4.13 NOISE AND VIBRATION

This section evaluates the noise and vibration impacts of the proposed Plan. The information presented was compiled from multiple sources, including SANDAG and other transportation project sponsors, the California Department of Transportation (Caltrans), the County of San Diego, cities, and other local jurisdictions.

4.13.1 EXISTING CONDITIONS

NOISE FUNDAMENTALS

This section describes widely published and generally accepted concepts related to airborne noise (Caltrans 2011b, 2013a; FTA 2018). Sound can be described as the mechanical energy of a vibrating object transmitted by pressure waves through a liquid or gaseous medium (e.g., air or water) to a hearing organ, such as a human ear. Noise is often defined as sound that is objectionable because it is unwanted, disturbing, or annoying. In the science of acoustics, the fundamental model consists of a sound (or noise) source, a receptor, and the propagation path between the two. The loudness of the noise source and the characteristics of the propagation path to the receptor determine the sound level and the characteristics of the noise perceived by the receptor. The following sections provide an explanation of key concepts and acoustical terms used in the analysis of environmental and community noise.

Frequency, Amplitude, and Decibels

Continuous sound can be described by its *frequency* (pitch) and *amplitude* (loudness). A low-frequency sound is perceived as low in pitch; a high-frequency sound is perceived as high-pitched. Frequency is expressed in terms of cycles per second, or Hertz (Hz) (e.g., a frequency of 250 cycles per second is referred to as 250 Hz). High frequencies are sometimes more conveniently expressed in kilohertz (kHz), or thousands of Hz. The audible frequency range for humans is generally between 20 Hz and 20,000 Hz.

The amplitude of pressure waves generated by a sound source correlates with the loudness of that source. The amplitude of a sound is described in terms of *sound pressure level* (SPL), also referred to simply as the sound level. The SPL is typically described using a logarithmic scale in terms of decibels, abbreviated dB.

Because decibels represent SPL using a logarithmic scale, sound levels cannot be added, subtracted, or averaged through ordinary arithmetic. On the dB scale, a doubling of sound energy corresponds to a 3-dB increase. In other words, when two identical sources are each producing the same SPL at a given receiver location, the total noise level would be 3 dB higher than for a single source under the same conditions. For example, 60 dB plus 60 dB equals 63 dB, and 80 dB plus 80 dB equals 83 dB. However, where ambient noise levels are high in comparison to a new noise source, there will be only a small change in overall noise levels when the new source is added. For example, when an ambient noise level of 70 dB is combined with a new source of 60 dB the resulting total noise level equals 70.4 dB.

Similarly, the arithmetic mean (average) of a series of noise levels does not accurately represent the overall average noise level. Instead, the values must be averaged using a linear scale before converting the result back into a logarithmic (dB) noise level. This method is typically referred to as calculating the "energy average" of the noise levels. The same decibel calculations are used for A-weighted decibels described below.

A-Weighting

The dB scale alone does not adequately characterize how humans perceive noise. Because the human ear is not equally sensitive to all frequencies within the sound spectrum, the frequency content of a sound has a substantial effect on the human response to that sound. In general, people are most sensitive to the frequency range of 1,000 to 5,000 Hz and perceive both higher and lower frequency sounds of the same amplitude with less intensity. To approximate the response of the human ear, sound levels in various frequency bands are adjusted (or "weighted"), depending on the human sensitivity to those frequencies. The resulting SPL is expressed in A-weighted decibels, abbreviated dBA. When people make judgments regarding the relative loudness or annoyance of a sound, their judgments correlate well with the A-weighted sound levels of those sounds. Table 4.13-1 describes typical A-weighted sound levels for various noise sources.

Table 4.13-1
Typical Noise Levels in the Environment

Common Outdoor Noise Source	Sound Level (dBA)	Common Indoor Noise Source
	— 110 —	Rock band
Jet flying at 1,000 feet		
	— 100 —	
Gas lawn mower at 3 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		
Gas lawn mower at 100 feet	— 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 in next room
Quiet urban nighttime	— 40 —	Theater, large conference room (background)
Quiet suburban nighttime		
	— 30 —	Library
Quiet rural nighttime		Bedroom at night
	— 20 —	
		Broadcast/recording studio
	— 10 —	
Lowest threshold of human hearing	— 0 —	Lowest threshold of human hearing

Source: California Department of Transportation 2013a.

Noise Descriptors

Because sound levels can vary markedly over a short period of time, various descriptors or noise "metrics" have been developed to quantify environmental and community noise. These metrics generally describe either the average character of the noise or the statistical behavior of the variations in the noise level. Some of the most common metrics used to describe environmental noise, including those metrics used in this EIR, are described below.

Equivalent Sound Level (L_{eq}) is the most common metric used to describe short-term average noise levels. The L_{eq} describes the average acoustical energy content of noise for an identified period of time, commonly 1 hour.

Maximum Sound Level (L_{max}) and **Minimum Sound Level (L_{min})** refer to the maximum and minimum sound levels, respectively, that occur during the noise measurement period. More specifically, they describe the root-mean-square sound levels that correspond to the loudest and quietest 1-second intervals that occur during the measurement.

Percentile-Exceeded Sound Level (L_{xx}) describes the sound level exceeded for a given percentage of a specified period. For example, the L_{50} is the sound level exceeded 50 percent of the time (such as 30 minutes per hour), and L_{25} is the sound level exceeded 25 percent of the time (such as 15 minutes per hour).

Community Noise Equivalent Level (CNEL) is a measure of the 24-hour average A-weighted noise level that is also time-weighted to "penalize" noise that occurs during the evening and nighttime hours when noise is generally recognized to be more disturbing (because people are trying to rest, relax, and sleep during these times). 5 dBA is added to the L_{eq} during the evening hours of 7 p.m. to 10 p.m., and 10 dBA is added to the L_{eq} during the nighttime hours of 10 p.m. to 7 a.m., and the energy average is then taken for the whole 24-hour day.

Day-Night Sound Level (L_{dn}) is very similar to the CNEL described above. L_{dn} is also a time-weighted average of the 24-hour A-weighted noise level. The only difference is that no "penalty" is applied to the evening hours of 7 p.m. to 10 p.m. 10 dBA is added to the L_{eq} during the nighttime hours of 10 p.m. to 7 a.m., and the energy average is then taken for the whole 24-hour day

It is noted that various federal, State, and local agencies have adopted CNEL or L_{dn} as the measure of community noise. While not identical, CNEL and L_{dn} are normally within 1 dBA of each other when measured in typical community environments, and many noise standards/regulations use the two interchangeably.

Sound Propagation

When sound propagates over a distance, it changes in both level and frequency content. The manner in which noise is reduced with distance depends on the following important factors.

Geometric Spreading. Sound from a single source (i.e., a "point" source) radiates uniformly outward as it travels away from the source in a spherical pattern. The sound level attenuates (or drops off) at a rate of 6 dBA for each doubling of distance. Highway noise is not a single stationary point source of sound. The movement of vehicles on a highway makes the source of the sound appear to emanate from a line (i.e., a "line" source) rather than from a point. This results in cylindrical spreading rather than the spherical spreading resulting from a point source. The change in sound level (i.e., attenuation or decrease) from a line source is 3 dBA per doubling of distance.

Ground Absorption. Usually the noise path between the source and the observer is very close to the ground. The excess noise attenuation from ground absorption occurs due to acoustic energy losses on sound wave reflection. For acoustically absorptive or "soft" sites (i.e., sites with an absorptive ground surface, such as soft dirt, grass, or scattered bushes and trees), an excess ground attenuation value of 1.5 dBA per doubling of distance is normally assumed. When added to the geometric spreading, the excess ground attenuation results in an overall drop-off rate of 4.5 dBA per doubling of distance for a line source and 7.5 dBA per doubling of distance for a point source for propagation over soft sites.

Atmospheric Effects. Research by Caltrans (2013a) and others has shown that atmospheric conditions can have a major effect on noise levels. Factors include wind, air temperature (including vertical temperature gradients), humidity, and turbulence. Receptors downwind from a source can be exposed to increased noise levels relative to calm conditions, whereas receptors upwind can have lower noise levels. Increased sound levels can also occur over relatively large distances because of temperature inversion conditions (i.e., increasing air temperature with elevation).

Shielding by Natural or Human-Made Features. A large object or barrier in the path between a noise source and a receptor can substantially attenuate noise levels at the receptor. The amount of attenuation provided by this shielding depends on the size of the object, proximity to the noise source and receptor, surface weight, solidity, and the frequency content of the noise source. Natural terrain features (such as hills and dense woods) and human-made features (such as buildings and walls) can substantially reduce noise levels. Walls are often constructed between a source and a receptor with the specific purpose of reducing noise. In addition to the noise that diffracts over the top of a barrier, noise will also diffract around the ends of the barrier, leading to "flanking" noise that can reduce the overall efficacy of the barrier. Assuming it is long enough to minimize the effects of flanking noise, a barrier that breaks the line of sight between a source and a receptor will typically result in at least 5 dB of noise reduction. A taller barrier may provide as much as 20 dB of noise reduction.

Human Response to Noise

Noise-sensitive receptors (also called "receivers") are locations where people reside or where the presence of unwanted sound may adversely affect the use of the land (see *Noise-Sensitive Land Uses*, below). Noise can have a range of effects on people including hearing damage, sleep interference, speech interference, performance interference, physiological responses, and annoyance (Caltrans 2013a, WHO 1999). Each of these is briefly described below.

Hearing Damage. A person exposed to high noise levels can suffer either gradual or traumatic hearing damage. Gradual hearing loss occurs with repeated exposure to excessive noise levels and is most commonly associated with occupational noise exposures in heavy industry or other very noisy work environments. Traumatic hearing loss is caused by sudden exposure to an extremely high noise level, such as a gunshot or explosion at very close range. The potential for noise-induced hearing loss is not generally a concern in typical community noise environments. Noise levels in neighborhoods, even in very noisy airport environs, are not sufficiently loud as to cause hearing loss.

Sleep Interference. Exposure to excessive noise levels at night has been shown to cause sleep disturbance. Sleep disturbance refers not only to awakening from sleep, but also to effects on the quality of sleep such as altering the pattern and stages of sleep. World Health Organization (WHO) guidelines recommend noise limits of 30 dBA L_{eq} (8-hour average) for continuous noise and 45 dBA L_{max} for single sound events inside bedrooms at night to minimize sleep disturbance (WHO 1999).

Speech Interference. Speech interference can be a problem in any situation where clear communication is desired, but is often of particular concern in learning environments (such as schools) or situations where poor communication could jeopardize safety. Normal conversational speech inside homes is typically in the range of 50 to 65 dBA (EPA 1977), and any noise in this range or louder may interfere with speech. As background noise levels rise, the intelligibility of speech decreases and the listener will fail to recognize an increasing percentage of the words spoken. A speaker may raise his or her voice in an attempt to compensate for higher background noise levels, but this in turn can lead to vocal fatigue for the speaker.

Performance Interference. Excessive noise has been found to have various detrimental effects on human performance, including information processing, concentration, accuracy, reaction times, and academic performance. Intrusive noise from individual events can also cause distraction. These effects are of obvious concern for learning and work environments.

Physiological Responses. Acute noise has been shown to cause measurable physiological responses in humans, including changes in stress hormone levels, pulse rate, and blood pressure. The extent to which these responses cause harm or are signs of harm is not clearly defined, but it has been postulated that they could contribute to stress-related diseases, such as hypertension, anxiety, and heart disease. However, research indicates links between environmental noise and permanent health effects are generally weak and inconsistent. Statistically significant health risks have been found for extended exposure to very high noise levels, such as for workers exposed to high levels of industrial noise for 5 to 30 years (WHO 1999).

Annoyance. The subjective effects of annoyance, nuisance, and dissatisfaction are possibly the most difficult to quantify, and no completely satisfactory method exists to measure these effects. This difficulty arises primarily from differences in individual sensitivity and habituation to sound, which can vary widely from person to person. What one person considers tolerable can be quite unbearable to another of equal hearing acuity. An important tool in estimating the likelihood of annoyance due to a new sound is by comparing it to the existing baseline or "ambient" environment to which that person has adapted. In general, the more the level or tonal (frequency) variations of a sound exceed the previously existing ambient sound level or tonal quality, the less acceptable the new sound will be, as judged by the exposed individual.

In most cases, effects from sounds typically found in the natural environment would be limited to annoyance or interference. Physiological effects and hearing loss would be more commonly associated with human-made noise, such as in an industrial or an occupational setting.

Studies have shown that under controlled conditions in an acoustics laboratory, a healthy human ear is able to discern changes in sound levels of 1 dBA. In the normal environment, the healthy human ear can detect changes of about 2 dBA; however, it is widely accepted that a doubling of sound energy, which results in a change of 3 dBA in the normal environment, is considered just noticeable to most people. A change of 5 dBA is readily perceptible, and a change of 10 dBA is perceived as being twice as loud.

Noise-Sensitive Land Uses

Sensitive noise receptors are generally considered persons who occupy land uses where noise is an important attribute of the environment for activities that require quiet, including sleeping, convalescing, and studying. These land uses typically include residential dwellings, hotels/motels, hospitals, nursing homes, educational facilities, and libraries. Each city or county typically provides a list of noise-sensitive receptors to consider in their general plan noise element and/or noise ordinance. Protected wildlife (special-status species) and their habitat may also be considered noise-sensitive receptors, especially during the species breeding season, such as protected nesting birds.

GROUNDBORNE VIBRATION FUNDAMENTALS

This section describes widely published and generally accepted concepts related to groundborne vibration (Caltrans 2013b, FTA 2018). Groundborne vibration is a small, rapidly fluctuating motion transmitted through the ground. The effects of groundborne vibrations are typically limited to causing nuisance or annoyance to people, but at extreme vibration levels damage to buildings may also occur.

In contrast to airborne sound, groundborne vibration is not a phenomenon that most people experience every day. The ambient groundborne vibration level in residential areas is usually much lower than the threshold of human perception. Most perceptible indoor vibration is caused by sources within buildings, such as mechanical equipment while in operation, people moving, or doors slamming. Typical outdoor sources of perceptible groundborne vibration are heavy construction activity (such as blasting, pile driving, or earthmoving), steel-wheeled trains, and traffic on rough roads. If a roadway is smooth, the groundborne vibration from traffic is rarely perceptible, even in locations close to major roads. The strength of groundborne vibration from typical environmental sources diminishes (or attenuates) rapidly over distance.

For the prediction of groundborne vibration, the fundamental model consists of a vibration source, a receptor, and the propagation path between the two. The power of the vibration source and the characteristics and geology of the intervening ground, which affect the propagation path to the receptor, determine the groundborne vibration level and the characteristics of the vibration perceived by the receptor.

Groundborne noise occurs when vibration propagating through a building causes room surfaces to vibrate and radiate noise into interior spaces. Many vibration sources, such as heavy construction and steel-wheeled trains, also generate substantial levels of airborne noise. This airborne noise typically dominates the overall noise level such that any groundborne noise contribution is negligible to a person inside the building. Groundborne noise is typically only an issue for scenarios that do not generate high levels of airborne noise at the receiver location. Examples include subway or tunnel operations where there is no airborne noise path or situations where people are located in buildings with substantial sound insulation, such as a recording studios. Groundborne noise is typically quantified using the A-weighted sound level.

Frequency and Amplitude

The frequency of a vibrating object describes how rapidly it is oscillating. The unit of measurement for the frequency of vibration is Hz (the same as used in the measurement of noise), which describes the number of cycles per second.

The amplitude of vibration can be measured in terms of displacement, velocity, or acceleration. Displacement describes the distance that a particle moves from its resting (or equilibrium) position as it oscillates and can be measured in inches. The amplitude of vibration velocity (the speed of the movement) can be measured in inches per second (in/s). The amplitude of vibration acceleration (the rate of change of the speed) can be measured in inches per second per second (in/s^2).

