5.11 NOISE

This section of the Draft Environmental Impact Report (DEIR) evaluates the potential for implementation of the Residences at Nohl Ranch Project to result in noise impacts in the City of Anaheim. This section discusses the fundamentals of sound; examines federal, state, and local noise guidelines, policies, and standards; reviews noise levels at existing receptor locations; evaluates potential noise and vibration impacts associated with the Proposed Project; and provides mitigation to reduce noise impacts at sensitive receptor locations. The analysis in this section is based in part on the noise modeling data in Appendix L of this DEIR.

5.11.1 Environmental Setting

5.11.1.1 NOISE AND VIBRATION FUNDAMENTALS

Noise is defined as unwanted sound and is known to have several adverse effects on people, including hearing loss, speech and sleep interference, physiological responses, and annoyance. 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." Based on these known adverse effects of noise, the federal government, the State of California, and many local governments have established criteria to protect public health and safety and to prevent disruption of certain human activities.

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 on a logarithmic scale.
- **A-Weighted Decibel (dBA).** An overall frequency-weighted sound level in decibels that approximates the frequency response of the human ear.
- **Equivalent Continuous Noise Level (L_{eq}); also called the Energy-Equivalent Noise Level.** The value of an equivalent, steady sound level which, in a stated time period (often over an hour) and at a stated location, has the same A-weighted sound energy as the time-varying sound. Thus, the L_{eq} metric is a single numerical value that represents the equivalent amount of variable sound energy received by a receptor over the specified duration.
- **Statistical Sound Level (L_n).** The sound level that is exceeded "n" percent of time during a given sample period. For example, the L_{50} level is the statistical indicator of the time-varying noise signal that is exceeded 50 percent of the time (during each sampling period); that is, half of the sampling time, the changing noise levels are above this value and half of the time they are below it. This is called the "median sound level."

The L_{10} level, likewise, is the value that is exceeded 10 percent of the time (i.e., near the maximum) and this is often known as the "intrusive sound level." The L_{90} is the sound level exceeded 90 percent of the time and is often considered the "effective background level" or "residual noise level."

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

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

- **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.

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

Sound Fundamentals

Sound is a pressure wave transmitted through the air. It is described in terms of loudness or amplitude (measured in decibels), frequency or pitch (measured in Hertz [Hz] or cycles per second), and duration (measured in seconds or minutes). The standard unit of measurement of the loudness of sound is the decibel (dB). Changes of 1 to 3 dB are detectable under quiet, controlled conditions and changes of less than 1 dBA are usually indiscernible. 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 discernable to most people in an exterior environment whereas a 10 dBA change is perceived as a doubling (or halving) of the sound.

The human ear is not equally sensitive to all frequencies. Sound waves below 16 Hz are not heard at all and are "felt" more as a vibration. Similarly, while 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. Since the human ear is not equally sensitive to sound at all frequencies, a special frequency dependent rating scale is usually used to relate noise to human sensitivity. The A-weighted decibel scale (dBA) performs this compensation by discriminating against frequencies in a manner approximating the sensitivity of the human ear.

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Sound Measurement

Sound intensity is measured through the A-weighted measure to correct for the relative frequency response of the human ear. That is, an A-weighted noise level de-emphasizes low and very high frequencies of sound similar to the human ear's de-emphasis of these frequencies.

Unlike linear units such as inches or pounds, decibels are measured on a logarithmic scale, representing points on a sharply rising curve. On a logarithmic scale, an increase of 10 dB is 10 times more intense than 1 dB, while 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 quiet) to 100 dBA (very loud).

Sound levels are generated from a source and their decibel level decreases as the distance from that source increases. 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. This drop-off rate is appropriate for noise generated by on-site operations from stationary equipment or activity at a project site. If noise is produced by a line source, such as highway traffic, the sound decreases by 3 dB for each doubling of distance in a hard site environment. Line source noise in a relatively flat environment with absorptive vegetation decreases by 4.5 dB for each doubling of distance.

