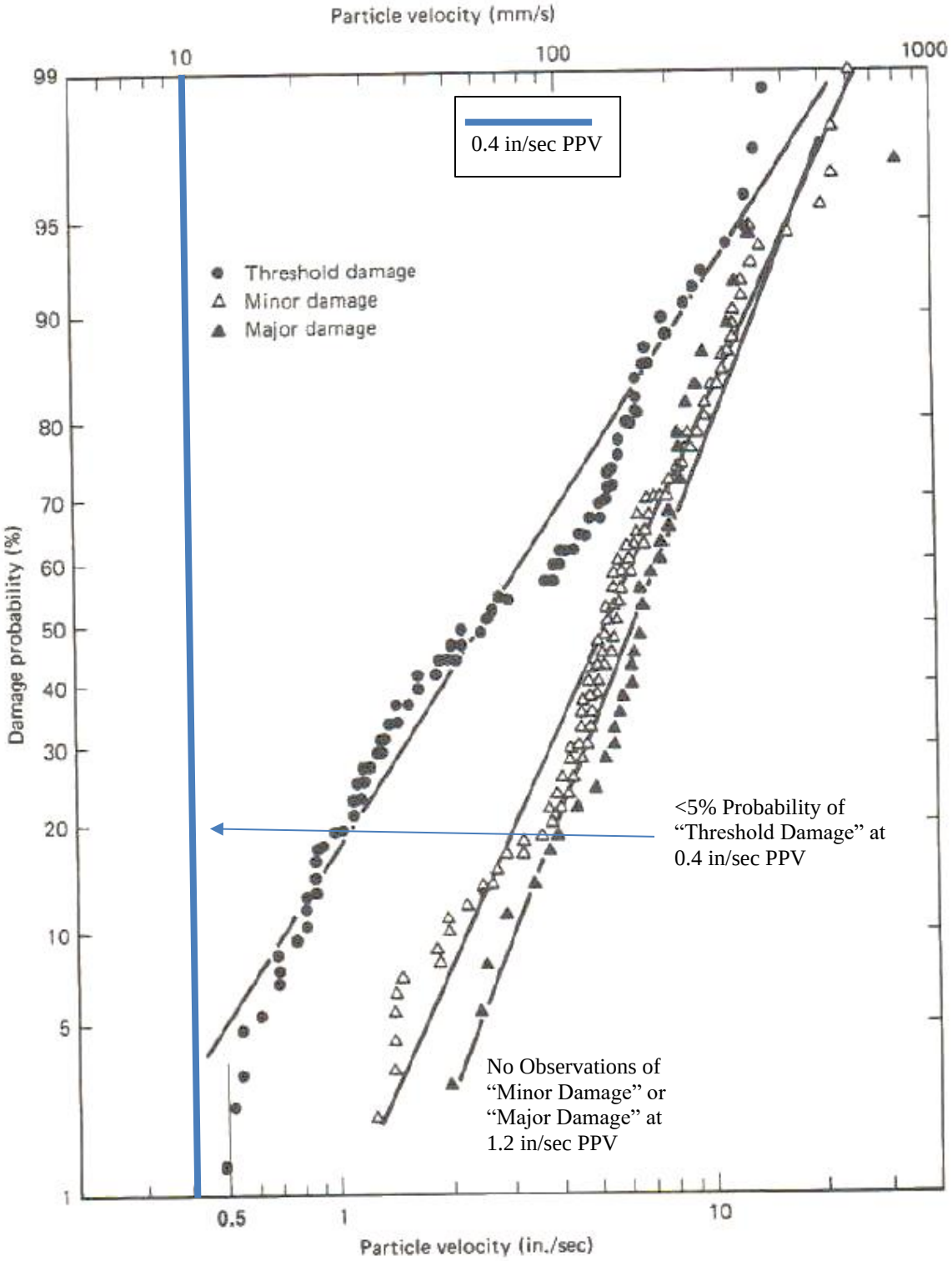
In summary, the construction of the project would not exceed the General Plan threshold of 0.08 in/sec PPV at the nearest historical building located at 734 The Alameda; however, construction activities would potentially generate vibration levels exceeding the 0.2 in/sec PPV threshold at nonhistorical properties adjoining the project site. This would be a potentially significant impact.

TABLE 15 Vibration Source Levels for Construction Equipment

Equipment		PPV (in/sec)				
		North Residential/Office Building (15ft)	**West Commercial Building (90ft)**	**Southwest Commercial Building (125ft)**	**Southwest Historical Building at 734 The Alameda (200ft)**	**East SAP Center (400ft)**
Clam shovel drop		**0.354**	0.049	0.034	0.021	0.010
Hydromill (slurry wall)	in soil	0.014	0.002	0.001	0.001	0.0004
	in rock	0.030	0.004	0.003	0.002	0.001
Vibratory Roller		**0.368**	0.051	0.036	0.021	0.010
Hoe Ram		0.156	0.022	0.015	0.009	0.004
Large bulldozer		0.156	0.022	0.015	0.009	0.004
Caisson drilling		0.156	0.022	0.015	0.009	0.004
Loaded trucks		0.133	0.019	0.013	0.008	0.004
Jackhammer		0.061	0.009	0.006	0.004	0.002
Small bulldozer		0.005	0.001	0.001	0.0003	0.0001

Source: Transit Noise and Vibration Impact Assessment Manual, Federal Transit Administration, Office of Planning and Environment, U.S. Department of Transportation, September 2018, as modified by Illingworth & Rodkin, Inc., March 2022.

