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

VI. Noise

Introduction and Purpose

The Noise Element describes how the City considers noise control in the planning process. This element identifies noise-sensitive land uses and noise sources, evaluates existing noise issues, defines potential noise impact areas, and advocates creative methods to protect the community from excessive noise. The element provides proactive solutions to noise problems varying from construction noise and clamoring mechanical equipment to roadway noise and the cacophony of barking dogs, and describes noise control measures designed to avoid noise problems before they occur.

The noise environment relates to a community's quality of life. Noise has been linked directly to numerous human health factors; aside from general annoyances, excessive noise is a source of discomfort, interferes with sleep, and disrupts communication and relaxation.

Recognizing that excessive or unusual noise affects human health and welfare, the state has developed guidelines both for determining community noise levels and for establishing programs to reduce community exposure to adverse noise levels. Policies, plans, and programs outlined in the Noise Element are designed to minimize the effects of human-caused noise in the community, and to improve residents' quality of life by regulating and reducing noise, particularly in residential areas and near such noise-sensitive land uses as residences, hospitals, convalescent and day care facilities, schools, and libraries. The element provides direction regarding practices and strategies to protect city residents and businesses from severe noise levels.

Mixed-use residential and commercial development present unique noise reduction challenges. Although located in predominantly commercial environments, the residential portions of mixed-use projects are nonetheless subject to residential noise standards and guidelines established by the state. Strategies to address these noise concerns focus on incorporating noise-reducing features into project design.

Scope and Content

California Government Code Section 65302(f) establishes the requirement for a noise element to "identify and appraise noise problems in a community" and to "analyze and quantify, to the extent practicable…current and projected noise levels." The noise element must identify the sources of noise and identify both existing and future noise contours—distances at which a predicted noise level will occur. State law requires that the noise element consider the following major noise sources:

- Highways and freeways
- Primary arterials and major local streets
- Railroad operations
- Aircraft and airport operations
- Local industrial facilities
- Other stationary sources

This element consists of this *Introduction and Purpose* summarizing the general purpose of the Noise Element; a *Noise Plan* describing fundamentals of sound and noise, defining noise standards, presenting contour maps, and recommending strategies to achieve goals and implement policies; and *Issues, Goals, and Policies* outlining the most important noise issues affecting the planning area.

Relationship to Other Elements

Noise policies and programs affect implementation of the Land Use Element as it relates to both noise sources and noise-sensitive uses. The noise contours and land use compatibility standards contained in the Noise Element should be used when evaluating planning and development decisions.

The Noise Element also relates directly to the Circulation Element, because Huntington Beach's primary noise sources are transportation-related noise along arterial roadways and highways, and, to a lesser extent, the freeway, railways, and aircraft. Noise policies mitigate excessive noise along transportation routes. Similarly, noise policies relate to the Housing Element by directing new housing development to appropriate sites away from sources of excessive noise and requiring that design features be incorporated to ensure acceptable indoor noise levels.

Noise Plan

The following describes the fundamentals of sound and noise, defines noise standards, and presents contour maps.

Measuring Noise

Noise Fundamentals

Noise sources in Huntington Beach fall into two categories: transportation oriented and non-transportation oriented. Examples of transportation-oriented noise include noise generated by vehicles, airplanes, and rail cars operating within the planning area. Examples of non-transportation noise include noise generated from mechanical or industrial processes, such as oil extraction, lawn equipment, and construction activities.

Noise is most often defined as unwanted sound. Although sound can be easily measured, the perception of noise levels is subjective and the physical response to sound complicates the analysis of its effects on people. People judge the relative magnitude of sound sensation in subjective terms such as noisiness or loudness. Sound pressure magnitude is measured and quantified using a logarithmic ratio of pressures, the scale of which gives the level of sound in decibels (dB). **Table N-1** presents the subjective effect of changes in sound pressure levels.

Table N-1
Changes in Sound Pressure Levels, dB

Decibel Change	Change in Apparent Loudness
+/- 3 dB	Threshold of human perceptibility
+/- 5 dB	Clearly noticeable change in noise level
+/- 10 dB	Twice/half as loud
+/- 20 dB	Louder/much quieter

Source: Engineering Noise Control, Bies and Hansen (1988).

To account for the pitch of sounds and an average human ear's response to such sounds, a unit of measure called an A-weighted sound pressure level (dBA) is used.

Noise Descriptors

Several rating scales have been developed to analyze the adverse effect of community noise on people. Since environmental noise fluctuates over time, these scales consider that the effect of noise on people is largely dependent on the total acoustical energy content of the noise as well as the time of day when the noise occurs. The following common metrics describe the way humans perceive sound:

- L_{eq}, the equivalent energy noise level, is the average acoustic energy content of noise for a stated period of time. For evaluating community impacts, this rating scale does not vary, regardless of whether the noise occurs during the day or the night.
- L_{dn}, the Day-Night Average Level, is a 24-hour average L_{eq} with a 10 dBA weighting added to noise during the hours of 10:00 p.m. to 7:00 a.m. to account for noise sensitivity in the nighttime. The logarithmic effect of these additions is that a 60 dBA 24 hour L_{eq} would result in a measurement of 66.4 dBA L_{dn}.
- CNEL, the Community Noise Equivalent Level, is a 24-hour average L_{eq} with a 10 dBA weighting added to noise during the hours of 10:00 p.m. to 7:00 a.m., and an additional 5 dBA weighting during the hours of 7:00 p.m. to 10:00 p.m. to account for noise sensitivity in the evening and nighttime. The logarithmic effect of these additions is that a 60 dBA 24-hour L_{eq} would result in a measurement of 66.7 dBA CNEL.
- L_{min}, the minimum instantaneous noise level experienced during a given period of time.
- L_{max}, the maximum instantaneous noise level experienced during a given period of time.

Assigning the proper noise descriptor when evaluating a noise source is essential to determining potential environmental impact on the community. Stationary-source noise (e.g., leaf blowers; heating, ventilation, and air conditioning; and loading docks) is generally analyzed using an hourly standard (L_{eq}). Transportation noise sources (e.g., vehicular traffic, aircraft overflights, and train passbys) occur as variable, individual events throughout the day. Hourly descriptors are not effective at describing transportation noise because it occurs at all hours. Instead, a 24-hour descriptor (L_{dn} or CNEL) is used to analyze transportation noise sources because the evening and nighttime penalties are applied to reflect increased sensitivity to noise during the evening and nighttime hours. CNEL is the noise level descriptor, consistent with state guidelines, applied by the City throughout this Noise Element to describe the current and future noise environment affected by transportation-generated noise.

Noise Sources and Concentration Areas

Land uses in the planning area include a range of residential, commercial, institutional, industrial, recreational, and open space areas. In general, the greatest source of noise throughout Huntington Beach is vehicle roadway noise generated along arterial roadways, as well as minor arterial roads within residential areas, and various stationary sources such as commercial heating, ventilation, and air conditioning (HVAC) units and petroleum extraction activities.

Mobile Sources

Roadways

Traffic noise originates from vehicles traveling on roads, with major roads such as Beach Boulevard, Bolsa Chica Street, Goldenwest Street, Adams Avenue, Brookhurst Street, and Pacific Coast Highway being significant contributors due to the volume and composition of traffic. Roadway noise is a combination of direct noise emissions from vehicles and the sound of tires passing over the road surface. In addition, large volumes of truck traffic can dramatically contribute to roadway noise, as the sounds generated from some vehicle brake technologies, large tires, and diesel engines greatly exceeds noise from passenger cars and light trucks.

Railways

The Union Pacific Railroad right-of-way runs east of Gothard Street, extending from the northern city limits to a terminus just north of Garfield Avenue. It provides freight service for the industrial corridor located along Gothard Street and is generally not located adjacent to noise-sensitive land uses. Current rail service is extremely limited, with approximately three trains per week traveling through the planning area. Although no specific proposal is anticipated at this time, the City intends to preserve options for future passenger rail transit along this corridor throughout the planning horizon of the General Plan.

Aircraft

No airport is located in the planning area, and no major flight corridors overlie Huntington Beach, although aircraft approaching or leaving nearby airports may fly over the community. Long Beach Airport is located approximately 12.5 miles to the northwest of the planning area, and John Wayne Airport is located approximately 3.5 miles to the southeast. The planning area is not located within the noise contours for either airport.

According to a Noise Analysis Report prepared by Veneklasen Associates in 2007, flights approaching Long Beach Airport regularly pass over the area near the intersection Bolsa Chica Street and Edinger Avenue at an altitude ranging between 1,600 feet to 2,100 feet. Individual commercial aircraft flying at these altitudes can result in noise levels of approximately 72 dBA on the ground. The control of aircraft flying over the city and the noise they make are under the jurisdiction of the Federal Aviation Administration (FAA). As such, the City has no authority over their operations.

Stationary Sources

Construction Activities

Construction activities are a regular and ongoing source of noise throughout the planning area. Noise levels generated by construction activities are generally isolated to the immediate vicinity of a construction site and occur during daytime hours in accordance with City regulations for relatively short-term periods ranging from a few weeks to a few months.

Commercial and Industrial Uses

Existing commercial uses are predominantly located in regional shopping centers such as Bella Terra, in Downtown Huntington Beach, and along the blocks adjacent to both sides of Beach Boulevard, Gothard Street, Edinger Avenue, and Warner Avenue. The primary noise sources associated with commercial

uses are commercial HVAC systems. Other noise sources include truck noise associated with the delivery of goods, as well as human activity.

Industrial uses are located primarily in the northwestern portion of the planning area (including and adjacent to the Boeing campus), along the Gothard Street corridor, in the Holly-Seacliff area, and along Pacific Coast Highway (near and including oil production facilities and the AES power plant). Aside from oil extraction, most industrial uses consist of warehousing, including vehicle and equipment storage along the Gothard Street corridor. Similar to commercial uses, the primary exterior noise sources associated with these uses are related to HVAC systems and medium-duty commercial trucks.

Land use changes anticipated in both the northwest industrial area and along the Gothard Street corridor will gradually transition to a mix of lighter industrial and commercial uses characterized by research and development and technology uses. These land use transitions are intended to be more compatible with sensitive receptor uses located in the vicinity of these areas, as these uses would be less noise intensive.

Oil Extraction

Huntington Beach has been an active site for oil extraction since the 1920s, and large-scale oil and gas production continues. Oil wells are scattered throughout much of the planning area, although most are concentrated along the coastal areas and mesas. Noise sources associated with oil extraction activities are related to heavy-duty vehicle use, including noise associated with site preparation, and are considered similar to construction noise levels.

