APPENDIX I
Noise and Vibration Report

MORGAN HILL DEVCO RESIDENTIAL PROJECT NOISE AND VIBRATION ASSESSMENT

Morgan Hill, California

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INTRODUCTION

The project proposes the construction of 364 residential units on the approximately 69.4-acre site located at the northeast quadrant of Barrett Avenue and Hill Road in the City of Morgan Hill, California. This site is mostly undeveloped, and the ground is predominantly fallowed. There are four vacant agricultural buildings currently on the site, which would be removed as part of the project. The project would include 223 one- to two-story single-family detached houses, 42 courtyard style homes, 21 senior cottages, 34 senior duets, and 44 accessory dwelling units (ADUs). The project would also include off-site improvements to Jackson Park, Jackson Elementary School, Hill Road, and Barrett Avenue.

This report evaluates the project's potential to result in significant noise impacts with respect to applicable guidelines established by the City of Morgan Hill. The report is divided into two 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 at the site to document existing noise conditions; 2) the Plan Consistency Analysis 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 mitigate project impacts to a less-than-significant level.

SETTING

Fundamentals of Environmental Noise

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

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

There are several methods of characterizing sound. The most common in California is the *A-weighted sound level (dBA).* This scale gives greater weight to the frequencies of sound to which

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

The scientific instrument used to measure noise is the sound level meter. Sound level meters can accurately measure environmental noise levels to within 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}/CNEL. Typically, the highest steady traffic noise level during the daytime is about equal to the L_{dn}/CNEL and nighttime levels are 10 dBA lower. The standard is designed for sleep and speech protection and most jurisdictions apply the same criterion for all residential uses. Typical structural attenuation is 12-17 dBA with open windows. With closed windows in good condition, the noise attenuation factor is around 20 dBA for an older structure and 25 dBA for a newer dwelling. Sleep and speech interference is therefore possible when exterior noise levels are about 57-62 dBA L_{dn}/CNEL with open windows and 65-70 dBA L_{dn}/CNEL if the windows are closed. Levels of 55-60 dBA are common along collector streets and secondary arterials, while 65-70 dBA is a typical value for a primary/major arterial. Levels of 75-80 dBA are normal noise levels at the first row of development outside a freeway right-of-way. In order to achieve an acceptable interior noise environment, bedrooms facing secondary roadways need to be able to have their windows closed; those facing major roadways and freeways typically need special glass windows.

Annoyance

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

TABLE 1 Definition of Acoustical Terms Used in this Report

Term	Definition
Decibel, dB	A unit describing, the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for air is 20 micro Pascals.
Sound Pressure Level	Sound pressure is the sound force per unit area, usually expressed in micro Pascals (or 20 micro Newtons per square meter), where 1 Pascal is the pressure resulting from a force of 1 Newton exerted over an area of 1 square meter. The sound pressure level is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressures exerted by the sound to a reference sound pressure (e.g., 20 micro Pascals). Sound pressure level is the quantity that is directly measured by a sound level meter.
Frequency, Hz	The number of complete pressure fluctuations per second above and below atmospheric pressure. Normal human hearing is between 20 Hz and 20,000 Hz. Infrasonic sound are below 20 Hz and Ultrasonic sounds are above 20,000 Hz.
A-Weighted Sound Level, dBA	The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise.
Equivalent Noise Level, L_{eq}	The average A-weighted noise level during the measurement period.
L_{max}, L_{min}	The maximum and minimum A-weighted noise level during the measurement period.
L_{01}, L_{10}, L_{50}, L_{90}	The A-weighted noise levels that are exceeded 1%, 10%, 50%, and 90% of the time during the measurement period.
Day/Night Noise Level, 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.

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, April 2020.

Regulatory Background

This section describes the relevant guidelines, policies, and standards established by State Agencies, Santa Clara County, and the City of Morgan Hill. The State CEQA Guidelines, Appendix G, are used to assess the potential significance of impacts pursuant to local General Plan policies, Municipal Code standards, or the applicable standards of other agencies. A summary of the applicable regulatory criteria is provided below.

Federal

2018 Federal Transit Administration's Transit Noise and Vibration Impact Assessment Manual. The Federal Transit Administration's (FDA) Transit Noise and Vibration Impact Assessment Manual includes general assessment criteria for construction noise. During daytime hours, the hourly average noise level limit is 90 dBA L_{eq} at residential land uses and 100 dBA L_{eq} at commercial and industrial land uses. Nighttime limits are 80 dBA L_{eq} at residential land uses and 100 dBA L_{eq} at commercial and industrial land uses.

State of California

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

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

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

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

2022 California Building Code, Title 24, Part 2. The current version of the California Building Code (CBC) requires interior noise levels in multi-family residential units attributable to exterior environmental noise sources to be limited to a level not exceeding 45 dBA L_{dn}/CNEL in any habitable room.

City of Morgan Hill General Plan. The Safety, Services and Infrastructure Chapter in the Morgan Hill 2035 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 Morgan Hill. The following policies are applicable to the proposed project:

Policy SSI-8.1- *Exterior Noise Level Standards:* Require new development projects to be designed and constructed to meet acceptable exterior noise level standards (as shown in Table SSI-1) as follows:

- Apply a maximum exterior noise level of 60 dBA L_{dn} in residential areas where outdoor use is a major consideration (e.g., backyards in single-family housing developments and recreation areas in multi-family housing projects). Where the City determines that providing an L_{dn} of 60 dBA or lower cannot be achieved after the application of reasonable and feasible mitigation, an L_{dn} of 65 dBA may be permitted.

- Indoor noise levels should not exceed an L_{dn} of 45 dBA in new residential housing units.

- Noise levels in new residential development exposed to an exterior L_{dn} 60 dBA or greater should be limited to a maximum instantaneous noise level (e.g., trucks on busy streets, train warning whistles) in bedrooms of 50 dBA. Maximum instantaneous noise levels in all other habitable rooms should not exceed 55 dBA. The maximum outdoor noise level for new residences near the railroad shall be 70 dBA L_{dn}, recognizing that train noise is characterized by relatively few loud events.

Policy SSI-8.2- *Impact Evaluation:* The impact of proposed development project on existing land uses should be evaluated in terms of the potential for adverse community response based on significant increase in existing noise levels, regardless of compatibility guidelines.

Policy SSI-8.5- *Traffic Noise Level Standards:* Consider noise level increases resulting from traffic associated with new projects significant if: a) the noise level increase is 5 dBA L_{dn} or greater, with

a future noise level of less than 60 dBA L_{dn}, or b) the noise level increase is 3 dBA L_{dn} or greater, with a future noise level of 60 dBA L_{dn} or greater.

Policy SSI-8.6- *Stationary Noise Level Standards:* Consider noise levels produced by stationary noise sources associated with new projects significant if they substantially exceed existing ambient noise levels.

Policy SSI-8.7- *Other Noise Sources:* Consider noise levels produced by other noise sources (such as ballfields) significant if an acoustical study demonstrates they would substantially exceed ambient noise levels.

Policy SSI-8.9- *Site Planning and Design:* Require attention to site planning and design techniques other than sound walls to reduce noise impacts, including: a) installing earth berms, b) increasing the distance between the noise source and the receiver; c) using non-sensitive structures such as parking lots, utility areas, and garages to shield noise-sensitive areas; d) orienting buildings to shield outdoor spaces from the noise source; and e) minimizing the noise at its source.

Policy SSI-9.1- *Techniques to Reduce Traffic Noise:* Use roadway design, traffic signalization, and other traffic planning techniques (such as limiting truck traffic in residential areas) to reduce noise caused by speed or acceleration of vehicles.

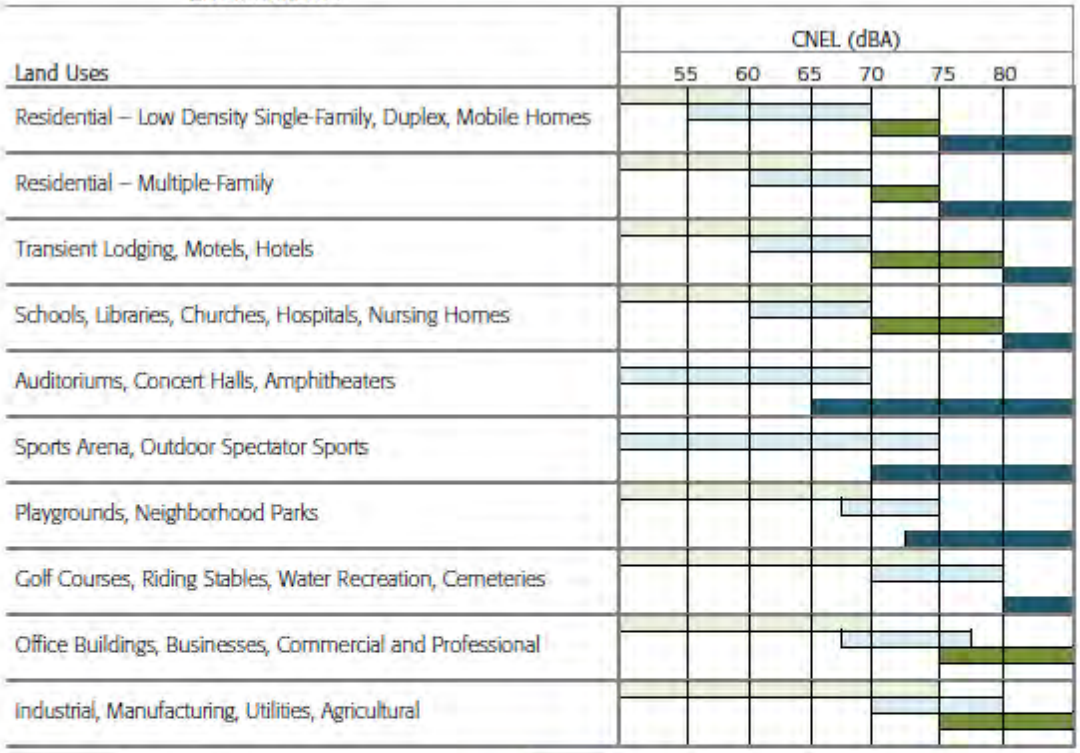
Policy SSI-9.3- *Sound Wall Design:* The maximum height of sound walls shall be eight feet. Residential projects adjacent to the freeway shall be designed to minimize sound wall height through location of a frontage road, use of two sound walls or other applicable measures. Sound wall design and location shall be coordinated for an entire project area and shall meet Caltrans noise attenuation criteria for a projected eight-lane freeway condition. If two sound walls are used, the first shall be located immediately adjacent to the freeway right-of-way and the second shall be located as necessary to meet Caltrans noise requirements for primary outdoor areas. The minimum rear yard setback to the second wall shall be 20 feet.

