4.13 NOISE AND VIBRATION

This section evaluates the noise and vibration impacts of the proposed Plan.

4.13.1 Existing Conditions

Prior to discussing the noise setting for the proposed Plan, background information about sound, noise, vibration, and common noise descriptors is needed to provide context and a better understanding of the technical terms referenced throughout this section.

NOISE FUNDAMENTALS

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 the human ear (Caltrans 2020a, 2013; FTA 2018). Noise is defined as sound that is objectionable because it is unwanted, disturbing, loud, unexpected, or annoying. In the science of acoustics, the fundamental model consists of a sound (or noise) source, a receiver, and the propagation path between the two. The loudness of the noise source and the obstructions or atmospheric factors affecting the propagation path to the receiver determine the sound level and characteristics of the noise perceived by the receiver. The following sections provide an explanation of key concepts and acoustical terms used in the analysis of environmental and community noise.

Noise Descriptors

Because sound levels can vary markedly over a short period of time, various descriptors have been developed to quantify environmental and community noise. Some of the most common descriptors used to describe environmental noise, including those 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. In effect, L_{eq} is the steady-state sound level containing the same acoustical energy as the time-varying sound level that occurs during the same period (Caltrans 2013: 2-48). For instance, the 1-hour equivalent sound level, also referred to as the hourly L_{eq}, is the energy average of sound levels occurring during a 1-hour period and is the basis for noise abatement criteria used by California Department of Transportation (Caltrans) and Federal Transit Administration (FTA) (Caltrans 2013: 2-47; FTA 2018).
- **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_x)** describes the sound level exceeded for a given percentage of a specified period. For example, L_{50} is the sound level exceeded for 50% of the time (such as 30 minutes per hour), and L_{25} is the sound level exceeded 25% of the time (such as 15 minutes per hour).
- **Community noise equivalent level (CNEL)** is a measure of the 24-hour average A-weighted sound 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). A 5 dBA penalty is added to the L_{eq} during the evening hours of 7:00 p.m. and 10:00 p.m., and a 10 dBA penalty is applied to the L_{eq} during the nighttime hours of 10:00 p.m. to 7:00 a.m. The energy average is then taken for the whole 24-hour day (Caltrans 2013: 2-48).
- **Day-night sound level (L_{dn} or DNL)** 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 7:00 p.m. to 10:00 p.m. while 10 dBA

is added to the L_{eq} during the nighttime hours of 10:00 p.m. to 7:00 a.m., and the energy average is then taken for the whole 24-hour day.

Various federal, state, and local agencies have adopted CNEL or L_{dn} as the measure of community noise. Although 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.

Frequency, Amplitude, and Decibels

Continuous sound can be described by *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, 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 (dB).

Because decibels represent SPL using a logarithmic scale, SPLs cannot be added, subtracted, or averaged through ordinary arithmetic. Under 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 resulting sound level would be 3 dB higher than if only one of the sound sources was producing sound under the same conditions. For example, if one idling truck generates an SPL of 70 dB, two trucks idling simultaneously would not produce 140 dB; rather, they would combine to produce 73 dB. Under the dB scale, three sources of equal loudness together produce a sound level approximately 5 dB louder than one source. 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 (dBA).

A-Weighting

The dB scale alone does not adequately characterize how humans perceive noise. Human hearing is limited in the range of audible frequencies, as well as in the way it perceives the SPL in that range. In general, people are most sensitive to the frequency range of 1,000–8,000 Hz and perceive sounds within this range better than sounds of the same amplitude with frequencies outside of this range. To approximate the response of the human ear, sound levels of individual frequency bands are adjusted (or “weighted”), depending on the human sensitivity to those frequencies. Then, an “A-weighted” sound level (expressed in units of dBA) can be computed based on this information.

