Fundamentals of Noise

NOISE

Noise is most often defined as unwanted sound; whether it is loud, unpleasant, unexpected, or otherwise undesirable. 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."

Noise Descriptors

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

- **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.

- **Decibel (dB).** A unitless measure of sound, expressed on a logarithmic scale and with respect to a defined reference sound pressure. The standard reference pressure is 20 micropascals (20 μPa).

- **Vibration Decibel (VdB).** A unitless measure of vibration, expressed on a logarithmic scale and with respect to a defined reference vibration velocity. In the U.S., the standard reference velocity is 1 micro-inch per second ($1x10^{-6}$ in/sec).

- **A-Weighted Decibel (dBA).** An overall frequency-weighted sound level in decibels that approximates the frequency response of the human ear.

- **Equivalent Continuous Noise Level (L_{eq}); also called the Energy-Equivalent Noise Level.** The value of an equivalent, steady sound level which, in a stated time period (often over an hour) and at a stated location, has the same A-weighted sound energy as the time-varying sound. Thus, the L_{eq} metric is a single numerical value that represents the equivalent amount of variable sound energy received by a receptor over the specified duration.

- **Statistical Sound Level (L_n).** 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 L_{90} is the sound level exceeded 90 percent of the time and is often considered the "effective background level" or "residual noise level."

- **Maximum Sound Level (L_{max})**. The highest RMS sound level measured during the measurement period.
- **Root Mean Square Sound Level (RMS).** The square root of the average of the square of the sound pressure over the measurement period.
- **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 PM to 7:00 AM.
- **Community Noise Equivalent Level (CNEL).** The energy average of the A-weighted sound levels occurring during a 24-hour period, with 5 dB added from 7:00 PM to 10:00 PM and 10 dB from 10:00 PM to 7:00 AM. 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 L_{dn} value). As a matter of practice, L_{dn} and CNEL values are interchangeable and are treated as equivalent in this assessment.
- **Peak Particle Velocity (PPV).** The peak rate of speed at which soil particles move (e.g., inches per second) due to ground vibration.
- **Sensitive Receptor.** Noise- and vibration-sensitive receptors include land uses where quiet environments are necessary for enjoyment and public health and safety. Residences, schools, motels and hotels, libraries, religious institutions, hospitals, and nursing homes are examples.

Characteristics of Sound

When an object vibrates, it radiates part of its energy in the form of a pressure wave. Sound is that pressure wave transmitted through the air. Technically, airborne sound is a rapid fluctuation or oscillation of air pressure above and below atmospheric pressure that creates sound waves.

Sound can be described in terms of amplitude (loudness), frequency (pitch), or duration (time). Loudness or amplitude is measured in dB, frequency or pitch is measured in Hertz [Hz] or cycles per second, and duration or time variations is measured in seconds or minutes.

Amplitude

Unlike linear units such as inches or pounds, decibels are measured on a logarithmic scale. 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 1 presents the subjective effect of changes in sound pressure levels. Ambient sounds generally range from 30 dBA (very quiet) to 100 dBA (very loud). Changes of 1 to 3 dB are detectable under quiet, controlled conditions, and changes of less than 1 dB are usually not discernible (even under ideal conditions). A 3 dB change in noise levels is considered the minimum change that is detectable with human hearing in outside environments. A change of 5 dB is readily discernible to most people in an exterior environment, and a 10 dB change is perceived as a doubling (or halving) of the sound.

Table 1 Noise Perceptibility

Change in dB	Noise Level
± 3 dB	Barely perceptible increase
± 5 dB	Readily perceptible increase
± 10 dB	Twice or half as loud
± 20 dB	Four times or one-quarter as loud

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

Frequency

The human ear is not equally sensitive to all frequencies. Sound waves below 16 Hz are not heard at all, but are "felt" more as a vibration. Similarly, though people with extremely sensitive hearing can hear sounds as high as 20,000 Hz, most people cannot hear above 15,000 Hz. In all cases, hearing acuity falls off rapidly above about 10,000 Hz and below about 200 Hz.

