5.9 NOISE

This section discusses the fundamentals of sound; examines federal, state, and local noise guidelines, policies, and standards; reviews noise levels at existing receptor locations; and evaluates potential noise impacts associated with buildout of the Beach Boulevard Specific Plan (Proposed Project). The noise modeling data are included in Appendix E of this Draft EIR.

5.9.1 Environmental Setting

Noise is most often defined as unwanted sound. 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."

5.9.1.1 TERMINOLOGY AND NOISE AND VIBRATION 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).
- **Frequency.** The number of times that the quantity repeats itself in 1 second (i.e., the number of cycles per second). The standard unit is hertz, denoted as "Hz" (previously, cycles-per-second).
- **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}).** 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."

- **Day-Night Level (L_{dn}).** 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 p.m. to 7:00 a.m.

- **Community Noise Equivalent Level (CNEL).** The energy average of the A-weighted sound levels occurring during a 24-hour period with 5 dB added to the levels occurring during the period from 7:00 p.m. to 10:00 p.m. and 10 dB added to the sound levels occurring during the period from 10:00 p.m. to 7:00 a.m.

  L_{dn} and CNEL values rarely differ by more than 1 dB. As a matter of practice, L_{dn} and CNEL values are considered equivalent and are treated as such in this assessment.

- **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.

5.9.1.2 FUNDAMENTALS 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 is described in terms of loudness or amplitude (measured in dB), frequency or pitch (measured in Hertz [Hz]), and duration or time variations (measured in seconds or minutes).

Amplitude

The range of pressures that causes airborne vibrations (i.e., sound) is quite large and would be cumbersome to measure lineally. Therefore, noise is measured on a logarithmic scale, which has a more manageable range of numbers, and a decibel (dB) is the standard unit for measuring sound pressure amplitude.[1] All noise levels in this study—reported in terms of dB—are relative to the industry-standard reference sound pressure of 20 micropascals.

On a logarithmic scale, an increase of 10 dB is 10 times more intense than 1 dB, 20 dB is 100 times more intense, and 30 dB is 1,000 times more intense. A sound as soft as human breathing is about 10 times greater than 0 dB. The decibel system of measuring sound gives a rough connection between the physical intensity of sound and its perceived loudness to the human ear. Ambient sounds generally range from 30 dBA (very

[1] The commonly held threshold of audibility is 20 micropascals, and the threshold of pain is around 200 million micropascals, a ratio of one to 10 million. By converting these pressures to a logarithmic scale (i.e., decibels), the range becomes a more convenient 0 dB to 140 dB.

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. These relationships are summarized in Table 5.9-1.

Table 5.9-1 Noise Perceptibility

± 3 dB	Threshold of human perceptibility
± 5 dB	Clearly noticeable change in noise level
± 10 dB	Half or twice as loud
± 20 dB	Much quieter or louder

Source: Bies and Hansen 2009.

Frequency

The human ear is not equally sensitive to all frequencies. Sound waves below 16 Hz are not heard at all, but "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 term "A-weighted" refers to a filtering of the noise signal in a manner corresponding to the way the human ear perceives the intensities of different frequencies of sound. 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.

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 5.9-2 shows typical noise levels from noise sources.

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Table 5.9-2 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: Caltrans 2013a

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

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 conservative and is appropriate for noise generated by onsite operations from stationary equipment/activities at a project site. This approach is commonly used for construction equipment noise evaluations. For more detailed assessments, if ground-level absorptive vegetation or other "soft site" conditions are considered, the distance attenuation (drop-off) rate would be increased by 1.5 dB per distance doubling; for a total of 7.5 dB per propagation distance doubling.

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 4.5 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 hearing protection regulations in the workplace. When the noise level reaches 120 dBA, an unpleasant "tickling" sensation occurs in the human ear; even with short-term exposure. This is called the threshold of feeling. As the sound reaches 140 dBA, the tickling sensation becomes painful, and this is called the threshold of pain. A sound level of 160 to 165 dBA will result in dizziness or loss of equilibrium. In community environments, the ambient or background noise problem is widespread, though 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.

Loud noise can be annoying and it can have negative health effects (USEPA 1978). The effects of noise on people fall into three general categories:

- Subjective effects, i.e., annoyance, nuisance, dissatisfaction.
- Interference with activities such as speech, sleep, learning.
- Physiological effects such as startling and hearing loss (temporary and permanent).

In most cases, environmental noise produces effects in the first two categories only. However, unprotected workers in some industrial work settings may experience noise effects in the last category.

5.9.1.3 FUNDAMENTALS OF VIBRATION

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.

Like noise, vibration is transmitted in waves, but through the earth or solid objects. Unlike noise, vibration is typically of a frequency that is felt rather than heard. Vibration can be either natural as in the form of earthquakes, volcanic eruptions, sea waves, landslides, or man-made as from explosions, the action of heavy machinery or heavy vehicles such as trains. Both natural and man-made vibration may be continuous such as from operating machinery, or transient as from an explosion. As with noise, vibration can be described by both its amplitude and frequency.

Amplitude

Vibration amplitude may be characterized in three ways: displacement, velocity, and acceleration. Vibration displacement is the distance that a point on a surface moves away from its original static position. The instantaneous speed that a point on a surface moves is the velocity, and the rate of change of the speed is the acceleration. 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.

The units for PPV and RMS velocity are normally inches per second (in/sec). However, vibration is often presented and discussed in dB units in order to compress the range of numbers. In this study, PPV and RMS velocities are in in/sec, and vibration levels are in dB relative to 1 microinch per second (abbreviated as VdB). Typically, groundborne vibration generated by human activities attenuates rapidly with distance from the source of the vibration. Man-made vibration problems are therefore usually confined to relatively short distances from the source (500 to 600 feet or less).

Frequency

Vibrations also vary in frequency, and this affects perception. Typical construction vibrations fall in the 10 to 30 Hz range and usually occur around 15 Hz. Traffic vibrations exhibit a similar range of frequencies; however, buses often generate frequencies around 3 Hz at high vehicle speeds due to their suspension systems. It is less common, but possible, to measure traffic frequencies above 30 Hz.

Propagation

As with sound moving through the air, the way in which vibration is transmitted through the earth is called propagation. Propagation of groundborne vibrations is complicated and difficult to predict because of the endless variations in the soil and rock through which waves travel. There are three main types of vibration propagation: surface, compression and shear waves. Surface waves, or Raleigh waves, travel along the ground's surface. These waves carry most of their energy along an expanding circular wave front, similar to ripples produced by throwing a rock into a pool of water. Compression waves, or P-waves, are body waves that carry their energy along an expanding spherical wave front. The particle motion in these waves is longitudinal (i.e., in a "push-pull" fashion). P-waves are analogous to airborne sound waves. Shear waves, or S-waves, are also body waves that carry energy along an expanding spherical wave front. However, unlike P-waves, the particle motion is transverse or side-to-side and perpendicular to the direction of propagation. As vibration waves propagate from a source, the energy is spread over an ever-increasing area so that the energy level striking a given point decreases with distance from the energy source. This geometric spreading loss is inversely proportional to the square of the distance. Wave energy is also reduced with distance as a result of material damping in the form of internal friction, soil layering, and void spaces. The amount of attenuation provided by material damping varies with soil type and condition as well as the frequency of the wave.

Psychological and Physiological Effects of Vibration

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 5.9-3 displays the human response and the effects on buildings resulting from continuous vibration (in terms of various levels of PPV).

Table 5.9-3 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: Caltrans 2013b.

Human response to ground vibration has been correlated best with the velocity of the ground, typically expressed in terms of the vibration decibel or VdB.[2] The US Federal Transit Administration (FTA) has developed rational vibration limits that can be used to evaluate human annoyance to groundborne vibration. These criteria are primarily based on experience with rapid transit and commuter rail systems (FTA 2008). Railroad and transit operations are potential sources of substantial ground vibration depending on distance, the type and the speed of trains, and the type of track. Trains generate substantial vibration due to their engines, steel wheels, heavy loads, and wheel-rail interactions.

Physical Effects of Vibration

Similarly, construction operations generally include a wide range of activities that can generate groundborne vibration, which varies in intensity. In general, blasting and demolition as well as pile driving and vibratory compaction equipment generate the highest vibrations. Because of the impulsive nature of such activities, PPV is used to measure and assess groundborne vibration and assess the potential of vibration to induce structural damage and annoyance for humans. Vibratory compactors or rollers, pile drivers, and pavement breakers can generate perceptible amounts of vibration at up to 200 feet. Heavy trucks can also generate groundborne vibrations, which can vary, depending on vehicle type, weight, and pavement conditions. Potholes, pavement joints, discontinuities, differential settlement of pavement, all increase the vibration levels from vehicles passing over a road surface. Construction vibration is normally of greater concern than vibration from normal traffic flows on streets and freeways with smooth pavement conditions (Caltrans 2013b).

