VEGUARD HOUSING
3378-3386 EL CAMINO REAL
NOISE AND VIBRATION ASSESSMENT

Santa Clara, California

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Project: 22-132

INTRODUCTION

A three-story, for-sale townhome community is proposed at 3378-3386 El Camino Real in Santa Clara, California. The site is currently developed with a commercial building, which would be demolished as part of the proposed project. The proposed building would include a total of 24 townhome units, ranging in size from approximately 1,875 to 2,479 square feet of building area (including garages).

This report evaluates the project's potential to result in significant noise and vibration impacts with respect to applicable California Environmental Quality Act (CEQA) guidelines. The report is divided into three sections: 1) the Setting Section provides a brief description of the fundamentals of environmental noise and groundborne vibration, summarizes applicable regulatory background, and describes the existing ambient noise environment at the project site; 2) the Plan Consistency Analysis Section discusses noise and land use compatibility utilizing applicable regulatory background; and, 3) the Impacts and Mitigation Measures Section describes the significance criteria used to evaluate project impacts, provides a discussion of each project impact, and presents measures, where necessary, to mitigate the impacts of the project on sensitive receptors in the vicinity.

SETTING

Fundamentals of Environmental Noise

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

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

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

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

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

Effects of Noise

Sleep and Speech Interference

The thresholds for speech interference indoors are about 45 dBA if the noise is steady and above 55 dBA if the noise is fluctuating. Outdoors the thresholds are about 15 dBA higher. Steady noises of sufficient intensity (above 35 dBA) and fluctuating noise levels above about 45 dBA have been shown to affect sleep. Interior residential standards for multi-family dwellings are set by the State of California at 45 dBA L_{dn}. Typically, the highest steady traffic noise level during the daytime is about equal to the L_{dn} 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 L_{dn} with open windows and 65 to 70 dBA L_{dn} 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 L_{dn} 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 L_{dn}. At a L_{dn} of about 60 dBA, approximately 12 percent of the population is highly annoyed. When the L_{dn} 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 L_{dn} of 60 to 70 dBA. Between a L_{dn} 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 L_{dn} 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.

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.

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 p.m. and 7:00 a.m.
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 p.m.to 10:00 p.m. and after addition of 10 decibels to sound levels measured in the night between 10:00 p.m. and 7:00 a.m.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Intrusive	That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level.

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

TABLE 2 Typical Noise Levels in the Environment

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

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

TABLE 3 Reaction of People and Damage to Buildings from Continuous or Frequent Intermittent Vibration Levels

Velocity Level, PPV (in/sec)	Human Reaction	Effect on Buildings
0.01	Barely perceptible	No effect
0.04	Distinctly perceptible	Vibration unlikely to cause damage of any type to any structure
0.08	Distinctly perceptible to strongly perceptible	Recommended upper level of the vibration to which ruins and ancient monuments should be subjected
0.1	Strongly perceptible	Threshold at which there is a risk of damage to fragile buildings with no risk of damage to most buildings
0.25	Strongly perceptible to severe	Threshold at which there is a risk of damage to historic and some old buildings.
0.3	Strongly perceptible to severe	Threshold at which there is a risk of damage to older residential structures
0.5	Severe – Vibrations considered unpleasant	Threshold at which there is a risk of damage to new residential and modern commercial/industrial structures

Source: Transportation and Construction Vibration Guidance Manual, California Department of Transportation, April 2020.

Regulatory Background – Noise

The State of California and the City of Santa Clara have established noise criteria, and the California Department of Transportation (Caltrans) have established vibration criteria, that are applicable in this assessment. The State of California Environmental Quality Act (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

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.

State of California

State CEQA Guidelines. 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:

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

(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; or

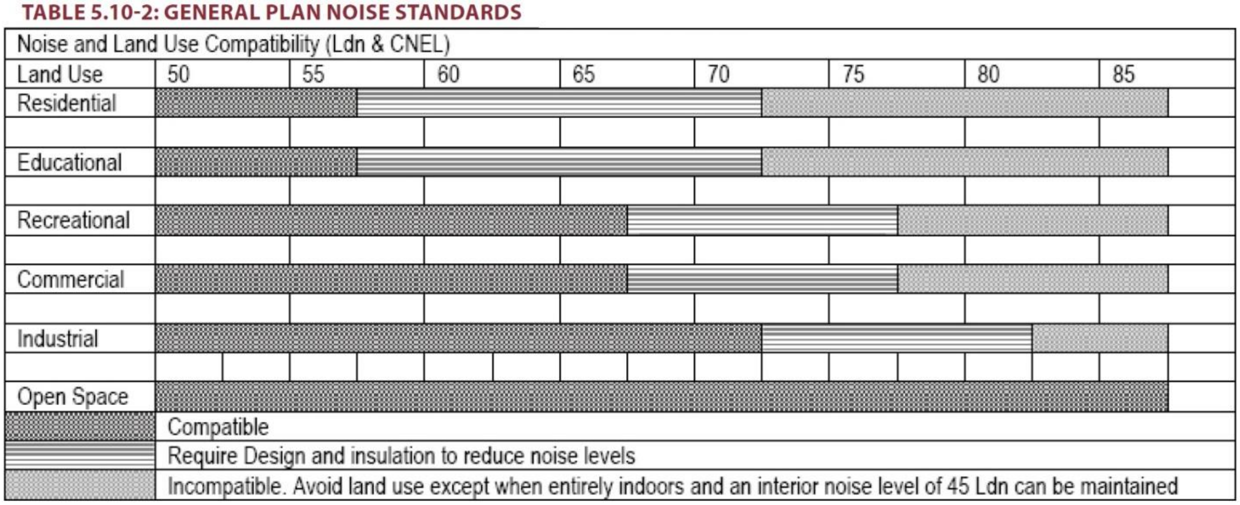
(c) For a project located within the vicinity of a private airstrip or an airport land use plan or where such a plan has not been adopted within two miles of a public airport or public use airport, if the project would expose people residing or working in the project area to excessive noise levels.

