

UNIVERSITY STATION NOISE AND VIBRATION ASSESSMENT

Santa Clara, California

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INTRODUCTION

The project proposes to remove the existing four office buildings (which total 216,000 square feet of office space) and two parking garages and construct a new five-story building with 297 multi-family residential units and 111 three-story townhouse units distributed amongst 26 buildings. Thirteen of the townhouse units would be located on what is currently the 0.94-acre San José parcel (which will be annexed to Santa Clara as described below) and the remaining townhouse units and the multi-family building would be on the Santa Clara parcel.

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 and vibration conditions in the project vicinity; 2) the Plan Consistency Analysis section discusses the compatibility of noise and vibration levels at the site in terms of policies in the City of Santa Clara General Plan; and, 3) the Impacts and Mitigation Measures Section describes the significance criteria used to evaluate project impacts, provides a discussion of each project impact, and presents mitigation measures, where necessary, to mitigate project impacts to a less-than-significant level.

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 the 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

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
Jet fly-over at 1,000 feet	110 dBA	Rock band
Gas lawn mower at 3 feet	100 dBA	
Diesel truck at 50 feet at 50 mph	90 dBA	Food blender at 3 feet
Noisy urban area, daytime	80 dBA	Garbage disposal at 3 feet
Gas lawn mower, 100 feet Commercial area	70 dBA	Vacuum cleaner at 10 feet 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 Quiet suburban nighttime	40 dBA	Theater, large conference room
Quiet rural nighttime	30 dBA	Library 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.

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 p.m. to 10:00 p.m.) and a 10 dB addition to nocturnal (10:00 p.m. to 7:00 a.m.) 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 CNEL. Typically, the highest steady traffic noise level during the daytime is about equal to the CNEL 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.¹ Sleep and speech interference is therefore possible when exterior noise levels are about 57 to 62 dBA CNEL with open windows and 65 to 70 dBA CNEL 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.

¹ Based on the U.S. Department of Transportation Federal Highway Administration document "Highway Traffic Noise: Analysis and Abatement Guidance" (2010) and data from Illingworth & Rodkin, Inc. noise monitoring projects.

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 CNEL 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 CNEL. At a CNEL of about 60 dBA, approximately 12 percent of the population is highly annoyed. When the CNEL 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 CNEL of 60 to 70 dBA. Between a CNEL 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 CNEL 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.²

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.

² Kryter, Karl D. *The Effects of Noise on Man*. Menlo Park, Academic Press, Inc., 1985.

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.

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 1×10^{-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 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 Federal Agencies, State Agencies, Santa Clara County, and the City of Santa Clara. The State CEQA Guidelines, Appendix G, are used to assess the potential significance of impacts pursuant to local General Plan policies 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*,³ which limit daytime construction noise to 80 dBA L_{eq} at residential land uses, 85 dBA L_{eq} at commercial and office uses, and to 90 dBA L_{eq} at industrial land uses.

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.

2022 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 Mineta 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.

³ Federal Transit Administration, *Transit Noise and Vibration Impact Assessment Manual*, FTA Report No. 0123, September 2018.

**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. <u>Residential:</u> 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.

- N-3 Noise impacts shall be evaluated according to the Aircraft Noise Contours (presented in Figure 1 below)
- 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.

City of Santa Clara

City of Santa Clara General Plan. The City of Santa Clara’s General Plan identifies noise and land use compatibility standards for various land uses and establishes policies to control noise within the community. Table 8.14-1 from the General Plan shows acceptable noise levels for various land uses. Residential land uses are considered compatible in noise environments of 55 dBA L_{dn}/CNEL or less. The guidelines state that where the exterior noise levels are greater than 55 dBA L_{dn}/CNEL and less than 70 dBA L_{dn}/CNEL, the design of the project should include measures to reduce noise levels to acceptable levels. Noise levels exceeding 70 dBA L_{dn}/CNEL at residential land uses are considered incompatible.

TABLE 8.14-1: GENERAL PLAN NOISE STANDARDS

Noise and Land Use Compatibility (Ldn & CNEL)									
Land Use	50	55	60	65	70	75	80	85	
Residential	Compatible		Require Design and insulation to reduce noise levels			Incompatible. Avoid land use except when entirely indoors and an interior noise level of 45 Ldn can be maintained			
Educational	Compatible		Require Design and insulation to reduce noise levels			Incompatible. Avoid land use except when entirely indoors and an interior noise level of 45 Ldn can be maintained			
Recreational	Compatible		Require Design and insulation to reduce noise levels			Incompatible. Avoid land use except when entirely indoors and an interior noise level of 45 Ldn can be maintained			
Commercial	Compatible		Require Design and insulation to reduce noise levels			Incompatible. Avoid land use except when entirely indoors and an interior noise level of 45 Ldn can be maintained			
Industrial	Compatible		Require Design and insulation to reduce noise levels			Incompatible. Avoid land use except when entirely indoors and an interior noise level of 45 Ldn can be maintained			
Open Space	Compatible								
	Require Design and insulation to reduce noise levels								
	Incompatible. Avoid land use except when entirely indoors and an interior noise level of 45 Ldn can be maintained								

Applicable goals and policies presented in the General Plan are as follows:

- 5.10.6-G1 Noise sources restricted to minimize impacts in the community.
- 5.10.6-G2 Sensitive uses protected from noise intrusion.
- 5.10.6-G3 Land use, development and design approvals that take noise levels into consideration.
- 5.10.6-P1 Review all land use and development proposals for consistency with the General Plan compatibility standards and acceptable noise exposure levels defined on Table 8.14-1.

- 5.10.6-P2 Incorporate noise attenuation measures for all projects that have noise exposure levels greater than General Plan “normally acceptable” levels, as defined on Table 8.14-1.
- 5.10.6-P3 New development should include noise control techniques to reduce noise to acceptable levels, including site layout (setbacks, separation and shielding), building treatments (mechanical ventilation system, sound-rated windows, solid core doors and baffling) and structural measures (earthen berms and sound walls).
- 5.10.6-P4 Encourage the control of noise at the source through site design, building design, landscaping, hours of operation and other techniques.
- 5.10.6-P5 Require noise-generating uses near residential neighborhoods to include solid walls and heavy landscaping along common property lines, and to place compressors and mechanical equipment in sound-proof enclosures.
- 5.10.6-P6 Discourage noise sensitive uses, such as residences, hospitals, schools, libraries and rest homes, from areas with high noise levels, and discourage high noise generating uses from areas adjacent to sensitive uses.
- 5.10.6-P7 Implement measures to reduce interior noise levels and restrict outdoor activities in areas subject to aircraft noise in order to make Office/Research and Development uses compatible with the Norman Y. Mineta International Airport land use restrictions.

City of Santa Clara Municipal Code. The City’s Municipal Code establishes noise level performance standards for fixed sources of noise. Section 9.10.40 of the Municipal Code limits noise levels at receiving single- and multi-family residences to 55 dBA during daytime hours (7:00 a.m. to 10:00 p.m.) and 50 dBA at night (10:00 p.m. to 7:00 a.m.); at receiving commercial and office buildings to 65 dBA during daytime hours and 60 dBA at night; and at receiving light industrial uses to 70 dBA anytime. The noise limits are not applicable to emergency work, licensed outdoor events, City-owned electric, water, and sewer utility system facilities, construction activities occurring within allowable hours, permitted fireworks displays, or permitted heliports.

Construction activities are not permitted within 300 feet of residentially zoned property except within the hours of 7:00 a.m. and 6:00 p.m. on weekdays and 9:00 a.m. and 6:00 p.m. on Saturdays. No construction is permitted on Sundays or holidays.

The City Code does not define the acoustical time descriptor such as L_{eq} (the average noise level) or L_{max} (the maximum instantaneous noise level) that is associated with the above limits. A reasonable interpretation of the City Code would identify the ambient base noise level criteria as an average or median noise level (L_{eq}/L_{50}).

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 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 Santa Clara

City of Santa Clara General Plan. Applicable goals and policies presented in the General Plan are as follows:

- 5.8.7-P5 Require new development to implement appropriate measures to reduce the negative effects, such as noise and vibration, of rail and freight services.

5.8.7-P7 Maintain consistency with the Federal Transportation Authority vibration standards for land uses in proximity to railroads, light rail and the future high speed rail.

Existing Noise Environment

The project site is located at 451 El Camino Real in Santa Clara along with a small parcel located in San José (to be annexed by the City of Santa Clara). The project site is situated between El Camino Real to the southwest and the Union Pacific Railroad (UPRR) tracks (that serve Caltrain, Amtrak, Altamont Corridor Express, and freight trains) to the northeast. The site is currently developed with six commercial office buildings and surface parking lots.

The noise environment at the site and in the surrounding area results primarily from local vehicular traffic along El Camino Real and railroad trains. Aircraft associated with San José Mineta International Airport also contribute to the noise environment.

A noise monitoring survey consisting of two long-term (LT-1, LT-2) and two short-term (ST-1, ST-2) noise measurements were made between Tuesday, December 17, 2024, and Friday, December 20, 2024 to quantify ambient noise levels. All measurement locations are shown in Figure 1.

Long-term measurement LT-1 was made in the southeastern corner of the project site, approximately 600 feet from the centerline of El Camino Real, and about 65 feet from the nearest UPRR railroad track. Hourly average noise levels at LT-1 typically ranged from 60 to 69 dBA L_{eq} during daytime hours (between 7:00 a.m. and 10:00 p.m.) and from 49 to 67 dBA L_{eq} during nighttime hours (between 10:00 p.m. and 7:00 a.m.). The day-night average noise level ranged from 68 to 69 dBA CNEL on Wednesday, December 18 and Thursday, December 19, 2024. The daily trend in noise levels at LT-1 is shown in Figures A1 through A4 of Appendix A.