Special Events

Many parks provide facilities for organized sports including baseball, soccer, and basketball. Noise from these activities can have a negative impact on neighboring residential land uses, particularly at parks where lighted fields allow evening activities. Additionally, the City regularly hosts special events on a local, regional, and international level. Local events include farmers markets, Surf City Nights, and evening music events in public parks, drawing crowds from a few dozen to a few thousand people. Regional and international events include the Huntington Beach Association of Volleyball Professionals Finals, the BB Jazz Festival at Central Park, and the Association of Surfing Professionals US Open of Surfing. Special events often use amplification devices, such as public address systems, and feature amplified music.

Noise Standards and Land Use Compatibility

Huntington Beach has developed land use compatibility standards, based on recommended parameters from the California Governor's Office of Planning and Research, that rate compatibility in terms of normally acceptable, conditionally acceptable, normally unacceptable, and clearly unacceptable. Using these land use compatibility guidelines, the City has established interior and exterior noise standards.

Some types of noise are only short-term irritants, like the banging of a hammer, the whine of a leaf blower, or amplified music and crowd noise from outdoor events. City noise regulations, including the Noise Control Ordinance, can control this type of noise. The City's Noise Ordinance (Chapter 8.40 of the Huntington Beach Municipal Code) identifies exterior and interior noise standards, specific noise restrictions, exemptions, and variances for sources of noise in the city. As such, the Municipal Code provides standards against intrusive noises such as loud gatherings, unauthorized construction-generated noise, and other invasive noises.

Noise environments and consequences of human activities are usually well represented by median noise levels during the day, night, or over a 24-hour period. Environmental noise levels would generally be considered low below 55 dBA CNEL, moderate in the 55 to 70 dBA CNEL range, and high above 70 dBA CNEL.

The City's land use-noise compatibility standards are presented in **Table N-2**. These standards are used in the land planning stage of the development process to identify project opportunities and constraints. In conjunction with the noise contour maps (**Figures N-1** and **N-2**), the standards may be used to determine whether a certain type of land use would be compatible with the existing and future noise environment. Proposed land uses should be compatible with existing and forecasted future noise levels. Projects with incompatible land use-noise exposures should incorporate noise attenuation and/or control measures within the project design that reduce noise to an acceptable interior level of 45 dBA CNEL or lower, as required by state regulations (California Code of Regulations Title 24) for residential uses.

The City's compatibility standards provide only for normally acceptable conditions, and are generally based on state recommendations and City land use designations. These standards, which use the CNEL noise descriptor, are intended to be applicable for land use designations exposed to noise levels generated by transportation-related sources. Land use compatibility noise exposure limits are generally established as 60 dBA CNEL for low-density and medium-density residential uses. However, for medium-high density residential, high-density residential, and mixed-use land use designations, a higher 65 dBA CNEL is permitted. Higher exterior noise levels are more often permitted for multiple-family housing and housing in mixed-use contexts than for single-family houses. This is

because multiple-family complexes are generally located in transitional areas between single-family and commercial districts or near major arterials served by transit, and a more integrated mix of residential and commercial activity (accompanied by higher noise levels) is often desired in such locations. These standards establish maximum interior noise levels for new residential development, requiring that sufficient insulation be provided to reduce interior ambient noise levels to 45 dBA CNEL.

The City's land use compatibility standards are based first on the General Plan land use designation of the property, and secondly on the proposed use of the property. For example, in the mixed-use designation, a multiple-family use exposed to transportation-related noise would have an exterior noise standard of 65 dBA CNEL, and an interior noise standard of 45 dBA CNEL. Noise standards for multiple-family and mixed-use land use designations are higher than those for single-family residential areas, reflecting that these uses are generally located along arterial roadways with higher ambient noise levels than single-family residential neighborhoods. The standards are purposefully general, and not every specific land use is identified. Application of the standards will vary on a case-by-case basis according to location, development type, and associated noise sources.

Table N-2
Land Use-Noise Compatibility Standards

General Plan Land Use Designation	Proposed Uses	Exterior Normally Acceptable[1] (dBA CNEL)	Exterior Conditionally Acceptable[2] (dBA CNEL)	Exterior Normally Unacceptable[3] (dBA CNEL)	Interior Acceptable[4] (dBA CNEL)
Residential					
Low Density	Single-family, mobile home, senior housing	Up to 60	61–65	≥66	45
Medium Density, Medium High Density, High Density	Attached single-family, duplex, townhomes, multi-family, condominiums, apartments	Up to 65	66–70	≥71	45
Mixed-Use					
Mixed-Use	Combination of commercial and residential uses	Up to 70	71–75	≥76	45
Commercial					
Neighborhood Commercial, General Commercial	Retail, professional office, health services, restaurant, government offices, hotel/motel	Up to 70	71–75	≥76	45
Visitor Commercial	Hotel/motel, timeshares, recreational commercial, cultural facilities	Up to 65	66–75	>75	45

General Plan Land Use Designation	Proposed Uses	Exterior Normally Acceptable[1] (dBA CNEL)	Exterior Conditionally Acceptable[2] (dBA CNEL)	Exterior Normally Unacceptable[3] (dBA CNEL)	Interior Acceptable[4] (dBA CNEL)
Office	Office, financial institutions	NA	NA	NA	NA
Public/Semi-public					
Semi-public (School)	Schools	Up to 60	61–65	≥66	45
Semi-public (Other)	Hospitals, churches, cultural facilities	Up to 65	66–70	≥71	45
Public	Public utilities, parking lot	NA	NA	NA	NA
Industrial					
Research and Technology	Research and development, technology, warehousing, business park	NA	NA	NA	NA
Industrial	Manufacturing, construction, transportation, logistics, auto repair	NA	NA	NA	NA
Open Space and Recreational					
Conservation	Environmental resource conservation	NA	NA	NA	NA
Park	Public park	Up to 65	65–75	≥76	NA
Recreation	Golf courses, recreational water bodies	Up to 65	66–75	≥76	NA
Shore	City and state beaches	NA	NA	NA	NA

Notes:

1. *Normally acceptable means that land uses may be established in areas with the stated ambient noise level, absent any unique noise circumstances.*
2. *Conditionally acceptable means that land uses should be established in areas with the stated ambient noise level only when exterior areas are omitted from the project or noise levels in exterior areas can be mitigated to the normally acceptable level. Where the location of outdoor activity areas is unknown, the exterior noise level standard shall be applied to the property line of the receiving land use. Where it is not practical to mitigate exterior noise levels at patio or balconies of apartment complexes, a common area such as a pool or recreation area may be designated as the outdoor activity area.*
3. *Normally unacceptable means that land uses should generally not be established in areas with the stated ambient noise level. If the benefits of the project in addressing other General Plan goals and policies outweigh concerns about noise, the use should be established only where exterior areas are omitted from the project or where exterior areas are located and shielded from noise sources to mitigate noise to the maximum extent feasible. Where the location of outdoor activity areas is unknown, the exterior noise level standard shall be applied to the property line of the receiving land use. Where it is not practical to mitigate exterior noise levels at patio or balconies of apartment complexes, a common area such as a pool or recreation area may be designated as the outdoor activity area.*
4. *Interior acceptable means that the building must be constructed so that interior noise levels do not exceed the stated maximum, regardless of the exterior noise level. Stated maximums are as determined for a typical worst-case hour during periods of use.*

In the case of hotel/motel facilities or other transient lodging, outdoor activity areas such as pool areas may not be included in the project design. In these cases, only the interior noise level criterion will apply. To ensure that noise produced by stationary sources does not adversely affect noise-sensitive land uses, the City applies a second set of standards. These hourly and maximum performance standards (expressed in L_{eq}) for stationary noise sources are designed to protect noise-sensitive land uses.

Noise Contours and Impact Areas

The community noise environment can be described using contours derived from monitoring major sources of noise. Noise contours define areas of equal noise exposure. Future noise contours have been estimated using information about both current and projected future land uses and traffic volumes. The contours assist in setting land use policies for distribution and establishing development standards.

The City completed a study of baseline noise sources and levels in June and July 2014. As part of the study, the City collected long-term (24-hour) noise measurements during a typical weekday at seven locations, and short-term (one-hour) noise measurements at eight locations, in the planning area. Long-term monitoring sites included locations characterized by unique noise generators due to high traffic volumes, large numbers of truck trips, or commercial or industrial activities occurring in the vicinity of noise-sensitive land uses. Short-term monitoring sites were generally located in residential areas where ambient noise levels are anticipated to be lower than those along major transportation corridors and commercial areas. The primary purpose of noise monitoring was to establish a noise profile that could be used to estimate current and future noise levels.

Measurements represent motor vehicle noise emanating from highways and freeways, the local roadway network, and industrial land uses. Typical noise sources measured during the short-term survey included vehicular traffic; standard gardening and landscaping equipment such as lawn mowers and leaf-blowers; police, ambulance, and fire sirens; motorcycles; heavy trucks; and typical home maintenance equipment such as handsaws. Of these sources, traffic noise was determined to be the predominant noise source in Huntington Beach. Typical of developed areas, noise levels in commercial and industrial areas were substantially higher than those in residential neighborhoods, particularly along major arterials such as Beach Boulevard, Goldenwest Street, and Bolsa Chica Street. Additionally, the planning area experiences regular aircraft overflight from commercial airlines from Los Angeles International Airport, Long Beach Airport, and John Wayne Airport.

Figure N-1 identifies modeled noise contours for baseline year 2014. A number of locations experience noise levels above 65 dBA CNEL, including areas near Pacific Coast Highway, Beach Boulevard, Goldenwest Street, Warner Avenue, Edinger Avenue, Brookhurst Street, Bushard Street, Springdale Street, Yorktown Avenue, and Heil Avenue.

The Land Use Element anticipates that Huntington Beach will accommodate additional future growth, accompanied by an increase in citywide traffic volumes. Traffic volume increases represent the major anticipated measurable new noise sources in the community over the long term. **Figure N-2** identifies anticipated changes in 2040 noise levels along major roads based upon future traffic levels. Noise levels may be expected to rise in areas located near roadways where traffic volumes will increase over time. Specifically, these areas include Bolsa Avenue, Atlanta Avenue, Adams Avenue, Pacific Coast Highway, Bolsa Chica Street, Goldenwest Street, and Brookhurst Street.