The resulting SPL is expressed in dBA. When people make judgments of the relative loudness or annoyance of a sound, their judgment correlates 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 flyover at 1,000 feet	100	—
Gas lawn mower at 3 feet	90	—
Diesel truck at 50 feet at 50 miles per hour	80	Food blender at 3 feet, garbage disposal at 3 feet

Common Outdoor Noise Source	Sound Level (dBA)	Common Indoor Noise Source
Noisy urban area during daytime, gas lawn mower at 100 feet	70	Vacuum cleaner at 10 feet, normal speech at 3 feet
Commercial area, heavy traffic at 300 feet	60	—
Quiet urban daytime	50	Large business office, dishwasher next room
Quiet urban nighttime	40	Theater, large conference room (background)
Quiet suburban nighttime	30	Library, bedroom at night
Quiet rural nighttime	20	—
—	10	Broadcast/recording studio
Lowest threshold of human hearing	0	Lowest threshold of human hearing

Note: dBA = A-weighted decibels.
Source: Caltrans 2013.

Sound Propagation

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

Geometric spreading. Sound from a localized source (i.e., a "point" source) radiates uniformly outward away from the source in a spherical pattern. The sound level attenuates (or decreases) at a rate of 6 dBA for each doubling of distance from a point source. Road and highway noise is not a single stationary source of sound. The movement of vehicles on a road or highway makes the source of sound appear to emanate from a line (i.e., a "line" source) rather than a point. Noise from a line source propagates outward in a cylindrical pattern, often referred to as cylindrical spreading. Sound levels attenuate at a rate of 3 dBA per doubling of distance from a line source.

Ground absorption. The noise path from a source to a receiver is usually very close to the ground. The excess noise attenuation from ground absorption occurs due to acoustic energy losses on sound wave reflection. For acoustically hard sites (i.e., sites with a reflective surface between the source and the receiver, such as a parking lot or body of water), no excess ground attenuation is assumed. For acoustically absorptive or soft sites (i.e., sites with an absorptive ground surface between the source and the receiver, such as soft dirt, grass, or scattered bushes and trees), an additional 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. Receivers located downwind from a source can be exposed to increased noise levels relative to calm conditions, whereas locations upwind can have lowered noise levels, because wind can carry sound. Sound levels can be increased over large distances (e.g., more than 500 feet) from the source because of atmospheric temperature inversion (i.e., increasing temperature with elevation). Other factors, such as air temperature, humidity, and turbulence, can also affect sound attenuation.

Shielding by natural or human-made features. A large object or barrier in the path between a noise source and a receiver can substantially attenuate noise levels at the receiver. The amount of attenuation provided by shielding depends on the size of the object, proximity to the noise source and the receiver, 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 receiver for 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 a 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 receiver will typically result in at least 5 dBA of noise reduction (Caltrans 2013: 2-41; FTA 2018: 15, 16). Barriers higher than the line of sight provide increased noise reduction

(FTA 2018: 16). Vegetation between the source and receiver is rarely effective in reducing noise because it does not create a solid barrier unless there are multiple rows of vegetation (FTA 2018: 15, 104, 106).

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 2013; WHO 1999). Each of these effects 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 a 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 environments, 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 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 50–65 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 to compensate for higher background noise levels, but this in turn can lead to vocal fatigue for the speaker.

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. In addition, 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. The difficulty arises primarily from differences in individual sensitivity and habituation to sound, which 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 exceeds 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 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 (Caltrans 2013).

Noise-Sensitive Land Uses

Sensitive noise receptors are generally considered people 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

Vibration is the periodic oscillation of a medium or object for a given reference point. 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 in buildings with substantial sound insulation, such as 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/sec).

Vibration Descriptors

As noted above, there are various ways 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 in/sec. 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 vibration decibels (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). (See Table 4.13-9 for vibration damage thresholds.) 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 would occur.

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 disturbance. For example, someone sleeping or reading may 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 spaces.

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 in time. Ambient noise levels are generally considered low when ambient levels are below 45 dBA CNEL, moderate in the 45–65 dBA CNEL range, and high above 65 dBA CNEL.

The existing noise environment in the Plan area is composed of transportation and nontransportation 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. Nontransportation, 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 (two-axle) and heavy trucks (trucks with three or more axles). In general, the greater the traffic volume on a roadway, the higher the noise levels 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 miles per hour (mph) generates approximately 85 dBA at 50 feet (Caltrans 2013), whereas an automobile traveling at the same speed generates only 74 dBA (FTA 2018). 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).

