Appendix K Noise Background and Modeling

Appendix

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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).

- **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

NOISE ELEMENT

TABLE OF CONTENTS

NOISE ELEMENT

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LIST OF TABLES

NOISE ELEMENT

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LIST OF EXHIBITS

NOISE ELEMENT

This page intentionally left blank

LIST OF GOALS

NOISE ELEMENT

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NOISE

1.0

PURPOSE STATEMENT

Noise at excessive levels can affect our environment and our quality of life. Aircraft, automobiles, trucks, railroads, construction equipment, factories and even home appliances contribute to the noise environment of modern life. Generally, motor vehicles are the most pervasive contributors to urban noise. Consequently, the expanding developments in cities produce a corresponding increase in traffic, which in turn leads to increased noise levels. Other major noise sources common in the urban and suburban environment are power gardening equipment, amplified music, power tools and air conditioners.

The noise element of a general plan is a comprehensive program for including noise control in the planning process. It is a tool for planners to achieve and maintain land use compatibility with environmental noise. The noise element provides goals and policies to guide compatible land uses and the incorporation of noise attenuation measures for new uses to protect people living and working in the City from an excessive noise environment.

A noise element is related to land use and housing elements in that its key objective is to provide noise exposure information for use in land use planning. When integrated with a land use element, a noise element will show acceptable land uses in relation to existing and projected noise contours. Since residential land uses are the most noise-sensitive, the noise exposure information should be considered when planning new housing.
The key feature of a noise element is the quantification of the community noise environment in terms of noise exposure contours of future transportation activities. The contours serve as guidelines to achieve noise compatible land uses to minimize the exposure of community residents to excessive noise and to provide baseline noise levels.

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2.0 BACKGROUND

AUTHORITY

A noise element as well as other general plan policies and implementing ordinances (zoning codes, noise ordinances, etc.) are effective tools in noise reduction and mitigation. Section 65302(g) of the California Government Code requires that each city have a noise element as part of the General Plan. The Hesperia Noise Element follows the guidelines adopted by the Office of Noise Control, pursuant to Section 46050.1 of the Health and Safety Code.

State guidelines are very specific about the content of a General Plan noise element. The Government Code (Section 65302(F)) states that the noise element should be prepared according to guidelines established by the Department of Health Services. At a minimum, the Government Code requires the element to analyze noise levels for the following:

- Highways and freeways;
- Primary arterial and major local streets;
- Passenger and freight railroad operations and ground rapid transit systems;
- Commercial, general aviation, heliport, helistop, and military airport operations, aircraft overflights, jet engine test stands, and all other ground facilities and maintenance functions related to airport operation;
- Local industrial plants, including but not limited to railroad classification yards; and
- Other ground sources identified by the local agencies as contributing to the community noise environment.

The noise element is related to the land use, housing, circulation, and open-space elements. Recognition of the interrelationship of noise and these four other mandated elements is necessary in order to prepare an integrated general plan.

BACKGROUND

The major source of noise in the City and the City Sphere of Influence is vehicular traffic. This includes automobiles, trucks, buses and motorcycles. Other sources of noise include BNSF and UP railroads, Hesperia Airport, industrial and commercial activity, and construction.

Noise-sensitive receptors are land uses associated with indoor and/or outdoor activities that may be subject to stress and/or significant interference from noise, such as residential dwellings, hotels, motels, dormitories, hospitals, educational facilities, and libraries.

Noise-sensitive receptors within the City include single- and multi-family residential, schools, parks, libraries, hospitals, and churches. Refer to the Land Use Element for further details.

CONSISTENCY WITH OTHER GENERAL PLAN ELEMENTS

This Noise Element is directly related to other elements of this General Plan, most specifically the Land Use, Circulation, Housing and Safety Elements. It covers a variety of issues such as the impact of noise on various land uses and which land uses create noise which may be incompatible with other land uses (Land Use Element); the impact of noise from vehicular and other traffic (Circulation Element); the effect of noise on residential areas (Housing Element) and the noise generated by aircraft (Safety Element). Several issues dealing with noise have a direct influence on policies and programs in these other elements of this General Plan.

Table NS-1 details the issues discussed in this Noise Element and identifies other elements which include discussions which also address these issues.

TABLE NS-1
COORDINATION WITH OTHER ELEMENTS

ISSUES	Circulation	Conservation	Housing	Land Use	Open Space	Safety
Noise						
Site Planning	X		X	X		
Barriers	X		X	X		X
Building Design	X		X	X		X

REGULATORY SETTING

The Federal government and the State of California recognize the relationship between noise and noise-sensitive land uses and have developed standards and regulations concerning noise and land use compatibility. The following has been adopted by the various agencies which relate to the Noise Element and assist in its implementation.

Federal

Noise Control Act of 1972 (PL 92-574)

The Noise Control Act established a national policy "to promote an environment for all Americans free from noise that jeopardizes their public health and welfare." The Act provides for a division of powers between the Federal, state and local governments, in which the primary Federal responsibility is for noise source emission control, with the states and other agencies retaining the rights to control noise sources and the level of noise within their communities and jurisdiction. The Noise Control Act was supplemented by the Quiet Communities Act of 1978 (PL 95-609).

Federal Transit Administration, Transit Noise and Vibration Impact Assessment, 2006

The FTA has developed acceptable vibration criteria for transportation related sources (Table N-1). The criteria are based in part on the frequency of events and related to groundborne vibration that can cause human annoyance or interference with the use of vibration-sensitive equipment. The criteria for acceptable groundborne vibration are expressed in terms of RMS velocity levels in VdB and are based on the maximum levels for a single event (Lmax). Land uses are grouped into three categories: Category 1, Category 2 and Category 3.

