Appendix L Noise Data

Appendix

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Fundamentals of Noise

NOISE

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

Noise Descriptors

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

- **Sound.** A disturbance created by a vibrating object, which, when transmitted by pressure waves through a medium such as air, is capable of being detected by a receiving mechanism, such as the human ear or a microphone.

- **Noise.** Sound that is loud, unpleasant, unexpected, or otherwise undesirable.

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

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

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

- **Statistical Sound Level (L_n).** The sound level that is exceeded "n" percent of time during a given sample period. For example, the L_{50} level is the statistical indicator of the time-varying noise signal that is exceeded 50 percent of the time (during each sampling period); that is, half of the sampling time, the changing noise levels are above this value and half of the time they are below it. This is called the "median sound level." The L_{10} level, likewise, is the value that is exceeded 10 percent of the time (i.e., near the maximum) and this is often known as the "intrusive sound level." The L_{90} is the sound level exceeded 90 percent of the time and is often considered the "effective background level" or "residual noise level."

- **Maximum Sound Level (L_{max})**. The highest RMS sound level measured during the measurement period.
- **Root Mean Square Sound Level (RMS).** The square root of the average of the square of the sound pressure over the measurement period.

- **Day-Night Sound Level (L_{dn} or DNL).** The energy-average of the A-weighted sound levels occurring during a 24-hour period, with 10 dB added to the sound levels occurring during the period from 10:00 PM to 7:00 AM.

- **Community Noise Equivalent Level (CNEL).** The energy average of the A-weighted sound levels occurring during a 24-hour period, with 5 dB added from 7:00 PM to 10:00 PM and 10 dB from 10:00 PM to 7:00 AM. NOTE: For general community/environmental noise, CNEL and L_{dn} values rarely differ by more than 1 dB (with the CNEL being only slightly more restrictive – that is, higher than the L_{dn} value). As a matter of practice, L_{dn} and CNEL values are interchangeable and are treated as equivalent in this assessment.

- **Peak Particle Velocity (PPV).** The peak rate of speed at which soil particles move (e.g., inches per second) due to ground vibration.

- **Sensitive Receptor.** Noise- and vibration-sensitive receptors include land uses where quiet environments are necessary for enjoyment and public health and safety. Residences, schools, motels and hotels, libraries, religious institutions, hospitals, and nursing homes are examples.

Characteristics of Sound

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

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

Amplitude

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

Table 1 Noise Perceptibility

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

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

Frequency

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

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

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

Duration

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

Because community receptors are more sensitive to unwanted noise intrusion during the evening and at night, state law and many local jurisdictions use an adjusted 24-hour noise descriptor called the Community Noise Equivalent Level (CNEL) or Day-Night Noise Level (L_{dn}). The CNEL descriptor requires that an artificial increment (or "penalty") of 5 dBA be added to the actual noise level for the hours from 7:00 PM to 10:00 PM and 10 dBA for the hours from 10:00 PM to 7:00 AM. The L_{dn} descriptor uses the same methodology except that there is no artificial increment added to the hours between 7:00 PM and 10:00 PM. Both descriptors give roughly the same 24-hour level, with the CNEL being only slightly more restrictive (i.e., higher). The CNEL or L_{dn} metrics are commonly applied to the assessment of roadway and airport-related noise sources.

Sound Propagation

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

Psychological and Physiological Effects of Noise

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

Table 2 Typical Noise Levels

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
Onset of physical discomfort	120+	
	110	Rock Band (near amplification system)
Jet Flyover at 1,000 feet		
	100	
Gas Lawn Mower at three feet		
	90	
Diesel Truck at 50 feet, at 50 mph		Food Blender at 3 feet
	80	Garbage Disposal at 3 feet
Noisy Urban Area, Daytime		
	70	Vacuum Cleaner at 10 feet
Commercial Area		Normal speech at 3 feet
Heavy Traffic at 300 feet	60	
		Large Business Office
Quiet Urban Daytime	50	Dishwasher Next Room
Quiet Urban Nighttime	40	Theater, Large Conference Room (background)
Quiet Suburban Nighttime		
	30	Library
Quiet Rural Nighttime		Bedroom at Night, Concert Hall (background)
	20	
		Broadcast/Recording Studio
	10	
Lowest Threshold of Human Hearing	0	Lowest Threshold of Human Hearing

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

Vibration Fundamentals

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

Vibration amplitudes are usually described in terms of either the peak particle velocity (PPV) or the root mean square (RMS) velocity. PPV is the maximum instantaneous peak of the vibration signal and RMS is the

square root of the average of the squared amplitude of the signal. PPV is more appropriate for evaluating potential building damage and RMS is typically more suitable for evaluating human response.

