APPENDIX E:
NOISE

Noise Descriptors

Noise is most often defined as unwanted sound. Although sound can be easily measured, the perception of noise and the physical response to sound complicate the analysis of its impact on people. People judge the relative magnitude of sound sensation in subjective terms such as "noisiness" or "loudness."

The following are brief definitions of terminology used in this section:

- **Sound.** A disturbance created by a vibrating object, which, when transmitted by pressure waves through a medium such as air, is capable of being detected by a receiving mechanism, such as the human ear or a microphone.
- **Noise.** Sound that is loud, unpleasant, unexpected, or otherwise undesirable.
- **Intrusive.** Noise which intrudes over and above the existing ambient noise at a given location. Relative intrusiveness depends on amplitude, duration, frequency, time of occurrence, and tonal or informational content, as well as the prevailing ambient noise level.
- **Decibel (dB).** A unit-less measure of sound on a logarithmic scale.
- **A-Weighted Decibel (dBA).** An overall frequency-weighted sound level in decibels that approximates the frequency response of the human ear.
- **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.
- **Equivalent Continuous Noise Level (L_{eq}).** The mean of the noise level (or energy) averaged over the measurement period.
- **Statistical Sound Level (Ln).** The sound level that is exceeded "n" percent of time during a given sample period. For example, the L_{50} level is the statistical indicator of the time-varying noise signal that is exceeded 50 percent of the time (during each sampling period); that is, half of the sampling time, the changing noise levels are above this value and half of the time they are below it. This is called the "median sound level." The L_{10} level, likewise, is the value that is exceeded 10 percent of the time (i.e. near the maximum) and this is often known as the "intrusive sound level." The L90 is the sound level exceeded 90 percent of the time and is often considered the "effective background level" or "residual noise level."
- **Day-Night Sound Level (L_{dn} or DNL).** The energy-average of the A-weighted sound levels occurring during a 24-hour period, with 10 dB added to the sound levels occurring during the period from 10:00 p.m. to 7:00 a.m.
- **Community Noise Equivalent Level (CNEL).** The energy-average of the A-weighted sound levels occurring during a 24-hour period, with 5 dB added to the levels occurring during the period from 7:00 p.m. to 10:00 p.m. and 10 dB added to the sound levels occurring during the period from 10:00 p.m. to 7:00 a.m. Note: For general community/environmental noise, CNEL and L_{dn} values rarely differ by more than 1 dB (with the CNEL being only slightly more restrictive – that is, higher than the Ldn value). As a matter of practice, L_{dn} and CNEL values are considered to be equivalent/ interchangeable and are treated as such in this assessment.

Characteristics of Sounds

When an object vibrates, it radiates part of its energy as acoustical pressure in the form of a sound wave. Sound can be described in terms of amplitude (loudness), frequency (pitch), and duration (time). The human hearing system is not equally sensitive to sound at all frequencies. Therefore, to approximate the human, frequency-dependent response, the A-weighted filter system is used to adjust measured sound levels. The normal range of human hearing extends from approximately 0 dBA (the threshold of detection) to 140 dBA (the threshold of pain).

Unlike linear units such as inches or pounds, decibels are measured on a logarithmic scale to better account for the large variations in pressure amplitude (the above range of human hearing, 0 to 140 dBA, represents a ratio in pressures of one hundred trillion to one). All noise levels in this study are relative to the industry-standard pressure reference value of 20 micropascals. Because of the physical characteristics of noise transmission and perception, the relative loudness of sound does not closely match the actual amounts of sound energy. Table N-1 presents the subjective effect of changes in sound pressure levels.

TABLE N-1 CHANGE IN APPARENT LOUDNESS

± 3 dB	Threshold of human perceptibility
± 5 dB	Clearly noticeable change in noise level
± 10 dB	Half or twice as loud
± 20 dB	Much quieter or louder

Source: Bies and Hansen, 2009.

Sound is generated from a source; the decibel level decreases as the distance from that source increases. Sound dissipates exponentially with distance from the noise source. This phenomenon is known as spreading loss or distance attenuation.

When sound is measured for distinct time intervals, the statistical distribution of the overall sound level during that period can be obtained. For example, L_{50} is the noise level that is exceeded 50 percent of the time. Similarly, the L_{02}, L_{08}, and L_{25} values are exceeded 2, 8, and 25 percent of the time or 1, 5, and 15 minutes per hour. 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. The energy-equivalent sound level (L_{eq}) is the most common parameter associated with community noise measurements. The L_{eq} metric is a single-number noise descriptor of the energy-average sound level over a given period of time. An hour is the most common period of time over which average sound is measured, but it can be measured over any duration. Other values typically noted during a noise survey are the L_{min} and L_{max}. These values are the minimum and maximum root-mean-square (RMS) noise levels obtained over the stated measurement period.