TABLE NS-2
FTA GROUNDBORNE CRITERIA FOR GENERAL ASSESSMENT

Land Use Category	Frequent Events	Occasional Events	Infrequent Events
Category 1: Buildings were vibration would interfere with interior operations.	65 VdB	65 VdB	65 VdB
Category 2: Residences and buildings where people normally sleep.	72 VdB	75 VdB	80 VdB
Category 3: Institutional land uses with primary daytime use.	75 VdB	78 VdB	83 VdB

VdB re 1 micro-inch/second
Source: FTA 2006

Notes:

"Frequent Events" is defined as more than 70 vibration events of the same source per day.
"Occasional Events" is defined as between 30 and 70 vibration events of the same source per day.
"Infrequent Events" is defined as more than 30 vibration events of the same kind per day.

The Category 1 criterion limits are based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes.
Vibration-sensitive manufacturing or research will require detailed evaluation to define the acceptable vibration levels.

State of California

Airport Land Use Compatibility Plans (ALUCP) (Public Utilities Code, §21670, et seq.)

The ALUCPs promote compatibility between public use and military airports and the land uses that surround them to the extent that these areas are not already devoted to incompatible land uses. The City is required to

modify its land use plans and ordinances to be consistent with the ALUCPs or to take steps to overrule the Airport Land Use Commission (ALUC).

California Environmental Quality Act (CEQA)

CEQA considers exposure to excessive noise an environmental impact. Implementation of CEQA ensures that during the decision-making stage of development, City officials and the public will be informed of any potentially excessive noise levels and available mitigation measures to reduce them to acceptable levels.

California Noise Insulation Standards (California Code of Regulations, Title 24)

Title 24 establishes an interior noise standard of 45 dBA CNEL for multiple unit and hotel/motel structures. Acoustical studies must be prepared for proposed multiple unit residential and hotel/motel structures within the CNEL noise contours of 60 dBA or greater. The studies must demonstrate that the design of the building will reduce interior noise in habitable rooms to 45 dBA CNEL or lower.

California Airport Noise Standards (California Code of Regulations Title 21)

Division 2.5, Chapter 6, Section 5012 of Title 21 establishes that the 65 dBA CNEL is the acceptable level of aircraft noise for persons living near an airport.

Caltrans Project Development Procedures Manual (Section 2 of Chapter 30

Highway Traffic Noise Abatement) and 23 CFR 772: These documents specify the Noise Abatement Criteria (NAC) for noise-sensitive land uses. These criteria are presented in Table N-2. The NAC is applicable to new highways and changes to the horizontal or vertical alignment of existing highways and is required for Caltrans and local agency projects that receive federal funding or require Federal Highway Administration (FHWA) approval action.

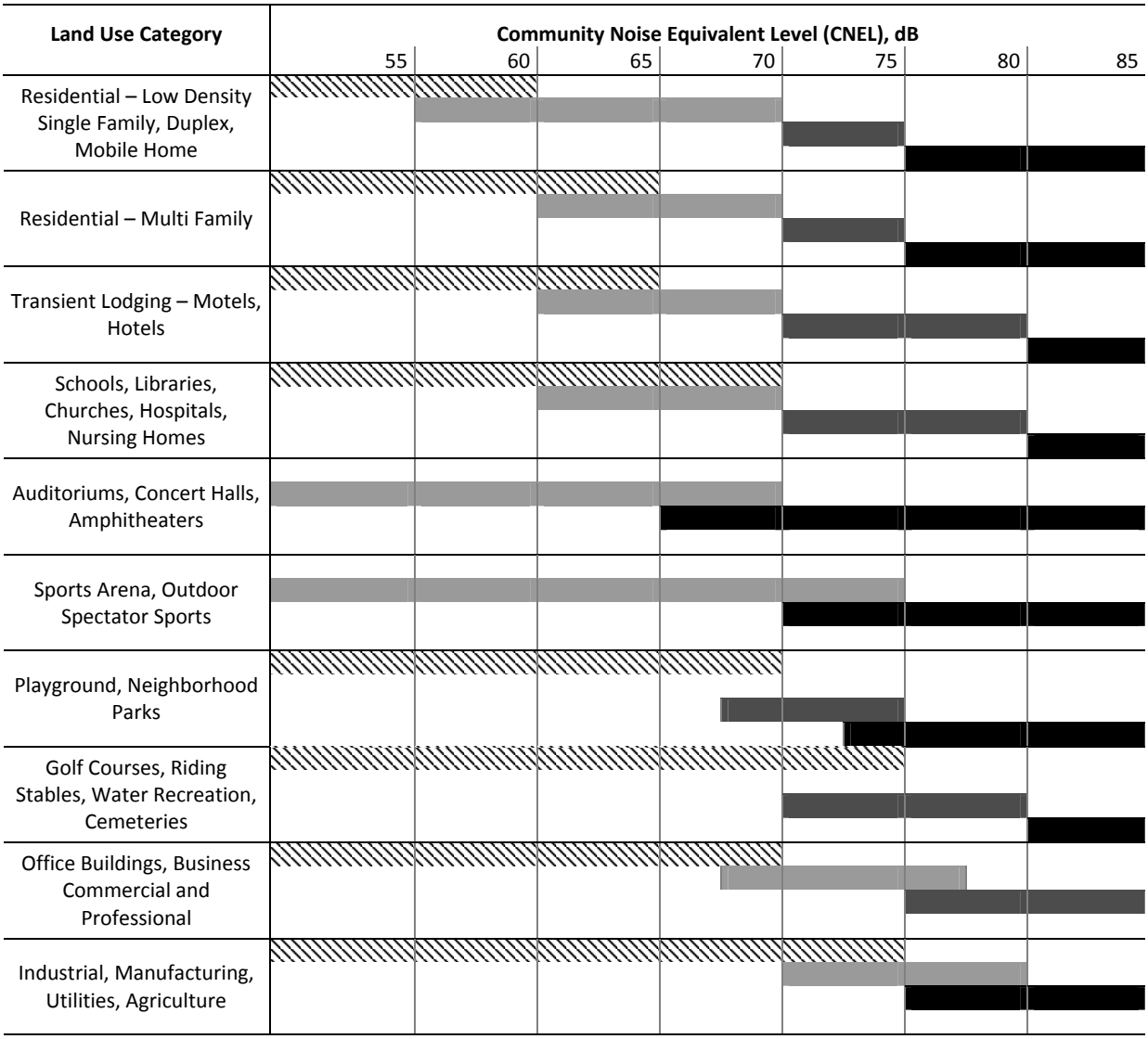
TABLE NS-3
FEDERAL AND CALIFORNIA STATE TRAFFIC NOISE ABATEMENT CRITERIA

Activity Category	Noise Abatement Criteria (Leq(h), dBA)	Description of Activity Category
A	57 (Exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (Exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals.
C	72 (Exterior)	Developed lands, properties, or activities not included in Categories A or B above.
D	--	Undeveloped lands.
E	52 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