Roadways that generate the highest noise levels in the Plan area are the interstate and state highways because 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 70–75 dBA L_{dn} at 50–100 feet from major highways. Heavily used roadways, such as arterials and major streets, also generate significant levels of noise, typically 65–70 dBA L_{dn} at similar distances (FTA 2018).

Noise from line sources, such as roadways, typically attenuate at a rate of 3–4.5 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 a 1.5 dBA reduction 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 100–200 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. Noise elements are discussed in Section 4.13.2, below.

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, whereas 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) (FTA 2018). In addition, the sounding of train air horns and crossing gate bells also contribute to higher noise levels near railway/roadway grade crossings (FTA 2018). 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 3–4.5 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 6–7.5 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 5–10 trains per day at speeds of 30–40 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 (L_{dn})
10–30	75
30–60	70
60–120	65
120–240	60
240–500	55
500–800	50
800 and up	45

Notes: L_{dn} = day-night sound level.

Source: FTA 2018.

In the Plan area, a wide range of land uses (some noise-sensitive) are located adjacent to railways, such as residences, schools, hospitals, shopping centers, industrial parks, agriculture, parks, and open space. 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). The presence of sensitive receptors within these screening distances does not mean noise impacts would 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	Screening Distance (feet) 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
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 and maintenance	350	225
Park & Ride lots with buses	225	150
Ferry boat terminals	300	150

Notes: FTA = Federal Transit Administration. 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. The screening distances are based on assumptions made using the lowest noise impact threshold (i.e., 50 dBA for all residential land use and buildings where people normally sleep).

Source: FTA 2018.

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 the US border with Mexico), and McClellan-Palomar (Carlsbad) Regional Airport
- **Military airfields:** Naval Air Station North Island, Marine Corps Air Station (MCAS) Miramar, MCAS Camp Pendleton, Naval Outlying Landing Field 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, Octotillo 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) determine 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 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 dBA CNEL) in the airport vicinity. Copies of the available existing noise contour maps for Plan area airports are provided in Appendix L, Noise Modeling Calculations and Existing Noise Contour Maps for Plan Area Airports (Appendix L). For smaller airports (e.g., Ramona Airport), noise levels range from approximately 60–70+ dBA CNEL. Lower noise levels (60–65 dBA CNEL) may extend several thousand feet from the airport boundaries along dominant flight path(s), whereas higher noise levels (70+ dBA CNEL) do not extend much (approx. 200 feet) beyond the airport boundaries (SDCRAA 2022a). For the largest airports (e.g., SDIA) reported noise levels range from approximately 60–75 dBA CNEL. The lower noise levels from major airports (60–65 dBA CNEL) may extend several miles from the airport boundaries along dominant flight path(s), whereas higher noise levels (75 dBA CNEL) may extend several thousand feet (SDCRAA 2014).

In addition to public-use and military airports, there are numerous private and special-use airstrips and helipads in the Plan area, many which are located within 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 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 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
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

Equipment	L_{max} at 50 Feet, dBA	Typical Duty Cycle (Percent)	L_{eq} at 50 Feet, dBA
Vacuum excavator (vac-truck)	85	40	81
Vibratory concrete mixer	80	20	73
Vibratory pile driver	101	20	94

Notes: kVA = kilovolt amp; dBA= A-weighted decibels; L_{max} = maximum sound level; L_{eq} = equivalent sound level.

Source: FHWA 2006.

As shown in Table 4.13-4, maximum noise levels generated by typical construction equipment range from approximately 73–90 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) generates 90–101 dBA at 50 feet (FHWA 2006). The noise levels vary for each type of equipment, because 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 earthmoving equipment under full load, which typically range from 85–90 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. In addition, construction noise levels would fluctuate depending on construction phase.