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 L_{dn}/CNEL in any habitable room.

<u>Local</u>

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 5.10-2 from the General Plan shows acceptable noise levels for various land uses. Commercial land uses are considered compatible in noise environments of 65 dBA L_{dn}/CNEL or less. The guidelines state that where the exterior noise levels are greater than 65 dBA L_{dn}/CNEL and less than 75 dBA L_{dn}/CNEL, the design of the project should include measures to reduce noise levels to acceptable levels. Noise levels exceeding 75 dBA L_{dn}/CNEL at commercial land uses are considered incompatible.

TABLE 5.10-2: GENERAL PLAN NOISE STANDARDS



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 5.10-1.

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 5.10-1.

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

California Department of Transportation. To avoid damage to buildings, Caltrans recommends that construction vibration levels are limited to 0.5 in/sec PPV for buildings structurally sound and designed to modern engineering standards, to 0.3 in/sec PPV for buildings that are found to be structurally sound but where structural damage is a major concern, to 0.25 in/sec PPV for historic and some old buildings, and to 0.08 in/sec PPV for ancient buildings or buildings that are documented to be structurally weakened (see Table 3).

Existing Noise Environment

The project site is located at 3378-3386 El Camino Real in the City of Santa Clara. The site is currently developed with an existing commercial building. The site is bound by El Camino Real to the north, a small commercial building to the west, a car dealership to the east, and a multi-family residential building to the south. To the north, opposite El Camino Real, are commercial uses. Additionally, a mixed-use residential building is currently under construction at 3402 El Camino Real. Due to the on-going construction activities, measurement sites were selected to minimize the impact of construction noise on the measurements.

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

A noise monitoring survey, which included one long-term and three short-term noise measurements, was performed at the site beginning on Tuesday October 4, 2022 and concluding on Thursday October 6, 2022. All measurement locations are shown in Figure 1. It should be noted that an active construction site is located about 80 feet west of the project's boundary. Efforts were made to position the sound level meters as far from the construction site as possible; however, some construction noise was measured during the noise monitoring survey.

Long-term noise measurement LT-1 was made approximately 65 feet from the centerline of El Camino Real in the northeastern corner of the site. Hourly average noise levels at LT-1 typically ranged from 64 to 70 dBA L_{eq} during the day and from 53 to 63 dBA L_{eq} at night. The average community noise equivalent level (CNEL) for the 24-hour period occurring on Wednesday October 5, 2022 was 69 dBA CNEL. The daily trends in noise levels at LT-1 are shown in Figures A1 through A3 in the Appendix of this report.

Each short-term noise measurement was made on Thursday October 6, 2022 in 10-minute intervals between 10:20 a.m. and 10:50 a.m. Table 4 summarizes the metrics measured at all three short-term measurements.

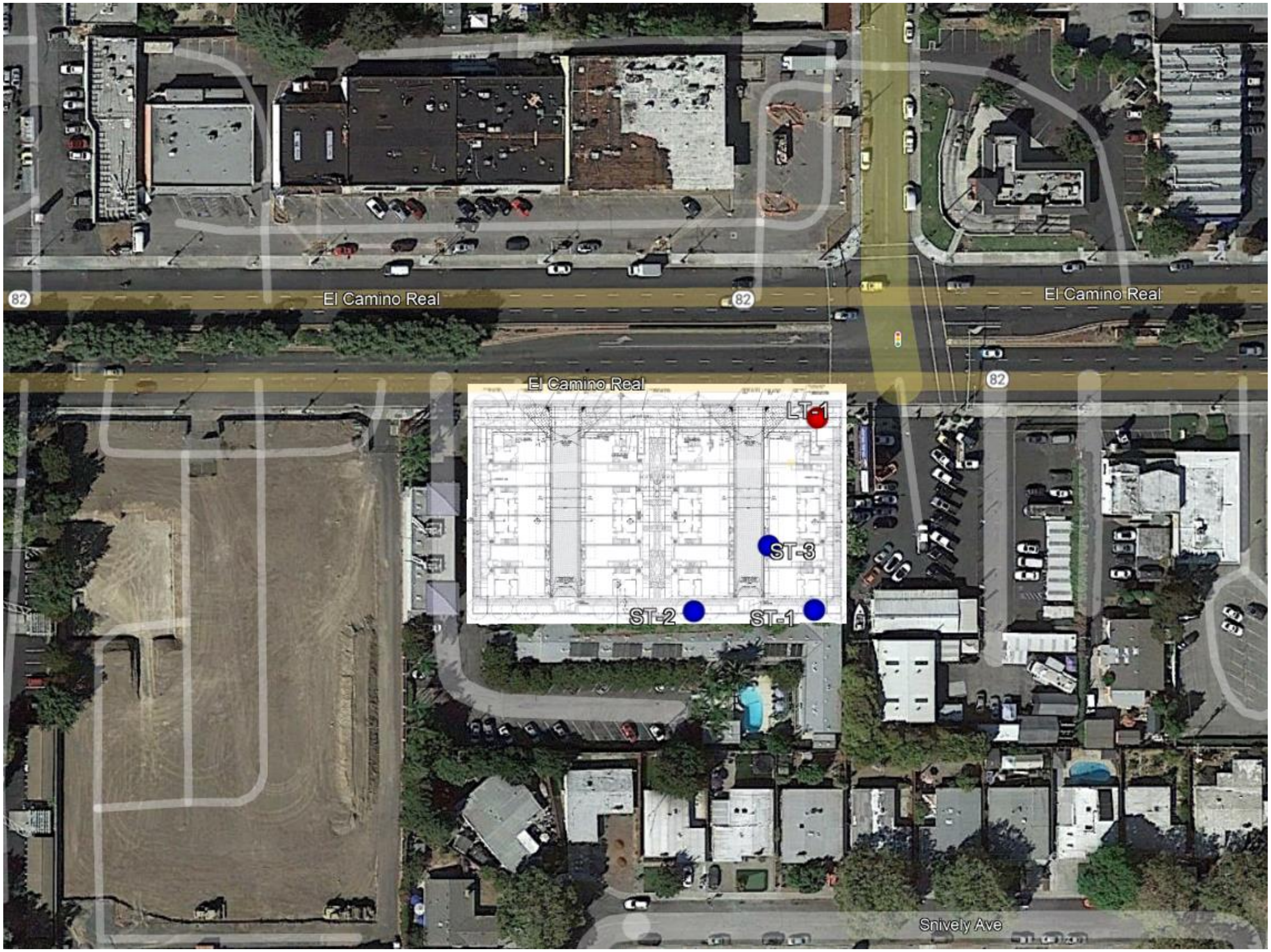
ST-1 was made in the southeastern corner of the project site, approximately 200 feet from the centerline of El Camino Real and ran concurrently with both ST-2 and ST-3. ST-2 was also measured at southern boundary of the project site (approximately 200 feet from the centerline of El Camino Real); however, ST-2 was positioned behind the existing commercial building located on the project site. While ST-1 would represent unattenuated noise levels at the rear of the site, ST-2 would represent attenuated noise levels at the same distance. During the measurement of ST-1, traffic along El Camino Real generated noise levels ranging from 51 to 63 dBA. Construction noise at the nearby site was audible and generated noise levels at ST-1 ranging from 42 to 49 dBA. The unattenuated 10-minute average noise level at ST-1 was 53 dBA L_{eq}, and the attenuated 10-minute average noise level at ST-2 was 52 dBA L_{eq}.