Long-term measurement LT-2 was made towards the northwestern corner of the project site, approximately 55 feet from the centerline of El Camino Real. Traffic along El Camino Real is the dominant noise source at this location. Hourly average noise levels at LT-2 typically ranged from 64 to 70 dBA L_{eq} during daytime hours (between 7:00 a.m. and 10:00 p.m.) and from 55 to 66 dBA L_{eq} during nighttime hours (between 10:00 p.m. and 7:00 a.m.). The day-night average noise level ranged from 70 to 71 dBA CNEL on Wednesday, December 18 and Thursday, December 19, 2024. 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 Wednesday, December 18, 2024, between 1:30 p.m. and 2:00 p.m. in 10-minute measurement periods. Table 6 summarizes the noise measurement results measured at each location.

FIGURE 1 Aerial Image of the Project Site and Vicinity with the Noise and Vibration Measurement Locations Identified



Source: Google Earth, 2025.

TABLE 6 Summary of Short-Term Noise Measurements

Noise Measurement Location	Date, Time	Measured Noise Level, dBA					
		L _{max}	L ₍₁₎	L ₍₁₀₎	L ₍₅₀₎	L ₍₉₀₎	L _{eq}
ST-1: ~70 feet away from edge of the UPRR railroad tracks (intermittent trains, aircraft noise)	12/18/2024, 1:30-1:40 p.m.	82	79	60	53	50	63
ST-2: ~100 feet away from the El Camino Real centerline (traffic noise)	12/18/2024, 1:50-2:00 p.m.	72	69	65	56	47	61

Existing Vibration Environment

Vibration measurements were made near the ST-1 location, approximately 65 feet from the edge of the nearest rail tracks. At this location, the vibration sensor was at-grade with the tracks.

Seven observed and recorded vibration measurements of individual train activity were conducted on Tuesday, December 17, 2024, between 1:30 p.m. and 3:30 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 ranged from 51 to 77 VdB during train passbys, and the average level produced by trains was 73 VdB. Table 7 summarizes each of the seven measurements made at V-1 (shown in Figure 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 Light Rail Train Pass-by Vibration Measurements Made at V-1

Date, Time	Train Type	Train Information				Vibration Level
		Track	Distance from V-1	Direction of Travel	Speed	
12/17/2024, 14:32	Caltrain	Far	130 feet	NB	35 mph	77 VdB
12/17/2024, 14:44	Caltrain	Near	100 feet	SB	35 mph	64 VdB
12/17/2024, 14:54	Amtrak	Far	130 feet	SB	25 mph	51 VdB
12/17/2024, 15:03	Caltrain	Far	130 feet	NB	30 mph	76 VdB
12/17/2024, 15:09	Amtrak	Far	130 feet	NB	25 mph	57 VdB
12/17/2024, 15:14	Caltrain	Near	100 feet	SB	30 mph	63 VdB
12/17/2024, 15:26	Caltrain	Far	130 feet	NB	35 mph	76 VdB

PLAN CONSISTENCY ANALYSIS

Noise and Land Use Compatibility

Noise levels at outdoor use areas that are affected by transportation noise in the City of Santa Clara are required to be maintained at or below 55 dBA CNEL to be considered normally acceptable for residential land uses, according to the City's General Plan. The City's normally acceptable threshold for recreational areas is 65 dBA CNEL. Additionally, residential interior noise levels are required to meet the performance standard of 45 dBA CNEL.

The existing measured noise environment at the site indicates a noise level of 69 dBA CNEL along the project property line nearest to the UPRR lines. The noise level along the property line closest to El Camino Real is around 71 dBA CNEL.

The future noise environment at the site would continue to result primarily from vehicular traffic along El Camino Real and trains along the UPRR lines. Noise from concerts and sporting events planned at the PayPal Park Stadium (1123 Coleman Avenue, San Jose) could also potentially contribute to the future noise levels in the area, although noise from trains and traffic would dominate the future noise environment at the project site.

Based on the traffic study⁴ prepared for this project, the proposed residential development is expected to generate no net new daily trips and no net new AM and PM peak hour trips. To estimate the future permanent noise level increase from traffic, a 2% traffic increase per year through 2045 was estimated along El Camino Real. This increase is typical for a built-out area. The noise level increase by the year 2045 along El Camino Real was calculated to be 2 dBA CNEL.

The future noise environment from trains along UPRR lines would be expected to increase with the addition of the BART trains⁵. The BART Silicon Valley Phase II project predicts a 2 dBA CNEL increase from existing noise levels at the ground level in the area nearest to the project site, from train operations in the future.

The California High Speed Rail (HSR) project⁶ is proposed to pass through the vicinity of the University Station project site. Based on the project documents, the construction and operation of high-speed trains using the UPRR corridor would result in a "severe impact" for the project site and the nearest neighbors. This could mean a permanent noise increase of 3 dBA CNEL or more. However, the project remains speculative and was not considered in the calculation of future noise levels.

Based on the noise level increases from traffic and trains discussed above, future noise exposure along the northern property line (closest to railroad lines) would be about 71 dBA CNEL. The

⁴ "Transportation Analysis for the Proposed University Station Residential Development in Santa Clara, California" by Hexagon Transportation Consultants, Inc. dated April 4, 2025

⁵ VTA's BART Silicon Valley Phase II - <https://www.vta.org/projects/documents?project=1533716>

⁶ California High Speed Rail - <https://hsr.ca.gov/programs/environmental-planning/program-eir-eis-documents-for-the-statewide-high-speed-rail-system-tier-1/final-program-environmental-impact-report-environmental-impact-statement-eir-eis-for-the-proposed-california-high-speed-rail-system-2005/>

southern property line along El Camino Real would be exposed to a future noise level of about 73 dBA CNEL.

Future Exterior Noise Environment

The project site plan shows two ground level courtyards at the five-story apartment complex along with a linear paseo located south of the townhomes. Two picnic areas are also proposed closer to the northern property line. In addition to these common use areas, townhome paseos, ground level private patios and Level 2 decks are proposed for the townhomes.

The proposed five-story apartment complex building would shield the courtyards (that include lounge area, spa, pools) from both traffic noise along El Camino Real and train activity along the railroad tracks. Considering aircraft noise from the San Jose Mineta International Airport, future exterior noise levels would be about 60 to 65 CNEL at both the courtyards. The proposed outdoor use area would be considered “conditionally acceptable” as per the City’s General Plan noise standards.

For the linear paseo proposed south of the townhomes, noise from traffic along El Camino Real would be shielded by the existing commercial building (445-455 El Camino Real). The linear paseo also benefits from shielding by the townhome buildings from trains along the railroad tracks. Future exterior noise levels would be at or below 55 dBA CNEL at the linear paseo due to shielding effects of the commercial building as well as the project townhomes. This proposed outdoor use area would be compatible with the future noise environment at the project site.

The ground level outdoor patios, townhome paseos and the picnic areas located towards the northern property line of the project site would be exposed to a future noise exposure of up to 71 dBA CNEL, without any shielding. This will exceed the City’s acceptable threshold of 55 dBA CNEL for residences. To address this, a 10-foot soundwall is proposed along the northern boundary of the project site adjacent to the railroad lines. This would reduce future exterior noise exposures at the townhomes by about 5 to 10 dBA to bring the noise exposures in the “conditionally acceptable” range between 55 dBA CNEL and 70 dBA CNEL.

Future Interior Noise Environment

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 CNEL, 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 CNEL, 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.

The northern facades of the proposed townhome buildings closest to the railroad tracks would be exposed to a future noise exposure of about 71 dBA CNEL. Assuming windows are partially open, future interior noise levels in these units would be up to 56 dBA CNEL.

The second row of townhome buildings located about 240 feet from the nearest railroad track and about 400 feet from El Camino Real, would benefit from shielding effects of the first row of townhome buildings and from the existing commercial building on 455 El Camino Real. These townhome facades would be exposed to a future noise exposure of around 55 to 60 dBA CNEL. Assuming windows are partially open, future interior noise levels in these units would be up to 45 dBA CNEL.

Residential units located along the southern façade of the five-story apartment complex would be directly exposed to traffic along El Camino Real with a future noise exposure of about 73 dBA CNEL. Units along the eastern and western facades of the apartment complex, although not directly facing El Camino Real would be exposed to a future noise exposure of about 70 dBA CNEL. Assuming windows are partially open, future interior noise levels in units along southern facades would be up to 58 dBA CNEL, and for units along the eastern and western facades would be up to 55 dBA CNEL.

To meet the interior noise requirements set forth by the City (45 dBA CNEL), implementation of noise insulation features would be required for the townhomes nearest to the railroad tracks as well as units directly facing El Camino Real.

Recommended 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 CNEL 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 residential units located along the northern property line of the site closest to the railroad tracks would require windows and doors with a minimum rating of STC 35 with adequate forced-air mechanical ventilation to meet the interior noise threshold of 45 dBA CNEL.
- Preliminary calculations indicate residential units located along the southern property line of the site closest to El Camino Real in the five-story apartment complex would require windows and doors with a minimum rating of STC 36 with adequate forced-air mechanical ventilation to meet the interior noise threshold of 45 dBA CNEL. Units along the eastern and western facades would require windows and doors with a minimum rating of STC 35 with adequate forced-air mechanical ventilation to meet the interior noise threshold of 45 dBA CNEL.