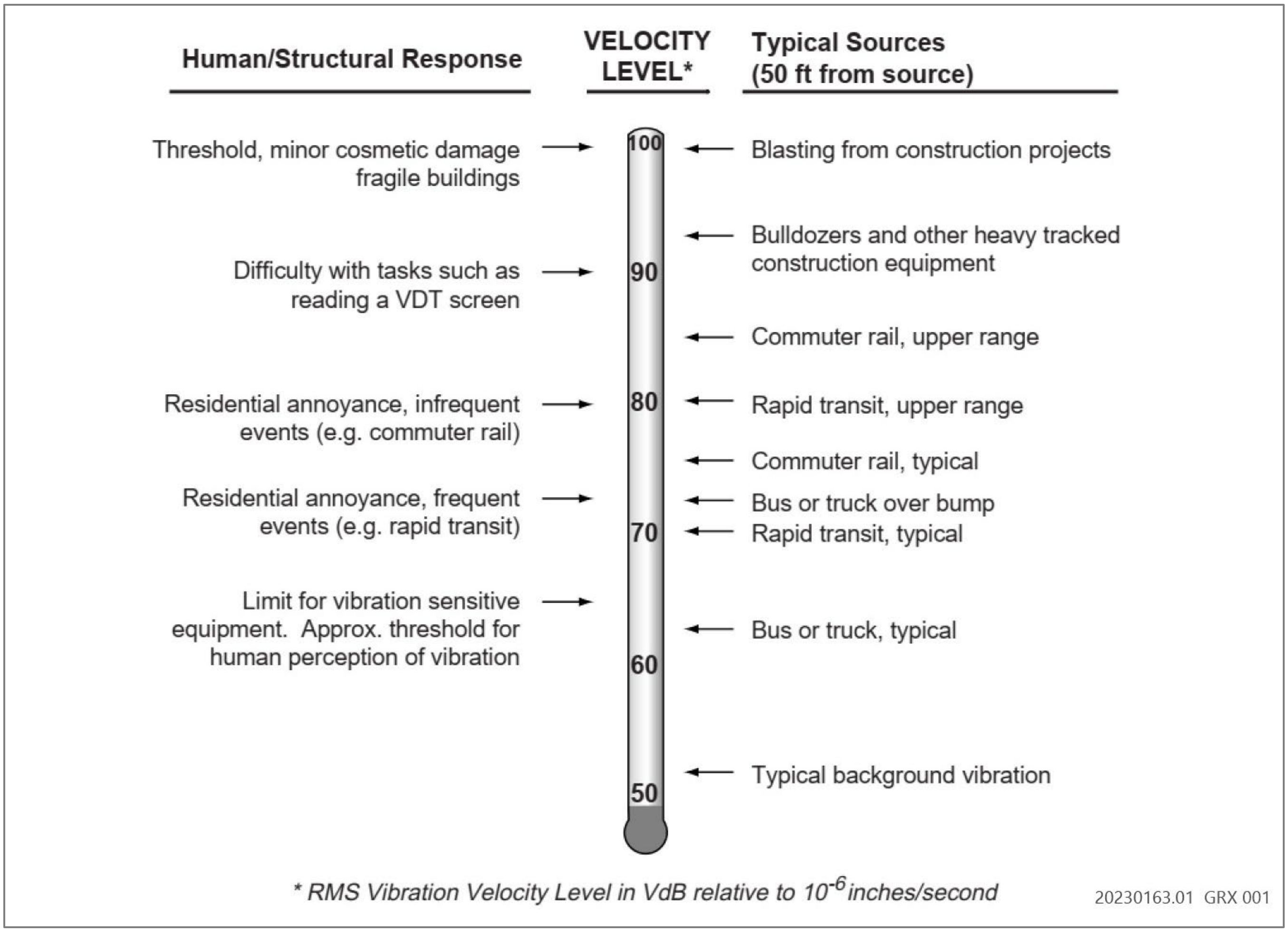
Noise levels from construction activities are typically considered point sources with typical attenuation rates of 6–7.5 dBA per doubling of distance, depending on the ground conditions, and additional attenuation provided by the presence of natural or human-made barriers or structures. Typically, construction 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 for construction noise impact analyses.

Commercial, Industrial, and Other Nontransportation Noise Sources

This category of ambient noise sources is extremely varied because it encompasses all the nontransportation 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, and so forth. 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. 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 sensitive manufacturing or research equipment (FTA 2018). Perceptible vibration is typically only part of the ambient environment 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.



Source: FTA 2018.