FIGURE 2 Probability of Cracking and Fatigue from Repetitive Loading



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

Mitigation Measure 2:

The following measures shall be implemented where vibration levels due to construction activities would exceed 0.2 in/sec PPV at residential/office building adjoining the site to the north:

- A list of all heavy construction equipment to be used for this project known to produce high vibration levels (e.g., tracked vehicles, vibratory compaction, jackhammers, hoe rams, clam shovel drop, and vibratory roller, etc.) shall be submitted to the City by the contractor. This list shall be used to identify equipment and activities that would potentially generate substantial vibration and to define the level of effort for reducing vibration levels below the thresholds.

- Place operating equipment on the construction site as far as possible from vibration-sensitive receptors.

- Use smaller equipment to minimize vibration levels to below 0.2 in/sec PPV shall be used at the property lines. For example, a smaller vibratory roller, such as the Caterpillar model CP433E vibratory compactor, could be used when compacting materials within 30 feet of the adjacent historic building.

- Avoid using vibratory rollers and clam shovel drops near sensitive areas.

- Select demolition methods not involving impact tools.

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

- Avoid dropping heavy equipment and use alternative methods for breaking up existing pavement, such as a pavement grinder, instead of dropping heavy objects, within 30 feet of the adjacent historic building.

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

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

Impact 3: **Excessive Aircraft Noise.** The project site is located just under 1.5 miles from Norman Y. Mineta International Airport. The noise environment attributable to aircraft is considered normally acceptable under the Santa Clara County ALUC noise compatibility policies for residential land uses. This is a **less-than-significant** impact with incorporation of the City's Interior Noise Standard for Residential Mixed-Use Development as a condition of approval.

Norman Y. Mineta San José International Airport is a public-use airport located just under 1.5 miles northwest of the project site. According to the City's new Airport Master Plan Environmental Impact Report,[6] the project site lies just within the 60 dBA CNEL/DNL contour line (see Figure 3) but outside the 65 dBA CNEL/DNL contour line. According to Policy EC-1.11 of the City's General Plan, the required safe and compatible threshold for exterior noise levels would be at or below 65 dBA CNEL/DNL for aircrafts. Therefore, the proposed project would be compatible with the City's exterior noise standards for aircraft noise.

Assuming the recommended STC ratings and forced-mechanical ventilation are incorporated into the proposed project, as discussed above in the Plan Consistency Section of this report, the future interior noise levels resulting from aircraft would below 45 dBA DNL. Therefore, future interior noise at the proposed building would be compatible with aircraft noise with incorporation of the City's Interior Noise Standard for Residential Mixed-Use Development as a condition of approval. This would be a less-than-significant impact.

Mitigation Measure 3: **No further mitigation required.**

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

FIGURE 3 2037 CNEL Noise Contours for SJIA Relative to Project Site

Figure 5
Scenario 2: With Project 2037 Noise Contour Map

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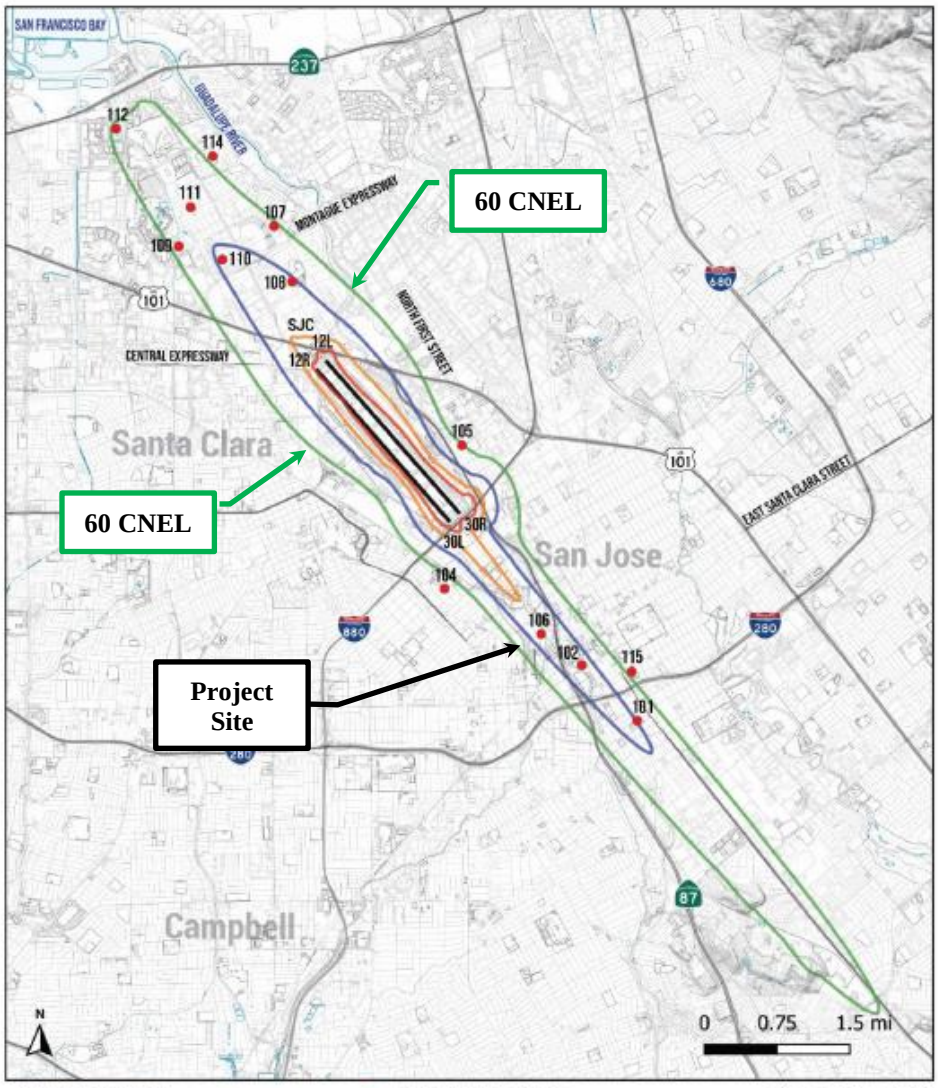

NORMAN Y. MINETA SAN JOSE INTERNATIONAL AIRPORT

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

Figure 5 Scenario 2: With Project 2037 Noise Contour Map

Source: BridgeNet International 2019

Cumulative Impacts

Cumulative noise impacts would include temporary construction noise from cumulative construction projects. Cumulative traffic noise increases due to the proposed project was studied in the *Downtown San José Strategy Plan 2040 EIR.* Therefore, no additional cumulative traffic noise increases would occur due to the proposed project.

