397 BLOSSOM HILL ROAD ENVIRONMENTAL NOISE AND VIBRATION ASSESSMENT

San José, California

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INTRODUCTION

The project proposes to demolish an existing one-story commercial use building and construct a mixed-use affordable housing development on a 2.04-acre site located at 397 Blossom Hill Road in San José. The residential portion of the development would include up to 150 apartments and the commercial portion of the development would include approximately 26,000 square feet of commercial space.

This report evaluates the project's potential to result in significant noise and vibration impacts with respect to applicable California Environmental Quality Act (CEQA) guidelines. The report is divided into three sections: 1) the Setting Section provides a brief description of the fundamentals of environmental noise, summarizes applicable regulatory criteria, and discusses the results of the ambient noise monitoring survey completed to document existing noise conditions; 2) the General Plan Consistency Section discusses noise and land use compatibility utilizing policies in the City's General Plan; and, 3) the Impacts and Mitigation Measures Section describes the significance criteria used to evaluate project impacts, provides a discussion of each project impact, and presents mitigation measures, where necessary, to provide a compatible project in relation to adjacent noise sources and land uses.

SETTING

Fundamentals of Environmental Noise

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

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

There are several methods of characterizing sound. The most common in California is the *A-weighted sound level (dBA).* This scale gives greater weight to the frequencies of sound to which the human ear is most sensitive. Representative outdoor and indoor noise levels in units of dBA are shown in Table 2. Because sound levels can vary markedly over a short period of time, a method for describing either the average character of the sound or the statistical behavior of the

variations must be utilized. Most commonly, environmental sounds are described in terms of an average level that has the same acoustical energy as the summation of all the time-varying events. This *energy-equivalent sound/noise descriptor* is called L_{eq}. The most common averaging period is hourly, but L_{eq} can describe any series of noise events of arbitrary duration.

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

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

Effects of Noise

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

TABLE 1 Definition of Acoustical Terms Used in this Report

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

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

TABLE 2 Typical Noise Levels in the Environment

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

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

Fundamentals of Groundborne Vibration

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

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

The two primary concerns with construction-induced vibration, the potential to damage a structure and the potential to interfere with the enjoyment of life, are evaluated against different vibration limits. Human perception to vibration varies with the individual and is a function of physical setting and the type of vibration. Persons exposed to elevated ambient vibration levels, such as people in an urban environment, may tolerate a higher vibration level.

Structural damage can be classified as cosmetic only, such as paint flaking or minimal extension of cracks in building surfaces; minor, including limited surface cracking; or major, that may threaten the structural integrity of the building. Safe vibration limits that can be applied to assess the potential for damaging a structure vary by researcher. The damage criteria presented in Table 3 include several categories for ancient, fragile, and historic structures, the types of structures most at risk to damage. Most buildings are included within the categories ranging from “Historic and some old buildings” to “Modern industrial/commercial buildings”. Construction-induced vibration that can be detrimental to the building is very rare and has only been observed in instances where the structure is at a high state of disrepair and the construction activity occurs immediately adjacent to the structure.

The annoyance levels shown in Table 3 should be interpreted with care since vibration may be found to be annoying at lower levels than those shown, depending on the level of activity or the sensitivity of the individual. To sensitive individuals, vibrations approaching the threshold of perception can be annoying. Low-level vibrations frequently cause irritating secondary vibration, such as a slight rattling of windows, doors, or stacked dishes. The rattling sound can give rise to exaggerated vibration complaints, even though there is very little risk of actual structural damage.

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, September 2013.

Regulatory Background

The State of California and the City of San José have established regulatory criteria that are applicable in this assessment. The 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.

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

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

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

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

Checklist items (a) and (b) are applicable to the proposed project. The project is not located within two miles of a public airport or in the vicinity of a private airstrip and would not expose people

residing or working in the project area to excessive aircraft noise levels; therefore, item (c) is not carried further in this analysis.

2016 California Building Code, Title 24, Part 2. The current version of the California Building Code (CBC) requires interior noise levels attributable to exterior environmental noise sources to be limited to a level not exceeding 45 dBA DNL/CNEL in any habitable room.

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

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

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

City of San José General Plan. The Environmental Leadership Chapter in the Envision San José 2040 General Plan sets forth policies with the goal of minimizing the impact of noise on people through noise reduction and suppression techniques, and through appropriate land use policies in the City of San José. The following policies are applicable to the proposed project:

EC-1.1 Locate new development in areas where noise levels are appropriate for the proposed uses. Consider federal, State, and City noise standards and guidelines as a part of new development review. Applicable standards and guidelines for land uses in San José include:

<u>Interior Noise Levels</u>

- The City's standard for interior noise levels in residences, hotels, motels, residential care facilities, and hospitals is 45 dBA DNL. Include appropriate site and building design, building construction and noise attenuation techniques in new development to meet this standard. For sites with exterior noise levels of 60 dBA DNL or more, an acoustical analysis following protocols in the City-adopted California Building Code is required to demonstrate that development projects can meet this standard. The acoustical analysis shall base required noise attenuation techniques on expected Envision General Plan traffic volumes to ensure land use compatibility and General Plan consistency over the life of this plan.

Exterior Noise Levels

- The City's acceptable exterior noise level objective is 60 dBA DNL or less for residential and most institutional land uses such as schools, 65 dBA DNL for playground and outdoor spaces, and 70 dBA DNL for commercial uses (Table EC-1). The acceptable exterior noise level objective is established for the City, except in the environs of the San José International Airport and the Downtown, as described below:

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

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

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

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

Normally Acceptable:

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

Conditionally Acceptable:

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

Unacceptable:

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

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

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

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

EC-1.3 Mitigate noise generation of new nonresidential land uses to 55 dBA DNL at the property line when located adjacent to existing or planned noise-sensitive residential and public/quasi-public land uses.

EC-1.6 Regulate the effects of operational noise from existing and new industrial and commercial development on adjacent uses through noise standards in the City's Municipal Code.

EC-1.7 Require construction operations within San José to use best available noise suppression devices and techniques and limit construction hours near residential uses per the City's Municipal Code. The City considers significant construction noise impacts to occur if a project located within 500 feet of residential uses or 200 feet of commercial or office uses would:

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

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

EC-2.3 Require new development to minimize vibration impacts to adjacent uses during demolition and construction. For sensitive historic structures, a vibration limit of 0.08 in/sec PPV (peak particle velocity) will be used to minimize the potential for cosmetic damage to a building. A vibration limit of 0.20 in/sec PPV will be used to minimize the potential for cosmetic damage at buildings of normal conventional construction.