Time variation in noise exposure is typically expressed in terms of a steady-state energy level equal to the energy content of the time varying period (called L_{eq}), or alternately, as a statistical description of the sound level that is exceeded over some fraction of a given observation period. For example, the L50 noise level represents the noise level that is exceeded 50 percent of the time. Half the time the noise level exceeds this level and half the time the noise level is less than this level. This level is also representative of the level that is exceeded 30 minutes in an hour. Similarly, the L_2, L_8 and L_{25} values represent the noise levels that are exceeded 2, 8, and 25 percent of the time or 1, 5, and 15 minutes per hour. These "L" values are typically used to demonstrate compliance for stationary noise sources with a city's noise ordinance, as discussed below. Other values typically noted during a noise survey are the L_{min} and L_{max}. These values represent the minimum and maximum root-mean-square noise levels obtained over the measurement period.

Because community receptors are more sensitive to unwanted noise intrusion during the evening and at night, an artificial dB increment be added to quiet time noise levels in a 24-hour noise descriptor called the Community Noise Equivalent Level (CNEL) or Day-Night Noise Level (L_{dn}). The CNEL descriptor requires that an artificial increment of 5 dBA be added to the actual noise level for the hours from 7:00 P.M. to 10:00 P.M. and 10 dBA for the hours from 10:00 P.M. to 7:00 A.M. The L_{dn} descriptor uses the same methodology except that there is no artificial increment added to the hours between 7:00 P.M. and 10:00 P.M. Both descriptors give roughly the same 24-hour level with the CNEL being only slightly more restrictive (i.e., higher).

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 our entire system, with prolonged noise exposure in excess of 75 dBA increasing body tensions, and thereby affecting blood pressure, functions of the heart and the nervous system. In comparison, extended periods of noise exposure above 90 dBA could result in permanent hearing damage. When the noise level reaches 120 dBA, a tickling sensation occurs in the human ear even with short-term exposure. This level of noise is called the threshold of feeling. As the sound reaches 140 dBA, the tickling sensation is replaced by the feeling of pain in the ear. This is called the threshold of pain. A sound level of 190 dBA will rupture the eardrum and permanently damage the inner ear.

Vibration Fundamentals

Vibration is an oscillatory motion through a solid medium, such as the ground or a building. 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.

Amplitude

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. The units for PPV are normally inches per second (in/sec). Typically, groundborne vibration generated by human activities attenuates rapidly with distance from the source of the vibration.

The way in which vibration is transmitted through the earth is called propagation. As vibration waves propagate from a source, the energy is spread over an ever-increasing area such that the energy level striking a given point is reduced with the distance from the energy source. This geometric spreading loss is inversely proportional to the square of the distance. The amount of attenuation provided by material damping varies with soil type and condition as well as the frequency of the wave.

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 5.11-1 displays the human response and the effects on buildings resulting from continuous vibration (in terms of various levels of PPV).

Table 5.11-1 Human Reaction to Typical Vibration Levels

Vibration Level Peak Particle Velocity	Human Reaction	Effect on Buildings
0.006–0.019 in/sec	Threshold of perception, possibility of intrusion	Vibrations unlikely to cause damage of any type
0.08 in/sec	Vibrations readily perceptible	Recommended upper level of vibration to which ruins and ancient monuments should be subjected
0.10 in/sec	Level at which continuous vibration begins to annoy people	Virtually no risk of "architectural" (i.e., not structural) damage to normal buildings
0.20 in/sec	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 in/sec	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 2013.

5.11.1.2 REGULATORY FRAMEWORK

To limit population exposure to physically and/or psychologically damaging as well as intrusive noise levels, the federal government, the State of California, various county governments, and most municipalities in the state have established standards and ordinances to control noise.

Federal Regulations

US Department of Housing and Urban Development

The US Department of Housing and Urban Development (HUD) has set a goal of 65 dBA L_{dn} as a desirable maximum exterior standard for residential units developed under HUD funding. (This level is also generally accepted within the State of California.) While HUD does not specify acceptable interior noise levels, standard construction of residential dwellings constructed under Title 24 standards typically provides in excess of 20 dBA of attenuation with the windows closed. Based on this premise, the interior L_{dn} should not exceed 45 dBA.

State Regulations

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 dB in any habitable room. The noise metric is evaluated as either the day-night average sound level (L_{dn}) or the CNEL, consistent with the noise element of the local general plan.