Policy SSI-9.5- *Noise Studies for Private Development:* In order to prevent significant noise impacts on neighborhood residents which are related to roadway extensions or construction of new roadways, require completion of a detailed noise study during project-level design to quantify noise levels generated by projects such as the Murphy Avenue extension to Mission View Drive and the Walnut Grove Extension to Diana Avenue. The study limits should include noise sensitive land uses adjacent to the project alignment as well as those along existing segments that would be connected to new segments. A significant impact would be identified where traffic noise levels would exceed the "normally acceptable" noise level standard for residential land uses and/or where ambient noise levels would be substantially increased with the project. Project specific mitigation measures could include, but not be limited to, considering the location of the planned roadway alignment relative to existing receivers in the vicinity, evaluating the use of noise barriers to attenuate project-generated traffic noise, and/or evaluating the use of "quiet pavement" to minimize traffic noise levels at the source. Mitigation should be designed to reduce noise levels into compliance with "normally acceptable" levels for residential noise and land use compatibility.

Policy SSI-9.6- *Earth Berms:* Allow and encourage earth berms in new development projects as an alternative to sound walls if adequate space is available.

Policy SSI-9.7- *Sound Barrier Design:* Require non-earthen sound barriers to be landscaped, vegetated, or otherwise designed and/or obscured to improve aesthetics and discourage graffiti and other vandalism.

TABLE SSI-1 STATE OF CALIFORNIA LAND USE COMPATIBILITY GUIDELINES FOR COMMUNITY NOISE ENVIRONMENTS



Source: Governor's Office of Planning and Research, General Plan Guidelines 2003.

City of Morgan Hill Municipal Code. The City of Morgan Hill's Municipal Code Chapter 8.28 states that "It is unlawful and a misdemeanor for any person to make or continue, or cause to be made or continued, any loud, disturbing, unnecessary or unusual noise or any noise which annoys, disturbs, injures or endangers the comfort, health, repose, peace or safety of other persons within the city." The following sections of the code would be applicable to the project:

D. 1. Construction activities as limited below. "Construction activities" are defined as including but not limited to excavation, grading, paving, demolition, construction, alteration or repair of any building, site, street or highway, delivery or removal of

construction material to a site, or movement of construction materials on a site. Construction activities are prohibited other than between the hours of seven a.m. and eight p.m., Monday through Friday and between the hours of nine a.m. to six p.m. on Saturday. Construction activities may not occur on Sundays or federal holidays. No third person, including but not limited to landowners, construction company owners, contractors, subcontractors, or employers, shall permit or allow any person working on construction activities which are under their ownership, control or direction to violate this provision. Construction activities may occur in the following cases without violation of this provision:

a. In the event of urgent necessity in the interests of the public health and safety, and then only with a permit from the chief building official, which permit may be granted for a period of not to exceed three days or less while the emergency continues and which permit may be renewed for periods of three days or less while the emergency continues.

b. If the chief building official determines that the public health and safety will not be impaired by the construction activities between the hours of eight p.m. and seven a.m., and that loss or inconvenience would result to any party in interest, the chief building official may grant permission for such work to be done between the hours of eight p.m. and seven a.m. upon an application being made at the time the permit for the work is issued or during the progress of the work.

c. The city council finds that construction by the resident of a single residence does not have the same magnitude or frequency of noise impacts as a larger construction project. Therefore, the resident of a single residence may perform construction activities on that home during the hours in this subsection, as well as on Sundays and federal holidays from nine a.m. to six p.m., provided that such activities are limited to the improvement or maintenance undertaken by the resident on a personal basis.

d. Public work projects are exempt from this section and the public works director shall determine the hours of construction for public works projects.

e. Until November 30, 1998, construction activities shall be permitted between the hours of ten a.m. to six p.m. on Sundays, subject to the following conditions. No power-driven vehicles, equipment or tools may be used during construction activities, except on the interior of a building or other structure which is enclosed by exterior siding (including windows and doors) and roofing, and which windows and doors are closed during construction activities. Construction activities must be situated at least one hundred fifty feet from the nearest occupied dwelling. No delivery or removal of construction material to a site, or movement of construction materials on a site, is permitted. No activity, including but not limited to the playing of radios, tape players, compact disc players or other devices, which creates a loud or unusual noise which offends,

disturbs or harasses the peace and quiet of the persons of ordinary sensibilities beyond the confines of the property from which the sound emanates is allowed.

2. If it is determined necessary in order to ensure compliance with this section, the chief building official may require fences, gates or other barriers prohibiting access to a construction site by construction crews during hours in which construction is prohibited by this subsection. The project manager of each project shall be responsible for ensuring the fences, gates or barriers are locked and/or in place during hours in which no construction is allowed. This subsection shall apply to construction sites other than public works projects or single dwelling units which are not a part of larger projects.

Chapter 18.76 establishes quantitative noise performance standards:

18.76.090 - Noise.

A. No land use or activity may produce a noise level in excess of the standards in Table 18.76-1.

Table 18.76-1: Maximum Noise Levels

Receiving Land Use	Maximum Noise Level at Lot Line of Receiving Use [1]
Industrial and Wholesale	70 dBA
Commercial	65 dBA
Residential or Public/Quasi Public	60 dBA

Notes:
[1] The planning commission may allow an additional 5 dBA noise level at the lot line if the maximum noise level shown in Table 18.76-1 cannot be achieved with reasonable and feasible mitigation.

B. Noise standards in Table 18.76-1do not apply to noise generated by vehicle traffic in the public right-of-way or from temporary construction, demolition, and vehicles that enter and leave the site of the noise-generating use (e.g., construction equipment, trains, trucks).

C. All uses and activities shall comply with Municipal Code Chapter 8.28 (Noise).

(Ord. No. 2277 N.S., § 5(Exh. A), 6-6-2018)

Existing Noise Environment

The project site is located northeast of the Hill Road/Barrett Avenue intersection in the City of Morgan Hill. The project site is bounded by Barrett Avenue, agricultural land, and rural residences to the south; Hill Road, warehouse/storage structures, industrial structures, and rural residences to the west; and single-family residences to the north and east. Sorrel Way is located northeast of the site. Jackson Park and Jackson Elementary School are located adjacent to the northeast portion of the project site.

The noise environment at the site and in the surrounding area results primarily from vehicular traffic along Hill Road. Local traffic along Barrett Avenue and other neighborhood roadways would also contribute to the existing noise environment. In addition, occasional aircraft flyovers associated with nearby San Martin Airport and San José International Airport have some contribution to the noise environment.

A noise monitoring survey consisting of two long-term (LT-1 and LT-2) and two short-term (ST-1 and ST-2) noise measurements was made at the site between Friday, August 13, 2021 and Tuesday, August 17, 2021. All measurement locations are shown in Figure 1.

Long-term noise measurement LT-1 was made approximately 75 feet east of the centerline of Hill Road. Hourly average noise levels at LT-1 typically ranged from 57 to 69 dBA L_{eq} during daytime hours (7:00 a.m. and 10:00 p.m.) and from 43 to 67 dBA L_{eq} during nighttime hours (10:00 p.m. and 7:00 a.m.). The day-night average noise level on Saturday, August 14th and Sunday, August 15th ranged from 63 to 64 dBA L_{dn}, and the day-night average noise level on Monday, August 16th was 67 dBA L_{dn}. The daily trend in noise levels at LT-1 is shown in Figures 2 through 6.

LT-2 was made at the eastern portion of the project site, at the end of Sorrel Drive. Hourly average noise levels at LT-2 typically ranged from 44 to 60 dBA L_{eq} during daytime hours and from 42 to 54 dBA L_{eq} during nighttime hours. The day-night average noise level on Saturday, August 14th and Sunday, August 15th ranged from 54 to 57 dBA L_{dn}, and the day-night average noise level on Monday, August 16th was 56 dBA L_{dn}. The daily trend in noise levels at LT-2 is shown in Figures 7 through 11.

Short-term noise measurements were made on Tuesday, August 17, 2021, between 8:20 a.m. and 8:50 a.m. in 10-minute intervals. The results of both measurements are summarized in Table 4. ST-1 was made along the northern boundary of the site, approximately 270 feet from the centerline of Hill Road. Typical traffic noise levels along Hill Road ranged from 50 to 58 dBA at ST-1. The 10-minute L_{eq} measured at ST-1 was 54 dBA. ST-2 was made outside of 2677 Barrett Avenue, approximately 65 feet northwest of the centerline of Barrett Avenue. Typical traffic noise levels along Barrett Avenue ranged from 54 to 70 dBA, and overhead jets generated noise levels up to 52 dBA at ST-2. The 10-minute L_{eq} measured at ST-2 was 53 dBA.

FIGURE 1 Noise Measurement Locations

Source: Google Earth 2021.