City of San José Municipal Code. The City's Municipal Code contains a Zoning Ordinance that limits noise levels at adjacent properties. Chapter 20.30.700 states that sound pressure levels generated by any use or combination of uses on a property shall not exceed 55 dBA at any property line shared with land zoned for residential use and to 60 dBA at commercial property lines, except upon issuance and in compliance with a Conditional Use Permit. No specific limits are given for industrial property lines. This code is not explicit in terms of the acoustical descriptor associated with the noise level limit. Consistent with General Plan policy E.C.-1.3, a reasonable interpretation of this standard would identify the ambient base noise level criteria as the day/night noise level (DNL).

Chapter 20.100.450 of the Municipal Code establishes allowable hours of construction within 500 feet of a residential unit between 7:00 am and 7:00 pm Monday through Friday unless permission is granted with a development permit or other planning approval. No construction activities are permitted on the weekends at sites within 500 feet of a residence.

Existing Noise Environment

The project site is located north of Blossom Hill Road, approximately 790 feet east of Snell Avenue in San José, California. The site is currently developed with a single-story furniture store and surrounded by a multi-family residential building to the north, a commercial building to the west, single family detached residential to the south and a commercial medical office building to the east. A noise monitoring survey was performed in the vicinity of the project site beginning Friday, October 5th, 2018 and concluding on Wednesday, October 10th, 2018. The monitoring survey included one long-term measurement and one short-term measurement, as shown in Figure 1.

Long-term noise measurement LT-1 was made 65 feet north of the centerline of Blossom Hill Road. The primary noise source at this location was traffic along Blossom Hill Road. Hourly average noise levels ranged from 63 to 72 dBA L_{eq} during daytime hours, and from 58 to 70 dBA L_{eq} at night. The day-night average noise level at LT-1 ranged from 72 to 73 dBA DNL. The daily trends in measured noise levels are given in Figures 2 through 5.

Short-term noise measurement ST-1 was located in the northwest corner of the site, approximately 350 feet from the center of Blossom Hill Road. The primary noise source at this location was distant traffic along Blossom Hill Road. Occasional aircraft overflights also affected the noise environment at the site. The 10-minute average noise level, measured between 1:10 pm and 1:20 pm on Wednesday, October 10th, 2018, was 53 dBA L_{eq}. A summary of the short-term measurement results is shown in Table 4.

TABLE 4 Summary of Short-Term Noise Measurement Data, October 10th, 2018

ID	Location (Start Time)	Measured Noise Levels, dBA				Primary noise source
		L_{10}	L_{50}	L_{90}	L_{eq}	
ST-1	Northeast corner of project site (10/10/2018, 1:10 pm to 1:20 pm)	56	48	45	53	Traffic on Blossom Hill Road