Since sensitivity to noise increases during the evening and at night, when excessive noise can interfere with relaxation and/or the ability to sleep, 24-hour descriptors have been developed that incorporate artificial noise penalties added to quiet-time noise events. Because of this increased sensitivity to unwanted noise intrusion during the evening and nighttime hours, State law requires, for planning purposes, that this increased noise sensitivity be accounted for. The Day/Night Average Sound Level, L_{dn}, is a measure of the cumulative noise exposure in a community, with a 10 dB addition to nocturnal (10:00 p.m. to 7:00

a.m.) noise levels. The Community Noise Equivalent Level (CNEL) is a similar 24-hour cumulative measure of noise; however it differs slightly from L_{dn} in that 5 dB is added to the levels occurring during the period from 7:00 p.m. to 10:00 p.m. and 10 dB added to the sound levels occurring during the period from 10:00 p.m. to 7:00 a.m.

Psychological and Physiological Effects of Noise

Physical damage to human hearing begins at prolonged exposure to noise levels higher than 85 dBA. Exposure to high noise levels affects the entire system; prolonged noise exposure in excess of 75 dBA increases body tensions, thereby affecting blood pressure and functions of the heart and nervous system. Extended periods of noise exposure above 90 dBA results in permanent cell damage, which is the main driver for employee hearing protection regulations in the workplace. For community environments, the ambient or background noise problem is widespread and generally more concentrated in urban areas than in outlying, less-developed areas Since most people do not routinely work with decibels or A-weighted sound levels, it is often difficult to appreciate what a given sound pressure level (SPL) number means. To help relate noise level values to common experience, Table N-2 shows typical noise levels from noise sources.

Causes for annoyance include interference with speech, radio, television, and sleep and rest, as well as induced structural vibrations. The L_{dn} as a measure of noise has been found to provide a valid correlation of noise level and the percentage of people annoyed. The threshold for annoyance from vehicle noise is about 55 dBA L_{dn}. At an L_{dn} of about 60 dBA, approximately 8 percent of the population is highly annoyed. When the L_{dn} increases to 70 dBA, the highly-annoyed proportion of the population increases to about 20 to 25 percent. There is, therefore, an increase of about 2 percent per decibel of increased noise between an L_{dn} of 60 to 70 dBA. The thresholds for speech interference indoors are approximately 45 dBA for continuous noise and approximately 55 dBA for fluctuating noise. Outdoors the thresholds are roughly 15 dBA higher. Steady noise above 35 dBA and fluctuating noise levels above roughly 45 dBA have been shown to affect sleep.

TABLE N-2 TYPICAL NOISE LEVELS

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	110	Rock Band
Jet Flyover at 1,000 feet		
	100	
Gas Lawn Mower at 3 feet		
	90	
Diesel Truck at 50 feet, at 50 miles per hour		Food Blender at 3 feet
	80	Garbage Disposal at 3 feet
Noisy Urban Area, Daytime		
	70	Vacuum Cleaner at 10 feet
Commercial Area		Normal speech at 3 feet
Heavy Traffic at 300 feet	60	
		Large Business Office
Quiet Urban Daytime	50	Dishwasher Next Room
Quiet Urban Nighttime	40	Theater, Large Conference Room (background)
Quiet Suburban Nighttime		
	30	Library
Quiet Rural Nighttime		Bedroom at Night, Concert Hall (background)
	20	
		Broadcast/Recording Studio
	10	
Lowest Threshold of Human Hearing	0	Lowest Threshold of Human Hearing

Source: Bies and Hansen, 2009.

Vibration Fundamentals

Vibration is an oscillatory motion through a solid medium in which the motion's amplitude can be described in terms of displacement, velocity, or acceleration. Vibration is normally associated with activities stemming from operations of railroads or vibration-intensive stationary sources, but can also be associated with construction equipment such as jackhammers, pile drivers, and hydraulic hammers. Vibration displacement is the distance that a point on a surface moves away from its original static position. The instantaneous speed that a point on a surface moves is the velocity, and the rate of change of the speed is the acceleration. Each of these descriptors can be used to correlate vibration to human response, building damage, and acceptable equipment vibration levels. During construction, the operation of construction equipment can cause groundborne vibration. During the operational phase of a project, receptors may be subject to levels of vibration that can cause annoyance due to noise generated from vibration of a structure or items within a structure. These types of vibration are best measured and described in terms of velocity and acceleration.

The three main types of waves associated with groundborne vibrations are surface or Rayleigh waves, compression or P-waves, and shear or S-waves.

- Surface or Rayleigh waves travel along the ground surface. They carry most of their energy along an expanding cylindrical wave front, similar to the ripples produced by throwing a rock into a lake. The particle motion is more or less perpendicular to the direction of propagation.
- Compression or P-waves are body waves that carry their energy along an expanding spherical wave front. The particle motion in these waves is longitudinal, in a push-pull motion. P-waves are analogous to airborne sound waves.
- Shear or S-waves are also body waves, carrying their energy along an expanding spherical wave front. Unlike P-waves, however, the particle motion is transverse, or perpendicular to the direction of propagation.