Source: FHWA 2006

The State of California Office of Noise Control has developed land use compatibility guidelines for a variety of land uses as shown in the Land Use Compatibility Plan (Exhibit NS-1). The compatibility guidelines are used in conjunction with the future noise exposure contours to identify projects or activities which may require special treatment to minimize noise exposure. The land use categories in this exhibit are generic ones identified by the State of California. Categories identified in Exhibit NS-1 need to be interpreted as to there applicability to the City of Hesperia's land use categories identified in this General Plan.

Exhibit NS-1
State of California Land Use Compatibility Plan



Normally Acceptable	Conditionally Acceptable	Normally Unacceptable	Clearly Unacceptable
Specified land use is satisfactory, assuming buildings are of conventional construction	New development should be undertaken only after detailed analysis of noise reduction requirements are made.	New development should be generally discouraged, if not, a detailed analysis of noise reduction requirements must be made.	New development should generally not be undertaken

Source: State of California General Plan Guidelines (2003)

City of Hesperia

The City has developed policies related to land use and acceptable noise levels as shown in Table NS-3. The table is a primary tool which allows the City to ensure integrated planning compatibility between land uses and outdoor noise compatibility guidelines. The information is used to identify projects or activities which may require special treatment to minimize noise exposure.

TABLE NS-4
INTERIOR AND EXTERIOR NOISE STANDARDS

Land Use Categories		Community Noise Equivalent Level (CNEL)	
Categories	**Land Uses**	**Interior[1]**	**Exterior[2]**
Residential	Single Family, Duplex, Multiple Family	45[3]	65
	Mobile Homes	n/a	65[4]
Commercial Industrial Institutional	Hotel, Motel, Transient Lodging	45	65[5]
	Commercial Retail, Bank, Restaurant	55	n/a
	Office Building, Research and Development, Professional Offices, City Office Building	50	n/a
	Amphitheatre, Concert Hall, Meeting Hall	45	n/a
	Gymnasium (Multipurpose)	50	n/a
	Sports Club	55	n/a
	Manufacturing, Warehousing, Wholesale, Utilities	65	n/a
	Movie Theatres	45	n/a
Institutional	Hospitals, School Classrooms	45	65
	Church, Library	45	n/a
Open Space	Parks	n/a	65

Interpretation

1. Indoor environment excluding: Bathrooms, toilets, closets, corridors.
2. Outdoor environment limited to:
   Private yard of single family
   Multi-family private patio or balcony which is served by a means of exit from inside.
   Mobile home park
   Hospital patio
   Park picnic area
   School playground
   Hotel and motel recreation area
3. Noise level requirement with closed windows. Mechanical ventilation system or other means of natural ventilation shall be provided per Building Code.
4. Exterior noise level should be such that interior noise level will not exceed 45 dBA CNEL.
5. Except those areas affected by aircraft noise.

The City Municipal Code identifies noise standards across property lines. The Section states the following:

Noise Measurement.

Noise will be measured with a sound level meter, which meets the standards of the American National Standards Institute (ANSI Section S1.4-1979, Type 1 or Type 2). Noise levels shall be measured using the "A" weighted sound pressure level scale in decibels (ref. pressure = 20 micro-newtons per meter squared). The unit of measure shall be designated as dB(A). The building official shall be the noise control officer.

Noise Standards.

The following table describes the noise standard for emanations from any source, as it affects adjacent properties:

TABLE NS-5
NOISE STANDARDS

Affected Land Use (Receiving Noise)	Maximum Noise Level	Time Period
A-1, A-2, R-1, R-3, and RR Zone Districts	55 dB(A)	10:00 p.m. – 7:00 a.m.
A-1, A-2, R-1, R-3, and RR Zone Districts	60 dB(A)*	7:00 a.m. – 10:00 p.m.
C-1, C-2, C-3, C-4, C-R, AP, and P-I Zone Districts	65 dB(A)*	Anytime
I-1 and I-2 Zone Districts	70 dB(A)*	Anytime

* *Due to wind noise, the maximum permissible noise level may be adjusted so that it is no greater than 5 dB(A) above the ambient noise level.*

No person shall operate or cause to be operated any source of sound at any location 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, either incorporated or unincorporated, to exceed:

- The noise standard for that receiving land use (as specified in subsection (B)(1) of this section) for a cumulative period of more than thirty (30) minutes in any hour; or

- The noise standard plus five dB(A) for a cumulative period of more than fifteen (15) minutes in any hour; or

- The noise standard plus ten dB(A) for a cumulative period of more than five minutes in any hour; or

- The noise standard plus fifteen (15) dB(A) for a cumulative period of more than one minute in any hour; or

- The noise standard plus twenty (20) dB(A) for any period of time.

If the measured ambient level exceeds any of the first four noise limit categories above, the allowable noise exposure standard will be increased to reflect the ambient noise level. If the ambient noise level exceeds the fifth noise limit category, the maximum allowable noise level under this category shall be increased to reflect the maximum ambient noise level.

If the alleged offense consists entirely of impact noise or simple tone noise, each of the noise levels in subsection (B)(1) of this section shall be reduced by five dB(A).

Exempt Noises.