FIGURE 1 Noise Measurement Locations

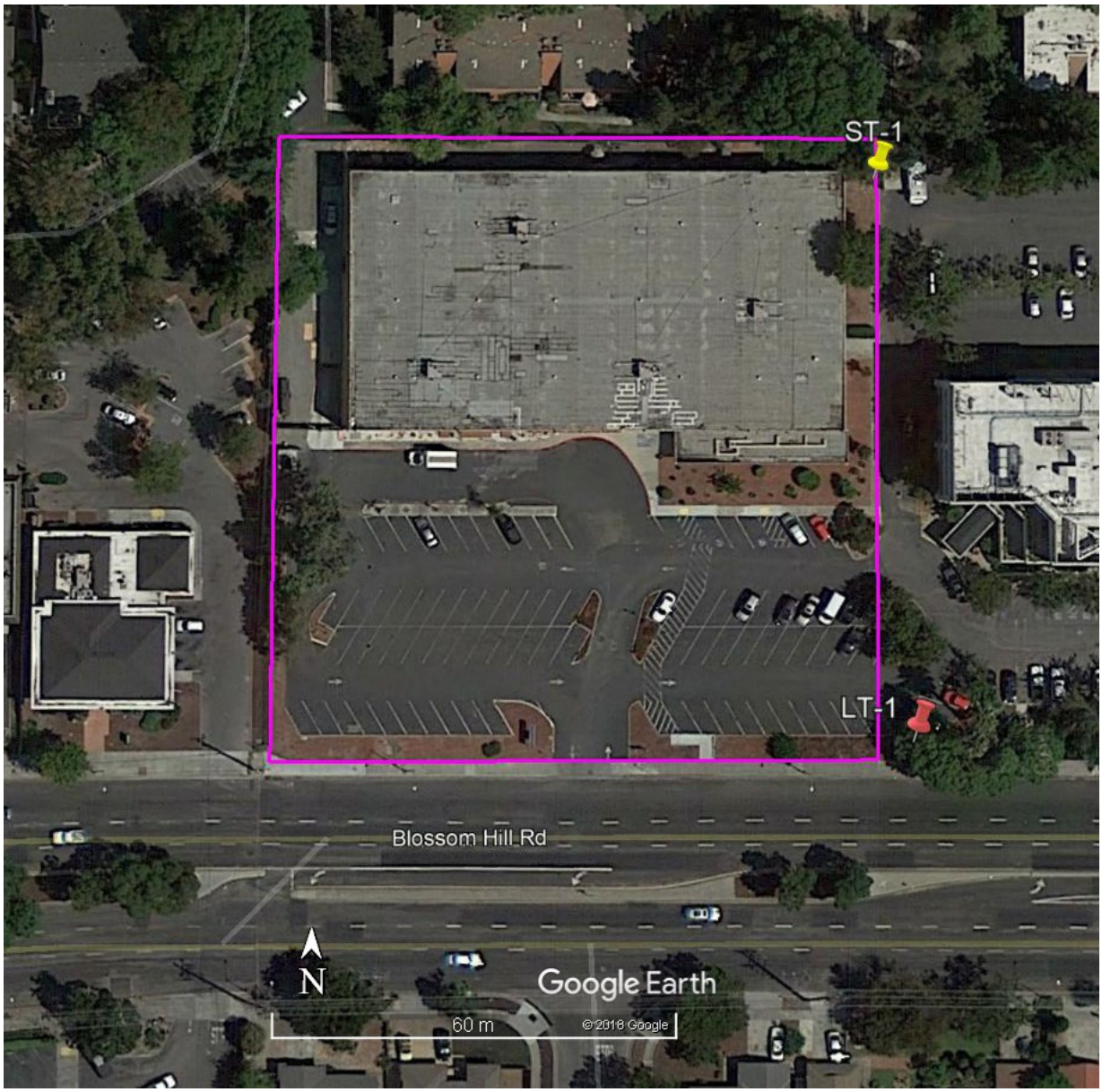


FIGURE 2 Daily Trend in Noise Levels at LT-1

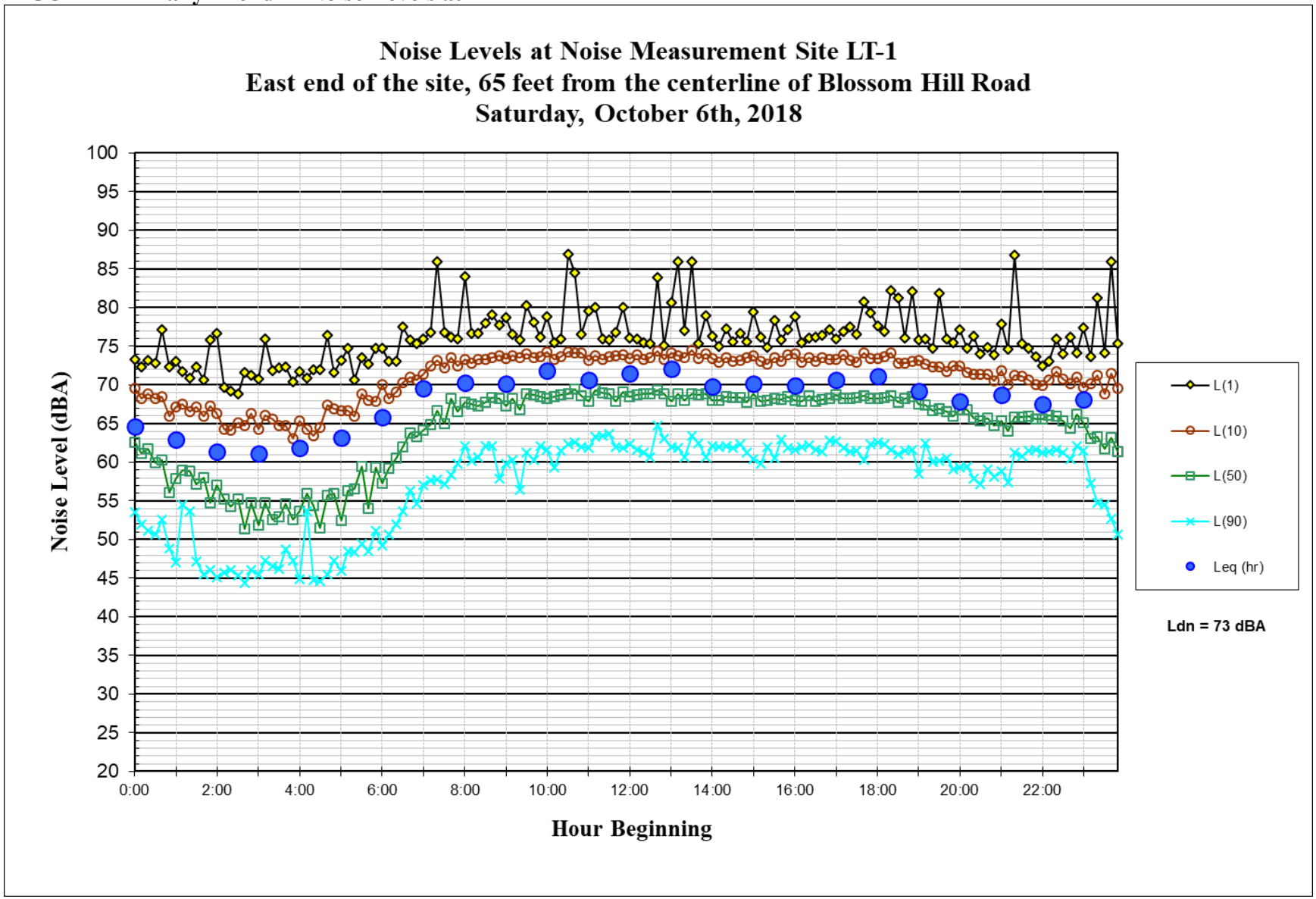


FIGURE 3 Daily Trend in Noise Levels at LT-1