Figure 4.13-1 Typical Levels of Groundborne Vibration

Existing vibration sources in the Plan area can be classified as transportation and nontransportation sources. Transportation sources include railroad train operations, including light rail, commuter, and freight trains. Nontransportation, 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. 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, a wide range of land uses (some vibration-sensitive) are 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). The presence of sensitive receptors within these screening distances does not mean vibration impacts would occur, simply that FTA procedures require additional analysis under these conditions. The screening distances will identify most of the potentially impacted areas; however when there is evidence of efficient propagation (e.g., previous complaints about existing transit facilities or a history of problems with construction vibration), the distances in Table 4.13-5 should be increased by a factor of 1.5, in accordance with FTA guidance (FTA 2018: 135).

Table 4.13-5 Example FTA Screening Distances for Rail Vibration

Type of Project	Critical Distance for Land Use Categories[1]—Distance from Right-of-Way or Property Line (feet): Land Use Category 1	Critical Distance for Land Use Categories[1]—Distance from Right-of-Way or Property Line (feet) Land Use Category 2	Critical Distance for Land Use Categories[1]—Distance from Right-of-Way or Property Line (feet) 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[2]	200	100	50
Bus projects (if not previously screened out)[3]	100	50	—

Notes: FTA = Federal Transportation Administration.

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 and 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).

2 Intermediate capacity transit is a transit system with less capacity than rail rapid transit but more capacity than typical bus operations, such as bus rapid transit, monorails, and trolleys (FTA 2018: 196).

3 Projects that involve rubber-tire vehicles and do not involve roadway irregularity, operation close to vibration-sensitive buildings, or vehicles operating within buildings are not likely to result in a vibration impact and no further analysis is needed (FTA 2018: 134). These uses are considered "screened out."

Source: FTA 2018.

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 occur adjacent to any single receptor for only a limited portion of the total duration. Construction vibration is of more concern when it takes place near vibration-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 (FTA 2018); 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/sec) at a reference distance of 25 feet, and the estimated distance to different levels of human response.

Table 4.13-6 Construction Equipment Vibration Levels (Peak Particle Velocity)

Equipment Item	Reference PPV at 25 Feet (in/sec)	Distance to Human Response (feet)[1] Barely Perceptible	Distance to Human Response (feet)[1] Distinctly Perceptible	Distance to Human Response (feet)[1] Strongly Perceptible	Distance to Human Response (feet)[1] 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

Notes: PPV = peak particle velocity; in/sec = inches per second.

1 Distances are calculated using the Reference PPV (PPV_{ref}) at 25 feet. The equation used to calculate these distances is $PPV = PPV_{ref} * (25/D)$ (Caltrans 2020a).

Sources: Caltrans 2020a; FTA 2018.

Commercial, Industrial, and Other Nontransportation Vibration Sources

Outside of the transportation and construction sources described above, few vibration sources 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 new vibration-sensitive uses in proximity to major industrial operations.

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), whereas 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.

Federal Aviation Authority

Airport Noise Compatibility Planning

Title 14 of the Code of Federal Regulations (CFR), Part 150 is published by the Federal Aviation Authority (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 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.

Federal Highway Administration and Environmental Protection Agency

Traffic Noise Impacts

CFR Title 23, Part 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 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 5–15 dBA (FHWA 2011). Specific increase criteria are defined by the state transportation agency (see discussion relating to Caltrans below). 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).

Since 2007, Caltrans has performed federal responsibilities for National Environmental Policy Act (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, 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

CFR Title 40, Part 201 and Title 49, Part 210 are closely interrelated. CFR Title 40, Part 201 is published by the US 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. CFR Title 49, Part 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

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

[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
7. the addition of a new or substantial alteration of a weigh station, rest stop, ride-share lot, or toll plaza. (FHWA 2011)

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	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, shipyards, utilities (water resources, water treatment, electrical), and warehousing.
G	—	—	—	Undeveloped lands that are not permitted.

Notes: FHWA = Federal Highway Administration; $L_{eq(h)}$ = equivalent sound level over a 1-hour period; $L_{10(h)}$ = equivalent sound level over a 10-hour period.

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.