Developments along the following roadway segments should be reviewed for potential future noise impacts:

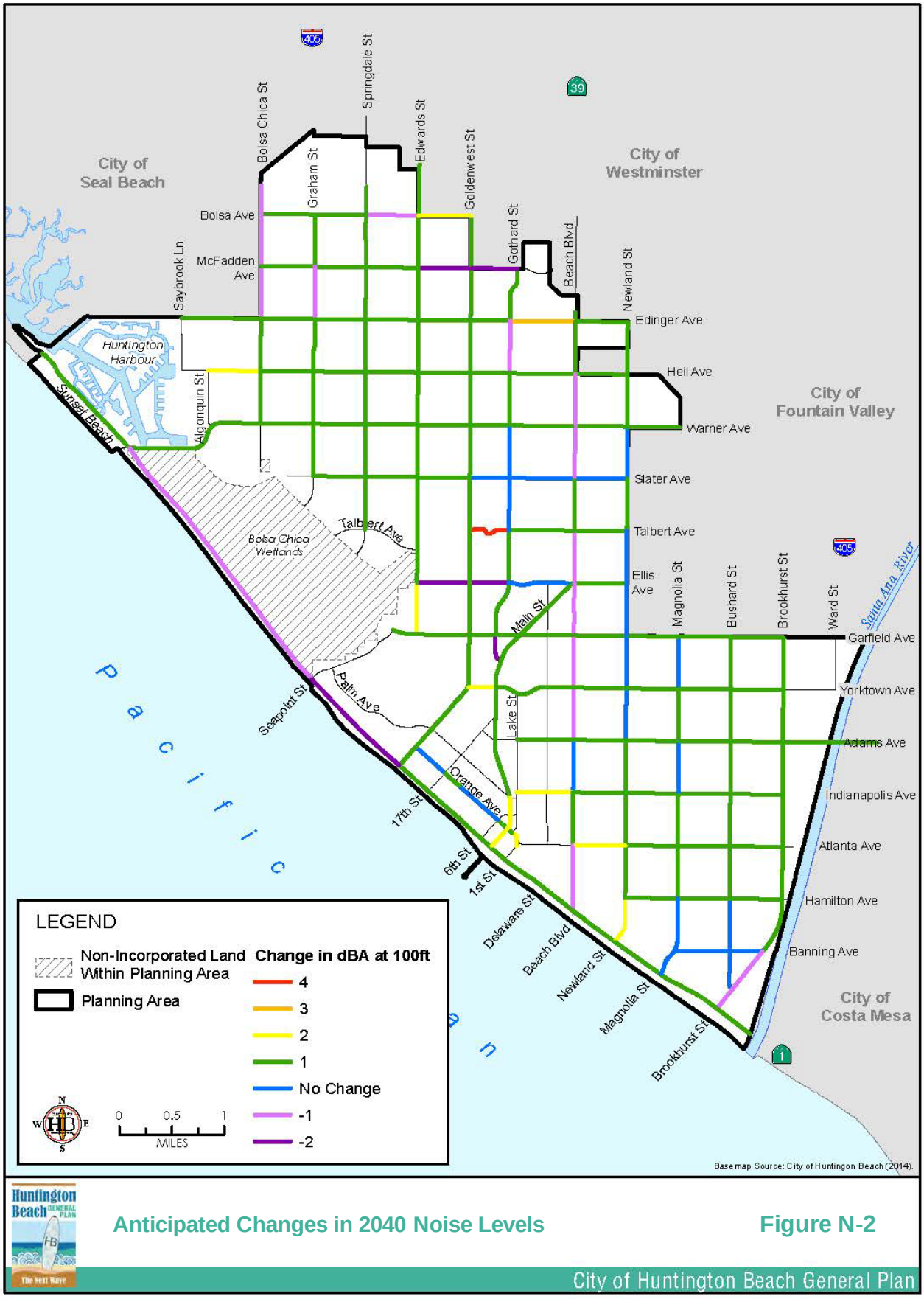
- Talbert Avenue between Goldenwest Street and Gothard Street
- Edinger Avenue between Gothard Street and Beach Boulevard
- Heil Avenue between Algonquin Street and Bolsa Chica Street
- Bolsa Avenue between Edwards Street and Goldenwest Street
- Edwards Street between Ellis Avenue and Garfield Avenue
- Yorktown Avenue between Goldenwest Street and Main Street
- Indianapolis Avenue between Lake Street and Beach Boulevard
- Main Street between Palm Avenue and Pacific Coast Highway
- Orange Avenue between 3rd Street and 1st Street
- Atlanta Avenue between Beach Boulevard and Newland Street
- Newland Street between Hamilton Avenue and Pacific Coast Highway

Many neighborhoods located along busy arterial streets have existing masonry walls between the roadway and the residential uses. Furthermore, topography in the planning area does not vary considerably. As a result, the contours shown in **Figures N-1** and **N-2** are considered reasonably representative of actual traffic noise conditions. Nonetheless, it is not possible to evaluate the localized effects of topography and screening by intervening structures on traffic noise within the framework of the Noise Element. Therefore, the City should consider the contour distances conservative estimates of traffic noise exposure (i.e., assuming noisier conditions than may be the case) to be supplemented by more detailed and project-specific study as needed.

Modeled Noise Contours for Baseline Year 2014

Figure N-1

City of Huntington Beach General Plan



Anticipated Changes in 2040 Noise Levels **Figure N-2**

Noise Reduction Strategies

The following strategies are intended to reduce noise impacts within Huntington Beach. These strategies should be employed along the roadway segments identified on page 6-12.

Noise Control Ordinance

The Noise Control Ordinance authorizes the City to regulate noise at its source, protect noise-sensitive land uses, and establish exterior and interior noise standards for residential properties. The City will continue to apply provisions of the Noise Control Ordinance.

State Noise Standards

Title 24 of the California Code of Regulations, also known as the California Building Code, establishes acoustical regulations for both exterior-to-interior sound insulation and sound and impact isolation between adjacent spaces of various occupied units. The Title 24 regulations state that interior noise levels generated by exterior noise sources shall not exceed 45 dB L_{dn}, with windows closed, in any habitable room for general residential uses.

Roadway Noise Barriers

The most efficient and effective means of controlling noise is to reduce noise at the source. However, the City has no direct control over noise produced by trucks, cars, and trains because federal and state noise regulations preempt local laws. Because the City cannot control transportation noise at the source, noise programs and standards use noise reduction methods that interrupt the path of the noise or shield adjacent land uses to reduce transportation noise along freeways, arterial roadways, and rail corridors. Such reduction methods may include building orientation, spatial buffers, landscaping, and noise barriers proposed during site planning and project design.

Using noise barriers, such as sound walls, is an effective way to achieve noise standards, but should be considered only after all other practical design-related noise reduction measures have been integrated into a project. New technologies should be used in place of sound walls as they become widely available, unless no other feasible options exist. Sound walls may not be desirable in some locations, such as intersections in commercial areas where visibility and access are equally important. For some projects, including those implemented by the California Department of Transportation (Caltrans) or the Orange County Transportation Authority (OCTA), using sound walls may be the only feasible option or may be beyond the City's control.

Truck Routes

Truck traffic generates noise that can disturb people in residential and other noise-sensitive land uses. Heavy trucks are not permitted to drive through residential neighborhoods unless they are making a delivery in the neighborhood. Truck routes in Huntington Beach are located mostly on higher capacity roadways to reduce noise on other streets, increase safety, reduce roadway maintenance needs, and improve traffic operations.

Stationary Sources

Noise levels from stationary sources are addressed primarily at the source. In a mixed-use development, acoustical design should be applied to reduce the exposure of residents to noise from both commercial portions of the development and external noise sources. When addressing stationary noise at the source is infeasible, the aforementioned noise reduction methods will be employed to reduce noise exposure to the levels presented in **Table N-3**.

The most common and feasible method to control exterior-to-interior noise levels is to improve the building structure and use wall/façade treatments that reduce noise levels. Buildings constructed consistent with the Title 24 of the California Building Code typically provide approximately 15 dBA of exterior-to-interior noise level reduction with windows open, and 25 dBA of noise level reduction with windows closed. Therefore, special consideration must be given to reducing interior noise levels to the required 45 dBA CNEL at noise-sensitive land uses exposed to noise levels in excess of 60 dBA. The ability to perform these calculations requires detailed floor plans and façade construction details. A qualified acoustical consultant should calculate the required noise level reduction and resulting interior noise levels. **Table N-3** provides an example of varying levels of building façade improvements that may be required to comply with the interior noise level standard of 45 dBA CNEL for land uses exposed to three different noise levels: 60 dBA CNEL, 65 dBA CNEL, and 70 dBA CNEL.

Residential Project Design

To mitigate non-transportation-related noise, the City will require adjustments to site plans, design features, higher insulation performance, spatial buffers, and other measures that absorb and block sound as needed. For example, bedrooms, balconies, and open space areas can be located away from streets and focused toward the interior of a project to reduce noise exposure. The City will develop guidelines to assist developers in designing structures that respond to noise concerns.

Table N-3
Sample Interior Noise Control Measures

Noise Level Exposure	Exterior-to-Interior Noise Level Reduction Required to Achieve 45 dBA CNEL	Noise Control Measures and Façade Upgrades
Less than 60 dBA CNEL	15 dBA	Normal construction practices consistent with the Uniform Building Code are typically sufficient.
60 dBA to 65 dBA CNEL	20 dBA	Normal construction practices consistent with the Uniform Building Code are sufficient with the addition of the following specifications: Air conditioning or mechanical ventilation systems are installed so that windows and doors may remain closed. Windows and sliding glass doors are mounted in low-air infiltration rated frames. Exterior doors are solid core with perimeter weather stripping and threshold seals.
66 dBA to 70 dBA CNEL	25 dBA	Normal construction practices consistent with the Uniform Building Code are sufficient with the addition of the following specifications: Air conditioning or mechanical ventilation systems are installed so that windows and doors may remain closed. Windows and sliding glass doors are mounted in low-air infiltration rated frames. Exterior doors are solid core with perimeter weather stripping and threshold seals. Glass in both windows and exterior doors should have a Sound Transmission Classification rating of at least 30. Roof or attic vents facing the noise source of concern should be boxed or provided with baffling.

Notes:

The information listed in this table represents sample guidance for interior noise control recommendations and is not intended for application to individual development projects, renovations, or retrofits. Noise-sensitive land uses located in areas with noise level exposures exceeding 65 dBA CNEL should perform acoustical analysis on a case-by-case basis.

Issues, Goals, and Policies

The noise issues addressed in this element include:

- Protecting noise-sensitive land uses
- Ensuring land use/noise compatibility
- Reducing noise from mobile sources
- Mitigating noise from construction, maintenance, and other sources

Protecting Noise-Sensitive Land Uses

Sensitive land uses have associated human activities that may be subject to stress or significant interference from noise. Noise-sensitive land uses are located in portions of the planning area that vary from moderately quiet residential areas to noisy major transportation corridors.

