5.9 NOISE AND VIBRATION

This section describes the existing noise environment for the project area, potential environmental impacts, recommended mitigation measures to help reduce or avoid the impacts and the level of significance of project impacts after mitigation.

5.9.1 EXISTING CONDITIONS

5.9.1.1 Noise and Vibration Overview

Background Information on Noise

Sound that is loud, disagreeable, unexpected, or unwanted is generally defined as noise. A sound wave is initiated in a medium by a vibrating object (e.g., vocal chords, the string of a guitar, the diaphragm of a radio speaker, etc.). The wave consists of minute variations in pressure, oscillating above and below the ambient atmospheric pressure. The number of pressure variation cycles occurring per second is referred to as the frequency of the sound wave and is expressed in hertz (Hz), which is equivalent to one complete cycle per second. The perception of sound is subjective and can vary substantially from person to person. Noise can be generated by a number of sources, including mobile sources (transportation sources) such as automobiles, trucks, and airplanes, and stationary sources (non-transportation noise sources) such as construction sites, machinery, and commercial and industrial operations. Common sources of environmental noise and associated noise levels are presented in Figure 5.9-1. Directly measuring sound pressure fluctuations would require the use of a very large and cumbersome range of numbers. The decibel (dB) scale was introduced to provide a more practical way of expressing the broad range of sound pressures.[1] The human ear is not equally sensitive to loudness at all frequencies in the audible spectrum. To better relate overall sound levels and loudness to human perception, frequency-dependent weighting scales were developed. The standard weighting scales are identified as A through E and there is a strong correlation between the way humans perceive sound and A-weighted sound levels (dBA). Expressing sound levels in terms of dBA can help predict community response to noise.

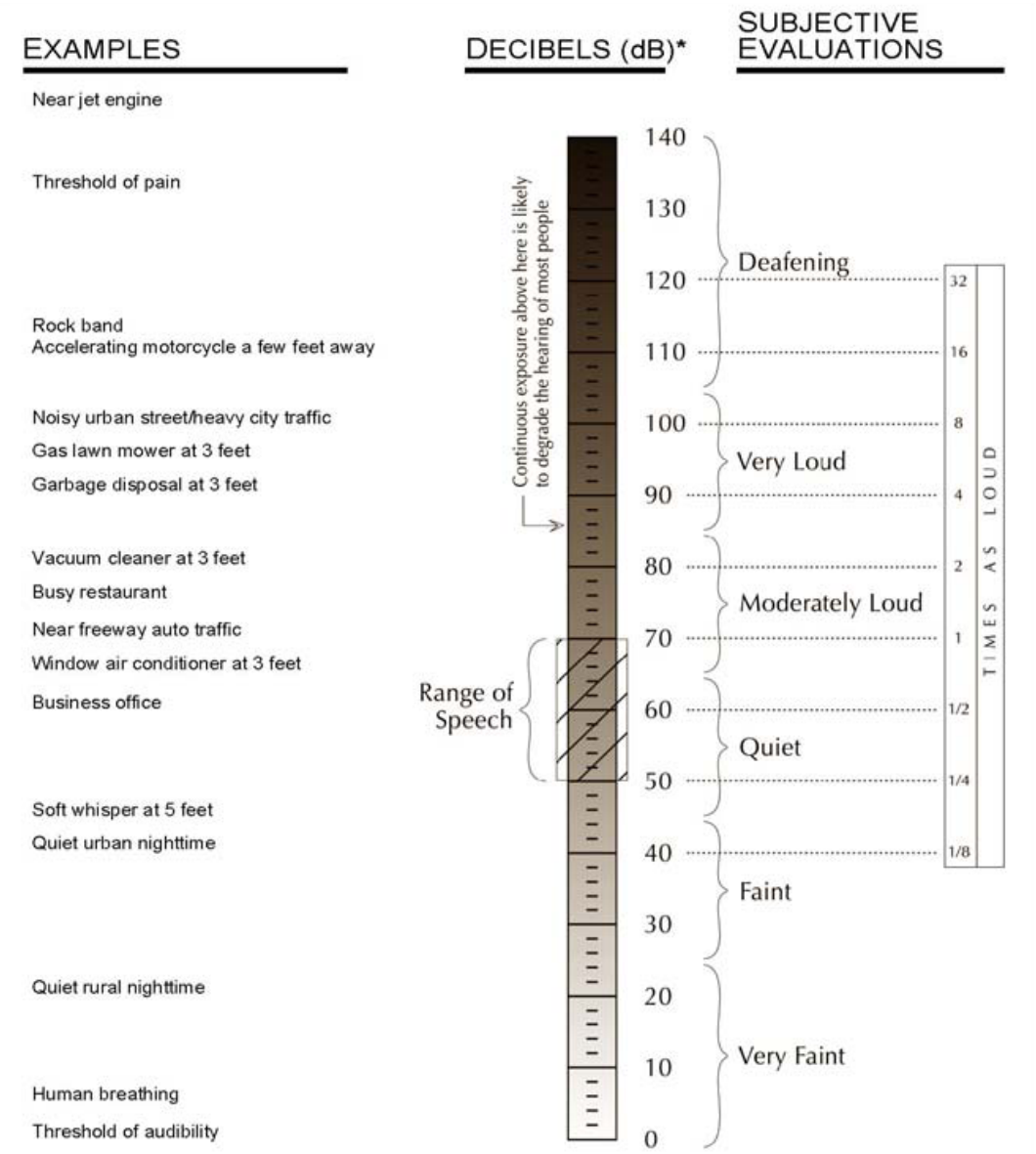
For the purposes of this analysis, all sound levels are discussed and presented in terms of A-weighted decibels unless specifically stated otherwise. As acoustic energy propagates between the source and receiver, noise levels attenuate (decrease) as a function of the distance from the source (divergence), ground absorption, atmospheric conditions, and the presence of physical barriers. Physical barriers to noise may be any natural or human-made feature such as a hill, tree, building, wall, or berm.[2]