FIGURE 2 Daily Trend in Noise Levels at LT-1, Friday, August 13, 2021

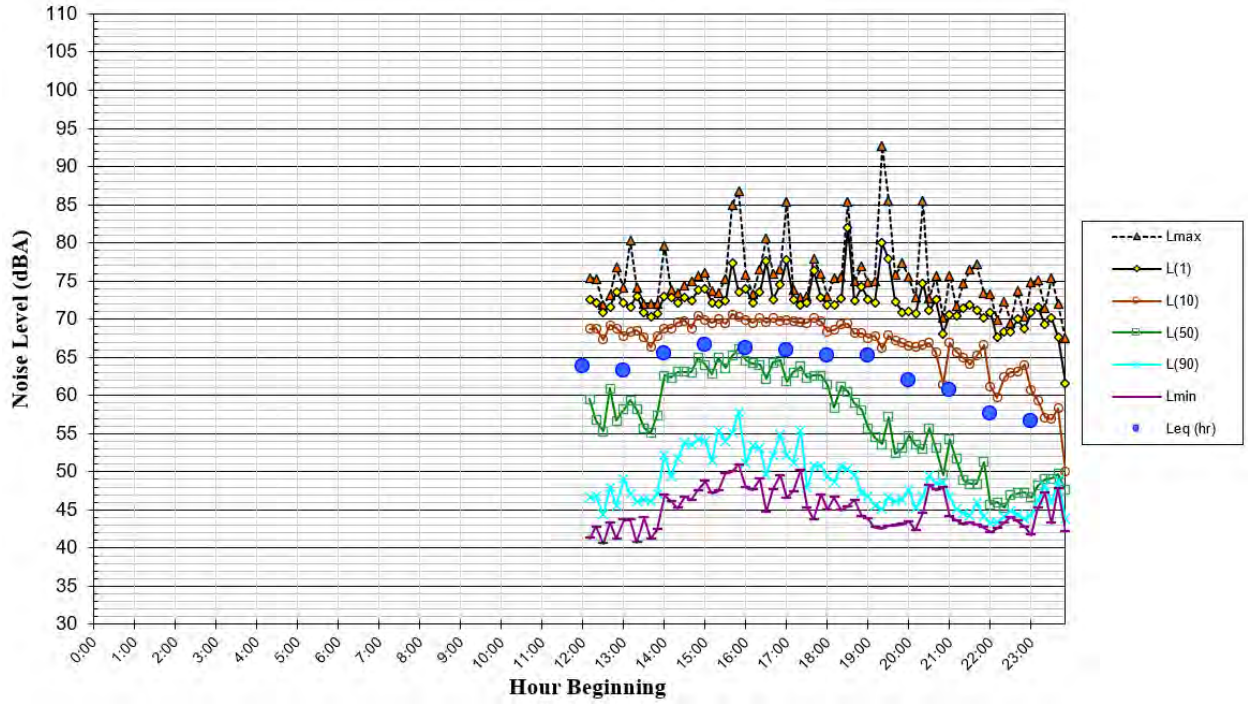


FIGURE 3 Daily Trend in Noise Levels at LT-1, Saturday, August 14, 2021

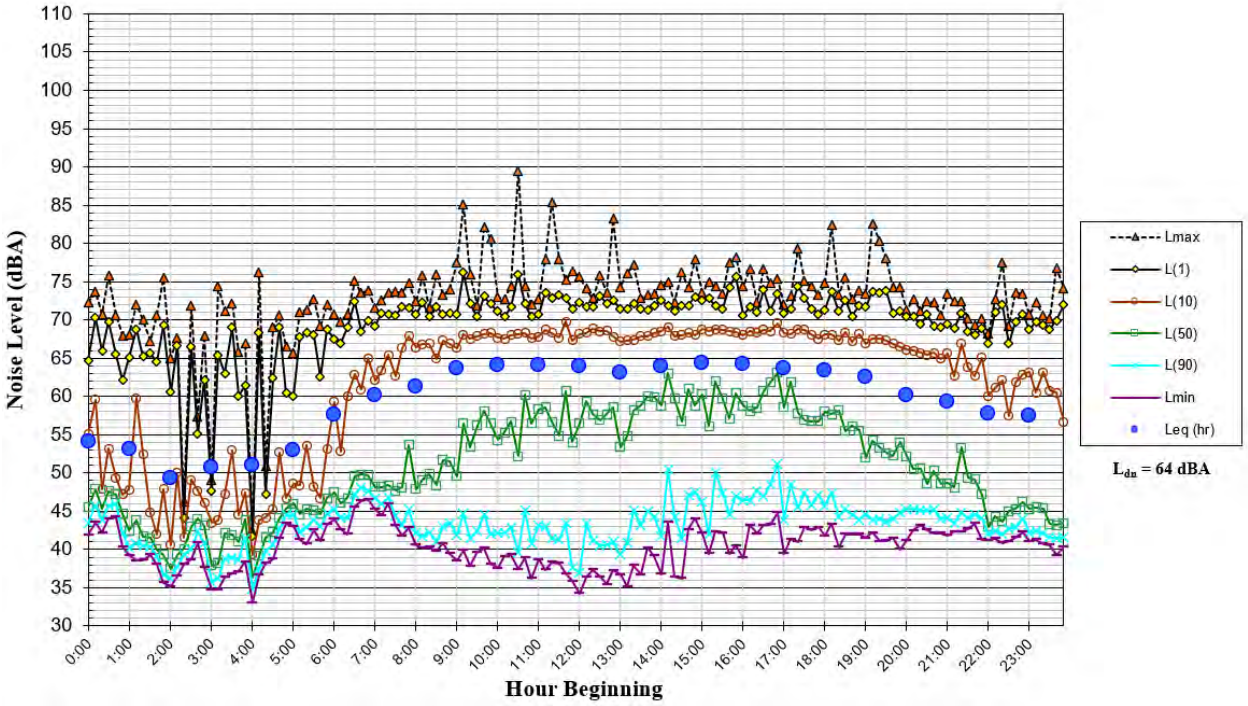


FIGURE 4 Daily Trend in Noise Levels at LT-1, Sunday, August 15, 2021

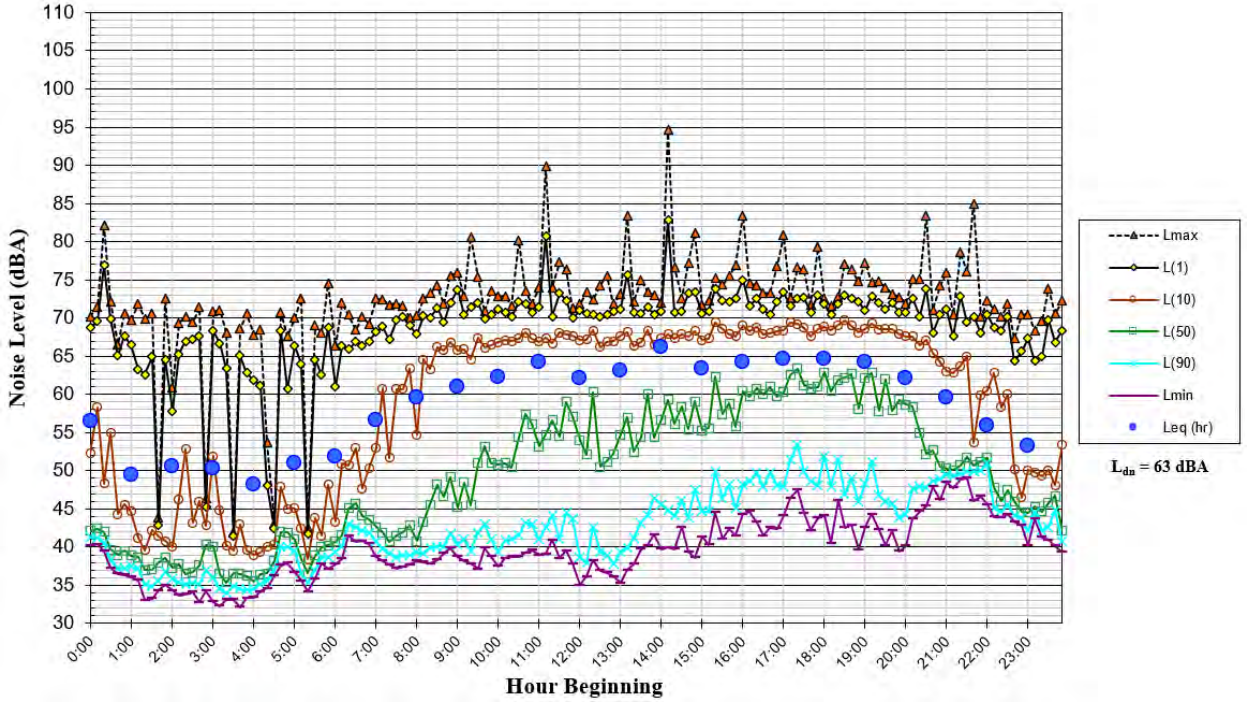


FIGURE 5 Daily Trend in Noise Levels at LT-1, Monday, August 16, 2021

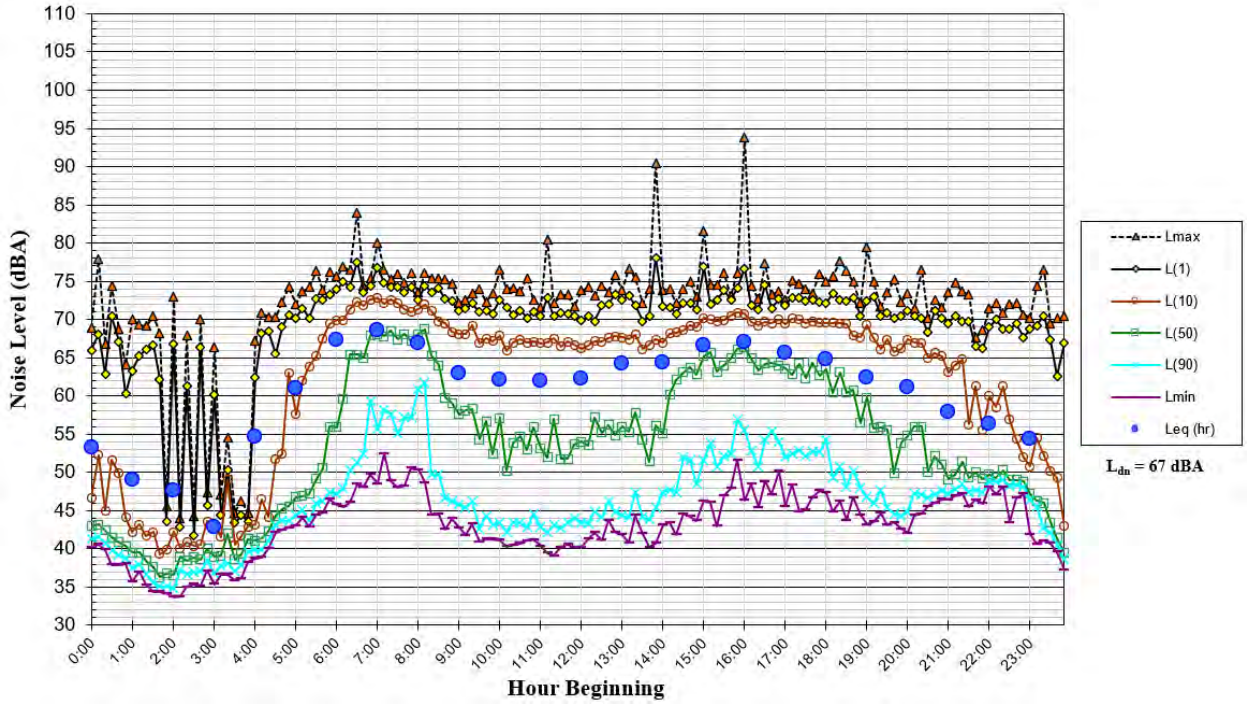


FIGURE 6 Daily Trend in Noise Levels at LT-1, Tuesday, August 17, 2021

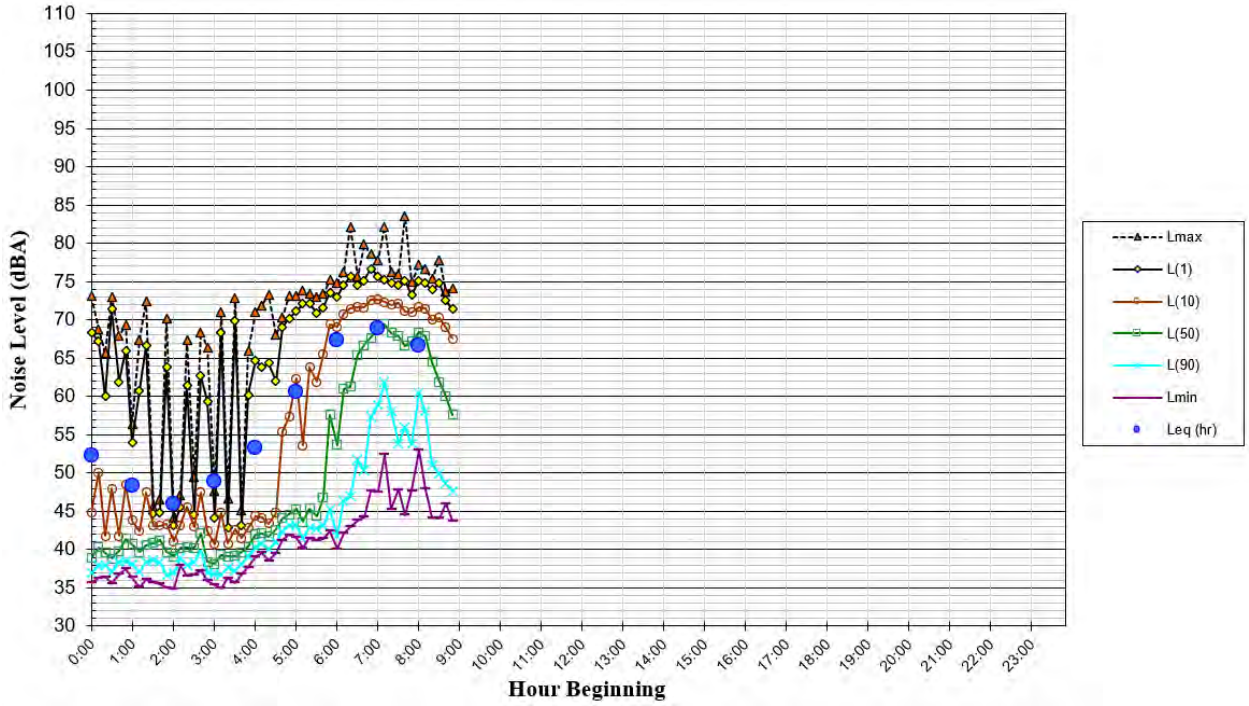


FIGURE 7 Daily Trend in Noise Levels at LT-2, Friday, August 13, 2021

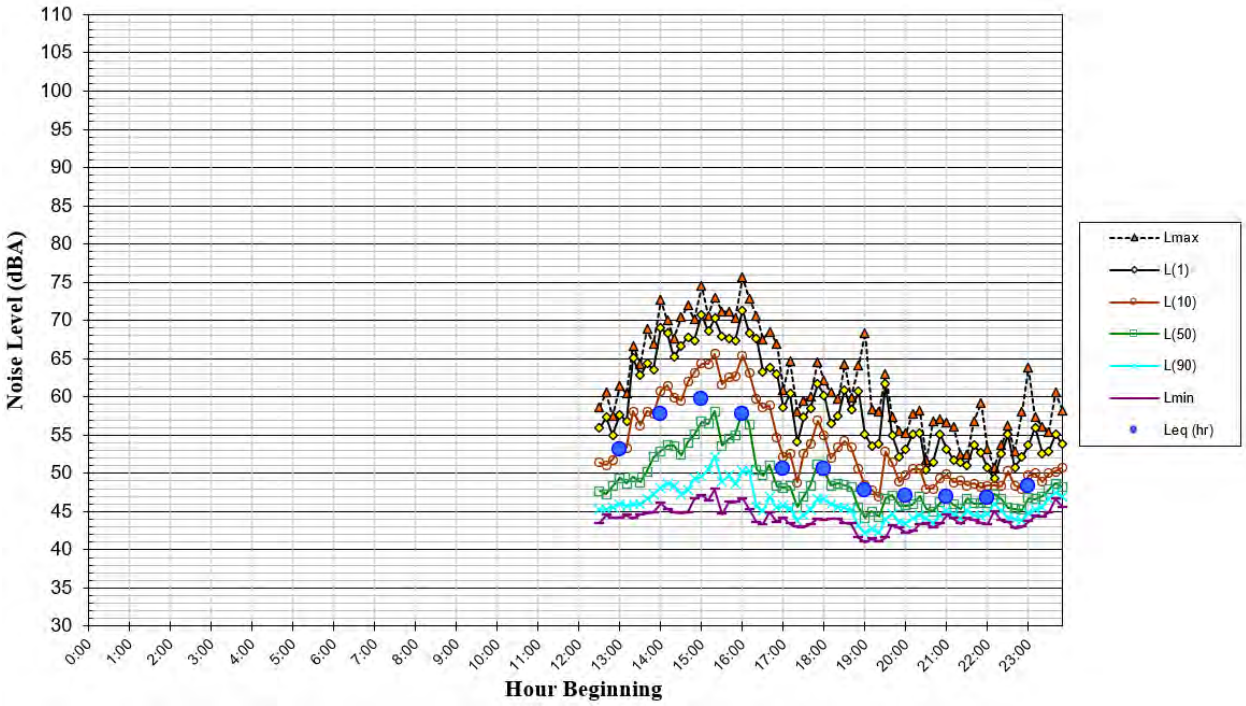


FIGURE 8 Daily Trend in Noise Levels at LT-2, Saturday, August 14, 2021

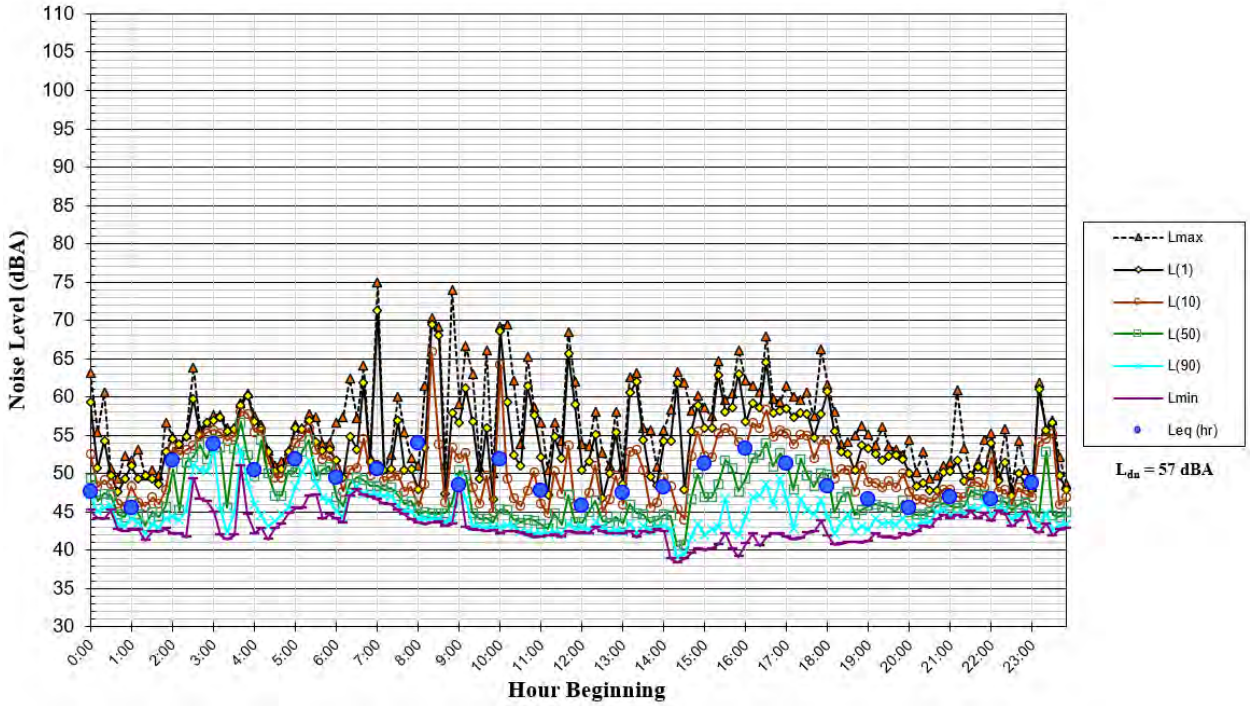


FIGURE 9 Daily Trend in Noise Levels at LT-2, Sunday, August 15, 2021

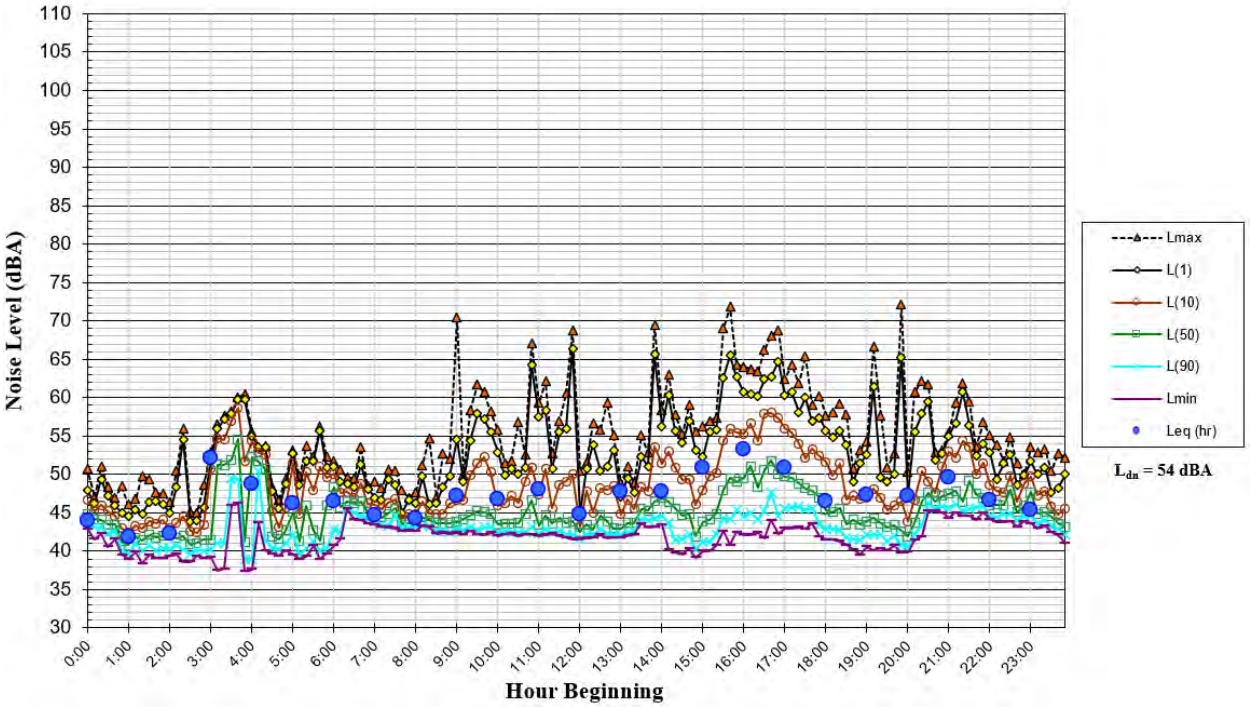


FIGURE 10 Daily Trend in Noise Levels at LT-2, Monday, August 16, 2021

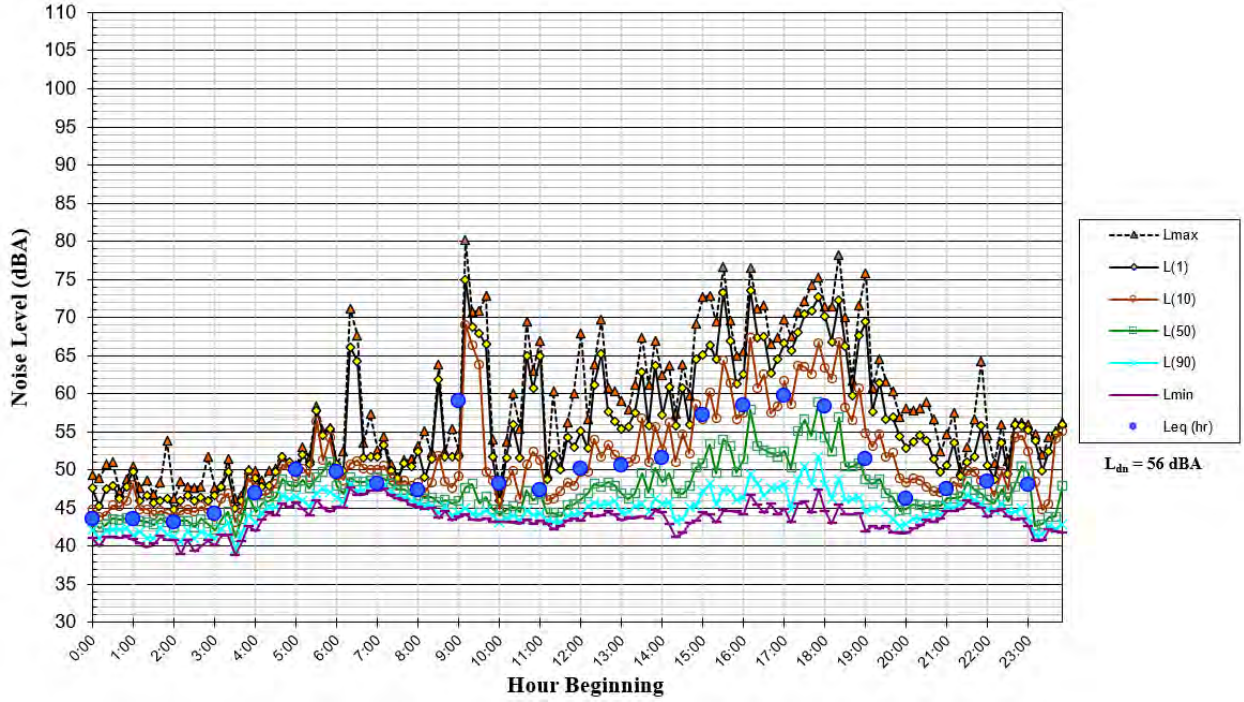


FIGURE 11 Daily Trend in Noise Levels at LT-2, Tuesday, August 17, 2021

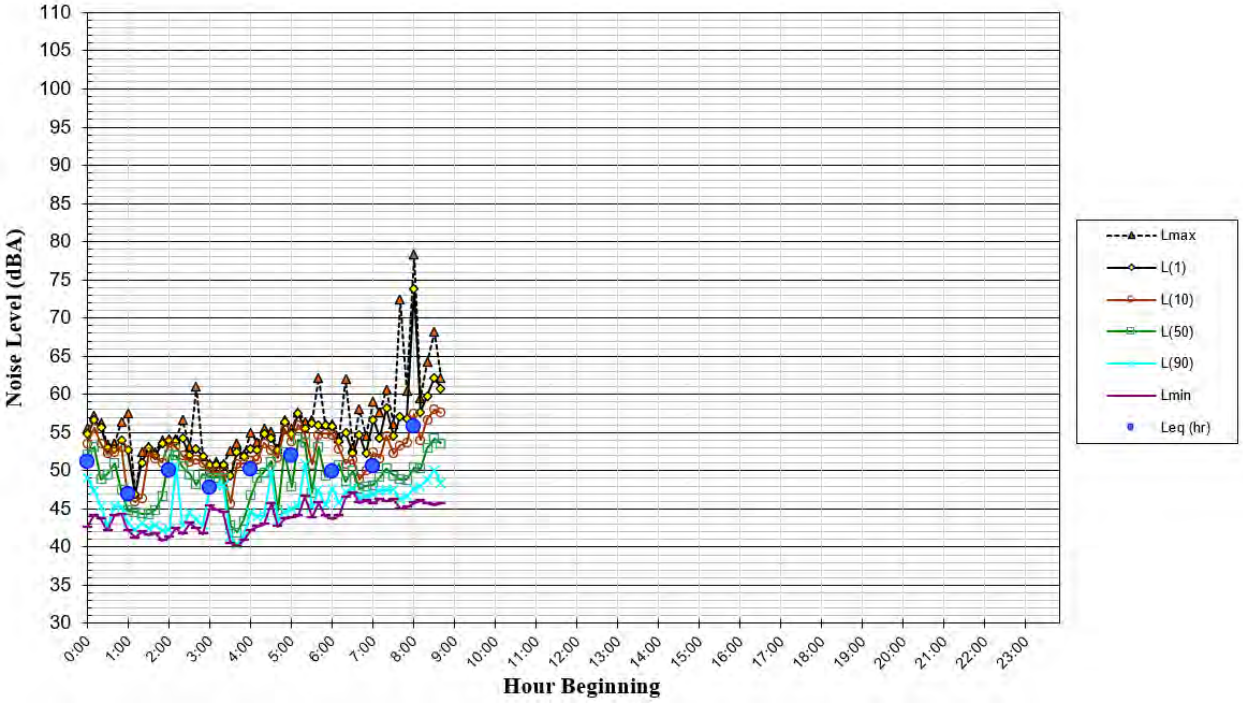


TABLE 4 Summary of Short-Term Noise Measurements (dBA)

Noise Measurement Location	Date, Time	Measured Noise Level, dBA					
		L_{max}	$L_{(1)}$	$L_{(10)}$	$L_{(50)}$	$L_{(90)}$	L_{eq}
ST-1: Northern boundary of the project site, ~270 feet from the centerline of Hill Road	8/17/2021, 8:20-8:30	60	58	56	54	50	54
ST-2: ~65 feet northwest of the centerline of Barrett Avenue	8/17/2021, 8:40-8:50	70	64	57	46	43	53

PLAN CONSISTENCY ANALYSIS

Noise and Land Use Compatibility

The City's 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 Morgan Hill. The applicable General Plan policies were presented in detail in the Regulatory Background section and are summarized below for the proposed project:

- The City's acceptable exterior noise level standard is 60 dBA L_{dn} or less for the proposed residential land uses.

- The City's acceptable interior noise level standard is 45 dBA L_{dn} or less for the proposed residential land uses.

- The City's acceptable exterior noise level standard is 70 dBA L_{dn} or less for neighborhood parks and playgrounds.

The future noise environment at the site would continue to result primarily from vehicular traffic along Hill Road. According to the traffic study completed for the proposed project, the traffic noise level increase at the project site would be up to 2 dBA L_{dn} under cumulative 2035 General Plan plus project buildout conditions.

Future Exterior Noise Environment

The proposed project includes single-family residences throughout the project site and senior condominiums located on the interior of the site. Each of the detached single-family homes would have backyards subject to the City's 60 dBA L_{dn} threshold. Additionally, several areas of open space are included at the project site. The site plan shows some of these open areas to include a walking trail, which is a transitory use that would not be subject to the City's exterior noise threshold as the exterior noise thresholds are typically enforced at locations where extended outdoor use would occur.

While most outdoor use areas would be set back from Hill Road, the backyards of residences located adjacent to the roadway would be exposed to the highest noise levels. Additionally, the backyards at the residences in the southwestern corner of the site would also have direct line-of-sight to Barrett Avenue, with setbacks of approximately 60 feet. The centers of these backyards would be set back from the centerline of Hill Road by 100 to 335 feet. The backyards of these four residences would be exposed to future exterior noise levels ranging from 61 to 68 dBA L_{dn} assuming no attenuation from privacy fences or sound walls.

All other residences along Hill Road would have backyards set back 85 to 335 feet from the centerline of the roadway. Some of these backyards would receive partial shielding from the residences facing north and south. Future exterior noise levels would range from below 60 to 67 dBA L_{dn} assuming no attenuation from privacy fences or sound walls.

One private open space area located on Parcel F would also have direct line-of-sight to Hill Road, with the center of the space set back approximately 290 feet. At this distance, future exterior noise levels would be at or below 61 dBA L_{dn} assuming no attenuation from privacy fences or sound walls.

Residences with backyards set back 150 feet or more from Hill Road or open spaces set back beyond this distance would be partially shielded by intervening buildings and would be exposed to future exterior noise levels of 60 dBA L_{dn} or less.

Several outdoor amenities are located to the east of the three-story senior condominiums. These outdoor use areas would be set back more than 900 feet from the centerline of Hill Road and would be mostly shielded by intervening buildings. These outdoor use areas would be exposed to future exterior noise levels below 60 dBA L_{dn}.

The future noise levels at the centers of the outdoor use areas associated with the residential component of the proposed project would exceed the City's normally acceptable threshold of 60 dBA L_{dn} at backyards nearest to Hill Road. Measures would be required to meet the City's exterior noise limit.