Goal N-1. Noise-sensitive land uses are protected in areas with acceptable noise levels.

Policies

A. Maintain acceptable stationary noise levels at existing noise-sensitive land uses such as schools, residential areas, and open spaces.

B. Incorporate design and construction features into residential, mixed-use, commercial, and industrial projects that shield noise-sensitive land uses from excessive noise.

Ensuring Land Use/Noise Compatibility

Some residential, commercial, and institutional land uses, particularly those located along arterial roadways, experience excessive vehicular noise. Commercial and industrial land uses also have the potential to generate noise that can be considered intrusive to noise-sensitive land uses. Mixed-use development projects often include both residential uses located above or in close proximity to commercial uses and stand-alone multi-family residential uses. A unique challenge presented by mixed-use development is that on one hand, such uses desire locations along busy street

corridors, and on the other hand, state-mandated interior noise requirements for residential uses must be met within the residential portions of such uses.

Goal N-2. Land use patterns are compatible with current and future noise levels.

Policies

A. Require an acoustical study for proposed projects in areas where the existing or projected noise level exceeds or would exceed the maximum allowable levels identified in Table N-2. The acoustical study shall be performed in accordance with the requirements set forth in this Noise Element.

B. Allow a higher exterior noise level standard for infill projects in existing residential areas adjacent to major arterials if no feasible mechanisms exist to meet exterior noise standards.

C. Minimize excessive noise from industrial land uses through incorporation of site and building design features that are intended to reduce noise impacts to sensitive land uses.

D. Encourage new mixed-use development projects to site loading areas, parking lots, driveways, trash enclosures, mechanical equipment, and other noise sources away from residential portions of the development, to the extent feasible.

Reducing Noise from Mobile Sources

Roadway noise from vehicle traffic is the most common source of noise in Huntington Beach. New development supporting anticipated population growth will increase traffic levels on arterials, resulting in increased noise levels. Future development of several vacant parcels and parcels that may support infill development or reuse will also have the potential to increase roadway noise levels in surrounding neighborhoods. In addition to roadways, rail and aircraft operations create noise in certain portions of the planning area. The general noise environment also includes occasional noise from private, police, emergency medical, and news/traffic monitoring helicopters.

Goal N-3. The community is not disturbed by excessive noise from mobile sources such as vehicles, rail traffic, and aircraft.

Policies

A. Mitigate noise created by any new transportation noise source so that it does not exceed the exterior or interior sound levels specified in Table N-2.

B. Prioritize use of site planning and project design techniques to mitigate excessive noise. The use of noise barriers shall be considered a means of achieving the noise standards only after all other practical design-related noise mitigation measures have been integrated into the project.

C. Employ noise-reducing technologies such as rubberized asphalt, fronting homes to the roadway, or sound walls to reduce the effects of roadway noise on noise-sensitive land uses.

D. Continue to work with local, state, and federal agencies to install, maintain, and renovate highway and arterial right-of-way buffers and sound walls.

E. Continue to work with regional, state, and federal agencies, including officials at John Wayne Airport and Long Beach Airport, to implement noise-reducing measures and to monitor and reduce noise associated with aircraft:

   a. Coordinate with Long Beach Airport to modify the approach of commercial aircraft to an altitude of 2,100 feet or higher when passing over the area near Bolsa Chica Street.

   b. Coordinate with Long Beach Airport so that aircraft delay deployment of landing gear and flaps until they are over the Naval Weapons Station to reduce the noise levels they produce over the community.

F. Continue to coordinate with the Federal Aviation Administration, Caltrans Division of Aeronautics, and the Orange County Airport Land Use Commission regarding the siting and operation of heliports and helistops to minimize excessive helicopter noise.

Mitigating Noise from Construction, Maintenance, and Other Sources

Construction is a necessary part of community development. Construction noise typically occurs intermittently, and the amount of noise depends on the nature or phase of construction. Activities such as site preparation, trucks hauling materials, concrete pouring, and use of power tools can generate noise. Construction equipment also creates noise that reaches high levels for brief periods. Although these types of noise sources tend to be short term, temporary, and limited, they can be a source of annoyance.

Goal N-4. Noise from construction activities associated with discretionary projects, maintenance vehicles, special events, and other nuisances is minimized in residential areas and near noise-sensitive land uses.

Policies

A. Reduce construction, maintenance, and nuisance noise at the source as the first and preferred strategy to reduce noise conflicts.

B. Require that new discretionary uses and special events such as restaurants, bars, entertainment, parking facilities, and other commercial uses or beach events where large numbers of people may be present adjacent to sensitive noise receptors comply with the noise standards in Table N-2 and the City Noise Ordinance.

C. Encourage shielding for construction activities to reduce noise levels and protect adjacent noise-sensitive land uses.

D. Limit allowable hours for construction activities and maintenance operations located adjacent to noise-sensitive land uses.

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Chapter 8.40 NOISE CONTROL

Note

Sections:

8.40.010 Declaration of Policy
8.40.020 Definitions
8.40.030 Noise Level Measurement Criteria
8.40.050 Exterior Noise Standards
8.40.090 Special Provisions
8.40.095 Leaf Blowers
8.40.100 Schools, Hospitals and Churches—Special Provisions
8.40.111 Prohibited Noises
8.40.112 Loud Noises
8.40.113 Vibration
8.40.120 Manner of Enforcement
8.40.130 Permit Process
8.40.150 Appeals

Note

* **Note:** §§ 8.40.140, 8.40.160 and 8.40.170 repealed by Ord. 3940-7/12.

8.40.010 Declaration of Policy

A. In order to control unnecessary, excessive and annoying sounds emanating from incorporated areas of the City, it is hereby declared to be the policy of the City to prohibit such sounds generated from all sources as specified in this chapter.

B. It is determined that certain noise levels are detrimental to the public health, welfare and safety and contrary to public interest; therefore, the City Council does ordain and declare that creating, maintaining, causing or allowing to create, maintain or cause any noise in a manner prohibited by, or not in conformity with the provisions of this chapter, is a public nuisance and shall be punishable as such. (2379-7/79)

8.40.020 Definitions

The following words, phrases and terms as used in this chapter shall have the meaning as indicated below:

"**Ambient noise level**" means the all-encompassing noise level associated with a given environment, being a composite of sounds from all sources, excluding the alleged offensive noise, at the location and approximate time at which a comparison with the alleged offensive noise is to be made.

"**A-weighted decibel (dBA)**" means the overall frequency-weighted sound level in decibels that approximates the frequency response of the human ear as represented by the A-weighted network. The reference pressure is 20 micropascals.

"**Commercial property**" means a parcel of real property which is developed and used either in part or in whole for commercial purposes including, but not limited to, retail and wholesale businesses and professional offices.

"**Cumulative period**" means an additive period or time composed of individual time segments which may be continuous or interrupted.

"**Decibel (dB)**" means a unit which denotes the ratio between two quantities which are proportional to power; the number of decibels corresponding to the ratio of two amounts of power is 10 times the logarithm to the base 10 of this ratio.

"**Domestic power tool**" means a mechanically-powered saw, sander, drill, grinder, lawn or garden tool, snow blower, leaf blower or similar device that is used in residential areas for work that is typically done by or for residential occupants.

"**Emergency machinery, vehicle or work**" means any machinery, vehicle or work used, employed or performed in an effort to protect, provide or restore safe conditions in the community or for the citizenry, or work by private or public utilities when restoring utility service.

"**Equivalent continuous sound level (Leq)**" means the value of an equivalent, steady sound level which, in a stated time period, has the same sound energy as the time-varying sound. Thus, the Leq metric is a single numerical value that represents the equivalent amount of variable sound energy received at a location over the specified duration.

"**Fixed noise source**" means a stationary device or point source which creates sounds while fixed or motionless, including, but not limited to, industrial and commercial machinery and equipment, pumps, fans, compressors, generators, air conditioners and refrigeration equipment, or an area source such as a special event on a property. That is, all sources that are non-mobile transportation sources (e.g., vehicle traffic on public roads and aircraft).

"**Grading**" means any excavating or filling of earth material, or any combination thereof, conducted to prepare said site for construction or the placement of the improvements thereon.

"**Impact noise**" means the noise produced by the collision of one mass in motion with a second mass which may be either in motion or at rest.

"**Impulsive noise**" means sound of short duration, usually less than one second, with an abrupt onset and rapid decay.

"**Industrial property**" means a parcel of real property which is developed and used in part or in whole for manufacturing purposes including research and development uses.

"**Leaf blower**" means any machine, however powered, used to blow leaves, dirt and other debris off sidewalks, driveways, lawns and other surfaces.

"**Maximum sound level (Lmax)**" means the highest RMS sound level measured during the measurement period.

"**Mobile noise source**" means any noise source other than a fixed noise source.

"**Motorboat**" means any vessel which operates on water and which is propelled by a motor, including, but not limited to, boats, barges, amphibious craft, water ski towing devices and hover craft.

"**Noise level**" means the "A" weighted sound pressure level in decibels obtained by using a sound level meter at slow response with a reference pressure of 20 micropascals (micronewtons per square meter). The unit of measurement shall be designated as dBA.

"**Parcel**" means an area of real property with a separate or distinct number or other designation shown on a plat recorded in the office of the County Recorder. Contiguous parcels owned by the same individual or entity shall be considered one parcel for purposes of this chapter.

"**Person**" means a person, firm, association, co-partnership, joint venture, corporation or any entity, public or private in nature.

"**Predominant tone noise**" means a noise characterized by a predominant frequency or frequencies so that other frequencies cannot be readily distinguished.

"**Residential property**" means a parcel of real property which is developed and used either in part or in whole for residential purposes, other than transient uses such as hotels or motels.

"**Root-mean-square sound level (RMS)**" means the square root of the average of the square of the sound pressure over the measurement period.

"**Simple tone noise**" means a noise characterized by a predominant frequency or frequencies so that other frequencies cannot be readily distinguished. In case of dispute, a simple tone noise shall exist if the one-third octave band sound pressure level in the band with the tone exceeds the arithmetic average of the sound pressure levels of the two contiguous one-third octave bands by five dB for center frequencies of 500 Hz and above and by eight dB for center frequencies between 160 and 400 Hz and by 15 dB for center frequencies less than or equal to 125 Hz.

"**Sound amplifying equipment**" means any machine or device used for the amplification of the human voice, music, or any other sound, excluding standard automobile stereos when used and heard only by the occupants of the vehicle and, as used in this chapter, warning devices on authorized emergency vehicles or horns or other warning devices on any vehicle used for traffic safety purposes.