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

Table 3 Human Reaction to Typical Vibration Levels

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

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

LOCAL REGULATIONS AND STANDARDS

Chapter 15.90

NOISE STANDARDS AND REGULATION

Sections:

15.90.010. Intent and purpose.

A. In order to control unnecessary, excessive and annoying sounds emanating from incorporated areas of the city, it shall be the policy of the city to prohibit such sounds generated from all sources as specified in this chapter except that noise regulated by any penal statute or ordinance and those activities that have been preempted by state or federal law.

B. Specified noise levels have been determined to be detrimental to the public health, welfare and safety and contrary to public interest; therefore, 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.

(Ord. 2982, 2001)

15.90.020. Definitions.

A. Whenever used in this chapter, the following words, phrases and terms 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.

CUMULATIVE PERIOD means an additive period of time composed of individual time segments that may be continuous or interrupted.

DECIBEL (dB) means a unit that denotes the ratio between two quantities which are proportional to power: the number of decibels corresponding to the ratio of 2 amounts of power is 10 times the logarithm to the base 10 of this ratio.

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.

FIXED NOISE SOURCE means a stationary device that 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.

GRADING means any excavating or filling of earth material or any combination thereof conducted to prepare a site for construction or other improvements thereon.

IMPACT NOISE means the noise produced by the collision of one mass in motion with a second mass that may be either in motion or at rest.

MOBILE NOISE SOURCE shall mean any noise source that is not stationary, including but not limited to motorized vehicles, trains, and aircraft.

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 micro-newtons per square meter. The unit of measurement shall be designated as dB(A).

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

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

SIMPLE TONE NOISE means a noise characterized by a predominant frequency or frequencies so that other frequencies

cannot be readily distinguished.

SOUND PRESSURE LEVEL of a sound, in decibels, means 20 times the logarithm to the base 10 of the ratio of the pressure of the sound to a reference pressure, which reference pressure shall be explicitly stated.

B. A ***NOISE ZONE*** is defined as an area where a specific set of standards has been established for allowable interior and exterior noise levels.

1. A ***RESIDENTIAL NOISE ZONE*** includes all properties with a residential zone classification, whether incorporated or unincorporated.

2. A ***COMMERCIAL NOISE ZONE*** includes all properties with a commercial or public land use zone classification, whether incorporated or unincorporated.

3. An ***INDUSTRIAL NOISE ZONE*** includes all properties with an industrial zone classification, whether incorporated or unincorporated.

(Ord. 2982, 2001)

15.90.030. Noise standards.

A. The following noise standards, unless otherwise specifically indicated, shall apply to all property within the Residential Noise Zone:

Allowable Interior

Noise Level	Time Period
Not to exceed 55 dB(A)	7:00 a.m. - 10:00 p.m.
Not to exceed 45 dB(A)	10:00 p.m. - 7:00 a.m.

Allowable Exterior

Noise Level	Time Period
Not to exceed 55 dB(A)	7:00 a.m. - 10:00 p.m.
Not to exceed 50 dB(A)	10:00 p.m. - 7:00 a.m.

B. Noise standards for a sensitive use:

1. A "sensitive use" for the purpose of this chapter means any private or public school, hospital, residential care facility for the elderly, and religious institution.

2. It shall be unlawful for any person at any location within the incorporated area of the city to create any noise that causes the noise level at any sensitive use, while the same is in operation to exceed the noise limits as specified for the Residential Noise Zone, notwithstanding the sensitive use may be located outside of the Residential Noise Zone.