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 new the residential projects are required to submit an acoustical report in areas where noise and land use compatibility is a concern. The report is required to analyze exterior noise sources affecting the proposed dwelling site, 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 requirements are met. If interior allowable noise levels are met by requiring that windows be inoperable 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.

Local Regulations

City of Anaheim Noise Element

The City has adopted the State Noise Compatibility Guidelines presented in Table 5.11-2. 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. At different exterior noise levels, individual land uses are identified as "clearly acceptable," "normally acceptable," "normally unacceptable," or "clearly unacceptable." 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.

The California Supreme Court decision—*California Building Industry Association v. Bay Area Air Quality Management District*, 62 Cal. 4th 369 (No. S 213478) (*CBIA v. BAAQMD*), issued December 17, 2015 rendered evaluation of the impact of existing environmental conditions on a project as generally no longer the purview of the CEQA process. As a result, although the noise from existing sources is taken into account as part of the baseline, the direct effects of exterior noise from nearby noise sources relative to land use compatibility of the project is no longer a required topic for impact evaluation under CEQA. Nonetheless, for the complete understanding of the public, this noise analysis will discuss noise compatibility as it applies to the development of the project. No determination of significance is required.

Table 5.11-2 Community Noise and Land Use Compatibility

Land Uses	CNEL (dBA) 55	60	65	70	75	80
Residential-Low Density Single Family, Duplex, Mobile Homes						
Residential- Multiple Family						
Transient Lodging: Hotels and Motels						
Schools, Libraries, Churches, Hospitals, Nursing Homes						
Auditoriums, Concert Halls, Amphitheaters						
Sports Arenas, Outdoor Spectator Sports						
Playground, Neighborhood Parks						
Golf Courses, Riding Stables, Water Recreation, Cemeteries						
Office Buildings, Businesses, Commercial, and Professional						
Industrial, Manufacturing, Utilities, Agriculture						

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: Anaheim 2004.

The City of Anaheim discourages the siting of new noise-sensitive uses in areas of excess of 65 dBA CNEL without appropriate mitigation. Below are the City of Anaheim General Plan Noise Element goals and policies applicable to the Project:

- **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:

  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.

Anaheim 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.

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 including, but not limited to, the following:

- 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[1] CNEL; interior noise levels shall be attenuated to a maximum of 45 dBA 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 dB 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 above the prescribed levels for exterior noise;[2] and

[1] The municipal code states "dB", but it is assumed that this limit is referring to an A-weighted decibel (i.e., dBA).
[2] The deviation from prescribed levels does not pertain to interior noise levels.

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

Construction Noise

The City has not established noise limits or exemptions for temporary construction activities. The Federal Transit Administration (FTA) recommends a noise level limit of 90 dBA L_{eq} for residential receptors, which is used in this analysis to assess construction noise impacts.

Vibration Standards

The Anaheim does not have specific limits or thresholds for vibration. The FTA provides criteria for acceptable levels of ground-borne vibration for various types of buildings. The FTA criteria were used for this analysis.

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 5.11-3.

Table 5.11-3 Groundborne Vibration Criteria: Architectural Damage

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

Source: FTA 2018.
PPV = peak particle velocity

5.11.1.3 EXISTING NOISE ENVIRONMENT

The California Supreme Court ruled that the CEQA does not generally require consideration of the effects of existing environmental conditions on a proposed project's future users or residents, but that CEQA does mandate analysis of how a project may exacerbate existing environmental hazards. The court said that portions of the CEQA guidelines that required consideration of the impacts of existing conditions were not valid (*CBIA v. BAAQMD*).

The Project Site is in a predominantly residential area with a noise environment influenced primarily by roadway noise from Nohl Ranch Road and Serrano Avenue. Noise from nearby residential uses (e.g., property maintenance and parking lot noise) and activity at Anaheim Hills Elementary School also contribute to the total noise environment intermittently in the Project vicinity.

The City of Anaheim General Plan's Safety Element includes future noise contours to assess the noise and land use compatibility of a project site. According to the future noise contour figure, the Project Site is within the 60 dBA CNEL contour for roadway noise and not within any railroad CNEL contours, which is considered

"normally acceptable" per City community noise and land use standards. As discussed above, due to *CBIA v. BAAQMD*, no determination of significance is required.