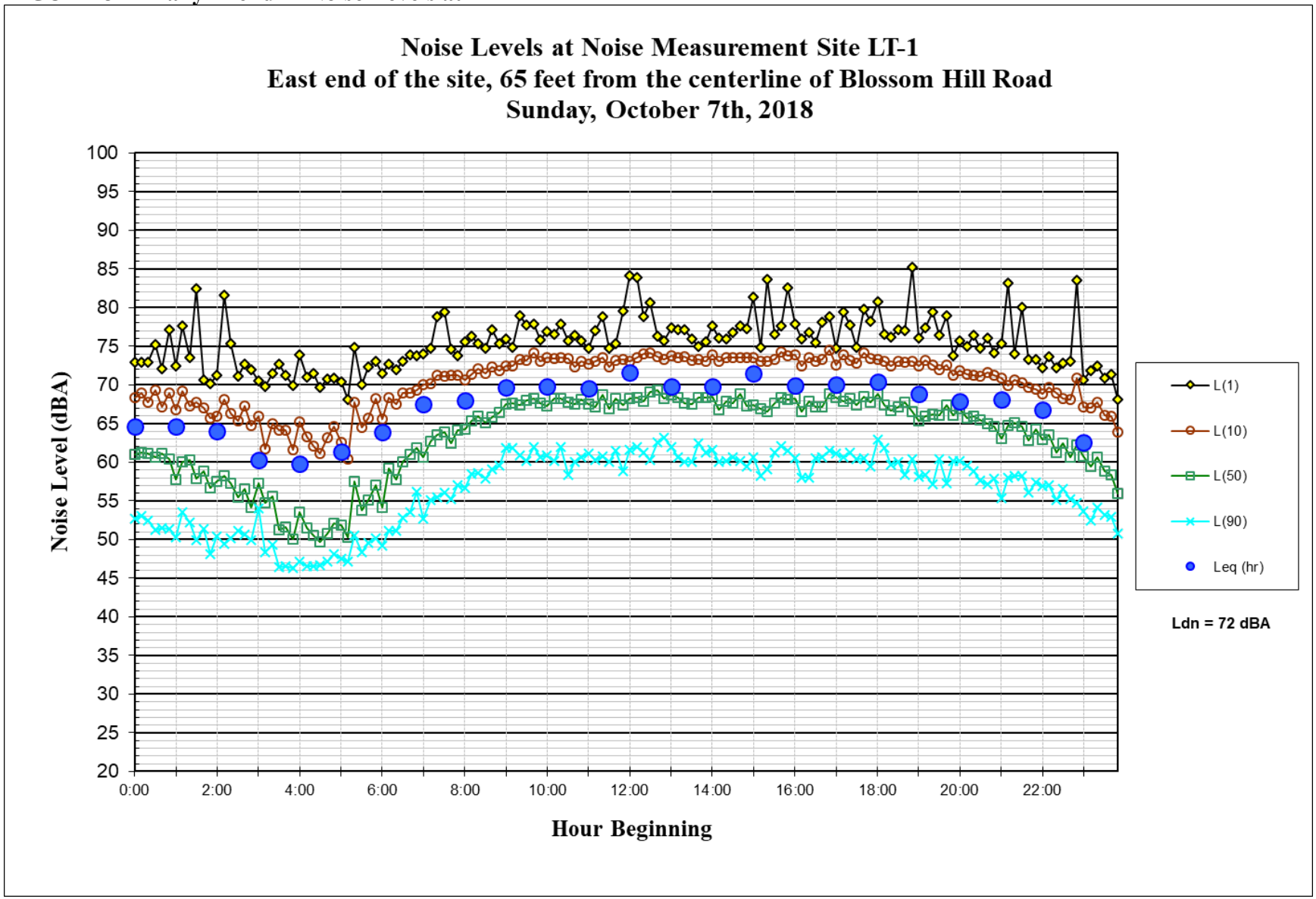


FIGURE 4 Daily Trend in Noise Levels at LT-1

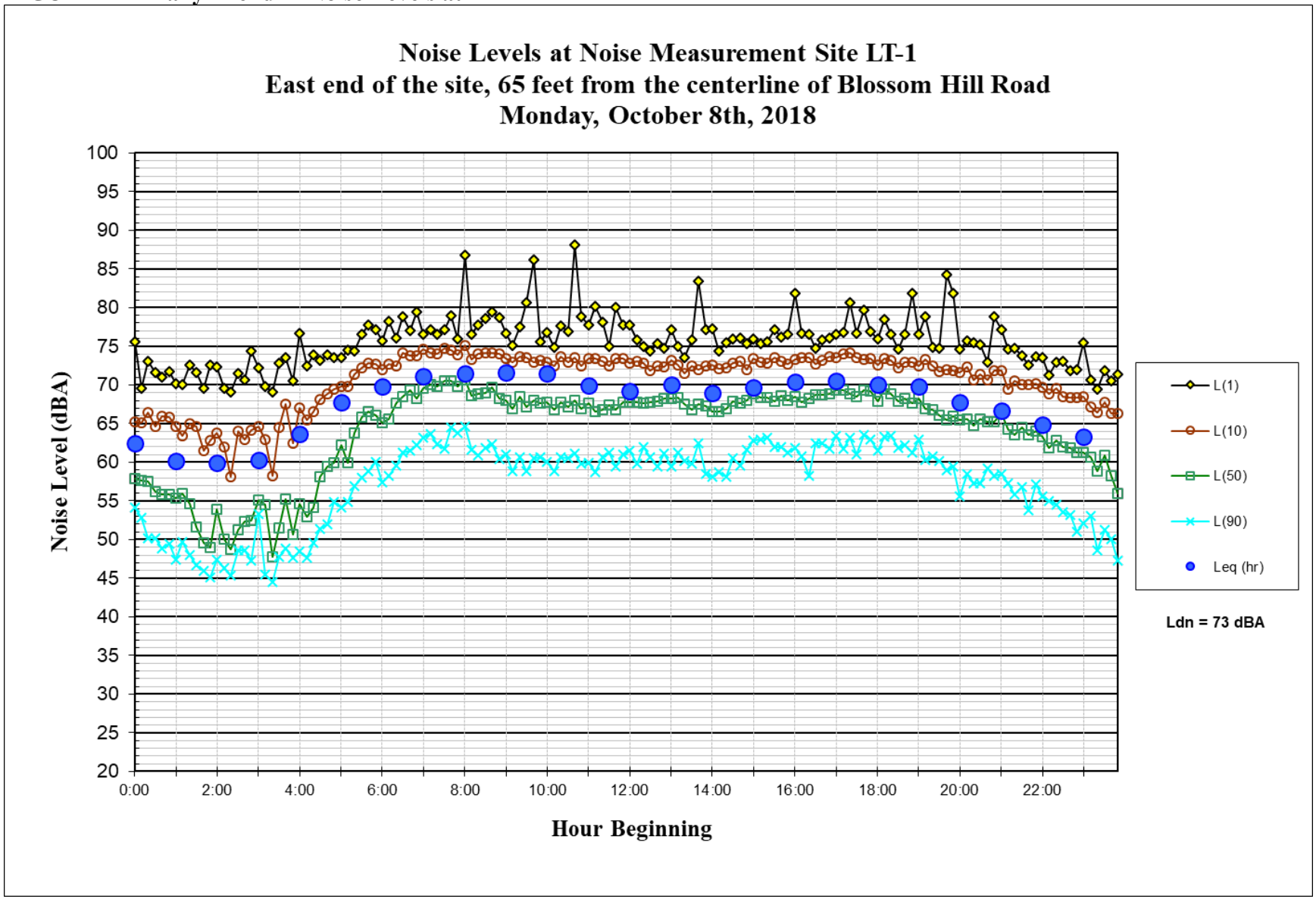
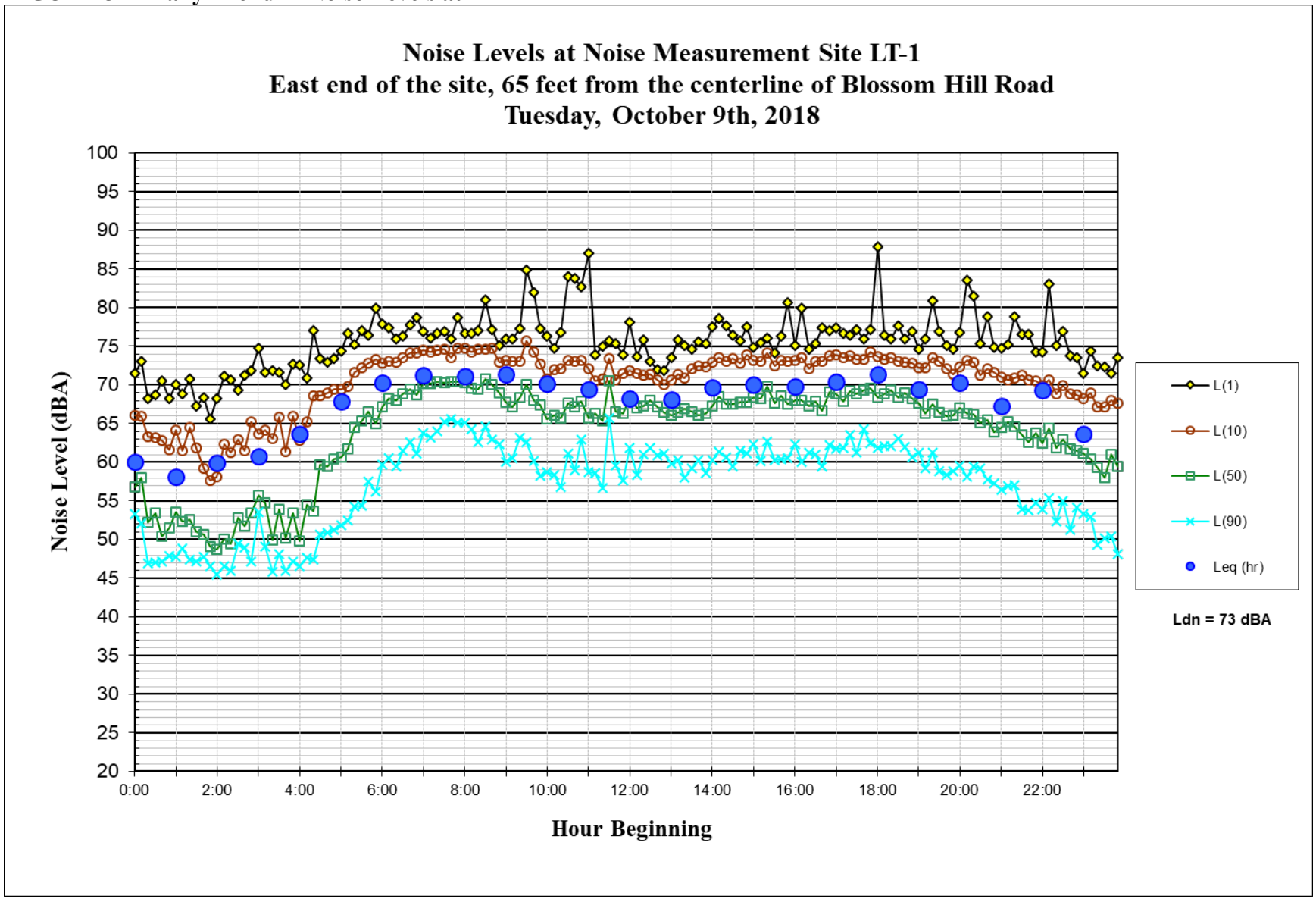