C. It shall be unlawful for any person at any location within the incorporated area of the city to create any noise which can be classified as being continuous, reoccurring, predictable, or whose operation of noise-generating capabilities can be stopped or started at a specified time, 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 on the property, either incorporated or unincorporated, to exceed:

1. The noise standard for a cumulative period of more than 30 minutes in any hour;

2. The noise standard plus 5 dB(A) for a cumulative period of more than 15 minutes but less than 30 minutes in any hour;

3. The noise standard plus 10 dB(A) for a cumulative period of more than 5 minutes but less than 15 minutes in any hour;

4. The noise standard plus 15 dB(A) for a cumulative period of more than one minute but less than five minutes in any hour;

5. The noise standard plus 20 dB(A) for a cumulative period of less than one minute in an hour.

D. In the event the ambient noise level exceeds any of the five noise limit categories listed in Subsection C, the cumulative period applicable to the category shall be increased to reflect the ambient noise level.

(Ord. 2982, 2001)

15.90.040. Activities exempt from standards.

A. The following activities shall be exempt from the noise level standards specified by this chapter:

1. School bands, school athletic and school entertainment events.

2. Outdoor gatherings, public dances, shows and sporting and entertainment events provided the events are conducted pursuant to a permit and/or license issued by the city.

3. Activities conducted on public parks, public playgrounds and public or private school grounds.

4. Any mechanical device, apparatus or equipment used, related to or connected with the use of machinery, vehicles, or work due to an emergency.

5. All mechanical devices, apparatus or equipment which are utilized for the protection or salvage of agricultural crops during periods of potential or actual frost damage or other adverse weather conditions.

6. Mobile noise sources associated with agricultural pest control through pesticide application.

7. Noise from vehicular traffic on public streets.

B. For the drilling of water wells, the Director of Development Services may approve or conditionally approve an exception or limited exemption from the noise level standards of this chapter.

(Ord. 2982, 2001)

15.90.050. Activities with special provisions.

A. The following activities shall be exempt from the noise level standards specified by this chapter provided they take place between the hours of 7 a.m. and 8 p.m. on any day except Sunday or a City-recognized holiday.

1. Noise sources associated with construction, repair, remodeling, or grading of any real property;

2. Mobile noise sources associated with agricultural operations;

3. Noise sources associated with the maintenance of real property, including normal maintenance and repair by city and utility crews.

B. Installation of air conditioning, refrigeration and pool equipment shall be certified to be within the provisions of this chapter for night and day operation noise levels.

(Ord. 2982, 2001: Ord. 3026, 2003)

15.90.060. Noise level measurement.

A. The location selected for measuring exterior noise levels shall be at any point on the affected property. The affected property shall be the address from which the complaint was received.

B. The location selected for measuring interior noise levels shall be made within the affected property at a point at least four feet from the wall, ceiling or floor nearest the noise source.

C. Any noise level measurements made pursuant to the provisions of this chapter shall be performed using a sound level meter that meets the American National Standard Institute's Standard S1.4 - 1971 for Type 1 or Type 2 sound level meters or an instrument and the associated recording and analyzing equipment which will provide equivalent data.

(Ord. 2982, 2001)

15.90.070. Enforcement.

A. The Director of Development Services and his duly authorized representatives are directed to enforce the provisions of this chapter.

B. No person shall interfere with, oppose or resist any authorized person charged with the enforcement of this chapter.

(Ord. 2982, 2001)

15.90.080. Appeal.

A. The owner or operator of a noise source who has been cited in violation of the provisions of this chapter may appeal the citation to the City Council. Within 15 days following receipt of a notice of appeal, the City Clerk shall forward to the City Council the recommendation of the Director of Development Services, the notice of appeal, and all evidence concerning the appeal received by the Director. In addition, any person may file with the City Council written arguments supporting or attacking the citation. The City Clerk shall mail to the applicant and the complainant a notice of the date set for hearing of the appeal. The notice shall be mailed at least ten days prior to the hearing date.

B. Within 60 days following its receipt of the notice of the appeal, the City Council shall affirm, modify or reverse the citation. The decision shall be based upon the evaluation by the City Council of the matter. As part of its decision, the City Council may direct the Director of Development Services to conduct further proceedings on the appeal. Failure of the City Council to affirm, modify or reverse the citation within the 60-day period shall constitute an affirmation of the citation.