5.9.1.4 NOISE- AND VIBRATION-SENSITIVE RECEPTORS

Certain land uses are particularly sensitive to noise and vibration, including residential, school, and open space/recreation areas where quiet environments are necessary for enjoyment, public health, and safety. Sensitive receptors within the City of Anaheim include residences, senior housing, schools, places of worship, and recreational areas. These uses are regarded as sensitive because they are where citizens most frequently engage in activities which are likely to be disturbed by noise, such as reading, studying, sleeping, resting, or otherwise engaging in quiet or passive recreation. Commercial and industrial uses are not considered noise- and vibration-sensitive receptors for the purposes of this analysis, since noise- and vibration-sensitive activities are less likely to be undertaken in these areas, and because these uses often themselves generate noise in excess of what they receive from other uses.

5.9.2 Regulatory Framework

5.9.2.1 FEDERAL

U.S. Environmental Protection Agency

The United States Environmental Protection Agency (EPA) has identified the relationship between noise levels and human response. The EPA has determined that over a 24-hour period, a L_{eq} of 70 dBA will result in some hearing loss. Interference with activity and annoyance will not occur if exterior levels are maintained

[2] The reference velocity is 1×10^{-6} in/sec RMS, which equals 0 VdB, and 1 in/sec equals 120 VdB.

at an L_{eq} of 55 dBA and interior levels at or below 45 dBA L_{eq}. While these levels are relevant for general planning and design, they are not land use planning criteria or environmental impact criteria because they do not consider economic cost, technical feasibility, or the needs of the community. As such, they are primarily useful for contextual and informational purposes.

5.9.2.2 STATE

California Building Code

The California Building Code (CBC), Title 24, Part 2, Volume 1, Chapter 12, Interior Environment, Section 1207.11.2, Allowable Interior Noise Levels, requires that interior noise levels attributable to exterior sources shall not exceed 45 dBA in any habitable room (using L_{dn} or CNEL). This is approach is often used in noise elements of many local General Plans. The City of Anaheim Noise Element is discussed below.

The California Green Building Standards Code (CALGreen), Chapter 5, Division, 5.5 has additional requirements for insulation that affect exterior-interior noise transmission for nonresidential structures: Pursuant to section 5.507.4.1, Exterior Noise Transmission, Prescriptive Method, Wall and roof-ceiling assemblies exposed to the noise source making up the building or addition envelope or altered envelope shall meet a composite sound transmission class (STC)[3] rating of at least 50 or a composite outdoor-indoor transmission class (OITC)[4] rating of no less than 40 with exterior windows of a minimum STC of 40 or OITC of 30 within a 65 dBA CNEL noise contour of an airport or within a 65 dBA CNEL or L_{dn} noise contour of a freeway, expressway, railroad, industrial source, or fixed-guideway source as determined by the noise element of the general plan. Where noise contours are not readily available, buildings exposed to a noise level of 65 dBA $L_{eq\ 1\text{-hour}}$ during any hour of operation shall have building, addition or alteration exterior wall and roof-ceiling assemblies exposed to the noise source meeting a composite STC rating of at least 45 (or OITC 35), with exterior windows of a minimum of STC 40 (or OITC 30).

Residential structures within the noise contours identified above require an acoustical analysis showing that the structure has been designed to limit intruding noise in the prescribed allowable levels. To comply with these regulations, applicants for new the residential projects are required to submit an acoustical analysis report. The report is required to show topographical relationship of noise sources and dwelling site, identification of noise sources and their characteristics, predicted noise spectra at the exterior of the proposed dwelling structure considering present and future land usage, basis for the prediction (measured or obtained from published data), noise attenuation measures to be applied, and an analysis of the noise insulation effectiveness of the proposed construction showing that the prescribed interior noise level

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[3] Sound Transmission Class (STC) is a single number rating used to compare the sound insulation properties of walls floors, ceilings, windows, or doors. The STC number is derived from measurements in 16 test bands and the measurement and calculation processes are defined in American Society of Testing Materials (ASTM) Standard E 413-16, "Classification for Rating Sound Insulation".

[4] The Outdoor-Indoor Transmission Class (OITC) is, similarly, a single number rating used to evaluate the ability of a wall, window, or building façade element to resist the transmission of transportation sound. The measurement and calculation processes are defined in American Society of Testing Materials (ASTM) Standard E 1332-90, "Standard Classification for Determination of Outdoor-Indoor Transmission Class". As a rule of thumb, OITC is less than STC and is related by OITC = STC +*F*, where *F* is a correction factor that depends on the type of architectural element of concern and on the type of exterior sound source. See Harris, Table 33.9.

requirements are met. If interior allowable noise levels are met by requiring that windows be unopenable or closed, the design for the structure must also specify the means that will be employed to provide ventilation and cooling, if necessary, to provide a habitable interior environment.

Governor's Office of Planning and Research

Additionally, state law requires that each county and city adopt a general plan that includes a noise element, which is to be prepared according to guidelines adopted by the Governor's Office of Planning and Research. The purpose of the noise element is to "limit the exposure of the community to excessive noise levels" (OPR 2003). The State Noise Compatibility Guidelines (consistent with the Anaheim Noise Compatibility guidelines presented in Table 5.9-4 presents a land use compatibility chart for community noise prepared by the California Office of Noise Control. This table provides urban planners with a tool to gauge the compatibility of land uses relative to existing and future noise levels, categorizing "normally acceptable," "conditionally acceptable," "normally unacceptable," and "clearly unacceptable" noise levels for various land uses. A conditionally acceptable designation implies new construction or development should be undertaken only after a detailed analysis of the noise reduction requirements for each land use is made and needed noise insulation features are incorporated in the design. By comparison, a normally acceptable designation indicates that standard construction can occur with no special noise reduction requirements.

5.9.2.3 LOCAL

City of Anaheim

The Proposed Project is subject to the General Plan Noise Element and the Anaheim Municipal Code.

Noise Element

The City has adopted the State Noise Compatibility Guidelines presented in Table 5.9-4. These are derived from the State General Plan Guidelines and are designed to ensure that proposed land uses are compatible with the predicted future noise environment. The City of Anaheim Noise Element employs the four acceptability classifications (as discussed above) with regard to a project's exterior noise level environment. It should be noted that the City of Anaheim discourages the siting of new noise-sensitive uses in areas of excess of 65 dBA CNEL without appropriate mitigation.

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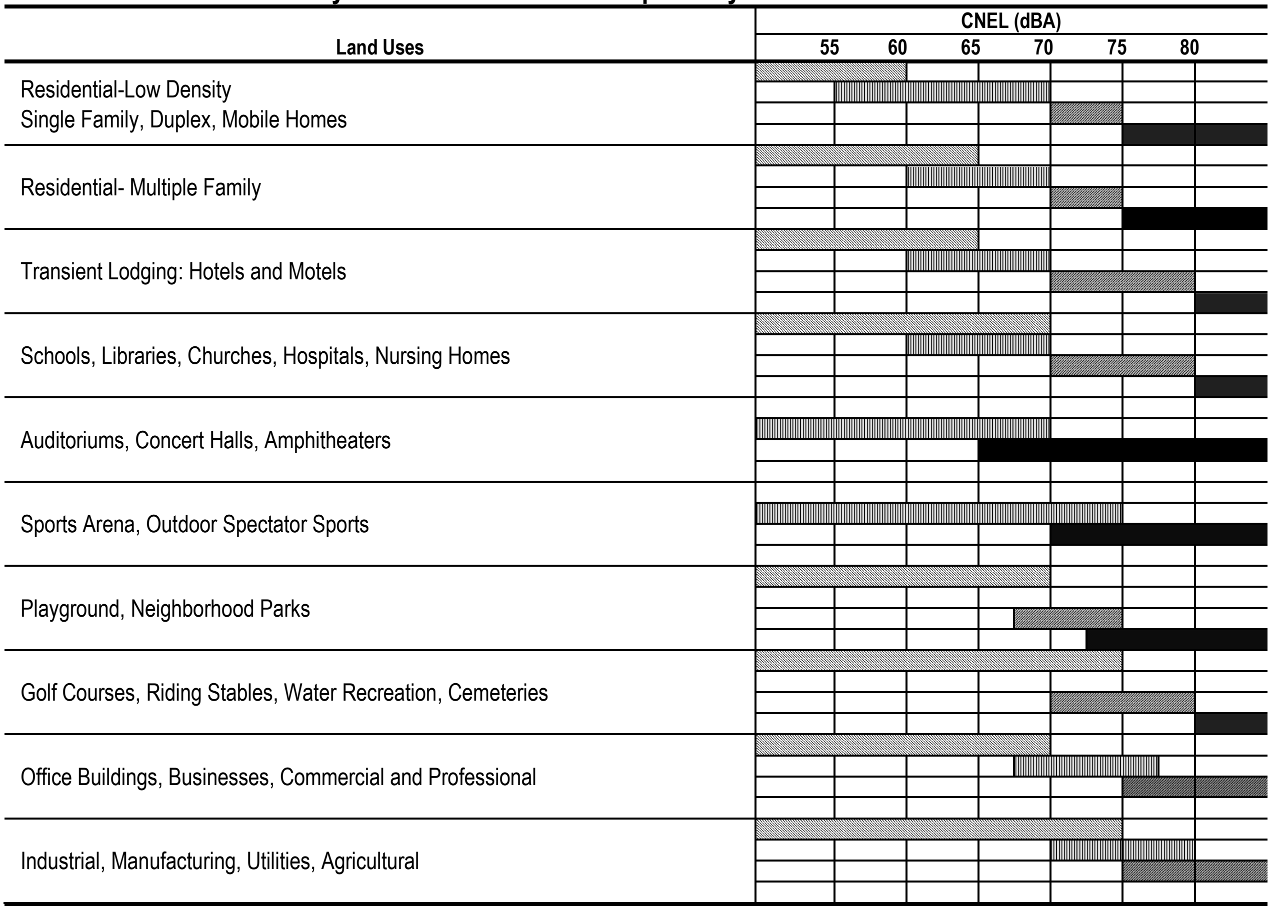
Table 5.9-4 Community Noise and Land Use Compatibility