Recommended Measures to Reduce Exterior Noise Levels

Methods available to reduce exterior noise levels at the backyards with direct line-of-sight to Hill Road include site planning alternatives (e.g., increased setbacks and using the proposed buildings as noise barriers), the construction of traditional noise barriers or earth berms, or a combination of the above. For the proposed project, the following options would effectively reduce noise levels to 60 dBA L_{dn} or below at residential backyards:

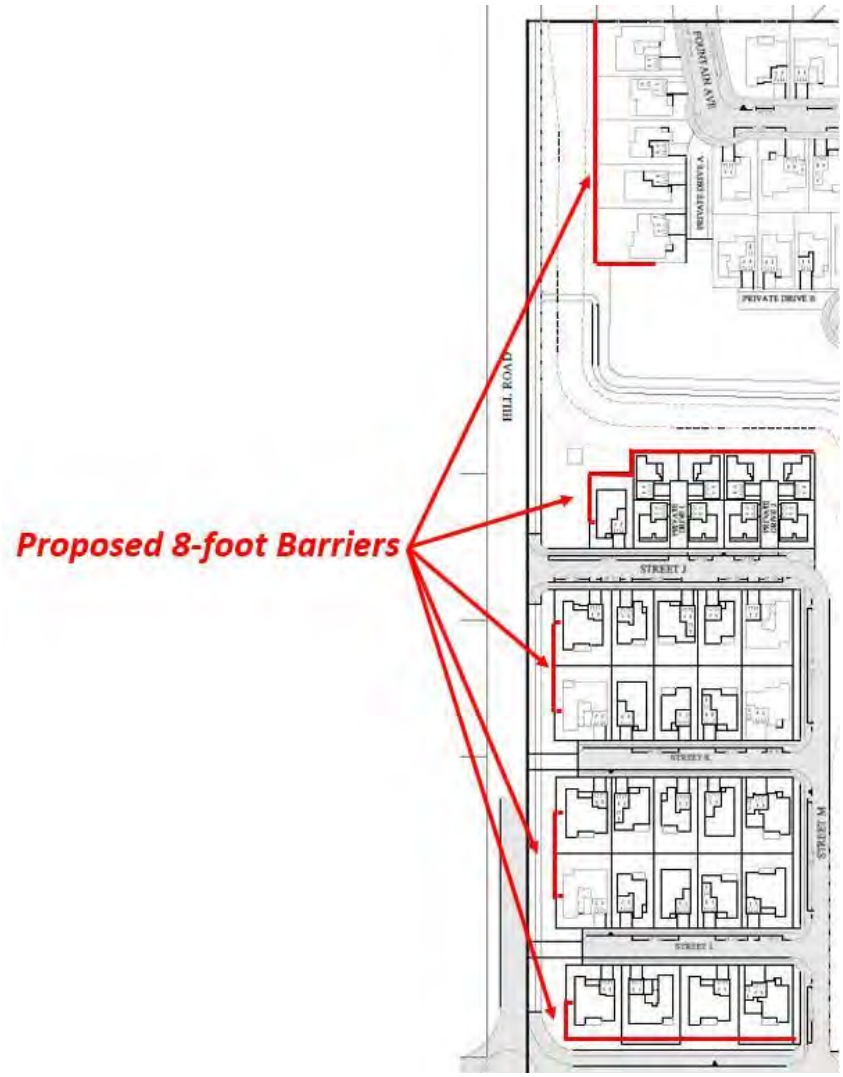
- Reorientating the residences so the backyards are shielded from the roadway by the structures would adequately shield the backyards from traffic noise.

- Increasing setbacks along Hill Road, such that the centers of the backyards would be 185 feet or more from the centerline of the roadway, would reduce noise levels in the backyards to 60 dBA L_{dn} or below.

- Constructing sound walls, specially-designed barrier fences, or berm/wall combinations capable of reducing noise levels by up to 7 dBA. Since the site plan shows walking paths and access driveways, the locations of the barriers would be along the residential property lines of the backyards and side yards, as shown in Figure 12. These noise barriers would need to break the line-of-sight from the backyards to Hill Road to be effective. The minimum height required would be 8 feet, as measured from the pad elevation of each residence. The proposed barriers should be continuous from grade to top, with no cracks or gaps, and have a minimum surface density of three lbs/ft^2 (e.g., one-inch thick wood fence boards, ½-inch laminated glass, concrete masonry units (CMU), or masonry). In the case of a berm/wall combination, the combined height should be 8 feet, with no cracks between the top of the berm and the bottom of the wall.

The final recommendations for noise attenuation shall be confirmed when detailed site plans and grading plans are available during final design of the project. A qualified acoustical consultant shall be retained to study the final plans and confirm final recommendations capable of reducing future exterior noise levels to 60 dBA L_{dn} or below at the centers of each proposed residential backyard.

FIGURE 12 Recommended Barrier Locations



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 L_{dn}, 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 L_{dn}, forced-air mechanical ventilation systems and sound-rated construction methods are normally required. Such methods or materials may include a combination of smaller window and door sizes as a percentage of the total building façade facing the noise source, sound-rated windows and doors, sound rated exterior wall assemblies, and mechanical ventilation so windows may be kept closed at the occupant's discretion.

The nearest façades of the detached single-family residences adjoining Hill Road would be set back from the centerline of the roadway by approximately 60 to 165 feet. At these distances, the rooms facing Hill Road would be exposed to future exterior noise levels ranging from 66 to 71 dBA L_{dn}. Assuming windows to be partially open, future interior noise levels would range from 51 to 56 dBA L_{dn}.

Residential units located more than 180 feet from the centerline of Hill Road would be exposed to future exterior noise levels up to 65 dBA L_{dn}. Assuming windows to be partially open, future interior noise levels would be up to 50 dBA L_{dn}. Beyond this distance, which would include the senior condominium units, residents would be exposed to future exterior noise levels at or below 60 dBA L_{dn} and future interior noise levels at or below 45 dBA L_{dn}.

To meet the interior noise requirements set forth by the State of California and the City of Morgan Hill of 45 dBA L_{dn}, implementation of noise insulation features would be required at residential buildings located within 180 feet of Hill Road.

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 L_{dn} 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 located within 150 feet of Hill Road would require windows and doors with a minimum rating of 31 to 35 STC with adequate forced-air mechanical ventilation to meet the interior noise threshold of 45 dBA L_{dn}.

- A qualified acoustical consultant shall review the final site plan, building elevations, and floor plans prior to construction and recommend building treatments to reduce interior noise levels to 45 dBA L_{dn} or lower. Such methods or materials that would reduce interior noise levels may include a combination of smaller window and door sizes as a percentage of the total building façade facing the noise source, sound-rated windows and doors, sound-rated exterior wall assemblies, and mechanical ventilation so windows may be kept closed at the occupant's discretion. The specific determination of what noise insulation treatments are necessary shall be conducted on a unit-by-unit basis during final design of the project. Results of the analysis, including the description of the necessary noise control treatments, shall be submitted to the City, along with the building plans and approved design, prior to issuance of a building permit.

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

NOISE IMPACTS AND MITIGATION MEASURES

This section describes the significance criteria used to evaluate project impacts under CEQA, provides a discussion of each project impact, and presents mitigation measures, where necessary, to reduce project impacts to less-than-significant levels.

Significance Criteria

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

- A significant noise impact would be identified if the project would generate a substantial temporary or permanent noise level increase over ambient noise levels at existing noise-sensitive receptors surrounding the project site and that would exceed applicable noise standards presented in the General Plan or Municipal Code at existing noise-sensitive receptors surrounding the project site.
    - Hourly average noise levels during construction that would exceed 90 dBA L_{eq} at residential land uses or exceed 100 dBA L_{eq} at commercial land uses would constitute a significant temporary noise increase in the project vicinity.
    - A significant permanent noise level increase would occur if project-generated traffic would result in: a) a noise level increase of more than 3 dBA L_{dn} and the total day-night average noise level exceeding the "normally acceptable" category at an existing noise environment meeting the "normally acceptable" threshold; b) a noise level increase of more than 5 dBA L_{dn} and the total day-night average noise level remains "normally acceptable" at an existing noise environment meeting the "normally acceptable" threshold; c) a noise level increase of more than 3 dBA L_{dn} at a "conditionally acceptable" existing noise environment; or d) a noise level increase of more than 3 dBA L_{dn} at an "unacceptable" existing noise environment.
    - A significant noise impact would be identified if the project would expose persons to or generate noise levels that would exceed applicable noise standards presented in the General Plan or Municipal Code.
- A significant impact would be identified if the construction of the project would generate excessive vibration levels surrounding receptors. Groundborne vibration levels exceeding 0.3 in/sec PPV would have the potential to result in cosmetic damage to normal buildings.
- A significant noise impact would be identified if the project would expose people residing or working in the project area to excessive aircraft noise levels.

Impact 1a: **Temporary Construction Noise.** Existing noise-sensitive land uses would be exposed to a temporary increase in ambient noise levels due to project construction activities. The incorporation of construction best management practices as part of the project's Noise Control Plan would result in a **less-than-significant** temporary noise impact.

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.

Chapter 8.28 of the City of Morgan Hill's Municipal Code establishes allowable hours of construction between 7:00 a.m. and 8:00 p.m., Monday through Friday, and between the hours of 9:00 a.m. to 6:00 p.m. on Saturday. Construction activities may not occur on Sundays or federal holidays. Construction for the proposed project is anticipated to take place during these allowable hours.

While noise thresholds for temporary construction are not provided in the City's General Plan or Municipal Code, the Federal Transit Administration (FDA) includes daytime construction noise limits in the *Transit Noise and Vibration Impact Assessment Manual* from 2018.[1] During daytime hours, an exterior threshold of 90 dBA L_{eq} shall be enforced at residential land uses and 100 dBA L_{eq} at commercial and industrial land uses. Therefore, the temporary construction noise impact would be considered significant if project construction activities produced noise levels exceeding 90 dBA L_{eq} at residential land uses or 100 dBA L_{eq} at commercial land uses surrounding the site.

Construction activities generate considerable amounts of noise, especially during earth-moving activities when heavy equipment is used. The construction of the proposed project would involve demolition of the existing agricultural structures located at the site, excavation, and building construction. The hauling of excavated materials and construction materials would generate truck trips on local roadways, as well. For the proposed project, pile driving is not expected.

Construction activities for the proposed project would include in-tract and off-site public improvements, recreational amenities, and residential development. Full demolition and construction of the project would last approximately 60 months.

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. 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) from the equipment. Table 6 shows the average noise level ranges, by construction phase.

The off-site improvements proposed for the project would include improvements to Jackson Park in the form of relocating the detention basin to the north, connecting it to a storm drain culvert that would divert 100-year flows to the basin. Additionally, approximately two acres of public open space dedication, of which 1.4 acres would go towards public open space, and 0.36 acres would be offered to Jackson Park. Other off-site improvements include improvements to Hill Road, Barrett Avenue, and Sorrel Way. The Hill Road and Barrett Avenue improvements would include

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

curb and gutter with landscape strip, sidewalk, and streetlights. Barrett Avenue would be improved to meet public street standards and include a roundabout. Sorrel Way would be connected through the project near Jackson Park, and improvements would be made to the intersection at Sorrel Way and Barrett Avenue. The roadway extension along Sorrel would impact existing residences for a short period of time when work is in close proximity to the residences, and improvements along Barrett Avenue would be rather minor and not generate excessive noise levels. Construction of the roundabout would potentially result in elevated noise levels at the existing residences located at that intersection, and construction would generate hourly average noise levels ranging from 78 to 88 dBA L_{eq} for a limited time period. Hourly average noise levels generated by construction are about 72 to 88 dBA L_{eq} for residential developments measured at a distance of 50 feet from the center of a busy construction site. Construction-generated noise levels drop off at a rate of about 6 dBA per doubling of the distance between the source and receptor. Shielding by buildings or terrain often result in lower construction noise levels at distant receptors.

A detailed list of equipment expected to be used during construction of the proposed project was provided and is summarized in Table 7. 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 every piece of equipment would operate simultaneously, which would represent the worst-case scenario. 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.