Vibration Descriptors

As noted above, there are various way to quantify groundborne vibration based on its fundamental characteristics. Because vibration can vary markedly over a short period of time, various descriptors have been developed to quantify vibration. The two most common descriptors used in the analysis of groundborne vibration are *peak particle velocity* and *vibration velocity level*, each of which are described below.

Peak Particle Velocity (PPV) is defined as the maximum instantaneous positive or negative peak amplitude of the vibration velocity. The unit of measurement for PPV is inches per second (in/s). Unlike many quantities used in the study of environmental acoustics, PPV is typically presented using linear values and does not employ a dB scale.

Vibration Velocity Level (L_V) describes the root-mean-square (RMS) vibration velocity. L_V is essentially a "smoothed" value that quantifies the average vibration amplitude over a 1-second period. L_V is reported on a logarithmic decibel scale with the abbreviation VdB commonly used to distinguish vibration decibels from noise level decibels.

Vibration Propagation

Vibration energy spreads out as it travels through the ground, causing the vibration level to diminish (attenuate) with distance away from the source. High-frequency vibrations reduce much more rapidly than low frequencies so that low frequencies tend to dominate the spectrum at large distances from the source. The propagation of groundborne vibration is also influenced by geological factors such as soil conditions, depth to bedrock, soil strata, frost conditions, and water conditions.

Effects of Groundborne Vibration

Vibration can result in effects that range from annoyance to structural damage. Annoyance or disturbance of people may occur at vibration levels substantially below those that would pose a risk of damage to buildings. Each of these effects is discussed below.

Potential Building Damage

When groundborne vibration encounters a building, vibrational energy is transmitted to the structure, causing it to vibrate, and, if the vibration levels are high enough, damage to the building may occur. Depending on the type of building and the vibration levels, this damage could range from cosmetic architectural damage (e.g., cracked plaster, stucco, or tile) to more severe structural damage (e.g., cracking of floor slabs, foundations, columns, beams, or wells). Buildings can typically withstand higher levels of vibration from transient sources than from continuous or frequent intermittent sources. Transient sources are those that 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. Older, fragile buildings (which may include important historical buildings) are of particular concern. Modern commercial and industrial buildings can generally withstand much higher vibration levels before potential damage becomes a problem.

Human Disturbance/Annoyance

Groundborne vibration can be annoying to people and can cause serious concern for nearby neighbors of vibration sources, even when vibration is well below levels that could cause physical damage to structures. Groundborne vibration is almost exclusively a concern inside buildings and is rarely perceived as a problem outdoors, where the motion may be discernible, but there is less adverse reaction without the effects associated with the shaking of a building. When groundborne vibration waves encounter a building, vibrational energy is transmitted to the structure causing building surfaces (walls, floors, and ceilings) to vibrate. This movement may be felt directly by building occupants and may also generate a low-frequency rumbling noise as sound waves are radiated by the vibrating surfaces. At higher frequencies, building vibration can cause other audible effects such as rattling of windows, building fixtures, or items on shelves or hanging on walls. These audible effects due to groundborne vibration are referred to as *groundborne noise*. Any perceptible effect (vibration or groundborne noise) can lead to annoyance. The degree to which a person is annoyed depends on the activity in which they are participating at the time of the disturbance. For example, someone sleeping or reading will be more sensitive than someone who is engaged in any type of physical activity.

Vibration-Sensitive Land Uses

Because building damage would be considered a permanent negative effect at any building, regardless of land use, any type of building would typically be considered sensitive to vibration damage impacts. Fragile structures, which often include historical buildings, are most susceptible to damage and are of particular concern.

Land uses that would be considered sensitive to human annoyance caused by vibration are generally the same as those that would be sensitive to noise and would typically include residential dwellings, hotels/motels, hospitals, nursing homes, educational facilities, and libraries. It is noted, however, that vibration effects are typically only considered inside occupied buildings and not at outside areas such as residential yards, parks, or open space.

AMBIENT NOISE LEVELS AND EXISTING NOISE SOURCES

Ambient noise is the background noise level of any location or environment, normally specified to compare it to a new intrusive noise source. Ambient noise includes all sounds present in an environment and can be measured at any moment in time, but it typically varies over time. Ambient noise levels are generally considered low when ambient levels are below 45 dBA CNEL, moderate in the 45 to 65 dBA CNEL range, and high above 65 dBA CNEL.

The existing noise environment in the Plan Area is composed of transportation and non-transportation sources. Transportation sources include roadway vehicle traffic; railroad train operations, including light rail, commuter, and freight trains; and aircraft operations. Generally, transportation-related noise sources (e.g., vehicle traffic noise) characterize the ambient noise environment of an area. Non-transportation, or localized stationary/fixed sources include mechanical equipment, commercial/industrial equipment and operations, construction equipment, and any other sources not associated with the transportation of people or goods. Existing noise exposure associated with these primary noise sources in the San Diego region is presented below.

Vehicle Traffic Noise

The ambient noise environment in the Plan Area is primarily defined by roadway vehicle traffic. The traffic noise level generated on a roadway is dependent on traffic speed, traffic volume, and the relative percentage of medium (2-axle) and heavy (3+ axle) trucks. In general, the greater the traffic volume is on a roadway, the higher the noise levels that are generated on that roadway. This holds true until the traffic volume is so great (i.e., approaching capacity) that traffic flow degrades and traffic speeds decrease as the roadway becomes congested, which lowers traffic noise levels. All else being equal, roadways with larger percentages of trucks (particularly heavy trucks) will generate higher noise levels. A heavy truck traveling 50 mph generates approximately 85 dBA, whereas an automobile traveling the same speed generates only 71 dBA. As a result the heavy truck sounds more than twice as loud as the automobile (an increase of 10 dBA is usually perceived as a "doubling" of sound).

The overall noise level from a vehicle is the combination of multiple subsources. All vehicle types generate noise from the road-tire interaction (i.e., the noise of the tires rolling across the pavement) as well as from the engine and exhaust. In addition heavy trucks often have elevated exhaust stacks (typically around 10 to 11 feet high) that represent an additional source of noise located higher above the roadway than for smaller vehicle types.

Roadways that generate the highest noise levels in the Plan Area are the interstate and state highways as they have the highest speed limits, the largest traffic volumes, and the highest percentage of trucks. Figure 2-1 in Chapter 2, *Project Description,* shows the interstate and state highway network and significant arterials in the Plan Area. Traffic typically generates 70 to 75 dB L_{dn} at 50 to 100 feet from major highways. Heavily used roadways, such as arterials and major streets, also generate significant levels of noise, typically 65 to 70 dB L_{dn} at similar distances (FTA 2018).

Noise from line sources, such as roadways, typically attenuate at a rate of 3 to 4.5 dBA per doubling of distance, depending on the ground conditions (FHWA 2011). Additional attenuation is provided by the presence of natural or human-made barriers or structures. In populated areas, a general rule for estimating noise reductions due to intervening structures is to assume one row of buildings every 100 feet from the roadway and apply a -4.5 dBA reduction in traffic noise levels for the first row and -1.5 dBA for every subsequent row, up to a maximum of -10 dBA attenuation (FTA 2018). Highway traffic noise is not usually a serious problem for people who live more than 500 feet from heavily traveled freeways or more than 100 to 200 feet from lightly traveled roads (FHWA 2011).

In the San Diego region, there is a wide range of land uses located adjacent to highways and major streets, including residences, schools, churches, hospitals, shopping centers, industrial parks, agriculture, parks, and open space. Of these, residences, schools, churches, and hospitals are typically considered noise sensitive by cities and the County, as defined in the noise elements of their respective general plans.

Rail Noise

Ambient noise levels in the Plan Area are also characterized by noise from rail operations. The two basic types of railroad operations are freight and passenger train operations, the latter consisting of commuter and intercity passenger trains and steel-wheel urban railway transit (i.e., trolley). Generally, freight train operations can occur at all hours of the day and night, while passenger train operations are concentrated within the daytime and evening periods. Train operations are intermittent and rail lines are widely dispersed except for limited locations with a higher concentration of activity such as freight rail/switching yards or transit centers where various railways converge (e.g., at the Santa Fe Depot in downtown San Diego). As a result, large parts of the Plan Area experience little to no rail noise, and it does not contribute substantially to the ambient noise levels in these areas. Nonetheless, train operations generate substantial noise levels in the immediate vicinity of the railways.

The overall noise level from rail lines is the combination of multiple subsources. These include the propulsion systems (typically electric control systems and motors for light rail and rapid transit, and diesel engines for larger locomotives) and their ancillary devices (e.g., cooling fans and gears), and noise generated by the interaction of the wheels and tracks (rolling noise due to continuous rolling contact; impact noise when a wheel encounters a rail joint, turnout, or crossover; and squeal generated by friction on tight curves). For very high-speed railway vehicles, air turbulence can also be a significant source of noise. In addition, the sounding of train air horns and crossing gate bells also contributes to higher noise levels near railway/roadway grade crossings. Other sources of noise associated with rail operations are train stations, maintenance yards and shops, power substations, and switchyards.

Similar to traffic noise, described above, mobile rail noise sources are considered line sources with typical attenuation rates of 3 to 4.5 dBA per doubling of distance, depending on the ground conditions (FHWA 2011), and additional attenuation provided by the presence of natural or human-made barriers or structures. Stationary sources (such as crossing bells) are considered point sources with typical attenuation rates of 6 to 7.5 dBA per doubling of distance, depending on the ground conditions, and additional attenuation provided by the presence of natural or human-made barriers or structures.

Average railway noise levels (L_{dn}) at distances from mainline railway corridors can be estimated based on an average train traffic volume of 5 to 10 trains per day at speeds of 30 to 40 mph from the center of the railway, as shown in Table 4.13-2 (FTA 2018).

Table 4.13-2
Estimating Railway Noise Exposure for General Assessment

Distance from Railway (feet)	Noise Exposure Estimates (Ldn)
10–30	75
30–60	70
60–120	65
120–240	60
240–500	55
500–800	50
800 and up	45

Source: FTA 2018.

In the Plan Area, there is a wide range of land uses (some noise-sensitive) located adjacent to railways, including but not limited to residences, schools, churches, hospitals, shopping centers, industrial parks, agriculture, parks, and open space. The Federal Transit Administration (FTA) provides "screening distances" to estimate where significant noise impacts may occur relative to various rail and other transportation facilities. Some examples are provided in Table 4.13-3 (FTA 2018). It is noted that the presence of sensitive receptors within these screening distances does not mean noise impacts would definitely occur, simply that FTA procedures require additional analysis under these conditions.

Table 4.13-3
Example FTA Screening Distances for Rail and Other Transportation Facility Noise

Type of Project		Screening Distance (feet)	
		Unobstructed	With Intervening Buildings
Commuter Rail Mainline		750	375
Commuter Rail Station	With Horn Blowing	1,600	1,200
	Without Horn Blowing	250	200
Commuter Rail-Highway Crossing with Horns and Bells		1,600	1,200
Rail Rapid Transit (RRT)		700	350
RRT Station		200	100
Light Rail Transit (LRT)		350	175
Streetcar		200	100
Access Roads to Stations		100	50
Low and Intermediate Capacity Transit	Steel Wheel	125	50
	Rubber Tire	90	40
	Monorail	175	70
Yards and Shops		1,000	650
Parking Facilities		125	75
Access Roads to Parking		100	50
Ventilation Shafts		200	100
Power Substations		250	125

Type of Project		Screening Distance (feet) Unobstructed	With Intervening Buildings
Bus Systems			
Busway		500	250
Bus Rapid Transit (BRT) on exclusive roadway		200	100
Bus Facilities	Access Roads	100	50
	Transit Mall	225	150
	Transit Center	225	150
	Storage & Maintenance	350	225
	Park & Ride Lots w/Buses	225	150
Ferry Boat Terminals		300	150

Source: FTA 2018.
[1] Although some of the project types referenced in this table are not directly related to rail projects, the screening distances reflected as part of the FTA Transit Noise and Vibration Impact Assessment Manual may be relevant to other aspects of the proposed Plan.

Aircraft Noise

The Plan Area is also affected by noise from aircraft operations, which generate substantial noise levels in the immediate vicinity of airport runways and approach and departure flight paths. The San Diego region includes the following airports, as shown in Figure 4.9-1 in Section 4.9, *Hazards and Hazardous Materials*:

- **International and domestic airports:** San Diego International Airport (SDIA), Tijuana International Airport (directly across U.S. border with Mexico), and McClellan-Palomar (Carlsbad) Regional Airport.
- **Military airfields:** Naval Air Station (NAS) North Island, Marine Corps Air Station (MCAS) Miramar, MCAS Camp Pendleton, Naval Outlying Landing Field (NOLF) Imperial Beach, and Coast Guard Air Station San Diego.
- **Towered General Aviation airports:** Brown Field, Gillespie Field, Montgomery Field, and Ramona Airport.
- **Non-towered General Aviation airports**: Agua Caliente Airport, Borrego Valley Airport, Fallbrook Community Airpark, Jacumba Airport, Oceanside Municipal Airport, Ocotillo Airport, and Pauma Valley Airport.

In addition to the numerous daily aircraft operations originating and terminating at these facilities, aircraft not utilizing these airports fly over the San Diego region at various altitudes, and contribute to the overall ambient noise environment. The proximity of the noise receptor to the airport and aircraft flight path(s) determines the noise exposure. Other contributing factors include the type of aircraft, type and number of aircraft operations (e.g., takeoffs, landings, flyovers), altitude of the aircraft, and atmospheric conditions, which may alter to the approach and departure direction of aircraft as well as affect aircraft noise propagation.

As discussed in further detail below, State law requires land use commissions to prepare and adopt an airport land use compatibility plan (ALUCP) for each public use and military airport. These plans typically include airport noise contour maps illustrating the average daily noise exposure (measured in dB CNEL) in the airport's vicinity. Copies of the available existing noise contour maps for Plan Area airports are provided in Appendix N. For smaller airports (e.g., Ramona Airport) reported noise levels range from approximately 50 to 65 dB CNEL. Lower noise levels (50 to 55 dB CNEL) may extend several thousand feet from the airport boundaries along dominant flight path(s); while higher noise levels (65 dB CNEL) do not extend much beyond the airport boundaries (SDCRAA 2008). For the largest airports (e.g., SDIA) reported noise levels range from approximately 60 to 75 dB CNEL. The lower noise levels from major airports (60 to 65 dB CNEL) may extend several miles from the airport boundaries along dominant flight path(s), while higher noise levels (75 dB CNEL) may extend several thousand feet (SDCRAA 2014).

In addition to the public-use or military airports, there are numerous private and special-use airstrips and helipads in the Plan Area, many which are located in the eastern areas of the region or remote vacation destinations. Several private helipads are located on the roofs of hospitals and buildings owned by large corporations or used by police stations. Private airstrips/helipads located within the San Diego region are not required to prepare noise contours because their noise levels are substantially less than airports due to lower activity levels and their use restrictions are much less defined than with public-use airports (SDCRAA 2014).

Construction Noise

Construction activities generate temporary, short-term noise levels. For large transportation projects, the total period of construction can be months or even years; however, these project often have a large linear footprint (e.g. a stretch of freeway or railroad), which means that peak construction activities only occur adjacent to any single receptor for a limited portion of the total duration. Construction noise is of more concern when it takes place near noise-sensitive land uses, or occurs at night or in early morning hours. Construction noise can also affect nearby noise-sensitive special-status wildlife species and habitat by interfering with the ability to establish territory, vocalize, or successfully reproduce. Additional discussion of noise-sensitive special-status wildlife is provided in Section 4.4, *Biological Resources.* Local governments typically regulate noise associated with construction equipment and activities through enforcement of noise ordinance standards, implementation of general plan policies, and imposition of conditions of approval for building or grading permits.

Noise generated from construction equipment varies greatly depending on the construction activity being performed, equipment type, model, age, condition, and usage. High impact construction techniques, such as pile driving, blasting, and crack-and-seat pavement breaking, produce the highest noise levels and typically dominate the local noise environment when they occur; however, these techniques are not required for all construction projects. Outside of high-impact techniques, heavy equipment operation (e.g., earthmoving) typically dominates the noise generated at construction sites. Stationary sources such as generators, pumps, and compressors may also produce substantial continuous noise.