Explanatory Notes

Normally Acceptable: With no special noise reduction requirements assuming standard construction.	**Normally Unacceptable:** New construction is discouraged. If new construction does not proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.
Conditionally Acceptable: New construction or development should be undertaken only after a detailed analysis of the noise reduction requirement is made and needed noise insulation features included in the design.	**Clearly Unacceptable:** New construction or development should generally not be undertaken.

Source: City of Anaheim General Plan Noise Element 2004.

In concert with these Noise Compatibility Guidelines, the Noise Element also contains goals and policies to help generally direct the City and its staff with city-wide noise pollution control. The City of Anaheim General Plan Noise Element Goals and Policies applicable to the project are:

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Goal 1.1 Protect sensitive land uses from excessive noise through diligent planning and regulation.

Policies:

2) Continue to enforce acceptable noise standards consistent with health and quality of life goals and employ effective techniques of noise abatement through such means as a noise ordinance, building codes, and subdivision and zoning regulations.

3) Consider the compatibility of proposed land uses with the noise environment when preparing, revising or reviewing development proposals.

4) Require mitigation where sensitive uses are to be placed along transportation routes to ensure that noise levels are minimized through appropriate means of mitigation thereby maintaining quality of life standards.

5) Encourage proper site planning and architecture to reduce noise impacts.

6) Discourage the siting of sensitive uses in areas in excess of 65 dBA CNEL without appropriate mitigation.

7) Require that site-specific noise studies be conducted by a qualified acoustic consultant utilizing acceptable methodologies while reviewing the development of sensitive land uses or development that has the potential to impact sensitive land uses.

Goal 2.1 Encourage the reduction of noise from transportation-related noise sources such as motor vehicles, aircraft operations, and railroad movements.

Policies:

3) Require that development generating increased traffic and subsequent increases in the ambient noise level adjacent to noise-sensitive land uses provide appropriate mitigation measures.

11) Encourage the development of alternative transportation modes that minimize noise within residential areas.

Goal 3.1 Protect residents from the effects of "spill over" or nuisance noise emanating from the City's activity centers.

Policies:

1) Discourage new projects located in commercial or entertainment areas from exceeding stationary-source noise standards at the property line of proximate residential or commercial uses, as appropriate.

2) Prohibit new industrial uses from exceeding commercial or residential stationary-source noise standards at the most proximate land uses, as appropriate. (Industrial noise may spill over to proximate industrial uses so long as the combined noise does not exceed the appropriate industrial standards.)

3) Enforce standards to regulate noise from construction activities. Particular emphasis shall be placed on the restriction of the hours in which work other than emergency work may occur. Discourage construction on weekends or holidays except in the case of construction proximate to schools where these operations could disturb the classroom environment.

4) Require that construction equipment operate with mufflers and intake silencers no less effective than originally equipped.

5) Encourage the use of portable noise barriers for heavy equipment operations performed within 100 feet of existing residences or make applicant provide evidence as to why the use of such barriers is infeasible.

Municipal Code

Stationary Sources of Noise

Stationary sources of noise are governed under Anaheim Municipal Code, Chapter 6.70, Sound Pressure Levels. Section 6.70.010 states that no person shall, within the City, create any sound, radiated for extended periods from any premises which produces a sound pressure level at any point on the property in excess of 60 dBA (Re 0.0002 Microbar). Section 6.70.010 of the municipal code also exempts certain noise sources from the provisions of this code, including traffic sounds, sound created by emergency activities and sound created by governmental units.

Municipal Code Chapter 6.72, Amplified Sound, includes provisions meant to regulate the use of sound-amplifying equipment within the City of Anaheim. Additional details related to Chapter 6.72 are included in Appendix E this Draft EIR.

Residential Zoning Noise Regulations

Section 18.40.090 of the Anaheim Municipal Code, Sound Attenuation for Residential Developments, applies to residential developments involving the construction of two or more dwelling units, or residential subdivisions resulting in two or more parcels, and located within six-hundred feet of any railroad, freeway, expressway, major arterial, primary arterial or secondary arterial, as designated by the Circulation Element of the General Plan. A noise level analysis is required for any new residential development or subdivision that meets these criteria, which must include mitigation measures that would be required to comply with applicable City noise standards. Additional details on these standards with respect to the Proposed Project are in Section 5.9.5, *Environmental Impacts.*

Commercial and Mixed-Use Zoning Noise Regulations

Section 18.32.130, Compatibility Standards, of the Municipal Code includes noise standards to ensure the compatibility of uses in a mixed-use project. Residential portions of a mixed-use project shall be designed to limit the interior noise caused by the commercial and parking portions of the Proposed Project to a maximum of 45 dBA CNEL in any habitable room with windows closed. Commercial uses shall be designed and operated, and hours of operation limited so neighboring residents are not exposed to offensive noise, especially from traffic, trash collection, routine deliveries, and/or late-night activities. No use shall produce continual loading or unloading of heavy trucks at the site between the hours of 8:00 p.m. and 6:00 a.m.

Construction Noise

Per Section 6.70.010, noise sources associated with construction or building repair are exempt from the City Sound Pressure Level standards between the hours of 7:00 a.m. to 7:00 p.m. Additional work hours may be permitted if deemed necessary by the Director of Public Works or Building Official.

5.9.2.4 VIBRATION STANDARDS

The City of Anaheim does not set quantitative vibration level standards for structural damage or annoyance. In lieu of such local standards and for purposes of this CEQA assessment, impacts are defined as significant if they exceed the FTA standards for vibration. These are presented in more detail below in Section 5.9.5, *Environmental Impacts*.

5.9.3 Existing Conditions

Sensitive Receptors

Certain land uses are particularly sensitive to noise and vibration. In general, these uses include residences, schools, hospital facilities, houses of worship, and open space/recreation areas where quiet environments are necessary for the enjoyment, public health, and safety of the community. Commercial uses are not particularly sensitive to noise or vibration and neither are light-industrial or industrial uses.

The Project Area is made up of primarily residential, commercial, and public designations. Residential uses include a variety of housing types, such as duplexes, four-plexes, townhomes, garden apartments, and manufactured homes. Commercial uses include, office, retail, restaurants, motels, and automotive-oriented commercial such as gas stations, an auto dealership, and a salvage yard. Medical uses include the West Anaheim Medical Center (hospital) and several buildings providing medical office space.

Ambient Noise Environment

The major source of noise in the study area is traffic. Beach Boulevard is an eight-lane divided roadway with posted speed limits of 45 miles per hour. Other major roads in the study area are east–west streets, including Ball Road, Orange Avenue, and Lincoln Avenue.

Certain land uses are particularly sensitive to noise and vibration. These uses include residential, school, and open space/recreation areas where quiet environments are necessary for enjoyment, public health, and safety. Commercial and industrial uses are not considered noise- and vibration-sensitive uses, since noise is not particularly detrimental to the operations associated with these land use types. Approximately 31 percent of the Project Area consists of residential uses, and approximately 20 percent consists of commercial uses such as retail, lodging, and auto-oriented commercial uses. The rest of the Project Area consists of primarily right-of-way, vacant land, park area, and institutional uses such as medical centers and city facilities.

As noted above, there are many residential areas along Beach Boulevard. However, the majority of nearby residences are within the communities of single-family homes to the east and to the west of the Project Area.

In addition to transportation-related noise, nontransportation sources generate noise in the Project Area. Residential uses generate noise from landscaping, maintenance activities, and air conditioning systems. Commercial uses generate noise from heating, ventilation, air conditioning (HVAC) systems; auto sales and repair; car wash equipment; drive thru speakerphones; and other sources. Noise from stationary sources is regulated through the City's noise ordinance.