From the City's website,[7] the following planned or approved projects are located within 1,000 feet of the proposed project:

- **SAP Center Garage** – this project is located north of the SAP Center, which is approximately 615 feet northeast of the project site. Construction for this project is expected to start in January 2023 and be completed by April 2024. While these two projects could potentially overlap for about a month, these two project sites would not have shared receptors with direct exposure to both sites. This would not result in a cumulative construction impact.

- **Stockton Hotel** – this project is located at 292 Stockton Avenue, approximately 535 feet north of the project site. This project consists of a nine-story hotel with 311 rooms and 19 residential units. This project is in the pre-construction review process and would likely be completed before construction of the Apollo project starts. This would not result in a cumulative construction impact.

- **715 West Julian Street** – this project is located approximately 735 feet northwest of the project site. This project would include the construction of a seven-story building with 249 residential units and 26,572 square feet of commercial space. This project is currently under construction and would be completed prior to construction of the Apollo project. This would not result in a cumulative construction impact.

No other planned or proposed projects are located within 1,000 feet of the Apollo project site.[8] Therefore, there would not be any cumulative construction impacts.

[7] https://gis.sanjoseca.gov/maps/devprojects/

[8] The Downtown West project and the 250 Stockton Avenue project are not listed here, as they are not included on the City's site. Since both of these projects, as well as the Apollo project, fall within the *Downtown Strategy 2040 Plan Area*, the incorporation of mitigation measures in the *Downtown Strategy 2040* and all individual projects would result in a less-than-significant cumulative construction impact at shared receptors surrounding the sites.