The following sources of noise are exempt:

- Motor vehicles not under the control of the industrial use;
- Emergency equipment, vehicles and devices;
- Temporary construction, repair, or demolition activities between seven a.m. and seven p.m. except Sundays and federal holidays.

The City Municipal Code establishes vibration standards as follows:

Vibration Standard.

No ground vibration shall be allowed which can be felt without the aid of instruments at or beyond the lot line; nor will any vibration be permitted which produces a particle velocity greater than or equal to 0.2 inches per second measured at or beyond the lot line.

Vibration Measurement.

Vibration velocity shall be measured with a seismograph or other instrument capable of measuring and recording displacement and frequency, particle velocity or acceleration. Readings are to be made at points of maximum vibration along any lot line next to a residential or commercial district or a community industrial lot.

Exempt Vibrations.

The following sources of vibration are not regulated by this code:

- Motor vehicles not under the control of the industrial use;
- Temporary construction, maintenance or demolition activities between seven a.m. and seven p.m. except Sundays and federal holidays.

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3.0 ISSUES

The following goals and policies emphasize the control and abatement of noise through standards, site planning, and noise mitigation.

NOISE MITIGATION

Effective noise abatement measures are unique for each situation. The physical techniques to mitigate noise vary in their noise reduction capabilities. Factors to consider when evaluating potential noise mitigation include: the amount of noise reduction desired, where physical techniques would be most effective, and aesthetics. The following measures can be used to mitigate noise impacts:

Site Planning

Proper site planning to reduce noise impacts should be considered for all noise-sensitive developments. Buildings can be oriented on a site in such a way as to exploit the site's noise attenuating features. By consideration of a site's natural topography, size and shape, it is often possible to reduce and possibly eliminate noise impacts from vehicular traffic and railroads. Site planning techniques include the following:

- Increasing the distance from the noise source to sensitive receptors by creation of setbacks;
- Placing non-noise-sensitive uses such as parking lots and utility areas between the noise source and receiver; and
- Orienting usable outdoor living space such as balconies, patios, and child play areas away from roadways.

Goal: NS-1	**To achieve and maintain an environment which is free from excessive or harmful noise through identification, control and abatement.**
Implementation Policy: NS-1.1	Incorporate noise reduction features during site planning and into land use planning decisions to mitigate anticipated noise impacts on affected residential and noise-sensitive land uses.
Implementation Policy: NS-1.2	Control and abate undesirable sounds through the use of the land use compatibility criteria shown in Exhibit NS-1, Table NS-3, and the Municipal Code Section 16.20.125(B).
Implementation Policy: NS-1.3	Enforce the California Noise Insulation Standards (California Code of Regulations, Title 24). Title 24 requires that an acoustical analysis be performed for all new multi-family residences in areas where the exterior sound level exceeds 60 dBA CNEL. The analysis shall ensure that the building design limits the interior noise environment to 45 dBA CNEL or below.
Implementation Policy: NS-1.4	Require that an acoustical analysis be performed for all new single-family residences in areas where the exterior sound level exceeds 60 dBA CNEL. The analysis shall ensure that the building design limits the interior noise environment to 45 dBA CNEL or below.
Implementation Policy: NS-1.5	Require the design and construction of commercial, industrial, office, and mixed-use structures to be developed with noise attenuation methods to minimize excessive noise upon noise-sensitive land uses.

Implementation Policy: NS-1.6	Provide developers and builders with development noise policy guidelines. The guidelines shall provide specific design criteria, minimum standards for submittal of acoustical studies and descriptions of acceptable noise mitigation measures.
Implementation Policy: NS-1.7	Ensure that residential uses and areas intended for frequent outdoor use (See Table NS-3 footnote 2.) are not subjected to inappropriate noise levels resulting from transportation systems.
Implementation Policy: NS-1.8	Coordinate with state and local agencies to maintain and enforce noise control policies and standards.
Implementation Policy: NS-1.9	Encourage commercial, industrial, office and mixed-use developments to locate loading areas, parking lots, driveways, trash enclosures, mechanical equipment, and other noisier components away from noise-sensitive land uses.
Implementation Policy: NS-1.10	Limit the hours of construction activity in, and around, residential areas in order to reduce the intrusion of noise in the early morning and late evening hours and on weekends and holidays.
Implementation Policy: NS-1.11	Limit delivery hours for businesses with loading areas or docks fronting, siding, or bordering or gaining access on driveways adjacent to noise-sensitive areas.
Implementation Policy: NS-1.12	Implement nighttime and daytime on-site noise level limits to address noise generated by commercial and industrial uses where it affects abutting residential and other noise-sensitive land uses.

Implementation Policy: NS-1.13	Ensure adequate noise control measures at construction sites by requiring that construction equipment be fitted with manufacturer-recommended mufflers and ensuring physical separation of machinery maintenance and staging areas from adjacent residential uses.
Implementation Policy: NS-1.14	Encourage noise compatible land uses within airport influence areas in accordance with federal and state noise standards and guidelines.
Implementation Policy: NS-1.15	Require an avigation easement for new residential development within the Airport Noise Area, as defined in the Land Use Element.
Implementation Policy: NS-1.16	Review the noise element when major changes in the noise environment occur.

Barriers

Noise barriers such as walls and earthen berms are commonly used to mitigate noise from ground transportation, commercial and industrial sources. Noise barriers can be used to reduce the noise level both outdoors and indoors. The effectiveness of a barrier depends upon factors such as the relative height of the barrier relative to the line-of-sight from the source to the receiver, the distance from the barrier to the source and to the receiver and the reflections of sound. To be effective, a barrier must block the line-of-sight from the source to the receiver. A barrier must also be of solid construction (i.e., masonry) without holes or gaps and be long enough to prevent sound from passing around the ends. Under the best of circumstances, a properly designed noise barrier can reduce noise as much as 15 decibels. A site-specific acoustical analysis is required to determine the proper height and placement of a barrier.