When describing sound and its effect on a human population, A-weighted (dBA) sound levels are typically used to approximate the response of the human ear. The A-weighted noise level has been found to correlate well with people's judgments of the "noisiness" of different sounds and has been used for many years as a measure of community and industrial noise. Although the A-weighted scale and the energy-equivalent metric are commonly used to quantify the range of human response to individual events or general community sound levels, the degree of annoyance or other response also depends on several other perceptibility factors, including:

- Ambient (background) sound level
- General nature of the existing conditions (e.g., quiet rural or busy urban)
- Difference between the magnitude of the sound event level and the ambient condition
- Duration of the sound event
- Number of event occurrences and their repetitiveness
- Time of day that the event occurs

Duration

Time variation in noise exposure is typically expressed in terms of a steady-state energy level equal to the energy content of the time varying period (called L_{eq}), or alternately, as a statistical description of the sound level that is exceeded over some fraction of a given observation period. For example, the L_{50} noise level represents the noise level that is exceeded 50 percent of the time; half the time the noise level exceeds this level and half the time the noise level is less than this level. This level is also representative of the level that is exceeded 30 minutes in an hour. Similarly, the L_2, L_8 and L_{25} values represent the noise levels that are exceeded 2, 8, and 25 percent of the time or 1, 5, and 15 minutes per hour, respectively. These "n" values are typically used to demonstrate compliance for stationary noise sources with many cities' noise ordinances. Other values typically noted during a noise survey are the L_{min} and L_{max}. These values represent the minimum and maximum root-mean-square noise levels obtained over the measurement period, respectively.

Because community receptors are more sensitive to unwanted noise intrusion during the evening and at night, state law and many local jurisdictions use an adjusted 24-hour noise descriptor called the Community Noise Equivalent Level (CNEL) or Day-Night Noise Level (L_{dn}). The CNEL descriptor requires that an artificial increment (or "penalty") of 5 dBA be added to the actual noise level for the hours from 7:00 PM to 10:00

PM and 10 dBA for the hours from 10:00 PM to 7:00 AM. The L_{dn} descriptor uses the same methodology except that there is no artificial increment added to the hours between 7:00 PM and 10:00 PM. Both descriptors give roughly the same 24-hour level, with the CNEL being only slightly more restrictive (i.e., higher). The CNEL or L_{dn} metrics are commonly applied to the assessment of roadway and airport-related noise sources.

Sound Propagation

Sound dissipates exponentially with distance from the noise source. This phenomenon is known as "spreading loss." For a single-point source, sound levels decrease by approximately 6 dB for each doubling of distance from the source (conservatively neglecting ground attenuation effects, air absorption factors, and barrier shielding). For example, if a backhoe at 50 feet generates 84 dBA, at 100 feet the noise level would be 79 dBA, and at 200 feet it would be 73 dBA. This drop-off rate is appropriate for noise generated by on-site operations from stationary equipment or activity at a project site. If noise is produced by a line source, such as highway traffic, the sound decreases by 3 dB for each doubling of distance over a reflective ("hard site") surface such as concrete or asphalt. Line source noise in a relatively flat environment with ground-level absorptive vegetation decreases by an additional 1.5 dB for each doubling of distance.

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, with prolonged noise exposure in excess of 75 dBA increasing body tensions, thereby affecting blood pressure and functions of the heart and the 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, through generally worse in urban areas than in outlying, less-developed areas. Elevated ambient noise levels can result in noise interference (e.g., speech interruption/masking, sleep disturbance, disturbance of concentration) and cause annoyance. 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 number means. To help relate noise level values to common experience, Table 2 shows typical noise levels from familiar sources.

Table 2 Typical Noise Levels

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
Onset of physical discomfort	120+	
	110	Rock Band (near amplification system)
Jet Flyover at 1,000 feet		
	100	
Gas Lawn Mower at three feet		
	90	
Diesel Truck at 50 feet, at 50 mph		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: California Department of Transportation (Caltrans). 2013, September. Technical Noise Supplement ("TeNS").

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. As with noise, vibration can be described by both its amplitude and frequency. Vibration displacement is the distance that a point on a surface moves away from its original static position; velocity is the instantaneous speed that a point on a surface moves; and acceleration is the rate of change of the speed. 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.

Vibration amplitudes are usually described in terms of either the peak particle velocity (PPV) or the root mean square (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 and RMS is typically more suitable for evaluating human response.

As with airborne sound, annoyance with vibrational energy is a subjective measure, depending on the level of activity and the sensitivity of the individual. To sensitive individuals, vibrations approaching the threshold of perception can be annoying. Persons accustomed to elevated ambient vibration levels, such as in an urban environment, may tolerate higher vibration levels. Table 3 displays the human response and the effects on buildings resulting from continuous vibration (in terms of various levels of PPV).