Vibration amplitudes are usually described in terms of either the peak particle velocity (PPV) or the RMS velocity. PPV is the maximum instantaneous peak of the vibration signal and RMS is the square root of the average of the squared amplitude of the signal. PPV is more appropriate for evaluating potential building damage, whereas RMS is typically more suitable for evaluating human response.

The units for PPV and RMS velocity are normally inches per second (in/sec). Often, vibration is presented and discussed in dB units in order to compress the range of numbers required to describe the vibration. In this study, all PPV and RMS velocity levels are in in/sec and all vibration levels are in dB relative to one micro-inch per second (abbreviated as VdB). Typically, groundborne vibration generated by human activities attenuates rapidly with distance from the source of the vibration. Even the more persistent Rayleigh waves decrease relatively quickly as they move away from the source of the vibration. Man-made vibration problems are, therefore, usually confined to relatively short distances (500 to 600 feet or less) from the source.

Effects of Vibration

Human response to ground vibration has been correlated best with the velocity of the ground. The velocity of the ground is expressed on the decibel scale. The reference velocity is 1×10^{-6} inch/second RMS, which equals 0 VdB, and 1 inch/second equals 120 VdB. The abbreviation "VdB" is used in this

document for vibration decibels to reduce the potential for confusion with sound decibels. One of the problems with developing suitable criteria for groundborne vibration is the limited research into human response to vibration and, more importantly, human annoyance inside buildings. The U.S. Department of Transportation Federal Transit Administration (FTA) has developed rational vibration limits that can be used to evaluate human annoyance to groundborne vibration. These criteria are primarily based on experience with rapid transit and commuter rail systems. Railroad and transit operations are potential sources of substantial ground vibration depending on distance, the type and the speed of trains, and the type of track. Trains generate substantial vibration due to their engines, steel wheels, heavy loads, and wheel-rail interactions.

Additionally, construction operations generally include a wide range of activities that can generate groundborne vibration, which varies in intensity depending on several factors. In general, blasting and demolition of structures, as well as pile driving and vibratory compaction equipment generate the highest vibrations. Because of the impulsive nature of such activities, the use of the peak particle velocity descriptor (PPV) has been routinely used to measure and assess groundborne vibration and almost exclusively to assess the potential of vibration to induce structural damage and the degree of annoyance for humans. Vibratory compactors or rollers, pile drivers, and pavement breakers can generate perceptible amounts of vibration at up to 200 feet. Heavy trucks can also generate groundborne vibrations, which can vary, depending on vehicle type, weight, and pavement conditions. Potholes, pavement joints, discontinuities, differential settlement of pavement, etc., all increase the vibration levels from vehicles passing over a road surface. Construction vibration is normally of greater concern than vibration from normal traffic flows on streets and freeways with smooth pavement conditions.

"Architectural" damage can be classified as cosmetic only, such as minor cracking of building elements, while "structural" damage may threaten the integrity of a building. Safe vibration limits that can be applied to assess the potential for damaging a structure vary by researcher and there is no general consensus as to what amount of vibration may pose a threat for structural damage to a building. Construction-induced vibration that can be detrimental to the building is very rare and has only been observed in instances where the structure is in a high state of disrepair and the construction activity occurs immediately adjacent to the structure. Table N-3 shows the criteria established by the FTA for the likelihood of structural damage due to vibration.

TABLE N-3 GROUNDBORNE VIBRATION CRITERIA: ARCHITECTURAL DAMAGE

Building Category		PPV (in/sec)	L_v (VdB)[a]
I.	Reinforced concrete, steel, or timber (no plaster)	0.5	102
II.	Engineered concrete and masonry (no plaster)	0.3	98
III.	Non-engineered timber and masonry buildings	0.2	94
IV.	Buildings extremely susceptible to vibration damage	0.12	90

[a] RMS velocity calculated from vibration level (VdB) using the reference of one micro-inch/second.
Source: Federal Transit Administration, Transit Noise and Vibration Impact Assessment, 2006.

To sensitive individuals, vibrations approaching the threshold of perception can be annoying. Persons exposed to elevated ambient vibration levels such as people in an urban environment may tolerate a higher vibration level. Table N-4 displays human annoyance and the effects on buildings resulting from continuous vibration. As discussed previously, annoyance is a subjective measure and vibrations may be found to be annoying at much lower levels than those shown, depending on the level of activity or the sensitivity of the individual.

TABLE N-4 REACTION OF PEOPLE AND DAMAGE TO BUILDINGS FOR CONTINUOUS/FREQUENT INTERMITTENT VIBRATION LEVELS

Velocity Level, PPV (in/sec)	Human Reaction	Effect on Buildings
0.02	Barely perceptible	Vibration unlikely to cause damage of any type to any structure
0.08	Distinctly perceptible	Recommended upper level of the vibration to which ruins and ancient monuments should be subjected
0.1	Strongly perceptible	Virtually no risk of damage to normal buildings
0.3	Strongly perceptible to severe	Threshold at which there is a risk of damage to older residential dwellings such as plastered walls or ceilings
0.5	Severe – Vibrations considered unpleasant	Threshold at which there is a risk of damage to newer residential structures