A row of houses or other buildings may act as a barrier. A row of one- or two-story houses (with about 30 percent open gaps) provides a barrier attenuation of approximately 3 to 5 decibels; two rows of houses, 6 to 10 decibels; and three or more rows of houses, 10 to 12 decibels.

Building Design

The location of a building on its site, the arrangement of rooms, and the location of doors and windows all have a bearing on interior noise control. The sides of a building which face a roadway or other noise source should house those activities that can tolerate the greatest amount of noise. Noise-sensitive areas include bedrooms, living rooms and dens. Less noise-sensitive areas may include kitchens and bathrooms. Hallways, closets and storage rooms are generally not noise-sensitive.

Indoor noise levels are controlled by the noise reduction characteristics of the building shell. In general, doors and windows are the acoustical weak link in a building. Therefore, careful consideration should be given to their placement. By limiting the number and size of these openings on the sides of the building exposed to noise, interior noise levels will be reduced.

Often it is necessary to allow for a closed window condition to control interior noise. When this occurs, an alternative means of ventilation such as heat pumps or forced air units is required to meet the Uniform Building Code requirements. Heavy-pane or double-pane windows are frequently required to increase the sound insulation within a room. Doors facing a noise source should be solid-core and should be equipped with an appropriate gasket.

An interior noise analysis will be required for new residential development located in areas where future noise levels would exceed 60 dBA CNEL. The interior noise analysis should evaluate the proposed building shell (exterior wall, windows, and doors) to ensure that interior noise levels will not exceed 45 dBA CNEL. The analysis should be performed prior to obtaining a building permit.

Goal: NS-2	To achieve and maintain an environment which is free from excessive vibration.
Implementation Policy: NS-2.1	Control exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels as set forth in Table NS-1 and Municipal Code Section 16.20.130.
Implementation Policy: NS-2.2	Evaluate potential vibration impacts during site planning and into land use planning decisions for proposed residential building within 200 feet of the centerline of the nearest track of the BNSF and UP railroad.

4.0

SUMMARY OF GOALS AND IMPLEMENTATION POLICIES NOISE ELEMENT

Site Planning	
Goal: NS-1	**To achieve and maintain an environment which is free from excessive or harmful noise through identification, control and abatement.**
Implementation Policy: NS-1.1	Incorporate noise reduction features during site planning and into land use planning decisions to mitigate anticipated noise impacts on affected noise-sensitive land uses.
Implementation Policy: NS-1.2	Control and abate undesirable sounds through the use of the land use compatibility criteria shown in Exhibit NS-1, Table N-3, and Municipal Code Section 16.20.125(B).
Implementation Policy: NS-1.3	Enforce the California Noise Insulation Standards (California Code of Regulations, Title 24). Title 24 requires that an acoustical analysis be performed for all new multi-family residences in areas where the exterior sound level exceeds 60 dBA CNEL. The analysis shall ensure that the building design limits the interior noise environment to 45 dBA CNEL or below.
Implementation Policy: NS-1.4	Require that an acoustical analysis be performed for all new single-family residences in areas where the exterior sound level exceeds 60 dBA CNEL. The analysis shall ensure that the building design limits the interior noise environment to 45 dBA CNEL or below.
Implementation Policy: NS-1.5	Require the design and construction of commercial, industrial, office and mixed-use structures developments with noise attenuation methods to minimize excessive noise upon noise-sensitive land uses.

Implementation Policy: NS-1.6	Provide developers and builders with development noise policy guidelines. The guidelines shall provide specific design criteria, minimum standards for submittal of acoustical studies and descriptions of acceptable noise mitigation measures.
Implementation Policy: NS-1.7	Ensure that areas frequent outdoor use (See Table N-3 footnote 2.) at noise-sensitive land uses are not subjected to inappropriate noise levels resulting from transportation systems.
Implementation Policy: NS-1.8	Coordinate with state and local agencies to maintain and enforce noise control policies and standards.
Implementation Policy: NS-1.9	Encourage commercial, industrial, office and mixed-use developments to locate loading areas, parking lots, driveways, trash enclosures, mechanical equipment, and other noisier components away from noise-sensitive land uses.
Implementation Policy: NS-1.10	Limit the hours of construction activity in, and around, residential areas in order to reduce the intrusion of noise in the early morning and late evening hours and on weekends and holidays.
Implementation Policy: NS-1.11	Limit delivery hours for businesses with loading areas or docks fronting, siding, or bordering or gaining access on driveways adjacent to noise-sensitive areas.
Implementation Policy: NS-1.12	Implement nighttime and daytime on-site noise level limits to address noise generated by commercial and industrial uses where it affects abutting residential and other noise-sensitive land uses.

Implementation Policy: NS-1.13	Ensure adequate noise control measures at construction sites by requiring that construction equipment be fitted with manufacturer-recommended mufflers and ensuring physical separation of machinery maintenance and staging areas from adjacent residential uses.
Implementation Policy: NS-1.14	Encourage noise compatible land uses within airport influence areas in accordance with federal and state noise standards and guidelines.
Implementation Policy: NS-1.15	Require an avigation easement for new residential development within the Airport Noise Area, as defined in the Land Use Element.
Implementation Policy: NS-1.16	Review the noise element when major changes in the noise environment occur.
Building Design	
Goal: NS-2	**To achieve and maintain an environment which is free from excessive vibration.**
Implementation Policy: NS 2.1	Control exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels as set forth in Table NS-1 and Municipal Code Section 16.20.130.
Implementation Policy: NS 2.2	Evaluate potential vibration impacts during site planning and into land use planning decisions for proposed residential building within 200 feet of the centerline of the nearest track of the BNSF and UP railroad.

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5.0 GLOSSARY

The terms and definitions in this glossary are commonly found in environmental noise literature.

Ambient Noise: All-encompassing noise at a given place and time. This is usually a composite of sounds from all sources near and far, including any specific sources of interest.

A-Weighted Level: The sound level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the response of the human ear and gives good correlation with subjective reactions to noise.