Sensitive Receptors

Certain land uses, such as residences, schools, and hospitals, are particularly sensitive to noise and vibration. Sensitive receptors in the City 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 particularly sensitive to noise or vibration.

The Project Site is a corner lot bounded by Nohl Ranch Road and Serrano Avenue in a residential area. The Project Site is adjacent to single-family homes to the north and east. To the south across Serrano Avenue are additional single-family homes, and to the southwest is Anaheim Hills Elementary School. Primary noise in the Project vicinity is traffic from local roadways.

5.11.2 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 Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies.

N-2 Generation of excessive groundborne vibration or groundborne noise levels.

N-3 For a project located within the vicinity of a private airstrip or 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, if the project would expose people residing or working in the project area to excessive noise levels.

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

- Threshold N-3

This impact will not be addressed in the following analysis.

5.11.3 Plans, Programs, and Policies

Project Design Features

PDF N-1 At least 21 days prior to the start of construction activities, all off-site businesses and residents within 300 feet of Project Site will be notified of the planned construction activities. The notification will include a brief description of the Proposed Project, the activities that would occur, the hours when construction would occur, and the construction period's overall

duration. The notification will include the telephone numbers of the City's and Contractor's authorized representatives that are assigned to respond in the event of a noise or vibration complaint.

PDF N-2 At least 10 days prior to the start of construction activities, a sign will be posted at the entrance(s) to the job site, clearly visible to the public, that includes permitted construction days and hours, as well as the telephone numbers of the City's and contractor's authorized representatives that are assigned to respond in the event of a noise or vibration complaint. If the authorized contractor's representative receives a complaint, he/she will investigate, take appropriate corrective action, and report the action to the City.

PDF N-3 During the entire active construction period, equipment and trucks used for project construction will utilize the best available noise control techniques wherever feasible (e.g., improved mufflers, equipment redesign, intake silencers, ducts, engine enclosures, and acoustically attenuating shields or shrouds).

PDF N-4 If impact tools are needed (e.g., jack hammers and hoe rams), they will be hydraulically or electrically powered wherever possible. Where the use of pneumatic tools is unavoidable, an exhaust muffler on the compressed air exhaust will be used along with external noise jackets on the tools.

PDF N-5 During the entire active construction period, stationary noise sources will be located as far from sensitive receptors as possible, and they will be muffled and enclosed within temporary sheds, or insulation barriers or other measures will be incorporated to the extent feasible.

PDF N-6 Select haul routes that avoid the greatest amount of sensitive use areas.

PDF N-7 Signs will be posted at the job site entrance(s), within the on-site construction zones, and along queueing lanes (if any) to reinforce the prohibition of unnecessary engine idling. All other equipment will be turned off if not in use for more than 5 minutes.

PDF N-8 During the entire active construction period and to the extent feasible, the use of noise-producing signals, including horns, whistles, alarms, and bells, will be for safety warning purposes only. The construction manager will use smart back-up alarms, which automatically adjust the alarm level based on the background noise level, or switch off back-up alarms and replace with human spotters in compliance with all safety requirements and laws.

5.11.4 Environmental Impacts

5.11.4.1 METHODOLOGY

This noise evaluation was prepared in accordance with the requirements of CEQA to determine if the Proposed Project would result in significant construction and operational impacts at nearby sensitive receptors. Per *CBIA v. BAAQMD*, noise compatibility for onsite sensitive receptors is no longer the purview of the CEQA. However, the City requires projects to be designed to achieve the interior noise standards of Title 24,

including the noise insulation requirements of the California Green Building Standards Code, which require exterior-interior noise insulation sufficient to achieve interior noise levels of 45 dBA. Construction noise modeling was conducting using the Federal Highway Administration (FHWA) Roadway Construction Noise Model (RCNM). Transportation noise sources were modeled using average daily trips (ADT) segment volumes provided by LSA Engineers (see Appendix O).

5.11.4.2 IMPACT ANALYSIS

Impact 5.11-1: Construction activities would not result in substantial temporary noise increases in ambient noise levels in the vicinity of the Project Site in excess of standards established by other applicable agency. [Threshold N-1 (part)]

Construction activities are anticipated to continue for approximately 22 months. Proposed phases include asphalt and concrete demolition, site preparation, grading, building construction, paving, and architectural coating. Two types of short-term noise impacts could occur during construction: (1) mobile-source noise from transport of workers, material deliveries, and debris and soil haul and (2) stationary-source noise from use of construction equipment. Existing uses surrounding the Project Site would be exposed to construction noise.