The magnitude of overall construction noise levels depends on the type of construction activity, the schedule of multiple pieces of construction equipment operating simultaneously, the duration of the activity, the distance between the activity and noise-sensitive receptors, and the presence or absence of any noise attenuating features. Table 4.13-4 provides a list of typical construction equipment, their maximum operational noise level (L_{max}) at 50 feet, their typical duty cycles (i.e., percentage operated within a period of time), and the resulting average noise level (L_{eq}) at 50 feet.

Table 4.13-4
Construction Equipment Noise Levels

Equipment	L^{max} at 50 Feet, dBA	Typical Duty Cycle (percent)	L^{eq} at 50 Feet, dBA
Auger Drill Rig	84	20	77
Backhoe	78	40	74
Blasting	94	1	74

Equipment	L_{max} at 50 Feet, dBA	Typical Duty Cycle (percent)	L_{eq} at 50 Feet, dBA
Chain Saw	84	20	77
Clam Shovel	87	20	80
Compactor (ground)	83	20	76
Compressor (air)	78	40	74
Concrete Mixer Truck	79	40	75
Concrete Pump	81	20	74
Concrete Saw	90	20	83
Crane (mobile or stationary)	81	16	73
Dozer	82	40	78
Dump Truck	77	40	73
Excavator	81	40	77
Front End Loader	79	40	75
Generator (25 KVA or less)	81	50	78
Generator (more than 25 KVA)	73	50	70
Grader	85	40	81
Hydra Break Ram	90	10	80
Impact Pile Driver (diesel or drop)	101	20	94
Jackhammer	89	20	82
Mounted Impact Hammer (hoe ram)	90	20	83
Paver	77	50	74
Pneumatic Tools	85	50	82
Pumps	81	50	78
Rock Drill	81	20	74
Scraper	84	40	80
Tractor	84	40	80
Vacuum Excavator (vac-truck)	85	40	81
Vibratory Concrete Mixer	80	20	73
Vibratory Pile Driver	101	20	94

Source: FHWA 2006.
KVA = kilovolt amp

As shown in Table 4.13-4, maximum noise levels generated by typical construction equipment range from approximately 73 to 90 dBA measured at 50 feet (assuming no attenuation from intervening features such as buildings or topography); high impact equipment (pile driving, blasting, and impact hammers) generate higher levels of 90 to 101 dBA at 50 feet (FHWA 2006). The noise levels vary for each type of equipment, as equipment may come in different sizes and with different engines. Construction equipment noise levels also vary as a function of the activity level or duty cycle. In a typical construction project, the loudest short-term noise levels are typically those of earth-moving equipment under full load, which typically range from 85 to 90 dBA at 50 feet from the source.

Noise impacts on sensitive receptors resulting from construction projects would depend on several factors, such as the type of project, land use of the given area, proximity of sensitive receptors, duration of construction activities, and presence or absence of barriers between noise source and receptor. Additionally, construction noise levels would fluctuate depending on construction phase.

Noise levels from construction activities are typically considered point sources with typical attenuation rates of 6 to 7.5 dBA per doubling of distance, depending on the ground conditions, and additional attenuation provided by the presence of natural or human-made barriers or structures. Typically, construction projects involve ground conditions with a mix of acoustically soft and hard surfaces, or surfaces that fall somewhere between the two extremes (such as bare dirt); therefore, the 6 dBA attenuation rate is often conservatively assumed and for construction noise impact analyses.

Commercial, Industrial, and Other Non-Transportation Noise Sources

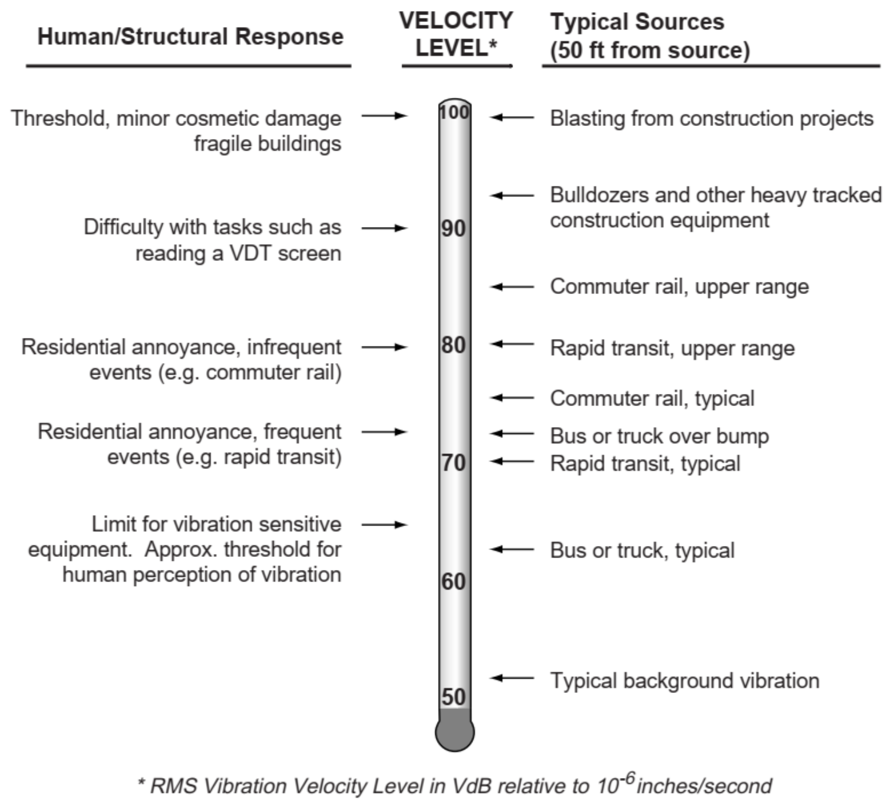
This category of ambient noise sources is extremely varied because it encompasses all the non-transportation noise sources resulting from the multitude of land uses throughout the Plan Area. One major category of noise sources is mechanical equipment, which ranges from small residential heating, ventilation and air conditioning (HVAC) units to large industrial systems with chillers, fans, compressor, cooling towers, etc. General noise sources associated with many different land uses include parking lot noise (e.g., opening and closing of vehicle doors, people talking, car alarms) and delivery activities (e.g., loading docks, use of forklifts, hydraulic lifts). Other noise sources include large machinery associated with industrial, manufacturing, and agricultural operations; municipal/utility operations (landfills, water treatment plants, power stations, etc.); activities at schools, parks, amphitheaters, and athletic facilities; landscape maintenance (leaf blowers and lawnmowers); and operations at port facilities, to name just a few.

While these types of noise sources may be substantial contributors to the local ambient noise levels, their effects are generally localized and do not extend over a large geographical area in the same way as noise from transportation systems.

AMBIENT VIBRATION LEVELS AND EXISTING VIBRATION SOURCES

Background vibration is usually much lower than the threshold of human perception. The ambient vibration velocity level in residential areas is usually 50 VdB or lower, and the threshold of perception for humans is approximately 65 VdB. Low levels of background vibration are usually of concern only when the vibration affects very sensitive manufacturing or research equipment (FTA 2018). Perceptible vibration is typically part of the ambient environment only at locations in proximity to specific notable vibration sources such as uneven roads used by heavy vehicles, rapid transit lines, commuter or freight rail, or heavy industrial operations. Construction activities may also produce perceptible vibration, but these are usually short term rather than part of the permanent ambient environment. Figure 4.13-1 illustrates typical vibration velocity levels experienced by receivers in proximity to various vibration sources.

Figure 4.13-1
Typical Levels of Groundborne Vibration



Source: FTA 2018.

Existing vibration sources in the Plan Area can be classified as transportation and non-transportation sources. Transportation sources include railroad train operations, including light rail, commuter, and freight trains. Non-transportation or localized stationary/fixed sources include construction equipment and heavy industrial machinery. Existing vibration exposure associated with these sources in the San Diego region is presented below.

Train/Rail Vibration

Rail lines, including light rail, rail rapid transit, commuter rail, and freight rail, generate vibration at land uses adjacent to their alignments. Generally, freight train operations can occur at all hours of the day and night, while passenger train operations are concentrated within the daytime and evening periods. Train operations are intermittent, and rail lines are widely dispersed except for limited locations with a higher concentration of activity such as freight rail/switching yards or transit centers where various railways converge (e.g., at the Santa Fe Depot in downtown San Diego). As a result, large parts of the Plan Area experience little to no rail-related groundborne vibration or groundborne noise. Nonetheless, train operations generate substantial vibration levels in the immediate vicinity of the railways.

In the Plan Area, there is a wide range of land uses (some vibration-sensitive) located adjacent to railways. The FTA provides “screening distances” to estimate where significant vibration impacts may occur relative to various rail facilities. Some examples are provided in Table 4.13-5 (FTA 2018). It is noted that the presence of sensitive receptors within these screening distances does not mean vibration impacts would definitely occur, simply that FTA procedures require additional analysis under these conditions.

Table 4.13-5
Example FTA Screening Distances for Rail Vibration

Type of Project	Critical Distance for Land Use Categories1 Distance from Right-of-Way or Property Line (feet)		
	Land Use Category 1	Land Use Category 2	Land Use Category 3
Conventional Commuter Railroad	600	200	120
Rail Rapid Transit	600	200	120
Light Rail Transit and Streetcars	450	150	100
Intermediate Capacity Transit	200	100	50
Bus Projects (if not previously screened out)	100	50	--

Source: FTA 2018.
[1] For the Vibration Screening Procedure, evaluate special buildings as follows:
Category 1 – concert halls and TV studios, Category 2 – theaters and auditoriums.
Land Use Category 1: High Sensitivity (e.g., buildings where vibration-sensitive research and manufacturing is conducted, hospitals with vibration-sensitive equipment, and universities conducting physical research operations).
Land Use Category 2: Residential (e.g., all residential land use and buildings where people normally sleep, such as hotels and hospitals).
Land Use Category 3: Institutional (e.g., institutions and offices that have vibration-sensitive equipment and have the potential for activity interference such as schools, churches, and doctors' offices).

Construction Vibration

Construction activities generate temporary, short-term vibration levels. For large transportation projects, the total period of construction can be months or even years; however, these projects often have a large linear footprint (e.g., a stretch of freeway or railroad), which means that peak construction activities only occur adjacent to any single receptor for a limited portion of the total duration. Construction vibration is of more concern when it takes place near sensitive buildings, or occurs at night or in early morning hours.

Vibration generated from construction equipment varies greatly depending on the construction activity being performed and the equipment being used. High impact construction techniques, such as pile driving, blasting, and crack-and-seat pavement breaking, produce the highest vibration levels and typically dominate the local vibration environment when they occur; however, these techniques are not required for all construction projects. Outside of high-impact techniques, heavy equipment operation (e.g., earthmoving) typically dominates the vibration generated at construction sites.

Because vibration impacts are assessed based on short-term metrics, such as the 1-second RMS vibration velocity level or the instantaneous PPV, the magnitude of the worst case vibration level at any given receiver is typically dominated by the single most vibration-intensive task while it occurs closest to the individual receiver.

Table 4.13-6 provides a list of typical construction equipment, the associated PPV (in/s) at a reference distance of 25 feet, and the estimated distances to different levels of human response.

Table 4.13-6
Construction Equipment Vibration Levels (PPV)

Equipment Item	Reference PPV at 25 feet (in/s)	Distance to Human Response (feet)[1]			
		Barely Perceptible	Distinctly Perceptible	Strongly Perceptible	Severe
Crack-and-Seat Operations	2.4[2]	3,646	1,034	450	128
Impact Pile Driver	0.65[2]	1,112	316	138	39
Vibratory Pile Driver	0.65[2]	1,112	316	138	39
Hydraulic Breaker	0.24[2]	450	128	56	16
Vibratory Roller	0.21[3]	399	113	50	14
Large Bulldozer	0.089[3]	183	52	23	7
Caisson Drilling	0.089[3]	183	52	23	7
Jackhammer	0.035[3]	79	23	10	3
Small Bulldozer	0.003[3]	9	3	2	1

[1] Caltrans 2020
[2] FTA 2018
Note: Distances are calculated using the Reference PPV (PPV_{ref}) at 25 feet. The equation used to calculate these distances is $PPV = PPV_{ref} * (25/D)^{1.1}$, as referenced in Caltrans 2020.

Commercial, Industrial, and Other Non-Transportation Vibration Sources

Outside of the transportation and construction sources described above, there are few vibration sources that would affect the perceptible ambient conditions at sensitive receptors. Perceptible vibration from mechanical equipment and industrial machinery is primarily limited to the structures in which it occurs because it does not generate enough vibrational energy to propagate large distances. In addition, vibrating equipment is often treated at the source (for instance with vibration-damping mounts) specifically to minimize vibration transfer. Finally, local zoning and land use planning tend to protect against placing vibration-sensitive receivers in proximity to major industrial operations.

ANTICIPATED EFFECTS FROM CLIMATE CHANGE

No studies were found that investigate the impacts of climate change on noise and vibration.

4.13.2 REGULATORY SETTING

FEDERAL LAWS, REGULATIONS, PLANS, AND POLICIES

Some federal regulations provide specific quantitative noise limits (such as maximum permissible noise levels for specific vehicle types), while others provide requirements and guidance for noise-related programs to be prepared by others (such as requirements for noise contour maps and noise compatibility programs for public use airports). Key federal regulations are briefly described below.

FAA, FHWA, and EPA

Aircraft Noise Regulations

14 Code of Federal Regulations (CFR) 36 is published by the Federal Aviation Authority (FAA) and establishes maximum acceptable noise levels for various specific aircraft types, taking into account the model year, aircraft weight, and number of engines.

Airport Noise Compatibility Planning

14 CFR 150 is published by the FAA and prescribes the procedures, standards, and methodology governing the development, submission, and review of airport noise exposure maps and airport noise compatibility programs for public use airports (including heliports). The Part 150 program (Airport Noise Compatibility Planning) proposes measures to reduce the land use incompatibility. Under the program, airport projects such as land acquisition and acoustic treatment of residences, become eligible for federal funding. The Part 150 program establishes a voluntary program that airports can utilize to conduct airport noise compatibility planning, and the program also prescribes a system for measuring airport noise impacts and presents guidelines for identifying incompatible land uses. Part 150 noise exposure maps are depicted with annual average DNL contours around an airport. DNL is equivalent to L_{dn}, and similar to CNEL, as discussed in Section 4.13.1, *Existing Conditions*; FAA accepts California's use of CNEL.

Part 150 considers all land uses with noise levels less than 65 DNL to be compatible with aircraft operations. At higher noise exposures, selected land uses are also deemed acceptable, depending upon the nature of the use and the degree of structural noise attenuation provided. However, these designations do not constitute a federal determination that any use of land covered by the Part 150 program is acceptable or unacceptable under federal, state, or local law; the responsibility for determining the acceptable and permissible land uses and the relationship with specific noise contours rests with the local authorities.

Traffic Noise Impacts

23 CFR 772 is published by the FHWA and is the federal regulation governing traffic noise impacts. A federal or federally funded project would have a traffic noise impact if the project involved the construction of a new highway, or the significant modification of an existing freeway (a "Type I"[1] project), where the project would result

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[1] Type I projects include:

1. The construction of a highway on new location; or
2. The physical alteration of an existing highway where there is either:
   a. Substantial Horizontal Alteration.; or
   b. Substantial Vertical Alteration; or
3. The addition of a through-traffic lane(s) including the addition of a through-traffic lane that functions as a High-Occupancy Vehicle (HOV) lane, High-Occupancy Toll (HOT) lane, bus lane, or truck climbing lane; or
4. The addition of an auxiliary lane, except for when the auxiliary lane is a turn lane; or
5. The addition or relocation of interchange lanes or ramps added to a quadrant to complete an existing partial interchange; or
6. Restriping existing pavement for the purpose of adding a through-traffic lane or an auxiliary lane; or

in a substantial operational noise increase, or when the predicted operational noise levels approach or exceed the FHWA Noise Abatement Criteria (NAC). A "substantial increase" is not specifically defined by FHWA, but is indicated to be in the range of 5 to 15 dBA. Specific increase criteria are defined by the state transportation agency. FHWA has developed NAC for activity categories at various noise-sensitive land uses as summarized in Table 4.13-7. Noise levels that "approach" the NAC are defined as 1 dBA less than the criterion level (i.e., 66 dBA L_{eq} for Activity Category B land uses).