(Ord. 2982, 2001)

Chapter 7

Noise

Fullerton will be a city which preserves its character by supporting community efforts dedicated to health and safety.
-The Fullerton Vision

Introduction

Noise is sound from mobile and stationary sources. Things like vehicle traffic, passenger and freight trains, and airport operations are generally the more significant contributors to the community noise environment. Certain industrial plants, entertainment and night life venues, and other stationary sources can contribute as well. Excessive noise affects the quality of our environment, both at home and work, as well as the enjoyment of recreational activity.

The Noise Element provides a basis to control and abate environmental noise and protect citizens from excessive exposure.

The following goal and policies are provided to achieve the Fullerton Vision as it pertains to Noise.

Associated Tables and Exhibits

Table 8: Land Use Compatibility for Community Noise Environments (page 164)
Table 9: Community Noise Adjustment Table (page 165)
Table 10: Airport Environs Land Use Plan - Limitations on Land Use Due to Noise (page 169)

Exhibit 13: Future Noise Contours (page 167)
Exhibit 14: Airport Noise Contours (page 171)

Overarching Policies

OAP1. Comply with State and Federal laws and regulations while maintaining local control in decision-making.

OAP2. Pursue Federal, State and local funding options to support implementation of The Fullerton Plan.

OAP3. Leverage the advantages and advances of technology.

OAP4. Seek opportunities for increased efficiency and effectiveness.

Purpose

The purpose of the Noise Element is to examine noise sources in the City in order to identify and appraise the potential for noise conflicts and problems and to identify ways to reduce existing and potential noise impacts. The local noise element must recognize the land use compatibility guidelines established by the State Department of Health Services.

This Element is required per California Government Code Section 65302.

GOAL 8: Protection from the adverse effects of noise.

Policies

Specific statements that provide a directive or framework for City decision-making that directly contribute to the attainment of the goal.

Region/Subregion Level

P8.1 Noise Reduction Measures
Support regional and subregional efforts to implement projects or programs that abate and/or attenuate noise across jurisdictions, particularly where the source is not under the City's authority.

P8.2 Mobile Sources
Support projects, programs, policies and regulations to control and abate noise generated by mobile sources.

City Level

P8.3 Consideration of Noise in Land Use Decisions
Support projects, programs, policies and regulations which ensure noise-compatible land use planning recognizing the relative importance of noise sources in order of community impact, the local attitudes towards these sources, and the suburban or urban characteristics of the environment, while identifying noise sensitive uses.

P8.4 Noise Reduction Measures
Support projects, programs, policies and regulations to control and abate noise generated by stationary sources.

Neighborhood/District Level

P8.5 Focus Area Planning
Support projects, programs, policies and regulations to evaluate ways to ensure noise-compatible land use planning as part of community-based planning of Focus Areas.

Project Level

P8.6 Noise Receptors
Support projects, programs, policies and regulations to permit uses where the noise level of the surroundings—after taking into account noise insulation features and other control techniques of the use—is not detrimental to the use.

P8.7 Noise Generators
Support projects, programs, policies and regulations to permit uses and/or activities where the noise generated by the use and/or activity is not detrimental or otherwise a nuisance to the surroundings.

Noise
Tables and Exhibits

How to Use Noise Tables

California Government Code Section 65302(f) mandates that the legislative body of each county and city adopt a noise element as part of its comprehensive general plan. The local noise element must recognize the land use compatibility guidelines established by the State Department of Health Services, as shown in Table 8: Land Use Compatibility for Community Noise Environments. The objective of the noise compatibility guidelines in Table 8 is to provide the community with a means of judging the noise environment it deems to be generally acceptable. These standards and criteria are incorporated into the land use planning process to reduce future noise and land use incompatibilities. This table is the primary tool that allows the City to ensure integrated planning between land uses and outdoor noise.

Table 9 summarizes correction factors to the guidelines in Table 8 in order to account for some of the factors that may cause the noise to be more or less acceptable. These factors may include seasonal variations in noise source levels, existing outdoor ambient levels, general societal attitudes towards the noise source, prior history of the source, and tonal characteristics of the source. Exhibit 13 provides the future traffic noise contours for the various roadway segments within the City based on analysis of existing noise levels and projection of noise levels at buildout (2030).

In addition to Table 8, Table 10: Airport Environs Land Use Plan Limitations Due to Aircraft Noise provides land use plan limitations based on aircraft noise from Fullerton Municipal Airport. Exhibit 14 provides the noise contours related to aircraft noise as evaluated in the Fullerton Airport Master Plan.