ST-3 was made approximately 155 feet from the centerline of El Camino Real and was also unattenuated. Traffic noise during this 10-minute period generated noise levels of 52 to 65 dBA. The unattenuated 10-minute average noise levels at ST-3 and ST-1 during this measurement period was 54 dBA L_{eq}.

TABLE 4 Summary of Short-Term Noise Measurement Data (dBA)

Noise Measurement Location	Date, Time	L_{max}	$L_{(1)}$	$L_{(10)}$	$L_{(50)}$	$L_{(90)}$	10-min L_{eq}
ST-1: ~200 feet from the centerline of El Camino Real (unattenuated)	10/6/2022, 10:20-10:30 a.m.	63	61	56	51	47	53
	10/6/2022, 10:40-10:50 a.m.	63	60	57	52	47	54
ST-2: ~200 feet from the centerline of El Camino Real (attenuated)	10/6/2022, 10:20-10:30 a.m.	60	58	55	51	48	52
ST-3: ~155 feet from the centerline of El Camino Real (unattenuated)	10/6/2022, 10:40-10:50 a.m.	65	61	58	53	47	54

FIGURE 1 Noise Measurement Locations



Source: Google Earth, 2022.

PLAN CONSISTENCY ANALYSIS

Noise and Land Use Compatibility

Noise levels in outdoor use areas that are affected by transportation noise 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. Additionally, residential interior noise levels are required to meet the performance standard of 45 dBA CNEL.

The future noise environment at the project site would continue to be dominated by traffic along El Camino Real. A traffic study was not completed for the proposed project; however, project trips generated by the proposed 24 townhomes would be insignificant compared to existing peak hour traffic volumes along El Camino Real (i.e., 0 dBA CNEL increase over existing volumes). To estimate a traffic noise increase under future conditions, a conservative 1% to 2% increase in traffic volumes each year for the next 20 years was assumed for standard traffic volume increase in a developed area. Under this assumption, the total increase by the year 2042 would be about 2 dBA CNEL at the project site.

Future Exterior Noise Environment

The project's site plan does not show outdoor areas intended for extended use. Exterior noise thresholds are not enforced at private balconies, porches, or front yard areas, which are all that the proposed project would include. Therefore, the project is compatible with the future noise environment at the site.

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.

Residential units located along the northern building façades would be set back approximately 70 feet from the centerline of El Camino Real. At these distances, the units facing the roadway would be exposed to future exterior noise levels up to 70 dBA CNEL. Assuming windows to be partially open, future interior noise levels in these units would be up to 55 dBA CNEL.

The eastern and western façades of the proposed project buildings would receive partial shielding from existing and project buildings to the east and west. However, there would be some direct line-of-sight to El Camino Real, with setbacks ranging from 70 to 190 feet from the centerline. At these distances, the rooms along the eastern and western façades would be exposed to future exterior noise levels would range from 65 to 70 dBA CNEL. Assuming windows to be partially open, future interior noise levels in these rooms would range from 50 to 55 dBA CNEL.

To meet the interior noise requirements set forth by the State of California of 45 dBA CNEL, implementation of noise insulation features would be required.

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 that residential units along the northern building façades, as well as along the eastern and western façades within 120 feet of the centerline of El Camino Real, would require windows and doors with a minimum rating of 31 to 34 STC with adequate forced-air mechanical ventilation to meet the interior noise threshold of 45 dBA CNEL.

- For residential units along the eastern and western building façades located between 120 and 190 feet of the centerline of El Camino Real, windows and doors with a minimum rating of 28 to 30 STC with adequate forced-air mechanical ventilation would be required to meet the interior noise threshold of 45 dBA CNEL.

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

Conditions of Approval

Interior Noise Standard for Residential 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 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.

NOISE IMPACTS AND MITIGATION MEASURES

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; or

(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.** Existing and future noise-sensitive land uses would be exposed to a temporary increase in ambient noise levels due to project construction activities. The incorporation of construction best management practices would result in a **less-than-significant** temporary noise 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 beginning of October 2023, and the project is expected to be completed by the end of July 2025. Construction phases would include demolition, site preparation, grading, trenching, building construction, architectural coating, and paving. 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.

The City's Municipal Code limits construction activities (including the loading and unloading of materials and truck movements) within 300 feet of residentially zoned property 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.