Noise Assessment Metrics

The intensity of environmental noise fluctuates over time, and several different descriptors of time-averaged noise levels are used. The selection of an appropriate noise descriptor for a specific source depends on the spatial and temporal distribution, duration, and fluctuation of both the noise source and the

[1] A sound level expressed in dB is the logarithmic ratio of two like pressure quantities, with one pressure quantity being a reference sound pressure. For sound pressure in air, the standard reference quantity is generally considered to be 20 micropascals (µPa), which directly corresponds to the threshold of human hearing. The use of the dB is a convenient way to handle the million-fold range of sound pressures to which the human ear is sensitive. A dB is logarithmic; it does not follow normal algebraic methods and cannot be directly added. For example, a 65 dB source of sound, such as a truck, when joined by another 65 dB source, results in a sound amplitude of 68 dB, not 130 dB (i.e., doubling the source strength increases the sound pressure by 3 dB). A sound level increase of 10 dB corresponds to 10 times the acoustical energy, and an increase of 20 dB equates to a 100-fold increase in acoustical energy.

[2] Noise from mobile sources generally is attenuated at a rate of 3 dB (across hard surfaces, such as asphalt) to 4.5 dB (across soft surfaces, such as grasslands) per doubling of distance.



* dB are "average" values as measured on the A-scale of a sound-level meter.
From Concepts in Architectural Acoustics: M. David Egan, McGraw Hill, 1972 and U.S. Department of Housing and Urban Development, Office of Community Planning and Development "The Noise Guidebook."

Source: AECOM (2010).

Figure 5.9-1
Common Noise Sources and Levels

environment. The noise descriptors most often used to describe environmental noise are described below:

- **SEL** (Sound Exposure Level): The equivalent sound level over a 1-second time interval for a discrete sound event (e.g., aircraft overflight).

- **L_{max}** (Maximum Noise Level): The maximum instantaneous noise level during a specific period of time, typically 1 hour.

- **L_n** (Statistical Descriptor): The noise level exceeded n% of a specific period of time. For example, L_{50} is the median noise level, or level exceeded 50% of the time. This statistic is typically calculated based on a 1-hour time period; therefore, L_{50} represents 30 minutes of the hour, while L_{25}, $L_{8.3}$, and $L_{1.7}$ represent 15, 5, and 1 minute(s), respectively.

- **L_{eq}** (Equivalent Noise Level): The average noise level.[3] The L_{eq} represents an average of the sound energy occurring over a specified time period. In effect, the L_{eq} is the steady-state sound level containing the same acoustic energy as the time-varying sound that actually occurs during the same period. The 1-hour, A-weighted equivalent sound level (L_{eq}[h]) is the energy average of A-weighted sound levels occurring during a 1-hour period.

- **L_{dn}** (Day-Night Average Noise Level): The 24-hour L_{eq} with a 10 dB "penalty" for noise events that occur between the noise-sensitive hours of 10 PM and 7 AM. In other words, 10 dB is "added" to noise events that occur in the nighttime hours, which generates a higher reported noise level when determining compliance with noise standards. The L_{dn} attempts to account for the fact that noise during this specific period of time is a potential source of disturbance with respect to normal sleeping hours.

- **CNEL** (Community Noise Equivalent Level): The CNEL is similar to the L_{dn} described above, but with an additional 5 dB "penalty" added to noise events that occur between the noise-sensitive hours of 7 PM and 10 PM, which are typically reserved for relaxation, conversation, reading, and other activities that could be disrupted by noise. When the same 24-hour noise data are used, the reported CNEL is typically 0.5 dB higher than the L_{dn}.

Human Response to Noise

Excessive and chronic exposure to elevated noise levels can interfere with communications, sleep, and learning and even result in hearing loss at very high levels.[4] The degree to which noise results in annoyance and interference is highly subjective and may be influenced by several non-acoustic factors. The number and effect of these non-acoustic environmental and physical factors vary depending on individual characteristics of the noise environment, such as sensitivity, level of activity, location, time of day, and length of exposure. One key aspect in the prediction of human response to new noise sources is the individual level of adaptation to an existing noise environment. The greater the change in the noise levels that are attributed to a new noise source, relative to the environment to which an individual has become accustomed, the less tolerable the new noise source will be to the individual.