Existing Roadway Noise

For roadway noise, daily traffic flows along roadways in the vicinity of the Project were provided by Fehr and Peers (2017) and were used to calculate roadway noise. Roadway noise levels and distances to the 60, 65, and 70 dBA CNEL contours are shown in Table 5.9-5.

Table 5.9-5 Existing Roadway Noise Levels, and Distances to Contour Lines

Roadway	Segment	CNEL (dBA) at 50 feet	Distance to Noise Contours (feet)		
			70 dBA CNEL	65 dBA CNEL	60 dBA CNEL
Beach Boulevard	North of Orangethorpe Avenue	**73**	80	172	370
Beach Boulevard	Between SR-91 and La Palma Avenue	**75**	106	228	491
Beach Boulevard	Between La Palma Avenue and Crescent Avenue	**75**	115	249	536
Beach Boulevard	Between Crescent Ave & Lincoln Ave	**77**	141	303	653
Beach Boulevard	Between Lincoln Ave & Orange Ave	**76**	135	290	625
Beach Boulevard	Between Orange Ave & Ball Rd	**76**	135	290	625
Beach Boulevard	Between Ball Rd & Cerritos Ave	**77**	139	298	643
Beach Boulevard	Between Cerritos Ave and Katella	**76**	135	291	626
Beach Boulevard	South of Katella Avenue	**77**	136	294	633
La Palma Avenue	Between Knott Avenue and Western Avenue	**72**	65	139	301
La Palma Avenue	Between Western Avenue and Beach Boulevard	**72**	66	143	307
La Palma Avenue	Between Beach Boulevard and Stanton Avenue	**70**	53	114	246
La Palma Avenue	East of Stanton Avenue	**71**	59	128	276
Lincoln Avenue	Between Valley View Street and Knott Avenue	**70**	52	113	243
Lincoln Avenue	Between Western Avenue and Beach Boulevard	**71**	55	119	256
Lincoln Avenue	Between Beach Boulevard and Dale Avenue	**69**	40	86	186
Lincoln Avenue	Between Dale Avenue and Magnolia Avenue	**68**	40	85	184
Broadway	Between Dale Avenue and Magnolia Avenue	**64**	20	44	95
Broadway	Between Magnolia Avenue and Gilbert Street	**65**	22	47	100
Orange Avenue	Between Western Avenue and Beach Boulevard	**69**	42	90	193
Orange Avenue	Between Beach Boulevard and Dale Avenue	**66**	29	63	135
Ball Road	Between Western Avenue and Beach Boulevard	**71**	59	127	274
Ball Road	Between Beach Boulevard and Dale Avenue	**69**	43	93	201
Cerritos Avenue	Between Western Avenue and Beach Boulevard	**69**	46	100	214

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Table 5.9-5 Existing Roadway Noise Levels, and Distances to Contour Lines

Roadway	Segment	CNEL (dBA) at 50 feet	Distance to Noise Contours (feet) 70 dBA CNEL	65 dBA CNEL	60 dBA CNEL
Cerritos Avenue	Between Beach Boulevard and Dale Avenue	**67**	32	69	149
Cerritos Avenue	Between Dale Avenue and Magnolia Avenue	**67**	29	63	136
Stanton Avenue	Between La Palma Avenue and Crescent Avenue	**70**	48	103	222

Input information from Fehr and Peers, 2017.
Calculated using FHWA calculation methods for roadway noise.

Ambient Noise Measurements

Short-term ambient noise monitoring was conducted by PlaceWorks in April of 2017. The field work was conducted on a Wednesday, between 3:30 PM and 5:30 PM. The general noise environment around the Project Area is a combination of local and distant roadway noise, general community noise, rustling vegetation, and various activities in the neighborhood (e.g., people talking, lawnmowers). Meteorological conditions during the measurement periods were favorable for outdoor sound measurements and typical conditions for the season. Generally, conditions included clear skies, daytime temperatures of approximately 76 to 81 degrees Fahrenheit (°F), and winds of less than 9 miles per hour (MPH).

Noise monitoring was performed using Larson-Davis Model 820 integrating/logging Sound Level Meters, which satisfy the American National Standards Institute (ANSI) Standard S1.3 for Type 1 accuracy of general environmental noise measurement instrumentation. The sound level meters were programmed to acquire noise levels with the "slow" time constant and using the "A" weighting filter network. The meters were field calibrated immediately prior to the first set of readings. The calibration was rechecked immediately after the conclusion of the readings and no notable meter "drift" was noted (i.e., less than ½ dB deviation). This work effort included six short-term samples of 15 minutes duration. For the short-term samples, the sound level meter and microphone were mounted on a tripod 5 feet above the ground and equipped with a windscreen during all measurements. Noise measurement locations are described below and shown in Figure 5.9-1, *Noise Monitoring Locations*.

- **Short-Term Location 1 (ST-1):** Short-term noise monitoring Location 1 was at the south end of the Project Area along Beach Boulevard, approximately 375 feet south of Ball Road in the Pick-Your-Part parking lot. Fifteen minutes of noise measurements were taken beginning at 3:36 PM on Wednesday, April 12, 2017, at which time the air temperature was 77°F with 42 percent relative humidity (RH), and wind speed of approximately 2 mph.

  The noise environment of this site was dominated by roadway noise from Beach Boulevard. Secondary noise sources include children screaming from Adventure City across Beach Boulevard, parking lot activity (i.e. shutting doors, starting engines, people talking), and more distant roadway noise from Ball Road.

Figure 5.9-1 - Noise Monitoring Locations

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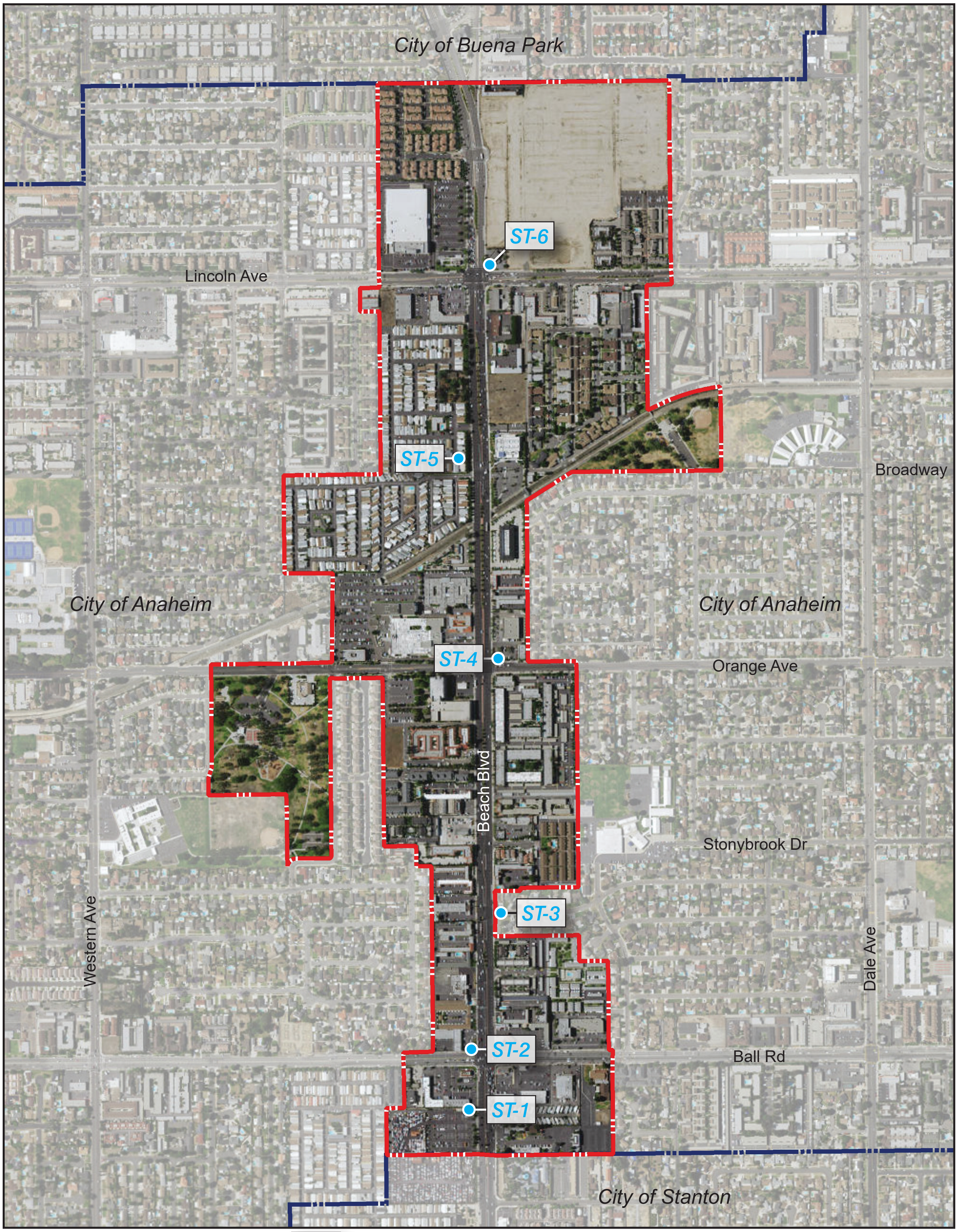

Specific Plan Boundary
ST-1 Short-Term Noise Measurement Locations (6)
Anaheim City Boundary
0 1,000 Scale (Feet)
Source: ESRI, 2017

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- **Short-Term Location 2 (ST-2):** Short-term noise monitoring Location 2 was at the northwest corner of Beach Boulevard and Ball Road. Fifteen minutes of noise measurements were taken beginning at 3:58 PM on Wednesday, April 12h, 2017, at which time the air temperature was 81°F with 40 percent RH, and wind speed of approximately 1.5 mph.