Source: Transportation- and Construction-Induced Vibration Guidance Manual, California Department of Transportation, June 2004

Another potential environmental impact topic with respect to vibration is during the construction phase of any given project. Vibration levels generated by construction activities vary depending on site-specific conditions, such as soil characteristics, construction methods, equipment used, and the characteristics of the receiving building. High-energy vibrational sources used during construction include pile driving, caisson drilling, the use of jackhammers, rock drills and other high-power or vibratory tools, and/or the use of rolling stock equipment (tracked vehicles, compactors, etc.) have greatest potential to generate high ground vibration levels and are of primary concern in regard to structural damage; particularly when their use occurs within 100 feet of structures. Other construction-related equipment may also potentially generate substantial vibration in the immediate vicinity. Table N-5 lists vibration levels for typical construction equipment.

TABLE N-5 GROUNDBORNE VIBRATION LEVELS FOR CONSTRUCTION EQUIPMENT

Equipment	Approximate Velocity Level at 25 Feet (VdB)	Approximate RMS[a] Velocity at 25 Feet (inch/sec)
Pile Driver (Impact) Upper Range	112	1.518
Pile Driver (Impact) Lower Range	104	0.644
Pile Driver (Sonic) Upper Range	105	0.734
Pile Driver (Sonic) Lower Range	93	0.170
Large Bulldozer	87	0.089
Caisson Drilling	87	0.089
Jackhammer	79	0.035
Small Bulldozer	58	0.003
Loaded Trucks	86	0.076
FTA Criteria – Human Annoyance (Daytime)	78 to 90[b]	—
FTA Criteria – Structural Damage	—	0.2 to 0.5[c]

a. RMS velocity calculated from vibration level (VdB) using the reference of 1 micro-inch/second.
b. Depending on affected land use. For residential 78VdB, for offices 84 VdB, workshops 90 VdB.
c. Depending on affected building structure, for timber and masonry buildings 0.2 in/sec, for reinforced-concrete, steel, or timber 0.5 in/sec.
Source: Federal Transit Administration, Transit Noise, and Vibration Impact Assessment, 2006.

Noise- and Vibration-Sensitive Receptors

Certain land uses are particularly sensitive to noise and vibration, including residential, school, and open space/recreation areas where quiet environments are necessary for enjoyment, public health, and safety. Sensitive land uses within the City of San Mateo include residences, schools, places of worship, and recreational areas. These uses are regarded as sensitive because they are where citizens most frequently engage in activities which are likely to be disturbed by noise, such as reading, studying, sleeping, resting, or otherwise engaging in quiet or passive recreation. Commercial and industrial uses are not considered noise- and vibration-sensitive uses for the purposes of this analysis since noise- and vibration-sensitive activities are less likely to be undertaken in these areas, and because these uses often themselves generate noise in excess of what they receive from other uses.

REGULATORY FRAMEWORK

To limit population exposure to physically and/or psychologically damaging as well as intrusive noise levels, the federal government, the State of California, various county governments, and most municipalities in the state, have established standards and ordinances to control noise. This section describes the regulatory framework related to noise and vibration in the vicinity of the Project site.

State of California Noise Standards

State of California Building Code

The State of California's noise insulation standards are codified in the California Code of Regulations, Title 24, Building Standards Administrative Code, Part 2, California Building Code. These noise standards are applied to new construction in California for the purpose of ensuring that the level of exterior noise transmitted to and received within the interior living spaces of buildings is compatible with their comfortable use. For new residential dwellings, hotels, motels, dormitories, and school classrooms, the acceptable interior noise limit for habitable rooms in new construction is 45 dBA CNEL or L_{dn}. Title 24 requires acoustical studies for residential development in areas exposed to more than 60 dBA CNEL to demonstrate that the structure has been designed to limit interior noise in habitable rooms to acceptable noise levels. Where exterior noise levels are projected to exceed 60 dBA CNEL or L_{dn} at the façade of a building, a report must be submitted with the building plans describing the noise control measures that have been incorporated into the design of the Project to meet the 45 dBA noise limit.

City of San Mateo Noise and Vibration Standards

San Mateo Vision 2030 General Plan Noise Element

The Noise Element of the City of San Mateo Vision 2030 General Plan sets forth goals, policies, and actions, shown in Table N-6, to assess and control environmental noise.