- All remaining units would benefit from shielding provided by project buildings and other units. This implies that these units require windows and doors with standard construction materials and adequate forced-air mechanical ventilation to meet the 45 dBA CNEL interior threshold.

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

Conditions of Approval

- **Exterior Noise Standard:** The project requires the installation of a 10-foot wall along the northern project boundary adjacent to the railroad tracks to satisfy the City’s “conditionally acceptable” exterior noise threshold.
- **Interior Noise Standard:** 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 CNEL or lower within the residential units. 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

Policy 5.8.7-P7 of the City of Santa Clara General Plan requires consistency with the Federal Transportation Authority vibration standards for land uses in proximity to railroads, light rail and the future high-speed rail. 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 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

According to the Caltrain website⁷, there are about 100 Caltrain train pass-bys in a 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 residential buildings. For other trains such as Amtrak (6 trains per day) and Altamont Corridor Express that have less than 30 train pass-bys in a 24-hour period, the ‘infrequent events’ category of the FTA vibration impact criteria applies with a maximum vibration level of 80 VdB for residential buildings.

⁷ <https://www.caltrain.com/media/34716>

Caltrain pass-bys resulted in measured vibration levels of 63 to 77 VdB at a setback ranging from 100 to 130 feet from the railway tracks. Amtrak pass-bys resulted in measured vibration levels of about 57 to 59 VdB at 150 feet from the railroad tracks.

At the proposed townhome setback, Amtrak and Altamont Corridor Express trains would not exceed the 80 VdB threshold. For Caltrain trains, the measured vibration levels for the northbound trains exceed the FTA vibration impact threshold of 72 VdB.

Based on previously collected train vibration measurements near the project site⁸ and considering the existing setbacks of nearby residential developments, the proposed townhomes closest to the railroad tracks should be set back approximately 110 feet from the nearest operational Caltrain track or about 10 feet more than the currently proposed setback to comply with the FTA's vibration impact threshold of 72 VdB.

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) 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.

Impact 1a: Temporary Construction Noise. Construction of the proposed project would expose existing residential land uses located within 300 of the project site to a temporary increase in noise levels. With the incorporation of construction best management practices this would be a **less-than-significant** impact.

The project would be constructed in three phases. Phase 1 would include demolition of all structures on-site, site preparation, grading, and trenching over the course of approximately two months. The townhouse development would be constructed in Phase 2, which would have a duration of approximately 15 months. The multi-family residential development would be

⁸ From the Illingworth and Rodkin Noise and Vibration Measurement Database

constructed in Phase 3, which would have a duration of approximately 32 months. The total construction duration would be 49 months. The earliest year of full operation for the total project was assumed to be 2030.

Construction phases would include demolition, site preparation, grading/excavation, trenching/foundation, building exterior, architectural coating, and paving. The construction phases would be divided into site preparation, townhome construction and multi-story apartment construction as well. 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.

Since the City of Santa Clara does not establish noise level thresholds for construction activities, the Federal Transit Administration (FTA) thresholds are used in this analysis to establish acceptable noise levels for temporary construction work. The FTA identifies construction noise limits in the *Transit Noise and Vibration Impact Assessment Manual*.⁹ During daytime hours, an exterior threshold of 80 dBA L_{eq} shall be enforced at residential land uses and 85 dBA L_{eq} shall be enforced at commercial 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 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 results in lower construction noise levels at distant receptors.

⁹ Federal Transit Administration, *Transit Noise and Vibration Impact Assessment Manual*, FTA Report No. 0123, September 2018.

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
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
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 the site preparation phase is summarized in Table 10. Table 11 shows the equipment used for the townhome construction. Equipment used for the multi-story apartment construction is shown in Table 12. Tables 10,11, and 12 also show 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.

TABLE 10 Construction Noise Levels for Phase 1 (Site Preparation) at a Distance of 50 feet

Phase of Construction	Total Number of Workdays	Construction Equipment (Quantity)	Construction Noise Level at 50 feet, dBA L _{eq}
Demolition	20	Concrete/Industrial Saws (1) ^a Rubber-Tired Dozer (1) Tractor/Loader/Backhoe (3) ^a	85
Site Preparation	10	Graders (1) ^a Rubber-Tired Dozer (1) Tractor/Loader/Backhoe (1) ^a	84
Grading/Excavation	30	Grader (1) ^a Rubber-Tired Dozer (1) Tractor/Loader/Backhoe (2) ^a	84
Trenching/ Foundation	30	Tractor/Loader/Backhoe (1) ^a Excavator (1) ^a	82

^a Denotes two loudest pieces of construction equipment per phase.

TABLE 11 Construction Noise Levels for Phase 2 (Townhomes) at a Distance of 50 feet

Phase of Construction	Total Number of Workdays	Construction Equipment (Quantity)	Construction Noise Level at 50 feet, dBA Leq
Building – Exterior	200	Crane (1) Forklift (1) Generator Sets (1) ^a Tractor/Loader/Backhoe (1) ^a Welders (3)	82
Building – Interior/ Architectural Coating	10	Air Compressor (1) ^a	74
Paving	10	Cement and Mortar Mixers (1) Pavers (1) Paving Equipment (1) ^a Rollers (1) Tractor/Loader/Backhoe (1) ^a	85

^a Denotes two loudest pieces of construction equipment per phase.

TABLE 12 Construction Noise Levels for Phase 3 (Apartments) at a Distance of 50 feet

Phase of Construction	Total Number of Workdays	Construction Equipment (Quantity)	Construction Noise Level at 50 feet, dBA Leq
Building – Exterior	300	Crane (1) Forklift (3) Generator Sets (1) ^a Tractor/Loader/Backhoe (3) ^a Welders (1)	82
Building – Interior/ Architectural Coating	20	Air Compressor (1) ^a	74
Paving/Flatwork	20	Paver (2) ^a Paving Equipment (2) ^a Roller (2)	83

^a Denotes two loudest pieces of construction equipment per 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.

To assess construction noise impacts at the receiving property lines of existing noise-sensitive receptors, the worst-case hourly average noise level, which is calculated by combining all pieces of equipment per phase, was propagated from the geometrical center of the project site for each

phase of construction (Site Preparation, Townhomes and Apartment construction) to the receiving property lines of the surrounding land uses.

These noise level estimates are shown in Tables 13, 14 and 15, respectively for the Site Preparation, Townhomes and Apartment construction phases. Noise levels in Table 13, 14 and 15 do not assume reductions due to intervening buildings or existing barriers.

TABLE 13 Construction Noise Levels for Phase 1 (Site Preparation) at the Receiving Property Lines in the Project Vicinity

Phase of Construction	Calculated Hourly Average Noise Levels, L_{eq} (dBA)			
	Sonesta Hotel (200 ft)	West Retail (560 ft)	455 El Camino Real (75 ft)	East Residences (780 ft)
Demolition	75	66	84	64
Site Preparation	73	64	81	61
Grading/Excavation	74	65	82	62
Trenching/Foundation	70	61	78	58

TABLE 14 Construction Noise Levels for Phase 2 (Townhomes) at the Receiving Property Lines in the Project Vicinity

Phase of Construction	Calculated Hourly Average Noise Levels, L_{eq} (dBA)			
	Sonesta Hotel (520 ft)	West Retail (850 ft)	455 El Camino Real (115 ft)	East Residences (520 ft)
Building – Exterior	63	59	76	63
Building – Interior/Architectural Coating	53	49	67	53
Paving/Flatwork	65	61	78	65

TABLE 15 Construction Noise Levels for Phase 3 (Apartments) at the Receiving Property Lines in the Project Vicinity

Phase of Construction	Calculated Hourly Average Noise Levels, L_{eq} (dBA)			
	Sonesta Hotel (160 ft)	West Retail (280 ft)	455 El Camino Real (260 ft)	East Residences (950 ft)
Building – Exterior	76	71	72	61
Building – Interior/ Architectural Coating	64	59	59	48
Paving/Flatwork	76	71	72	61

As shown in Tables 10-12, construction noise levels would intermittently range from 74 to 85 dBA L_{eq} when activities occur 50 feet from nearby receptors. When focused near the center of the project site for each phase, construction noise levels would typically range from 58 to 84 dBA L_{eq} for Phase 1 (Site Preparation), from 49 to 78 dBA L_{eq} for Phase 2 (Townhomes) and from 48 to 76 dBA L_{eq} for Phase 3 (Apartments) at the surrounding receptors (see Tables 13-15).

The construction noise levels for Phase 1 (Site Preparation) at the 455 El Camino Real mixed-use building exceeds the 80 dBA L_{eq} FTA criteria. All other phases and neighboring land uses would be exposed to temporary construction noise levels below the FTA thresholds. Additionally, the project site is located within 300 feet of existing residential uses. Reasonable regulation of the hours of construction, as well as regulation of the arrival and operation of heavy equipment and the delivery of construction material, are necessary to protect the health and safety of persons, promote the general welfare of the community, and maintain the quality of life. The construction crew shall adhere to the following construction best management practices to reduce construction noise levels emanating from the site and minimize disruption and annoyance at existing noise-sensitive receptors in the project vicinity. The incorporation of construction best management practices would reduce temporary construction noise levels as much as possible.

Construction Best Management Practices

- Ensure that excavating, grading and filling activities, and other construction activities (including the loading and unloading of materials and truck movements) within 300 feet of residentially zoned property, are limited to the hours of 7:00 a.m. to 6:00 p.m. on weekdays and between the hours of 9:00 a.m. and 6:00 p.m. on Saturdays. No construction is permitted on Sundays or holidays.
- Construct solid plywood fences around ground-level construction sites adjacent to operational businesses, residences, or other noise-sensitive land uses such as 455 El Camino Real.
- Equip all internal combustion engine-driven equipment with intake and exhaust mufflers that are in good condition and appropriate for the equipment.
- Unnecessary idling of internal combustion engines should be strictly prohibited.