  The noise environment of this site was dominated by roadway noise from Beach Boulevard and Ball Road. Any secondary noise sources did not contribute to the overall ambient noise environment as compared to roadway noise.

- **Short-Term Location 3 (ST-3):** Short-term noise monitoring Location 3 was along Rome Avenue in a residential strip approximately 100 feet east of Beach Boulevard. Fifteen minutes of noise measurements were taken beginning at 4:19 PM on Wednesday, April 12, 2017, at which time the air temperature was 76°F with 48 percent RH, and wind speed between 6 and 9 miles per hour.

  The noise environment of this site was characterized primarily by roadway noise from Beach Boulevard. Residential operations were also clearly audible at this location (i.e., people talking, property maintenance).

- **Short-Term Location 4 (ST-4):** Short-term noise monitoring Location 4 was at the northeast corner of Beach Boulevard and Orange Avenue. Fifteen minutes of noise measurements were taken beginning at 4:37 PM on Wednesday, April 12, 2017, at which time the air temperature was 77°F with 42 percent RH, and wind speed between 1 and 3 miles per hour.

  The noise environment of this site was dominated by roadway noise from Beach Boulevard and Orange Avenue. Parking lot activity (i.e. shutting doors, starting engines, people talking) and rustling bushes were also noted at this location.

- **Short-Term Location 5 (ST-5):** Short-term noise monitoring Location 5 was in the Pacific Sunset Estates Residential Community. The noise monitor was positioned approximately 100 feet west of Beach Boulevard. Fifteen minutes of noise measurements were taken beginning at 5:01 PM on Wednesday, April 12, 2017, at which time the air temperature was 81°F with 49 percent RH, and wind speed between 0 and 1 miles per hour.

  The noise environment of this site was characterized primarily by roadway noise from Beach Boulevard. However, the approximately 5.5-foot brick wall at the eastern boundary of the residential community shielded quite a bit of roadway noise from Beach Boulevard. Residential activity and rustling trees/bushes also contributed to the noise environment at this location.

- **Short-Term Location 6 (ST-6):** Short-term noise monitoring Location 6 was near the north side of the Project Area, at the northeast corner of Beach Boulevard and Lincoln Avenue. Fifteen minutes of noise measurements were taken beginning at 5:21 PM on Wednesday, April 12, 2017, at which time the air temperature was 76°F with 53 percent RH, and wind speed between 4 and 6 miles per hour.

The noise environment of this site was dominated by roadway noise from Beach Boulevard and Lincoln Avenue. Operational noise from the 76 gas station (i.e., shutting doors, starting engines, people talking) was also noted at the site, but did not contribute to the overall ambient noise environment as compared to roadway noise.

Summary of Ambient Measurements

The noise environment around the Project Area is considered to be generally louder than a typical urban residential area due to the number of major roadways. During the ambient noise survey, the daytime, energy-average (L_{eq}) noise levels within the Project Area, as measured during the short-term noise measurements, ranged from 58 to 72 dBA L_{eq}. For receivers that were directly exposed to roadway noise (i.e., ST-2, ST-4, ST-6), the measured L_{eq} was in the range of 68 to 72 dBA. The short-term noise measurement results are summarized in Table 5.9-6, *Short-Term Noise Measurements Summary*. Additional details about the noise monitoring results are included in Appendix E of this technical report.

Table 5.9-6 Short-Term Noise Measurements Summary

Monitoring Location	Description	L_{min}	L_{eq}	L_{max}
ST-1	Pick-Your-Part Parking Lot; 100 ft west of Beach	53	65	83
ST-2	SW Corner of Beach Blvd and Ball Rd	58	72	88
ST-3	Residential Community near Beach/Rome	48	59	72
ST-4	NE Corner of Beach Blvd and Orange Ave	55	68	83
ST-5	Pacific Sunset Estates; 100 ft west of Beach	43	58	78
ST-6	NE Corner of Beach Blvd and Lincoln Ave	59	71	85

Noise sampling conducted by PlaceWorks staff on April 12, 2017, for a minimum of 15 minutes at each site with a Larson Davis 820 sound level meter.

5.9.4 Thresholds of Significance

According to Appendix G of the CEQA Guidelines, a project would normally have a significant effect on the environment if the project would result in:

N-1 Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies.

N-2 Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels.

N-3 A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project.

N-4 A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.

N-5 For a project located within an airport land use plan or where such a plan has not been adopted, within two miles of a public airport or public use airport, expose people residing or working in the project area to excessive noise levels.

N-6 For a project within the vicinity of a private airstrip, expose people residing or working the project area to excessive noise levels.

The Initial Study, included as Appendix A, substantiates that impacts associated with the following threshold(s) would be less than significant:

- Threshold N-6

These impacts will not be addressed in the following analysis.

5.9.5 Environmental Impacts

The following impact analysis addresses thresholds of significance for which the initial study disclosed potentially significant impacts. The applicable thresholds are identified in brackets after the impact statement.

Impact 5.9-1: Construction activities would potentially result in temporary noise increases in the vicinity of the Project Area. [Threshold N-4]

Impact Analysis: Buildout of the Beach Boulevard Specific Plan would occur over an approximately 20-year period and would consist of many different projects with their own construction time frames and equipment. Individual construction projects in the Project Area would have their own schedule and would only affect areas near the construction site. Residential areas are considered noise sensitive and would have the potential to be affected by construction activities during implementation of the Proposed Project. The most noise-sensitive receivers would be the existing and future residential uses immediately adjacent to the boundaries of the Project Area.

The Proposed Project would increase the number of permitted residential units in the Project Area from 1,477 total dwelling units[5] to 5,128 units—roughly 3,651 more than existing conditions. The Proposed Project also increases potential nonresidential building square footage from approximately 1.3 million square feet to approximately 2.2 million square feet.

The City of Anaheim recognizes that the control of construction noise is difficult and provides an exemption for this type of noise when the work is performed within the hours specified in Section 6.70.010 of the City's Municipal Code (i.e., 7:00 a.m. to 7:00 p.m.).[6] Given the lack of specific details about the future developments at the site, a generalized, program-level set of construction equipment items were used for the assessment below. Noise generated during construction is based on the type of equipment used, the location of the equipment relative to sensitive receptors, and the timing and duration of the noise-generating activities. Two types of temporary noise impacts could occur during construction activities associated with development of

[5] Including Low-medium Density, Medium Density, Mixed-use Medium Density, Mixed-use High Density
[6] Additional work hours may be permitted if deemed necessary by the Director of Public Works or Building Official.

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the Proposed Project. First, the transport of workers and movement of materials to and from the site could incrementally increase noise levels along local access roads. The second type of temporary noise impact is related to demolition, site preparation, grading, and/or physical construction. Construction is performed in distinct steps, each of which has its own mix of equipment and noise characteristics. Table 5.9-7, *Construction Equipment Noise Emission Levels*, lists typical construction equipment noise levels recommended for noise-impact assessments, based on a distance of 50 feet between the equipment and noise receptor.

Table 5.9-7 Construction Equipment Noise Emission Levels

Construction Equipment	Typical Max Noise Level (dBA L_{max}) at 50 feet from the source	Construction Equipment	Typical Max Noise Level (dBA L_{max}) at 50 feet from the source
Air Compressor	81	Pile-Driver (Impact)	101
Backhoe	80	Pile-Driver (Sonic)	96
Ballast Equalizer	82	Pneumatic Tool	85
Ballast Tamper	83	Pump	76
Compactor	82	Rail Saw	90
Concrete Mixer	85	Rock Drill	98
Concrete Pump	71	Roller	74
Concrete Vibrator	76	Saw	76
Crane, Derrick	88	Scarifier	83
Crane, Mobile	83	Scraper	89
Dozer	85	Shovel	82
Generator	81	Spike Driver	77
Grader	85	Tie Cutter	84
Impact Wrench	85	Tie Handler	80
Jack Hammer	88	Tie Inserter	85
Loader	85	Truck	88
Paver	89		

Source: FTA 2006.