"**Sound pressure level**" of a sound, in decibels, means 20 times the logarithm to the base of 10 of the ratio of the pressure of the sound to the reference pressure of 20 micropascals.

"**Vibration decibel (VdB)**" means a measure of vibration expressed on a logarithmic scale with the reference velocity of one micro-inch per second (1x10-6 in/sec).

"**Vibration-sensitive use**" means residential, hotels, motels, schools, hospitals and medical offices with vibration-sensitive equipment, churches, cultural land uses, commercial, office and government uses. Outdoor areas with no buildings and industrial and manufacturing uses are not considered vibration sensitive. (2379-7/79, 4222-9/21)

8.40.030 Noise Level Measurement Criteria

Any noise level measurements made pursuant to the provisions of this chapter shall be performed using a sound level meter which meets at least American National Standards Institute (ANSI) Type 2 standards. While the exterior noise standards in Section 8.40.050 are applied to the property line of the receiving use, the location for measuring noise levels may be at any legally accessible vantage point where a reasonable person would conclude the noise may exceed this chapter's noise standards. All noise level measurements shall be performed in accordance with the procedures established by the City and shall be at a height of at least four feet, at least four feet away from reflective surfaces, and for a duration of at least 15 minutes, where feasible. The measurement shall be made using the A-weighting network (dBA) with "slow" meter response. Impulsive or impact noises shall be measured using "fast" meter response. The purpose of the measurement is to determine if the alleged noise violation exceeds the standards established in Section 8.40.050. If for any reason the alleged offending noise cannot be turned off, shut down or temporarily removed from the area, then the ambient noise shall be estimated by performing a representative measurement in the same general area of the source but at a sufficient distance such that the noise source is inaudible. (2379-7/79, 3940-7/12, 4222-9/21)

8.40.050 Exterior Noise Standards

A. The following exterior noise standards shall apply to the applicable land use. It is unlawful for any person at any location within the incorporated area of the City to create any noise due to a fixed noise source (or any mobile source not pre-empted by State or Federal laws), or to allow the creation of any noise on property owned, leased, occupied, or otherwise controlled by such person, which causes the noise level when measured at the property line of any residential, hotel, motel, public institutional, recreational, or commercial property, either within or outside the City, to exceed the applicable noise standards:

Exterior Noise Standards

Land Use	Leq Noise Level dBA	Lmax Noise Level dBA	Time Period
Low-Density Residential	55	75	7 a.m.–10 p.m.
	50	70	10 p.m.–7 a.m.
Medium-, High-Density Residential, Hotels, Motels	60	80	7 a.m.–10 p.m.
	50	70	10 p.m.–7 a.m.
Schools	55	75	Hours of Operation
Hospitals, Churches, Cultural, Museum, Library,	60	80	Hours of Operation

Public Park, Recreational			
Commercial/Office	65	85	Hours of Operation

B. The above standard does not apply to the establishment of multifamily residence private balconies and patios. Multifamily developments with balconies or patios that do not meet noise standards are required to provide occupancy disclosure notices to all future tenants regarding potential noise impacts.

C. The above daytime (7:00 a.m.–10:00 p.m.) standards for hotels, motels and commercial uses shall apply only to active outdoor use areas such as a pool or outdoor courtyard.

D. In the event the alleged offensive noise consists entirely of impact or impulsive noise, simple tone noise, speech, music, or any combination thereof, each of the above noise levels shall be reduced by five dBA.

E. If the alleged offense affects a property outside the City's jurisdiction, the exterior noise standards shall be enforced at the City boundary.

F. In the event the measured ambient noise level exceeds any of the noise limit categories above, the noise limit shall be increased to reflect said ambient noise level.

G. In the event that the noise source and the affected property are within different land use categories, the noise standards of the affected property shall apply. (2379-8/79, 2788-9/85, 3940-7/12, 4222-9/21)

8.40.090 Special Provisions

The following activities shall be exempt from the provisions of this chapter:

A. School bands, school athletics and school entertainment events, provided such events are conducted on school property or authorized by special permit from the City.

B. Activities lawfully permitted in public parks, public playgrounds and public or private school grounds.

C. Any mechanical device, apparatus or equipment used, related to or connected with emergency City work, including City contractors.

D. Noise sources associated with construction, repair, remodeling, or grading of any real property, provided that: (1) the City has issued a building, grading or similar permit for such activities; (2) said activities do not take place between the hours of 7:00 p.m. and 7:00 a.m., Monday through Saturday, or at any time on Sunday or a Federal holiday; and (3) the average construction noise levels do not exceed 80 dBA Leq at nearby noise-sensitive land uses. If outdoor construction activities are permitted by the City after 7:00 p.m. or before 7:00 a.m., the average construction Noise Levels at nearby noise-sensitive land uses shall be limited to 50 dBA Leq.

E. Mobile noise sources associated with pest control through pesticide application, provided that the application is made in accordance with restricted material permits issued by or regulations enforced by the Agricultural Commissioner.

F. Noise sources associated with the maintenance of real property and use of domestic power tools provided said activities take place between the hours of 8:00 a.m. and 7:00 p.m. Monday through Saturday or between the hours of 9:00 a.m. and 6:00 p.m. on Sunday or a Federal holiday. Noise from typical and occasional property maintenance and the use of domestic power tools which does not require a building permit shall not be subject to the noise limits in subsection D of this section.

G. Leaf blower noise shall be governed by Section 8.40.095.

H. Any activity or equipment to the extent that design regulation thereof has been pre-empted by State or Federal laws.

I. Noise sources associated with temporary public or private events located on private or public property, provided that a permit has been obtained from the City.

J. Noise generated outdoors by business operations which are temporarily prohibited from occurring indoors due to City-declared emergency conditions. This applies only to City-approved businesses whose operations would typically occur indoors. Noise generated by sound amplifying equipment such as stereos or megaphones is not exempt. (2379-7/79, 3131-4/92, 3940-7/12, 4222-9/21)

8.40.095 Leaf Blowers

A. **Unlawful to Propel Debris Beyond Parcel Boundary.** It is unlawful for any person to use or operate any leaf blower in such a manner as to blow, dispel or make airborne, dust, leaves, grass cuttings, paper, trash or any other type of unattached debris or material, beyond the parcel boundaries of the parcel being cleaned, unless the consent of the adjoining owner or person in possession is obtained. It is unlawful for any person to use or operate any leaf blower within the City in such a way as to blow leaves, dirt and other debris onto the public rights-of-way or private property and to allow such debris to remain there in excess of 30 minutes.

B. **Special Prohibitions.** It is unlawful for any person to operate a leaf blower within a residential zone or within 100 feet of a residential zone of the City of Huntington Beach, except under the following conditions:

1. **Time Restriction.** Noise sources associated with the maintenance of real property provided said activities take place between the hours of 8:00 a.m. and 7:00 p.m. Monday through Saturday or between the hours of 9:00 a.m. and 6:00 p.m. on Sunday or a Federal holiday.

2. **Distance Restriction.** Leaf blowers shall not be operated within a horizontal distance of 10 feet of any operable window, door, or mechanical air intake opening or duct.

3. **Duration of Use Restriction.** Leaf blowers shall not be operated for more than 15 minutes per hour, per day, on parcels less than one-half acre and no more than 30 minutes per hour on parcels greater than one-half acre up to one acre. Leaf blowers shall not be operated for more than two hours on parcels of one acre or more.

4. **Number Restriction.** No person shall operate more than one leaf blower per parcel on one-half acre, no more than two leaf blowers on parcels greater than one-half acre and no more than three leaf blowers on parcels greater than one acre or more.

5. The maximum decibel level of 70 dBA as measured 10 feet from the leaf blower shall not be exceeded. (3131-4/92, 4222-9/21)

8.40.100 Schools, Hospitals and Churches—Special Provisions

It is unlawful for any person to create any noise which causes the noise level at any school, hospital or church while same is in use, to exceed the noise limits specified for exterior noise standards in Section 8.40.050, or which noise level unreasonably interferes with the use of such institutions, including, unreasonably disturbs or annoys persons at a school, hospital or church, provided conspicuous signs are displayed in three separate locations within one-tenth of a mile of the institution indicating the presence of a school, hospital or church. (2379-7/79, 4222-9/21)

8.40.111 Prohibited Noises

A. It is unlawful for any person to willfully make or continue, or cause to be made or continued, any loud, unnecessary or unusual noise which disturbs the peace or quiet of any neighborhood or which causes discomfort or annoyance to any reasonable person of normal sensitiveness residing in the area.

B. In determining whether a violation of the provisions of this section exists, the City will determine:

1. The level of the noise;
2. The level and intensity of background noise, if any;
3. The proximity of the noise to residences;
4. The zoning where the noise emanates;
5. The density of the area within which the noise emanates;
6. The time the noise occurs;
7. The duration of the noise and its tonal content; and
8. Whether the noise is recurrent, intermittent or constant. (3216-12/93, 4222-9/21)

8.40.112 Loud Noises

It is unlawful for any person to:

A. Use, operate, or permit to be operated any radio, receiving set or device, television set, musical instrument, phonograph, digital music player, CD, DVD, tape player, juke box, or other sound-amplifying device for producing or reproducing sound in such a manner as to disturb the peace, quiet, and comfort of other persons.

B. Make or allow to be made any noise which continues for more than a five-minute period between the hours of 10:00 p.m. and 7:00 a.m. if such noise is audible for 50 feet or more from the source of the noise.

C. Maintain, manage, or control any business or residential property in violation of subsection A or B of this section.

D. When within 200 feet of residences, load, unload, open, close or other handling of boxes, crates, containers, building materials, refuse handling or similar objects, between the hours of 10:00 p.m. and 7:00 a.m. in such a manner as to cause a noise disturbance across a noise-sensitive property line. This includes, but is not limited to, noise disturbances related to commercial delivery operations, vehicle idling, vehicle queuing, vehicle backup alarms, and vehicle refrigeration equipment.

E. Repair, rebuild, modify, or test any motor vehicle, motorcycle, or motorboat in such a manner as to cause a noise disturbance across a noise-sensitive property line.

F. Operate, play or permit the operation of any sound amplifying equipment in any place of public entertainment at a sound level greater than 90 dBA as read by the slow response on a sound level meter at any point that is normally occupied by customers, unless a conspicuous and legible sign is located immediately outside or near the public entrance stating, “Warning: Sound Levels Within May Cause Permanent Hearing Impairment.”

G. Sound or permit the sounding of any amplified signal from such as a bell, chime, siren, whistle, vehicle horn or similar device, intended primarily for non-emergency purposes which causes a noise disturbance across a noise-sensitive property line. Devices used in conjunction with school and place of worship shall be exempt from this provision.