Table 4.13-7
FHWA Noise Abatement Criteria[1]

Activity Category	Activity $L_{eq(h)}$	Criteria $L_{10(h)}$ [2]	Evaluation Location	Description of Activities
A[3]	57	60	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B[3]	67	70	Exterior	Residential
C	67	70	Exterior	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings.
D[3]	52	55	Interior	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios.
E	72	75	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A–D or F.
F	--	--		Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, ship-yards, utilities (water resources, water treatment, electrical), and warehousing.
G	--	--		Undeveloped lands that are not permitted.

Source: 23 CFR Part 772.
[1] Hourly A-Weighted Sound Levels Decibels (dBA); either $L_{eq(h)}$ or $L_{10(h)}$ (but not both) may be used on a project.
[2] The $L_{eq(h)}$ and $L_{10(h)}$ Activity Criteria values are for impact determination only, and are not design standards for noise abatement measures.
[3] Includes undeveloped lands permitted for this activity category.

It is noted that, since 2007, Caltrans has performed federal responsibilities for NEPA compliance for highway projects in California that are funded by FHWA. This legal arrangement, referred to as NEPA Assignment, eliminates FHWA's project-specific review and approval. In reviewing and approving projects under NEPA,

7. The addition of a new or substantial alteration of a weigh station, rest stop, ride-share lot, or toll plaza.

Caltrans is responsible for complying with all applicable federal environmental laws and with FHWA NEPA regulations, policies, and guidance, such as traffic noise regulations.

Noise Emission Standards for Rail

These two parts of the code are closely interrelated. 40 CFR 201 is published by the Environmental Protection Agency (EPA) and establishes noise emission standards for transportation equipment used by interstate rail carriers. Equipment covered by the regulation includes locomotives (under both operation stationary and moving conditions), rail cars, retarders, car coupling operations, and locomotive load cell tests. 49 CFR 210 is published by the Federal Railroad Administration (FRA) and prescribes minimum compliance regulations for enforcement of 40 CFR 201.

Noise Emission Standards for Trucks and Motorcycles

40 CFR 205 is also published by the EPA and establishes noise emission standards for medium and heavy duty trucks, motorcycles, and motorcycle exhaust systems.

Federal Transit Administration and Federal Railroad Administration

FTA has prepared a guidance manual (FTA 2018) that presents procedures for predicting and assessing noise and vibration impacts of proposed mass transit projects. The FTA manual was originally published in 1995 and subsequently updated in 2006 and again in 2018. All types of bus and rail projects are covered. This establishes the FTA's methodology for addressing potential noise impacts under NEPA and 23 CFR 771, and is generally required for federal or federally funded transit projects (analysis is not required for projects classified as categorical exclusions). FRA has adopted the FTA methodologies and significance criteria for its own guidance manual (FRA 2012) for predicting and assessing noise and vibration impacts of proposed high-speed ground transportation projects (including high-speed trains using traditional steel-wheel on steel-rail technology as well as magnetically levitated [maglev] systems). The FRA manual was originally published in 1998 and subsequently updated in 2012.

FTA and FRA noise impact thresholds are based on a project's incremental noise increase relative to existing noise conditions. Project noise levels are divided into three categories (no impact, moderate impact, and severe impact) as illustrated in Figure 4.13-2. While higher project noise levels are permitted in areas with higher existing ambient conditions, the thresholds are designed to limit the total noise increase, with the smallest allowable increase at locations already affected by the highest existing noise levels.

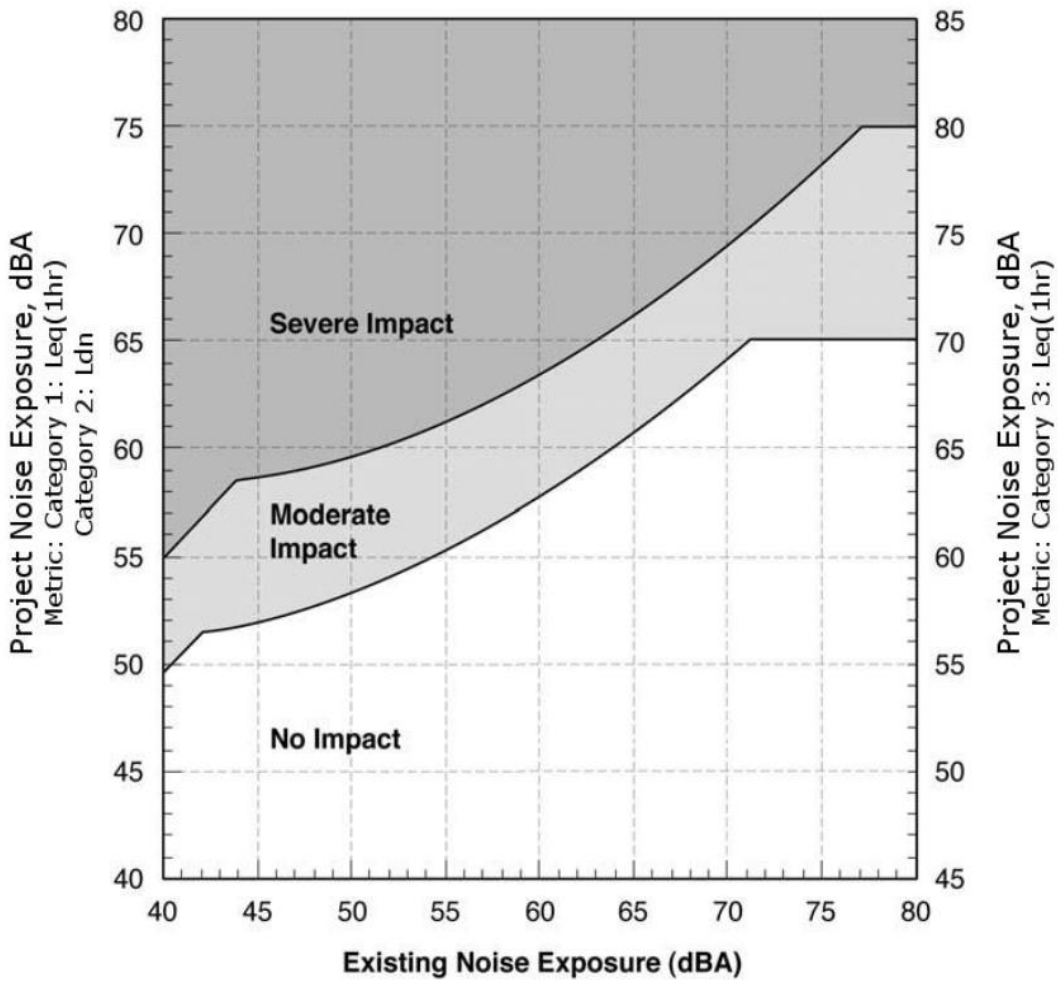
Construction Noise

According to the FTA manual, "[p]roject construction noise criteria should take into account the existing noise environment, the absolute noise levels during construction activities, the duration of the construction, and the adjacent land use". While FTA does not specify standardized criteria for construction noise impacts, it provides varying guidelines to be considered on a case-by-case basis depending, in part, on the level of detail available regarding the anticipated construction activities and schedule. Additionally, FTA considers a 10 dBA increase in high ambient noise levels (L_{dn} greater than 65 dB) to be a substantial temporary increase in noise levels. FTA does not provide guidance for a temporary substantial increase in noise levels in quieter areas.

Groundborne Noise and Vibration

The FTA manual also provides groundborne noise and vibration criteria for both project operations and construction. For operational vibration, the criteria are based on the potential for human annoyance and activity interference. The general criteria are summarized in Table 4.13-8.

Figure 4.13-2
FTA Noise Impact Criteria for Noise-Sensitive Uses (dBA)



Source: FTA 2018.

Land Use Category 1: Tracts of land where quiet is an essential element in their intended purposes. This category includes lands set aside for serenity and quiet, and such land uses as outdoor amphitheaters and concert pavilions, as well as National Historic Landmarks with significant outdoor uses. Also included are recording studios and concert halls. The noise metric for Category 1 is the outdoor 1-hour L_{eq} during the noisiest hour of activity.

Land Use Category 2: Residences and buildings where people normally sleep. This category includes homes, hospitals, and hotels where a nighttime sensitivity to noise is assumed of utmost importance. The noise metric for Category 2 is the outdoor L_{eq} or CNEL.

Land Use Category 3: Institutional land uses with primarily daytime and evening uses. This category includes schools, libraries, theaters, and churches where it is important to avoid interference with such activities as speech, meditation, and concentration on reading material. Places for meditation or study associated with cemeteries, monuments, museums, campgrounds, and recreational facilities can also be considered in this category. Certain historical sites and parks are also included. The noise metric for Category 3 is the outdoor 1-hour L_{eq} during the noisiest hour of activity.

Table 4.13-8
Groundborne Vibration and Groundborne Noise Impact Criteria for FTA General Assessment

Land Use Category	Groundborne Vibration Impact Levels			Groundborne Noise Impact Levels		
	Frequent Events[1]	Occasional Events[2]	Infrequent Events[3]	Frequent Events[1]	Occasional Events[2]	Infrequent Events[3]
Category 1: Buildings where vibration would interfere with interior operations.	65 VdB4	65 VdB4	65 VdB4	N/A5	N/A5	N/A5
Category 2: Residences and buildings where people normally sleep	72 VdB	75 VdB	80 VdB	35 dBA	38 dBA	43 dBA
Category 3: Institutional land uses with primarily daytime use	75 VdB	78 VdB	83 VdB	40 dBA	43 dBA	48 dBA

Source: FTA 2018.
[1] "Frequent Events" is defined as more than 70 vibration events of the same source per day. Most rapid transit projects fall into this category.
[2]"Occasional Events" is defined as between 30 and 70 vibration events of the same source per day. Most commuter trunk lines have this many operations.
[3] "Infrequent Events" is defined as fewer than 30 vibration events of the same kind per day. This category includes most commuter rail branch lines.
[4] This criterion limit is based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes. Vibration-sensitive manufacturing or research will require detailed evaluation to define the acceptable vibration levels. Ensuring lower vibration levels in a building often requires special design of the HVAC systems and stiffened floors.
[5] Vibration-sensitive equipment is generally not sensitive to ground-borne noise.

Additional criteria are provided for various types of special buildings such as concert halls, TV studios, recording studios, auditoriums, and theaters.

For vibration generated by construction, two types of potential impact are addressed: human annoyance and structural damage. Human annoyance from construction is assessed using the same general criteria discussed above for operational sources. FTA criteria for potential building damage are summarized in Table 4.13-9.

Table 4.13-9
FTA Construction Vibration Damage Criteria

Building Category	PPV (in/s)
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.

Department of Defense Instruction 4165.57

Department of Defense Instruction 4165.57 establishes policy, assigns responsibilities, and prescribes procedures for the DoD Air Installations Compatible Use Zones (AICUZs) program for military air installations. It also establishes policy and assigns responsibility for educating air installation personnel and engaging local communities on issues related to noise, safety, and compatible land use in and around air installations, and prescribes procedures for plotting noise contours for land use compatibility analysis. The noise compatibility criteria are basically the same as those indicated by the FAA in 14 CFR 150. As a result, AICUZ compatibility standards identify residential land uses as being compatible with aircraft noise levels of up to 65 dB CNEL.

STATE LAWS, REGULATIONS, PLANS, AND POLICIES

California State Aeronautics Act

The California State Aeronautics Act (SAA), pursuant to Public Utilities Code (PUC), Section 21001 et seq., was established "to protect the public interest in aeronautics and aeronautical progress." Airport land use compatibility planning, as required by the SAA, outlines the statutory requirements for Airport Land Use Commissions (ALUCs) including the preparation of ALUCPs for each public use airport in California. Caltrans' Division of Aeronautics administers much of the SAA and provides guidance for meeting the baseline safety and compatibility requirements.

Airport Land Use Compatibility Plans

The State requires that the San Diego County Regional Airport Authority (SDCRAA), as the ALUC, prepare ALUCPs for each public-use and military airport in San Diego County, as directed in PUC Section 21675. An ALUCP contains policies and criteria that address compatibility between airports and future land uses that surround them by addressing noise, overflight, safety, and airspace protection concerns to minimize the public's exposure to excessive noise and safety hazards within the airport influence area for each airport over a 20-year horizon.

ALUCPs include airport runway noise level contours typically in 5 dB increments between 50 and 75 dB CNEL (the range varies depending on the size of the airport). These noise contours reflect the existing and anticipated growth of the airport for at least the next 20 years and include potential development planning. ALUCPs provide noise compatibility criteria, typically in the form of a table or matrix that lists various different land uses and categorizes their compatibility across a range of different noise levels in 5 dB increments. The acceptability of each land use is to each 5-dB noise range is categorized as either "compatible," "conditionally compatible," or "incompatible."

Noise Insulation Standards

The California Noise Insulation Standards in Title 24 of the California Code of Regulations (CCR) set requirements for new residential units, hotels, and motels that may be subject to relatively high levels of transportation-related noise. For areas with exterior noise levels greater than 60 dBA, the noise insulation standard is 45 dBA in any habitable room; an acoustical analysis demonstrating how dwelling units have been designed to meet this interior standard is required where such units are proposed in such areas. 24 CCR Part 2, Section 1207.11.2 states, "[t]he noise metric must be either the day-night average sound level (Ldn) or the community noise equivalent level (CNEL), consistent with the noise element of the local general plan."

California Department of Transportation

Caltrans manages California's highways and freeways, provides intercity rail services, and permits public-use airports and special-use hospital heliports. Caltrans has programs and divisions with policies or regulations—including Aeronautics, Highway Transportation, Rail, and Mass Transportation. Caltrans Division of Rail uses FRA and FTA noise criteria and methodologies for assessing rail-related noise or vibration impacts. The Caltrans Division of Aeronautics is responsible for licensing and permitting programs for airports and heliports. Assistance for the development and maintenance of aviation facilities through engineering and aviation experience is also provided, as well as systems planning and environmental and community service programs. Caltrans provides numerous noise and vibration impact guidance documents for traffic noise, rail noise, airport noise, construction noise, and vibration, including the following.

- *Technical Noise Supplement to the Traffic Noise Analysis Protocol* (TeNS Manual) (2013a).
- *Traffic Noise Analysis Protocol (Protocol) for New Highway Construction, Reconstruction, and Retrofit Barrier Projects* (2011b).
- C*alifornia Airport Land Use Planning Handbook.* Division of Aeronautics (2011a).
- *Transportation and Construction Vibration Guidance Manual* (2013b).

Traffic Noise Guidance

As described previously, Caltrans is responsible for implementing 23 CFR 772 for federal or federally funded highway projects under NEPA Assignment. Therefore, Caltrans Protocol uses the same NAC as presented in 23 CFR 772 and provides further details on the policies and procedures to be used in conducting applicable traffic noise studies in California. Traffic noise impacts as defined occur when the predicted noise level in the design year approaches or exceeds the NAC, or a predicted noise level substantially exceeds the existing noise level (a “substantial” noise increase). In California, a substantial noise increase for these projects is considered to occur when the project’s predicted worst-hour design-year traffic noise level exceeds the existing worst-hour traffic noise level by 12 dBA or more. The use of 12 dB was established in California many years ago and is based on the concept that a 10 dB increase generally is perceived as a doubling of loudness. A collective decision by Caltrans staff, which was approved by FHWA, was made to use 12 dB (Caltrans 2011b).