For each construction phase, the worst-case hourly average noise level, as estimated at the property line of each surrounding land use, is also shown in Table 7. For overall construction noise levels, multiple pieces of equipment used simultaneously would add together creating a collective noise source. While every piece of equipment per phase would likely be scattered throughout the site, the noise-sensitive receptors surrounding the site would be subject to the collective noise source generated by all equipment operating at once. Therefore, to assess construction noise impacts at the receiving property lines of noise-sensitive receptors, the collective worst-case hourly average noise level for each phase was centered at the geometrical center of the site and propagated to the nearest property line of the surrounding land uses. These noise level estimates are also shown in Table 7. Noise levels in Table 7 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 at Nearby Land Uses

Phase of Construction	No. Of Days	Construction Equipment (Quantity)	Calculated Hourly Average Noise Levels, L_{eq} (dBA)				
			West Res. (940ft)	North Res. (680ft)	South Res. (790ft)	East Res. (960ft)	School (1,530ft)
Demolition	70	Concrete/Industrial Saw (1) Excavator (3) Rubber-Tired Dozer (2)	61 dBA	64 dBA	63 dBA	61 dBA	57 dBA
Site Preparation	40	Rubber-Tired Dozer (3) Tractor/Loader/Backhoe (4)	62 dBA	65 dBA	64 dBA	62 dBA	58 dBA
Grading/ Excavation	110	Excavator (2) Grader (1) Scraper (2) Rubber-Tired Dozer (1) Tractor/Loader/Backhoe (2)	63 dBA	66 dBA	64 dBA	63 dBA	59 dBA
Trenching/ Foundation	110	Tractor/Loader/Backhoe (1) Excavator (1)	56 dBA	59 dBA	58 dBA	56 dBA	52 dBA
Building – Exterior	1110	Crane (1) Forklift (3) Generator Set (1) Tractor/Loader/Backhoe (3) Welder (1)	61 dBA	63 dBA	62 dBA	60 dBA	56 dBA
Building – Interior/ Architectural Coating	75	Air Compressor (1)	48 dBA	51 dBA	50 dBA	48 dBA	44 dBA
Paving	75	Paver (2) Paving Equipment – Roller (2) Roller (2)	61 dBA	64 dBA	63 dBA	61 dBA	57 dBA

When construction activities occur near noise-sensitive receptors surrounding the site, construction noise levels would not exceed 90 dBA L_{eq} at nearby residences. Therefore, extended exposure to excessive construction noise at the nearest noise-sensitive receptors would be less-than-significant.

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. Construction activities will be conducted in accordance with the provisions of the City's General Plan and the Municipal Code, which limits temporary construction work to between the hours of 7:00 a.m. and 8:00 p.m. Monday through Friday and between 9:00 a.m. to 6:00 p.m. on Saturday. Construction is prohibited on Sundays and federal holidays. Further, the City shall require the construction crew to 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.

Construction Best Management Practices

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

- Equipment and trucks used for construction shall use the best available noise control techniques (e.g., improved mufflers, equipment redesign, use of intake silencers, ducts, engine enclosures, and acoustically attenuating shields or shrouds);

- Impact tools (e.g., jackhammers, pavement breakers, and rock drills) used for construction shall be hydraulically or electrically powered wherever possible to avoid noise associated with compressed air exhaust from pneumatically powered tools; and

- Stationary noise sources shall be located as far from adjacent receptors as possible, and they shall be muffled and enclosed within temporary sheds, incorporate insulation barriers, or include other measures.

- Construct temporary noise barriers, where feasible, to screen stationary noise-generating equipment. 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.

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

- 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.

- Where feasible, temporary power service from local utility companies should be used instead of portable generators.

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

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

- Substitute nail guns for manual hammering, where feasible.

- Avoid the use of circular saws, miter/chop saws, and radial arm saws near the adjoining noise-sensitive receptors. Where feasible, shield saws with a solid screen with material having a minimum surface density of 2 lbs/ft^2 (e.g., such as ¾" plywood).

- Maintain smooth vehicle pathways for trucks and equipment accessing the site, and avoid local residential neighborhoods as much as possible.

- During interior construction, the exterior windows facing noise-sensitive receptors should be closed.

- During interior construction, locate noise-generating equipment within the building to break the line-of-sight to the adjoining receptors.

- 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.

The implementation of the reasonable and feasible controls outlined above would reduce construction noise levels emanating from the site, minimizing disruption and annoyance. With the implementation of these controls, as well as the Municipal Code limits on allowable construction hours, and considering that construction is temporary, the impact would be reduced to a less-than-significant level.

Mitigation Measure 1a: No further mitigation required.

Impact 1b: **Permanent Noise Level Increase/Exceed Applicable Standards.** The proposed project would not result in a substantial permanent noise level increase or exceed applicable standards at noise-sensitive receptors in the project vicinity. **This is a less-than-significant impact.**

Policy SSI-8.5 of the City of Morgan Hill General Plan considers noise level increases resulting from new projects significant if: a) the noise level increase is 5 dBA L_{dn} or greater, with a future noise level of less than 60 dBA L_{dn}, or b) the noise level increase is 3 dBA L_{dn} or greater, with a future noise level of 60 dBA L_{dn} or greater. According to the 2035 noise contours included in the Morgan Hill 2035 Draft Environmental Impact Report,[2] the surrounding residences would have future noise levels exceeding 60 dBA L_{dn}. Therefore, a significant impact would occur if noise levels due to the proposed project would permanently increase ambient levels by 3 dBA L_{dn}.

Under the City of Morgan Hill's Noise Element and Municipal Code, noise levels produced by operational noise at the project site would be considered significant if noise levels substantially exceed existing ambient noise levels.

Project Traffic Increase

The traffic study completed for the proposed project included peak hour traffic volumes for 25 intersections in the project vicinity. The traffic volumes for the existing plus project scenario were compared to the traffic volumes for the existing scenario for all roadway segments included in the traffic study. A traffic noise increase of less than 2 dBA L_{dn} was calculated along each roadway segment included in the study. Therefore, the project-generated traffic noise would not result in a substantial, permanent noise level increase at noise-sensitive receptors.

Mechanical Equipment

Various mechanical equipment, such as heating, ventilation, and air conditioning (HVAC) units, are typical for residential dwellings. At the time of this study, the type, size, number, and generated noise levels of such units were unknown. Additionally, the locations of potential HVAC units on the project site are unavailable at this time. For purposes of assessing the worst-case scenario, each detached single-family residential unit is assumed to have an HVAC system, and the units would be located along the exterior building façades at the rear of side of the structures. Additionally, the senior condominium units are also expected to have HVAC units located on the rooftops.

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. Therefore, multiple units clustered in the same general vicinity are usually operating simultaneously at any given time. Assuming any given residential receptors surrounding the site would be exposed to up to three HVAC units operating simultaneously at any given time for a 24-hour period, the estimated day-night average noise level at 3 feet would be up to 74 dBA L_{dn}, assuming no attenuation from privacy fences, sound walls, or enclosures.

[2] Placeworks, "Morgan Hill 2035 DEIR," January 13, 2016.

The detached single-family residences proposed at the site would be located along all boundaries of the site and would be facing existing residential uses. Existing residences located south of Barrett Avenue and west of Hill Road would be more than 100 feet from the nearest potential HVAC unit. However, adjoining residential property lines north of the site and east of the site would potentially be facing HVAC units and be located within 30 feet. Each of the existing residences adjoining the site to the north and to the east have existing privacy fences approximately 5 feet in height that would provide about 5 dBA reduction from the HVAC noise. Additionally, the nearby school would be approximately 185 feet from the nearest HVAC units. Calculated hourly average noise levels and day-night average noise levels at the receiving property lines of the surrounding receptors are summarized in Table 8. Additionally, estimated noise level increases due to mechanical equipment noise is also summarized in the table.

TABLE 8 Estimated Mechanical Equipment Noise Levels Propagated to the Property Lines of the Nearest Receptors

Receptor	Distance to Receiving Property Line	Hourly L_{eq}, dBA	L_{dn}, dBA	Noise Level Increase, dBA L_{dn}
North and East Residences	30 feet	43	49	0
South and West Residences	100 feet	37	44	0
Nearby School	185 feet	32	38	0

For all receiving receptors, noise levels generated by mechanical equipment noise at the project site would not exceed ambient noise levels at the receiving property lines. Additionally, the noise level increase due to mechanical equipment noise would not be measurable or detectable (0 dBA L_{dn} increase).

Total Combined Project-Generated Noise

The total noise level increase generated by the proposed project would be less than 2 dBA L_{dn}. Therefore, operational noise levels produced by the proposed project would not exceed ambient noise levels produced by local vehicular traffic along the surrounding roadways, and noise due to the proposed project would not result in a substantial permanent noise level increase. This is a less-than-significant impact.

Mitigation Measure 1b: None required.

Impact 2: Exposure to Excessive Groundborne Vibration. Construction-related vibration is not expected to exceed 0.3 in/sec PPV at existing buildings surrounding the project site. This is a **less-than-significant** impact.

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

The California Department of Transportation recommends a vibration limit of 0.5 in/sec PPV for buildings structurally sound and designed to modern engineering standards, which typically consist of buildings constructed since the 1990s. Conservative vibration limits of 0.3 in/sec PPV has been used for buildings that are found to be structurally sound but where structural damage is a major concern (see Table 3 above for further explanation). For historical buildings or buildings that are documented to be structurally weakened, a cautious limit of 0.08 in/sec PPV is often used to provide the highest level of protection. No historical buildings or buildings that are documented to be structurally weakened adjoin the project site. For the purposes of this study, groundborne vibration levels exceeding the conservative 0.3 in/sec PPV limit at the existing residential and commercial buildings surrounding the site would have the potential to result in a significant vibration impact.

Table 9 presents typical vibration levels that could be expected from construction equipment at a distance of 25 feet. Project construction activities, such as drilling, the use of jackhammers, rock drills and other high-power or vibratory tools, and rolling stock equipment (tracked vehicles, compactors, etc.), may generate substantial vibration in the immediate vicinity. Jackhammers typically generate vibration levels of 0.035 in/sec PPV, and drilling typically generates vibration levels of 0.09 in/sec PPV at a distance of 25 feet. Vibration levels would vary depending on soil conditions, construction methods, and equipment used. Table 9 also summarizes the distances to the 0.08 in/sec PPV threshold for historical buildings and to the 0.3 in/sec PPV threshold for all other buildings.

TABLE 9 Vibration Source Levels for Construction Equipment

Equipment		PPV at 25 ft. (in/sec)	Minimum Distance to Meet 0.08 in/sec PPV (feet)	Minimum Distance to Meet 0.3 in/sec PPV (feet)
Clam shovel drop		0.202	58	18
Hydromill (slurry wall)	in soil	0.008	3	1
	in rock	0.017	6	2
Vibratory Roller		0.210	60	19
Hoe Ram		0.089	28	9
Large bulldozer		0.089	28	9
Caisson drilling		0.089	28	9
Loaded trucks		0.076	24	8
Jackhammer		0.035	12	4
Small bulldozer		0.003	1	<1

Source: Transit Noise and Vibration Impact Assessment Manual, Federal Transit Administration, Office of Planning and Environment, U.S. Department of Transportation, FTA Report No. 0123, September 2018, as modified by Illingworth & Rodkin, Inc., December 2021.