APPENDIX A

FIGURE A1 Daily Trend in Noise Levels for LT-1, Tuesday, February 22, 2022

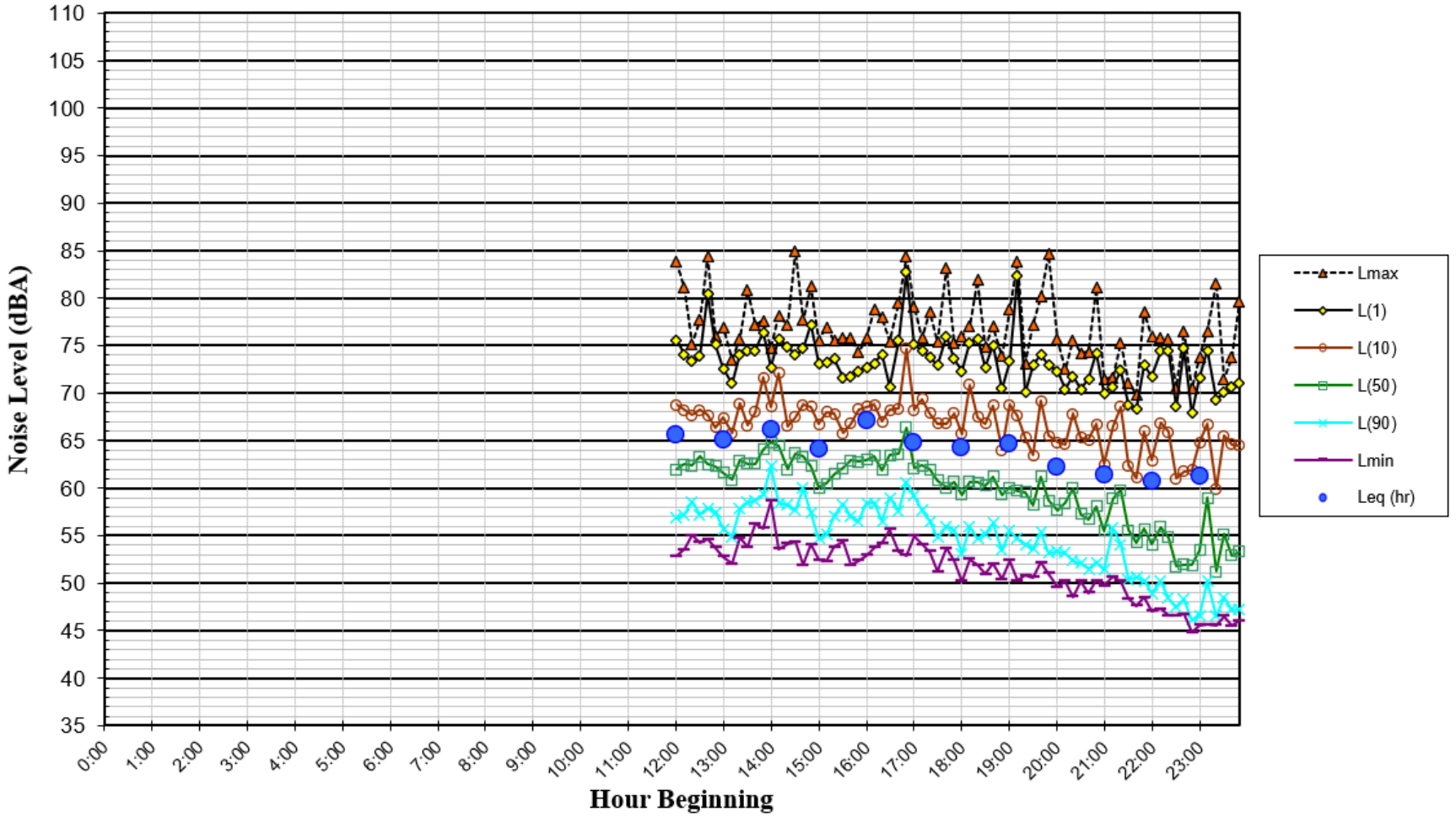

FIGURE A2 Daily Trend in Noise Levels for LT-1, Wednesday, February 23, 2022