[3] This is also sometimes called the equivalent or energy-averaged sound level.

[4] The non-auditory physiological health effects of noise on humans have been the subject of considerable research attempting to discover correlations between exposure to elevated noise levels and health problems, such as hypertension and cardiovascular disease. The mass of research infers that noise-related health issues are predominantly the result of behavioral stressors and not a direct noise-induced response. The extent to which noise contributes to non-auditory health effects remains a subject of considerable research, with no definitive conclusions.

One way of anticipating a person's subjective reaction to a new noise is to compare the new noise with the existing noise environment to which the person has become adapted, i.e., the "ambient" noise level. Generally, a 1 dB increase in noise level is imperceptible; a 3 dB increase is barely perceptible; a 6 dB increase is clearly noticeable; and a 10 dB increase is perceived as approximately twice as loud (Egan 1988).[5] A noise level increase of 3 dB or more is typically considered a substantial degradation of the ambient noise environment.

Background Information on Vibration

Vibration is the periodic oscillation of a medium or object with respect to a given reference point. Sources of vibration include natural phenomena (e.g., earthquakes, volcanic eruptions, ocean waves, landslides, etc.) and those introduced by human activity (e.g., explosions, machinery, traffic, trains, construction equipment, etc.). Vibration sources may be continuous, (e.g., operating factory machinery) or transient in nature (e.g., explosions). Vibration levels are depicted in terms of amplitude and frequency relative to displacement, velocity, or acceleration.

Vibration amplitudes are commonly expressed in peak particle velocity (PPV) or root-mean-square (RMS) vibration velocity. PPV is defined as the maximum instantaneous positive or negative peak of a vibration signal. PPV is typically used in the monitoring of transient and impact vibration and has been found to correlate well to the stresses experienced by buildings (FTA 2006, Caltrans 2004). PPV and RMS vibration velocity are normally described in inches per second (in/sec).

Although PPV is appropriate for evaluating the potential for building damage, it is not always suitable for evaluating human response to vibration. The response of the human body to vibration relates well to average vibration amplitude; therefore, vibration impacts on humans are evaluated in terms of RMS vibration velocity. Similar to airborne sound, vibration velocity can be expressed in decibel notation as vibration level (VdB).[6]

Typical outdoor sources of perceptible groundborne vibration include construction equipment, steel-wheeled trains, and traffic on rough roads. Although the effects of vibration may be imperceptible at low levels, moderate and high levels of vibration may be detectible and produce damage to nearby buildings (e.g., loosening and cracking of plaster or stucco coatings). The range of vibration that is relevant to this analysis occurs from approximately 50 VdB, which is the typical background vibration level, to 100 VdB, which is the general threshold where minor damage can occur to fragile buildings (FTA 2006).

5.9.1.2 Regulatory Setting

Federal Plans, Guidelines, Policies, Regulations, and Laws

United States Environmental Protection Agency

The United States Environmental Protection Agency's (USEPA) Office of Noise Abatement and Control was originally established to coordinate federal noise control activities. After its inception, the USEPA's Office of Noise Abatement and Control issued the Federal Noise Control Act of 1972, establishing programs and guidelines to identify and address the effects of noise on public health, welfare, and the

[5] These reactions to changes in noise levels were developed on the basis of test subjects' reactions to changes in the levels of steady-state pure tones or broad-band noise and to changes in levels of a given noise source. It is probably most applicable to noise levels in the range of 50 dB to 70 dB, as this is the usual range of voice and interior noise levels.

[6] Similar to noise levels, the logarithmic nature of the decibel serves to compress the broad range of numbers required to describe vibration.

environment. In 1981, the USEPA administrators determined that noise would be better addressed by state and local governments. Consequently, in 1982, responsibilities for regulating noise control policies were transferred to state and local governments.[7]

State Plans, Guidelines, Policies, Regulations, and Laws

State of California

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

California Department of Transportation

For the protection of fragile, historic, and residential structures, the California Department of Transportation (Caltrans) recommends a threshold of 0.2 in/sec PPV for normal residential buildings and 0.08 in/sec PPV for old or historically significant (as defined under CEQA) structures (Caltrans 2004).

Additionally, Caltrans has developed guidelines for assessing the human response to vibration produced by transportation and construction sources (Table 5.9-1). These guidelines address the subjective reactions of people to both short-term vibration (e.g., from temporary construction activities) and long-term/permanent vibration (e.g., from transit operations).

TABLE 5.9-1
CALTRANS GUIDELINES ON POTENTIAL CRITERIA FOR VIBRATION ANNOYANCE

HUMAN RESPONSE	IMPACT LEVELS (VdB RELATIVE TO 1 MICROINCH PER SECOND (PPV, INCHES PER SECOND)	
	TRANSIENT SOURCES	CONTINUOUS/FREQUENT INTERMITTENT SOURCES
Barely perceptible	80 (0.040)	68 (0.010)
Distinctly perceptible	96 (0.250)	80 (0.040)
Strongly perceptible	107 (0.900)	88 (0.100)
Severe	114 (2.000)	100 (0.400)

Notes:
Transient sources create a single isolated vibration event, such as blasting or drop balls. Continuous/frequent intermittent sources include impact pile drivers, pogo-stick compactors, crack-and-seat equipment, vibratory pile drivers, and vibratory compaction equipment.
Source: Caltrans (2004).