Table 3 Human Reaction to Typical Vibration Levels

Vibration Level, PPV (in/sec)	Human Reaction	Effect on Buildings
0.006–0.019	Threshold of perception, possibility of intrusion	Vibrations unlikely to cause damage of any type
0.08	Vibrations readily perceptible	Recommended upper level of vibration to which ruins and ancient monuments should be subjected
0.10	Level at which continuous vibration begins to annoy people	Virtually no risk of "architectural" (i.e. not structural) damage to normal buildings
0.20	Vibrations annoying to people in buildings	Threshold at which there is a risk to "architectural" damage to normal dwelling – houses with plastered walls and ceilings
0.4–0.6	Vibrations considered unpleasant by people subjected to continuous vibrations and unacceptable to some people walking on bridges	Vibrations at a greater level than normally expected from traffic, but would cause "architectural" damage and possibly minor structural damage

Source: California Department of Transportation (Caltrans). 2020, April. *Transportation and Construction Vibration Guidance Manual.* Prepared by ICF International.

LOCAL REGULATIONS AND STANDARDS

20.20.300 - Performance standards.

A. In the OS open space and A agricultural districts, no primary, secondary, incidental or conditional use or activity related thereto shall be conducted or permitted:
   1. In a manner that causes or results in the harmful discharge of any waste materials into or upon the ground, into or within any sanitary or storm sewer system, into or within any water system or water, or into the atmosphere; or
   2. In a manner that constitutes a menace to persons or property or in a manner that is dangerous, obnoxious, or offensive by reason of the creation of a fire, explosion, or other physical hazard, or by reason of air pollution, odor, smoke, noise, dust vibration, radiation, or fumes; or
   3. In a manner that creates a public or private nuisance.

B. Without limiting the generality of the preceding subsection, the following specific standards shall apply in the open space and agricultural zoning districts:
   1. Air pollution. Total emissions from any use or combination of uses on a site shall not exceed the emissions and health risk thresholds as established by the director of planning.
   2. Noise. The sound pressure level generated by any use or combination of uses on a property shall not exceed the decibel levels indicated in Table 20-45 at any property line, except upon issuance and in compliance with a special use permit as provided in Chapter 20.100.

Table 20-45

Additional Noise Standards

	Maximum Noise Level in Decibels at Property Line
Open space or agricultural use adjacent to a property used or zoned for residential purposes	55
Open space or agricultural use adjacent to a property used or zoned for commercial purposes	60

Open space or agricultural use adjacent to a property used or zoned for industrial or use other than commercial or residential purposes	70

3. Vibration. There shall be no activity on any site that causes ground vibration that is perceptible without instruments at the property line of the site.

(Ords. 26456, 29364.)

20.30.700 - Performance standards.

A. In the R-1, R-2, R-M, and R-MH residential districts, no primary, secondary, incidental or conditional use or activity related thereto shall be conducted or permitted:
   1. In a manner that causes or results in the harmful discharge of any waste materials into or upon the ground, into or within any sanitary or storm sewer system, into or within any water system or water, or into the atmosphere; or
   2. In a manner that constitutes a menace to persons or property or in a manner that is dangerous, obnoxious, or offensive by reason of the creation of a fire, explosion, or other physical hazard, or by reason of air pollution, odor, smoke, noise, dust, vibration, radiation, or fumes; or
   3. In a manner that creates a public or private nuisance.

B. Without limiting the generality of the preceding subsection, the following specific standards shall apply in the residential zoning districts:
   1. Air Pollution. Total emissions from any use or combination of uses on a site shall not exceed the emissions and health risk thresholds as established by the director of planning.
   2. Noise. The sound pressure level generated by any use or combination of uses on a property shall not exceed the decibel levels indicated in Table 20-85 at any property line, except upon issuance and in compliance with a special use permit as provided in Chapter 20.100.

Table 20-85

Noise Standards

	Maximum Noise Level in Decibels at Property Line

Any residential or non-residential use	55

3. Vibration. There shall be no activity on any site that causes ground vibration that is perceptible without instruments at the property line of the site.

(Ords. 26388, 26456, 26505, 29821.)

20.100.450 - Hours of construction within 500 feet of a residential unit.

A. Unless otherwise expressly allowed in a development permit or other planning approval, no applicant or agent of an applicant shall suffer or allow any construction activity on a site located within 500 feet of a residential unit before 7:00 a.m. or after 7:00 p.m., Monday through Friday, or at any time on weekends.