Table 8 Land Use Compatibility For Community Noise Environments				
Land Use Category	Community Noise Exposure (CNEL)			
	Normally Acceptable	Conditionally Acceptable	Normally Unacceptable	Clearly Unacceptable
Residential-Low Density, Single-Family, Duplex, Mobile Homes	50 - 60	55 - 70	70 – 75	75 – 85
Residential – Multiple Family	50 – 65	60 – 70	70 – 75	70 – 85
Transient Lodging – Motel, Hotels	50 – 65	60 – 70	70 – 80	80 – 85
Schools, Libraries, Churches, Hospitals, Nursing Homes	50 – 70	60 – 70	70 – 80	80 – 85
Auditoriums, Concert Halls, Amphitheaters	NA	50 – 70	NA	65 – 85
Sports Arenas, Outdoor Spectator Sports	NA	50 – 75	NA	70 – 85
Playgrounds, Neighborhood Parks	50 – 70	NA	67.5 – 77.5	72.5 – 85
Golf Courses, Riding Stables, Water Recreation, Cemeteries	50 – 70	NA	70 – 80	80 – 85
Office Buildings, Business Commercial and Professional	50 – 70	67.5 – 77.5	75 – 85	N/A
Industrial, Manufacturing, Utilities, Agriculture	50 – 75	70 – 80	75 – 85	N/A

CNEL = community noise equivalent level; NA = not applicable

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

CONDITIONALLY ACCEPTABLE: New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features have been included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning, will normally suffice.

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

CLEARLY UNACCEPTABLE: New construction or development should generally not be undertaken.

Source: Office of Planning and Research, California, General Plan Guidelines, October 2003.

Table 9 Community Noise Adjustment Table		
Type of Correction	**Description**	**Amount of Correction to be Added to Measured CNEL in dB**
Seasonal Correction	Summer (or year-round operation)	0
	Winter only (or windows always closed)	-5
Correction for Outdoor Residual Noise Level	Quiet suburban or rural community (remote from large cities and from industrial activity and trucking).	+10
	Quiet suburban or rural community (not located near industrial activity).	+5
	Urban residential community (not immediately adjacent to heavily traveled roads and industrial areas).	0
	Noisy Urban residential community (near relatively busy roads or industrial areas).	-5
	Very noisy urban residential community.	-10
Correction for Previous Exposure and Community Attitudes	No prior experience with the intruding noise.	+5
	Community has had some previous exposure to intruding but little effort is being made to control the noise. This correction may also be applied in a situation where the community has not been exposed to the noise previously, but the people are aware that bona fide efforts are being made to control the noise.	0
	Community has had considerable previous exposure to the intruding noise and the noise maker's relations with the community are good.	-5
	Community aware that operation causing noise is very necessary and it will not continue indefinitely. This correction can be applied for an operation of limited duration and under emergency circumstances.	-10
Pure Tone or Impulse	No pure tone or impulsive character.	0
	Pure tone or impulsive character present.	+5
Source: Office of Planning and Research, California, General Plan Guidelines, October 2003.		

