Appendix G Noise Background and Modeling 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).

- **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

CHAPTER 2. - NOISE

Footnotes:
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***Editor's note—** Prior to amendment by Ord. No. 84-18, adopted Sept. 11, 1984, the provisions of this chapter derived from Ord. No. 136, §§ 2—13, adopted March 25, 1975.*

Sec. 6-8-201. - Declaration of policy.

The City Council has adopted the following regulations in order to control unnecessary, excessive and annoying noise in the City of Irvine. The provisions of this chapter are applicable to nontransportation-related stationary noise sources.

(Code 1976, § VI.K-301; Ord. No. 84-18, 9-11-84)

Sec. 6-8-202. - Definitions.

The following definitions are provided to clarify words, phrases and terms used in this chapter.

Ambient noise level: 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: An additive period of time composed of individual time segments which may be continuous or interrupted.

Decibel (dB): A unit of noise measurement indicating the loudness of sound, based on logarithmic (base 10) scale.

Emergency work: Any mechanical device, apparatus or equipment which is 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.

Grading: Any excavating or filling of earth material or any combination thereof conducted to prepare a site for construction or the placement of the improvements thereon.

Impact noises: The noise produced by the collision of one mass in motion with a second mass which may be either in motion or at rest.

Noise level: The "A" weighted sound pressure level in decibels obtained by using a sound level meter. The "A" weighted discriminates against the lower and higher frequencies according to a relationship with the sensitivity of the human ear. The unit of measurement is designated as dB(A).

Predominant tone noise: A noise characterized by a predominant frequency or frequencies so that other frequencies cannot be readily distinguished.

Stationary noise source: The source which is often referred to as "fixed source" (non-transportation-related) including, but not limited to, mechanical electric equipment, various power tools, construction, commercial, industrial and agricultural activity and animal noise.

(Code 1976, § VI.K-302; Ord. No. 84-18, 9-11-84)

Sec. 6-8-203. - Noise level measurement criteria.

Any noise level measurements made pursuant to the provisions of this chapter shall be performed using a sound level meter. The location selected for measuring exterior noise levels shall be anywhere on the affected property. The interior noise measurement shall be made at a point in the affected unit at least four feet from the wall, ceiling or floor nearest the noise source.

(Code 1976, § VI.K-303; Ord. No. 84-18, 9-11-84)

Sec. 6-8-204. - General provision.

A. *Designated noise zones.* The properties hereinafter described, whether within or without the City, are hereby assigned to the following noise zones:

1. *Noise zone 1:* All hospitals, libraries, churches, schools and residential properties.
2. *Noise zone 2:* All professional office and public institutional properties.
3. *Noise zone 3:* All commercial properties excluding professional office properties.
4. *Noise zone 4:* All industrial properties.

B. *Exterior and interior noise standards.*

1. The following noise standards, unless otherwise specifically indicated, shall apply to all property within a designated noise zone.

NOISE STANDARDS

dB(A)

Noise Levels for a Period Not Exceeding (minutes/hour)

	Noise Zone	Time Period	30	15	5	1	0 (anytime)
1	Exterior	7:00 a.m.—10:00 p.m.	55	60	65 [1]	70	75
		10:00 p.m.—7:00 a.m.	50	55	60	65 [1]	70
	Interior	7:00 a.m.—10:00 p.m.	—	—	55	60	65
		10:00 p.m.—7:00 a.m.	—	—	45	50	55
2	Exterior	Any time	55	60	65	70	75
	Interior	Any time	—	—	55	60	65
3	Exterior	Any time	60	65	70	75	80
	Interior	Any time	—	—	55	60	65
4	Exterior	Any time	70	75	80	85	90
	Interior	Any time	—	—	55	60	65

1. This standard does not apply to multifamily residence private balconies. Multifamily developments with balconies that do not meet the 65 CNEL are required to provide occupancy disclosure notices to all future tenants regarding potential noise impacts.
2. It shall be unlawful for any person at any location within the City to create any noise 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 any property within designated noise zones either within or without the City to exceed the applicable noise standard.
3. Each of the noise standards specified above shall be reduced by five dB(A) for impact, or predominant tone

noise or for noises consisting of speech or music.

4. In the event that the noise source and the affected property are within different noise zones, the noise standards of the affected property shall apply.

(Code 1976, § VI.K-304; Ord. No. 84-18, 9-11-84; Ord. No. 05-06, § 2, 2-22-05)

Sec. 6-8-205. - Special provisions.