Community Noise Equivalent Level (CNEL): The average equivalent A-weighted sound level during a 24-hour day, obtained after addition of five decibels to sound levels in the evening from 7:00 p.m. to 10:00 p.m. and after addition of 10 decibels to sound levels in the night from 10:00 p.m. to 7:00 a.m.

Day-Night Sound Level (Ldn): The average equivalent A-weighted sound level during a 24-hour day, obtained after the addition of 10 decibels to sound levels in the night after 10:00 p.m. and before 7:00 a.m. (Note: CNEL and Ldn represent daily levels of noise exposure averaged on an annual or daily basis, while Leq represents the equivalent energy noise exposure for a shorter time period, typically one hour.)

Decibel (dB): A unit of measurement describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure, which is 20 micropascals (20 micronewtons per square meter).

Equivalent Sound Level (Leq): The energy-averaged A-weighted sound level during a measured time interval. It is equal to the level of a continuous steady sound containing the same total acoustical energy over the averaging time period as the actual time-varying sound.

Frequency: The number of oscillations per second of a periodic wave sound and of a vibrating solid, expressed in units of hertz (Hz), formerly cycles per second (cps). 1 Hz = 1 cps = 1 oscillation per second.

Heavy Truck: A vehicle type for the purpose of noise prediction modeling defined as all vehicles with three or more axles designed for transportation of cargo. Generally, the gross weight is more than 26,500 pounds.

Hertz (Hz): Unit of frequency, formerly called cycles per second (cps). 1 Hz = 1 cps.

Maximum Sound Level (Lmax): Represents the root-mean-square (RMS) maximum noise level obtained during the measurement interval.

Medium Truck: A vehicle classification for the purpose of noise prediction modeling, defined as all vehicles with two axles and six wheels designed for transportation of cargo. Generally, the gross weight is more than 10,000 pounds and less than 26,500 pounds.

Minimum Sound Level (Lmin): Represents the root-mean-square minimum noise level obtained during the measurement interval. The Lmin value obtained for a particular monitoring location is often called the "acoustic floor" for that location.

Noise Barrier: A generic term for any feature that blocks or diminishes sound in its path from the source to receiver. Although the term can technically refer to any feature, manmade or natural, the two most common features included in noise barriers are sound walls and earth berms.

Noise Contours: Lines drawn about a noise source indicating equal levels of noise exposure.

Noise Sensitive Land Use: Land uses associated with indoor and/or outdoor activities that may be subject to stress and/or significant interference from noise, such as residential dwellings, transient lodging, dormitories, hospitals, educational facilities, public assembly facilities, amphitheatres, congregate care facilities, childcare facilities, and libraries.

Peak Particle Velocity (PPV): The peak signal value of an oscillating vibration velocity waveform. Usually expressed in inches/second in the United States.

Percentile Noise Level (Ln): Characterizes the time-varying character of environmental noise by identifying the noise level exceeded n% of the time. For example, the statistical noise descriptors L10, L50, and L90 are the noise levels exceeded during 10, 50, and 90 percent of a stated time, respectively. Sound levels associated with L10 typically describe transient or short-term events, whereas levels associated with L90 describe the steady-state (or most prevalent) noise conditions.

Receiver/Receptor: A stationary far-field position at which noise or vibration levels are specified.

Root Mean Square (RMS): The square root of the mean-square value of an oscillating waveform, where the mean-square value is obtained by squaring the value of amplitudes at each instant of time and then averaging these values over the sample time.

Single Event Level (SEL): The summation of the A-weighted sound energy at a particular location over the true duration of a noise event normalized to a duration of one second. The true duration is defined as the amount of time the noise event exceeds background levels. For events lasting more than one second, SEL does not directly represent the sound level heard at any given time, but rather provides a measure of the net impact of the entire acoustic event. SEL combines an event's overall sound level along with its duration. SEL provides a comprehensive way to describe noise events for use in modeling and comparing noise environments.

Sound: A physical disturbance in a medium that is capable of being detected by the human ear.

Vibration: An oscillation wherein the quantity is a parameter that defines the motion of a mechanical system.

Vibration Velocity Level (VdB): Ten times the common logarithm of the ratio of the square of the amplitude of the RMS vibration velocity to the square of the amplitude of the reference RMS vibration velocity.

16.20.125 - Noise.

A. Noise Measurement. Noise will be measured with a sound level meter, which meets the standards of the American National Standards Institute (ANSI Section S1.4-1979, Type 1 or Type 2). Noise levels shall be measured using the "A" weighted sound pressure level scale in decibels (ref. pressure = 20 micro-newtons per meter squared). The unit of measure shall be designated as dB(A). The building official shall be the noise control officer.

B. Noise Standards.

1. The following table describes the noise standard for emanations from any source, as it affects adjacent properties:

NOISE STANDARDS

Affected Land Use (Receiving Noise)	Maximum Noise Level	Time Period
A-1, A-2, R-1, R-3 and RR Zone Districts	55 dB(A)	10:00 p.m. - 7:00 a.m.
A-1, A-2, R-1, R-3 and RR Zone Districts	60 dB(A)*	7:00 a.m. - 10:00 p.m.
C-1, C-2, C-3, C-4, C-R, AP, and P-I Zone Districts	65 dB(A)*	Anytime
I-1 and I-2 Zone Districts	70 dB(A)*	Anytime

* Due to wind noise, the maximum permissible noise level may be adjusted so that it is no greater than five dB(A) above the ambient noise level.

2. No person shall operate or cause to be operated any source of sound at any location 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, either incorporated or unincorporated, to exceed:

a. The noise standard for that receiving land use (as specified in subsection (B)(1) of this section) for a cumulative period of more than thirty (30) minutes in any hour; or

b. The noise standard plus five dB(A) for a cumulative period of more than fifteen (15) minutes

in any hour; or

c. The noise standard plus ten dB(A) for a cumulative period of more than five minutes in any hour; or

d. The noise standard plus fifteen (15) dB(A) for a cumulative period of more than one minute in any hour; or

e. The noise standard plus twenty (20) dB(A) for any period of time.