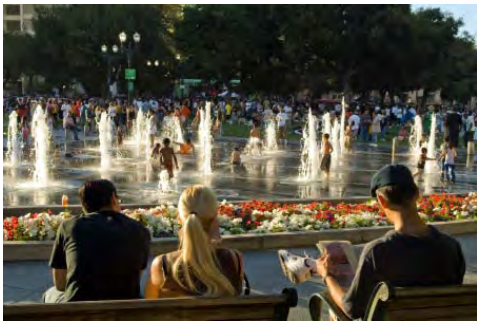
B. Without limiting the scope of Section 20.100.310, no applicant or agent of an applicant shall suffer or allow any construction activity on a site subject to a development permit or other planning approval located within 500 feet of a residential unit at any time when that activity is not allowed under the development permit or planning approval.

C. This section is applicable whenever a development permit or other planning approval is required for construction activity.

(Ords. 26248, 26594.)

Envision
San José 2040





GENERAL PLAN

CITY OF SAN JOSE
CAPITAL OF SILICON VALLEY

Envision San José 2040

GENERAL PLAN

Building a City of Great Places

"We are blessed to live in this area with great beauty combined with a robust economy. We must plan carefully for the land remaining under our stewardship so that this good fortune is preserved and enhanced."

E.H. Renzel, Jr., San Jose Mayor 1945-1946
written in the month of his 100th birthday, August 2007

ENVISIONSAN JOSE2040

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3. Environmental Leadership

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Appendices

1. "Technical Report, Geological Investigation, City of San José's Sphere of Influence", prepared by Cooper-Clark and Associates, hereinafter called the Cooper-Clark Technical Studies.

2. The City of San José Fault Hazard Maps, prepared by the San José Department of Public Works, which include State of California Special Study Zones.

3. Digital Flood Insurance Rate Maps (DFIRM), City of San José, California, prepared for the National Flood Insurance Program by the Federal Emergency Management Agency.

4. Flood Awareness Maps for Santa Clara County, prepared by the California Department of Water Resources.

5. Anderson Dam EAP 2003 Flood Inundation Maps, prepared by the SCVWD.

6. The City of San José Special Flood Hazard Area Regulations (San José Municipal Code Section 17.08).

7. "Flooding in San José, Study Session on Flood Management Issues November 19, 2007", prepared by the San José City Council and SCVWD Board of Directors.

8. The City of San José Geologic Hazard Regulations (San José Municipal Code Section 17.10).

9. City of San José Emergency Operations Plan, August 17, 2004.

10. SCVWD Water Resources Protection Guidelines and Standards (2006 or as amended), prepared collaboratively by SCVWD, the City of San José and other local jurisdictions.

11. Association of Bay Area Governments (ABAG) Hazard Mitigation Plan "Taming Natural Disasters", adopted per Council Resolution No. 73721 as the City of San José's local hazard mitigation plan.

These sources describe the soils, geologic and flooding conditions throughout the area, but they are not intended to identify the site specific characteristics of individual properties. For instance, flood maps are a guide created for insurance purposes and represent a condition at a snapshot in time. The frequency, depth and lateral extent of flooding is influenced by land development, land subsidence, and global warming or other climatic changes. The Plan's policies require detailed site-specific evaluation of properties when the sources referenced above indicate there may be a potential hazard. This evaluation is to confirm the accuracy of the generalized information provided in the referenced sources, identifying the specific impacts of a proposed development, and developing appropriate mitigation measures for those impacts.

There are many interrelationships between the various topics within the Hazards section of the Plan. For example, the control of erosion and prevention of landslides can have positive effects on the reduction of potential flooding impacts. Earthquakes can magnify, and in fact

are a direct cause of one type of liquefaction, a hazardous soil condition. Fires in watershed areas can increase erosion and storm water runoff, thereby increasing flooding potential.

The discussion of natural hazards also relates to other elements of the *Envision General Plan*. The potential for land subsidence is directly related to the issues discussed in the Water Resources section, since land subsidence is caused from overdrafting the groundwater basin. The discussion of flooding hazards in this section is directly related to the planning for improved flood protection facilities discussed in the Facilities and Services section. This section also addresses man-made hazards, including noise, fire hazards and hazardous materials. Safety hazards associated with vehicular, rail and air transportation are addressed in the Transportation goals and policies.

In the event of a fire, geologic, or other hazardous occurrence, the City of San José's Emergency Plan provides comprehensive, detailed instructions and procedures regarding the responsibilities of City personnel and coordination with other agencies to ensure the safety of San José's citizens. The Emergency Plan includes evacuation procedures but does not delineate evacuation routes. Instead, procedures are outlined for different types of emergencies occurring in different locations of San José.

Noise and Vibration

Goal EC-1 – Community Noise Levels and Land Use Compatibility

Minimize the impact of noise on people through noise reduction and suppression techniques, and through appropriate land use policies.