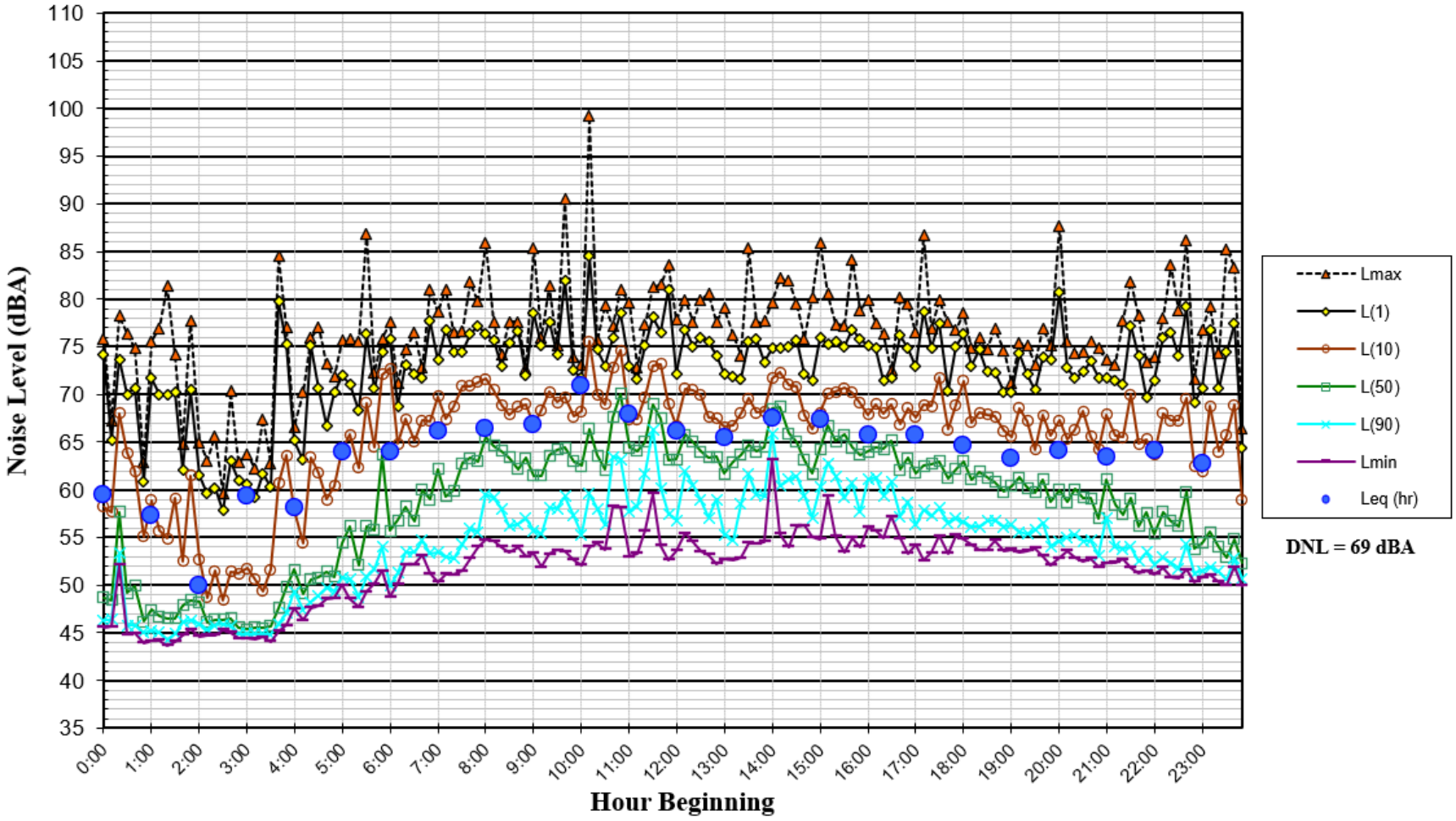

FIGURE A3 Daily Trend in Noise Levels for LT-1, Thursday, February 24, 2022

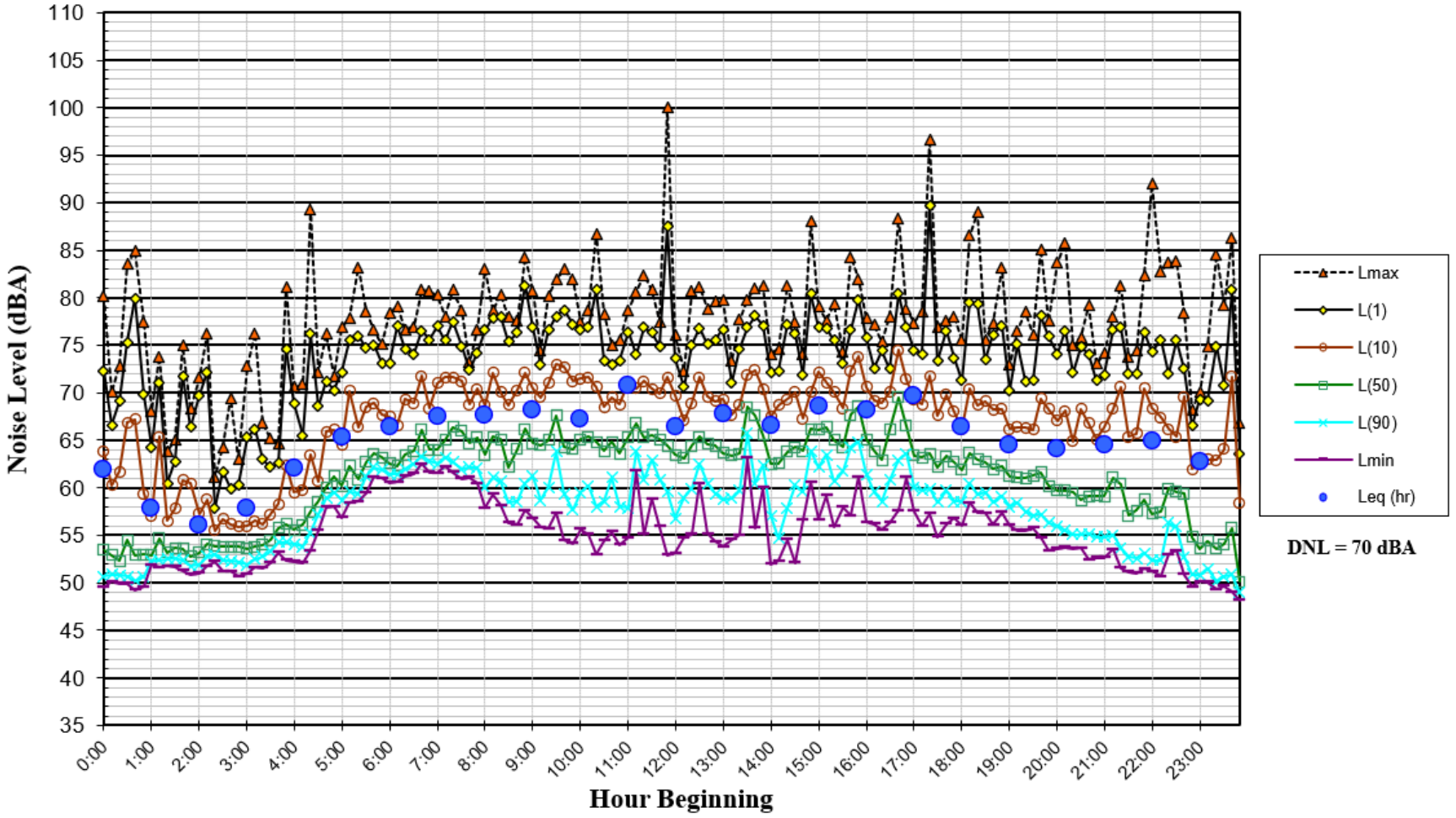

FIGURE A4 Daily Trend in Noise Levels for LT-1, Friday, February 25, 2022