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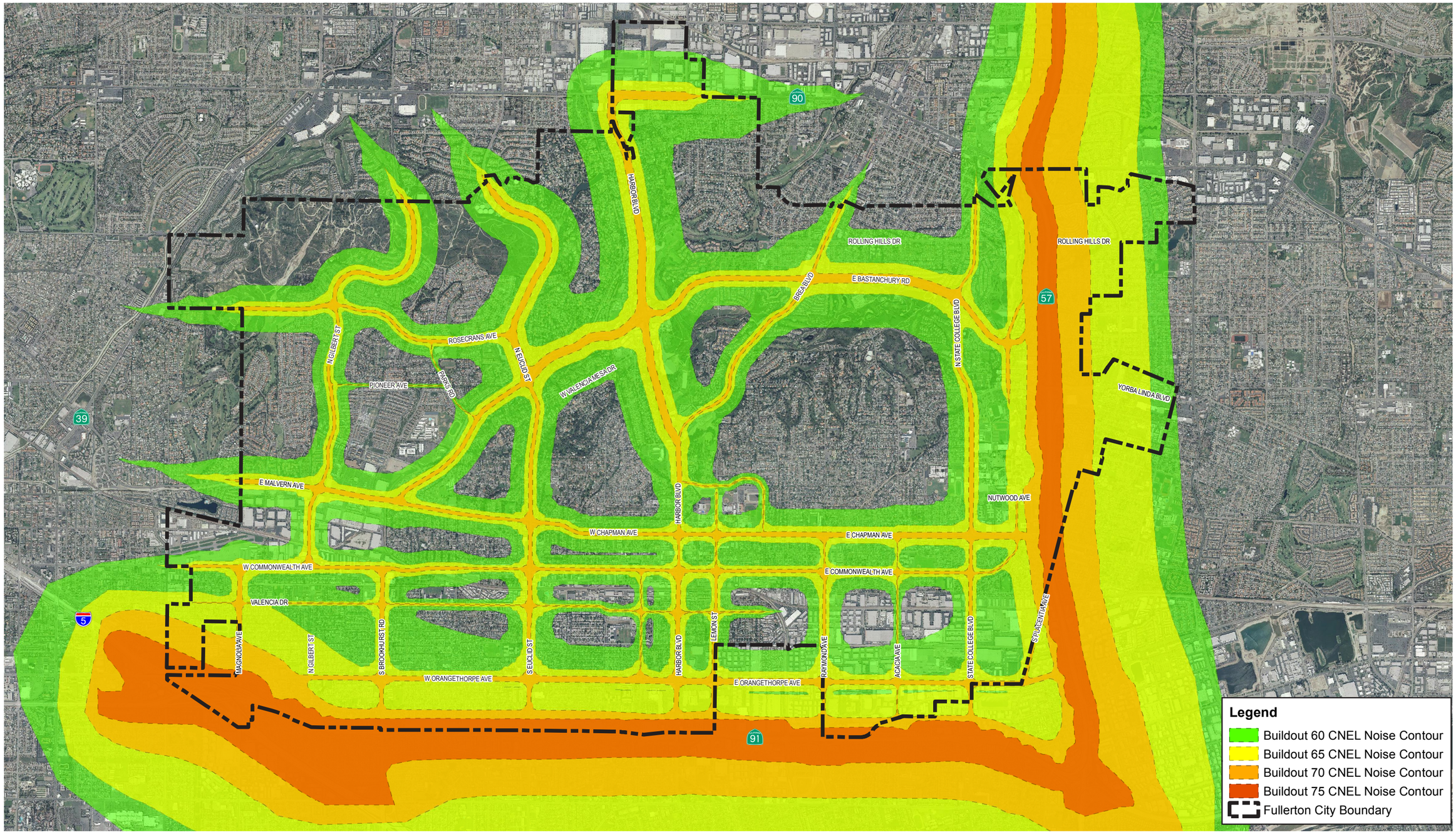

Exhibit 13: Future Noise Contours

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Table 10
Airport Environs Land Use Plan - Limitations on Land Use Due to Noise

Land Use Category	Community Noise Exposure (CNEL)		
	Normally Consistent	Conditionally Consistent	Normally Inconsistent
Residential (all types): Single and Multi-Family Residences	55-60	65	70-85
Community Facilities: Churches, Libraries, Schools, Preschools, Day-Care Centers, Hospitals, Nursing/Convalescent Homes, ad other Noise sensitive uses	55-65	N/A	70-85
Commercial: Retail, Office	55-65	70-85	N/A
Industrial	55-65	70-85	N/A

Normally Consistent - Conventional construction methods used. No special noise reduction requirements.

Conditionally Consistent – Must use sound attenuation required by the California Noise Insulation Standards, Title 25, California Code of Regulations. Residential use sound attenuation required to ensure that the interior CNEL does not exceed 45 dB. Commercial and industrial structures shall be sound attenuated to meet Noise Impact Zone "1" criteria.

Normally Inconsistent – All residential units are inconsistent unless are sound attenuated to ensure that the interior CNEL does not exceed 45 dB, and that all units are indoor oriented so as to preclude noise impingement on outdoor living areas.

Source: Orange County Airport Land Use Commission, Airport Environs Land Use Plan for Fullerton Municipal Airport, November 18, 2004.