While noise thresholds for temporary construction are not provided in the City's General Plan or Municipal Code, 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 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 5). Table 6 shows typical hourly average construction-generated noise levels measured at a distance of 50 feet from the center of the site during busy construction periods (e.g., earth moving equipment, impact tools, etc.). As shown in Table 6, typical residential buildings generate construction noise levels ranging from 72 to 88 dBA L_{eq} at a distance of 50 feet from the center of the active 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; however, for purposes of assessing a worst-case scenario, construction noise levels in this report are estimated assuming no attenuation due to intervening buildings or structures.

Equipment expected to be used in each construction stage are summarized in Table 7, 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 7 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 7, 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 8. Noise levels in Table 8 do not assume reductions due to intervening buildings or existing barriers.

TABLE 5 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 6 Typical Ranges of Construction Noise Levels at 50 Feet, L_{eq} (dBA)

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

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

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

TABLE 7 Estimated Construction Noise Levels for the Proposed 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	15 days	Concrete/Industrial Saw (2)[a] Excavator (1) Rubber-Tired Dozer (2) Tractor/Loader/Backhoe (1)[a]	85 dBA L_{eq}
Site Preparation	10 days	Grader (1)[a] Rubber-Tired Dozer (1) Tractor/Loader/Backhoe (1)[a]	84 dBA L_{eq}
Grading/Excavation	10 days	Excavator (1) Grader (1)[a] Rubber-Tired Dozer (1) Tractor/Loader/Backhoe (1)[a]	84 dBA L_{eq}
Trenching/Foundations	30 days	Tractor/Loader/Backhoe (1)[a] Excavator (1)[a]	82 dBA L_{eq}
Building – Exterior	120 days	Forklift (2)[a] Tractor/Loader/Backhoe (1)[a]	80 dBA L_{eq}
Building – Interior/ Architectural Coating	175 days	Air Compressor (2)[a] Aerial Lift (1)[a]	75 dBA L_{eq}
Paving	30 days	Paver (1) Paving Equipment (1)[a] Roller (1) Tractor/Loader/Backhoe (1)[a]	84 dBA L_{eq}

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

TABLE 8 Estimated Construction Noise Levels at Nearby Land Uses

Phase of Construction	Calculated Hourly Average Noise Levels, L_{eq} (dBA)				
	West Future Residences (210ft)	West Commercial (135ft)	North Commercial (185ft)	East Commercial (130ft)	South Residences (80ft)
Demolition	72 dBA L_{eq}	76 dBA L_{eq}	73 dBA L_{eq}	76 dBA L_{eq}	80 dBA L_{eq}
Site Preparation	71 dBA L_{eq}	75 dBA L_{eq}	72 dBA L_{eq}	75 dBA L_{eq}	80 dBA L_{eq}
Grading/Excavation	71 dBA L_{eq}	75 dBA L_{eq}	72 dBA L_{eq}	75 dBA L_{eq}	80 dBA L_{eq}
Trenching/Foundations	69 dBA L_{eq}	73 dBA L_{eq}	70 dBA L_{eq}	73 dBA L_{eq}	78 dBA L_{eq}
Building – Exterior	68 dBA L_{eq}	72 dBA L_{eq}	69 dBA L_{eq}	72 dBA L_{eq}	76 dBA L_{eq}
Building – Interior/ Architectural Coating	62 dBA L_{eq}	66 dBA L_{eq}	63 dBA L_{eq}	66 dBA L_{eq}	71 dBA L_{eq}
Paving	72 dBA L_{eq}	76 dBA L_{eq}	73 dBA L_{eq}	76 dBA L_{eq}	80 dBA L_{eq}

As shown in Table 8, construction noise levels would intermittently range from 62 to 80 dBA L_{eq} at future and existing residences and from 63 to 76 dBA L_{eq} at existing commercial uses surrounding the project site when activities are focused near the center of the project site. These construction noise levels would potentially exceed the exterior threshold of 80 dBA L_{eq} at residential land uses adjoining the site to the south when construction is concentrated closer to the southern boundary. Further, the 90 dBA L_{eq} threshold for commercial land uses could also be exceeded when construction occurs along the shared boundaries to the east and to the west. This would be a significant impact.

Mitigation Measure 1a:

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

Develop a construction noise control plan, including, but not limited to, the following available controls:

- 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, including hotel properties, 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 temporary noise barriers along the perimeter of the project site. Temporary noise barrier fences would provide a 5 dBA noise reduction if the noise barrier interrupts the line-of-sight between the noise source and receptor and if the barrier is constructed in a manner that eliminates any cracks or gaps.

- 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 noise-sensitive receptors nearest the project site 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.

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

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

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

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. Operational noise levels generated by the proposed project could potentially exceed applicable standards at the future noise-sensitive receptors west of the project site. This is a **less-than-significant** impact with the incorporation of the City's standard conditions of approval for mechanical equipment.

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 traffic increased levels by 3 dBA CNEL or more.

Under the City of Santa Clara 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 existing commercial land uses, noise would be restricted to 65 dBA during daytime hours and to 60 dBA during nighttime hours.

Project Traffic Increase

A traffic study was not required for the proposed project; however, peak hour trips generated by a total of 24 townhome units would be fewer than 100 during both peak AM and peak PM hours. Compared to the existing volumes along El Camino Real, these peak hour trips would not result in a measurable or detectable noise level increase (0 dBA CNEL increase). This impact is a less-than-significant impact.

Mechanical Equipment

The site plan for the proposed building shows heating, ventilation, and air conditioning (HVAC) units on the ground level along the building façades near the front entrances. Typical noise levels produced by residential HVAC units would 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. Since each unit would be located outside each individual townhome unit, the most combined HVAC noise would be from up to two units clustered together. Assuming up to two units would operate simultaneously at any given time, the estimated combined noise level at 3 feet would be up to 66 dBA.

Table 9 shows the estimated mechanical equipment noise propagated to the surrounding land uses.