- Locate stationary noise-generating equipment, such as air compressors or portable power generators, as far as possible from sensitive receptors as feasible. If they must be located near receptors, adequate muffling (with enclosures where feasible and appropriate) shall be used to reduce noise levels at the adjacent sensitive receptors. Any enclosure openings or venting shall face away from sensitive receptors.
- Construction staging areas shall be established at locations that will create the greatest distance between the construction-related noise sources and nearest noise-sensitive receptors during all project construction.
- Locate material stockpiles, as well as maintenance/equipment staging and parking areas, as far as feasible from residential receptors.
- Control noise from construction workers' radios to a point where they are not audible at existing residences bordering the project site.
- Designate a "disturbance coordinator" who would be responsible for responding to any complaints about construction noise. The disturbance coordinator will determine the cause of the noise complaint (e.g., bad muffler, etc.) and will require that reasonable measures be implemented to correct the problem. Conspicuously post a telephone number for the disturbance coordinator at the construction site and include in it the notice sent to neighbors regarding the construction schedule.

Reasonable regulation of the hours of construction, as specified in Santa Clara's General Plan and Municipal Code, as well as regulation of the arrival and operation of heavy equipment and the delivery of construction material, are necessary to protect the health and safety of persons, promote the general welfare of the community, and maintain the quality of life. Implementation of the above standard construction controls would reduce construction noise levels emanating from the site by up to 5 dBA, minimizing disruption and annoyance. These controls, in combination with the limitations on hours set forth in the General Plan and City's Municipal Code, would reduce the impact to a **less-than-significant** level

Mitigation Measure 1a: No further mitigation measures required.

Impact 1b: Permanent Noise Level Increase/Exceed Applicable Standards. The proposed project would not result in a substantial permanent noise increase at receptors in the project vicinity. Operational noise levels generated by the proposed project would not exceed General Plan thresholds. This is a **less-than-significant** impact.

A significant impact would occur if the permanent noise level increase due to project-generated traffic was 3 dBA CNEL or greater for future ambient noise levels exceeding 60 dBA CNEL or was 5 dBA CNEL or greater for future ambient noise levels at or below 60 dBA CNEL. Existing ambient measurements made in the project site vicinity indicate that existing and future ambient noise levels at the noise-sensitive receptors in the project site vicinity would result in noise levels over 60 dBA CNEL. Therefore, a significant impact would occur if project-generated permanent noise sources increased levels by 3 dBA CNEL or more.

Under the City's Municipal Code, noise generated by fixed sources of noise would be restricted to 55 dBA during daytime hours (7:00 a.m. to 10:00 p.m.) and to 50 dBA during nighttime hours (10:00 p.m. to 7:00 a.m.) at residentially zoned land uses. At receiving commercial and office buildings, noise would be restricted to 65 dBA during daytime hours and 60 dBA at night. At existing industrial land uses, noise would be restricted to 70 dBA anytime.

Project Traffic Increase

The traffic study¹⁰ completed for this project included trip generation data that indicated that the proposed residential development is expected to generate a minor increase (308 trips) in net new daily trips but would not generate any net new AM and PM peak hour trips compared to existing conditions. This indicates that there would be no permanent noise increase at the noise receptors in the vicinity from project traffic.

Mechanical Equipment

Residential buildings located near noisy roadways, such as El Camino Real with UPRR tracks in close proximity, typically include heating, ventilation, and air conditioning (HVAC) units. For the multifamily five-story building, the site plan indicates rooftop screened mechanical equipment. No rooftop equipment is proposed for the townhomes.

Noise levels for residential HVAC units typically range from 53 to 63 dBA at 3 feet during operation. These types of units typically cycle on and off continuously during daytime and nighttime hours. Assuming up to twenty units would operate simultaneously at any given time at the rooftop of the multifamily project building, the estimated combined noise level at 3 feet would be up to 76 dBA. The closest receptors to the project building include an existing commercial, hotel and retail use. These are located about 55 to 65 feet away from the five-story project building.

Assuming a minimum setback of 20 feet from the edge of the roof, the minimum attenuation for the elevated rooftop equipment would be 20 dBA for the ground-level receptors (commercial, retail and hotel). Hourly noise levels at these receptors would be up to 35 dBA L_{eq} at 55 feet, assuming shielding from the rooftop edge. This would result in a CNEL of up to 41 dBA CNEL from mechanical equipment alone. Considering the existing noise environment of 69 to 71 dBA CNEL at the site, noise increases from rooftop mechanical equipment would not be measurable or detectable at the closest receptors (0 dBA CNEL increase). This would not exceed the 3 dBA CNEL threshold set by the City's General Plan.

For the individual townhomes, condensers for cooling could be located at ground level in areas just outside each building. Assuming about 5 units operating simultaneously near the closest noise sensitive residential receptor (1270 Campbell Avenue), noise levels could reach up to 46 dBA L_{eq} at 45 feet. This would result in a CNEL of up to 52 dBA CNEL from mechanical equipment. Considering the existing noise environment of 69 to 71 dBA CNEL at the site, noise increases

¹⁰ "Transportation Analysis for the Proposed University Station Residential Development in Santa Clara, California" by Hexagon Transportation Consultants, Inc. dated April 4, 2025

from townhome mechanical equipment would not be measurable or detectable at the closest receptors (0 dBA CNEL increase). This would not exceed the 3 dBA CNEL threshold set by the City's General Plan.

Total Combined Project-Generated Noise

The operational noise levels produced by the proposed project combined (i.e., traffic, mechanical equipment) would not result in an increase of 3 dBA CNEL or more at the 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.

Operational noise levels due to mechanical equipment at the nearest receptors would also be lower than City's municipal code daytime and nighttime limits. This is a less-than-significant impact.

Mitigation Measure 1b: None required.

Impact 2: Exposure to Excessive Groundborne Vibration. Construction-related vibration levels would not 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.

The California Department of Transportation (Caltrans) recommends a vibration limit of 0.5 in/sec PPV for new residential and modern commercial/industrial structures, which typically consist of buildings constructed since the 1990s. A vibration limit of 0.3 in/sec PPV is used for older residential structures, which would apply to most structures built since the 1940s. For historical buildings or some older buildings, a vibration limit of 0.25 in/sec PPV would apply. These vibration limits are conservative and designed to provide protection for existing buildings in California. 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.

Each of the buildings surrounding the site are considered structures built to modern construction standards, and the 0.5 in/sec PPV threshold would apply to vibration generated by project construction. Conservatively, the 0.3 in/sec PPV threshold would be applied to the nearest residences and commercial buildings surrounding the site since construction dates for these buildings is not known.

According to the San Jose Historic Resource Inventory,¹¹ and the Santa Clara Historic Resource Inventory¹² all historical buildings are located more than 200 feet from the project site and not considered a sensitive receptor during construction activities at the site.

Table 16 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 16 also summarizes the distances to the 0.2 in/sec PPV thresholds for all historical and nonhistorical buildings, respectively.

Vibration levels are highest close to the source and then attenuate with increasing distance at the rate $\left(\frac{D_{ref}}{D}\right)^{1.1}$, where D is the distance from the source in feet and D_{ref} is the reference distance of 25 feet. 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 the potential for damage to buildings on receiving land uses, not at receptors at the nearest property lines.

TABLE 16 Vibration Source Levels for Construction Equipment

Equipment	PPV at 25 ft. (in/sec)	Minimum Distance to Meet 0.2 in/sec PPV (feet)
Clam shovel drop	0.202	26
Hydromill (slurry wall)	in soil	2
	in rock	3
Vibratory Roller	0.210	27
Hoe Ram	0.089	13
Large bulldozer	0.089	13
Caisson drilling	0.089	13
Loaded trucks	0.076	11
Jackhammer	0.035	6
Small bulldozer	0.003	<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., May 2025.

¹¹ <https://www.sanjoseca.gov/your-government/departments-offices/planning-building-code-enforcement/planning-division/historic-resources/historic-resources-inventory>

¹² <https://www.santaclaraca.gov/home/showpublisheddocument/12893/635713044859030000>

All nearby buildings are located at a minimum distance of 70 feet or more from the nearest project site boundary. At this distance, vibration levels would be below 0.07 in/sec PPV. These buildings would not be exposed to construction vibration levels exceeding the 0.3 in/sec PPV threshold.

Mitigation Measure 2: None required.