According to the Protocol, significance of noise impacts for Caltrans’ CEQA documents (e.g., for projects that are subject to Caltrans oversight but are not subject to NEPA because there is no federal funding) is based on the project-related increase in noise and other project-specific conditions (but not the NAC). No single numerical threshold is used on all projects, and the project threshold is developed by the project team on a case-by-case basis. The Caltrans definition for a substantial increase in noise (i.e., a 12 dB increase between existing and design-year with-project conditions) has been used, but there would be cases where an increase less than 12 dB would approach significance (such as a quiet rural environment) or where a 12 dB increase would not necessarily be deemed significant (noisy urban environment) (Caltrans 2011b).

Construction Noise

As presented in the Protocol, Section 14-8.02, Noise Control of Caltrans Standard Specifications establishes a construction noise exposure/production limit of 86 dB L_{max} at 50 feet from job site from 9 p.m. to 6 a.m.

Airport Noise Guidance

Caltrans Division of Aeronautics prepared the *California Airport Land Use Planning Handbook* (Handbook), which provides guidance for conducting airport land use compatibility planning, most notably for the preparation, adoption, and amendment of an ALUCP (Caltrans 2011a). The Handbook provides a checklist of typical ALUCP contents, which includes scope of the ALUCP, airport information, compatibility policies and criteria, compatibility zone maps (including CNEL contours), review policies, preliminary review of plans and projects, land use information, compatibility issues, local government implementation, and supporting materials (Caltrans 2011a).

Vibration

Caltrans provides guidelines for the analysis of groundborne vibration relating to transportation and construction-induced vibration, including guideline criteria for potential building damage and human annoyance, as shown in Tables 4.13-10 and 4.13-11.

Table 4.13-10
Caltrans Guideline Vibration Building Damage Criteria

Structure and Condition	Maximum PPV (in/s)	
	Transient Sources	Continuous/Frequent Intermittent Sources
Extremely fragile historic buildings, ruins, ancient monuments	0.12	0.08
Fragile buildings	0.2	0.1
Historic and some old buildings	0.5	0.25
Older residential structures	0.5	0.3
New residential structures	1.0	0.5
Modern industrial/commercial buildings	2.0	0.5

Source: Caltrans 2013b.
Note: 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.

Table 4.13-11
Caltrans Guideline Vibration Human Annoyance Criteria

Human Response	Maximum PPV (in/s)	
	Transient Sources	Continuous/Frequent Intermittent Sources
Barely perceptible	0.04	0.01
Distinctly perceptible	0.25	0.04
Strongly perceptible	0.9	0.10
Severe	2.0	0.4

Source: Caltrans 2013b.
Note: 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.

General Plan Guidelines

The Governor's Office of Planning and Research (OPR) is required to adopt and periodically revise guidelines for the preparation and content of local general plans. The 2017 OPR General Plan Guidelines include noise/land use compatibility guidelines, which are shown in Table 4.13-12.

Table 4.13-12
OPR Noise/Land Use Compatibility Guidelines

Land Use Category	Community Noise Exposure, L_{dn} or CNEL, dB							
		55	60	65	70	75	80	
Residential – Low Density Single Family, Duplex, Mobile Homes								
Residential – Multifamily								
Transient Lodging – Motels, Hotels								
Schools, Libraries, Churches, Hospitals, Nursing Homes								
Auditoriums, Concert Halls, Amphitheaters								
Sports Arena, Outdoor Spectator Sports								
Playgrounds, Neighborhood Parks								
Golf Courses, Riding Stables, Water Recreation, Cemeteries								
Office Buildings, Business Commercial and Professional								

Land Use Category	Community Noise Exposure, L_{dn} or CNEL, dB
	55 · 60 · 65 · 70 · 75 · 80
Industrial, Manufacturing, Utilities, Agriculture	

Normally Acceptable	Conditionally Acceptable	Normally Unacceptable	Clearly Unacceptable
Specified land use is satisfactory based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.	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. Conventional construction, but with closed windows and fresh air supply systems or air conditioning, will normally suffice.	New construction or development should generally 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.	New construction or development should generally not be undertaken.

REGIONAL AND LOCAL LAWS, REGULATIONS, PLANS, AND POLICIES

General Plan Noise Elements

Local jurisdictions (cities and the County of San Diego) within the Plan Area adopt a noise element as part of their General Plan to identify, appraise, and remedy noise problems in local communities. Noise elements analyze and quantify current and projected noise levels associated with local noise sources, including, but not limited to, highways and freeways, primary arterials and major local streets, rail operations, air traffic associated with the airports, local industrial plants, and other ground stationary sources that contribute to the community noise environment. Beyond statutory federal standards, local jurisdictions may adopt their own noise goals and policies in their noise elements, or adopt noise/land use compatibility guidelines similar to, or the same as, those recommended by the State of California (OPR) (see Table 4.13-12). With the exception of two cities, Del Mar and Oceanside, all other jurisdictions in the region have adopted similar guidelines. The cities of Del Mar and Oceanside consider 65 dB CNEL as the maximum noise level compatible with residential land uses (City of Del Mar 1985, City of Oceanside 2002). For the purposes of assessing noise impacts, standards in the Noise Element are most commonly applied to transportation noise sources. The assessment of non-transportation noise levels is typically based on standards provided in the municipal code.

Local Noise/Vibration Ordinances/Municipal Code

In addition to noise element policies of general plans, local jurisdictions regulate noise through enforcement of their noise ordinances, which are typically contained in the municipal code. The municipal code standards are not applicable to transportation noise sources (roadways, railroads, etc.), but rather are used to control noise from stationary (i.e., non-transportation) sources such as commercial and industrial facilities by setting noise level limits. In addition, most noise ordinances provide separate standards to control noise from construction activities; these are usually a combination of noise levels limits and/or restrictions on the hours during which construction is permitted. Table 4.13-13 and Table 4.13-14 summarize the municipal noise level limits and the construction noise regulations, respectively, for each jurisdiction within the San Diego region. Some local jurisdictions also have regulations related to vibration, as summarized in Table 4.13-15.

Table 4.13-13
Summary of Applicable Property Line Noise Level Limits

Jurisdiction	General Land Use Zone								
	Residential			Commercial			Industrial		
	Daytime	Evening	Nighttime	Daytime	Evening	Nighttime	Daytime	Evening	Nighttime
Carlsbad	--	--	--	--	--	--	--	--	--
Chula Vista	55	55	45	65	65	60	70/80[1]	70/80[1]	70/80[1]
Coronado	50–55	45–50	40–45	60	60	50	--		--
Del Mar	50	50	40	60	60	50	60[2]	60[2]	50[2]
El Cajon	60	55	50	65	60	55	75	75	75
Encinitas	50–55	50–55	45–50	60	60	55	60	60	55
Escondido	50–55	50–55	45–50	60	60	55	70–75[1]	70–75[1]	70–75[1]
Imperial Beach[3]	--		--	--		--	--		--
La Mesa	60	55	50–55	65	65	60	70	70	70
Lemon Grove	50–60	45–55	40–50	60	55	55	70	70	70
National City	55–60	55–60	45–50	65	65	60	70–80[1]	70–80[1]	70–80[1]
Oceanside	50–55	50–55	45–50	65	65	60	70	70	65
Poway	50–55	50	40–45	60	55	55	70	70	70
San Diego, City	50–60	45–55	40–50	65	60	60	75	75	75
San Diego, County	50–55	50–55	45–50	60	60	55	70–75	70–75	70–75
San Marcos	--	--	--	--	--	--	--	--	--
Santee	50–55	45–50	40–45	60	55	50	70–75	70–75	70–75
Solana Beach	50–55	50–55	45	60	60	55	70	70	60
Vista	50–55	50–55	45–50	60	60	55	70	70	70

Source: City of Carlsbad 2021, City of Chula Vista 2021, City of Coronado 2021, City of Del Mar 2021, City of El Cajon 2021, City of Encinitas 2021, City of Escondido 2021, City of Imperial Beach 2021, City of La Mesa 2021, City of Lemon Grove 2021, City of National City 2021, City of Oceanside 2021, City of Poway 2021, City of San Diego 2021, County of San Diego 2021, City of San Marcos 2021, City of Santee 2021, City of Vista 2021.
--no sound level limits
[1] Light industry/heavy industry
[2] Railroad right-of-way zone
[3] The City of Imperial Beach noise ordinance does not contain quantifiable noise level limits at property lines but regulates noise based on disturbance of "the peace, quiet and comfort of the community by creating unreasonably loud or disturbing unnecessary noises."

Table 4.13-14
Summary of Local Construction Noise Standards

Jurisdiction	Municipal Code	Construction Hours Prohibited	Construction Noise Level Limits
Carlsbad	8.48	After 6 p.m. any day; before 7:00 a.m. weekdays; before 8:00 a.m. Saturday; Sundays; federal holidays.	None
Chula Vista	17.24	10:00 p.m.–7:00 a.m., Monday through Friday, and 10:00 p.m. and 8:00 a.m. Saturday and Sunday.	None
Coronado	41.10	7:00 p.m.–7:00 a.m. Monday through Saturday; Sundays; legal holidays	75 dBA L_{eq}
Del Mar	9.20	7:00 p.m.–7:00 a.m., Monday through Friday, and before 9:00 a.m. or after 7:00 p.m. Saturdays; Sundays; City holidays	75 dBA L_{eq} at residential properties
El Cajon	17.115	7:00 p.m.–7:00 a.m., within 500 feet of residential uses	None
Encinitas	9.32	7:00 p.m.–7:00 a.m. Monday through Saturdays; Sundays; federal holidays	75 dBA $L_{eq(8)}$ at residential properties
Escondido	17-234	6:00 p.m.–7:00 a.m., Monday through Friday, before 9:00 a.m. or after 5:00 p.m. Saturdays; Sundays; legal holidays	75 dBA L_{eq} at residential properties
Imperial Beach	9.32	10:00 p.m.–7:00 a.m.	Noises disturbing to the comfort and repose of any person residing or working in the vicinity, or 75 dBA 10 p.m.–7 a.m.
La Mesa	10.80	10:00 p.m.–7:00 a.m. Monday through Saturday; Sundays	None
Lemon Grove	9.24	7:00 p.m.–7:00 a.m. Monday through Saturday; Sundays; legal holidays	75 dBA $L_{eq(8)}$ at residential properties
National City	12.10	7:00 p.m.–7:00 a.m. weekdays; weekends; holidays	60–75 dBA at residential properties, 70-85 dBA at semi-residential/commercial properties
Oceanside	38.15	Case-by-case basis	Case-by-case basis
Poway	8.08	5:00 p.m.–7:00 a.m. Monday through Saturday; Sundays; federal holidays	75 dBA $L_{eq(8)}$ at residential properties
San Diego, City	59.5	7:00 p.m.–7:00 a.m. Monday through Saturday; Sundays; certain legal holidays	75 dBA L_{eq} at residential properties
San Diego, County	36.40	7:00 p.m.–7:00 a.m. Monday through Saturday; Sundays; legal holidays	75 dBA $L_{eq(8)}$ at residential properties
San Marcos	10.24	6:00 p.m.–7:00 a.m. Monday through Friday, before 8:00 a.m. or after 5:00 p.m. Saturdays; Sundays	None
Santee	5.04.090	7:00 p.m.–7:00 a.m. Monday through Saturday; Sunday; holidays	None

Jurisdiction	Municipal Code	Construction Hours Prohibited	Construction Noise Level Limits
Solana Beach	7.34	7:00 p.m.–7:00 a.m. weekdays; 7:00 p.m.-8:00 a.m. Saturday; Sundays; nine holidays	75 dBA $L_{eq(8)}$ at residential properties
Vista	NA	None	None

Source: City of Carlsbad 2021, City of Chula Vista 2021, City of Coronado 2021, City of Del Mar 2021, City of El Cajon 2021, City of Encinitas 2021, City of Escondido 2021, City of Imperial Beach 2021, City of La Mesa 2021, City of Lemon Grove 2021, City of National City 2021, City of Oceanside 2021, City of Poway 2021, City of San Diego 2021, County of San Diego 2021, City of San Marcos 2021, City of Santee 2021, City of Vista 2021. Dates shown are publication dates.

Table 4.13-15
Summary of Local Vibration Standards

Jurisdiction	Municipal Code	Vibration Regulation
Carlsbad	21.34.090	All industrial uses shall comply with the following performance standards: All uses shall be so operated as not to generate vibration discernible without instruments by the average person while on or beyond the lot upon which the source is located or within an adjoining enclosed space if more than one establishment occupies a structure. Vibration caused by motor vehicles, trains and temporary construction is exempted from this standard.
Chula Vista	19.66.080	No vibration, other than from transportation facilities or temporary construction work, shall be permitted which is discernible without instruments at the points of measurement specified in CVMC 19.66.060(A).
El Cajon	17.115	Every use shall be so operated that the ground vibration generated by such use is not harmful or injurious to the use or development of surrounding properties. No vibration shall be permitted which is perceptible without instruments at any use along the property line on which such use is located. For the purpose of this determination, the boundary of any lease agreement or operating unit or properties operating as a unit shall be considered the same as the property line.
Encinitas	30.40.010	Every use shall be so operated that the ground vibration generated at any time and measured at any point along the lot line of the lot on which the use is located shall not be perceptible and shall not exceed the vibration levels set forth in the regulation.
Lemon Grove	17.24.080	Vibrations. No detectable vibrations shall be permitted off the development site.
National City	12.10.180	The vibration perception threshold (motion velocity of 0.01 in/sec over the range of one to one hundred HZ) at or beyond the property boundary of the source on private property, or at a distance of 150 feet from the source if originating from a public space or ROW.
San Marcos	20.300.070	Vibration. Vibration may disturb the conduct of certain activities and create discomfort for some individuals. To minimize the disturbance and inconvenience from vibrations, no person or use shall create, maintain, or cause ground vibration that is discernible without instruments to a person of normal sensitivity at any point on a property that is adjacent to the property of the vibration source. The ground vibration caused by moving vehicles, trains, aircraft, or temporary construction or demolition is exempted.
Santee	13.30.030	Vibration. No operation or activity is permitted which will create vibration noticeable without instruments at the perimeter of the subject property

Source: City of Carlsbad 2021, City of Chula Vista 2021, City of El Cajon 2021, City of Encinitas 2021, City of Lemon Grove 2021, City of National City 2021, City of San Marcos 2021, City of Santee 2021. Dates shown are publication dates.

San Diego County Regional Airport Authority

In the San Diego region, the relationships of transportation, transit, and mobility, and of population growth to noise associated with aircraft in flight are the responsibility of the SDCRAA, established under State law to protect the safety and welfare of the general public and the ability of airports to operate now and in the future (SDCRAA 2014). One of SDCRAA's responsibilities is to serve as the ALUC for San Diego County. The SDCRAA is charged with creating, adopting, or updating ALUCPs for the region's 16 public-use and military airports in accordance with applicable State and federal laws. SDCRAA has adopted ALUCPs for 16 public-use or military airports in the San Diego region (SDIA 2021), including the following (with year of latest update):

- Agua Caliente Airport (2011)
- Borrego Valley Airport (2011)
- Brown Field (2010)
- Fallbrook Community Airpark (2011)
- Gillespie Field (2010)
- Jacumba Airport (2011)
- MCAS Camp Pendleton (2008)
- MCAS Miramar (2011)
- McClellan-Palomar Airport (2011)
- Montgomery Field (2010)
- Naval Air Station North Island (2020)
- Naval Outlying Landing Field - Imperial Beach (2015)
- Oceanside Municipal Airport (2010)
- Ocotillo Airport (2011)
- Ramona Airport (2011)
- SDIA – Lindbergh Field (2014)

The other remaining airports in the San Diego region include Tijuana International Airport (under the authority of Mexico), Coast Guard Air Station San Diego (military airfield), and Pauma Valley Airport (private airfield), which are not required to prepare an ALUCP.