[7] However, noise control guidelines and regulations contained in the USEPA rulings in prior years remain in place by designated federal agencies, allowing more individualized control for specific issues by designated federal, state, and local government agencies.

Regional and Local Plans, Policies, Regulations, and Ordinances

The City of Yorba Linda General Plan Noise Element and Noise Ordinance establish the City's policies and standards for noise exposure. The project area is predominantly located within the City of Yorba Linda's limits with the exception of a portion located in unincorporated Orange County (east of Coal Canyon Road).

County of Orange Noise Element

The County of Orange General Plan Noise Element presents a noise compatibility matrix. The matrix provided in Table 5.9-2 presents guidelines for noise compatibility for different land uses.

TABLE 5.9-2
COUNTY OF ORANGE COMPATIBILITY MATRIX FOR LAND USE AND CNEL

TYPE OF USE	65+ DECIBELS CNEL	60 TO 65 DECIBELS CNEL
Residential	3a, b, e	2a, e
Commercial	2c	2c
Employment	2c	2c
Open Space		
Local	2c	2c
Community	2c	2c
Regional	2c	2c
Educational Facilities		
Schools (K through 12)	2c, d, e	2c, d, e
Preschool, college, other	2c, d, e	2c, d, e
Places of Worship	2c, d, e	2c, d, e
Hospitals		
General	2a, c, d, e	2a, c, d, e
Convalescent	2a, c, d, e	2a, c, d, e
Group Quarters	1a, b, c, e	2a, c, e
Hotel / Motels	2a, c	2a, c
Accessory Uses		
Executive Apartments	1a, b, e	2a, e
Caretakers	1a, b, c, e	2a, c, e

ACTION REQUIRED TO ENSURE COMPATIBILITY BETWEEN LAND USE AND NOISE FROM EXTERNAL SOURCES
1 = Allowed if interior and exterior community noise levels can be mitigated.
2 = Allowed if interior levels can be mitigated.
3 = New residential uses are prohibited in areas within the 65-dB CNEL contour from any airport or air station; allowed in other areas if interior and exterior community noise levels can be mitigated. The prohibition against new residential development excludes limited "infill" development within an established neighborhood.

STANDARDS REQUIRED FOR COMPATIBILITY OF LAND USE AND NOISE
a = Interior Standard: CNEL of less than 45 dB (habitable rooms only).
b = Exterior Standard: CNEL of less than 65 dB in outdoor living areas.
c = Interior Standard: L_{eq} (h)=45 to 65 dB interior noise level, depending on interior use.
d = Exterior Standard: L_{eq} (h) of less than 65 dB in outdoor living areas.
e = Interior Standard: As approved by the Board of Supervisors for sound events of short duration such as aircraft flyovers or individual passing railroad trains.

KEY DEFINITIONS
Habitable Room– Any room meeting the requirements of the Uniform Building Code or other applicable regulations which is intended to be used for sleeping, living, cooking or dining purposes, excluding such enclosed spaces as closets, pantries, bath or toilet rooms, service rooms, connecting corridors, laundries, unfinished attics, foyers, storage spaces, cellars, utility rooms and similar spaces.

Interior – Spaces that are covered and largely enclosed by walls.

L_{eq} (h) – The A-weighted equivalent sound level averaged over a period of "h" hours. An example would be L_{eq} (12) where the equivalent sound level is the average over a specified 12- hour period (such as 7:00 AM to 7:00 PM). Typically, time period "h" is defined to match the hours of operation of a given type of use.

Outdoor Living Area – Outdoor living area is a term used by the County of Orange to define spaces that are associated with residential land uses typically used for passive private recreational activities or other noise-sensitive uses. Such spaces include patio areas, barbecue areas, jacuzzi areas, etc. associated with residential uses; outdoor patient recovery or resting areas associated with hospitals, convalescent hospitals, or rest homes; outdoor areas associated with places of worship which have a significant role in services or other noise-sensitive activities; and outdoor school facilities routinely used for educational purposes which may be adversely impacted by noise. Outdoor areas usually not included in this definition are: front yard areas, driveways, greenbelts, maintenance areas, and storage areas associated with residential land uses; exterior areas at hospitals that are not used for patient activities; outdoor areas associated with places of worship and principally used for short-term social gatherings; and outdoor areas associated with school facilities that are not typically associated with educational uses prone to adverse noise impacts (for example, school play yard areas).

County of Orange Noise Ordinance

The County of Orange Noise Ordinance is contained in the County Code, Title 4, Division 6 – Noise Control. The intent of the County Noise Ordinance is to protect receptors on private property from noise generated on a nearby parcel. The ordinance only has limits for residential uses; institutional, commercial, and industrial uses are not protected. The County Noise Ordinance, which uses percentile noise levels, contains exterior noise limits of 55 dBA L_{50} daytime (7 AM to 10 PM) and 50 dBA L_{50} nighttime (10 PM to 7 AM). Similarly, the interior noise limits are 55 dBA L_{50} daytime (7 AM to 10 PM) and 45 dBA L_{50} nighttime (10 PM to 7 AM).