FIGURE 5 Daily Trend in Noise Levels at LT-1



GENERAL PLAN CONSISTENCY ANALYSIS

The impacts of site constraints such as exposure of the proposed project to excessive levels of noise and vibration are not considered under CEQA. This section addresses Noise and Land Use Compatibility for consistency with the policies set forth in the City's General Plan.

Noise and Land Use Compatibility

The applicable General Plan policies were presented in detail in the Regulatory Background section and are summarized below for the proposed project:

- The City's acceptable exterior noise level objective is 60 dBA DNL or less for the proposed residential uses (Table EC-1).
- The City's acceptable exterior noise level objective is 70 dBA DNL for the proposed office and commercial uses (Table EC-1).
- The City's standard for interior noise levels in residences is 45 dBA DNL.
- The Cal Green Code standards specify an interior noise environment attributable to exterior sources not to exceed an hourly equivalent noise level ($L_{eq\ (1\text{-}hr)}$) of 50 dBA in occupied areas of non-residential uses during any hour of operation.

Future Exterior Noise Environment

The proposed building would be located to the north of Blossom Hill Road, approximately 790 feet east of Snell Avenue. Exterior use areas would include a courtyard and outdoor patio on Level 1 and a lookout terrace on Level 2. The Level 1 courtyard would include outdoor seating, a lawn, a veggie garden, and an outdoor multi-purpose room.

The primary noise source for the proposed exterior use areas would continue to be traffic on Blossom Hill Road. Future traffic noise levels at the site were calculated based on the results of the noise monitoring survey and future increase in traffic noise on Blossom Hill Road. Based on comparison between existing and future traffic volumes and trip generation data provided for the project[1], future traffic noise levels on Blossom Hill Road are calculated to increase 1 dB over existing levels.

The Level 1 courtyard area opens up to Blossom Hill Road and would be exposed to noise levels as high as 72 dBA DNL in areas closest to Blossom Hill Road. Interior portions of the courtyard would be exposed to 66 dBA DNL. The outdoor patio on northwestern side of the building, located about 200 feet from the center of and partially shielded from Blossom Hill Road, would be exposed to up to 62 dBA DNL. The Level 2 lookout terrace would be exposed to up to 62 dBA DNL.

[1] *397 Blossom Hill Road Affordable Housing Mixed-Use Project - Volumes and Trip Generation*, Hexagon Traffic Consultants, data received on February 8, 2019.

Noise levels at outdoor use areas throughout the site would exceed the City's acceptable exterior noise level criteria of 60 dBA DNL for residential use. Noise reduction strategies that would reduce day-night average noise levels to 60 dBA DNL or less include redesigning the layout of the proposed building in order to shield the outdoor areas from traffic noise generated by vehicular activity on Blossom Hill Road. This strategy allows the building itself to provide acoustical shielding from traffic noise to the outdoor areas. Another alternative would be to construct sound walls to block the direct line of sight between receptors and the road.

Future Interior Noise Environment

The project proposes to construct a four-level mixed use building with 147 residential units on Levels 2 through 4, approximately 16,000 square feet of commercial space on Level 1, and at-grade parking. South facing building façades would be located as close as 70 feet from the center of Blossom Hill Road. The calculated exterior noise level exposures of building façades are summarized in Table 5. Based on the results of the noise monitoring survey, DNL levels and loudest hour L_{eq} levels are anticipated to be similar.

TABLE 5 Predicted Exterior Noise Levels at Building Façades

Building façade	Exterior Noise Level (dBA DNL/L_{eq})		Interior Noise Level, Windows Partially Open[1]	Recommended Sound Rated Construction[2] for 45 dBA DNL threshold
	Commercial Level 1	Residential Levels 2-4		
Outer north facing façade	-	54	39	Not required
North façade facing courtyard	61	61	46	Forced-air ventilation
Outer east and west facades	65	67	52	Forced-air ventilation
Inner east and west façades facing courtyard	66	66	51	Forced-air ventilation
South façade facing Blossom Hill Road	74	74	59	Forced-air ventilation & STC 32 windows

[1] Assumes a 15 dBA exterior-to-interior noise reduction with windows partially open.
[2] Analysis assumes window area to be 40% of the façade area or less and wood stud wall with cavity of STC 39 rating.