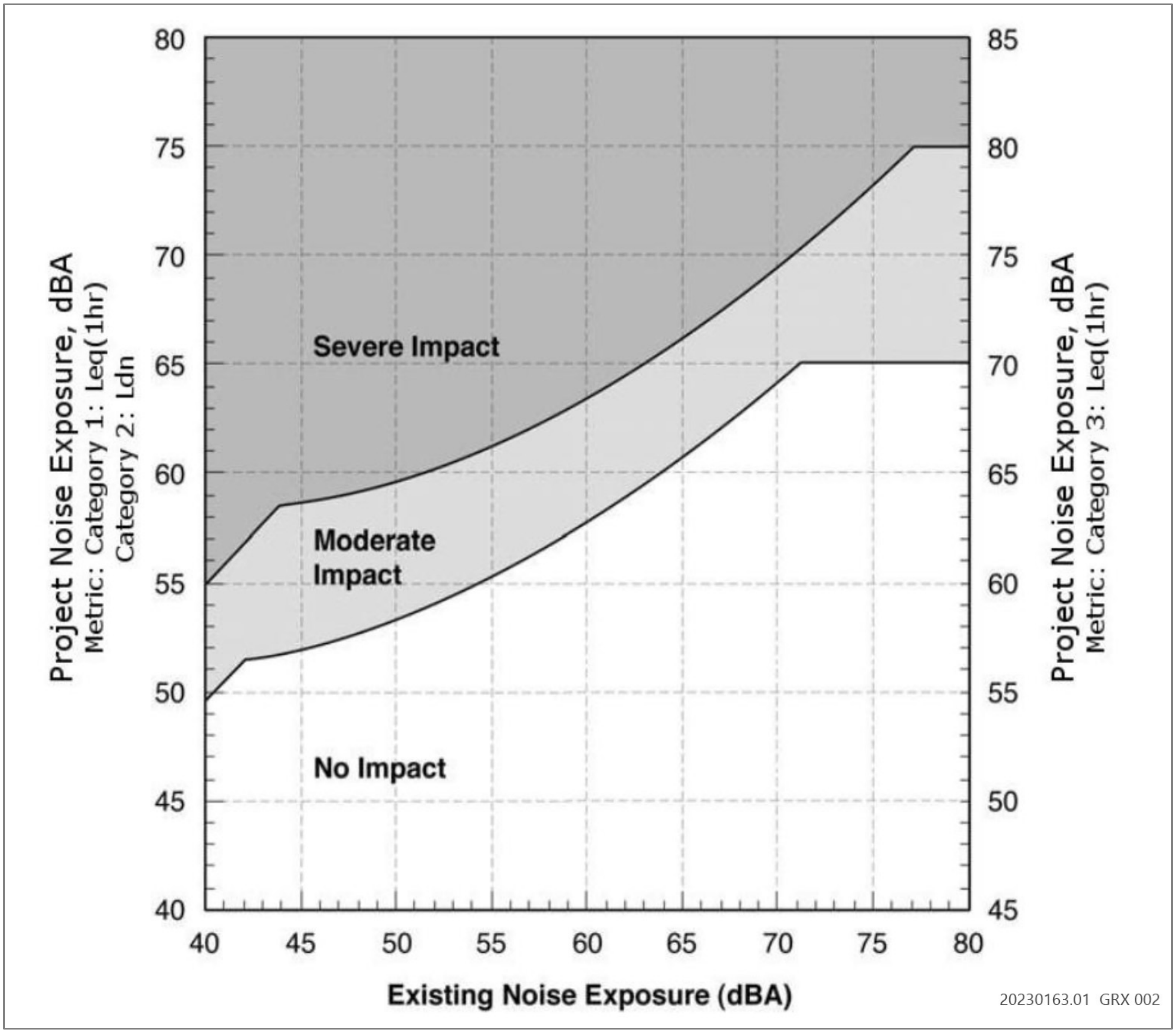
3 Includes undeveloped lands permitted for this activity category.

Source: 23 CFR Part 772.

Federal Transit Administration and Federal Railroad Administration

FTA has prepared the *Transit Noise and Vibration Impact Assessment 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. The manual establishes 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, *High-Speed Ground Transportation Noise and Vibration Impact Assessment* (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 long-term operational noise increase relative to existing noise conditions. Project operational 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.



Source: FTA 2018.

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

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" (FTA 2018: 172). Although 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.

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.