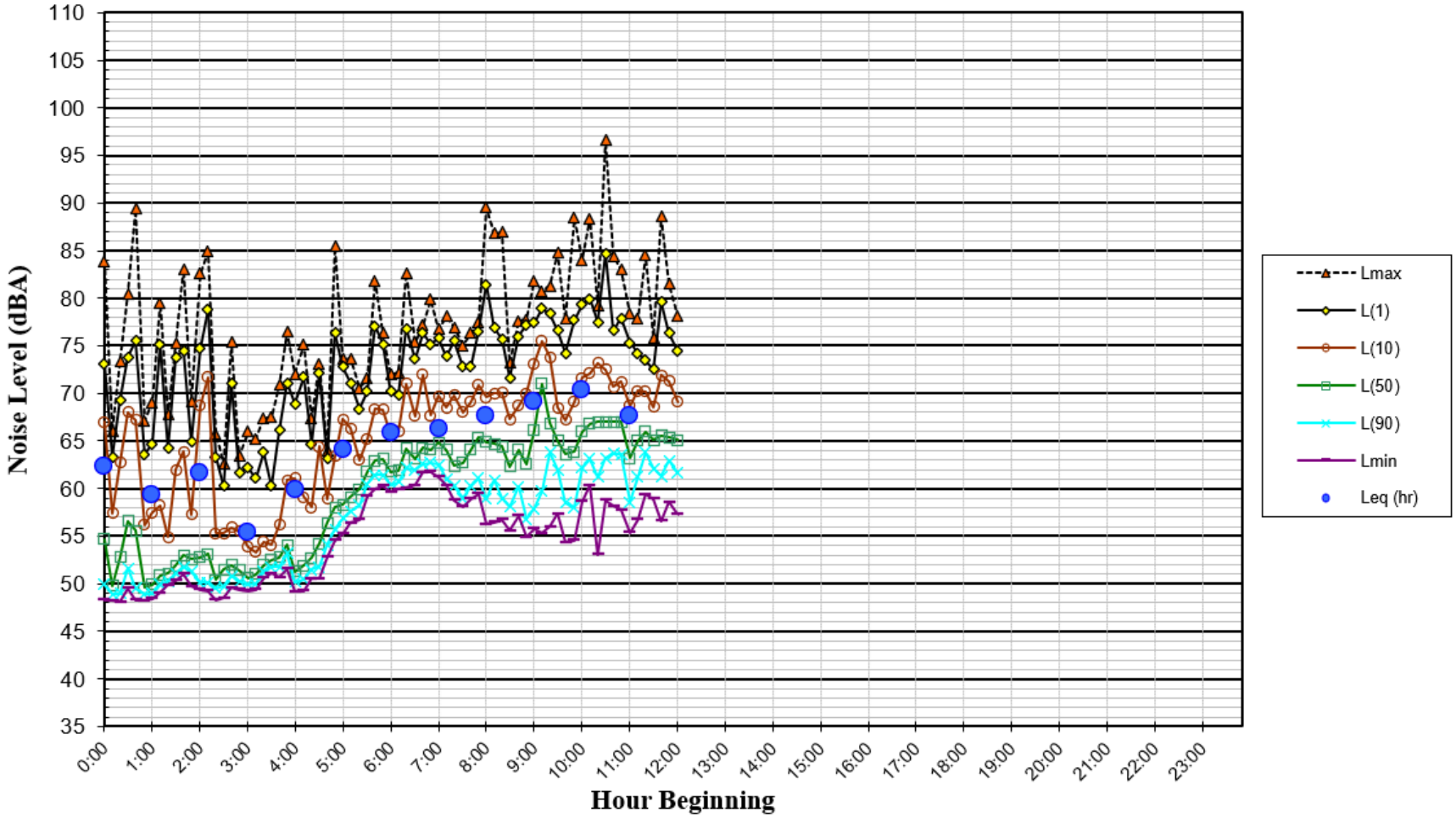

FIGURE A5 Daily Trend in Noise Levels for LT-2, Tuesday, February 22, 2022

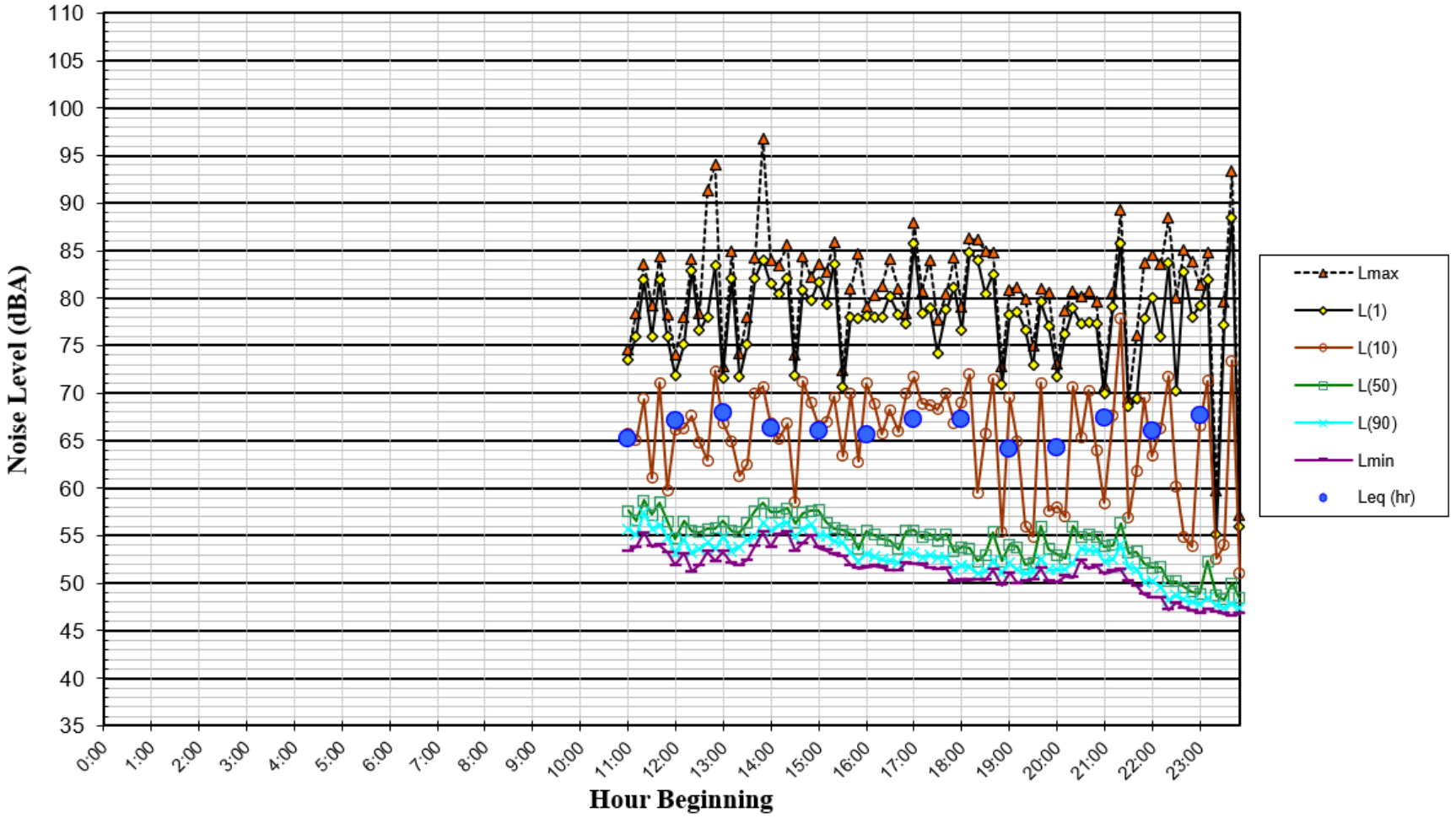

FIGURE A6 Daily Trend in Noise Levels