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LEGEND

- FULLERTON MUNICIPAL AIRPORT
- COMMERCIAL
- INDUSTRIAL
- RESIDENTIAL
- PLANNED URBAN DEVELOPMENT
- CITY BOUNDARY LINE
- CNEL 65 – YEAR 2002
- CNEL 70 – YEAR 2002
- CNEL 65 – YEAR 2023
- CNEL 70 – YEAR 2023
- AIRPORT PROPERTY LINE

PARCELS

(#)	APN	(#)	APN	(#)	APN	(#)	APN	(#)	APN
1	066–391–33	6	280–212–05	11	030–051–07	16	030–052–07	21	066–270–73
2	066–391–40	7	280–212–07	12	030–051–08	17	030–052–08	22	066–270–58
3	066–391–42	8	280–212–03	13	030–052–04	18	030–052–09	23	066–270–43
4	280–292–71	9	030–051–28	14	030–052–05	19	030–040–16	24	066–220–49
5	280–212–06	10	030–051–27	15	030–052–06	20	066–270–76	25	066–220–50

NORTH

SCALE IN FEET

0 300 600

Exhibit 14: Airport Noise Contours

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CONSTRUCTION NOISE MODELING

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 05/13/2021
Case Description: FUL-07

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Buildign/Asphalst Demolition	Residential	65.0	60.0	55.0

Equipment

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

Results

Equipment	Calculated (dBA) Lmax	Leq	Noise Limits (dBA) Day Lmax	Leq	Evening Lmax	Leq	Night Lmax	Leq	Noise Limit Exceedance (dBA) Day Lmax	Leq	Evening Lmax	Leq	Night Lmax	Leq
Excavator	80.7	76.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Front End Loader	79.1	75.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Front End Loader	79.1	75.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	80.7	80.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 05/13/2021
Case Description: FUL-07

**** Receptor #1 ****

Baselines (dBA)

Description	Land Use	Daytime	Evening	Night
Site Preperation	Residential	65.0	60.0	55.0

Equipment

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

Results

	Calculated (dBA)		Noise Limits (dBA)				Noise Limit Exceedance (dBA)					
			Day		Evening		Night		Day		Evening		Night	
Equipment	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Excavator	80.7	76.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Front End Loader	79.1	75.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	80.7	79.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 05/13/2021
Case Description: FUL-07

**** Receptor #1 ****

Baselines (dBA)

Description	Land Use	Daytime	Evening	Night
Rough Grading	Residential	65.0	60.0	55.0

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
Scraper	No	40		83.6	50.0	0.0
Dozer	No	40		81.7	50.0	0.0

Results

	Calculated (dBA)		Noise Limits (dBA)				Noise Limit Exceedance (dBA)					
			Day		Evening		Night		Day		Evening		Night	
Equipment	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
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
Scraper	83.6	79.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
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	85.0	84.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 05/13/2021
Case Description: FUL-07

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Rough Grading Soil Haul	Residential	65.0	60.0	55.0

Equipment

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

Results

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
Excavator	80.7	76.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Front End Loader	79.1	75.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	80.7	79.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 05/13/2021
Case Description: FUL-07

**** Receptor #1 ****

Baselines (dBA)

Description	Land Use	Daytime	Evening	Night
Fine Grading	Residential	65.0	60.0	55.0

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
Roller	No	20	80.0	50.0		0.0
Scraper	No	40	83.6	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
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
Roller	80.0	73.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Scraper	83.6	79.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	85.0	83.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 06/03/2021
Case Description: FUL-07

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Ground/Soil Improvement	Residential	65.0	60.0	55.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Auger Drill Rig	No	20	84.4	50.0	0.0	

Results

Noise Limits (dBA)

Noise Limit Exceedance (dBA)

Equipment	Calculated (dBA) Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq	Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq
Auger Drill Rig	84.4	77.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	84.4	77.4	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: 05/13/2021
Case Description: FUL-07

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Building Construction	Residential	65.0	60.0	55.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Crane	No	16		80.6	50.0	0.0
Man Lift	No	20		74.7	50.0	0.0