C. If the measured ambient level exceeds any of the first four noise limit categories above, the allowable noise exposure standard shall be increased to reflect the ambient noise level. If the ambient noise level exceeds the fifth noise limit category, the maximum allowable noise level under this category shall be increased to reflect the maximum ambient noise level.

D. If the alleged offense consists entirely of impact noise or simple tone noise, each of the noise levels in subsection (B)(1) of this section shall be reduced by five dB(A).

E. Exempt Noises. The following sources of noise are exempt:

1. Motor vehicles not under the control of the industrial use;
2. Emergency equipment, vehicles and devices;
3. Temporary construction, repair, or demolition activities between seven a.m. and seven p.m. except Sundays and federal holidays.

(Ord. 2002-07 Exh. A, 2002; Amended during 1997 codification; Ord. 75 § 2 (part), 1990; SBCC § 87.1305)

16.20.130 - Vibration.

A. Vibration Standard. No ground vibration shall be allowed which can be felt without the aid of instruments at or beyond the lot line; nor will any vibration be permitted which produces a particle velocity greater than or equal to 0.2 inches per second measured at or beyond the lot line.

B. Vibration Measurement. Vibration velocity shall be measured with a seismograph or other instrument capable of measuring and recording displacement and frequency, particle velocity or acceleration. Readings are to be made at points of maximum vibration along any lot line next to a residential or commercial district or a community industrial lot.

C. Exempt Vibrations. The following sources of vibration are not regulated by this code:

1. Motor vehicles not under the control of the industrial use;
2. Temporary construction, maintenance or demolition activities between seven a.m. and seven p.m. except Sundays and federal holidays.

(SBCC § 87.1310)

CONSTRUCTION NOISE MODELING

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 06/07/2022
Case Description: PATH-03

**** Receptor #1 ****

Baselines (dBA)

Description	Land Use	Daytime	Evening	Night
Site Preparation	Residential	60.0	55.0	50.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Tractor	No	40	84.0		50.0	0.0
Front End Loader	No	40		79.1	50.0	0.0
Dozer	No	40		81.7	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
Tractor	84.0	80.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
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
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
Total	84.0	82.8	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: 06/07/2022
Case Description: PATH-03

**** Receptor #1 ****

Baselines (dBA)

Description	Land Use	Daytime	Evening	Night
Site Prep & Rough Grading	Residential	60.0	55.0	50.0

Equipment

Description	Impact Device	Spec Usage (%)	Actual Lmax (dBA)	Receptor Lmax (dBA)	Estimated Distance (feet)	Shielding (dBA)
Dozer	No	40	81.7	50.0		0.0
Scraper	No	40	83.6	50.0		0.0
Tractor	No	40	84.0	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
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
Scraper	83.6	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
Tractor	84.0	80.0	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	84.0	84.0	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: 06/07/2022
Case Description: PATH-03

**** Receptor #1 ****

Baselines (dBA)

Description	Land Use	Daytime	Evening	Night
Utility Trenching	Residential	60.0	55.0	50.0

Equipment

Description	Impact Device	Spec Usage (%)	Actual Lmax (dBA)	Receptor Lmax (dBA)	Estimated Distance (feet)	Shielding (dBA)
Excavator	No	40	80.7	50.0	0.0	
Front End Loader	No	40	79.1	50.0	0.0	

Results

			Noise Limits (dBA)				Noise Limit Exceedance (dBA)					
	Calculated (dBA)		Day		Evening		Night		Day		Evening		Night	
Equipment	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Excavator	80.7	76.7	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	80.7	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: 06/07/2022
Case Description: PATH-03

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Main Building Construction	Residential	60.0	55.0	50.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Man Lift	No	20		74.7	50.0	0.0
Man Lift	No	20		74.7	50.0	0.0
Man Lift	No	20		74.7	50.0	0.0

Results

Equipment	Calculated (dBA) Lmax	Leq	Noise Limits (dBA) Day Lmax	Leq	Evening Lmax	Leq	Night Lmax	Leq	Noise Limit Exceedance (dBA) Day Lmax	Leq	Evening Lmax	Leq	Night Lmax	Leq
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
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
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
Total	74.7	72.5	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: 06/07/2022
Case Description: PATH-03

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Main Building Construction and Modular Building Installation	Residential	60.0	55.0	50.0

Equipment

Description	Impact Device	Spec Usage (%)	Actual Lmax (dBA)	Receptor Lmax (dBA)	Estimated Distance (feet)	Shielding (dBA)
Man Lift	No	20	74.7	50.0		0.0
Man Lift	No	20	74.7	50.0		0.0
Man Lift	No	20	74.7	50.0		0.0

Results

Equipment	Calculated (dBA) Lmax	Leq	Noise Limits (dBA) Day Lmax	Leq	Evening Lmax	Leq	Night Lmax	Leq	Noise Limit Exceedance (dBA) Day Lmax	Leq	Evening Lmax	Leq	Night Lmax	Leq
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
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
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
Total	74.7	72.5	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: 06/07/2022
Case Description: PATH-03

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Architectural Coating	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
Man Lift	No	20		74.7	50.0	0.0
Man Lift	No	20		74.7	50.0	0.0

Results

Equipment	Calculated (dBA) Lmax	Leq	Noise Limits (dBA) Day Lmax	Leq	Evening Lmax	Leq	Night Lmax	Leq	Noise Limit Exceedance (dBA) Day Lmax	Leq	Evening Lmax	Leq	Night 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
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
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
Total	77.7	75.5	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: 06/07/2022
Case Description: PATH-03

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Finishing/Landscaping	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
Front End Loader	No	40		79.1	50.0	0.0