Interior noise levels would vary depending upon the design of the buildings (relative window area to wall area) and the selected construction materials and methods. Standard residential construction provides approximately 15 dBA of exterior-to-interior noise reduction, assuming the windows are partially open for ventilation. Standard construction with the windows closed provides approximately 20 to 25 dBA of noise reduction in interior spaces. Where exterior noise levels are 60 dBA DNL, or less interior noise levels would be considered acceptable levels with standard construction and windows in the open or closed position. Where exterior noise levels range from 60 to 70 dBA DNL, the inclusion of adequate forced-air mechanical ventilation can reduce interior noise levels to acceptable levels by allowing occupants the option of closing the windows to control noise. In noise environments of 70 dBA DNL or greater, a combination of forced-air

mechanical ventilation systems and sound-rated construction methods is often required to meet the interior noise level limit. 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.

As shown in Table 5, north facing residential units would achieve the 45 dBA DNL threshold with standard construction and windows partially open for ventilation. Northern units facing the courtyard and western and eastern units facing the exterior of the site or the courtyard would achieve the City's interior threshold with standard construction and inclusion of forced air mechanical ventilation to allow occupants the option of keeping windows closed to control noise. Residential units with south facing façades adjacent to Blossom Hill Road would achieve the interior standard with the inclusion of forced-air mechanical ventilation and windows and exterior doors with STC[2] ratings of 32 or higher. These calculations assume a window to wall ratio of 40% or less and a wall construction providing a sound rating of STC 39 or better. Figure 6 shows the preliminary recommendations to reduce interior noise to acceptable levels.

Commercial use spaces on Level 1 of proposed building would have standard commercial construction and forced air mechanical ventilation, allowing occupants the option of keeping windows closed. Commercial-use construction with closed windows would be anticipated to provide approximately 25 dBA of noise reduction from exterior noise sources, resulting in interior noise levels up to 49 dBA $L_{eq\ (1\text{-}hr)}$. These levels would comply with the acceptable interior limit of 50 dBA $L_{eq\ (1\text{-}hr)}$ specified by the Cal Green Code.

Recommended Conditions of Approval

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

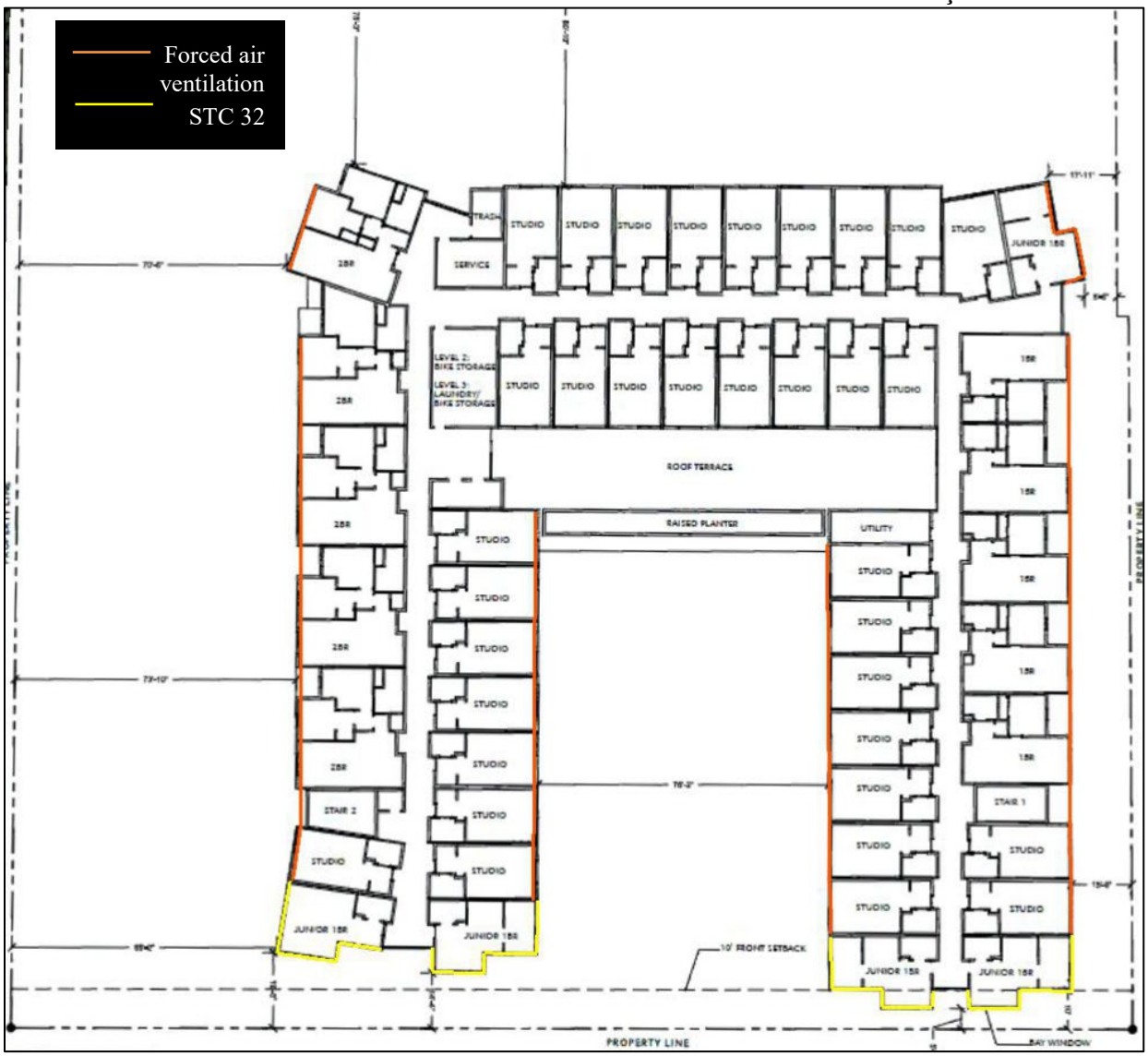
When refining the project's site plan, locate outdoor use areas away from Blossom Hill Road and shield noise-sensitive outdoor spaces with buildings or noise barriers where feasible.

- Provide a suitable form of forced-air mechanical ventilation, as determined by the local building official, so that windows can be kept closed to control noise.