Results

Equipment	Calculated (dBA) Lmax	Leq	Noise Limits (dBA) Day Lmax	Leq	Evening Lmax	Leq	Night Lmax	Leq	Noise Limit Exceedance (dBA) Day Lmax	Leq	Evening Lmax	Leq	Night Lmax	Leq
Crane	80.6	72.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Man Lift	74.7	67.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	80.6	73.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 05/13/2021
Case Description: FUL-07

**** Receptor #1 ****

Baselines (dBA)

Description	Land Use	Daytime	Evening	Night
Paving	Residential	65.0	60.0	55.0

Equipment

Description	Impact Device	Spec Usage (%)	Actual Lmax (dBA)	Receptor Lmax (dBA)	Estimated Distance (feet)	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

	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
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: 05/13/2021
Case Description: FUL-07

**** Receptor #1 ****

Baselines (dBA)

Description	Land Use	Daytime	Evening	Night
Utility Trenching	Residential	65.0	60.0	55.0

Equipment

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

Results

	Noise Limits (dBA)						Noise Limit Exceedance (dBA)					
	Calculated (dBA)		Day		Evening		Night		Day		Evening		Night	
Equipment	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Excavator	80.7	76.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Front End Loader	79.1	75.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Front End Loader	79.1	75.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	80.7	80.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 05/13/2021
Case Description: FUL-07

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Architectural Coating	Residential	65.0	60.0	55.0

Equipment

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

Results

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

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 05/13/2021
Case Description: FUL-07

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Finish/Landscaping	Residential	65.0	60.0	55.0

Equipment

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

Results

	Calculated (dBA)		Noise Limits (dBA) Day		Evening		Night		Noise Limit Exceedance (dBA) Day		Evening		Night	
Equipment	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
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
Total	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

FUL-07.0: Construction Noise Modeling Attenuation Calculations

Levels in dBA Leq

Phase	RCNM Reference Noise Level	Apartment Homes to north	Apartment Homes to west	Single-family homes to south	Hope International University to northwest	College Park Building to north
Distance in feet	*50*	*90*	*535*	*205*	*700*	*430*
Site Prep	79	74	58	67	56	60
Rough Grading	84	79	64	72	61	66
Rough Grading Soil Haul	79	74	58	67	56	60
Demolition	81	75	60	68	58	62
Fine Grading	84	79	63	72	61	65
Distance in feet	*50*	*95*	*200*	*205*	*500*	*425*
Ground/Soil Improvement*	77	72	65	65	57	59
Building Construction	74	68	62	62	54	55
Utility Trenching	81	75	68	68	61	62
Architectural Coating	74	68	62	61	54	55
Distance in feet	*50*	*90*	*785*	*205*	*815*	*490*
Paving (parking garage)	85	80	61	73	61	65

** RCNM Auger Drill Rig used as representative equipment for geopiers. Substituted equipment verified by construction manager and applicant*

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

FUL-07.0: Vibration Damage Attenuation Calculations

Levels in in/sec PPV

Distance in feet	**Vibration Reference Level at *25 feet***	**Residential to north** *75*
Vibratory Roller	0.21	0.040
Large Bulldozer	0.089	0.017
Caisson Drilling	0.089	0.017
Loaded Trucks	0.076	0.015
Jackhammer	0.035	0.007
Small Bulldozer	0.003	0.001

TRAFFIC NOISE INCREASE CALCULATIONS

FUL-07.0 Fullerton Hub

Traffic Noise Calculations

	ADT Volumes				dBA CNEL Increae	
Roadway Segment	Existing No Project	Existing Plus Project	Future Without Project	Future With Project	Project Noise Increase	Cumulative Increase
State College Blvd from Fender to Nutwood	24,321	24,479	27,590	27,748	0.0	0.6
State College Blvd from Nutwood to Yorba Linda	30,625	30,711	35,450	35,536	0.0	0.6
E Chapman Avenue from College Blvd to Sr 57	34,801	35,865	38,250	39,314	0.1	0.5
E Chapman Avenue from SR 57 to Bradford Ave	24,067	24,261	29,260	29,454	0.0	0.9
Commonwealth Ave from Nutwood Ave to Chapman	10,190	10,539	13,430	13,779	0.1	1.3
Commonwealth Ave from Chapman Ave to College Blvd	9,287	9,390	12,830	12,933	0.0	1.4
					0.1	1.4

ADT Volumes provided by Fehr & Peers