A. Construction activities and agricultural operations may occur between 7:00 a.m. and 7:00 p.m. Mondays through Fridays, and 9:00 a.m. and 6:00 p.m. on Saturdays. No construction activities shall be permitted outside of these hours or on Sundays and federal holidays, except Columbus Day, unless a temporary waiver is granted by the Chief Building Official or his or her authorized representative. Trucks, vehicles, and equipment that are making or are involved with material deliveries, loading, or transfer of materials, equipment service, maintenance of any devices or appurtenances for or within any construction project in the City shall not be operated or driven on City streets outside of these hours or on Sundays and federal holidays unless a temporary waiver is granted by the City. Any waiver granted shall take impact upon the community into consideration. No construction activity and agricultural operations will be permitted outside of these hours except in emergencies including maintenance work on the City rights-of-way that might be required.

Deliveries to or pickups from any commercial property sharing a property line with any residential property may occur between 7:00 a.m. and 10:00 p.m. daily. No deliveries to or pickups from any such properties shall occur outside of these hours.

B. Maintenance of real property operations may exceed the noise standards between 7:00 a.m. and 7:00 p.m. on any day except Sundays, or between 9:00 a.m. and 6:00 p.m. on Sundays or a federal holiday.

C. The use of leaf blowers shall be regulated as follows:

1. *Definition of leaf blower.* Leaf blowers are defined as portable power equipment that is powered by fuel or electricity and used in any landscape maintenance, construction, property repair, or property maintenance for the purpose of blowing, dispersing or redistributing dust, dirt, leaves, grass clippings, cuttings and trimmings from trees and shrubs or other debris.

2. *Limitations on use.*

a. All leaf blowers shall be equipped with a permanently installed limiter that restricts the individual equipment motor performance to half throttle speed or less, and will produce not more than 70 decibels dB(A) measured at the midpoint of a wall area 20 feet long and 10 feet high and at a horizontal distance 50 feet away from the midpoint of the wall, or not more than 76 dB(A) at a horizontal distance of 25 feet using a sound level meter set at level A.

b. Each individual leaf blower shall be tested and certified for use by the City of Irvine or its designated representative. Each individual leaf blower shall bear the label of required approval in a visible location on the equipment prior to use and at all times during use. A fee for the City to recover all costs connected with equipment approvals shall be charged in an amount set by City resolution.

c. The use of leaf blowers is prohibited except between the hours of 8:00 a.m. and 5:00 p.m. Monday through Friday and between 9:00 a.m. and 5:00 p.m. on Saturday.

d. Leaf blower operations shall not cause dirt, dust, debris, leaves, grass clippings, cuttings or trimmings from trees or shrubs to be blown or deposited on any adjacent or other parcel of land, lot, or public right-of-way/property other than the parcel, land, or lot upon which the leaf blower is being operated. Deposits of

dirt, dust, leaves, grass clippings, debris, cuttings or trimmings from trees or shrubs shall be removed and disposed of in a sanitary manner which will prevent dispersement by wind, vandalism or similar means within six hours of deposit by the user or property occupant.

e. 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.

f. No person using leaf blowers shall exceed noise limitations set by Section 6-8-204 of the City Code of Ordinances.

3. *Education.*

a. Each person operating an individual leaf blower is required to complete not less than one training session of content and time approved by the City of Irvine Administrative Authority prior to operation of leaf blower equipment. Training and qualification shall be required for certification at least every two years for each individual equipment user.

b. The equipment operator shall carry certification of the training and qualification at all times during equipment use and make it available upon demand. Failure to abide by the use requirements contained in this Code and/or the certification training provided will be cause for the City of Irvine to revoke such certification.

c. *Exception:* An individual residential property occupant operating a single leaf blower himself or herself in a manner confined to his or her own property shall be excepted from the education requirements set forth by this subsection.

4. *Fees.* A fee for the City to recover all costs connected with training, testing, certification and enforcement shall be charged in an amount established by resolution of the City Council, which may be amended from time-to-time.

D. The following activities shall be exempted from the provision of this chapter:

1. School bands, school athletic and school entertainment events, provided said events are conducted on school property or authorized by special permit from the City.

2. Activities otherwise lawfully conducted on public parks, public playgrounds and public or private school grounds.

3. Any mechanical device, apparatus or equipment which is utilized for emergency work, pest control, and protection or harvest of agricultural crops during periods of potential or actual frost damage or other adverse weather conditions.