- Provide sound rated windows to south facing residential façades adjacent to Blossom Hill Road to maintain interior noise levels at acceptable levels. Preliminary calculations show that sound-rated windows with minimum STC Ratings of 32 or higher would be satisfactory for units to achieve acceptable interior noise levels, assuming window-to-wall ratio of 40% or less. The specific determination of what noise insulation treatments are necessary shall be conducted on a room-by-room basis during final design of the project.

[2] **Sound Transmission Class (STC)** A single figure rating designed to give an estimate of the sound insulation properties of a partition. Numerically, STC represents the number of decibels of speech sound reduction from one side of the partition to the other. The STC is intended for use when speech and office noise constitute the principal noise problem.

FIGURE 6 Recommended Sound Rated Construction for Residential Façades



Source: Site Plan

NOISE IMPACTS AND MITIGATION MEASURES

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

Significance Criteria

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

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

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

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

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

2. **Generation of Excessive Groundborne Vibration:** A significant impact would be identified if the construction of the project would expose persons to excessive vibration levels. Groundborne vibration levels exceeding 0.2 in/sec PPV would have the potential to result in cosmetic damage to buildings.

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

A significant noise impact would occur if construction, traffic, or activities generated by the project would substantially increase noise levels at sensitive receptors in the project vicinity.

a) Permanent Noise Increase from On-Site Operational Noise

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

Parking Lot

Parking would be provided in an enclosed garage on the ground floor and in 78 surface parking spots, located to the west and north of the building. Access to the site and parking areas would be provided from Blossom Hill Road, on the west side of the proposed building. Parking activities occurring in the enclosed garage would not be anticipated to be audible outside of the proposed building. Noise sources associated with on-site circulation and the use of the surface parking lot would include vehicular circulation, louder engines, car alarms, squealing tires, door slams and human voices. The typical sound of a passing car at 15 mph would be about 50 to 60 dBA L_{max} at a distance of 50 feet. The noise of an engine start is similar. Door slams typically produce noise levels lower than engine starts. The hourly average noise level resulting from the combined noise generating activities in a small parking lot would reach 40 dBA L_{eq} at a distance of 50 feet from the parking area.

The nearest residential land use is located 25 feet to the north of the proposed northern-most parking lot. These residences would experience hourly average noise levels of 46 dBA L_{eq} from parking activities. Parking lot activity noise levels would be similar to or below levels generated by traffic along Blossom Hill Road, would not exceed the City's 55 dBA DNL limit at residences or 60 dBA DNL limit at commercial uses, and would not measurably contribute to the existing ambient noise environment.. This is a **less-than-significant** impact.

Mechanical Equipment

The proposed project would include mechanical equipment such as heating, ventilation, and air conditioning systems (HVAC). Details and location of mechanical equipment was not available at the time of analysis. Equipment, such as the air conditioning units, located inside or in a fully enclosed room with a roof would not be anticipated to be audible at off-site locations. Typical residential rooftop exhaust fans are anticipated to generate noise levels of 50 to 60 dBA at 50 feet from the equipment, depending on the equipment selected. Shielding from equipment enclosures and surrounding structures would provide 10 to 15 dBA of reduction.

The closest residences are located about 80 feet from the northern edge of the roof of the proposed building. Assuming a credible worst-case scenario with unshielded equipment placed about 10 feet

from the northern edge of the building, rooftop equipment noise could reach noise levels as high as 45 to 55 dBA L_{eq} at residences to the north, resulting in day-night average noise levels of 51 to 61 dBA DNL. These levels would exceed the 55 dBA DNL limit at the property line. Mechanical equipment located 180 feet or further from residential property lines or in shielded areas would be anticipated to meet the 55 dBA DNL limit. This is a **potentially significant** impact.

Mitigation Measure 1a: The following mitigation measures would reduce this impact to a less-than-significant level.

Prior to the issuance of building permits, mechanical equipment shall be selected and designed to reduce impacts on surrounding uses to meet the City's requirements. A qualified acoustical consultant shall be retained by the project applicant to review mechanical noise as the equipment systems are selected in order to determine specific noise reduction measures necessary to reduce noise to comply with the City's 55 dBA DNL residential noise limit. Noise reduction measures could include, but are not limited to, selection of equipment that emits low noise levels and/or installation of noise barriers such as enclosures and parapet walls to block the line of sight between the noise source and the nearest receptors.

b) Permanent Noise Increase from Project Traffic

A significant permanent noise increase would be identified if traffic noise generated by the project would substantially increase noise levels at sensitive receivers in the vicinity. A substantial increase would occur if: a) the noise level increase is 5 dBA DNL or greater, with a future noise level of less than 60 dBA DNL, or b) the noise level increase is 3 dBA DNL or greater, with a future noise level of 60 dBA DNL or greater.

To calculate the noise increases attributable to project-generated traffic at nearby noise sensitive areas, AM and PM peak hour traffic volumes for the Existing + Project conditions were compared to Existing traffic volumes[1]. Based on these calculations, project traffic volumes would result in traffic noise increases of less than 1 dBA L_{eq} along the roadway network. Day-night average (DNL) noise level increases would be anticipated to be similar. This increase would not typically be noticeable and would be below the 3 dBA and 5 dBA DNL thresholds of significance. This is a **less-than-significant** impact.

c) Temporary Noise Increase from Project Construction

Chapter 20.100.450 of the City's Municipal Code establishes allowable hours of construction within 500 feet of a residential unit between 7:00 am and 7:00 pm Monday through Friday unless permission is granted with a development permit or other planning approval. No construction activities are permitted on the weekends at sites within 500 feet of a residence. Policy EC-1.7 of the City's General Plan states that for large or complex projects within 500 feet of residential land uses or within 200 feet of commercial land uses or offices involving substantial noise-generating activities lasting more than 12 months, a construction noise logistics plan that specifies hours of construction, noise and vibration minimization measures, posting or notification of construction schedules, and designation of a noise disturbance coordinator who would respond to neighborhood

complaints will be required to be in place prior to the start of construction and implemented during construction to reduce noise impacts on neighboring residents and other uses.

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

Construction activities would be carried out in stages. During each stage of construction, there would be a different mix of equipment operating, and noise levels would vary by stage and vary within stages, based on the amount of equipment in operation and the location at which the equipment is operating. Typical construction noise levels at a distance of 50 feet are shown in Tables 6 and 7. Table 6 shows the average noise level ranges, by construction phase, and Table 7 shows the maximum noise level ranges for different construction equipment. Most demolition and construction noise falls with the range of 80 to 90 dBA at a distance of 50 feet from the source.