H. Operate or permit the operation of any motorboat in such a manner to cause a noise disturbance across a noise-sensitive property line.

I. Operate or cause to be operated any motor vehicle or motorcycle not equipped with a muffler or other sound dissipative device in good working order and in constant operation. No person shall remove or render inoperative, or cause to be removed or rendered inoperative, other than for purposes of maintenance, repair, or replacement, any muffler or sound dissipative device on a motor vehicle or motorcycle.

J. Own, maintain, control, or operate any premises or property where noise continues after being informed, anytime within the preceding 30 days by the Police Department or Community Development Department that a violation of this chapter has been committed on said premises.

K. Violations of this section are hereby declared a nuisance per se. (3514-12/01, 4222-9/21)

8.40.113 Vibration

Notwithstanding other sections of this chapter, it is unlawful for any person to create, maintain or cause any operational ground vibration on any property which exceeds 72 VdB at nearby vibration-sensitive land uses. The vibration limit at vibration-sensitive uses with high sensitivity such as operations conducting medical research and imaging shall be 65 VdB. (4222-9/21)

8.40.120 Manner of Enforcement

A. The Director of Community Development (“Director”) or Police Chief and his or her duly authorized representatives are directed to enforce the provisions of this chapter. The Director or Police Chief and their duly authorized representatives are authorized pursuant to Penal Code Section 836.5 to arrest any person without a warrant when they have reasonable cause to believe that such person has violated a provision of this chapter in their presence.

B. If the Director or Police Chief and their duly authorized representatives conduct noise monitoring tests or other noise measurement readings for purposes of enforcement, and the noise level is found to exceed the noise levels in this chapter, the property owner or the operator of the noise source shall be required to pay the City’s cost of the noise monitoring tests or readings. (2379-7/79, 2533-2/82, 3216-12/93, 3940-7/12, 4222-9/21)

8.40.130 Permit Process

A. An application for a temporary permit to deviate from this chapter ("noise deviation permit") shall be submitted to the Director with all prescribed information and fees. In part, the application shall set forth: (1) all facts regarding the request for deviation; (2) all actions the applicant took to comply with the provisions of this chapter; (3) the reasons why compliance with this chapter cannot be achieved; (4) any proposed methods to minimize noise during the temporary activity; and (5) any such additional information the Director may require.

B. Within 10 days after receipt of a complete application, the City will notify all property owners within 300 feet of the proposed application.

C. A separate application shall be filed for each noise source; provided, however, that several mobile sources under common ownership, or several fixed sources on a single property may be combined into one application.

D. In all cases, the Director shall process the application in compliance with the California Environmental Quality Act.

E. The Director may approve, conditionally approve or deny the noise deviation permit no sooner than 20 days after notification was provided to property owners within 300 feet of the proposed noise source of the application. In acting upon the application, the Director shall weigh the factors set forth at subsection A above, and those set forth in Section 8.40.111 of this chapter.

F. The Director's decision on the permit shall be served by mail upon the applicant and all property owners within 300 feet of the proposed noise source. The Director's decision shall be effective 11 days after the mailing of the decision unless an appeal is filed.

G. An applicant for a permit shall remain subject to this chapter until a permit is granted, and all rights to a hearing and appeal are exhausted. (2379-7/79, 3940-7/12, 4222-9/21)

8.40.150 Appeals

Appeal Process. A person desiring to appeal the Director's decision on a noise deviation permit shall file a written notice of appeal with the director within 10 days after the Director's decision. Notice of appeal shall be accompanied by a fee as set forth in the City's current fee resolution and shall follow the hearing requirements in Chapter 248 of the Huntington Beach Zoning and Subdivision Ordinance. (3940-7/12, 4222-9/21)

CONSTRUCTION NOISE MODELING

HBCS-02 - Construction Noise Modeling Attenuation Calculations

Levels in dBA Leq

Phase	RCNM Reference Noise Level	Single-Family Residence at 3682 Fenley Drive (North)	Single-Family Residence at 10211 Humbolt Street (East)	Los Alamitos HS Dance Building (South)	Los Alamitos HS Gymnasium Building G (West)
Distance in feet	*50*	*230*	*415*	*890*	*435*
Asphalt/Building Demolition	84.6	71.3	66.2	59.6	65.8
Site Preparation	83.4	70.1	65.0	58.4	64.6
Rough Grading	84.6	71.3	66.2	59.6	65.8
Distance in feet	*50*	*230*	*415*	*890*	*435*
Paving	85.2	71.9	66.8	60.2	66.4

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

HBCS-02 - Vibration Damage Attenuation Calculations

Levels, PPV (in/sec)

Distance in feet	**Vibration Reference Level at *25 feet***	**Residence to the North** *80*	**Residence to the East** *370*	**Residence to the South** *745*	**Residence to the West** *400*
Vibratory Roller	0.21	0.037	0.004	0.001	0.003
Static Roller	0.05	0.009	0.001	0.000	0.001
Hoe Ram	0.089	0.016	0.002	0.001	0.001
Large Bulldozer	0.089	0.016	0.002	0.001	0.001
Caisson Drilling	0.089	0.016	0.002	0.001	0.001
Loaded Trucks	0.076	0.013	0.001	0.000	0.001
Jackhammer	0.035	0.006	0.001	0.000	0.001
Small Bulldozer	0.003	0.001	0.000	0.000	0.000

HBCS-02 - Vibration Annoyance Attenuation Calculations

Levels in VdB

Equipment	Vibration @ 25 ft	Residence to the North	Residence to the East	Residence to the South	Residence to the West
Distance in feet		*80*	*370*	*745*	*400*
Vibratory Roller	94.0	78.8	58.9	49.8	57.9
Static Roller	82.0	66.8	46.9	37.8	45.9
Hoe Ram	87.0	71.8	51.9	42.8	50.9
Large Bulldozer	87.0	71.8	51.9	42.8	50.9
Caisson Drilling	87.0	71.8	51.9	42.8	50.9
Loaded Trucks	86.0	70.8	50.9	41.8	49.9
Jackhammer	79.0	63.8	43.9	34.8	42.9
Small Bulldozer	58.0	42.8	22.9	13.8	21.9

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 02/01/2022
Case Description: Sowers ES

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Asphalt/Building Demolition	Residential	60.0	55.0	50.0

Equipment

Description	Impact Device	Spec Usage (%)	Actual Lmax (dBA)	Receptor Lmax (dBA)	Estimated Distance (feet)	Shielding (dBA)
Concrete Saw	No	20	89.6	50.0	0.0	
Excavator	No	40	80.7	50.0	0.0	
Dozer	No	40	81.7	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
Concrete Saw	89.6	82.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
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
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	89.6	84.6	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: 02/01/2022
Case Description: Sowers ES

**** Receptor #1 ****

Baselines (dBA)

Description	Land Use	Daytime	Evening	Night
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)
Grader	No	40	85.0	50.0		0.0
Dozer	No	40	81.7	50.0		0.0
Tractor	No	40	84.0	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
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
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	85.0	84.6	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: 02/01/2022
Case Description: Sowers ES

**** Receptor #1 ****

Baselines (dBA)

Description	Land Use	Daytime	Evening	Night
Paving	Residential	60.0	55.0	50.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Drum Mixer	No	50	80.0	50.0		0.0
Pavement Scarafier	No	20	89.5	50.0		0.0
Tractor	No	40	84.0	50.0		0.0

Results

Equipment	Calculated (dBA) Lmax	Calculated (dBA) Leq	Noise Limits (dBA) Day Lmax	Noise Limits (dBA) Day Leq	Noise Limits (dBA) Evening Lmax	Noise Limits (dBA) Evening Leq	Noise Limits (dBA) Night Lmax	Noise Limits (dBA) Night Leq	Noise Limit Exceedance (dBA) Day Lmax	Noise Limit Exceedance (dBA) Day Leq	Noise Limit Exceedance (dBA) Evening Lmax	Noise Limit Exceedance (dBA) Evening Leq	Noise Limit Exceedance (dBA) Night Lmax	Noise Limit Exceedance (dBA) Night Leq
Drum Mixer	80.0	77.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Pavement Scarafier	89.5	82.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
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	89.5	85.2	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: 02/01/2022
Case Description: Sowers ES

**** Receptor #1 ****

Baselines (dBA)

Description	Land Use	Daytime	Evening	Night
Site Preparation	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
Dozer	No	40	81.7	50.0		0.0
Tractor	No	40	84.0	50.0		0.0

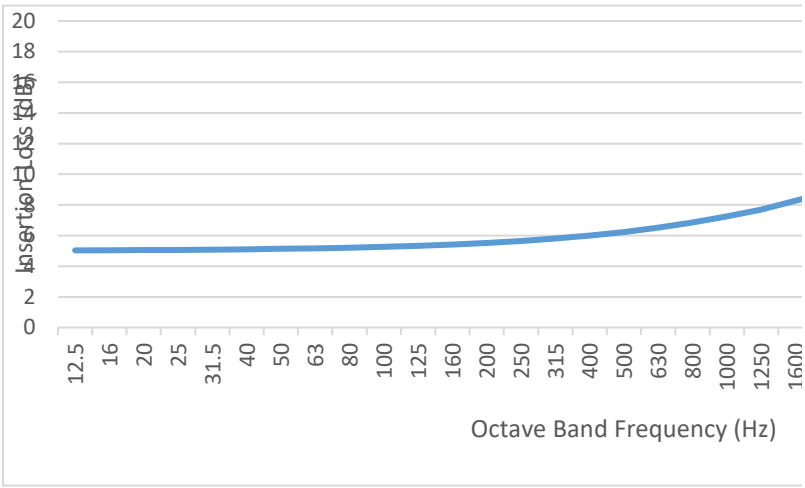
Results

	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
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
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	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

STATIONARY NOISE MODELING

Barrier Insertion Loss Calculator

Distances	Inputs
From source to barrier	5
From reciever to barrier	75.0
Barrier Height	7.0
Source Height	5.0
Reciever Height	16.0
a	5.4
b	75.5
c	80.8
Path Length Δ = a+b-c	0.2
Speed of Sound (fps)	1140.0