The adopted ALUCPs of public-use airports in the San Diego region include an analysis of the existing and future aircraft noise level contours to assist local agencies in developing land use plans for areas surrounding the airports. ALUCPs differentiate allowed and prohibited land uses according to noise and land use compatibility guidelines. AICUZ studies also include contour maps, which are included in the noise element of general plans of each jurisdiction affected by public use and military airports, and are considered in the development of land use plans at the local level.

4.13.3 SIGNIFICANCE CRITERIA

Appendix G of the CEQA Guidelines provides criteria for evaluating the significance of a project's environmental impacts on noise, in the form of Initial Study checklist questions. The significance criteria specifically developed for this EIR are based on the Appendix G checklist questions provided from the updates to the CEQA Guidelines (OPR 2018), with modifications. For the purposes of this EIR, the proposed Plan would have a significant noise impact if it would result in:

NOI-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; or generate a substantial absolute increase in ambient noise.

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

NOI-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, the project would expose people residing or working in the project area to excessive noise levels.

4.13.4 ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

NOI-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; OR GENERATE A SUBSTANTIAL ABSOLUTE INCREASE IN AMBIENT NOISE

ANALYSIS METHODOLOGY

This section discusses the construction and operation noise impacts of forecasted regional growth and land use change, and planned transportation network improvements in comparison to the applicable noise standards and guidelines from city and county general plans (i.e., noise elements) and noise ordinances, or federal or State agencies (e.g., FTA and Caltrans). Noise impacts (NOI-1) are considered significant if they substantially increase ambient noise levels and exceed the applicable established noise standards required based on the type of project (e.g., local development, transit, highway projects, etc.).

Local construction and operational noise standards, determined at the project level, may apply to regional growth and land use change, as well as local transportation network improvements. As outlined under *Regional and Local Laws, Regulations, Plans, and Policies*, these local standards are typically supplied by the local noise element (noise/land use compatibility) for transportation noise, and the noise ordinance (municipal code) for non-transportation noise sources including construction. For noise and land use compatibility, the County of San Diego and all cities in the San Diego region, except for Del Mar and Oceanside, have adopted the OPR 2017 noise/land use compatibility guidelines as their land use compatibility noise standards, including 60 dB CNEL established as the "normally acceptable" noise level for residential uses. The cities of Del Mar and Oceanside have adopted 65 dB CNEL as the maximum noise level compatible with residential land uses (City of Del Mar 1985, City of Oceanside 2002). For construction and operational noise that would cause potential temporary or permanent increases in ambient noise levels at nearby sensitive receptors, local jurisdictions do not typically provide impact thresholds based solely on the magnitude of a temporary absolute increase in noise levels. Rather, the noise levels are considered substantial when they exceed the applicable regulatory standard.

For certain specific project types, thresholds based on local standards are replaced by thresholds based on the requirements or guidelines of other (regional, State, or federal) agencies:

- Caltrans/FHWA traffic noise criteria (NAC and substantial noise increases) for federal or federally funded highway project.
- Caltrans CEQA-only substantial noise increase standards for state highway projects, or local roadway projects with Caltrans oversight, that are not subject to NEPA.
- Caltrans construction noise criteria and specifications.

- FTA/FRA criteria (for construction and operational noise) for federal or federally funded rail, high speed rail, and other transit projects.
- ALUCP or AICUZ criteria for public use and military airports (discussed under Threshold NOI-3, below).

Detailed quantitative analysis of potential impacts is not practical given the high-level (programmatic) nature of the proposed Plan and the lack of specific project details. For this reason, the analysis is largely qualitative, supplemented with published data or sample calculations, where possible, to illustrate the points discussed in the analysis.

IMPACT ANALYSIS

2025

Regional Growth and Land Use Change

Between 2016 and 2025, regional population is forecasted to increase by 161,338 people (5 percent), adding 97,661 housing units (8 percent) and 115,328 jobs (7 percent). Much of this growth will occur in and around cities throughout the region. To accommodate regional growth by 2025, new development would include new housing units, services, commercial areas, industrial centers, schools, and civic uses.

New development could occur throughout the region and could result in new or increased noise at nearby land uses. Noise increases would be variable and dependent on the location of the improvements relative to the land uses, presence of shielding between the sources and receiver, and the existing ambient noise level from other nearby noise sources. Other factors that would affect the character of the noise increase would be the nature of the noise. Construction noise sources including conventional construction equipment such as bulldozers, graders, and backhoes could represent a temporary increase at nearby land uses. For projects where high impact construction equipment such as pile driving, blasting, or rock drilling would be necessary, a temporary increase would occur at nearby land uses as well as at land uses farther away. Based on noise levels in Table 4.13-4, conventional construction equipment would be on the order of 83 dBA at a distance of 50 feet and 94 dBA for high impact construction equipment (pile driving). Therefore, construction noise would attenuate to 75 dBA at distances of 125 and 400 feet, respectively (based on an attenuation rate of 6 dB per doubling of distance).[2] Stationary noise may also result in a permanent increase in noise at nearby land uses as new sources such as HVAC systems could exceed relevant thresholds outlined in the local jurisdictions municipal codes or general plans.

Additionally, regional growth and land use change could introduce new noise-sensitive receptors in areas that may exceed the local jurisdictional thresholds. As discussed in Section 4.13.2, *Regulatory Setting,* local jurisdictions have adopted both regulations promulgated in the jurisdiction’s municipal codes and/or general plans. Adherence to these regulations would be required. Additionally, federal or State requirements for noise reduction may be required dependent on the type of development and the presence of a federal action or nexus. However, while adherence to regulations would reduce noise impacts, there is no assurance that noise impacts would be below levels of significance. As such, impacts of regional growth and land use change as they relate to noise would be significant.

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[2] Distances are considered conservative as they do not account for excess ground attenuation, or the presence of intervening structures such as barriers, topography, or buildings.

Transportation Network Improvements and Programs

Improvements to transportation networks such as new managed or toll lanes, or general operational improvements that would increase capacity along the freeway network throughout the region, as well as improvements to arterial streets could result in new or increased noise at nearby land uses.[3] Operational increases in noise could result from an increase in traffic volumes and/or a change in the vehicle mix, which could exceed either local municipal, State, and/or federal thresholds. Noise increases would be variable and dependent on the location of improvements relative to the land uses, the presence of shielding between the sources and receiver, and the existing ambient noise level from other nearby noise sources. Noise from operational additions such as new toll or managed lanes would generally increase the noise levels from the facility incrementally. A 3 dB increase would require a doubling of the noise sources. Therefore, noise increases may not be perceptible at nearby noise-sensitive land uses.

Transportation projects would be subject to the requirements of the local jurisdiction discussed above in Section 4.13.2. Transportation network projects with federal involvement or located on the state highway system would be required to comply with federal (23 CFR 772) and State (Caltrans) guidance. For projects with federal involvement to be subject to the requirements of 23 CFR 772, the project would have to meet the definition of a Type I project (as defined in Section 4.13.1). If a project did not meet the definition, it would not require noise analysis regardless of any Federal nexus. Therefore, while noise from freeway facilities may only increase incrementally, these increases may still result in impacts.

Other improvements include the Otay Mesa Port of Entry (POE) Commercial Vehicle Enforcement Facility (CVEG) modernization; pilot programs for streamlining commercial vehicle operations for reducing wait times at the Otay Mesa POE; improvements to the Otay Mesa POE southbound truck route, including Otay Truck Route and La Media Road; and tolling equipment and Regional Border Management System investments on State Route (SR) 11. Support for ongoing maintenance and rehabilitation of the Complete Corridor system are also included in the 2025 phase. Similar to the transportation network projects above, these would likely be subject to local, State, and/or federal requirements.

Transit-oriented improvements are proposed in the Phased Transit Leap improvements, including double-tracking at certain locations on the Los Angeles–San Diego–San Luis Obispo (LOSSAN) rail corridor along with a station addition in the Gaslamp Quarter, San Diego. Rapid Route improvements and operational support, maintenance facilities, and vehicle purchases are included in the 2025 phase, as are local bus route frequency enhancements. These improvements could result in new or increased noise at nearby land uses. Operational increases in noise could result from an increase in rail or rapid bus transit traffic, which could exceed either local municipal, State, and/or federal thresholds. Similar to transportation improvements, noise increases would be variable and dependent on the location of improvements relative to the land uses, the presence of shielding between the sources and receiver, and the existing ambient noise level from other nearby noise sources. As referenced above, an increase of 3 dB would result from a doubling of the source noise, such as from increased operation of passenger and freight trains from doubling tracking or increased bus services from new Rapid Routes. While increases of this nature may not be noticeable, impacts may still occur.

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[3] Chapter 2 includes a complete list of interstate and state highways and facilities where proposed improvements are anticipated.

FTA guidance determines impacts based on the increase associated with the project over the ambient noise level (Figure 4.13-2). As such impacts could occur that would require consideration. Additionally, new operational stationary or maintenance noise sources could result in increased noise levels at nearby land uses. Any improvements associated with the Phased Transit Leap Network would be subject to the requirements of the local jurisdiction, as discussed above in Section 4.13.2, as well as federal (FTA Noise and Vibration Guidance and FRA regulations) requirements. Projects subject to the requirements of the FTA guidance that are at or exceed the screening distances from noise-sensitive receptors, as listed Table 4.13-3, may not require detailed noise analysis.

Construction noise sources associated with transportation network improvements could result in a temporary increase at nearby land uses dependent on the factors listed above. As discussed construction noise would likely attenuate to 75 dBA within 125 and 400 feet for conventional and high impact construction equipment, respectively. Construction noise sources for either of these types of improvements would be subject to the requirements of local jurisdictions, and/or State requirements such as SS 14-8.02 or the guidance in the *FTA Transit Noise and Vibration Manual*.

As discussed in Section 4.13.2 local jurisdictions have adopted both regulations promulgated in their municipal codes and/or general plans. Adherence to these regulations would be required. Federal or State requirements for noise reduction may be required dependent on the type of project and the presence of a federal action or nexus. However, while adherence to regulations would reduce noise impacts, there is no assurance that noise impacts would be reduced to below levels of significance. As such, impacts from transportation network improvements and programs as they relate to noise are significant.

2025 Conclusion

Between 2016 and 2025, regional growth and land use change and transportation network improvements could increase noise levels throughout the region, resulting in new or increased noise impacts that exceed applicable standards or represent substantial increases in ambient noise levels. Therefore, the impact (NOI-1) in the year 2025 would be significant.

2035

Regional Growth and Land Use Change

Between 2026 and 2035, regional population is forecasted to increase by 149,500 people (4 percent), adding 121,650 housing units (9 percent) and 159,728 jobs (9 percent). Similar to horizon year 2025, growth will occur in and around cities throughout the region. To accommodate regional growth by 2035, new development would include new housing units, services, commercial areas, industrial centers, schools, and civic uses.

New development could occur throughout the region and could result in new or increased noise at nearby land uses. Noise increases would be variable, as discussed above in horizon year 2025. Construction noise sources could represent a temporary increase at nearby land uses. It is anticipated that construction noise would attenuate to 75 dBA at distances of 125 feet (for conventional construction equipment) and 400 feet (for high impact construction equipment). Stationary noise sources may also result in a permanent increase in noise at nearby land uses. Additionally, regional growth and land use change could introduce new noise-sensitive receptors in areas that may exceed the local jurisdictional thresholds. As discussed above under year 2025, adherence to applicable regulations would be required. However, while adherence to regulations would reduce noise impacts, there is no assurance that noise impacts would be reduced below levels of significance. As such, impacts of regional growth and land use change as they relate to noise would be significant.

Transportation Network Improvements and Programs

Improvements to transportation network include new managed lanes and connectors along the regional interstate and state highway system as well as improvements to arterial streets, which could result in new or increased noise at nearby land uses.[4] As discussed above, operational increases in noise would be dependent on a variety of factors and could exceed either local municipal, State, and/or federal thresholds. Similar to horizon year 2025, operational increases may only increase incrementally. However, transportation projects would be subject to the requirements of the local jurisdiction discussed above in Section 4.13.2. Transportation network projects with federal involvement or located on the state highway system would be required to comply with federal (23 CFR 772) and State (Caltrans) guidance. For projects with federal involvement to be subject to the requirements of 23 CFR 772, the project would have to meet the definition of a Type I project (as defined in Section 4.13.2). If a project did not meet the definition, the project would not require noise analysis regardless of any federal nexus. Other improvements that are planned during this time horizon that may not be subject to federal requirements could include expected ATDM improvements along the federal and state highway systems as well as shoulder widening projects. Therefore, while noise from freeway facilities may only increase incrementally, these increases may still result in impacts.

Other transportation-oriented improvements could include Phased Transit Leap improvements, including double-tracking at certain locations on LOSSAN rail corridor along with increases in COASTER frequencies, the Del Mar Tunnel and along the Green Line, new stations at the Central Mobility Hub and at Camp Pendleton, and a Grade Separation at Leucadia Boulevard. Other transit-based improvements would include the Anchor Mobility Hub at the San Ysidro Transit Center and various Rapid Routes along the Central Mobility Hub. The 2035 phase also includes a major new commuter rail line (Route 582) between National City and Sorrento Mesa in addition to light rail investments with SPRINTER, Blue Line, and Orange Line double-tracking and grade separations. Improvements during the 2035 horizon year could result in new or increased noise at nearby land uses similar to horizon year 2025. As referenced above, an increase of 3 dB would result from a doubling of the source noise, such as from increased operation of passenger and freight trains from double-tracking or increased bus services from new Rapid Routes. While increases of this nature may not be noticeable, impacts may still occur.

FTA guidance determines impacts based on the increase associated with the project over the ambient noise level (Figure 4.13-2). As such, impacts could occur that would require consideration. Operational increases in noise would be variable and could result from an increase in rail or rapid bus transit traffic that could exceed either local municipal thresholds or State and/or federal thresholds. New operational stationary or maintenance noise sources could result in increased noise levels at nearby land uses. Any improvements associated with the Phased Transit Leap Network would be subject to the requirements of the local jurisdiction discussed above in Section 4.13.2 as well as federal (FTA Noise and Vibration Guidance and FRA regulations) requirements. Projects subject to the requirements of the FTA guidance that are at or exceed the screening distances from noise-sensitive receptors, as listed Table 4.13-3, may not require detailed noise analysis.

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[4] Chapter 2 includes a complete list of interstate and state highways and facilities where proposed improvements are anticipated.

Construction noise sources associated with transportation network improvements or Phased Transit Leap Network Improvements could result in a temporary increase at nearby land uses dependent on the factors listed above. Construction noise would likely attenuate to 75 dBA within 125 and 400 feet for conventional and high impact construction equipment, respectively. Construction noise sources for either of these types of improvements would be subject to the requirements of local jurisdictions, and/or State requirements such as SS 14-8.02 or the guidance in the *FTA Transit Noise and Vibration Manual*.

As discussed above for the 2025 phase, adherence to federal, State, and local regulations would be required. However, while adherence to regulations would reduce noise impacts, there is no assurance that impacts would be reduced below levels of significance. As such, impacts from transportation network improvements and programs as they relate to noise would be significant.

2035 Conclusion

Between 2026 and 2035, regional growth and land use change and transportation network improvements could increase noise levels throughout the region, resulting in new or increased noise impacts that exceed applicable standards or represent substantial increases in ambient noise levels. Therefore, the impact (NOI-1) in the year 2035 would be significant.

2050

Regional Growth and Land Use Change

By 2050, regional population is forecasted to increase by 125,725 people (3 percent), adding 61,433 housing units (4 percent) and 164,843 jobs (8 percent). Similar to horizon years 2025 and 2035, growth will occur in and around cities throughout the region. To accommodate regional growth by 2025, new development would include new housing units, services, commercial areas, industrial centers, schools, and civic uses.