Construction Vehicles

The transport of workers and materials to and from the construction site would incrementally increase noise levels along Nohl Ranch and Serrano Avenue. Individual construction vehicle pass-bys may create momentary noise levels of up to approximately 85 dBA (L_{max}) at 50 feet from the vehicle, but these occurrences would generally be infrequent and short lived.

Construction generates temporary trips by workers and vendors. Project construction is anticipated to have six phases that will generate different numbers of trips. The building construction phase is anticipated to generate the most daily trips—66 worker and 17 vendor trips for a total of 83 daily trips during 220-day period. Haul trips, separate from worker and vendor trips, are estimated as a total over the period of the construction phase to be averaged into daily trips. During demolition of asphalt and concrete, an estimated 390 haul trips will take place over a 20-day demolition period, averaging 20 haul trips per day. The Project Site is at the corner of Nohl Ranch Road and Serrano Drive. Existing ADT in the Project vicinity range from 424 to 39,356 ADT and are summarized in Table 5.11-4. The addition of worker/vendor trips or haul trips would result in an approximate noise increase of 1.0 dB or less. Therefore, noise impacts from construction-related truck traffic would be less than significant at noise-sensitive receptors along the construction routes, and no mitigation measures would be required.

Table 5.11-4 Existing Roadway ADT

Road Segment	Existing ADT
Nohl Ranch Road, Stage Coach to Serrano	5,599
Serrano Avenue, Kendra to Nohl Ranch	14,121
Serrano Avenue, Nohl Ranch to Canyon Rim	14,013
Carnegie Avenue, Nohl Ranch to Calle Venado	695
Calle Venado, Carnegie to Serrano	424
Cannon Street, Serrano to Taft	39,356
Cannon Street, Taft to Santiago Canyon Road	34,268

Source: LSA 2019.

Construction Equipment

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. Each phase of construction involves the use of different kinds of construction equipment and therefore has its own distinct noise characteristics. Noise levels from construction activities are dominated by the loudest piece of construction equipment. The dominant noise source is typically the engine, although work piece noise (such as dropping of materials) can also be noticeable. Noise levels from Project-related construction activities were calculated from the simultaneous use of all applicable construction equipment at spatially averaged distances (i.e., from the center of the general construction area) to the property line of the closest sensitive receptors. Although construction may occur across the entire site, the center of the Proposed Project best represents the potential average construction-related noise levels to the various sensitive receptors during the overall construction portion of the Proposed Project.

The nearest sensitive receptors are single-family homes to the north, east, and south and Anaheim Hills Elementary School to the southwest, as measured from the acoustical center of the Project construction site. Approximate distances are:

- Residences to the north are 120 feet
- Residences to the east are 250 feet
- Residences to the south are 200 feet
- Anaheim Hills Elementary School is 450 feet

Each phase of construction has a different equipment mix, depending on the work to be accomplished. The noise produced at each phase is determined by combining the L_{eq} contributions from each piece of equipment used at a given time. Construction activities associated with the Proposed Project would not require blasting or pile driving. In the construction of residential and mixed-use projects, demolition and grading typically generate the highest noise levels because they require the largest equipment. Construction noise quite often exhibits a high degree of variability because factors such as noise attenuation due to distance, the number and type of

equipment, and the load and power requirements to accomplish tasks at each construction phase result in different noise levels at a given sensitive receptor. Heavy equipment, such as a dozer or a loader, can have maximum, short-duration noise levels in excess of 80 dBA at 50 feet. Since noise from construction equipment is intermittent and diminishes at a rate of 6 dB per doubling distance,[3] the average noise levels at noise-sensitive receptors would be lower, because mobile construction equipment would move around the site with different loads and power requirements.