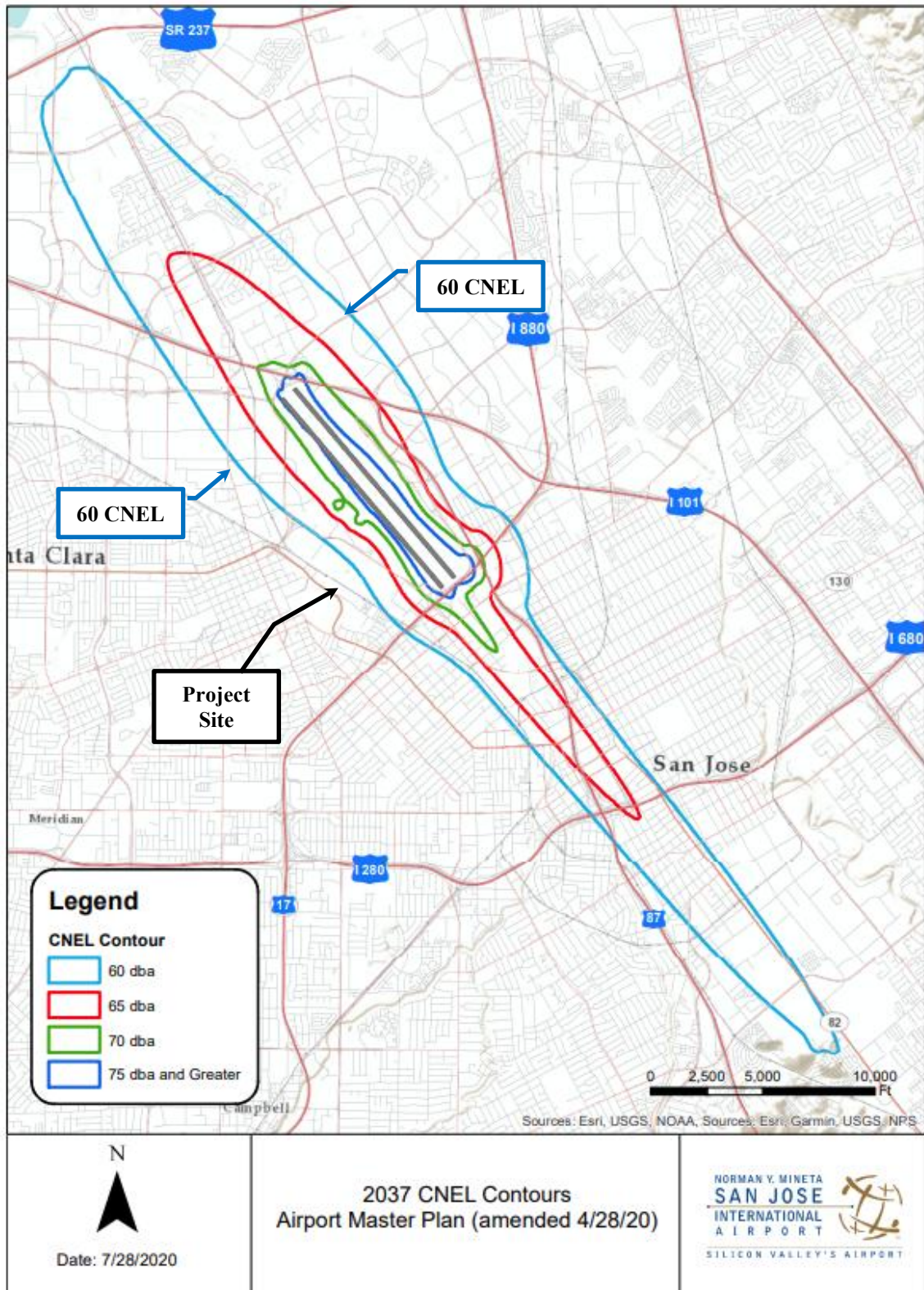
Impact 3: Excessive Aircraft Noise. The project site is located outside the 60 dBA CNEL noise contour of the San José Mineta International Airport, and the noise environment attributable to aircraft is considered normally acceptable under the Santa Clara County ALUC noise compatibility policies for residential land uses. This is a **less-than-significant** impact.

San José Mineta International Airport is a public-use airport located about 0.5 miles north of the project site. According to the City's Airport Master Plan Environmental Impact Report,¹³ the project site lies outside the 60 dBA CNEL contour line (see Figure 2). According to Policy EC-1.11 of the City's General Plan, the required safe and compatible threshold for exterior noise levels due to aircraft would be at or below 60 dBA CNEL. Assuming standard construction materials for aircraft noise below 60 dBA CNEL, the future interior noise levels resulting from aircraft would be below 45 dBA CNEL. Therefore, future exterior and interior noise levels due to aircraft would be compatible with the proposed residential project. This would be a less-than-significant impact.

Mitigation Measure 3: None required.

¹³ David J. Powers & Associates, Inc., Integrated Final Environmental Impact Report, Amendment to Norman Y. Mineta San Jose International Airport Master Plan, April 2020.

FIGURE 2 2037 CNEL Noise Contours Relative to Project Site



Source: 2037 CNEL Contours – Airport Master Plan.¹⁴

¹⁴ https://www.flysanjose.com/sites/default/files/noise/2037_CNEL.pdf

Cumulative Impacts

Cumulative noise impacts could result from cumulative traffic noise increases expected under future conditions or temporary construction noise from cumulative construction projects. A significant cumulative traffic noise increase would occur if two criteria are met: 1) if the cumulative traffic noise level increase was 3 dBA DNL or greater for future levels exceeding 60 dBA DNL or was 5 dBA DNL or greater for future levels at or below 60 dBA DNL; and 2) if the project would make a “cumulatively considerable” contribution to the overall traffic noise increase. A “cumulatively considerable” contribution would be defined as an increase of 1 dBA DNL or more attributable solely to the proposed project.

The traffic study completed for the proposed project did not include future cumulative traffic volumes. With a minor increase (308 trips) in net new project trips for the proposed project as per the traffic study (no net new AM or PM peak hour trips), the project’s contribution would not be measurable or detectable (i.e., 0 dBA CNEL noise level increase). It is assumed that these peak hour trips would be insignificant under future cumulative conditions, as well. Therefore, the project is not expected to result in a significant cumulative traffic noise increase. This is a less-than-significant impact.

From the City of Santa Clara’s website¹⁵, the nearest planned/approved project would be the Gateway (Hunter/Storm) located at 1205 Coleman Avenue. This project would construct a phased, mixed-use development consisting of 1,565 residential units, a 152,000 square foot, 225 room, full-service hotel, 45,000 square feet of supporting retail, a 2.1-acre park, structured parking facilities, private and public streets, and on and off-site public and private improvements. Since this project is already under construction, it’s construction schedule is unlikely to overlap with the project’s construction schedule.

From the City of San Jose’s website¹⁶, the nearest planned/approved project would be the Coleman Highline Building 5 located at 1179-1185 Coleman Avenue. This project would construct a 292,455-square-foot, 5-story office, a 12,000 SF, 2-story amenity building, and a 3,414-square-foot utility enclosure on 4.5-acre site located on the west corner of Coleman Ave and Aviation Ave. The Coleman Highline Building 5 project is currently in the “planning approved” project status. Since this project would be located about 850 feet north of the project site on the other side of the UPRR tracks, noise from construction of this project would not be expected to cumulatively add to the noise from the construction of the University Station project. This would not be cumulative construction impact.

15 <https://missioncity.maps.arcgis.com/apps/MapTour/index.html?appid=5afdbed13fad458cb6288c46a0bad060#>