A key portion of the County Noise Ordinance with respect to the proposed project is Section 4-6-7(e), which states that construction noise is exempt from the limits "provided said activities do not take place between the hours of 8:00 PM and 7:00 AM on weekdays, including Saturday, or at any time on Sunday or a Federal holiday."

City of Yorba Linda Noise Element

The City of Yorba Linda General Plan Noise Element presents a noise compatibility matrix. The matrix, provided in Table 5.9-3, presents guidelines for noise compatibility for different land uses.

TABLE 5.9-3
CITY OF YORBA LINDA NOISE COMPATIBILITY MATRIX

LAND USE CATEGORY	COMMUNITY NOISE EXPOSURE (L_{dn} or CNEL, dBA)			
	NORMALLY ACCEPTABLE	CONDITIONALLY ACCEPTABLE	NORMALLY UNACCEPTABLE	CLEARLY UNACCEPTABLE
Residential – Low Density, Single-Family, Duplex, Mobile Homes	50-60	55-70	70-75	75-85
Residential – Multiple Family	50-65	60-70	70-75	75-85
Transient Lodging – Motel, Hotels	50-65	60-70	70-80	80-85

TABLE 5.9-3
CITY OF YORBA LINDA NOISE COMPATIBILITY MATRIX

LAND USE CATEGORY	COMMUNITY NOISE EXPOSURE (L_{dn} or CNEL, dBA)			
	NORMALLY ACCEPTABLE	CONDITIONALLY ACCEPTABLE	NORMALLY UNACCEPTABLE	CLEARLY UNACCEPTABLE
Schools, Libraries, Churches, Hospitals, Nursing Homes	50-70	60-70	70-80	80-85
Auditoriums, Concert Halls, Amphitheaters	NA	50-70	65-85	NA
Sports Arenas, Outdoor Spectator Sports	NA	50-75	70-85	NA
Playgrounds, Neighborhood Parks	50-70	NA	67.5-75	72.5-85
Golf Courses, Riding Stables, Water Recreation, Cemeteries	50-75	NA	70-80	80-85
Office Buildings, Business Commercial and Professional	50-70	67.5-77.5	NA	75-85
Industrial, Manufacturing, Utilities, Agriculture	50-75	70-80	NA	75-85

NA: Not Applicable
Normally Acceptable – Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.
Conditionally Acceptable – New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning, will normally suffice.
Normally Unacceptable – New construction or development should be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.
Clearly Unacceptable – New construction or development should generally not be undertaken.
Source: City of Yorba Linda (1993).

City of Yorba Linda Noise Ordinance

The City of Yorba Linda's Noise Ordinance is contained in Municipal Code Section 8.32, Noise Control.

8.32.060 Noise standards - Exterior.

A. The City Noise Ordinance uses percentile noise levels and contains a "base noise level" of 55 dBA L_{50} daytime (7 AM to 10 PM) and 50 dBA L_{50} nighttime (10 PM to 7 AM), which are identical to those in the County Noise Ordinance.

B. It is unlawful for any person, at any location within the City, to create any noise which causes the noise level when measured on any residential property to exceed:

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

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

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

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

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

C. In the event the ambient noise level exceeds any of the five noise limit categories stated in subsection B of this section, the cumulative period applicable to said category shall be increased to reflect said ambient noise level. Furthermore, the maximum permissible noise level shall never exceed the maximum ambient noise level.

8.32.070 Noise standards - Interior.

A. It is unlawful for any person at any location within the City to create any noise which causes the noise level when measured within a dwelling unit on any residential property during the period 10 PM to 7 AM to exceed:

1. Forty-five dB(A) for a cumulative period of more than five minutes in any hour;

2. Fifty dB(A) for a cumulative period of more than one minute in any hour; or

3. Fifty-five dB(A) for any period of time.

B. In the event that the ambient noise level exceeds any of the above three noise limit categories, the cumulative period applicable to said category shall be increased to reflect said ambient noise level. Furthermore, the maximum permissible noise level shall never exceed the maximum ambient noise level.

Similar to the County Noise Ordinance, the City's Noise Ordinance only provides protection for residential uses and does not protect institutional, commercial, office, and industrial uses. The City Noise Ordinance also states in Sections 8.32.060(C) and 8.32.070(B) that if the ambient conditions are louder than the ordinance limits, then the ambient conditions become the critical limits. In other words, when the ambient noise is louder than the Noise Ordinance limits, then the noise generated by the source cannot be louder than the ambient noise level.

Furthermore, Section 8.32.090 of the City Noise Ordinance exempts noise from construction between 7:00 AM and 8:00 PM, Monday through Saturday. No exemption is provided for Sunday or federal holidays. These hours are the same as those from the County of Orange Noise Ordinance exemption, so the County and City ordinances are equally restrictive and compliance with one will ensure compliance with the other.