To calculate construction noise as it affects sensitive receptors, the FHWA RCNM calculation methodology was used. The RCNM includes reference noise levels for numerous equipment pieces. Since the RCNM calculations do not account for shielding due to intervening buildings and structures, ground effects, or air absorption, the results of these calculations are conservative (that is, they represent a "worst case" scenario). Using information provided by the Project Applicant and methodologies and inputs employed in the air quality assessment, the expected construction equipment mix was estimated and categorized by construction activity. The associated, aggregate sound levels—grouped by construction activity—are summarized in Table 5.11-5.

Table 5.11-5 Project-Related Construction Noise Levels, Energy-Average (L_{eq}) Sound Levels

	Sound Level at Various Distances from Construction Activities, dBA L_{eq}			
Construction Activity Phase	North Single-Family (120 ft.)	East Single-Family (250 ft.)	South Single-Family (200 ft.)	Southwest Anaheim Hills Elementary School (450 ft.)
Asphalt and Concrete Demo	78	72	74	67
Site Preparation	73	67	69	62
Grading	77	71	73	66
Building Construction	73	67	69	62
Paving	78	72	74	67
Architectural Coating	66	60	62	55

Calculations performed with the FHWA's RCNM software are included in Appendix L. Distance measurements were taken using Google Earth (2018) from the acoustical center of the Project Site.

As shown in table 5.11-5, average noise levels during construction could reach 78 dBA L_{eq}, which would not exceed the FTA criterion of 90 dBA L_{eq}, therefore resulting in a less than significant construction noise impact.

Level of significance Before Mitigation: Less than significant.

Impact 5.11-2 Project implementation would not result in a substantial permanent increase in ambient noise levels in the vicinity of the Project Site in excess of local standards. [Threshold N-1 (part)]

Stationary Noise

Heating, ventilation, and air conditioning (HVAC) systems will be installed at the new proposed residential units. Typical HVAC equipment generates noise levels ranging up to 67 dBA at distance of 25 feet. The nearest residences or sensitive receptors are north and east approximately 40 feet from the property line. The nearest

[3] The sound attenuation rate is generally conservative because it does not take into account attenuation provided by the existing buildings and structures around the project site.

possible location for HVAC equipment would be approximately 40 feet to sensitive receptors to the north and produce noise levels of 63 dBA. The HVAC system would be on the roof, hidden from view by between five-foot roof slopes. A five-foot slope keeping the HVAC system out of the line of sight would contribute an additional 5 dBA attenuation, resulting in noise levels of 58 dBA at the nearest sensitive receptors. This would not exceed the City of Anaheim's stationary noise standard of 60 dBA, resulting in a less than significant impact.

Traffic Noise

Noise impacts can be broken down into three categories. The first is "audible" impacts, which refer to increases in noise level that are perceptible to humans. Audible increases in general community noise levels generally refer to a change of 3 dBA 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 dBA. The last category includes changes in noise level of less than 1 dBA 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 dBA or more) are considered potentially significant. Note that a doubling of traffic flows (i.e., 10,000 vehicles per day to 20,000 per day) would be needed to create a 3 dBA increase in traffic-generated noise levels. An increase of 3 dBA is used as a threshold for a substantial increase.

The ADT volumes along roadways in the Project area were provided by LSA for the Proposed Project. To determine the permanent traffic noise level increase, the Cumulative plus Project ADT volumes were compared to the Existing ADT volumes, as shown in Table 5.11-6. The Project-related noise increase was estimated to be 0.5 dBA or less throughout all traffic study roadway segments. Since the noise level increase due to Project-generated traffic would be less than 3 dBA, the Proposed Project would not cause a substantial permanent noise level increase at surrounding noise-sensitive receptors on weekday events. This is a less than significant impact.

Table 5.11-6 Project-Related Increase in Traffic Noise

	Average Daily Traffic Volumes					
Roadway Segment	Existing	Existing Plus Project	Cumulative No Project 2035	Cumulative Plus Project 2035	Project Noise Increase (dBA)	Cumulative Noise Increase (dBA)
Nohl Ranch Rd (Stage Coach Rd to Serrano Ave)	5,599	5,182	4,954	4,202	-0.3	-1.2
Serrano Ave (Kendra Dr to Nohl Ranch Rd)	14,121	14,196	17,891	17,386	<0.1	0.9
Serrano Ave (Nohl Ranch Rd to Canyon Rim Rd)	14,013	14,023	17,407	17,325	<0.1	0.9
Carnegie Ave (Nohl Ranch Rd to Calle Venado)	695	750	693	743	0.3	0.3
Calle Venado (Carnegie Ave to Serrano Ave)	424	479	422	453	0.5	0.3
Cannon St (Serrano Ave to Taft Ave)	39,356	39,431	54,652	54,291	<0.1	1.4
Cannon St (Taft Ave to Santiago Canyon Rd)	34,268	34,343	49,564	49,203	<0.1	1.6

Source: LSA 2019.