New development could occur throughout the region and could result in new or increased noise to nearby land uses. Noise increases would be variable as discussed under horizon year 2025. Construction noise sources could represent a temporary increase at nearby land uses. It is anticipated that construction noise would attenuate to 75 dBA at distances of 125 feet (for conventional construction equipment) and 400 feet (for high impact construction equipment). Other factors that would affect the character of the noise increase would be the nature of the noise increase. Construction noise sources could represent a temporary increase at nearby land uses dependent on the factors listed above, whereas installation of stationary noise sources may also result in a permanent increase in noise at nearby land uses. Additionally, regional growth and land use change could introduce new noise-sensitive receptors in areas that may exceed the local jurisdictional thresholds. As discussed above under years 2025 and 2035, adherence to applicable regulations would be required. However, while adherence to regulations would reduce noise impacts, there is no assurance that impacts would be reduced below levels of significance. As such, impacts of regional growth and land use change as they relate to noise would be significant.

Transportation Network Improvements and Programs

Improvements to transportation network include new managed lanes throughout the region as well as improvements to arterial streets, which could result in new or increased noise at nearby land uses.[5] Operational increases in noise could result from an increase in traffic volumes and/or a change in the vehicle mix, which could exceed either local municipal, State, and/or federal thresholds. Noise increases would be variable and dependent on the location of improvements relative to the land uses, presence of shielding between the sources and receiver, and the existing ambient noise level from other nearby noise sources. Transportation projects would be subject to the requirements of the local jurisdictions discussed above in Section 4.13.2. Transportation network projects with federal involvement or located on the state highway system would be required to comply with federal (23 CFR 772) and State (Caltrans) guidance. For projects with federal involvement to be subject to the requirements of 23 CFR 772, the project would have to meet the definition of a Type I project (as defined in Section 4.13.2). If a project did not meet the definition, the project would not require noise analysis regardless of any federal nexus. Therefore, while noise from freeway facilities may only increase incrementally, these increases may still result in impacts.

Other transportation-oriented improvements could include Phased Transit Leap improvements, including double-tracking at certain locations on LOSSAN rail corridor along with increases in COASTER frequencies. The 2050 phase also includes three major new commuter rail lines: between Downtown San Diego and El Cajon (Route 581); National City to the U.S. Border (Route 582 [Extension]), and the Central Mobility Hub to the U.S. Border (Route 583). There are also planned light rail investments with SPRINTER, Green Line, and Orange Line double-tracking, as well as double-tracking and grade separations on the Blue Line. Other transit-based improvements would include Rapid Routes throughout the region. Improvements during the 2050 horizon year could result in new or increased noise at nearby land uses similar to horizon years 2025 and 2035. As referenced above, an increase of 3 dB would result from a doubling of the source noise, such as from increased operation of passenger and freight trains from double-tracking or increased bus services from new Rapid Routes. While increases of this nature may not be noticeable, impacts may still occur. FTA guidance determines impacts based on the increase associated with the project over the ambient noise level (Figure 4.13-2). As such impacts could occur that would require consideration. Operational stationary or maintenance noise sources could result in increased noise levels at nearby land uses. Any improvements associated with the Phased Transit Leap Network would be subject to the requirements of the local jurisdiction, as discussed in Section 4.13.2, as well as federal (FTA Noise and Vibration Guidance and FRA regulations) requirements. Projects subject to the requirements of the FTA guidance that are at or exceed the screening distances from noise-sensitive receptors, as listed Table 4.13-3, may not require detailed noise analysis.

Construction noise sources associated with transportation network improvements or Phased Transit Leap Network Improvements could result in a temporary increase at nearby land uses dependent on the factors listed above. Construction noise would likely attenuate to 75 dBA within 125 and 400 feet for conventional and high impact construction equipment, respectively. Construction noise sources for either of these types of improvements would be subject to the requirements of local jurisdictions and/or State requirements such as SS 14-8.02 or the guidance in the *FTA Transit Noise and Vibration Manual*.

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[5] Chapter 2 includes a complete list of interstate and state highways and facilities where proposed improvements are anticipated.

As discussed under the 2025 and 2035 phases, adherence to federal, State, and local regulations would be required. However, while adherence to regulations would reduce noise impacts, there is no assurance that impacts would be reduced below levels of significance. As such, impacts from transportation network improvements and programs as they relate to noise are significant.

2050 Conclusion

Between 2036 and 2050, regional growth and land use change and transportation network improvements could increase noise levels throughout the region, resulting in new or increased noise impacts that exceed applicable standards or represent substantial increases in ambient noise levels. Therefore, the impact (NOI-1) in the year 2050 would be significant.

Exacerbation of Climate Change Effects

No climate change effects on the generation of a substantial temporary or permanent increase in ambient noise levels have been documented. The proposed Plan is not expected to exacerbate climate change effects on generation of a substantial temporary or permanent increase in ambient noise levels.

MITIGATION MEASURES

NOI-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; OR GENERATE A SUBSTANTIAL ABSOLUTE INCREASE IN AMBIENT NOISE

2025, 2035, and 2050

NOI-1a Implement Construction Noise Reduction Measures for Development Projects and Transportation Network Improvements. During project-level CEQA review and during construction of development projects and transportation network improvements, the County of San Diego, cities, and other local jurisdictions can and should, SANDAG shall, and other transportation project sponsors can and should, implement construction noise reduction measures to substantially lessen the exposure of noise-sensitive receptors to construction noise levels to achieve applicable noise standards or prevent substantial temporary increases in noise levels in the planning, design, project-level CEQA review, and construction of development projects or transportation network improvements. These measures should include, but are not limited to, the following.

- Maintain construction equipment and vehicles per manufacturers' specifications and fit equipment with noise suppression devices (e.g., improved mufflers, equipment redesign, intake silencers, wraps, ducts, engine enclosures).
- Minimize construction equipment idling when equipment is not in use.
- Provide buffer zones or other techniques between stationary equipment (such as generators, compressors, rock crushers, and cement mixers) and the noise receptor.
- For impact tools (e.g., jack hammers, pavement breakers, rock drills), use hydraulically or electrically powered tools; where use of pneumatic tools is unavoidable, use an exhaust muffler on the compressed

air exhaust. Use external jackets on the tools themselves. Use quieter procedures such as drills rather than impact equipment.

- For rock-crushing or screening operations, place material stockpiles as a noise barrier blocking line-of-sight between the operations and receptors.

In addition, for pile driving or other activities generating greater than 90 dBA during construction of development projects or transportation network improvements, the County of San Diego, cities, and other local jurisdictions can and should, SANDAG shall, and other transportation project sponsors can and should, implement noise reduction measures, including but not limited to, the following.

- Erect temporary noise barriers around the noise generating activities, particularly adjacent to residential buildings.
- Implement "quiet" pile driving technology (such as pre-drilling of piles, the use of more than one pile driver to shorten the total pile driving duration) or vibratory pile-driving, where feasible, in consideration of geotechnical and structural requirements and conditions.
- Monitor the effectiveness of noise attenuation measures by performing compliance noise monitoring at noise-sensitive receptors during construction.

NOI-1b Implement Operational Noise Reduction Measures for Transportation Network Improvements. During the planning, design, and project-level CEQA review, and construction of transportation network improvements, SANDAG shall, and other transportation project sponsors can and should, implement operational noise reduction measures to substantially lessen the exposure of noise-sensitive receptors to construction noise levels to achieve applicable noise standards or prevent substantial permanent increases in noise levels. These measures should include, but are not limited to, the following.

- Utilize techniques such as grade separation, buffer zones, landscaped berms, dense plantings, sound walls, reduced-noise paving materials, building insulation, and traffic calming measures.

In addition, for railway projects, SANDAG shall, and other transportation project sponsors can and should, implement measures to substantially lessen noise levels to achieve FTA/FRA railway noise exposure thresholds during planning, design, and project-level CEQA review. These measures should include, but are not limited to, the following.

- Use wheel treatments such as damped wheels and resilient wheels.
- Use vehicle treatments such as vehicle skirts and under car acoustically absorptive material.
- Establish sufficient buffer zones between railroad and receptors.
- Use sound reduction barriers such as landscaped berms and dense plantings.
- Install sound insulation treatments for impacted structures.
- Implement FRA "quiet zone" requirements in cooperation with local jurisdictions (i.e., reducing or eliminating the requirement for train locomotives to blast their horns) for Plan improvements at new and existing at-grade rail crossings.
- Conduct project-level noise analysis for new and expanded rail corridors and features such as new rail tracks and double-tracking to ensure that measures are implemented to substantially lessen noise levels that exceed applicable standards.

NOI-1c Implement Operational Noise Reduction Measures for Development Projects. During planning, design, and project-level CEQA review of development projects, the County of San Diego, cities, and other local jurisdictions can and should implement noise reduction measures to meet local noise standards, including but not limited to, the following.

- Use land use measures such as zoning, site design, and buffers to ensure that future development is noise compatible with adjacent transportation facilities and land uses.
- Site noise-sensitive land uses away from noise-generating facilities. Once sited, orient outdoor use areas of land uses (e.g., backyards) away from adjacent noise sources to shield area with buildings, or construct noise barriers to reduce exterior noise levels.

SIGNIFICANCE AFTER MITIGATION

2025, 2035, and 2050

Mitigation measures NOI-1a, NOI-1b, and NOI-1c would substantially reduce significant noise impacts caused by exceedances of noise standards. However, it cannot be guaranteed that all future project-level impacts would be mitigated to a less than significant level. Therefore, this impact (NOI-1) would remain significant and unavoidable.

NOI-2 GENERATION OF EXCESSIVE GROUNDBORNE VIBRATION OR GROUNDBORNE NOISE LEVELS

ANALYSIS METHODOLOGY

This section discusses the construction and operational vibration impacts of forecasted regional growth and land use change, and planned transportation network improvements in comparison to the applicable standards and guidelines. Few of the local jurisdictions (cities and County) provide vibration criteria; therefore, guidance and criteria from FTA and Caltrans are used. Vibration impacts (NOI-2) are considered significant if they exceed the criteria provided by FTA or Caltrans (as applicable, depending on project type) for human annoyance/disturbance or building damage.

Detailed quantitative analyses of potential impacts is not practical given the high-level (programmatic) nature of the proposed Plan and the lack of specific project details. For this reason, the analysis is largely qualitative, supplemented with published data or sample calculations, where possible, to illustrate the points discussed in the analysis.

IMPACT ANALYSIS

2025

Regional Growth and Land Use Change

Between 2016 and 2025, regional population is forecasted to increase by 125,725 people (3 percent), adding 61,433 housing units (4 percent) and 164,843 jobs (8 percent). Growth will occur in and around cities throughout the region. To accommodate regional growth by 2025, new development would include new housing units, services, commercial areas, industrial centers, schools, and civic uses.

Vibration sources associated with new development such as housing and commercial development are generally associated with conventional construction equipment which could expose nearby vibration-sensitive land uses to levels of vibration that exceed local or State thresholds for damage or annoyance. Both Caltrans and the FTA include vibration criteria for damage and human annoyance (Tables 4.13-8 through 4.13-11) that can also be applied to land use project construction. Other local jurisdictions within the region also have vibration thresholds. Additionally, construction may include vibration generating equipment in close proximity to fragile buildings or sensitive receptors and may include vibration intensive equipment, such as pile-drivers. Therefore, construction vibration impacts are significant.

However, operational vibration from residential and commercial sources are generally associated with vehicles such as trucks accessing local roadway networks. These sources generally do not produce noticeable levels of vibration. Therefore, impacts from operations would be less than significant.

Transportation Network Improvements and Programs

Transportation network improvements along highway facilities include new Managed Lanes on Interstate (I-) 5 from Manchester Avenue to Vandegrift, new toll lanes on SR 11 to the Otay Mesa POE, Interchange and Arterial Operational improvements at SR 94 and SR 125, and regional transportation system improvements along the regional highway system, including investments along: I-5, I-15, SR 15, I-805, I-8, SR 78, SR 56, SR 52, SR 94, SR 54, SR 163, SR 125, SR 905, and SR 67. Improvements to local arterial streets are also planned throughout the region. Other improvements include the Otay Mesa POE CVEG modernization; pilot programs for streamlining commercial vehicle operations for reducing wait times at the Otay Mesa POE; improvements to the Otay Mesa POE southbound truck route, including Otay Truck Route and La Media Road; and tolling equipment and Regional Border Management System investments on SR 11. Support for ongoing maintenance and rehabilitation of the Complete Corridor system are also included in the 2025 phase.

Improvements to transportation networks listed above throughout the region as well as improvements to arterial streets could result in new or increased vibration. Operational vibration increases could result from increased truck or bus traffic accessing the highway or local roadway system. Generally, trucks and buses would not produce significant levels of vibration at distances of more than 25 feet (based on the reference sources listed by the FTA). As such impacts from operational improvements along the regional highway and local roadway system would not likely result in significant vibration impacts at nearby receptors.

Transit-oriented improvements included in the Phased Transit Leap improvements include double-tracking at certain locations on the LOSSAN rail corridor along with a station addition in the Gaslamp Quarter, San Diego. Rapid Route improvements and operational support, maintenance facilities, and vehicle purchases are included in the 2025 phase, as are local bus route frequency enhancements. These improvements could result in new or increased vibration at nearby land uses. Increased vibration could result from new or increased rail or rapid bus transit traffic, which could exceed either local municipal, State, and/or federal thresholds. The FTA includes a screening distance tool (Table 4.13-5) that identifies distances to land uses at which vibration would attenuate to below impact levels. Therefore, projects located at distances that exceed these criteria would not likely be subject to levels of vibration that would result in impacts. However, as many of the improvements are located close to vibration-sensitive land uses, improvements associated with the Phased Transit Leap Network would be subject to the requirements of the local jurisdiction discussed above in Section 4.13.2, as well as federal and State (FTA and Caltrans guidance) requirements. Even with compliance with these requirements, impacts would be significant.

Construction vibration sources associated with transportation network improvements or Phased Transit Leap Network Improvements could result in a temporary increase at nearby land uses. Vibration sources could include conventional construction equipment sources such as loaded trucks or bull dozers and/or high impact construction equipment such as pile drivers, or blasting. Improvements would be subject to the requirements of local jurisdiction, State, and/or federal guidance. Even with compliance with these requirements, impacts would be significant.

2025 Conclusion

Improvements associated with regional growth and land use changes and transportation network improvements could generate increases in groundborne vibration or groundborne noise levels. Therefore, the impact (NOI-2) in the year 2025 would be significant for construction relating to both regional growth and transportation network improvements, and relating to operation of transportation network improvements. Non-construction impacts relating to regional growth are less than significant.

2035

Regional Growth and Land Use Change

Between 2026 and 2035, regional population is forecasted to increase by 149,500 people (4 percent), adding 121,650 housing units (9 percent) and 159,728 jobs (9 percent). Similar to horizon year 2025, Growth will occur generally in and around cities throughout the region. To accommodate regional growth by 2035, new development would include new housing units, services, commercial areas, industrial centers, schools, and civic uses.

Vibration sources associated with new development such as housing and commercial development are generally associated with conventional construction equipment which could expose nearby vibration-sensitive land uses to levels of vibration that exceed local or State thresholds for damage or annoyance. Both Caltrans and the FTA include vibration criteria for damage and human annoyance (Tables 4.13-8 through 4.13-11). Other local jurisdictions within the region also have vibration thresholds. Additionally, construction may include vibration generating equipment in close proximity to fragile buildings or sensitive receptors and may include vibration intensive equipment, such as pile-drivers, and thus construction vibration impacts are considered significant.

Operational vibration from residential and commercial sources are generally associated with vehicles such as trucks accessing local roadway networks. These sources generally do not produce noticeable levels of vibration. Therefore, impacts from operations would be less than significant.