TABLE N-6 GOALS, POLICIES, AND ACTIONS OF THE SAN MATEO VISION 2030 GENERAL PLAN NOISE ELEMENT

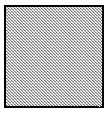
Goal/ Policy Number	Goal/Policy Content
Goal 1	Protect "noise sensitive" land uses from excessive noise levels.
Policy N1.1	Interior Noise Level Standard. Require submittal of an acoustical analysis and interior noise insulation for all "noise sensitive" land uses listed in Table N-1 that have an exterior noise level of 60 dB (L_{dn}) or above, as shown on Figure N-1 [of the General Plan]. The maximum interior noise level shall not exceed 45 dB (L_{dn}) in any habitable rooms.
Policy N1.2	Exterior Noise Level Standard. Require an acoustical analysis for new parks, play areas, and multi-family common open space (intended for the use and the enjoyment of residents) that have an exterior noise level of 60 dB (L_{dn}) or above, as shown on Figure N-1 [of the General Plan]. Require an acoustical analysis that uses peak hour L_{eq} for new parks and play areas. Require a feasibility analysis of noise reduction measures for public parks and play areas. Incorporate necessary mitigation measures into residential project design to minimize common open space noise levels. Maximum exterior noise should not exceed 67 dB (L_{dn}) for residential uses and should not exceed 65 dB (L_{eq}) during the noisiest hour for public park uses.
Goal 2	Minimize unnecessary, annoying, or unhealthful noise.
Policy N2.1	Noise Ordinance. Continue implementation and enforcement of the City's existing noise control ordinance: a) which prohibits noise that is annoying or injurious to neighbors of normal sensitivity, making such activity a public nuisance, and b) restricts the hours of construction to minimize noise impact.
Policy N2.2	Minimize Noise Impact. Protect all "noise-sensitive" land uses listed in Tables N-1 and N-2 [of the General Plan] from adverse impacts caused by the noise generated on-site by new developments. Incorporate necessary mitigation measures into development design to minimize noise impacts. Prohibit long-term exposure increases of 3 dB (L_{dn}) or greater at the common property line, or new uses which generate noise levels of 60 dB (L_{dn}) or greater at the property line, excluding existing ambient noise levels.
Policy N2.3	Minimize Commercial Noise. Protect land uses other than those listed as "noise sensitive" in Table N-1 [of the General Plan] from adverse impacts caused by the on-site noise generated by new developments. Incorporate necessary mitigation measures into development design to minimize noise impacts. Prohibit new uses that generate noise levels of 65dB (L_{dn}) or above at the property line, excluding existing ambient noise levels.
Policy 2.4	Traffic Noise. Recognize projected increases in ambient noise levels resulting from traffic increases, as shown on Figure N-2 [of the General Plan]. Promote the installation of noise barriers along highways where "noise-sensitive" land uses listed in Table N-1 [of the General Plan] are adversely impacted by unacceptable noise levels [60 dB (L_{dn}) or above]. Require adequate noise mitigation to be incorporated into the widening of SR 92 and US 101. Accept noise increases on El Camino Real at existing development, and require new multi-family development to provide common open space having a maximum exterior noise level of 67 dB (L_{dn}).
Policy 2.5	Railroad Noise. Promote the installation of noise barriers along the railroad corridor where "noise-sensitive" land uses are adversely impacted by unacceptable noise levels [60 dB (L_{dn}) or greater]. Promote adequate noise mitigation to be incorporated into any rail service expansion or track realignment. Study the need of depressing the rail line to eliminate at-grade crossings or other mitigation measures to decrease noise levels prior to substantial expansion of the rail service.

Source: San Mateo Vision 2030 General Plan Noise Element.

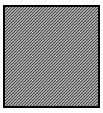
The Noise Element also sets forth land use compatibility guidelines for noise-sensitive land uses and outdoor activity areas. Although the land use noise compatibility guidelines adopted by the City of San Mateo are similar to those provided the State of California General Plan Guidelines, the City of San Mateo has opted to make a variety of changes to better reflect local conditions and to provide for more "distinct" noise compatibility categories, as, shown in Table N-7. It is also important to note that the City of San Mateo specifies that these compatibility guidelines are intended to be "utilized to evaluate the suitability of land-use changes only and not to determine cumulative noise impacts."

TABLE N-7 NOISE SENSITIVE LAND-USE COMPATIBILITY GUIDELINES FOR COMMUNITY NOISE ENVIRONMENTS AND NOISE GUIDELINES FOR OUTDOOR ACTIVITIES

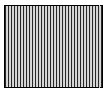
Land Use Category	Day-Night Average Sound Level (L_{dn}), Decibels 55 60 65 70 75 80
Single-Family Residential	
Multi-Family Residential	
Hotels, Motels, and Other Lodging Uses	
Long-Term Care Facilities	
Hospitals	
Schools	
Multi-Family Common Open Space Intended for the Use and Enjoyment of Residents	
	Average Sound Level (L_{eq}), Decibels 55 60 65 70 75 80
Parks, Playgrounds	



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.



Normally Unacceptable:
New construction should be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.



Conditionally Acceptable:
New construction should be undertaken only after a detailed analysis of the noise reduction requirement is conducted and needed noise insulation features included in the design.

Source: San Mateo Vision 2030 General Plan Noise Element.

San Mateo Municipal Code

Chapter 7.30 Noise Regulations

The City of San Mateo Municipal Code (Code) contains a variety of quantitative, land-use based noise standards, as well as a variety of provisions to control noise in general and from specific sources. All noise levels referred to in the municipal code, whether denoted as dB or dBA, refer to the A-weighted decibel scale. Section 7.30.030 of the Code adopts designated noise zones based on land use categories, and Section 7.30.040 sets specific maximum permissible sound levels for each of those zones.