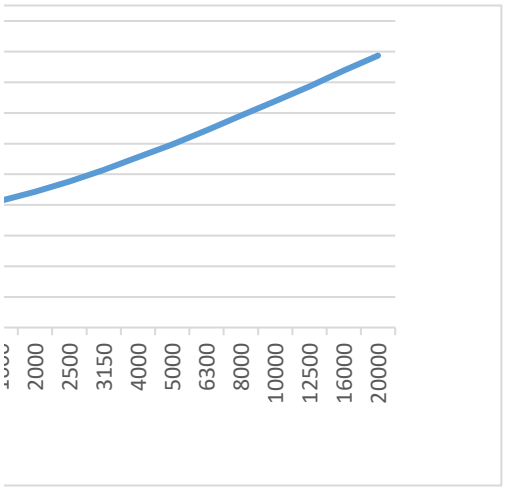
Octave Band (Hz)		16			31.5			63	
1/3 Octave Band (Hz)	12.5	16	20	25	31.5	40	50	63	80
Fresnel Number= N	0.0018698	0.002	0.003	0.004	0.005	0.006	0.007	0.009	0.012
Insertion Loss (IL) [dB]	**5.0339219**	**5.043**	**5.054**	**5.068**	**5.085**	**5.108**	**5.135**	**5.169**	**5.214**

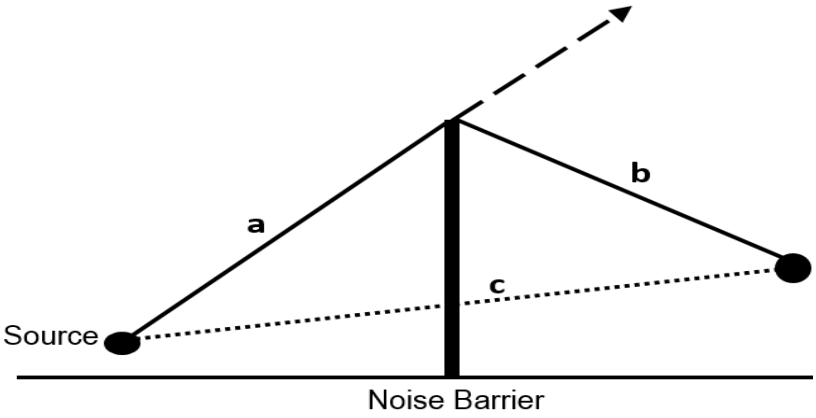
IL= 20 dB if N>12.5

A-weighting Corr

Ldn Source Sp

Formulas and methods from Utexas Design Guide for Highway Noise Barriers





	125			250			500			1k			2k		
100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150
0.015	0.019	0.024	0.03	0.037	0.047	0.06	0.075	0.094	0.12	0.15	0.187	0.239	0.299	0.374	0.471
5.266	**5.331**	**5.421**	**5.522**	**5.645**	**5.802**	**6.002**	**6.229**	**6.511**	**6.861**	**7.247**	**7.696**	**8.271**	**8.862**	**9.521**	**10.27**
ections	*-16.1*	*-13.4*	*-10.9*	*-8.6*	*-6.6*	*-4.8*	*-3.2*	*-1.9*	*-0.8*	*0*	*0.6*	*1*	*1.2*	*1.3*	*1.2*
ectrum	*75.15*	*69.75*	*68.75*	*64.95*	*62.85*	*63.65*	*64.45*	*64.55*	*66.95*	*66.65*	*65.15*	*63.35*	*61.05*	*58.05*	*55.95*
	69.8	64.3	63.2	59.3	57.0	57.6	58.2	58.0	60.1	59.4	57.5	55.1	52.2	48.5	45.7

Receiver

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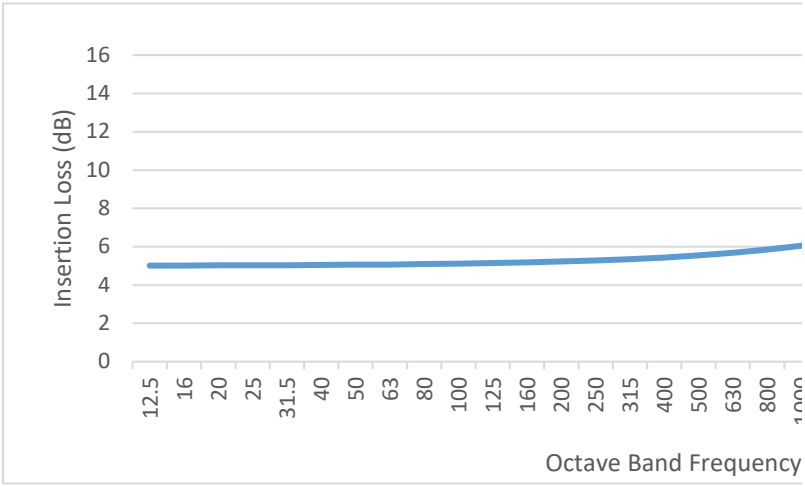
4k			8k			16k	
4000	5000	6300	8000	10000	12500	16000	20000
0.598	0.74791994	0.942	1.197	1.496	1.87	2.393	2.992
11.11	**11.94783287**	**12.86**	**13.83**	**14.77**	**15.72**	**16.78**	**17.74**

1	**Flat**	**A-wht**
51.65	**79**	**74.0**
40.5	**73**	**66.8**
	Reduction =	7.2

Barrier Insertion Loss Calculator

Distances	Inputs
From source to barrier	5
From reciever to barrier	350.0
Barrier Height	6.0
Source Height	5.0
Reciever Height	16.0
a	5.1
b	350.1
c	355.2
Path Length Δ = a+b-c	0.1
Speed of Sound (fps)	1140.0



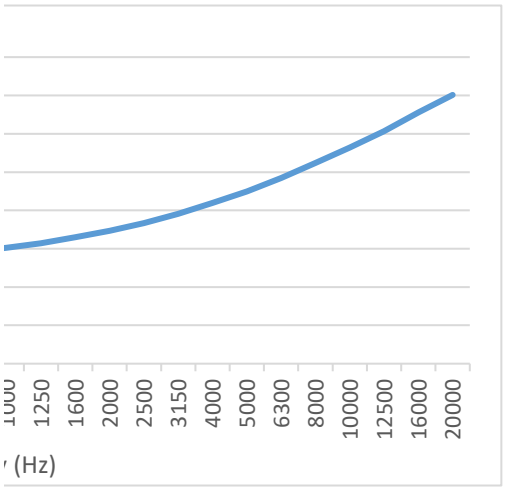
Octave Band (Hz)		16			31.5			63	
1/3 Octave Band (Hz)	12.5	16	20	25	31.5	40	50	63	80
Fresnel Number= N	0.0007836	0.001	0.001	0.002	0.002	0.003	0.003	0.004	0.005
Insertion Loss (IL) [dB]	**5.014239**	**5.018**	**5.023**	**5.028**	**5.036**	**5.045**	**5.057**	**5.071**	**5.091**

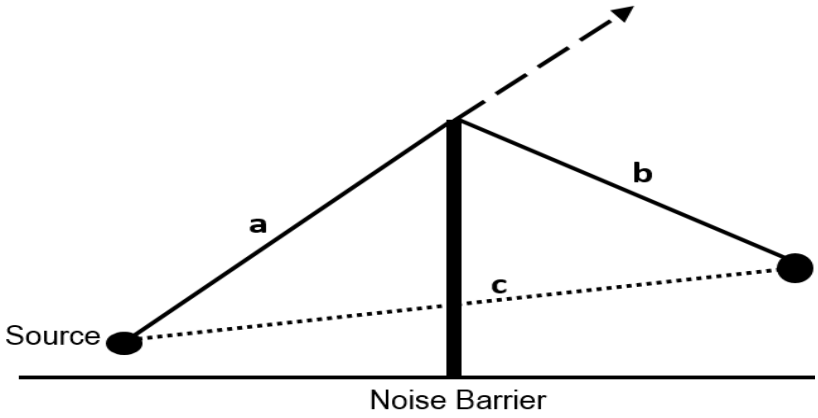
IL= 20 dB if N>12.5

A-weighting Corr

Ldn Source Sp

Formulas and methods from Utexas Design Guide for Highway Noise Barriers





	125			250			500			1k			2k		
100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150
0.006	0.008	0.01	0.013	0.016	0.02	0.025	0.031	0.039	0.05	0.063	0.078	0.1	0.125	0.157	0.197
5.113	**5.141**	**5.18**	**5.224**	**5.279**	**5.349**	**5.44**	**5.545**	**5.68**	**5.851**	**6.046**	**6.281**	**6.596**	**6.937**	**7.336**	**7.816**
ections	*-16.1*	*-13.4*	*-10.9*	*-8.6*	*-6.6*	*-4.8*	*-3.2*	*-1.9*	*-0.8*	*0*	*0.6*	*1*	*1.2*	*1.3*	*1.2*
ectrum	*75.15*	*69.75*	*68.75*	*64.95*	*62.85*	*63.65*	*64.45*	*64.55*	*66.95*	*66.65*	*65.15*	*63.35*	*61.05*	*58.05*	*55.95*
	70.0	64.6	63.5	59.7	57.5	58.2	58.9	58.9	61.1	60.6	58.9	56.8	54.1	50.7	48.1

Receiver

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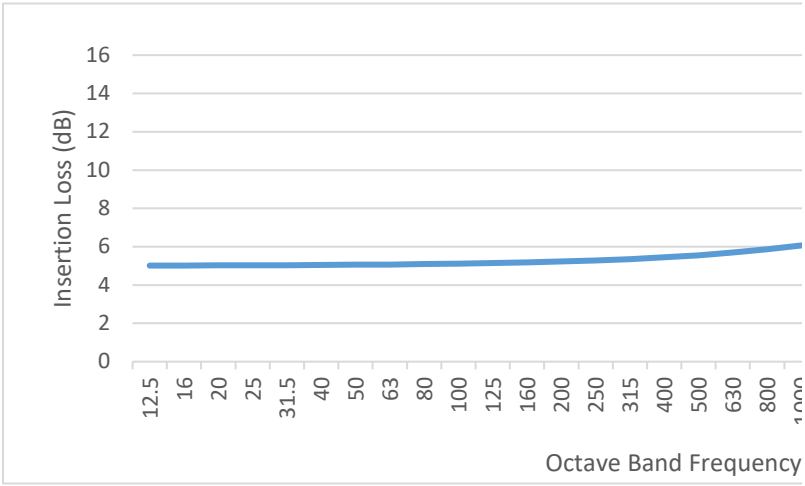
4k			8k			16k	
4000	5000	6300	8000	10000	12500	16000	20000
0.251	0.31344678	0.395	0.502	0.627	0.784	1.003	1.254
8.389	**8.99400082**	**9.692**	**10.48**	**11.28**	**12.13**	**13.11**	**14.03**