Policies – Community Noise Levels and Land Use Compatibility

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

Interior Noise Levels

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

Exterior Noise Levels

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

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

- For single family residential uses, use a standard of 60 dBA DNL for exterior noise in private usable outdoor activity areas, such as backyards.

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

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

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

Normally Acceptable:

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

Conditionally Acceptable:

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

Unacceptable:

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

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

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

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

EC-1.4 Include appropriate noise attenuation techniques in the design of all new General Plan streets projected to adversely impact noise sensitive uses.

EC-1.5 Encourage the State Department of Transportation and County transportation agencies to provide visually pleasing sound attenuation devices on all new and existing freeways and expressways.

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

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

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

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

EC-1.8 Allow commercial drive-through uses only when consistency with the City's exterior noise level guidelines and compatibility with adjacent land uses can be demonstrated.

EC-1.9 Require noise studies for land use proposals where known or suspected loud intermittent noise sources occur which may impact adjacent existing or planned land uses. For new residential development affected by noise from heavy rail, light rail, BART or other single-event noise sources, implement mitigation so that recurring maximum instantaneous noise levels do not exceed 50 dBA Lmax in bedrooms and 55 dBA Lmax in other rooms.

EC-1.10 Monitor Federal legislative and administrative activity pertaining to aircraft noise for new possibilities for noise-reducing modifications to aircraft engines beyond existing Stage 3 requirements. Encourage the use of quieter aircraft at the San José International Airport.

EC-1.11 Require safe and compatible land uses within the Mineta International Airport noise zone (defined by the 65 CNEL contour as set forth in State law) and encourage aircraft operating procedures that minimize noise.

EC-1.12 Encourage the Federal Aviation Administration to enforce current cruise altitudes that minimize the impact of aircraft noise on land use.

Actions – Community Noise Levels and Land Use Compatibility

EC-1.13 Update noise limits and acoustical descriptors in the Zoning Code to clarify noise standards that apply to land uses throughout the City.

EC-1.14 Require acoustical analyses for proposed sensitive land uses in areas with exterior noise levels exceeding the City's noise and land use compatibility standards to base noise attenuation techniques on expected Envision General Plan traffic volumes to ensure land use compatibility and General Plan consistency.

Goal EC-2 - Vibration

Minimize vibration impacts on people, residences, and business operations.

Policies - Vibration

EC-2.1 Near light and heavy rail lines or other sources of ground-borne vibration, minimize vibration impacts on people, residences, and businesses through the use of setbacks and/or structural design features that reduce vibration to levels at or below the guidelines of the Federal Transit Administration. Require new development within 100 feet of rail lines to demonstrate prior to project approval that vibration experienced by residents and vibration sensitive uses would not exceed these guidelines.

EC-2.2 Require new sources of ground-borne vibration, such as transit along fixed rail systems or the operation of impulsive equipment, to minimize vibration impacts

AMBIENT NOISE MONITORING DATA

Measurement Report

Report Summary

Meter's File Name	S_T_Data.006.s	Computer's File Name	LxT_0005425-20241107 140207-S_T_Data.006.ldbin
Meter	LxT1 0005425	Firmware	2.404
User	JR	Location	ST-1
Job Description	PANC-01.0		
Note			

Start Time	2024-11-07 14:02:07	Duration	0:15:00.0		
End Time	2024-11-07 14:17:07	Run Time	0:15:00.0	Pause Time	0:00:00.0
Pre-Calibration	2024-10-11 12:08:23	Post-Calibration	None	Calibration Deviation	---

Results

Overall Metrics

LA_{eq}	54.8 dB		
LAE	84.3 dB	SEA	--- dB
EA	30.2 µPa²h		
EA8	966.4 µPa²h		
EA40	4.8 mPa²h		
LZ_{peak}	99.2 dB	2024-11-07 14:08:15	
LAS_{max}	66.3 dB	2024-11-07 14:09:10	
LAS_{min}	46.0 dB	2024-11-07 14:10:31	
LA_{eq}	54.8 dB		
LC_{eq}	67.0 dB	LC_{eq} - LA_{eq}	12.2 dB
LAI_{eq}	56.9 dB	LAI_{eq} - LA_{eq}	2.1 dB

Exceedances

	Count	Duration
LAS > 85.0 dB	0	0:00:00.0
LAS > 115.0 dB	0	0:00:00.0
LZpk > 135.0 dB	0	0:00:00.0
LZpk > 137.0 dB	0	0:00:00.0
LZpk > 140.0 dB	0	0:00:00.0