TABLE 9 Estimated Operational Noise Levels for the Rooftop Equipment

Receptor	Distance from Nearest HVAC Equipment	Hourly L_{eq}, dBA	CNEL, dBA	Noise Level Increase, dBA CNEL
West Future Residential	80 feet	Up to 38	44	N/A[a]
West Commercial	15 feet	Up to 52	59	0
South Residential	30 feet	Up to 46	53	0
North Commercial	150 feet	Up to 32	39	0
East Commercial	15 feet	Up to 52	59	0

[a] Since future receptors do not currently exist, they would not be subject to a noise level increase under future conditions.

Based on the estimated noise levels in Table 9, mechanical equipment noise levels are not expected to exceed the City's daytime or nighttime thresholds at residential and commercial uses surrounding the site. For all existing receptors in the project vicinity, the noise level increase due to mechanical equipment noise would not be measurable or detectable (0 dBA CNEL increase).

Total Combined Project-Generated Noise

The operational noise levels produced by the proposed project combined (i.e., traffic and mechanical equipment) would not result in a measurable or detectable noise level increase (0 dBA CNEL). Further, operational noise levels due to mechanical equipment would not exceed the City's daytime or nighttime thresholds at receptors surrounding the project site. This would be a less-than-significant impact.

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

Impact 2: **Exposure to Excessive Groundborne Vibration due to Construction.** Construction-related vibration levels resulting from activities at the project site would potentially exceed 0.3 in/sec PPV at the existing structures to the west and to the north the project site. **This is a potentially significant impact.**

The construction of the project may generate vibration when heavy equipment or impact tools (e.g., jackhammers, hoe rams) are used. Construction activities would include grading, foundation work, paving, and new building framing and finishing. According to the equipment list provided at the time of this study, impact or vibratory pile driving activities, which can cause excessive vibration, are not expected for the proposed project.

For structural damage, the California Department of Transportation recommends a vibration limit of 0.5 in/sec PPV for buildings structurally sound and designed to modern engineering standards, 0.3 in/sec PPV for buildings that are found to be structurally sound but where structural damage is a major concern, and a conservative limit of 0.08 in/sec PPV for ancient buildings or buildings that are documented to be structurally weakened. No known ancient buildings or buildings that are documented to be structurally weakened adjoin the project area. Therefore, conservatively, groundborne vibration levels exceeding 0.3 in/sec PPV would have the potential to result in a significant vibration impact.

Table 10 presents typical vibration levels that could be expected from construction equipment, as measured 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 10 also summarizes the estimated vibration levels at the nearest existing buildings surrounding the project site. Construction vibration levels would depend on the specific 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. Therefore, the distances used to propagate construction vibration levels (as shown in Table 10), which are different than the distances used to propagate construction noise levels (as shown in Table 8), were estimated under the assumption that each piece of equipment was operating along the nearest boundary of the project site, which would represent the worst-case scenario.

As shown in Table 10, vibration levels could potentially exceed the conservative 0.3 in/sec PPV at buildings adjoining the project site to the south and to the west, which would be within 20 feet of the nearest project boundary.

A study completed by the US Bureau of Mines analyzed the effects of blast-induced vibration on buildings in USBM RI 8507.[2] The findings of this study have been applied to buildings affected by construction-generated vibrations.[3] As reported in USBM RI 8507[2] and reproduced by Dowding,[3] Figure 2 presents the damage probability, in terms of "threshold damage," "minor damage," and "major damage," at varying vibration levels. Threshold damage, which is described as cosmetic damage in this report, 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 0.6 in/sec PPV would result in less than 8% chance of cosmetic damage, while maximum vibration levels of 1.2 in/sec PPV would result in about 20% 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 conventional buildings located 20 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.

In summary, the construction of the project would potentially exceed the State's threshold of 0.3 in/sec PPV at buildings adjoining the site. This would be a potentially significant impact.

Mitigation Measure 2:

The following measures are recommended to reduce vibration impacts from construction activities to a less-than-significant level:

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[2] 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.

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

- Limit vibration-inducing equipment to the extent feasible within 20 feet of existing structures adjoining the southern and western boundaries.

- Where possible, use of the heavy vibration-generating construction equipment shall be prohibited within 20 feet of the adjacent buildings to the south and west.

- Use a smaller vibratory roller, such as the Caterpillar model CP433E vibratory compactor, when compacting materials within 20 feet of adjacent structures to the south and west.

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

- Alternative methods for breaking up existing pavement, such as a pavement grinder, shall be used instead of dropping heavy objects, within 20 feet of adjacent buildings to the south and west.