16 <https://gis.sanjoseca.gov/maps/devprojects/>

APPENDIX A

FIGURE A1 Daily Trend in Noise Levels for LT-1, Tuesday, December 17, 2024

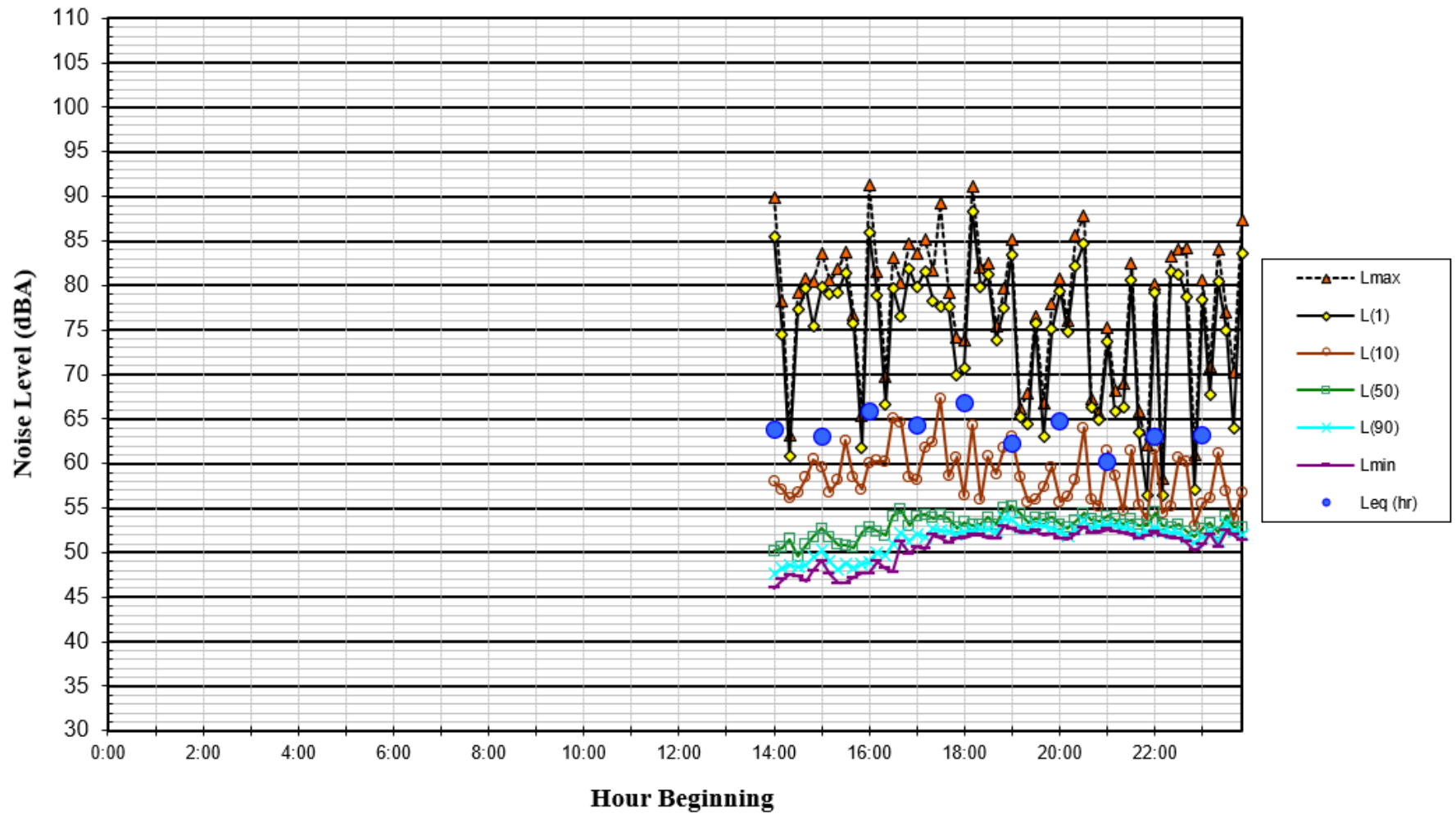


FIGURE A2 Daily Trend in Noise Levels for LT-1, Wednesday, December 18, 2024

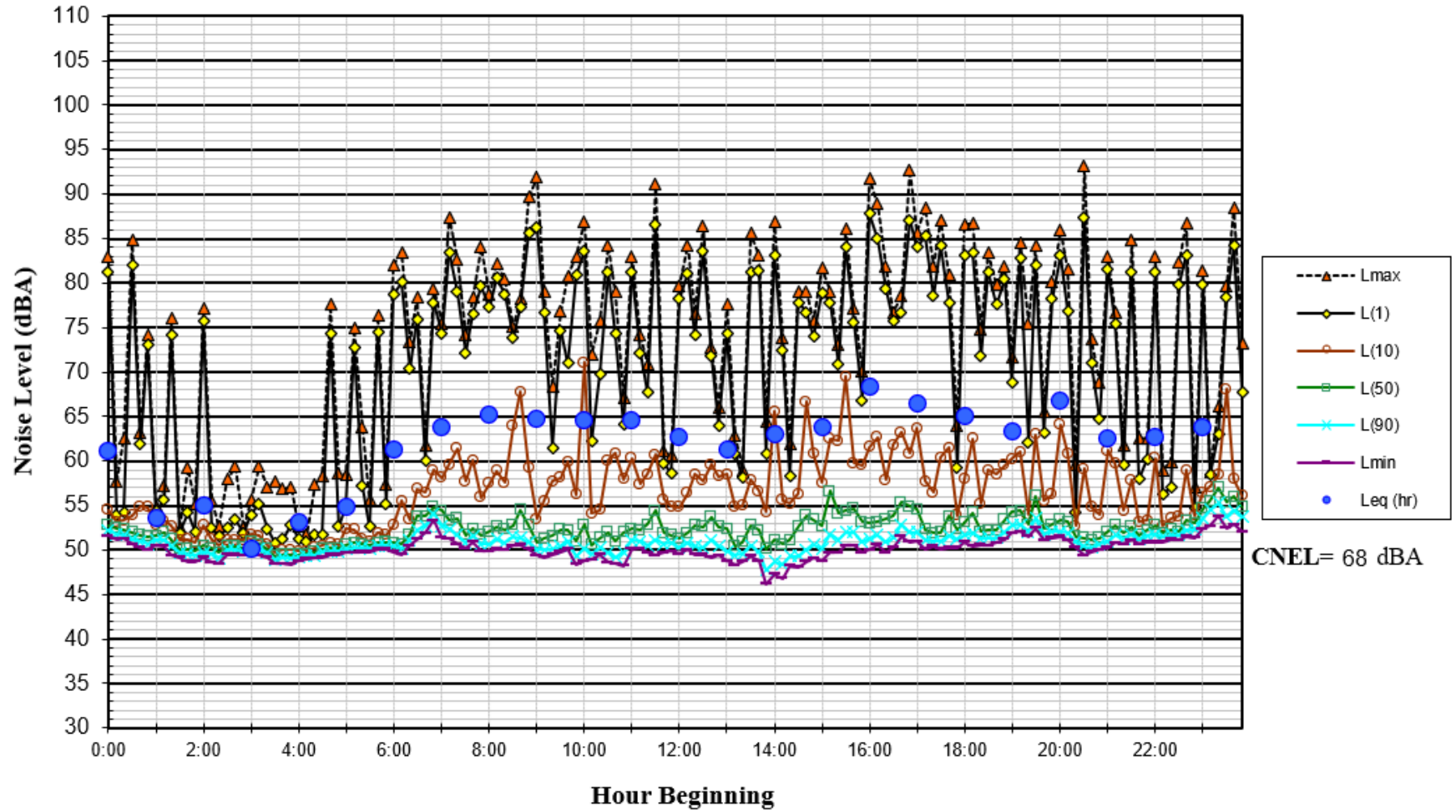


FIGURE A3 Daily Trend in Noise Levels for LT-1, Thursday, December 19, 2024