Transportation Network Improvements and Programs

Transportation network improvements along highway facilities include new Managed Lanes and Managed Lane Connectors along SR 15, SR 52, SR 94, SR 78, SR 163, SR 125, I-5, I-8, I-15, and I-805 as well as direct access ramps (DARs) along I-5 and SR 125. Local arterial improvements are also planned between 2026 and 2035. These improvements, as well as improvements to arterial streets, could result in new or increased vibration. Operational vibration could result from increased truck or bus traffic accessing the highway or local roadway system. Generally, trucks and buses would not produce significant levels of vibration more than 25 feet (based on the reference sources listed by the FTA). As such impacts from operational improvements along the regional highway and local roadway system would not likely result in significant vibration impacts at nearby receptors.

Other transportation-oriented improvements could include Phased Transit Leap improvements, including double-tracking at certain locations on the LOSSAN rail corridor along with increases in COASTER frequencies, the Del Mar Tunnel and along the Green Line, new stations at the Central Mobility Hub and at Camp Pendleton, and a Grade Separation at Leucadia Boulevard. Other transit-based improvements would include the Anchor Mobility Hub at the San Ysidro Transit Center and various Rapid Routes along the Central Mobility Hub. The 2035 phase also includes a major new commuter rail line (Route 582) between National City and Sorrento Mesa in addition to light rail investments with SPRINTER, Blue Line, and Orange Line double-tracking and grade separations. These improvements could result in new or increased vibration at nearby land uses. Increased vibration could result from new or increased rail or rapid bus transit traffic, which could exceed either local municipal, State, and/or federal thresholds. The FTA includes a screening distance tool (Table 4.13-5) that identifies distances to land uses at which vibration would attenuate to below impact levels. Therefore, projects located at distances that exceed these criteria would not likely be subject to levels of vibration that would result in impacts. However, as many of the improvements are located close to vibration-sensitive land uses, improvements associated with the Phased Transit Leap Network would be subject to the requirements of the local jurisdictions discussed in Section 4.13.2, as well as federal and State (FTA Noise and Vibration Guidance and Caltrans guidance) requirements. Even with compliance with these requirements, impacts would be significant.

Construction vibration sources associated with transportation network improvements or Phased Transit Leap Network Improvements could result in a temporary increase at nearby land uses. Vibration could result from the use of conventional construction equipment sources such as loaded trucks or bull dozers and/or high impact construction equipment such as pile drivers, or from blasting. Improvements would be subject to the requirements of local jurisdiction, State, and/or federal guidance. Even with compliance with these requirements, impacts would be significant.

2035 Conclusion

Improvements associated with regional growth and land use changes and transportation network improvements could generate substantial increases in groundborne vibration or groundborne noise levels. Therefore, the impact (NOI-2) in the year 2035 would be significant for construction relating to both regional growth and transportation network improvements, and relating to operation of transportation network improvements. Non-construction impacts relating to regional growth are less than significant.

2050

Regional Growth and Land Use Change

Between 2026 and 2050, regional population is forecasted to increase by 125,725 people (3 percent), adding 61,433 housing units (4 percent) and 164,843 jobs (8 percent). Similar to horizon years 2025 and 2035, growth will occur in and around cities throughout the region. To accommodate regional growth by 2050, new development would include new housing units, services, commercial areas, industrial centers, schools, and civic uses.

Vibration sources associated with new development such as housing and commercial development are generally associated with conventional construction equipment which could expose nearby vibration-sensitive land uses to levels of vibration that exceed local or State thresholds for damage or annoyance. Both Caltrans and the FTA include vibration criteria for damage and human annoyance (Tables 4.13-8 through 4.13-11). Other local jurisdictions within the region also have vibration thresholds. Additionally, construction may include vibration generating equipment in close proximity to fragile buildings or sensitive receptors and may include vibration intensive equipment, such as pile-drivers, and thus construction vibration impacts are considered significant.

Operational vibration from residential and commercial sources are generally associated with vehicles such as trucks accessing local roadway networks. These sources generally do not produce noticeable levels of vibration. Therefore, impacts from operations would be less than significant.

Transportation Network Improvements and Programs

Improvements to the regional transportation system improvements along the regional highway system include new Managed Lanes and Managed Lane Connectors along SR 52, SR 56, SR 54, SR 125, and SR 905, and on I-5, I-8, 1 I-5, and I-805, as well as DARs along SR 125 and SR 905. Other improvements are assumed along SR 76, SR 78, SR 79, SR 94, and I-8. Local arterial improvements are also planned during this time frame. Improvements to transportation networks throughout the region as well as improvements to arterial streets could result in new or increased vibration. Operational vibration increases could result from increased truck or bus traffic accessing the highway or local roadway system. Generally, trucks and buses would not produce significant levels of vibration more than 25 feet (based on the reference sources listed by the FTA). As such, impacts from operational improvements along the regional highway and local roadway system would not likely result in significant vibration impacts at nearby receptors.

Other transportation-oriented improvements could include Phased Transit Leap improvements, including double-tracking at certain locations on LOSSAN rail corridor along with increases in COASTER frequencies. This phase also includes three major new rail lines with routes between Downtown San Diego and El Cajon (Route 581); National City to the U.S. Border (Route 582 [Extension]), and the Central Mobility Hub to the U.S. Border (Route 583). It also includes light rail investments with SPRINTER, Green Line, and Orange Line double-tracking, as well as double-tracking and grade separations on the Blue Line. Other transit-based improvements would include Rapid Routes throughout the region.

These improvements could result in new or increased vibration at nearby land uses. Increased vibration could result from new or increased rail or rapid bus transit traffic, which could exceed either local municipal, State, and/or federal thresholds. The FTA includes a screening distance tool (Table 4.13-5) that identifies distances to land uses at which vibration would attenuate to below impact levels. Therefore, projects located t distances that exceed these criteria would not likely be subject to levels of vibration that would result in impacts. However, as many of the improvements are located close to vibration-sensitive land uses, improvements associated with the Phased Transit Leap Network would be subject to the requirements of the local jurisdictions discussed in Section 4.13.2, as well as federal and State (FTA Noise and Vibration Guidance and Caltrans guidance) requirements. Even with compliance with these requirements, impacts would be significant.

Construction vibration sources associated with transportation network improvements or Phased Transit Leap Network Improvements could result in a temporary vibration increase at nearby land uses. Vibration sources could include conventional construction equipment such as loaded trucks or bull dozers, and/or high impact construction equipment such as pile drivers, or blasting. Improvements would be subject to the requirements of local jurisdiction, State, and/or federal guidance. Even with compliance with these requirements, impacts would be significant.

2050 Conclusion

Improvements associated with regional growth and land use changes and transportation network improvements could generate substantial increases in groundborne vibration or groundborne noise levels. Therefore, the impact (NOI-2) in the year 2050 would be significant for construction relating to both regional growth and transportation network improvements, and relating to operation of transportation network improvements. Non-construction impacts relating to regional growth are less than significant.

Exacerbation of Climate Change Effects

The proposed Plan is not expected to exacerbate climate change effects on generation of excessive groundborne vibration or noise levels.

MITIGATION MEASURES

NOI-2 GENERATION OF EXCESSIVE GROUNDBORNE VIBRATION OR GROUNDBORNE NOISE LEVELS

2020, 2035, and 2050

NOI-2a Implement Construction Groundborne Vibration and Noise Reduction Measures. SANDAG shall, and other transportation project sponsors, the County of San Diego, cities, and other local jurisdictions can and should, implement measures during design, project-level CEQA review, and construction of transportation network improvements or development projects, to reduce groundborne vibration and noise levels generated by onsite construction equipment, including, but not limited to, the following.

- Predrill pile holes within 300 feet of any sensitive receptor.
- Where feasible, use soil mix wall for excavation.
- Incorporate a comprehensive construction vibration specification into all construction bid documents.
- Require contractor to assess potential for damage to buildings within 100 feet of a tunnel boring.
- Require contractor to perform a physical survey to document existing condition of a building that might incur damage.
- If pile driving and/or other vibration-generating construction activities are to occur within 60 feet of a historic structure whose integrity would be impaired by exceeding the vibration threshold for historic structures, implement measures to reduce vibration impacts, including but not limited to, the following.
  - Retain a structural engineer or other appropriate professional to determine threshold levels of vibration and cracking that would damage any historic structure, and design construction methods to not exceed the thresholds.
  - Require groundborne vibration monitoring of nearby historic structures. Implement a monitoring program to detect ground settlement or lateral movement of structures in the vicinity of pile-driving activities and identify corrective measures to be taken should monitored vibration levels indicate the potential for vibration damage to historic structures.
  - Require contractor to assess potential damage to buildings within 200 feet of areas where excavation requires the use of driven piles either by impact or vibratory methods.

NOI-2b Implement Groundborne Vibration and Noise-Reducing Measures for Rail Operations. SANDAG shall, and other transportation project sponsors can and should, implement vibration-reducing measures to meet FTA vibration guidelines (FTA 2018) during the planning, design, project-level CEQA review, construction, and operation of rail projects, including, but not limited to, providing special track support systems such as floating slabs, resiliently supported ties, high-resilience fasteners, and ballast mats.

In addition, rail operators can and should implement groundborne vibration and noise-reducing measures to meet applicable FTA vibration guidelines (FTA 2018) during the planning, design, project-level CEQA review, construction, and operation of rail projects, including, but not limited to, the following.

- Conduct rail grinding on a regular basis to keep tracks smooth.
- Conduct wheel truing to re-contour wheels to provide a smooth running surface and removing wheel flats.
- To reduce groundborne noise, achieve vibration isolation of the track from underlying surface using the following.
    - Highly resilient direct fixation fasteners
    - Rail suspended fastener system
    - Isolated slab track system
    - Floating slab track system

SIGNIFICANCE AFTER MITIGATION

Mitigation measures NOI-2a and NOI-2b would substantially reduce significant vibration impacts caused by exceedances of groundborne vibration criteria. However, it cannot be guaranteed that all future project-level impacts can be mitigated to a less than significant level. Therefore, this impact (NOI-2) would remain significant and unavoidable.

NOI-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, THE PROJECT WOULD EXPOSE PEOPLE RESIDING OR WORKING IN THE PROJECT AREA TO EXCESSIVE NOISE LEVELS.

ANALYSIS METHODOLOGY

This section discusses the potential noise impacts of locating land development and transportation improvements of the proposed Plan in proximity to public-use and military airports, or private airstrips and helipads in the San Diego region.

The locations of forecasted regional growth and land use change, as well as planned transportation improvements, associated with the proposed Plan are analyzed to determine whether people residing by or working near public-use airports and military airfields, or private airstrips and helipads would be exposed to excessive noise levels. *Excessive* is defined as exceeding land use compatibility noise level limits in ALUCPs or AICUZ studies for public-use and military airports, and in FAA and Caltrans Aeronautics Division regulations and permitting for private airstrips or helipads.

Detailed quantitative analyses of potential impacts is not practical given the high-level (programmatic) nature of the proposed Plan and the lack of specific project details. For this reason, the analysis is largely qualitative, supplemented with published data or sample calculations, where possible, to illustrate the points discussed in the analysis.

IMPACT ANALYSIS

2025

Regional Growth and Land Use Change

Between 2016 and 2025, regional population is forecasted to increase by 125,725 people (3 percent), adding 61,433 housing units (4 percent) and 164,843 jobs (8 percent). Growth will occur in and around cities throughout the region. To accommodate regional growth by 2025, new development would include new housing units, services, commercial areas, industrial centers, schools, and civic uses.

The regional growth plans would not result in operational changes to flight plans, ALUCPs, or AICUZs. However, regional growth could result in noise-sensitive (generally residential) land uses being developed along the flight paths of some of the regional airports or even within some ALUCPs or AICUZs. Regional airports and air installations are described above under Section 4.13.1 (Aircraft Noise). As the locations of new housing are not known, it is possible that new housing could be developed in proximity to a ALUCP or AICUZ, or within 2 miles of an airport. Many of the local jurisdictions' general plans include land use compatibility guidelines that designate acceptable levels of noise, which would be applicable for airport noise. Additionally, the procedures included in the ALUCPs or AICUZs would reduce noise exposure from airport noise.

For airstrips, separation between developed land uses and the facilities would be identified in project-level planning or CEQA review. Separation between private airports and development is identified in accordance with FAA standards. Compliance with local jurisdiction general plans and FAA standards would reduce noise from airstrips and ensure land use compatibility with any new development. Therefore, while regional growth and land use change would result in increased residences located throughout the region; however, based on the discussion above, it would not result in residents being exposed to excessive noise from public or military airfields, or private airstrips. Therefore, impacts would be less than significant.

Transportation Network Improvements and Programs

Neither the Corridor Network or Phased Transit Leap Network Improvements would develop noise-sensitive land uses within the region or within an ALUCP or AICUZ. Transportation network improvements would include highway widenings, double-tracking of rail lines, and support and maintenance facilities. Improvements of this nature are not considered noise sensitive. Therefore, impacts would be less than significant.

2025 Conclusion

Improvements associated with regional growth between 2016 and 2025 would not expose noise-sensitive land uses to levels of noise in excess of applicable standards. As such, the impact (NOI-3) in the year 2025 would be less than significant.

2035

Regional Growth and Land Use Change

Between 2026 and 2035, regional population is forecasted to increase by 149,500 people (4 percent), adding 121,650 housing units (9 percent) and 159,728 jobs (9 percent). Similar to horizon year 2025, growth will occur generally in and around cities throughout the region. To accommodate regional growth by 2035, new development would include new housing units, services, commercial areas, industrial centers, schools, and civic uses.

As discussed under 2025, many of the local jurisdictions' general plans include land use compatibility guidelines that designate acceptable levels of noise, which would be applicable for airport noise. Additionally, the procedures included in the ALUCPs or AICUZs would reduce noise exposure from airport noise. Compliance with local jurisdiction general plans and FAA standards would reduce noise from airstrips and ensure land use compatibility with any new development. Therefore, while regional growth and land use change would result in increased residences located throughout the region, it would not result in residents being exposed to excessive noise from public or military airfields, or private airstrips. Therefore, impacts would be less than significant.

Transportation Network Improvements and Programs

As discussed above, neither the Corridor Network nor Phased Transit Leap Network Improvements would develop noise-sensitive land uses within the region or within an ALUCP or AICUZ. Therefore, impacts would be less than significant.

2035 Conclusion

Improvements associated with regional growth between 2026 and 2035 would not expose noise-sensitive land uses to levels of noise in excess of applicable standards. As such, the impact (NOI-3) in the year 2035 would be less than significant.

2050

Regional Growth and Land Use Change

Between 2036 and 2050, regional population is forecasted to increase by 125,725 people (3 percent), adding 61,433 housing units (4 percent) and 164,843 jobs (8 percent). Similar to horizon years 2025 and 2035, growth will occur in and around cities throughout the region. To accommodate regional growth by 2025, new development would include new housing units, services, commercial areas, industrial centers, schools, and civic uses.

As discussed under the 2025 and 2035 analyses, many of the local jurisdictions' general plans include land use compatibility guidelines that designate acceptable levels of noise, which would be applicable for airport noise. Additionally, the procedures included in the ALUCPs or AICUZs would reduce noise exposure from airport noise. Compliance with local jurisdiction general plans and FAA standards would reduce noise from airstrips and ensure land use compatibility with any new development. Therefore, while regional growth and land use changes would result in increased residences located throughout the region, it would not result in residents being exposed to excessive noise from public or military airfields, or private airstrips. Therefore, impacts would be less than significant.

Transportation Network Improvements and Programs

As discussed above, neither the Corridor Network nor Phased Transit Leap Network Improvements would develop noise-sensitive land uses within the region or within an ALUCP or AICUZ. Therefore, impacts would be less than significant.

2050 Conclusion

Improvements associated with regional growth between 2036 and 2050 would not expose noise-sensitive land uses to levels of noise in excess of applicable standards. As such, the impact (NOI-3) in the year 2050 would be less than significant.

Exacerbation of Climate Change Effects

No climate change effects on exposing people near airports to excessive noise levels have been documented. The proposed Plan is not expected to exacerbate climate change effects on exposing people near airports to excessive noise levels.