4. Any activity or equipment to the extent that design regulation thereby has been preempted by State or federal law.

The Chief Building Official or his or her duly authorized representative and City police shall enforce where necessary the provisions of this chapter. No person shall interfere with, oppose or resist any authorized person charged with the enforcement of this chapter when such person is engaged in the performance of his or her duty.

(Code 1976, § VI.K-305; Ord. No. 84-18, 9-11-84; Ord. No. 88-11, §§ 1, 2, 5-24-88; Ord. No. 90-2, § 1, 2-13-90; Ord. No. 90-7, § 1, 4-10-90; Ord. No. 05-16, § 2, 7-12-05)

Sec. 6-8-206. - Reserved.

Sec. 6-8-207. - Enforcement.

The Chief Building Official or his or her duly authorized representative shall enforce the provisions of this chapter. No person shall interfere with, oppose or resist any authorized person charged with the enforcement of this chapter while such person is engaged in the performance of his or her duty.

(Code 1976, § VI.K-306; Ord. No. 84-18, 9-11-84)

Sec. 6-8-208. - Waiver procedure.

A. The owner or operator of a noise source which violates any of the provisions of this chapter may apply for temporary waiver with the Chief Building Official. Any waiver granted shall take impact upon the community into consideration and state why immediate compliance cannot be achieved, a proposed method of achieving compliance, and a proposed time schedule for its accomplishment. Said application shall be accompanied by a fee as listed in the City Council resolution for variances where deemed appropriate and necessary by the City administrative authority.

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

C. An applicant for a waiver shall remain subject to prosecution under the terms of this chapter until a waiver is granted.

D. Within 60 days of receipt of an appeal, the City Council shall either affirm, modify or reverse the decision of the Chief Building Official at a duly notified public hearing.

(Code 1976, § VI.K-307; Ord. No. 84-18, 9-11-84; Ord. No. 90-7, § 2, 4-10-90)

Sec. 6-8-209. - Appeals.

A. The decision of the Chief Building Official on waiver applications may be appealed to the City Council. Appeals shall be filed with the City Clerk and shall be accompanied by a letter stating the reason for the appeal.

B. An appeal shall be accompanied by a deposit/fee as established by resolution, which shall be on an annual basis by City Council resolution.

C. An appeal shall be filed within 15 days of the decision of the Chief Building Official.

D. Within 60 days of receipt of an appeal, the City Council shall either affirm, modify or reverse the decision of the Chief Building Official at a duly notified public hearing.

(Code 1976, § VI.K-308; Ord. No. 84-18, 9-11-84)

CONSTRUCTION NOISE MODELING

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 10/29/2021
Case Description: COI-56

**** Receptor #1 ****

Baselines (dBA)

Description	Land Use	Daytime	Evening	Night
Asphalt Demolition	Residential	55.0	50.0	45.0

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

	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
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: 10/29/2021
Case Description: COI-56

**** Receptor #1 ****

Baselines (dBA)

Description	Land Use	Daytime	Evening	Night
Site Prep	Residential	55.0	50.0	45.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Dozer	No	40		81.7	50.0	0.0
Tractor	No	40	84.0		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
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
Tractor	84.0	80.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	84.0	84.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 10/29/2021
Case Description: COI-56

**** Receptor #1 ****

Baselines (dBA)

Description	Land Use	Daytime	Evening	Night
Rough Grading	Residential	55.0	50.0	45.0

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
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
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
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	85.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 10/29/2021
Case Description: COI-56

**** Receptor #1 ****

Baselines (dBA)

Description	Land Use	Daytime	Evening	Night
Utility Trenching	Residential	55.0	50.0	45.0

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

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 10/29/2021
Case Description: COI-56

**** Receptor #1 ****

Baselines (dBA)

Description	Land Use	Daytime	Evening	Night
Fine Grading	Residential	55.0	50.0	45.0

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
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
Scraper	83.6	79.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Tractor	84.0	80.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	85.0	85.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 10/29/2021
Case Description: COI-56

**** Receptor #1 ****

Baselines (dBA)

Description	Land Use	Daytime	Evening	Night
Asphalt Paving	Residential	55.0	50.0	45.0

Equipment

Description	Impact Device	Spec Usage (%)	Actual Lmax (dBA)	Receptor Lmax (dBA)	Estimated Distance (feet)	Shielding (dBA)
Paver	No	50	77.2	50.0	0.0	
Pavement Scarafier	No	20	89.5	50.0	0.0	
Roller	No	20	80.0	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
Paver	77.2	74.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
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
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
Total	89.5	83.5	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: 10/29/2021
Case Description: COI-56