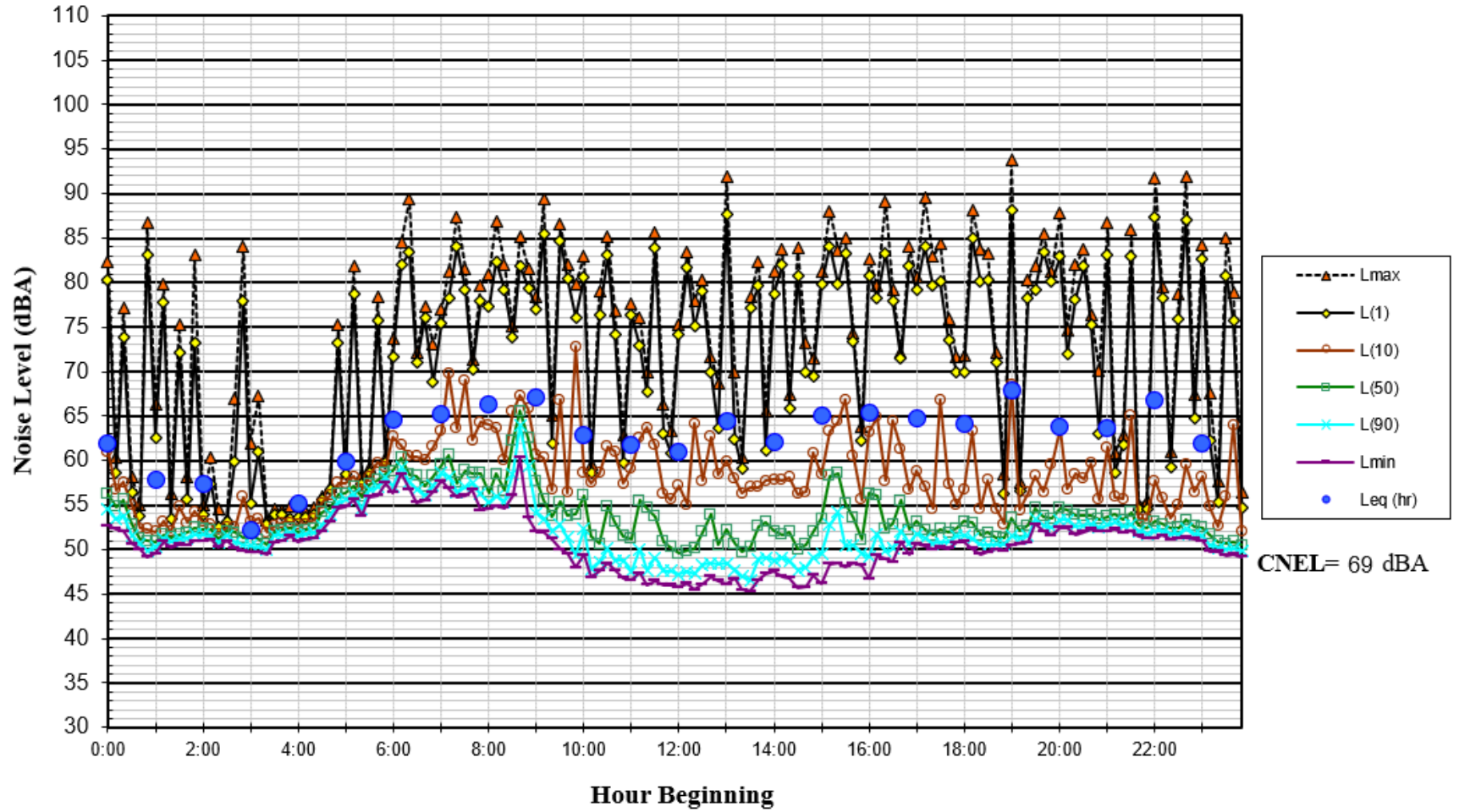


FIGURE A4 Daily Trend in Noise Levels for LT-1, Friday, December 20, 2024

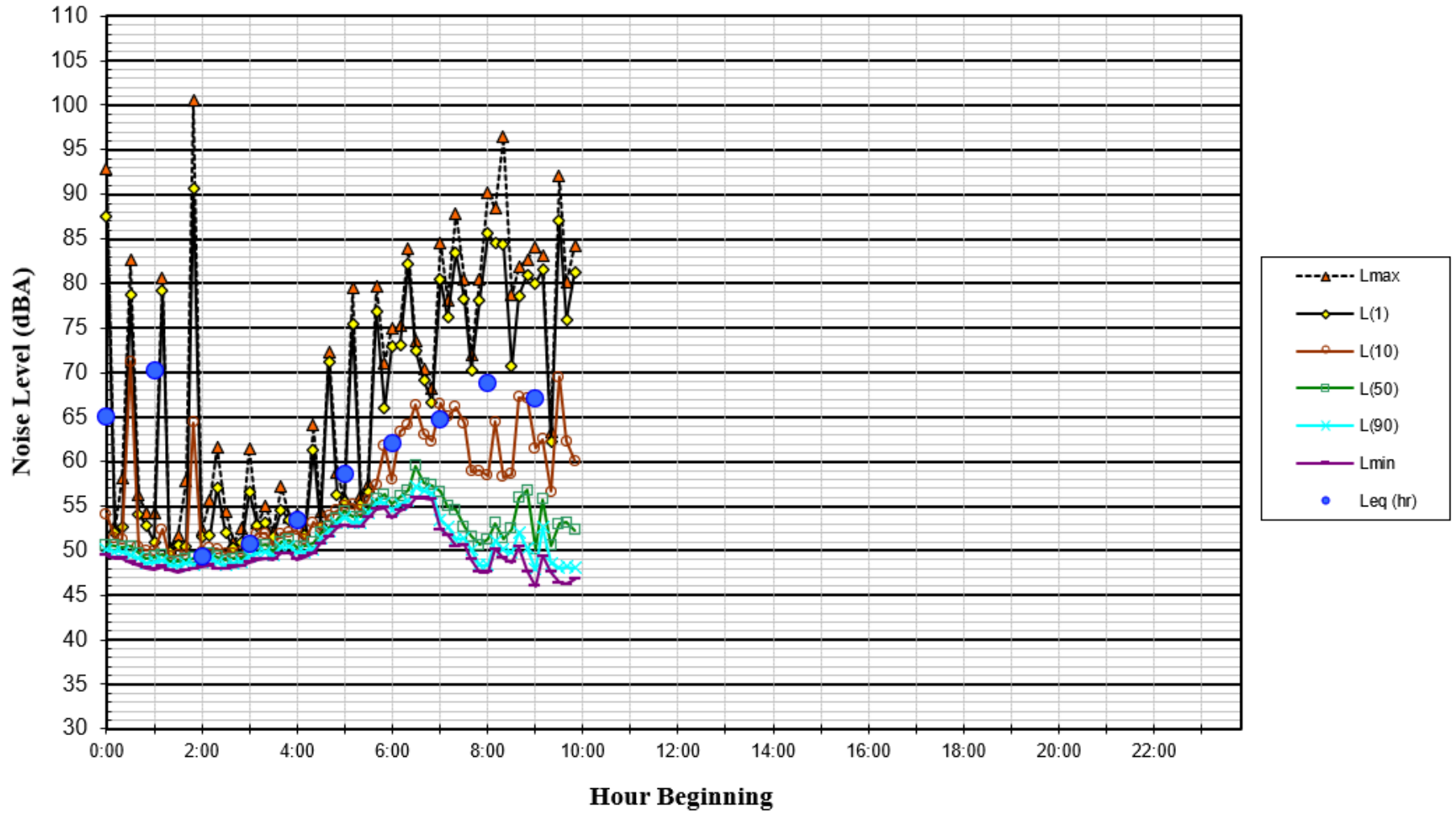


FIGURE A5 Daily Trend in Noise Levels for LT-2, Tuesday, December 17, 2024

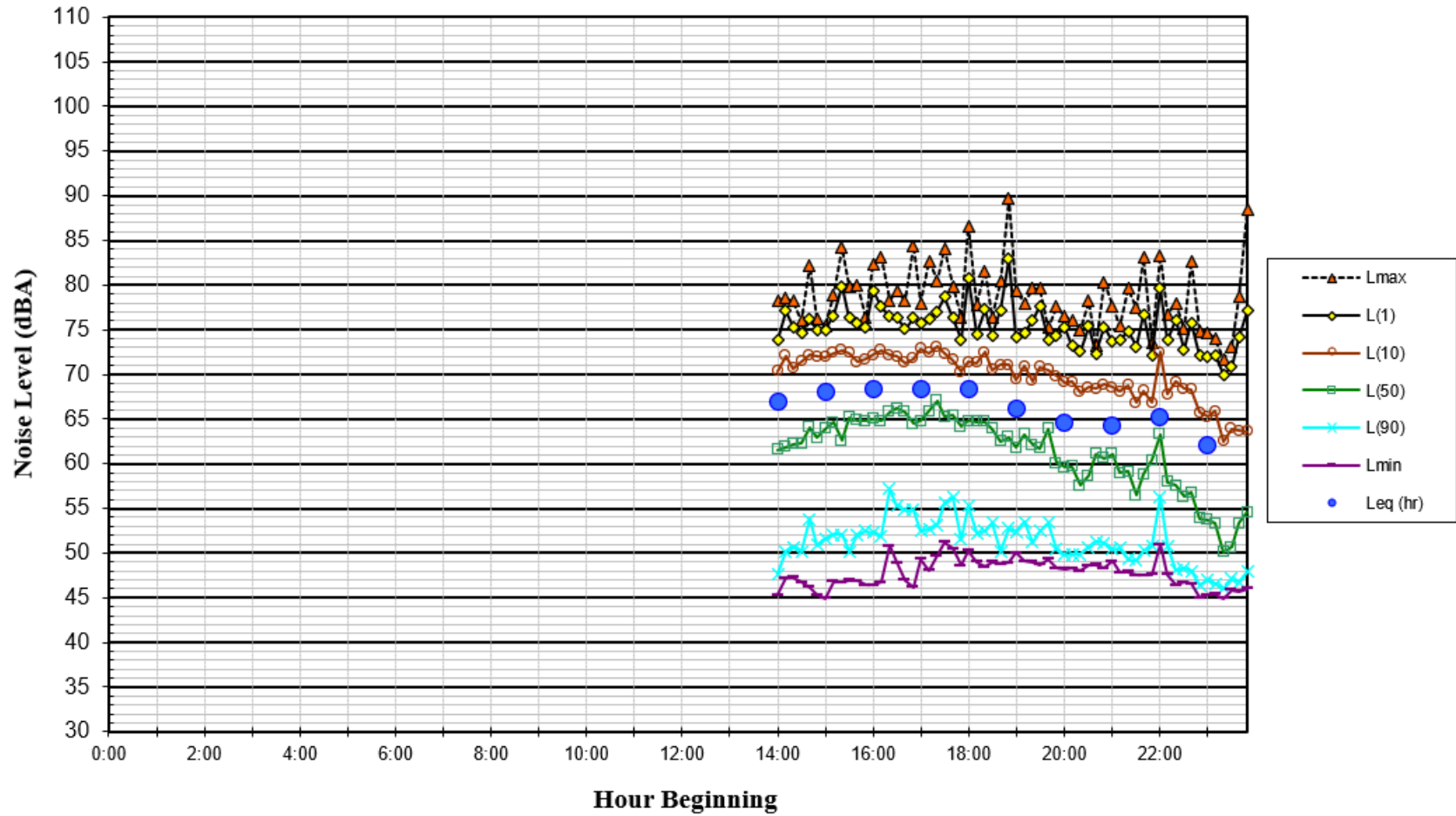


FIGURE A6 Daily Trend in Noise Levels for LT-2, Wednesday, December 18, 2024