The following list describes each Noise Zone, as characterized in the San Mateo Municipal Code:

- **Noise Zone 1**. All property in any single family residential zone (including adjacent parks and open space) as designated on the City's zoning map prepared pursuant to the provisions of Title 27, or any revisions thereto.
- **Noise Zone 2**. All property in any commercial/mixed residential, multi-family residential, specific plan district or Planned Unit Development (PUD) as designated on the City's zoning map prepared pursuant to the provisions of Title 27, or any revisions thereto.
- **Noise Zone 3**. All property in any commercial or central business district as designated on the City's zoning map prepared pursuant to the provisions of Title 27, or any revisions thereto.
- **Noise Zone 4**. All property in any manufacturing or industrial zone as designated on the City's zoning map prepared pursuant to the provisions of Title 27, or any revisions thereto.

Table N-8 reproduces Table 7.30.040 from the San Mateo Municipal Code and contains the standards for each noise zone. Based on these noise level standards, the San Mateo Municipal Code stipulates:

(a) It is unlawful for any person to operate or cause to be operated any source of sound at any location within the City or allow the creation of any noise on property owned, leased, occupied or otherwise controlled by such person, which causes the noise level when measured on any other property to exceed:

1. *The noise level standard for that property as specified in Table 7.30.040 for a cumulative period of more than thirty minutes in any hour;*
2. *The noise level standard plus five dB for a cumulative period of more than fifteen minutes in any hour;*
3. *The noise level standard plus ten dB for a cumulative period of more than five minutes in any hour;*
4. *The noise level standard plus fifteen dB for a cumulative period of more than one minute in any hour; or*
5. *The noise level standard or the maximum measured ambient level, plus twenty dB for any period of time.*

(b) If the measured ambient level for any area is higher than the standard set in Table 7.30.040 [shown in Table 4.9-7]*, then the ambient shall be the base noise level standard for purposes of subsection (a)(1) of this section. In such cases, the noise levels for purposes of subsections (a)(2) through (a)(5) of this section shall be increased in five dB increments above the ambient.*

TABLE N-8 SAN MATEO MUNICIPAL CODE TABLE 7.30.040: NOISE LEVEL STANDARDS

Noise Zone	Time Period	Noise Level (dB)
Zone 1	10 p.m.–7 a.m.	50
	7 a.m.– 10 p.m.	60
Zone 2	10 p.m.–7 a.m.	55
	7 a.m.– 10 p.m.	60
Zone 3	10 p.m.–7 a.m.	60
	7 a.m.– 10 p.m.	65
Zone 4	Anytime	70

Source: San Mateo Municipal Code: "Adapted from 'The Model Community Noise Control Ordinance,' Office of Noise Control, California Department of Health"

Additionally, Section 7.30.050 the Code also adopts the following interior noise limit:

It is unlawful for any person to operate or cause to be operated any source of sound, on multifamily residential property or multi-tenant commercial or industrial property at a noise level more than ten dB above the level allowed by Section 7.30.040 three feet from any wall, floor or ceiling inside any unit on the same property when the windows and doors of the unit are closed, except within the unit in which the noise source or sources is located.

Beyond these general limitations on the generation of noise, the Code adopts a variety of special provisions to limit noise generation from specific sources, such as sound performances and special events, vehicle horns, and alarm systems. The Code also contains sections pertaining to amplified sound, and sound from entertainment venues and events, including social gatherings and musical performances. Additionally, the Code contains general exemptions for noise generated by activities relating to utility and street repairs, street sweepers, garbage service, emergency response, emergency generators, and fire alarms.

Noise resulting from City-permitted construction, alternation, repair, or land development activities is generally allowed by the Municipal Code, but is subject to certain restrictions. Construction hours are limited to between 7:00 a.m. and 7:00 p.m. on weekdays, 8:00 a.m. and 5:00 p.m. on Saturdays, and 12:00 p.m. to 4:00 p.m. on Sundays and holidays. These limitations on construction are prescribed by both Section 7.30.060(e) of the noise regulations and Section 23.06.060 under Title 23 Buildings and Construction. Construction permits may in some cases allow construction outside of these hours provided that no individual piece of equipment results in a noise level exceeding 90 dBA at a distance of 25 feet from the equipment or as close to 25 feet as possible for equipment within a structure, or provided that the noise level at any point outside of the property plane is not in exceedance of 90 dBA. Additionally, Section 23.06.060 exempts indoor construction from these requirements, provided that such indoor construction does not result in noise levels exceeding applicable standards as measured ten feet from the property line. Furthermore, Section 23.06.061 allows granting of exemptions for construction hours if, in addition to meeting a variety of other criteria, the exemption would be for emergency work or if the exemption would reduce the total noise associated with the project by decreasing the duration of construction.