1	**Flat**	**A-wht**
51.65	**79**	**74.0**
43.3	**74**	**67.9**
	Reduction =	6.1

Barrier Insertion Loss Calculator

Distances	Inputs
From source to barrier	5
From reciever to barrier	370.0
Barrier Height	6.0
Source Height	5.0
Reciever Height	16.0
a	5.1
b	370.1
c	375.2
Path Length Δ = a+b-c	0.1
Speed of Sound (fps)	1140.0



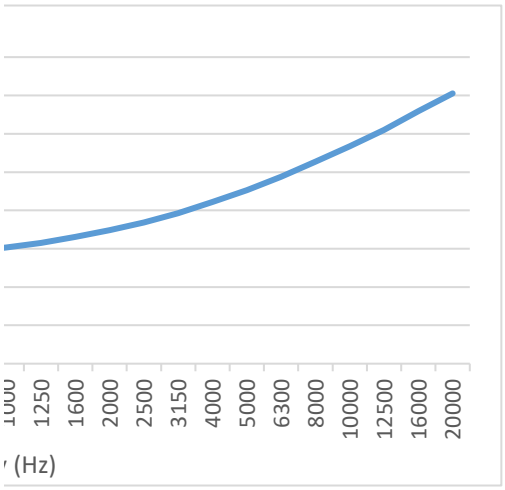
Octave Band (Hz)		16			31.5			63	
1/3 Octave Band (Hz)	12.5	16	20	25	31.5	40	50	63	80
Fresnel Number= N	0.0007986	0.001	0.001	0.002	0.002	0.003	0.003	0.004	0.005
Insertion Loss (IL) [dB]	**5.0145107**	**5.019**	**5.023**	**5.029**	**5.037**	**5.046**	**5.058**	**5.073**	**5.092**

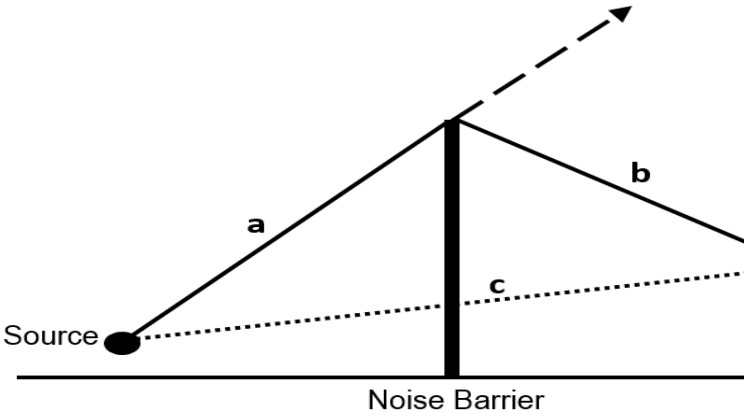
IL= 20 dB if N>12.5

A-weighting Corr

Ldn Source Sp

Formulas and methods from Utexas Design Guide for Highway Noise Barriers





	125			250			500			1k			2k	
100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500
0.006	0.008	0.01	0.013	0.016	0.02	0.026	0.032	0.04	0.051	0.064	0.08	0.102	0.128	0.16
5.115	**5.144**	**5.183**	**5.228**	**5.284**	**5.356**	**5.448**	**5.555**	**5.692**	**5.866**	**6.064**	**6.303**	**6.623**	**6.968**	**7.372**
ections	*-16.1*	*-13.4*	*-10.9*	*-8.6*	*-6.6*	*-4.8*	*-3.2*	*-1.9*	*-0.8*	*0*	*0.6*	*1*	*1.2*	*1.3*
ectrum	*75.15*	*69.75*	*68.75*	*64.95*	*62.85*	*63.65*	*64.45*	*64.55*	*66.95*	*66.65*	*65.15*	*63.35*	*61.05*	*58.05*
	70.0	64.6	63.5	59.7	57.5	58.2	58.9	58.9	61.1	60.6	58.8	56.7	54.1	50.7

		4k			8k			16k	
3150	4000	5000	6300	8000	10000	12500	16000	20000
0.201	0.256	0.319435686	0.402	0.511	0.639	0.799	1.022	1.278
7.859	**8.437**	**9.048466803**	**9.752**	**10.55**	**11.35**	**12.2**	**13.19**	**14.11**

1.2	*1*	**Flat**	**A-wht**
55.95	*51.65*	**79**	**74.0**
48.1	43.2	**74**	**67.9**
		Reduction =	6.1

HBCS-02 Bus Yard Attenuation Calculations

NORTH — Levels in dBA Leq

Worst Case Scenario by Activity *Distance in feet*	City Noise Standard *Property Line*	City Noise Standard with Penalty *Property Line*	Measured Ambient *Property Line*	Reference Bus Yard Levels *30*	Level at Residences to the North *75*	Exceed Existing Ambient
Bus Idling, Back-up Alarms, Air	50	45	60	64	56	No
Bus Horn	50	45	60	70	63	Yes

NORTH — Levels in dBA Lmax

Worst Case Scenario by *Distance in feet*	City Noise Standard *Property Line*	City Noise Standard with Penalty *Property Line*	Measured Ambient *Property Line*	Reference Bus Yard Levels *30*	Level at Residences to the North *75*	Exceed Existing Ambient
Bus Idling, Back-up Ala	70	65	77	83	75	No
Bus Horn	70	65	77	76	68	No

North — Mitigated Levels in dBA Leq

Worst Case Scenario by Activity *Distance in feet*	City Noise Standard *Property Line*	City Noise Standard with Penalty *Property Line*	Measured Ambient *Property Line*	Reference Bus Yard Levels *30*	Level at Residences to the North *75*	Exceed Existing Ambient
Bus Idling, Back-up Alarms, Air	50	45	60	64	49	No
Bus Horn	50	45	60	70	55	No

North — Mitigated Levels in dBA Lmax

Worst Case Scenario by *Distance in feet*	City Noise Standard *Property Line*	City Noise Standard with Penalty *Property Line*	Measured Ambient *Property Line*	Reference Bus Yard Levels *30*	Level at Residences to the North *75*	Exceed Existing Ambient
Bus Idling, Back-up Ala	70	65	77	83	67	No
Bus Horn	70	65	77	76	61	No

East — Levels in dBA Leq

Worst Case Scenario by Activity *Distance in feet*	City Noise Standard *Property Line*	City Noise Standard with Penalty *Property Line*	Measured Ambient *Property Line*	Reference Bus Yard Levels *30*	Level at Residences to the East *350*	Exceed Existing Ambient
Bus Idling, Back-up Alarms, Air	50	45	59	64	43	No
Bus Horn	50	45	59	70	49	No

East — Levels in dBA Lmax

Worst Case Scenario by *Distance in feet*	City Noise Standard *Property Line*	Measured Ambient *Property Line*	MC Nighttime Residential Noise Standard with Penalty *Property Line*	Reference Bus Yard Levels *30*	Level at Residences to the East *350*	Exceed MC 65 dBA
Bus Idling, Back-up Ala	70	61	65	83	61	No
Bus Horn	70	61	65	76	55	No

East — Mitigated Levels in dBA Leq

Worst Case Scenario by Activity *Distance in feet*	City Noise Standard *Property Line*	City Noise Standard with Penalty *Property Line*	Measured Ambient *Property Line*	Reference Bus Yard Levels *30*	Level at Residences to the North *350*	Exceed MC 45 dBA
Bus Idling, Back-up Alarms, Air	50	45	59	64	37	No
Bus Horn	50	45	59	70	43	No

East — Mitigated Levels in dBA Lmax

Worst Case Scenario by *Distance in feet*	City Noise Standard *Property Line*	Measured Ambient *Property Line*	MC Nighttime Residential Noise Standard with Penalty *Property Line*	Reference Bus Yard Levels *30*	Level at Residences to the North *350*	Exceed MC 65 dBA
Bus Idling, Back-up Ala	70	61	65	83	55	No
Bus Horn	70	61	65	76	49	No

SOUTH — Levels in dBA Leq

Worst Case Scenario by Activity *Distance in feet*	City Noise Standard *Property Line*	Measured Ambient *Property Line*	MC Nighttime Residential Noise Standard with Penalty *Property Line*	Reference Bus Yard Levels *30*	Level at Residences to the South *730*	Exceed MC Nighttime Standard
Bus Idling, Back-up Alarms, Air	50	NA	45	64	36	No
Bus Horn	50	NA	45	70	43	No

SOUTH — Levels in dBA Lmax

Worst Case Scenario by *Distance in feet*	City Noise Standard *Property Line*	Measured Ambient *Property Line*	MC Nighttime Residential Noise Standard with Penalty *Property Line*	Reference Bus Yard Levels *30*	Level at Residences to the South *730*	Exceed Existing Ambient
Bus Idling, Back-up Ala	70	NA	65	83	55	No
Bus Horn	70	NA	65	76	48	No

WEST — Levels in dBA Leq

Worst Case Scenario by Activity *Distance in feet*	City Noise Standard *Property Line*	Measured Ambient *Property Line*	MC Nighttime Residential Noise Standard with Penalty *Property Line*	Reference Bus Yard Levels *30*	Level at Residences to the West *370*	Exceed MC 45 dBA
Bus Idling, Back-up Alarms, Air	50	NA	45	64	42	No
Bus Horn	50	NA	45	70	49	Yes

WEST — Levels in dBA Lmax

Worst Case Scenario by *Distance in feet*	City Noise Standard *Property Line*	Measured Ambient *Property Line*	MC Nighttime Residential Noise Standard with Penalty *Property Line*	Reference Bus Yard Levels *30*	Level at Residences to the West *370*	Exceed MC 65 dBA
Bus Idling, Back-up Ala	70	NA	65	83	61	No
Bus Horn	70	NA	65	76	54	No

WEST — Mitigated Levels in dBA Leq

Worst Case Scenario by Activity *Distance in feet*	City Noise Standard *Property Line*	Measured Ambient *Property Line*	MC Nighttime Residential Noise Standard with Penalty *Property Line*	Reference Bus Yard Levels *30*	Level at Residences to the West *370*	Exceed MC 45 dBA
Bus Idling, Back-up Alarms, Air	50	NA	45	64	36	No
Bus Horn	50	NA	45	70	43	No

WEST — Mitigated Levels in dBA Lmax

Worst Case Scenario by *Distance in feet*	City Noise Standard *Property Line*	Measured Ambient *Property Line*	MC Nighttime Residential Noise Standard with Penalty *Property Line*	Reference Bus Yard Levels *30*	Level at Residences to the West *370*	Exceed MC 65 dBA
Bus Idling, Back-up Ala	70	59	65	83	55	No
Bus Horn	70	59	65	76	48	No

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