for LT-2, Wednesday, February 23, 2022

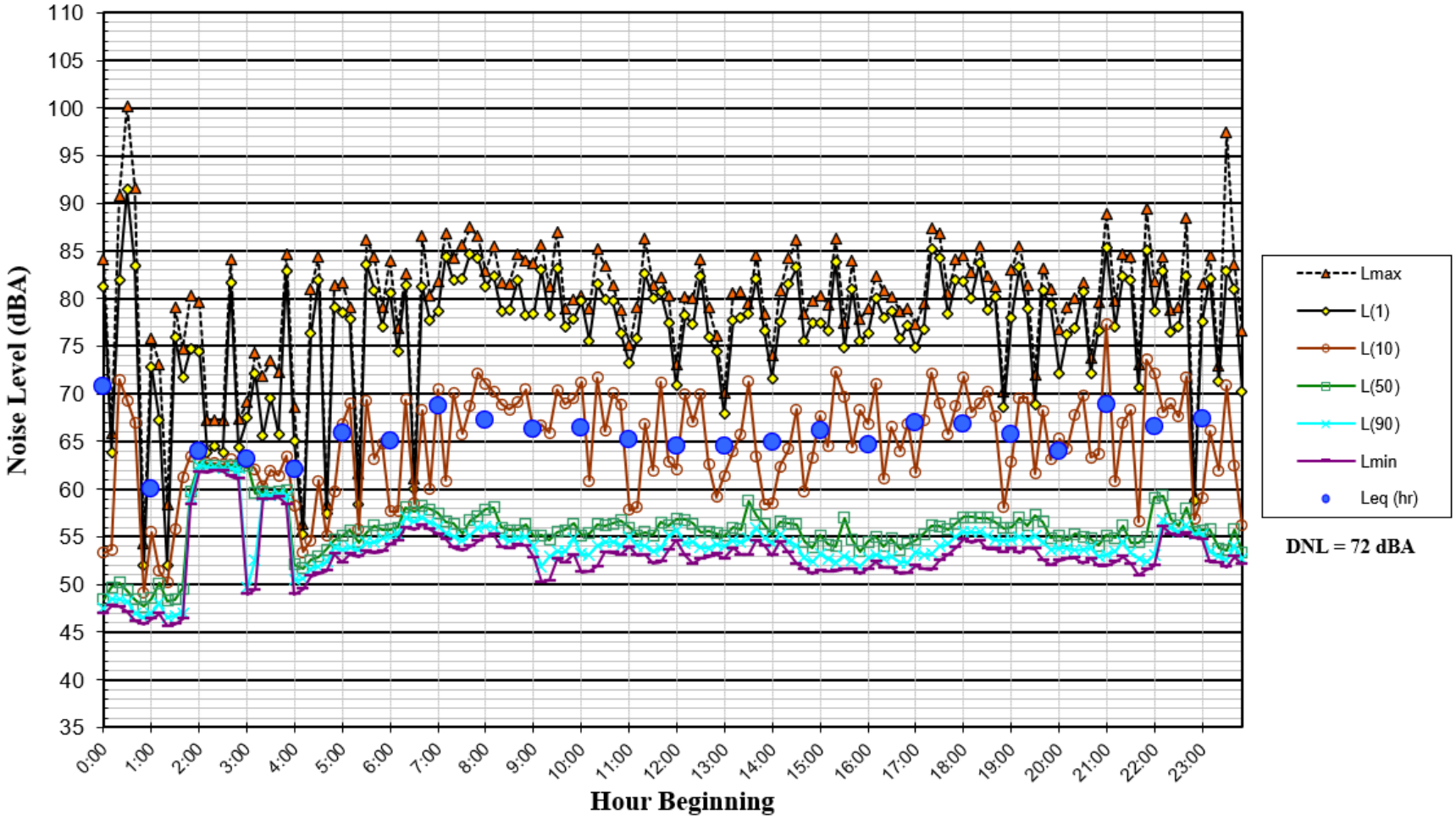

FIGURE A7 Daily Trend in Noise Levels for LT-2, Thursday, February 24, 2022

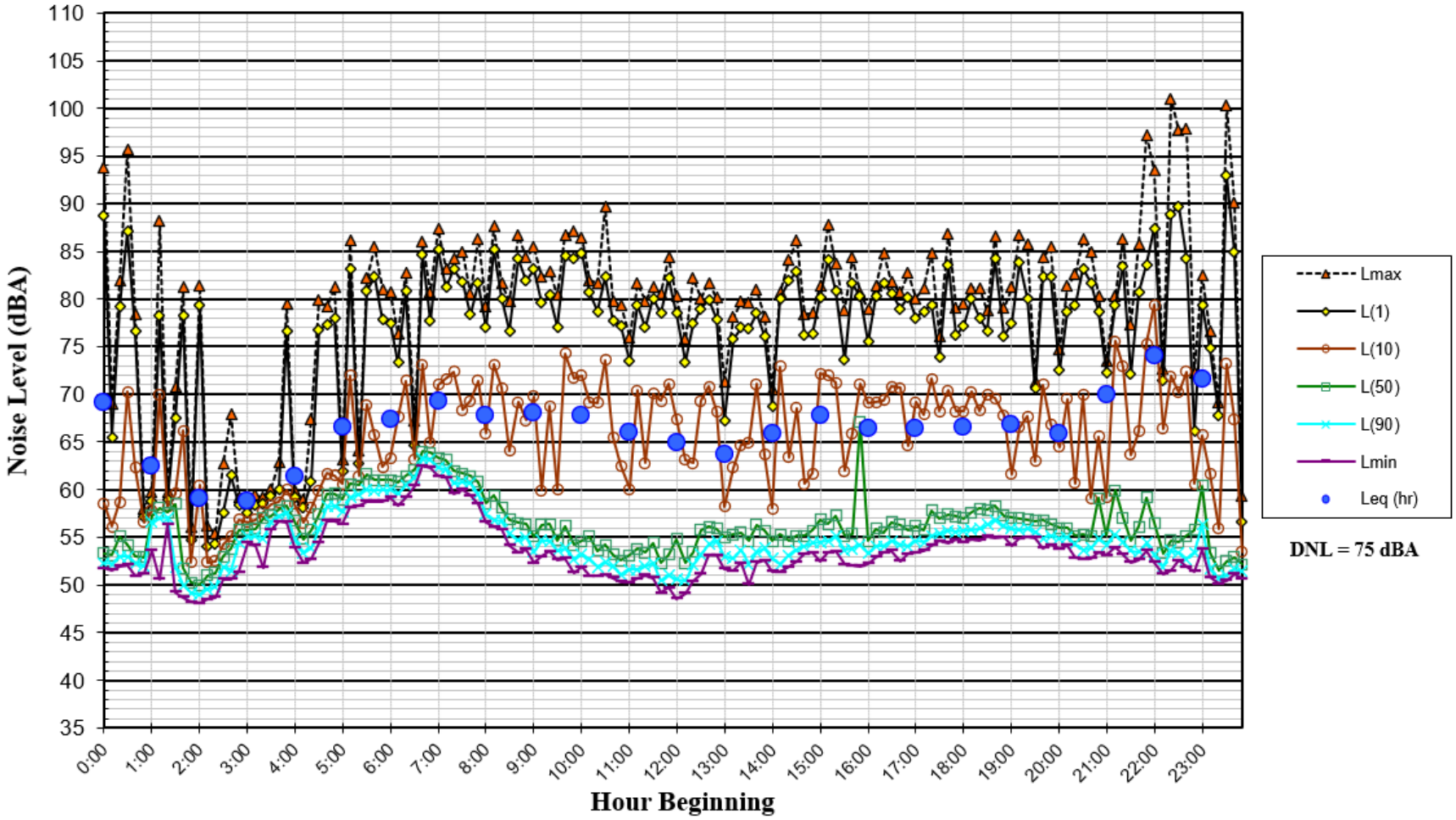