Vibration levels are highest close to the source and then attenuate with increasing distance at the rate $\left({}^{D_{ref}}/_{D}\right)^{1.1}$, where D is the distance from the source in feet and D_{ref} is the reference distance of 25 feet. While construction noise levels increase based on the cumulative equipment in use simultaneously, construction vibration levels would be dependent on the location of individual pieces of equipment. That is, equipment scattered throughout the site would not generate a collective vibration level, but a vibratory roller, for instance, operating near the project site boundary would generate the worst-case vibration levels for the receptor sharing that property line.

Further, construction vibration impacts are assessed based on damage to buildings on receiving land uses, not receptors at the nearest property lines. Therefore, the distances used to propagate construction vibration levels at existing structures surrounding the site, which are different than the distances used to propagate construction noise levels (as shown in Table 7), were estimated under the assumption that each piece of equipment from Table 9 was operating along the nearest boundary of the project site, which would represent the worst-case scenario.

The nearest buildings surrounding the site range from 5 to 105 feet from the nearest boundaries of the project site, as summarized in Table 10. At these distances, construction vibration levels would potentially exceed 0.3 in/sec PPV at the existing residential structures to the north and to the east. All residences opposite Barrett Avenue and opposite Hill Road, as well as the school, would not be exposed to vibration levels exceeding the 0.3 in/sec PPV threshold.

TABLE 10 Vibration Source Levels for Construction Equipment

Equipment		PPV (in/sec)				
		Nearest Adjoining Res. Building North & East (5ft)	**Farthest Adjoining Res. Building North & East (30ft)**	**Res. Opposite Barrett Avenue (85ft)**	**Res. Opposite Hill Road (105ft)**	**School (90ft)**
Clam shovel drop		**1.186**	0.165	0.053	0.042	0.049
Hydromill (slurry wall)	in soil	0.047	0.007	0.002	0.002	0.002
	in rock	0.100	0.014	0.004	0.004	0.004
Vibratory Roller		**1.233**	0.172	0.055	0.043	0.051
Hoe Ram		**0.523**	0.073	0.023	0.018	0.022
Large bulldozer		**0.523**	0.073	0.023	0.018	0.022
Caisson drilling		**0.523**	0.073	0.023	0.018	0.022
Loaded trucks		**0.446**	0.062	0.020	0.016	0.019
Jackhammer		0.206	0.029	0.009	0.007	0.009
Small bulldozer		0.018	0.002	0.001	0.001	0.001

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., December 2021.

A study completed by the US Bureau of Mines analyzed the effects of blast-induced vibration on buildings in USBM RI 8507.[3] The findings of this study have been applied to buildings affected by construction-generated vibrations.[4] As reported in USBM RI 8507[3] and reproduced by Dowding,[4] Figure 13 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 13, maximum vibration levels of 0.3 in/sec PPV or lower would result in virtually no measurable damage. With maximum vibration levels of 1.2 in/sec PPV, there would be about 20% chance of threshold or cosmetic damage, which no minor or major damage would be expected at the buildings immediately adjoining the project site.

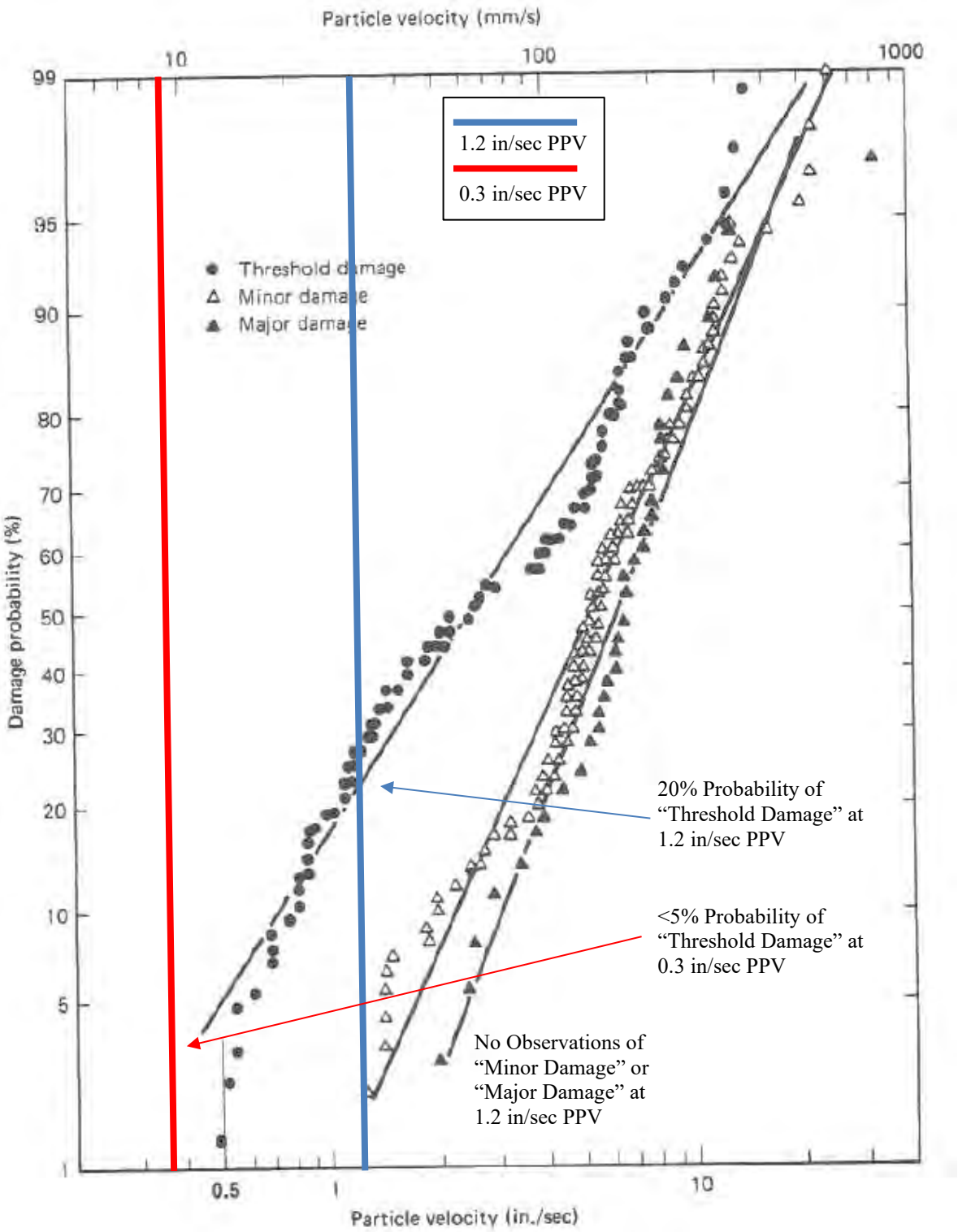
Heavy vibration-generating construction equipment, such as vibratory rollers or clam shovel drops, would have the potential to produce vibration levels exceeding 0.3 in/sec PPV at buildings within 20 feet of the project site.

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 generate vibration levels exceeding the 0.3 in/sec PPV threshold at buildings within 20 feet of the site. Such vibration levels would be capable of cosmetically damaging the adjacent buildings.

[3] Siskind, D.E., M.S. Stagg, J.W. Kopp, and C.H. Dowding, Structure Response and Damage Produced by Ground Vibration form Surface Mine Blasting, RI 8507, Bureau of Mines Report of Investigations, U.S. Department of the Interior Bureau of Mines, Washington, D.C., 1980.
[4] Dowding, C.H., Construction Vibrations, Prentice Hall, Upper Saddle River, 1996.

FIGURE 13 Probability of Cracking and Fatigue from Repetitive Loading



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

Mitigation Measure 2:

Critical factors pertaining to the impact of construction vibration on sensitive receptors include the proximity of the existing structures to the project site, the soundness of the structures, and the methods of construction used. Construction activity for the proposed project could potentially result in cosmetic damage to the residences adjacent to the active construction site if care is not taken to select the minimum appropriate equipment to complete the construction task. To address potential impacts related to vibration, the project will implement the following vibration controls as a condition of approval:

- Prohibit the use of heavy vibration-generating construction equipment within 25 feet of residences. Use a smaller vibratory roller, such as the Caterpillar model CP433E vibratory compactor, when compacting materials within 25 feet of residences to the north and east.

- Avoid dropping heavy equipment within 25 feet of residences. Use alternative methods, where feasible.

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

- Avoid using vibratory rollers or tampers within 25 feet of sensitive uses.

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

- The contractor shall alert heavy equipment operators to the close proximity of the adjacent structures so they can exercise extra care.

The implementation of these vibration controls would reduce the impact to a less-than-significant level.

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

San Martin Airport is a public non-towered airport located about 3.2 miles southwest of the project site. According to the Santa Clara County Airport Land Use Commission's Comprehensive Land Use Plan for this airport,[5] the project site lies outside the 2022 55 dBA CNEL noise contour. While aircraft flyovers would at times be audible at project site, noise levels due to aircraft would not result in future exterior noise levels of 60 dBA L_{dn}/CNEL or more, and therefore, both the exterior and interior noise levels resulting from aircraft would be compatible with the proposed project.

[5] Santa Clara County Airport Land Use Commission, "Comprehensive Land Use Plan Santa Clara County: South County Airport," September 10, 2008 and amended November 16, 2016.

Norman Y. Mineta San José International Airport is more than 20 miles northwest of the project site. The project site lies outside the 2037 noise contour figure for the airport, which is shown in the City's new Airport Master Plan Environmental Impact Report.[6] The proposed project would be compatible with the aircraft noise generated from the nearest airports. This is a less-than-significant impact.

Mitigation Measure 3: None required.

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 L_{dn} or greater for future levels exceeding 60 dBA L_{dn} or was 5 dBA L_{dn} or greater for future levels at or below 60 dBA L_{dn}; 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 L_{dn} or more attributable solely to the proposed project.

The traffic study included Year 2030 traffic volumes, with and without the project, and Year 2035 GP, with and without the project. When compared to the existing traffic volumes, several roadway segments resulted in future noise level increases of 3 dBA L_{dn} or more; however, these increases were calculated for scenarios with and without the project, which means the project would not result in a cumulatively considerable contribution. Therefore, the project would not result in a cumulative noise increase due to traffic.

There are no known approved projects surrounding the project site that would be constructed during the same timeframe as the proposed project. Therefore, the noise-sensitive receptors surrounding the project site would not be subject to cumulative construction impacts.

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