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

Land Use Category	Groundborne Vibration Impact Levels Frequent Events[1]	Groundborne Vibration Impact Levels Occasional Events[2]	Groundborne Vibration Impact Levels Infrequent Events[3]	Groundborne Noise Impact Levels Frequent Events[1]	Groundborne Noise Impact Levels Occasional Events[2]	Groundborne Noise Impact Levels Infrequent Events[3]
Category 1: Buildings where vibration would interfere with interior operations.	65 VdB[4]	65 VdB[4]	65 VdB[4]	NA[5]	NA[5]	NA[5]
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

Notes: FTA = Federal Transit Administration; VdB = vibration decibels; dBA = A-weighted decibels.

[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.

Source: FTA 2018.

The FTA manual uses the following land use categories when determining transit noise and vibration impacts:

- 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 nighttime sensitivity to noise is assumed to be 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.

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

Notes: PPV = peak particle velocity; in/sec = inches per second.

Source: FTA 2018.

Department of Defense Instruction 4165.57

Department of Defense Instruction 4165.57 establishes policy, assigns responsibilities, and prescribes procedures for the Department of Defense 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 dBA CNEL.

STATE LAWS, REGULATIONS, PLANS, AND POLICIES

California State Aeronautics Act

The California State Aeronautics Act (SAA), under 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. The 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 dBA 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 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. CCR Title 24, Part 2, Section 1207.11.2 states, "[t]he noise metric must be either the L_{dn} or the 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. The 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* (Caltrans 2013)
- *Traffic Noise Analysis Protocol for New Highway Construction, Reconstruction, and Retrofit Barrier Projects* (Caltrans 2020b) ("Protocol")
- *California Airport Land Use Planning Handbook*. Division of Aeronautics (Caltrans 2011)
- *Transportation and Construction Vibration Guidance Manual* (Caltrans 2020a)

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, the 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 dBA is based on the concept that a 10 dBA increase generally is perceived as a doubling of loudness (Caltrans 2020b).

According to the Protocol, the 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 dBA increase between existing and design-year with-project conditions) has been used, but there would be cases where an increase less than 12 dBA would approach significance (such as a quiet rural environment) or where a 12 dBA increase would not necessarily be deemed significant (noisy urban environment) (Caltrans 2020b).

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 dBA L_{max} at 50 feet from the job site from 9:00 p.m. to 6:00 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 2011). 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 2011).

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/sec) Transient Sources	Maximum PPV (in/sec) 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

Notes: PPV = peak particle velocity; in/sec = inches per second. Transient sources create a single isolated vibration event, such as blasting or drop balls. Continuous/frequent intermittent sources include impact pile drivers, pogo-stick compactors, crack-and-seat equipment, vibratory pile drivers, and vibratory compaction equipment.

Source: Caltrans 2020a.

Table 4.13-11 Caltrans Guideline Vibration Human Annoyance Criteria

Human Response	Maximum PPV (in/sec) Transient Sources	Maximum PPV (in/sec) 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

Notes: Notes: PPV = peak particle velocity; in/sec = inches per second. Transient sources create a single isolated vibration event, such as blasting or drop balls. Continuous/frequent intermittent sources include impact pile drivers, pogo-stick compactors, crack-and-seat equipment, vibratory pile drivers, and vibratory compaction equipment.

Source: Caltrans 2020a.