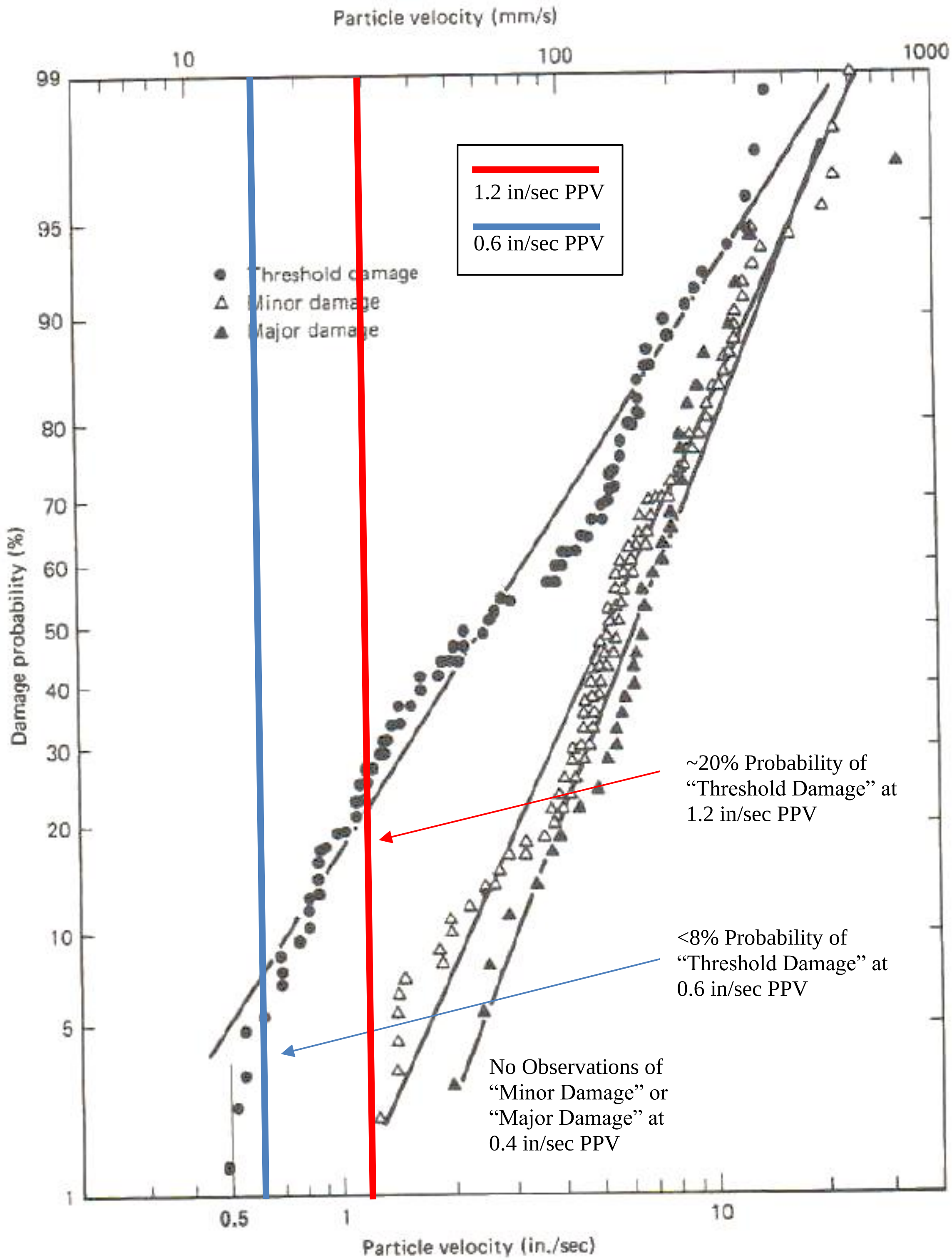
- Hoe rams, large bulldozers, drill rigs, loaded trucks, and other similar equipment shall not be used within 20 feet of adjacent buildings to the south and west.

TABLE 10 Vibration Source Levels for Construction Equipment

Equipment		PPV at 25 ft. (in/sec)	Estimated Vibration Levels at Structures Surrounding the Project Site, in/sec PPV				
			West Future Residences (more than 65 feet)	West Commercial (10 feet)	South Residential (5 feet)	North Commercial (165 feet)	East Commercial (20 feet)
Clam shovel drop		0.202	0.071	**0.553**	**1.186**	0.025	0.258
Hydromill (slurry wall)	in soil	0.008	0.003	0.022	0.047	0.001	0.010
	in rock	0.017	0.006	0.047	0.100	0.002	0.022
Vibratory Roller		0.210	0.073	**0.575**	**1.233**	0.026	0.268
Hoe Ram		0.089	0.031	0.244	**0.523**	0.011	0.114
Large bulldozer		0.089	0.031	0.244	**0.523**	0.011	0.114
Caisson drilling		0.089	0.031	0.244	**0.523**	0.011	0.114
Loaded trucks		0.076	0.027	0.208	**0.446**	0.010	0.097
Jackhammer		0.035	0.012	0.096	0.206	0.004	0.045
Small bulldozer		0.003	0.001	0.008	0.018	0.0004	0.004

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., October 2022.

FIGURE 2 Probability of Cracking and Fatigue from Repetitive Loading



Source: Dowding, C.H., Construction Vibrations, Prentice Hall, Upper Saddle River, 1996, as modified by Illingworth & Rodkin, Inc., October 2022.