**** Receptor #1 ****

Baselines (dBA)

Description	Land Use	Daytime	Evening	Night
Light Pole Installation	Residential	55.0	50.0	45.0

Equipment

Description	Impact Device	Spec Usage (%)	Actual Lmax (dBA)	Receptor Lmax (dBA)	Estimated Distance (feet)	Shielding (dBA)
Crane	No	16	80.6	50.0	0.0	
Auger Drill Rig	No	20	84.4	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											
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												
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
N/A												
Total	84.4	78.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
N/A												

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 10/29/2021
Case Description: COI-56

**** Receptor #1 ****

Baselines (dBA)

Description	Land Use	Daytime	Evening	Night
Finish/Landscaping	Residential	55.0	50.0	45.0

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

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 10/29/2021
Case Description: COI-56

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Architectural Coating	Residential	55.0	50.0	45.0

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

COI-56 Construction Noise Modeling Attenuation Calculations

Levels in dBA Leq

Phase	RCNM Reference Noise Level	Residences to northwest	Residences to southwest	Valley Oak Park to southwest	
Distance in feet	*50*	*270*	*675*	*740*	
Asphalt Demolition	85	70	62	61	
Distance in feet	*50*	*140*	*340*	*370*	
Utility Trenching	77	68	60	59	
Finish/Landscaping	77	68	60	59	
Distance in feet	*50*	*620*	*530*	*740*	
Rough Grading	85	63	64	62	
Fine Grading	85	63	64	62	
Site Preperation	84	62	64	61	
Distance in feet	*50*	*730*	*625*	*900*	
Architectural Coating	74	50	52	49	
Asphalt Paving	84	60	62	58	
Distance in feet	*50*	*170*	*720*	*750*	
Light Pole Installation	77	67	54	54	

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

COI-56 Vibration Annoyance Attenuation Calculations

Levels in VdB

Equipment	**Vibration @ 25 ft**	**Residential to northwest**	**Residential to southwest**
Distance in feet		*160*	*270*
Vibratory Roller	94	70	63
Hoe Ram	87	63	56
Large Bulldozer	87	63	56
Caisson Drilling	87	63	56
Loaded Trucks	86	62	55
Jackhammer	79	55	48
Small Bulldozer	58	34	27
Clam shovel	94	70	63

COI-56 Vibration Annoyance Attenuation Calculations

		Levels in in/sec PPV	
	Vibration Reference Level	**Residential to northwest**	**Residential to southwest**
Distance in feet	**at *25 feet***	*160*	*270*
Vibratory Roller	0.21	0.013	0.006
Hoe Ram	0.089	0.005	0.003
Large Bulldozer	0.089	0.005	0.003
Caisson Drilling	0.089	0.005	0.003
Loaded Trucks	0.076	0.005	0.002
Jackhammer	0.035	0.002	0.001
Small Bulldozer	0.003	0.000	0.000
Clam shovel	0.202	0.012	0.006

OPPERATIONAL NOISE MODELING

COI-56.0

Traffic Noise Calculations

	ADT Volumes*				dBA CNEL Increae		
Roadway Segment	Existing No Project	Existing Plus Project	Future No Project	Future Plus Project	Project Noise Increase	Cumulative Increase	Project Cumulative Contribution
Valley Oak Drive = south of Irvine Center Drive	4,200	4,517	8,100	8,417	0.3	3.0	0.2
Barranca Parkway west of Valley Oak Drive	11,500	11,817	15,400	15,717	0.1	1.4	0.1
Barranca Parkway - Valley Oak Drive to Sand Canyon A	13,700	14,017	18,200	18,517	0.1	1.3	0.1
Barranca Parkway - Sand Canyon Avenue to Laguna Ca	12,000	12,317	19,200	19,517	0.1	2.1	0.1

* Existing No Project and Buildout No Project daily volumes provided by the City of Irvine.

COI-56 - Stationary Noise Attenuation Calculatic

	Reference Levels, Distances, and
	Soccer Fields
Reference Distance in feet	*15*
Reference Levels, dBA Leq	60
Distance and Direction to	200 NW
Distance Only	200

	Soccer Fields
	Attenuated Noise Levels
Attenuated Levels at Receptors	37

Attenuation calculated through Inverse Square Law: Lp(R2) = Lp(R

Normalized Levels and Distances

	Soccer
	59.8
Reference Distance	**15**
Normalized Distance	*50*
Normalized Level dBA Leq	*49*