Community Noise

L_{DN}	L_{Day}	L_{Night}
--- dB	--- dB	0.0 dB

L_{DEN}	L_{Day}	L_{Eve}	L_{Night}
--- dB	--- dB	--- dB	--- dB

Any Data

	A		C		Z	
	Level	Time Stamp	Level	Time Stamp	Level	Time Stamp
L_{eq}	54.8 dB		67.0 dB		--- dB	
$L_{S(max)}$	66.3 dB	2024-11-07 14:09:10	--- dB	None	--- dB	None
$L_{S(min)}$	46.0 dB	2024-11-07 14:10:31	--- dB	None	--- dB	None
$L_{Peak(max)}$	--- dB	None	--- dB	None	99.2 dB	2024-11-07 14:08:15

Overloads

Count	Duration
0	0:00:00.0

Statistics

LAS 2.0	61.1 dB
LAS 8.0	57.9 dB
LAS 25.0	55.0 dB
LAS 50.0	53.2 dB
LAS 90.0	50.1 dB
LAS 99.0	48.0 dB

Measurement Report

Report Summary

Meter's File Name	S_T_Data.005.s	Computer's File Name	LxT_0005425-20241107 133440-S_T_Data.005.ldbin
Meter	LxT1 0005425	Firmware	2.404
User	JR	Location	ST-2
Job Description	PANC-01.0		
Note			

Start Time	2024-11-07 13:34:40	Duration	0:15:00.0		
End Time	2024-11-07 13:49:40	Run Time	0:15:00.0	Pause Time	0:00:00.0
Pre-Calibration	2024-10-11 12:08:23	Post-Calibration	None	Calibration Deviation	---

Results

Overall Metrics

LA_{eq}	47.5 dB		
LAE	77.0 dB	SEA	--- dB
EA	5.6 µPa²h		
EA8	179.9 µPa²h		
EA40	899.7 µPa²h		
LZ_{peak}	86.1 dB	2024-11-07 13:45:33	
LAS_{max}	61.1 dB	2024-11-07 13:34:40	
LAS_{min}	43.0 dB	2024-11-07 13:48:30	
LA_{eq}	47.5 dB		
LC_{eq}	59.5 dB	LC_{eq} - LA_{eq}	12.0 dB
LAI_{eq}	57.0 dB	LAI_{eq} - LA_{eq}	9.5 dB

Exceedances

	Count	Duration
LAS > 85.0 dB	0	0:00:00.0
LAS > 115.0 dB	0	0:00:00.0
LZpk > 135.0 dB	0	0:00:00.0
LZpk > 137.0 dB	0	0:00:00.0
LZpk > 140.0 dB	0	0:00:00.0

Community Noise

L_{DN}	L_{Day}	L_{Night}
--- dB	--- dB	0.0 dB

L_{DEN}	L_{Day}	L_{Eve}	L_{Night}
--- dB	--- dB	--- dB	--- dB

Any Data

	A		C		Z	
	Level	Time Stamp	Level	Time Stamp	Level	Time Stamp
L_{eq}	47.5 dB		59.5 dB		--- dB	
$L_{S(max)}$	61.1 dB	2024-11-07 13:34:40	--- dB	None	--- dB	None
$L_{S(min)}$	43.0 dB	2024-11-07 13:48:30	--- dB	None	--- dB	None
$L_{Peak(max)}$	--- dB	None	--- dB	None	86.1 dB	2024-11-07 13:45:33

Overloads

Count	Duration
0	0:00:00.0

Statistics

LAS 2.0	54.2 dB
LAS 8.0	50.0 dB
LAS 25.0	47.5 dB
LAS 50.0	46.0 dB
LAS 90.0	44.3 dB
LAS 99.0	43.6 dB

Measurement Report

Report Summary

Meter's File Name	S_T_Data.007.s	Computer's File Name	LxT_0005425-20241107 142905-S_T_Data.007.ldbin
Meter	LxT1 0005425	Firmware	2.404
User	JR	Location	ST-3
Job Description	PANC-01.0		
Note			

Start Time	2024-11-07 14:29:05	Duration	0:15:00.0		
End Time	2024-11-07 14:44:05	Run Time	0:15:00.0	Pause Time	0:00:00.0
Pre-Calibration	2024-10-11 12:08:23	Post-Calibration	None	Calibration Deviation	---