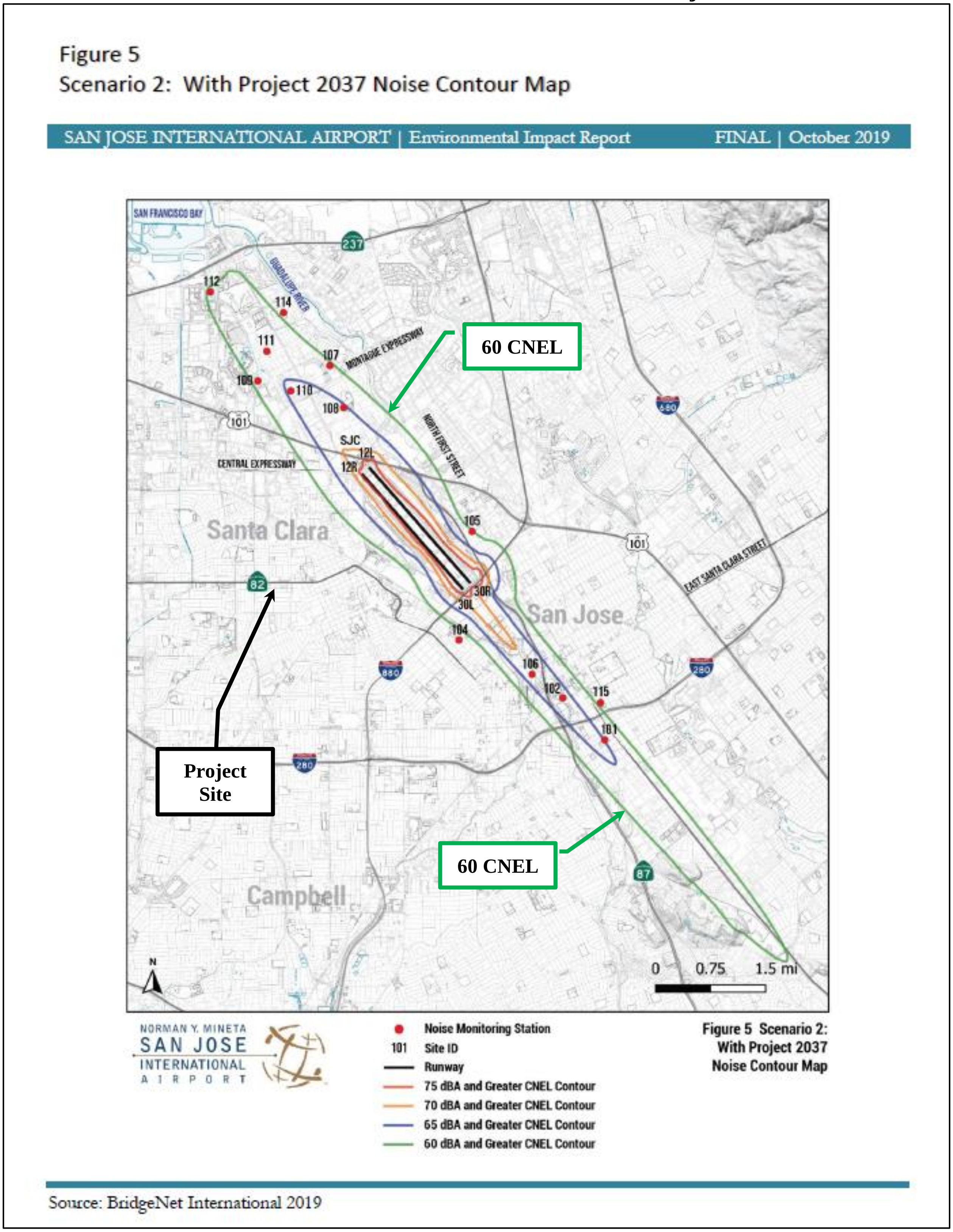
Impact 3: **Excessive Aircraft Noise.** The project site is located more than two miles from a public airport or public use airport, and the proposed project would not expose people residing or working in the area to excessive aircraft noise levels. **This is a less-than-significant impact.**

Norman Y. Mineta San José International Airport is a public-use airport located approximately 2.9 miles east of the project site. According to the new Airport Master Plan Environmental Impact Report,[4] the project site lies well outside the 60 dBA CNEL contour line (see Figure 3). Aircraft noise would result in exterior noise levels below the City's requirements for residential land uses. Therefore, the proposed project would be compatible with the City's exterior noise standards for aircraft noise.

Mitigation Measure 3: **None required.**

[4] 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



Cumulative Impacts

Cumulative noise impacts would include either cumulative traffic noise increases 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 CNEL or greater for future levels exceeding 60 dBA CNEL or was 5 dBA CNEL or greater for future levels at or below 60 dBA CNEL; 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 CNEL or more attributable solely to the proposed project.

A traffic study was not required for this project; therefore, the project would not be expected to result in a cumulatively considerable contribution along any roadway segments with noise-sensitive receptors. Therefore, the project would not result in a cumulative noise increase due to traffic.

From the City's website,[5] the following planned or approved projects are located within 1,000 feet of the proposed project:

- **3402 El Camino Real Mixed-Use Project (The Deck)** – this project is located approximately 100 feet west of the project site and is currently under construction. This project is expected to be completed and occupied prior to construction of the VeGuard Housing Project, and occupants of 3402 El Camino Real were treated as noise-sensitive receptors in this report. This would not be considered a significant cumulative construction impact.

No other planned or approved construction projects have been identified within 1,000 feet of the VeGuard Housing Project site. Therefore, the noise-sensitive receptors surrounding the project site would not be subject to cumulative construction impacts.

[5] https://missioncity.maps.arcgis.com/apps/MapTour/index.html?appid=5afdbed13fad458cb6288c46a0bad060