For any provisions of the noise regulations within the Code, the City may issue an exception permit, subject to certain conditions contained in Section 7.30.070 of the Code. If an applicant can demonstrate to appropriate City staff that a thorough analysis indicates that noise abatement techniques necessary to prevent noise levels in violation of the chapter are impractical or unreasonable, an exception permit may be issued; however, exception permits must, to the extent possible, minimize the public detriment caused by the exception, and should be over the shortest duration possible and never longer than six months. Such permits may be renewed "upon a showing of good cause," subject to additional compliance measures, as appropriate.

Other Municipal Code Chapters

Additional chapters in the San Mateo Municipal Code contain provisions relating to noise and vibration; however, the regulations are typically not quantitative or are related to highly specific sources of noise. The majority of other mentions of noise and vibration are found in Title 27, Zoning, of the Municipal Code. Most provisions in this title govern particular land uses, zoning designations, or permitted uses, and prohibit in general the generation of noise in such a manner as to cause a nuisance or otherwise violate other sections of the Code; other provisions nonspecifically require mitigation of adverse noise impacts. The zoning code does, however, contain one set of quantitative standards under Section 27.56.090, which specifies octave-band based noise limits for manufacturing district industrial facilities that interface with residential and commercial land uses; these standards are illustrated in Table N-9.

TABLE N-9 MANUFACTURING DISTRICT NOISE STANDARDS

Octave Band Cycles Per Second	Sound Level at Residential[a]	Sound Level at Commercial[b]
0 to 75	67	73
75 to 150	62	68
150 to 300	58	64
300 to 600	54	60
600 to 1200	49	55
1200 to 2400	45	51
2400 to 4800	41	47
Above 4800	37	43

a. Maximum permitted sound level in decibels along residence district boundaries or 125 feet from plant or operation property line.
b. Maximum permitted sound level in decibels along commercial district boundaries or 125 feet from plant or operation property line.
Source: San Mateo Municipal Code Section 27.56.090

Additionally, Section 27.56.120 requires processes and equipment located in manufacturing districts and which generate disturbing or earth shaking vibration to be set back at least 300 feet from property boundaries on all sides; this requirement notwithstanding, this provision also prohibits all vibration which would create a public nuisance or hazard beyond the property boundaries. Finally Section 27.32.030, which applies to all C2 commercial zoning designations, including the Project site, requires that new commercial uses avoid the excessive generation of noise and vibration.

Additional sections with notable mentions of noise include:

- Section 10.04.010, which prohibits disturbance of the peace through disruptions by noise, among other means.
- Chapter 10.80, which regulates the use of leaf blowers due to their potential to generate both noise and air pollution. Section 10.80.030 limits hours of operation for leaf blowers to between 8:00 a.m. and 5:00 p.m. Monday through Friday, and between 9:00 a.m. and 5:00 p.m. on Saturdays; use of leaf blowers is prohibited on Sunday and on all federal holidays. Section 10.80.040 requires leaf blowers be equipped with a nozzle extension, stipulates that leaf blowers must be run on a low setting, and prohibits the simultaneous use of more than one leaf blower on a single property.
- Section 24.01.010, which identifies noise reduction as a goal of the City's transportation system management policies.
- Section 11.12.050, which prohibits excessive, unnecessary acceleration of motor vehicles in such way as to generate noise from wheel friction on pavement, i.e., tire squealing.

Chapter 5.43 which regulates entertainment businesses. Section 5.43.150 sets performance standards for all entertainment businesses and requires that such businesses ensure that their premises incorporate sufficient sound-absorbing insulation such that no noise generated within the establishment is audible anywhere on adjacent properties or public rights-of-way, or within any other building or other unit within the same building. Additionally, entertainment businesses are required to comply with all other City noise standards.

EXISTING CONDITIONS

Short Term Noise Measurements

Five 15-minute short-term noise measurements were taken in the Project site between the hours of 10:55 pm. and 1:52 a.m. The locations of the measurements are illustrated in Figure N-1 and the results of the measurements are summarized in Table N-10 below.

TABLE N-10 SHORT-TERM NOISE MONITORING RESULTS

	L_{eq} dBA	L_{min} dBA	L_{max} dBA	L_{50} dBA
Short-Term Location 1	55.6	43.9	72.4	47.2
Short-Term Location 2	48.2	45.8	56.4	47.6
Short-Term Location 3	54.9	43.2	79.0	45.4
Short-Term Location 4	48.7	38.9	63.9	41.1
Short-Term Location 5	45.8	42.2	54.3	44.9

Source: The Planning Center | DC&E, 2013

Additional details regarding the noise measurements are as follows:

Short-Term Location 1

Short-term noise monitoring Location 1 is representative of noise received by the residential properties fronting Edison Street and 31st Avenue in the vicinity of the intersection of these two roadways. These properties generally face the Hillsdale Shopping Center and its associated parking garage. Land uses in the vicinity of this short-term location were single-family residential, directly facing the large regional commercial use of the Hillsdale Shopping Center. The site was located on the southwest corner of the T-intersection between 31st Avenue and Edison Street, approximately 800 feet to the southwest of El Camino Real. The microphone and sound meter were positioned immediately on the corner, approximately 15 feet from the nearest residential property line and 66 feet to the south of the primary Project construction area. Fifteen minutes of noise measurements were acquired, beginning at 10:55 p.m. on Friday, July 26th. During measurements, winds were light and variable, and the air temperature was 56°F.