Results

Equipment	Calculated (dBA) Lmax	Leq	Noise Limits (dBA) Day Lmax	Leq	Evening Lmax	Leq	Night Lmax	Leq	Noise Limit Exceedance (dBA) Day Lmax	Leq	Evening Lmax	Leq	Night Lmax	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
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	79.1	79.4	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: 06/07/2022
Case Description: PATH-03

**** Receptor #1 ****

Baselines (dBA)

Description	Land Use	Daytime	Evening	Night
Paving	Residential	60.0	55.0	50.0

Equipment

Description	Impact Device	Spec Usage (%)	Actual Lmax (dBA)	Receptor Lmax (dBA)	Estimated Distance (feet)	Shielding (dBA)
Paver	No	50	77.2	50.0	0.0	
Roller	No	20	80.0	50.0	0.0	
Front End Loader	No	40	79.1	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
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
Roller	80.0	73.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
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	80.0	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

PATH-03 Construction Noise Modeling Attenuation Calculations

Levels in dBA Leq

Phase	RCNM Reference Noise Level	Residences to the northeast	Residences to the west	Residences to the south (Luna Apartments)/Church
Distance in feet	*50*	*430*	*700*	*590*
Site Preparation	83	64	60	61
Rough Grading	84	65	61	63
Distance in feet	*50*	*200*	*330*	*400*
Building Construction	73	60	56	54
Architectural Coating	76	63	59	57
Distance in feet	*50*	*300*	*180*	*400*
Paving	79	63	68	61
Distance in feet	*50*	*100*	*100*	*100*
Utility Trenching	79	73	73	73
Finish and Landscaping	79	76	76	76

Attenuation calculated through Inverse Square Law: Lp(R2) = Lp(R1) - 20Log(R2/R1)

PATH-03 Vibration Damage Attenuation Calculations

		Levels in in/sec PPV		
Distance in feet	**Vibration Reference Level at *25 feet***	**Residences to the northeast** *130*	**Residences to the west** *120*	**Residences to the south (Luna Apartments)** *520*
Vibratory Roller	0.21	0.018	0.020	0.002
Hoe Ram	0.089	0.008	0.008	0.001
Large Bulldozer	0.089	0.008	0.008	0.001
Caisson Drilling	0.089	0.008	0.008	0.001
Loaded Trucks	0.076	0.006	0.007	0.001
Jackhammer	0.035	0.003	0.003	0.000
Small Bulldozer	0.003	0.000	0.000	0.000

TRANSPORATION NOISE MODELING

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessment
Developed for Chicago Create Project

Case: BNSF Cajon Sub Existing - School Hours

RESULTS			
Noise Source	**Ldn (dB)**	**Leq - daytime (dB)**	**Leq - nighttime (dB)**
All Sources	61	63	26
Source 1	57	59	26
Source 2	59	61	9
Source 3	0	0	0
Source 4	0	0	0
Source 5	0	0	0
Source 6	0	0	0
Source 7	0	0	0
Source 8	0	0	0

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	2

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	Freight Locomotive	9	Freight Cars	10		
Distance (source to receiver)	distance (ft)	350	distance (ft)	350		
Daytime Hours	speed (mph)	40	speed (mph)	40		
(7 AM - 10 PM)	trains/hour	2.2	trains/hour	2.2		
	locos/train	5	length of cars (ft) / train	7150		
Nighttime Hours	speed (mph)	0	speed (mph)	0		
(10 PM - 7 AM)	trains/hour	0	trains/hour	0		
	locos/train	0	length of cars (ft) / train	0		
Wheel Flats?		0.00%	% of cars w/ wheel flats	0.00%		
Jointed Track?	Y/N	n	Y/N	n		
Embedded Track?	Y/N	n	Y/N	n		
Aerial Structure?	Y/N	n	Y/N	n		
Barrier Present?	Y/N	n	Y/N	n		
Intervening Rows of of Buildings	number of rows	0	number of rows	0		

Traffic Noise Calculator: FHWA 77-108 **Project Title: Existing, PATH-03**

	Output						Inputs												
	dBA at 50 feet			Distance to CNEL Contour															
ID	$L_{eq\text{-}24hr}$	L_{dn}	CNEL	70 dBA	65 dBA	60 dBA	Roadway	Segment	ADT	Posted Speed Limit	Grade	% Autos	% Med Trucks	% Heavy Trucks	% Daytime	% Evening	% Night	Number of Lanes	Site Condition	Distance to Reciever
1	57.9	60.7	61.4	7	22	69	3rd Street	north of Mauna Loa	2,135	45	0.0%	97.4%	1.8%	0.7%	75.0%	15.0%	10.0%	4	Hard	50
2	56.8	59.6	60.3	5	17	53		south of Muana Loa	1,695	45	0.0%	97.4%	1.8%	0.7%	75.0%	15.0%	10.0%	1	Hard	50
3	57.1	59.9	60.6	6	18	57		north of Willow	1,789	45	0.0%	97.4%	1.8%	0.7%	75.0%	15.0%	10.0%	3	Hard	50
4	57.9	60.7	61.4	7	22	69		S/O Willow	2,124	45	0.0%	97.4%	1.8%	0.7%	75.0%	15.0%	10.0%	4	Hard	50
9	71.2	73.9	74.6	145	459	1453	Hesperia	north of Hercules	27,000	55	0.0%	97.4%	1.8%	0.8%	75.0%	15.0%	10.0%	2	Hard	50
5	61.3	64.1	64.8	15	47	150		north of Main Street	4,641	45	0.0%	97.4%	1.8%	0.7%	75.0%	15.0%	10.0%	4	Hard	50

STATIONARY NOISE MODELING

PATH-03 Outdoor Recreational Noise Modeling

Levels in dBA Leq

Noise Sources	Referecne Noise Levels	Residences to NE			
Distance in feet	*70*	*300*			
Hardcourts	64	51			
Distance in feet	*15*	*100*			
Soccer	60	44			

Attenuation calculated through Inverse Square Law: Lp(R2) = Lp(R1) - 20Log(R2/R1)