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 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.

Source: Mitigation of Nighttime Construction Noise, Vibrations and Other Nuisances, National Cooperative Highway Research Program, 1999.

Project construction is proposed from January 2020 through June 2021 and would involve demolition of existing structures and pavement, site preparation, grading and excavation, trenching, building erection, and paving. Impact pile driving, which produces substantial noise levels, is not anticipated as a method of construction.

Table 8 shows the construction noise levels anticipated during each phase of construction calculated using the Federal Highway Administration's (FHWA) Roadway Construction Noise Model (RCNM), based on the provided construction equipment list. At 50 feet from the noise source, maximum instantaneous noise levels generated by project construction equipment are calculated to range from 78 to 90 dBA L_{max} and hourly average noise levels are calculated to range from 74 to 85 dBA L_{eq}. Construction-generated noise levels drop off at a rate of about 6 dBA per doubling of the distance between the source and receptor.

TABLE 8 Calculated Construction Noise Levels for Each Phase of Construction

Construction Phase	At Distance of 50 ft.	
	L_{eq}, dBA	**L_{max}, dBA**
Demolition (3 days)	85	90
Site Preparation (2 days)	85	84
Grading/Excavation (7 days)	82	85
Trenching (15 days)	81	84
Building-Exterior (320 days)	76	81
Building-Interior (85 days)	74	78
Paving (3 days)	77	83

Noise sensitive uses surrounding the site include residences, located 25 feet to the north and 150 feet to the south and commercial buildings located 40 feet to the west and 40 feet to the east. The residential building to the north would be exposed to a maximum noise level of 96 dBA L_{max} during demolition phase and maximum noise levels of 84 to 91 dBA L_{max} during other phases of construction. Typical hourly average noise levels of 91 dBA L_{eq} during demolition and site preparation and 80 to 87 dBA L_{eq} during other phases of construction are anticipated. The residential building to the south would be exposed to a maximum noise level of 81 dBA L_{max} during demolition phase and maximum noise levels of 69 to 76 dBA L_{max} during other phases of construction. Typical hourly average noise levels of 76 dBA L_{eq} during demolition and site preparation and 65 to 73 dBA L_{eq} during other phases of construction are anticipated.

At commercial sites to the east and west, 40 feet from the project site, hourly average noise levels due to construction would be 76 to 87 dBA L_{eq}. Construction would be located within 500 feet of residential land uses and within 200 feet of commercial land uses for a period of more than 12 months. This is a **potentially significant** impact.

Mitigation Measure 1c: The following *Best Construction Management Practices* would reduce construction noise levels emanating from the site, limit construction hours, and minimize disruption and annoyance.

Best Construction Management Practices

- Construction activities shall be limited to the hours between 7:00 am and 7:00 pm, Monday through Friday, unless permission is granted with a development permit or other planning approval. No construction activities are permitted on the weekends at sites within 500 feet of a residence.

- Construct solid plywood fences around ground level construction sites adjacent to noise-sensitive land uses.

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

- Unnecessary idling of internal combustion engines should be strictly prohibited.

- Locate stationary noise-generating equipment such as air compressors or portable power generators as far as possible from sensitive receptors. Construct temporary noise barriers to screen stationary noise-generating equipment when located near adjoining sensitive land uses. Temporary noise barriers could reduce construction noise levels by 5 dBA.

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

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

- A temporary noise control blanket barrier could be erected, if necessary, along building façades facing residential areas during upper level construction. This mitigation would only be necessary if conflicts occurred which were irresolvable by proper scheduling. Noise control blanket barriers can be rented and quickly erected.

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

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

Impact 2: **Generation of Excessive Groundborne Vibration from Construction.** Construction-related vibration levels resulting from construction activities are not calculated to exceed 0.2 in/sec PPV at the nearest structures. **This is a less-than-significant impact.**

Policy EC-2.3 of the City of San José General Plan limits construction vibration to 0.08 in/sec PPV at sensitive historical structures and to 0.2 in/sec PPV at buildings of normal conventional construction. The vibration limits contained in this policy are conservative and designed to provide the ultimate level of protection for existing buildings in San José.

The construction of the project may generate perceptible vibration when heavy equipment or impact tools (e.g. jackhammers, hoe rams) are used in the vicinity of nearby sensitive land uses. Construction activities would include site demolition work, preparation work, excavation, foundation work, and new building framing and finishing. Impact pile driving is not anticipated as a method of construction.

Table 9 presents typical vibration levels that could be expected from construction equipment at a distance of 25 feet. Vibration levels would vary depending on soil conditions, construction methods, and equipment used. Table 9 also presents construction vibration levels at various distances from the construction equipment. Calculations were made to estimate vibration levels at distances at 25, 50, 100, and 150 feet from the site to represent other nearby buildings. Vibration levels are highest close to the source, and then attenuate with increasing distance at the rate of $(D_{ref}/D)^{1.1}$, where D is the distance from the source in feet and D_{ref} is the reference distance of 25 feet.

TABLE 9 Vibration Source Levels for Construction Equipment at Various Distances

Equipment		PPV at 25 ft. (in/sec)	PPV at 50 ft. (in/sec)	PPV at 100 ft. (in/sec)	PPV at 150 ft. (in/sec)
Clam shovel drop		0.202	0.094	0.044	0.028
Hydromill (slurry wall)	0.008	0.004	0.002	0.001	0.001
	0.017	0.008	0.004	0.002	0.002
Vibratory Roller		0.210	0.098	0.046	0.029
Hoe Ram		0.089	0.042	0.019	0.012
Large bulldozer		0.089	0.042	0.019	0.012
Caisson drilling		0.089	0.042	0.019	0.012
Loaded trucks		0.076	0.035	0.017	0.011
Jackhammer		0.035	0.016	0.008	0.005
Small bulldozer		0.003	0.001	0.001	0.000

Source: Transit Noise and Vibration Impact Assessment, United States Department of Transportation, Office of Planning and Environment, Federal Transit Administration, May 2006 as modified by Illingworth & Rodkin, Inc., February 2019.

Based on the City of San José Historic Resources Inventory, there are no historic structures within 300 feet of the project site. Existing structures of normal construction in the vicinity of the site include residential buildings located 25 feet to the north and 150 feet to the south, and commercial buildings located 40 feet to the east and 40 feet to the west. As shown in Table 9, vibration levels would not be anticipated to exceed 0.2 in/sec PPV at distances 25 feet or greater from construction. This is a **less-than-significant** impact.

Mitigation Measure 2: None needed.