Results

Overall Metrics

LA_{eq}	64.2 dB		
LAE	93.7 dB	SEA	--- dB
EA	263.0 µPa²h		
EA8	8.4 mPa²h		
EA40	42.1 mPa²h		
LZ_{peak}	102.1 dB	2024-11-07 14:32:45	
LAS_{max}	77.4 dB	2024-11-07 14:32:45	
LAS_{min}	44.3 dB	2024-11-07 14:42:21	
LA_{eq}	64.2 dB		
LC_{eq}	72.0 dB	LC_{eq} - LA_{eq}	7.8 dB
LAI_{eq}	68.1 dB	LAI_{eq} - LA_{eq}	3.9 dB

Exceedances

	Count	Duration
LAS > 85.0 dB	0	0:00:00.0
LAS > 115.0 dB	0	0:00:00.0
LZpk > 135.0 dB	0	0:00:00.0
LZpk > 137.0 dB	0	0:00:00.0
LZpk > 140.0 dB	0	0:00:00.0

Community Noise

L_{DN}	L_{Day}	L_{Night}
--- dB	--- dB	0.0 dB

L_{DEN}	L_{Day}	L_{Eve}	L_{Night}
--- dB	--- dB	--- dB	--- dB

Any Data

	A		C		Z	
	Level	Time Stamp	Level	Time Stamp	Level	Time Stamp
L_{eq}	64.2 dB		72.0 dB		--- dB	
$LS_{(max)}$	77.4 dB	2024-11-07 14:32:45	--- dB	None	--- dB	None
$LS_{(min)}$	44.3 dB	2024-11-07 14:42:21	--- dB	None	--- dB	None
$L_{Peak(max)}$	--- dB	None	--- dB	None	102.1 dB	2024-11-07 14:32:45

Overloads

Count	Duration
0	0:00:00.0

Statistics

LAS 2.0	73.1 dB
LAS 8.0	69.1 dB
LAS 25.0	64.4 dB
LAS 50.0	60.3 dB
LAS 90.0	46.5 dB
LAS 99.0	45.0 dB

CONSTRUCTION NOISE MODELING

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 10/31/2024
Case Description: PANC-01.0 Roberts Avenue - Demolition

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Reference at 50 feet	Residential	60.0	55.0	50.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Dozer	No	40		81.7	50.0	0.0
Front End Loader	No	40		79.1	50.0	0.0

Results

	Calculated (dBA)		Noise Limits (dBA) Day		Evening		Night		Noise Limit Exceedance (dBA) Day		Evening		Night	
Equipment	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Dozer	81.7	77.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Front End Loader	79.1	75.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	81.7	79.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 10/31/2024
Case Description: PANC-01.0 Roberts Avenue - Site Preparation

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Reference at 50 feet	Residential	60.0	55.0	50.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Grader	No	40	85.0		50.0	0.0
Dozer	No	40		81.7	50.0	0.0
Backhoe	No	40		77.6	50.0	0.0

Results

Equipment	Calculated (dBA) Lmax	Leq	Noise Limits (dBA) Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq	Noise Limit Exceedance (dBA) Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq
Grader	85.0	81.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Dozer	81.7	77.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Backhoe	77.6	73.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	85.0	83.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 10/31/2024
Case Description: PANC-01.0 Roberts Avenue - Grading

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Reference at 50 feet	Residential	60.0	55.0	50.0

Description	Impact Device	Usage (%)	Equipment Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Grader	No	40	85.0		50.0	0.0
Dozer	No	40		81.7	50.0	0.0
Front End Loader	No	40		79.1	50.0	0.0

Results

Equipment	Calculated (dBA) Lmax	Leq	Noise Limits (dBA) Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq	Noise Limit Exceedance (dBA) Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq
Grader	85.0	81.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Dozer	81.7	77.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Front End Loader	79.1	75.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	85.0	83.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 10/31/2024
Case Description: PANC-01.0 Roberts Avenue - Utilities Trenching

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Reference at 50 feet	Residential	60.0	55.0	50.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Backhoe	No	40		77.6	50.0	0.0
Front End Loader	No	40		79.1	50.0	0.0
Pickup Truck	No	40		75.0	50.0	0.0

Results

Equipment	Calculated (dBA) Lmax	Leq	Noise Limits (dBA) Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq	Noise Limit Exceedance (dBA) Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq
Backhoe	77.6	73.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Front End Loader	79.1	75.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Pickup Truck	75.0	71.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	79.1	78.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 10/31/2024
Case Description: PANC-01.0 Roberts Avenue - Asphalt Paving

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Reference at 50 feet	Residential	60.0	55.0	50.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Paver	No	50		77.2	50.0	0.0
Concrete Mixer Truck	No	40		78.8	50.0	0.0
Backhoe	No	40		77.6	50.0	0.0