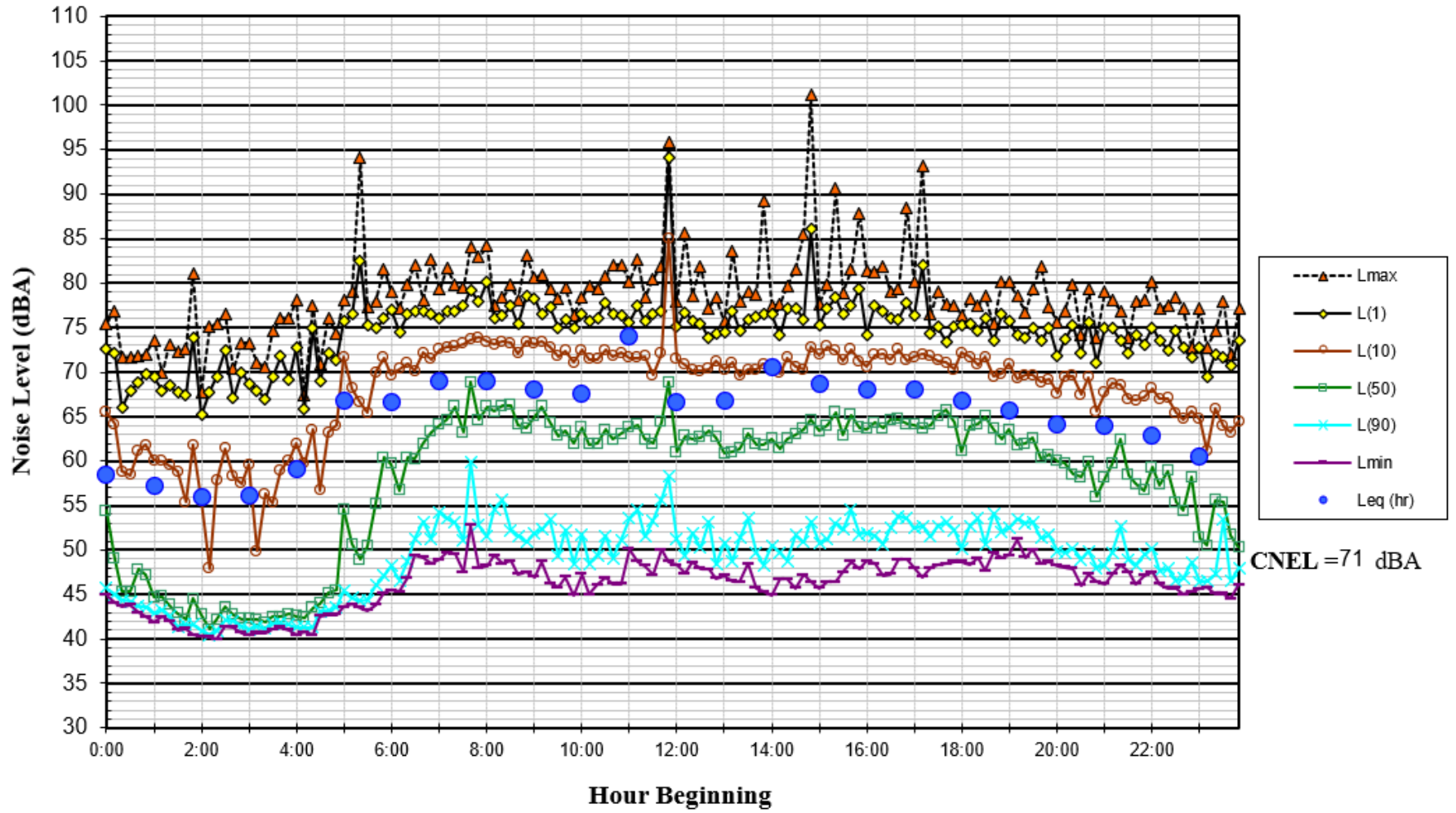


FIGURE A7 Daily Trend in Noise Levels for LT-2, Thursday, December 19, 2024

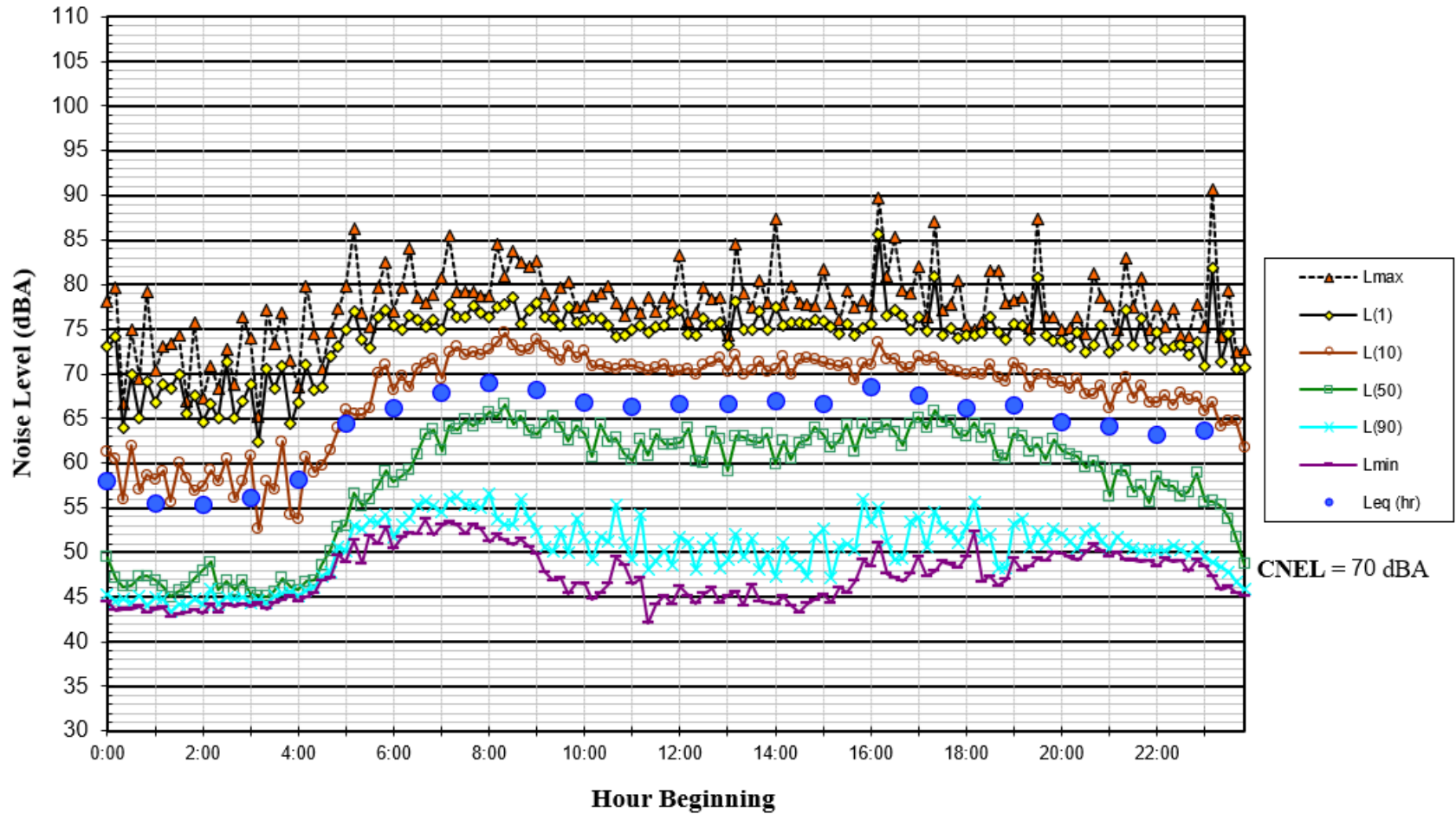


FIGURE A8 Daily Trend in Noise Levels for LT-2, Friday, December 20, 2024

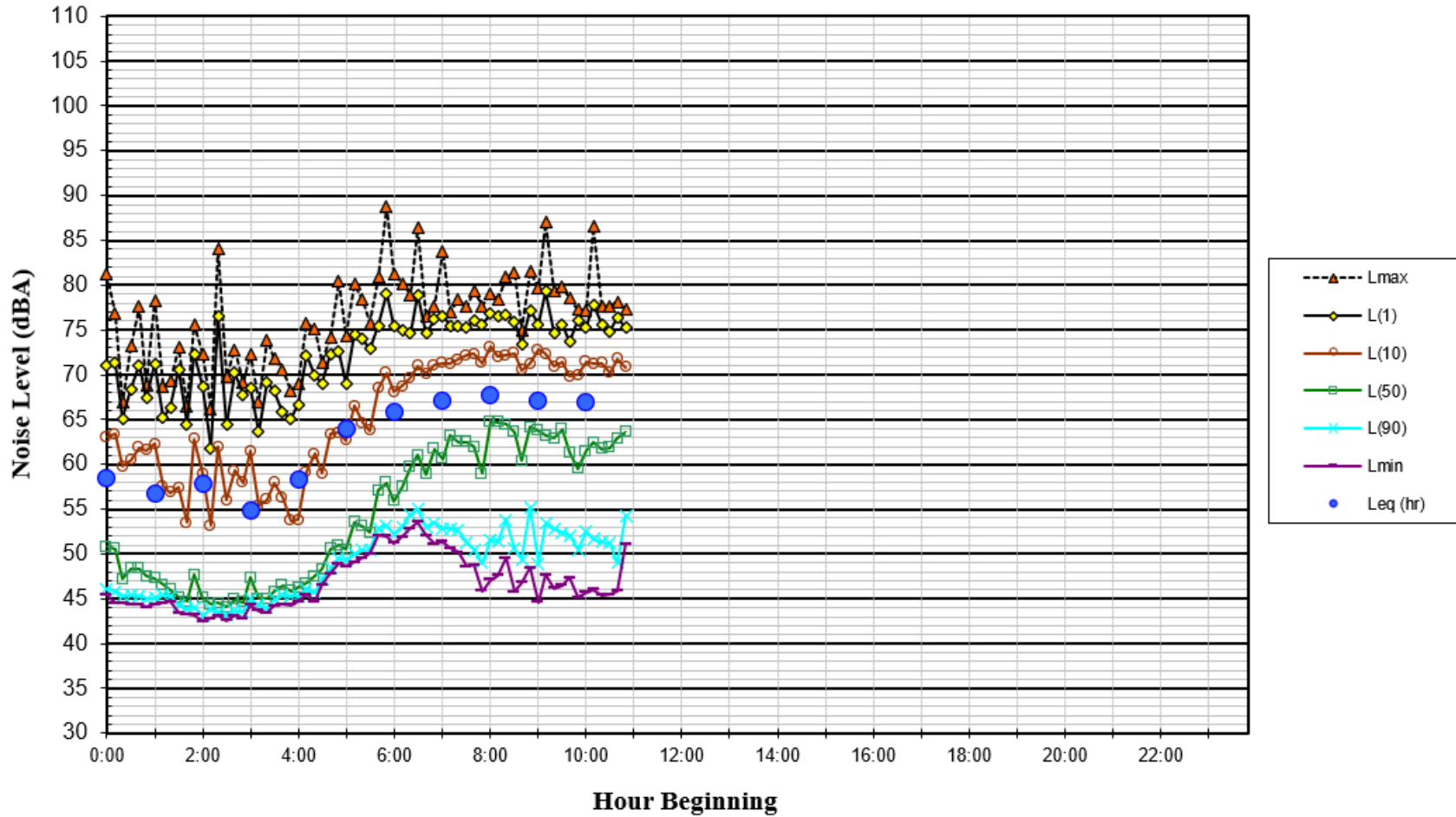


FIGURE A9 Vibration Levels at V-1, Tuesday, December 17, 2024