As shown in Table 5.9-7, construction equipment generates high levels of noise, with maximums ranging from 71 dBA to 98 dBA. Construction of individual development projects would temporarily increase the ambient noise environment and would have the potential to affect noise-sensitive land uses in the vicinity of that project. Construction noise impacts would depend on the distance from the receptor to the location of individual construction activities and on the presence of intervening structures. The average noise levels at noise-sensitive receptors would be much lower than what is presented in Table 5.9-7, because noise from construction equipment is intermittent and diminishes at a rate of at least 6 dB per doubling distance, and because mobile construction equipment would move around the site and be operated with different loads and power requirements.

Implementation of the Proposed Project would result in an increase in development intensity throughout the Project Area. Construction noise levels depend on the specific locations, site plans, and construction details of individual development projects, which are not known at this time. Construction-related noise would be localized and would occur intermittently for varying periods of time. Although the Proposed Project would take approximately 20 years to build out, it is anticipated that exposure of individual receptors to elevated construction noise levels would be for much shorter periods (e.g., a few months).

Construction of individual development projects would temporarily increase the ambient noise environment in the vicinity of each development project, potentially affecting existing and future sensitive uses in the vicinity. Even with the time-of-day constraints (from the municipal code), construction of any individual development may be close to noise-sensitive receptors, and noise disturbances may occur for prolonged periods. However, the specific locations, duration, and equipment required for individual projects are unknown at this time. Therefore, it cannot be specifically determined how noise-sensitive uses in the project area and surroundings would be affected. Therefore, construction noise impacts are considered potentially significant. To address this circumstance, future developments in the Project Area are expected to undergo project-specific construction noise impact assessments in accordance with CEQA, including construction noise level projections at nearby sensitive receptors.

Upon implementation of regulatory requirements, Impact 5.9-1 would be potentially significant.

Impact 5.9-2: Project implementation would result in long-term operation-related noise that would not exceed local standards. [Thresholds N-1 and N-3]

Impact Analysis: With respect to Project-related increases, noise impacts can be broken down into three categories. The first is "audible" impacts, which refer to increases in noise levels that are perceptible to humans. Audible increases in general community noise levels generally refer to a change of 3 dB or more since this level has been found to be the threshold of perceptibility in exterior environments. The second category, "potentially audible" impacts, refers to a change in noise level between 1 and 3 dB. The last category includes changes in noise level of less than 1 dB that are typically "inaudible" to the human ear except under quiet conditions in controlled environments. Only "audible" changes in noise levels at sensitive receptor locations (i.e., 3 dB or more) are considered potentially significant. Note that a doubling of traffic flows (e.g., 10,000 vehicles per day to 20,000 per day) would be needed to create a 3 dB increase in traffic-generated noise levels. An increase of 3 dB is often used as a threshold for a substantial increase.

For stationary noise sources in the city, Municipal Code Section 6.70.010 establishes an exterior noise limit of 60 dBA.

Many of the future residential developments in the Project Area will apply to Section 18.40.090 of the Anaheim Municipal Code, Sound Attenuation for Residential Development. This section applies to residential developments involving the construction of two or more dwelling units, or residential subdivisions resulting in two or more parcels, and located within six hundred feet of any railroad, freeway, expressway, major arterial, primary arterial or secondary arterial, as designated by the Circulation Element of the General Plan. A noise level analysis is required for any new residential development or subdivision that meets these criteria, and must include mitigation measures that comply with applicable City noise standards, including but not limited to:

- Exterior noise within the private rear yard of any single-family lot and/or within any common recreation areas, shall be attenuated to a maximum of 65 dBA CNEL; interior noise levels shall be attenuated to a maximum of 45 dB CNEL, or to a level designated by the Uniform Building Code, as adopted by the City (identified in Section 18.40.090).

- Exterior noise within common recreation areas of any single family attached or multiple family dwelling project shall be attenuated to a maximum of 65 dBA CNEL; interior noise levels shall be attenuated to a maximum of 45 dB CNEL, or to a level designated by the Uniform Building Code, as adopted by the City (identified in Section 18.40.090).

According to Section 18.040.090.060, the Planning Commission may grant a deviation from the requirements pertaining to exterior noise levels, given that all of the following conditions exist:

- The deviation does not exceed 5 dB CNEL above the prescribed levels for exterior noise.[7]

- Measures to attenuate noise to the prescribed levels would compromise or conflict with the aesthetic value of the project.

Section 18.32.130, Compatibility Standards, of the Municipal Code includes noise standards to ensure the compatibility of uses in a mixed-use project. Residential portions of a mixed-use project shall be designed to limit the interior noise caused by the commercial and parking portions of the project to a maximum of 45 dBA CNEL in any habitable room with windows closed. Commercial uses shall be designed and operated and hours of operation limited so neighboring residents are not exposed to offensive noise, especially from traffic, trash collection, routine deliveries, and/or late-night activities. No use shall produce continual loading or unloading of heavy trucks at the site between the hours of 8:00 p.m. and 6:00 a.m.

A significant impact would occur if the project would result in an increase in traffic noise levels of 3 dB or more. A significant stationary-source impact would occur if the activities or equipment associated with a project in the Project Area produce noise levels at nearby sensitive receptors in excess of local code standards. A significant zoning impact would occur if a new residential development in the Project Area (described by the criteria above) violates the Municipal Code Noise Standards.

The relevant classes of noise sources are assessed below with respect to these City regulations and requirements.

Traffic Noise

Future development in accordance with the Proposed Project would cause increases in traffic along local roadways. Traffic noise increases may affect various sensitive land uses, including residences, churches, and medical uses. Commercial and industrial areas are not considered noise sensitive and generally have higher tolerances for exterior and interior noise levels.

The traffic noise levels for existing conditions and future plus project conditions were estimated using the Federal Highway Administration's (FHWA) Highway Traffic Noise Prediction Model (FHWA 1978). The FHWA model predicts noise levels through a series of adjustments to a reference sound level. These

[7] The deviation from prescribed levels does not pertain to interior noise levels.

adjustments account for distances from the roadway, traffic flows, vehicle speeds, car/truck mix, length of exposed roadway, and road width. The distances to the 70, 65, and 60 CNEL contours for selected roadway segments in the vicinity of the Project Area are in Appendix E.

Table 5.9-8, *Specific Plan Buildout Traffic Noise Increases*, presents the noise level increases on roadways over existing conditions at 50 feet from the centerline of each roadway segment due to the Proposed Project. The "2035 Plus Project" traffic noise levels include effects of future regional ambient growth and growth due to the Proposed Project (Fehr and Peers 2017).

Table 5.9-8 Specific Plan Buildout Traffic Noise Increases

Roadway	Segment	CNEL @ 50 ft. (dBA)			
		Existing No Project	2035 Plus Project	Overall Increase	Project Contribution
Beach Boulevard	North of Orangethorpe Avenue	73.0	73.5	0.4	0.0
Beach Boulevard	Between SR-91 and La Palma Avenue	74.9	75.4	0.5	0.0
Beach Boulevard	Between La Palma Avenue and Crescent Avenue	75.4	75.7	0.3	0.2
Beach Boulevard	Between Crescent Ave & Lincoln Ave	76.7	77.4	0.7	0.4
Beach Boulevard	Between Lincoln Ave & Orange Ave	76.5	76.7	0.3	0.3
Beach Boulevard	Between Orange Ave & Ball Rd	76.5	76.5	0.1	0.1
Beach Boulevard	Between Ball Rd & Cerritos Ave	76.6	76.7	0.1	0.1
Beach Boulevard	Between Cerritos Ave and Katella	76.5	76.7	0.3	0.0
Beach Boulevard	South of Katella Avenue	76.5	76.8	0.2	0.0
La Palma Avenue	Between Knott Avenue and Western Avenue	71.7	72.3	0.7	0.0
La Palma Avenue	Between Western Avenue and Beach Boulevard	71.8	72.6	0.7	-0.1
La Palma Avenue	Between Beach Boulevard and Stanton Avenue	70.4	70.5	0.1	-0.1
La Palma Avenue	East of Stanton Avenue	71.1	71.5	0.3	0.1
Lincoln Avenue	Between Valley View Street and Knott Avenue	70.3	72.5	2.2	-0.1
Lincoln Avenue	Between Western Avenue and Beach Boulevard	70.6	72.3	1.6	-0.1
Lincoln Avenue	Between Beach Boulevard and Dale Avenue	68.5	70.4	1.8	0.2
Lincoln Avenue	Between Dale Avenue and Magnolia Avenue	68.5	69.8	1.4	0.1
Broadway	Between Dale Avenue and Magnolia Avenue	64.2	64.5	0.3	0.0
Broadway	Between Magnolia Avenue and Gilbert Street	64.5	64.9	0.4	0.0
Orange Avenue	Between Western Avenue and Beach Boulevard	68.8	69.2	0.4	0.2
Orange Avenue	Between Beach Boulevard and Dale Avenue	66.5	67.0	0.5	-0.4
Ball Road	Between Western Avenue and Beach Boulevard	71.1	71.7	0.6	0.1
Ball Road	Between Beach Boulevard and Dale Avenue	69.1	70.3	1.2	0.1
Cerritos Avenue	Between Western Avenue and Beach Boulevard	69.5	70.0	0.5	-0.1
Cerritos Avenue	Between Beach Boulevard and Dale Avenue	67.1	67.8	0.7	0.2
Cerritos Avenue	Between Dale Avenue and Magnolia Avenue	66.5	66.7	0.2	0.0
Stanton Avenue	Between La Palma Avenue and Crescent Avenue	69.7	70.1	0.4	0.1

Source: FHWA Highway Traffic Noise Prediction Model based on traffic volumes provided by Fehr and Peers (September 2017). Calculations in Appendix E.