5.9.1.3 Existing Noise Environment

As part of the 1993 Yorba Linda General Plan Noise Element development process, noise measurements were taken within the Featherly Regional Park section of the project area near the intersection of Gypsum Canyon Road and the Riverside Freeway (i.e., State Route 91 [SR-91]). The noise measurements demonstrated a sound level of 65.9 dBA at approximately 200 feet from the predominant noise sources: Gypsum Canyon Road and SR-91. This noise level is significantly above the County and City noise ordinance limits of 55 dBA.

On the north side of the residential area that borders the western half of the project area are a set of three railroad tracks used by freight and passenger trains. According to sound level estimates provided in the City of Yorba Linda General Plan Noise Element, sound levels from railway operations range from 55-60 dBA at residential properties bordering the north side of the project area (approximately 900 feet from the tracks) to 70-75 dBA at homes nearest the tracks (approximately 300 feet from the north side of the project area). The railway noise can also occur at any time of the day or night. As a result, many homes experience significant, existing noise impacts from the railway that are frequently above the ordinance noise limits.

In summary, the various sound level data presented in the City Noise Element indicate that ambient noise levels for noise-sensitive uses bordering the north side of the project area are impacted by many common urban noise sources and ambient noise levels, which occasionally exceed the City and County Noise Ordinance limits discussed in Section 5.9.1.2.

Existing Traffic Noise

Table 5.9-4 summarizes existing traffic noise levels along SR-91 adjacent to the project area. As shown in Table 5.9-4, the location of the 60 dB CNEL contour would be approximately 3,800 feet from the centerline of SR-91. Up to 60 dB CNEL is typically considered acceptable in residential environments. It should be noted that the 60 dB CNEL noise contour of 3,800 feet identified in Table 5.9-4 would extend well beyond (north of) East La Palma Avenue and the adjacent residential areas. In other words, the existing traffic noise is already exceeding the 60 dB CNEL threshold.

With regard to local street noise, a short portion (approximately 1,500 feet) of East La Palma Avenue between the north side of the project area and homes was also analyzed for the City of Yorba Linda General Plan Noise Element and a map depicting future noise contours showed sound levels of 60-70 dBA extending off of the roadway and into the neighboring residential area. Green River Road on the eastern side of the project area was also evaluated and had a noise level of over 60 dB in a residential mobile home park adjacent to the road. Most of the other streets near the project area are minor neighborhood roads with limited use and impact on ambient noise levels.

TABLE 5.9-4
TRAFFIC NOISE CONTOURS – EXISTING CONDITIONS

ROADWAY	SEGMENT		TRAFFIC VOLUME	NOISE LEVELS, dB L_{DN}	DISTANCE TO TRAFFIC NOISE CONTOURS, FEET		
	FROM	TO	ADT	TOTAL	70 dB	65 dB	60 dB
SR-91	Gypsum Canyon Road	Coal Canyon Road	268,000[a]	84 @ 100 feet	824	1776	3826
La Palma Avenue	Gypsum Canyon Road	Cam De Bryant	11,200[b]	67 @ 50 feet	33	72	155
Green River Road	West of Crestridge Drive		2,800[b]	61 @50 feet	13	29	62

Notes:
[a] 2013 Volumes, Caltrans Traffic Data.
[b] City of Yorba Linda Average Daily Traffic Volumes (2008)
Source: Data compiled by AECOM in 2014.

5.9.2 THRESHOLDS OF SIGNIFICANCE

Based upon the thresholds contained in Appendix G of the California Environmental Quality Act (CEQA) Guidelines, implementation of the proposed project would result in a significant impact on the environment related to noise if it would result in:

- 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.
- Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels.
- A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.

Please note that excessive groundborne vibration-related impacts are identified if the proposed project would result in damage to nearby residential structures, which would occur at the threshold of 0.2 in/sec PPV for normal residential buildings (Caltrans 2004).

5.9.3 METHODOLOGY RELATED TO NOISE AND VIBRATION

Construction noise levels were measured against the City of Yorba Linda and Orange County Noise Ordinances. Construction activities will be required to meet the noise ordinance standards of the City of Yorba Linda and County of Orange Noise Ordinance criteria discussed previously. As discussed, Section 8.32.090 of the City Noise Ordinance exempts noise from construction between 7:00 AM and 8:00 PM, Monday through Saturday. No exemption is provided for Sunday or federal holidays. These hours are the same as those from the County of Orange Noise Ordinance exemption, so the City and County ordinances are equally restrictive and compliance with one will ensure compliance with the other. Although operation of all construction equipment types would not likely occur at the same time, noise analysis was conducted as a worst-case scenario under the assumption that all equipment would be operated simultaneously. As a result, the noise level estimates presented below can be considered conservative ("conservative" in this context means the assumptions would tend to overestimate impacts).

For groundborne vibration, worst-case vibration levels for each type of construction equipment that would be operated as part of construction of the proposed project were compiled. These vibration levels were then compared to guidelines developed by Caltrans for assessing the human response to vibration produced by transportation and construction sources.