The noise environment of the site was characterized primarily by the sound of passing and distant traffic, ventilation equipment associated with the existing commercial uses, as well as occasional trains horns and aircraft noise in the distance. The 15-minute equivalent noise level at this location (L_{eq}) was 55.6 dBA.

Figure N-1 Noise Monitoring Locations

Short-Term Location 2

Short-term noise monitoring Location 2 is representative of noise received by the residential properties fronting Flores Street, which abut the parking garage at the back of the properties. Land uses in the vicinity of this short-term location were single-family residential juxtaposed with the large regional commercial use of the Hillsdale Shopping Center. The site was approximately 190 feet to the east-northeast of Flores Street, 300 feet to the north-northwest of 31st Avenue, and 800 feet to the southwest of El Camino Real. The microphone and sound meter were positioned on the upper level of the existing parking structure, approximately 30 feet from the rear property lines and 140 feet to the west of the primary project construction area. Fifteen minutes of noise measurements were acquired, beginning at 10:36 p.m. on Friday, July 26th. During measurements, winds were calm and the air temperature was 57°F.

The noise environment of the site was characterized primarily by the sound of ventilation equipment associated with the existing commercial uses, as well as distant traffic, commercial aircraft, and the distant sound of train horns. The 15-minute equivalent noise level (L_{eq}) at this location was 48.2 dBA.

Short-Term Location 3

Short-term noise monitoring Location 3 is representative of noise received by the residential properties adjacent to the northern edge of the Hillsdale Shopping Center parking structure and fronting Edison Street in the vicinity of 29th Avenue. These properties generally face the roadway that provides automobile access to the lower level of the parking structure and truck access to the basement areas of the shopping center. Land uses in the vicinity of this short-term location were a mix of low intensity single-family and medium intensity multi-family residential, juxtaposed with the large regional commercial use of the Hillsdale Shopping Center. The site was located at 2910 Edison Street, approximately 515 feet to the southwest of El Camino Real. The microphone and sound meter were positioned on the sidewalk, immediately adjacent to the nearest residential property line, approximately 22 feet from the centerline of Edison Street and 320 feet northwest of the primary project construction area. Fifteen minutes of noise measurements were acquired, beginning at 11:42 p.m. on Friday, July 26th. During measurements winds were light and variable, and the air temperature was 56°F.

The noise environment of the site was characterized primarily by the sound of distant traffic, ventilation equipment associated with the existing commercial uses, the passage of one large truck, and occasional train horns and aircraft noise in the distance. The 15-minute equivalent noise level (L_{eq}) at this location was 54.9 dBA.

Short-Term Location 4

Short-term noise monitoring Location 4 is representative of noise received by the residential properties in the vicinity of 28th Avenue and Edison Street. These properties generally face the roadways that provide automobile access to the lower level of the parking structure and truck access to the basement areas of the shopping center. Land uses in the vicinity of this short-term location were primarily multi-family residential with one small commercial office building and one large telecommunications building. The site was located at 35 28th Avenue, approximately 400 feet to the southwest of El Camino Real. The microphone and sound meter were positioned on the sidewalk, immediately adjacent to the nearest residential property line, approximately 28 feet from the centerline of both Edison Street and 29th Avenue, and 950 feet to the north-northwest of the primary project construction area. Fifteen minutes of

noise measurements were acquired, beginning at 1:37 a.m. on Saturday, July 27th. During measurements, winds were calm, and the air temperature was 55°F.

The noise environment of the site was characterized primarily by the sound of distant traffic, mechanical equipment associated with the telecommunications building, and very limited aircraft noise in the distance. The 15-minute equivalent noise level (L_{eq}) at this location was 48.7 dBA.

Short-Term Location 5

Short-term noise monitoring Location 5 is representative of the areas in the vicinity of 30th Avenue entrance ramp to the upper parking area of the Hillsdale Shopping Center. Land uses in the vicinity of this short-term Location were a mix of low intensity single-family and multi-family residential, juxtaposed with the large regional commercial use of the Hillsdale Shopping Center. The site was approximately 165 feet to the east-northeast of Flores Street, 266 feet to the south-southeast of 29th Avenue, and 800 feet to the southwest of El Camino Real. The microphone and sound meter were positioned approximately 20 feet from the centerline of 30th Avenue, and 340 feet to the northwest of the primary project construction area. Fifteen minutes of noise measurements were acquired, beginning at 10:15 p.m. on Friday, July 26th. During measurements, winds were light and variable and the air temperature was 57°F.

The noise environment of the site was characterized primarily by the sound of distant and passing traffic, commercial aircraft flyovers, and the occasional sound of mechanical equipment or noise from the residential uses. The 15-minute equivalent noise level (L_{eq}) at this location was 45.8 dBA.