Table 5.9-9 shows that overall traffic-generated increases due to both the Project and regional growth would range from 0.1 to 2.2 dB in the CNEL metric and that the Project-specific traffic noise contributions would range from -0.4 to 0.4 dB (in the CNEL metric). Note that a negative contribution indicates a reduction in noise is caused by a reduction in traffic volumes due to changes in land use designations and the corresponding trip generation in some areas of the Project Area. The Proposed Project includes an implementation action plan that includes several mobility and streetscape actions. These mobility and streetscape actions require site-specific transportation studies for new developments and initiate roadway/intersection improvements at several roadways. These mobility and streetscape actions will alleviate traffic in the Project Area, and will therefore reduce project-related roadway noise generation.

Based on the estimated traffic conditions provided by Fehr and Peers, no segments would experience substantial noise increases greater than 3 dB over existing conditions. Therefore, impacts would be less than significant, and no mitigation measures are necessary.

Beyond this program-level analysis, future developments in the Project Area are expected to analyze project-specific roadway noise increases in accordance with CEQA and the municipal code noise standards.

Stationary-Source Noise

Buildout of the Proposed Project would result in an increase in residential, commercial, mixed use, office, and public-recreational development within the planning area. The primary stationary noise sources associated with these land uses are landscaping and maintenance activities, HVAC systems, mechanical equipment, and operational noise from residents and/or patrons. As mentioned above, traffic noise generally dominates the noise environment around the Project Area. Noise generated by stationary sources associated with residential, commercial, mixed use, office, or public-recreational uses is generally short and intermittent, and these uses are not a substantial source of noise compared to roadway noise sources. Through the enforcement of municipal code standards, stationary-source noise from these types of proposed land uses would not substantially increase the existing noise environment.

Noise Affecting Future Residential Developments

Noise sources associated with future developments under the Proposed Project are subject to the municipal code standards of the City of Anaheim. According to the ambient noise measurements for the Proposed Project, there are several locations in the Project Area with a noise environment that is currently unacceptable for certain new residential uses. Through enforcement of municipal code standards, future residential projects would not be substantially impacted by the noise environment.

Since the details of individual developments in the Project Area are not known at this time, long-term operation-related noise would be potentially significant.

Impact 5.9-3: The Proposed Project would create short-term and/or long-term groundborne vibration and groundborne noise. [Threshold N-2]

Impact Analysis: The City of Anaheim does not set quantitative vibration level standards for structural damage or annoyance. In lieu of such local standards and for purposes of this CEQA assessment, impacts are defined as significant if they exceed the FTA standards for vibration, which are typically evaluated in terms of annoyance and architectural damage.

Vibration-Related Annoyance

The human reaction to various levels of vibration is highly subjective and varies from person to person. The FTA criteria for annoyance are shown in Table 5.9-9. These criteria are based on the work of many researchers suggesting that humans are sensitive to vibration velocities in the range of 8 to 80 Hz.

Table 5.9-9 Groundborne Vibration Criteria: Human Annoyance

Land Use Category	Description	Max Lv (VdB)
Workshop	Distinctly felt vibration. Appropriate to workshops and non-sensitive areas	90
Office	Felt vibration. Appropriate to offices and non-sensitive areas.	84
Residential – Daytime	Barely felt vibration. Adequate for computer equipment.	78
Residential – Nighttime	Vibration not felt, but groundborne noise may be audible inside quiet rooms.	72

Source: FTA 2006.
Note: Max Lv (VdB): Lv is the velocity level in decibels, as measured in 1/3-octave bands of frequency over the frequency ranges of 8 to 80 Hz.

Vibration-Related Architectural Damage

Structures amplify groundborne vibration, and wood-frame buildings, such as typical residential structures, are more affected by ground vibration than heavier buildings. The level at which groundborne vibration is strong enough to cause architectural damage has not been determined conclusively. The most conservative estimates are reflected in the FTA standards, shown in Table 5.9-10.

Table 5.9-10 Groundborne Vibration Criteria: Architectural Damage

Building Category		PPV (in/sec)	Lv (VdB)
I.	Reinforced concrete, steel, or timber (no plaster)	0.5	102
II.	Engineered concrete and masonry (no plaster)	0.3	98
III.	Non-engineered timber and masonry buildings	0.2	94
IV.	Buildings extremely susceptible to vibration damage	0.12	90

Source: FTA 2006.
Note: Lv (VdB): Lv is the velocity level in decibels, as measured in 1/3-octave bands of frequency over the frequency ranges of 8 to 80 Hz.

Using these FTA criteria, the potential vibration impacts resulting from construction and vehicle flows of the Proposed Project are addressed separately below.

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Construction Vibration Impacts

Buildout of the Proposed Project would occur over an approximately 20-year period and would consist of many different projects with their own construction time frames and equipment. Individual construction projects in the Project Area would have their own schedules and would only affect areas near the construction site. Residential areas are considered vibration sensitive and would have the potential to be affected by construction activities during implementation of the Proposed Project. The most vibration-sensitive structures would be the existing and future residential uses immediately adjacent to the boundaries of the Proposed Project.

Construction operations can generate varying degrees of ground vibration, depending on the construction procedures and equipment. Operation of construction equipment generates vibrations that spread through the ground and diminish with distance from the source. The effects on nearby buildings depend on soil type, ground strata, and receptor-building construction. They can range from no perceptible effects at the lowest vibration levels, to low rumbling sounds and perceptible vibrations at moderate levels, to slight structural damage at the highest levels. Vibration from construction activities rarely reaches levels that can damage structures, but can achieve the audible and perceptible ranges in buildings close to the construction site. Table 5.9-11 lists vibration levels for typical construction equipment.

Table 5.9-11 Vibration Levels for Typical Construction Equipment

Equipment	Approximate RMS Velocity[1] Level at 25 Feet (VdB)	Approximate PPV at 25 Feet (in/sec)
Pile Driver (impact) Upper Range	112	1.518
Pile Driver (impact) Lower Range	104	0.644
Pile Driver (sonic) Upper Range	105	0.734
Pile Driver (sonic) Lower Range	93	0.170
Vibratory Roller	94	0.210
Large Bulldozer	87	0.089
Caisson Drilling	87	0.089
Jackhammer	79	0.035
Small Bulldozer	58	0.003
Loaded Trucks	86	0.076
FTA Criteria: Residential, Human Annoyance (Daytime/nighttime)	78/72	—
FTA Criteria: Structural Damage (Non-engineered timber and masonry buildings)	—	0.200

Source: FTA 2006.
[1] RMS velocity calculated from vibration level (VdB) using the reference of 1 microinch/second.

As shown in Table 5.9-12, vibration generated by construction equipment has the potential to exceed the FTA criteria of 78 VdB for human annoyance and 0.200 in/sec for structural damage. However, groundborne vibration is almost never annoying to people who are outdoors, so it is usually evaluated in terms of indoor receivers (FTA 2006). Construction details and equipment for individual development projects are not known at this time. Therefore, vibration impacts may occur from construction equipment associated with development of the proposed project, and construction vibration impacts are considered potentially significant.

Roadway-Related Vibration Impacts

Operation of new commercial land uses could generate additional truck trips, which could potentially generate vibration along the traveled roadways. Additionally, truck trips could be generated during construction of new development projects in the Project Area. Caltrans has studied the effects of vehicle vibration on sensitive land uses and notes that "heavy trucks, and quite frequently buses, generate the highest earth borne vibrations of normal traffic" (Caltrans 2013b). Caltrans also notes that the highest traffic-generated vibration is along freeways and state routes and finds that "vibrations measured on freeway shoulders (five meters from the centerline of the nearest lane) have never exceeded 0.08 inches per second, with the worst combinations of heavy trucks. This level coincides with the maximum recommended safe level for ruins and ancient monuments (and historic buildings)" (Caltrans 2013b). Further, trucks do not typically generate high levels of vibration because they travel on rubber wheels and do not have vertical movement, which generates ground vibration (Caltrans 2013b). Given these observations and guidance notes from Caltrans, roadways in the Project Area are not expected to generate excessive vibration. Therefore, there would be no impact due to roadway-related vibration.