For traffic-related noise, AECOM compiled 2013 traffic volumes from Caltrans for segments of the SR-91 Freeway and then calculated (assuming an average vehicle speed of 65 miles per hour) the noise levels of those volumes. To provide a conservative estimate of construction vehicle-related noise increases, the addition of 220 daily construction vehicle trips were added to existing traffic volumes along SR-91 (refer to Table 5.9-4) to determine the expected increase in noise (dB L_{dn}). This information was also used as a reference for comparison with existing traffic-related noise levels along segments of East La Palma Avenue and Green River Road, which were modeled by the City of Yorba Linda (2008) as part of its General Plan Nosie Element. AECOM confirmed the noise levels along these segments using the 2008 traffic volumes.

5.9.4 POTENTIAL IMPACTS

5.9.4.1 Expose People to or Generate Noise Levels in Excess of Applicable Standards/ Substantial Temporary or Periodic Increase in Ambient Noise Levels Above Existing Levels Without the Project

Construction noise would be short-term and temporary, and operation of heavy-duty construction equipment would be intermittent and vary depending on the nature or phase of construction and activity (e.g., clearing/grubbing, grading, compacting, hauling of material by on- and off-site trucks, travel by construction workers, etc.).

Table 5.9-5 shows a detailed assessment of noise levels at the worst-case distance of 50 feet for each type of construction equipment. Although operation of all equipment types would not likely occur at the same time, noise analysis was conducted as a worst-case scenario under the assumption that all equipment would be operated simultaneously. As a result, the estimates presented below can be considered conservative ("conservative" in this context means the assumptions would tend to overestimate impacts). Noise level estimates can also be considered conservative since the reduction effects associated with topographical shielding, excess ground absorption, and atmospheric absorption were not considered in the calculations.

TABLE 5.9-5
PROJECT CONSTRUCTION EQUIPMENT NOISE LEVELS

EQUIPMENT/VEHICLE TYPE	TYPICAL MAXIMUM NOISE LEVEL (dB) AT 50 FEET
CONSTRUCTION EQUIPMENT	
Air Compressor	80
Backhoe	80
Concrete Pump Rig	82
Crane 20 Ton Grove	85
Dozer	85
Forklift	89
Generator	82
Loader	80
Motor Grader	85
Paving Machine	85
Roller	85
Sheeps Foot (Compactor – ground)	80
ON-SITE MOTOR VEHICLES	
Dump Truck On Site	80
Flatbed Truck On Site	80
Oil/Lube Truck International	80
Pickup Truck	77
Water Truck	80
OFF-SITE MOTOR VEHICLES	
18 Wheel Low Boy	80
Dump Truck Off Site	80
Flatbed Truck Off Site	80

TABLE 5.9-5
PROJECT CONSTRUCTION EQUIPMENT NOISE LEVELS

EQUIPMENT/VEHICLE TYPE	TYPICAL MAXIMUM NOISE LEVEL (dB) AT 50 FEET
Fuel Truck Off site	80
Red-Mix Truck	80

Source: Data compiled by AECOM in 2014.

Although noise ranges are generally similar for all construction phases, the highest peak noise levels (L_{max}) expected during construction will result from the grading, dozing, and rolling of the terrain associated with the installation of the paved bikeway and riding/hiking trails. All three pieces of equipment (i.e., motor grader, dozer, and roller from Table 5.9-5) have an L_{max} of 85 dBA at 50 feet and would combine to produce 88 dBA at 50 feet if all were operating at the same time and in the same vicinity. Average noise levels at construction sites typically range from approximately 65 to 89 dB L_{eq} at 50 feet, depending on the activities performed (FTA 2006).

Construction of the proposed project would result in potential disruption of noise-sensitive receptors located as near as 50 feet from the proposed bikeway segment along the western half and northern side of the project area. Assuming a maximum construction noise level of 88 dB L_{eq} at 50 feet with an attenuation rate of 6 dB per doubling of distance from the source, construction activities located within approximately 400 to 1,600 feet of daytime noise-sensitive receptors could result in exterior noise levels in excess of ambient noise level of 60 dB L_{eq} to 70 dB L_{eq} (see existing noise levels discussed above), where the daytime noise ordinance limits are 55 dBA.

Assuming an average exterior-to-interior noise level reduction of 25 dB (with windows closed), exterior construction-generated noise levels in excess of 70 dB L_{eq} at the façade of a building may result in interior noise levels in excess of 45 dB L_{eq}. Based on this same assumption, and assuming a maximum construction noise level of 88 dB L_{eq} at 50 feet with an attenuation rate of 6 dB per doubling of distance from the source, construction activities located up to approximately 1,600 feet from daytime noise-sensitive receptors would result in interior noise levels in excess of 45 dB L_{eq}.

Temporary noise generation as a result of construction by the project would expose existing sensitive receptors to noise levels that exceed the exterior County and City noise ordinances. However, as mentioned previously, Section 8.32.090 of the City of Yorba Linda and Section 4-6-7(e) of the County of Orange Noise Ordinances exempt noise from construction activity between 7:00 AM and 8:00 PM from Monday through Saturday. Therefore, with compliance with the City of Yorba Linda and County of Orange Noise Ordinances, noise associated with construction of the proposed project would be considered less than significant.