Results

	Calculated (dBA)		Noise Limits (dBA) Day		Evening		Night		Noise Limit Exceedance (dBA) Day		Evening		Night	
Equipment	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Paver	77.2	74.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Concrete Mixer Truck	78.8	74.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Backhoe	77.6	73.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	78.8	79.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 10/31/2024
Case Description: PANC-01.0 Roberts Avenue - Building Construction

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Reference at 50 feet	Residential	60.0	55.0	50.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Generator (<25KVA, VMS signs)	No	50		72.8	50.0	0.0
Man Lift	No	20		74.7	50.0	0.0
Backhoe	No	40		77.6	50.0	0.0

Results

Equipment	Calculated (dBA) Lmax	Leq	Noise Limits (dBA) Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq	Noise Limit Exceedance (dBA) Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq
Generator (<25KVA, VMS signs)	72.8	69.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Man Lift	74.7	67.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Backhoe	77.6	73.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	77.6	75.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 10/31/2024
Case Description: PANC-01.0 Roberts Avenue - Architectural Coating

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Reference at 50 feet	Residential	60.0	55.0	50.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Compressor (air)	No	40		77.7	50.0	0.0

Results

	Calculated (dBA)		Noise Limits (dBA)						Noise Limit Exceedance (dBA)					
			Day		Evening		Night		Day		Evening		Night	
Equipment	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Compressor (air)	77.7	73.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	77.7	73.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

TRAFFIC NOISE MODELING

Traffic Noise Calculator: FHWA 77-108 — **1170 and 1190 Roberts Avenue (PANC-01.0) Existing Traffic Noise**

	Output						Inputs														Auto Inputs	
	dBA at 50 feet			Distance to CNEL Contour			Segment															
ID	$L_{eq\text{-}24hr}$	L_{dn}	CNEL	70 dBA	65 dBA	60 dBA	Roadway	From	To	ADT	Posted Speed Limit	Grade	% Autos	% Med Trucks	% Heavy Trucks	% Daytime	% Evening	% Night	Number of Lanes	Site Condition	Distance to Reciever	Ground Absorption	Lane Distance
1	54	58	58	8	18	38	Roberts Ave	Project Site	Phelan Ave	4,225	25	0.0%	98.5%	1.0%	0.5%	75.0%	10.0%	15.0%	2	Soft	50	0.5	20
2	54	58	58	8	18	38	Roberts Ave	Project Site	Story Rd	4,225	25	0.0%	98.5%	1.0%	0.5%	75.0%	10.0%	15.0%	2	Soft	50	0.5	20
3	69	73	73	82	177	382	Story Road	Roberts Ave	Via Ferrari	31,074	40	0.0%	96.5%	2.0%	1.5%	75.0%	10.0%	15.0%	6	Soft	50	0.5	68
4	69	73	73	82	177	382	Story Road	Roberts Ave	Senter Rd	31,074	40	0.0%	96.5%	2.0%	1.5%	75.0%	10.0%	15.0%	6	Soft	50	0.5	68

Traffic Noise Calculator: FHWA 77-108 — **1170 and 1190 Roberts Avenue (PANC-01.0) Existing Plus Project Traffic Noise**

	Output						Inputs														Auto Inputs	
	dBA at 50 feet			Distance to CNEL Contour				Segment														
ID	$L_{eq\text{-}24hr}$	L_{dn}	CNEL	70 dBA	65 dBA	60 dBA	Roadway	From - To		ADT	Posted Speed Limit	Grade	% Autos	% Med Trucks	% Heavy Trucks	% Daytime	% Evening	% Night	Number of Lanes	Site Condition	Distance to Reciever	Ground Absorption	Lane Distance
1	54	58	58	8	18	38	Roberts Ave	Project Site	Phelan Ave	4,245	25	0.0%	98.5%	1.0%	0.5%	75.0%	10.0%	15.0%	2	Soft	50	0.5	20
2	54	58	58	8	18	39	Roberts Ave	Project Site	Story Rd	4,335	25	0.0%	98.5%	1.0%	0.5%	75.0%	10.0%	15.0%	2	Soft	50	0.5	20
3	69	73	73	82	178	383	Story Road	Roberts Ave	Via Ferrari	31,134	40	0.0%	96.5%	2.0%	1.5%	75.0%	10.0%	15.0%	6	Soft	50	0.5	68
4	69	73	73	82	178	383	Story Road	Roberts Ave	Senter Rd	31,124	40	0.0%	96.5%	2.0%	1.5%	75.0%	10.0%	15.0%	6	Soft	50	0.5	68