APPENDIX

FIGURE A1 Daily Trend in Noise Levels at LT-1, Tuesday, October 4, 2021

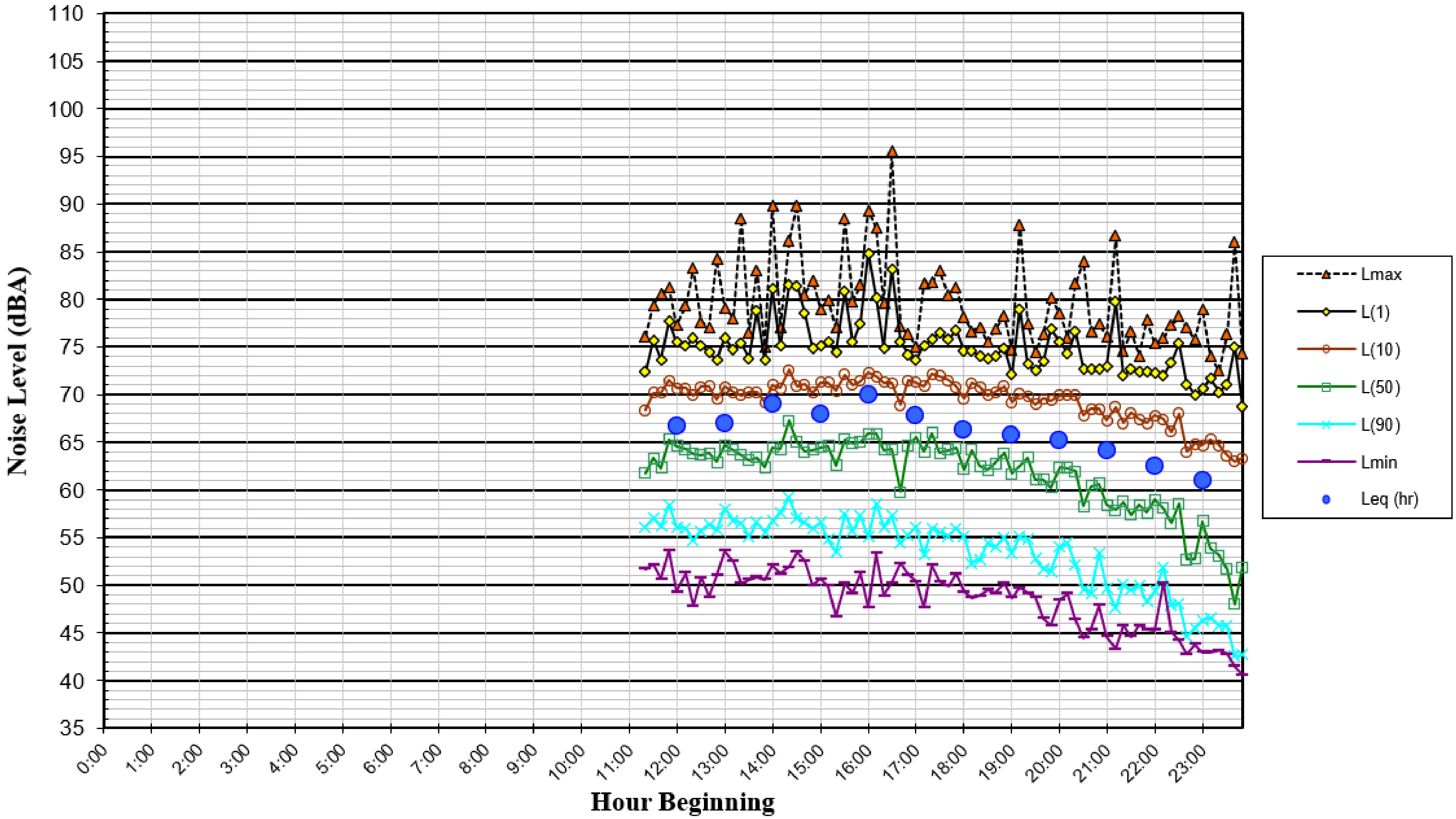


FIGURE A2 Daily Trend in Noise Levels at LT-1, Wednesday, October 5, 2022

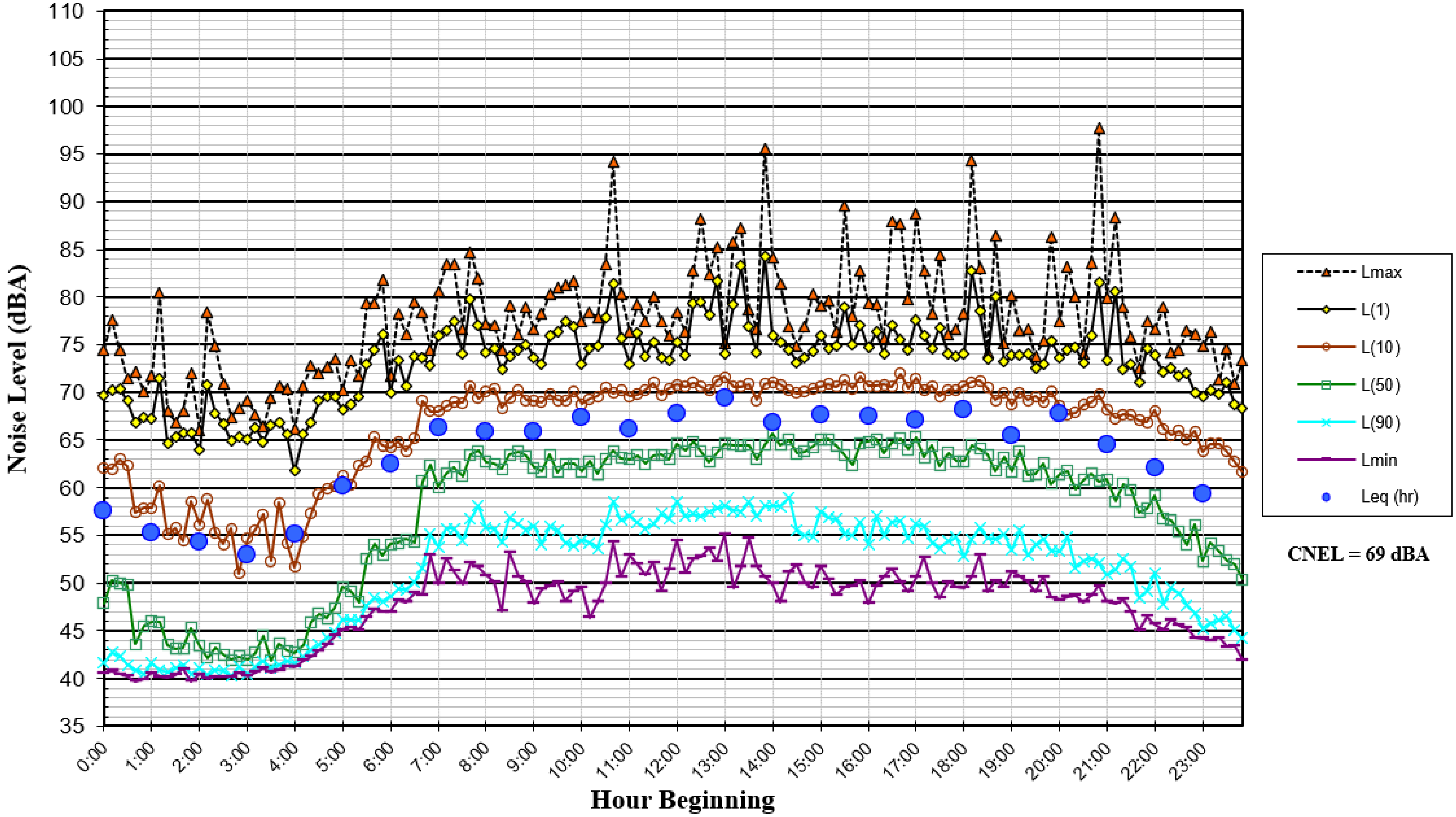


FIGURE A3 Daily Trend in Noise Levels at LT-1, Thursday, October 6, 2022