Construction of the proposed project would result in additional vehicle trips on the local roadway network from worker commutes and the transport of equipment and materials. The proposed project will require haul trucks for importing fill and delivery of trail and bridge materials. For work being performed on the northern side of the project area, access would be via Gypsum Canyon Road and East La Palma Avenue, with a majority of the construction trips (50 percent) arriving from the unpopulated, SR-91 side of the project area (i.e., south side). Approaching and leaving the project area from the south would limit the amount of construction traffic and associated noise on roads near the residential areas. However, because existing noise levels for homes adjacent to East La Palma Avenue are already elevated from existing traffic on the road and from SR-91 to the south, proposed project-related construction vehicles using East La Palma Avenue would not measurably increase traffic noise levels in the area and their impact would be less than significant. With regard to proposed project work on the southern and eastern portions of the

project area, trucks and equipment would enter the site from Coal Canyon Road and Green River Road. The Coal Canyon Road area does not have nearby noise-sensitive land uses, but Green River Road is adjacent to a residential mobile home park. However, as shown in Table 5.9-4, existing noise levels in the mobile home park area, which is as close as 250 feet from SR-91, are dominated by freeway noise levels that are well above 70 dB. Therefore, proposed project-related construction vehicles using Green River Road would not measurably increase traffic noise levels in the area and their impact would be less than significant.

Operation of the proposed project would not result in a substantial change to the existing noise levels within the project area. Although the proposed project is anticipated to result in an increased number of parkway users and additional maintenance activities, the associated noise levels will be similar to existing conditions and the impact would be less than significant.

The primary source of noise that could impact the project area would be from traffic on the adjacent streets and SR-91, with an existing noise level of approximately 84 dBA L_{dn} at 100 feet from the freeway. Since portions of the proposed project will be located as close as 100 feet from SR-91, implementation of the proposed project would expose future users of the parkway to the existing high noise levels. However, the proposed project would not introduce a noise-sensitive land use. In addition, ambient noise levels throughout the City and County portions of the project area are not expected to change as a result of the proposed project. Therefore, noise exposure impacts would be considered less than significant.

5.9.4.2 Exposure of Persons to or Generation of Excessive Groundborne Vibration or Groundborne Noise Levels

The proposed project would not introduce any permanent sources of vibration. However, temporary construction-related activities have the potential to result in varying degrees of short-term ground vibration, depending on the specific construction equipment used and operations involved. Ground vibration levels associated with various types of construction equipment are summarized in Table 5.9-6.

TABLE 5.9-6
REPRESENTATIVE VIBRATION SOURCE LEVELS FOR CONSTRUCTION EQUIPMENT

EQUIPMENT	PPV AT 25 FEET (IN/SEC)	APPROXIMATE L_V (VDB) AT 25 FEET[1]
Large Bulldozer	0.089	87
Trucks	0.076	86
Small Bulldozer	0.003	58

Notes:
[1] Where L_v is the RMS velocity expressed in VdB, assuming a crest factor of 4.
Source: FTA 2006.

Vibration would result from the use of heavy earth-moving equipment for area clearing, temporary roadway grading, excavation, and embankment improvement during construction of the proposed project. Assuming a maximum construction vibration level of 87 VdB (0.089 in/sec PPV) at 25 feet, construction of the proposed project would not exceed the 0.2 in/sec PPV threshold for damage to nearby residential structures. Therefore, construction-related vibration would be considered less than significant.

Based on Caltrans' guidelines for assessing the human response to vibration produced by transportation and construction sources, provided previously in Table 5.9-1, the maximum construction vibration level

would approach the human response level of "strongly perceptible" and, therefore, could result in vibration-related annoyance. However, this potential annoyance would be localized (i.e., would attenuate at a rate of 6 VdB per doubling of distance from the source), temporary (e.g., large bulldozers would be used intermittently throughout the project area), and would be limited to within the hours specified in the City of Yorba Linda and County of Orange Noise Ordinances. Therefore, temporary construction-related vibration annoyance would not be considered excessive and would be less than significant.

5.9.5 MITIGATION MEASURES

Although no significant impacts related to noise or vibration would occur due to compliance with the exemption hours stated in the City of Yorba Linda and County of Orange Noise Ordinances, the following mitigation measures are included to minimize noise and vibration related to construction activity:

N-1 The construction contractor shall locate fixed/stationary equipment as far as feasible from sensitive receptors.

N-2 The construction contractor shall store and maintain equipment as far as feasible from sensitive receptors.

N-3 The construction contractor shall ensure that all construction equipment are maintained and equipped with noise-reduction intake and exhaust mufflers and engine shrouds, in accordance with manufacturers' recommendations.

N-4 The construction contractor shall ensure that equipment engine shrouds are closed during equipment operation.

N-5 The construction contractor shall ensure that all motorized construction equipment is shut down when not in use to prevent excessive idling noise and vibration.

5.9.6 LEVEL OF SIGNIFICANCE AFTER MITIGATION

Implementation of the proposed project would not result in significant impacts related to noise or vibration. However, mitigation measures N-1 through N-5 are included to minimize noise and vibration related to construction activities.