Level of Significance Before Mitigation: Less than significant.

Impact 5.11-3: The Proposed Project would not create excessive groundborne vibration and groundborne noise. [Threshold N-2]

Potential vibration impacts associated with development projects are usually related to the use of heavy construction equipment during the demolition and grading phases of construction and/or the operation of large trucks over uneven surfaces during Project operations.

Operational Vibration

The operation of the Proposed Project would not include any substantial long-term vibration sources. Thus, no significant vibration effects from operations sources would occur.

Construction Vibration Impacts

Construction operations can generate varying degrees of ground vibration, depending on the construction procedures and equipment. Construction equipment generates vibrations that spread through the ground and diminish with distance from the source. The effect on buildings in the vicinity of the construction site varies depending on soil type, ground strata, and receptor-building construction. The effects from vibration 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 the levels that can damage structures.

For reference, a peak particle velocity of 0.2 in/sec is used as the limit for nonengineered timber and masonry buildings (which would apply to the surrounding structures) (FTA 2018). At a distance of 25 feet or greater, construction-generated vibration levels at the nearest building would be less than the 0.2 in/sec PPV vibration damage criterion. The nearest structures are residences to the north and east at 30 feet from the Project Site, which would result in vibration levels of up to 0.16 in/sec PPV or less; therefore, architectural damage is not anticipated to occur and would be a less than significant impact. Table 5.11-7 summarizes vibration levels for typical construction equipment at the nearest sensitive receptors.

Table 5.11-7 Vibration Levels for Typical Construction Equipment

Equipment	PPV (in/sec) at 25 Feet	PPV (in/sec) at 30 Feet
Large Bulldozer	0.089	0.068
Vibratory Roller	0.21	0.16
Small Bulldozer	0.003	<0.01
Loaded Trucks	0.076	0.058

Source: FTA 2018.
PPV = peak particle velocity

As shown in Table 5.11-7, vibration generated by certain vibration-intensive construction equipment would have to occur within 25 feet or less of the nearest sensitive receptor to exceed the 0.2 in/sec PPV criterion.

Level of Significance Before Mitigation: Less than significant impact.

5.11.5 Cumulative Impacts

Cumulative Operational Impact

A significant cumulative traffic noise increase would be considered significant if a cumulative traffic noise increase is greater than the 3 dBA, and the relative contribution from Project traffic is calculated to be 1 dBA or more to the overall cumulative increase. As shown in Table 5.11-6, a cumulative traffic noise increase, which compares the General Plan Buildout (2035) traffic condition over existing, would be 1.6 dBA; therefore, not exceeding 3 dBA significance threshold. Therefore, the Proposed Project, combined with cumulative General Plan projects, would not result in significant cumulative operational noise impact.

Construction Noise and Vibration

Cumulative impacts would occur if other projects are being constructed in the vicinity of the Proposed Project at the same time. There is one development project within one mile radius of the Project Site that is under City's review (Anaheim 2019b). Considering that there is only one project within one mile radius of the Project Site and that the construction schedule is unknown at the time of this DEIR preparation, it is speculative to assume that the construction schedule would overlap to result in cumulative construction noise impacts. Project construction noise would not combine with other planned and approved construction projects to create cumulatively considerable impacts. Cumulative construction and vibration impacts would be less than significant.

Level of Significance Before Mitigation: Less than significant impact.

5.11.6 Level of Significance Before Mitigation

Upon implementation of regulatory requirements and standard conditions of approval, the following impact would be less than significant: 5.11-3, 5.11-2, and 5.11-3.

5.11.7 Mitigation Measures

No mitigation measures would be required.

5.11.8 Level of Significance After Mitigation

No mitigation required; impacts would be less than significant before mitigation.

5.11.9 References

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