FIGURE A8 Daily Trend in Noise Levels for LT-2, Friday, February 25, 2022

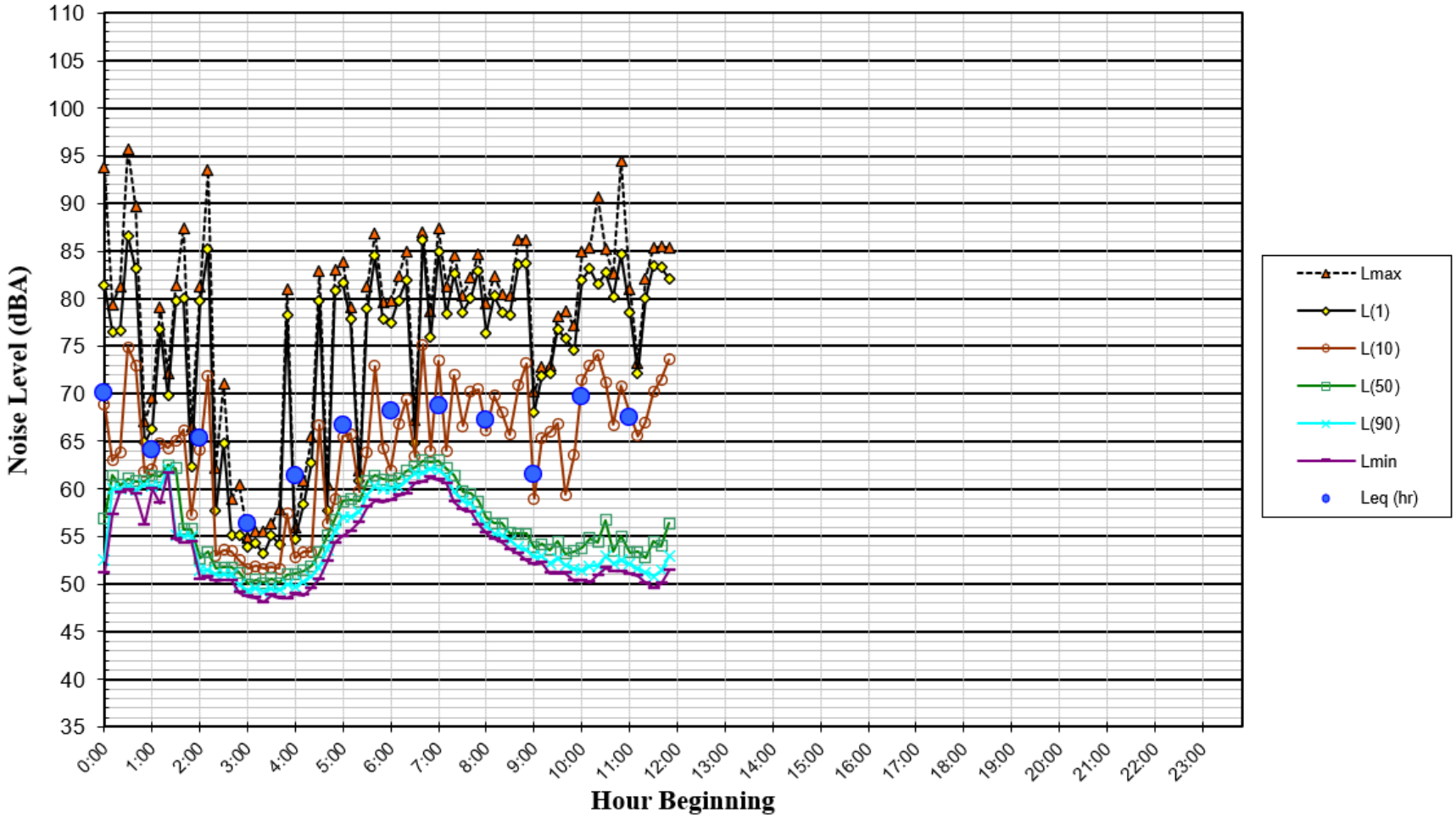

FIGURE A9 UPRR Train Vibration Levels at a Distance of 40 feet from the Edge of the Nearest Set of Tracks