Upon implementation of regulatory requirements, Impact 5.9-3 would be potentially significant with respect to construction vibration effects.

Impact 5.9-4: For a project located within an airport land use plan or where such a plan has not been adopted, within two miles of a public airport, expose people residing or working in the project area to excessive noise levels. [Threshold N-5]

Impact Analysis: There are no public-use airports within 2 miles of the Project Area (Airnav, 2017). The Fullerton Municipal Airport is approximately 2.5 miles to the north. At this distance, airport-related noise would not affect existing or future developments in the Project Area.[8] The Los Alamitos Joint Forces Training Base is approximately 3.5 miles southwest of the Project Area. According to the noise contour data provided for the Los Alamitos Joint Forces Training Base (Airport Land Use Commission, 2016), the southern end of the Project Area is approximately 1.25 miles from the nearest 60 dBA CNEL contour and approximately 1.6 miles from the nearest 65 dBA CNEL contour. While sporadic operations at these aircraft facilities may, at times, be audible in the Project Area, the distances would reduce noise to negligible amounts in the Project Area. Therefore, development of the Proposed Project would not expose people to excessive noise levels from aircraft approaching or departing the nearest airport facilities. No impact would occur, and no mitigation measures are necessary.

5.9.6 Cumulative Impacts

Cumulative noise impacts occur when multiple sources of noise, though individually not substantial, combine to result in excessive, cumulative noise exposure at noise-sensitive uses.

[8] Recent noise contour data is not available for the Fullerton Municipal Airport.

Short-Term Construction Noise and Vibration

Cumulative construction noise impacts have the potential to occur when multiple construction projects in the same general area generate noise within the same time frame and contribute to the increases in the ambient noise environment. The details of individual development projects in the approximately 20-year buildout of the Proposed Project are currently unknown. Therefore, it cannot be determined whether multiple, close-proximity projects would be developed simultaneously or the extent of their potential noise and vibration emissions e. Therefore, cumulative impacts related to construction would be potentially significant.

Long-Term Operation

To specifically estimate the Proposed Project's contribution to traffic noise, existing noise levels were compared to those projected with buildout of the Proposed Project. As demonstrated above, the Proposed Project's contribution to increases in ambient noise levels over the 20-year buildout period would be less than significant, even when accounting for traffic increases in the Project Area. However, future developments in the Project Area could expose existing or future residential projects to noise levels in excess of municipal code standards. Through the enforcement of code standards, noise impacts associated with zoning of future residential projects would not be substantial. Since the details of individual developments in the Project Area are not known at this time, long-term operation-related noise would be potentially significant.

Aircraft-Related Noise

Development of the Proposed Project would not expose people to excessive noise levels from aircraft approaching or departing the nearest airport facilities; no impact would occur.

5.9.7 Existing Regulations and Standard Conditions

State

- California Code of Regulations, Title 24, Part 11, California Green Building Standards Code.

City of Anaheim

General Plan Noise Element

- Goal 1.I through Goal 3.I.

Municipal Code

- Chapter 6.70, Sound Pressure Levels
- Section 6.70.010, City-wide noise level limits, Construction noise limitations
- Section 18.040.090, Residential Zoning Noise Regulations
- Section 18.32.130, Commercial and Mixed-Use Zoning Noise Regulations

5.9.8 Level of Significance Before Mitigation

Upon implementation of regulatory requirements and standard conditions of approval, the following impacts would be less than significant: 5.9-4.

Without mitigation, the following impacts would be **potentially significant**:

- **Impact 5.9-1** Construction activities would result in temporary noise increases in the vicinity of the project.
- **Impact 5.9-2** Project implementation would result in long-term operation-related noise that would exceed local standards.
- **Impact 5.9-3** The project would create short-term and/or long-term groundborne vibration and groundborne noise.

5.9.9 Mitigation Measures

Impact 5.9-1

N-1 Prior to issuance of demolition, grading and/or building permits, a note shall be provided on plans for grading, demolition, and construction activities, indicating that the property owner/developer shall be responsible for requiring contractors to implement the following measures to limit construction-related noise:

- Construction activity is limited to the daytime hours between 7:00 a.m. to 7:00 p.m., as prescribed in the City's Municipal Code. (Additional work hours may be permitted if deemed necessary by the Director of Public Works or Building Official.)
- All internal combustion engines on construction equipment and trucks are fitted with properly maintained mufflers.
- Stationary equipment such as generators and air compressors shall be located as far as feasible from nearby noise-sensitive uses.
- Stockpiling is located as far as feasible from nearby noise-sensitive receptors.
- Construction traffic shall be limited to the established haul routes.

N-2 Prior to the issuance of grading permits, each project applicant in the Project Area shall prepare a construction management plan that shall be approved by the City of Anaheim Public Works. The construction management plan shall:

- Establish truck haul routes on the appropriate transportation facilities. Truck routes that avoid congested streets and sensitive land uses shall be considered.

- Provide traffic control plans (for detours and temporary road closures) that meet the minimum City criteria. Traffic control plans shall determine if dedicated turn lanes for movement of construction truck and equipment on- and offsite are available.
- Minimize offsite road closures during the peak hours.
- Keep all construction-related traffic onsite at all times.
- Provide temporary traffic controls, such as a flag person, during all phases of construction to maintain smooth traffic flow.

Impact 5.9-2

N-3 Prior to issuance of a building permit, applicants for new residential or subdivision developments within the Project Area involving the construction of two or more dwelling units, or residential subdivisions resulting in two or more parcels, and located within six-hundred feet of any railroad, freeway, expressway, major arterial, primary arterial or secondary arterial, as designated by the Circulation Element of the General Plan, are required to submit a noise level analysis, which must include mitigation measures that comply with applicable City noise standards, including:

- Exterior noise in the private rear yard and/or common recreation areas of any single-family lot and/or multiple-family dwelling project shall be attenuated to a maximum of 65 dBA CNEL; interior noise levels shall be attenuated to a maximum of 45 dBA CNEL, as identified in the Anaheim Municipal Code Section 18.40.040-050.

The Planning Commission may grant a deviation from the requirements for exterior noise levels if all of the following conditions exist (Section 18.040.090.060):

- The deviation does not exceed 5 dB above the prescribed levels for exterior noise.[9]
- Measures to attenuate noise to the prescribed levels would compromise or conflict with the aesthetic value of the project.

In addition, residential portions of mixed-use projects shall be designed to limit the interior noise caused by the commercial and parking portions of the project to a maximum of 45 dBA CNEL in any habitable room with windows closed. Commercial uses shall be designed and operated, and hours of operation limited so neighboring residents are not exposed to offensive noise, especially from traffic, trash collection, routine deliveries, and/or late-night activities. No use shall produce continual loading or unloading of heavy trucks at the site between the hours of 8:00 p.m. and 6:00 a.m. (Section 18.32.130, Compatibility Standards).

The required exterior noise reduction can be accomplished with sound walls or berms, or by site plan/building layout design. The required interior noise reduction can be accomplished

[9] The deviation from prescribed levels does not pertain to interior noise levels.

with enhanced construction design or materials such as upgraded dual-glazed windows and/or upgraded exterior wall assemblies. These features shall be shown on all building plans and incorporated into construction of the project. City inspectors shall verify compliance of the building with the acoustic report's recommendations prior to issuance of a Certificate of Occupancy.

Impact 5.9-3

N-4 Prior to issuance of a building permit, applicants for projects in the Beach Boulevard Specific Plan that involve high-vibration construction activities, such as pile driving or vibratory rolling/compacting, shall be evaluated for potential vibration impacts to nearby sensitive receptors. The project applicant shall submit a vibration report prepared to the satisfaction of the City of Anaheim to determine if the use of pile driving and/or vibratory rolling/compacting equipment would exceed the Federal Transit Administration's vibration-annoyance criteria of 78 VdB during the daytime or vibration-induced architectural damage PPV criteria of 0.2 inch/second for wood-framed structures or 0.5 inches/second for reinforced masonry buildings. The construction contractor shall require the use of lower-vibration-producing equipment and techniques. Examples of lower-vibration equipment and techniques include avoiding vibratory rollers near sensitive areas and/or using drilled piles, sonic pile driving, or vibratory pile driving (as opposed to impact pile driving).

5.9.10 Level of Significance After Mitigation

The mitigation measures identified above would reduce potential impacts associated with noise to a level that is less than significant. Therefore, no significant unavoidable adverse impacts relating to noise remain.

5.9.11 References

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