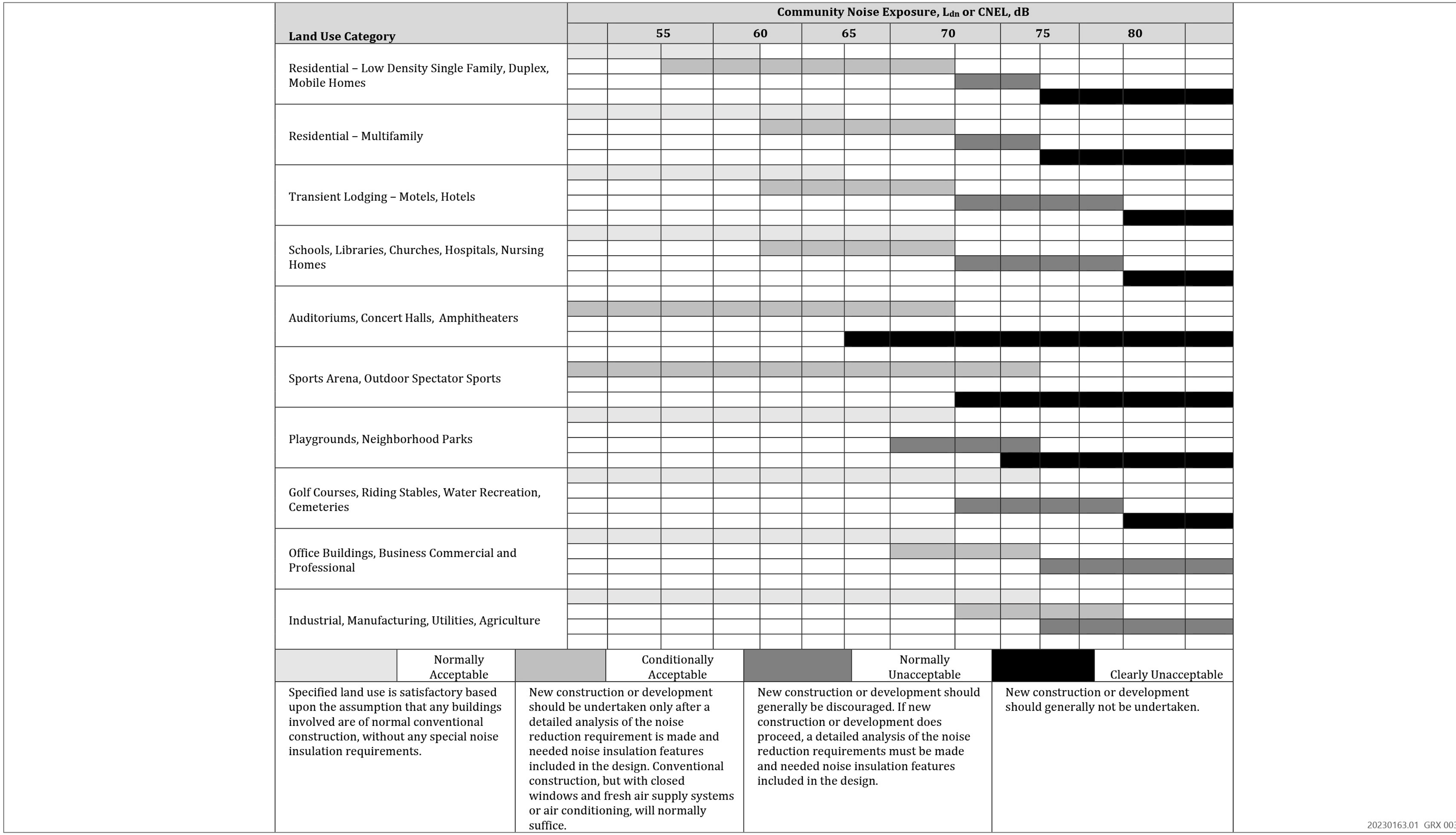
General Plan Guidelines

The Governor's Office of Planning and Research (OPR) (now known as the Governor's Office of Land Use and Climate Innovation) is required to adopt and periodically revise guidelines for the preparation and content of local general plans. OPR's 2017 State of California General Plan Guidelines include noise/land use compatibility guidelines, which are shown in Figure 4.13-3.

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 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 airports, local industrial and commercial land uses, and other ground stationary sources that contribute to the community noise environment. Beyond statutory federal standards, local jurisdictions can adopt their own noise goals and policies in their noise elements or adopt noise and land use compatibility guidelines similar to or the same as those recommended by the State (see Figure 4.13-3).



Note: OPR = Governor's Office of Planning and Research (now known as Governor's Office of Land Use and Climate Innovation).
Source: OPR 2017.

Figure 4.13-3 OPR Noise/Land Use Compatibility Guidelines

The County of San Diego and all the cities in the San Diego region, apart from Del Mar and Oceanside, have adopted the 2017 OPR Noise and Land Use Compatibility Guidelines as their land use compatibility noise standards, including the 60 dBA CNEL "normally acceptable" noise level for residential uses. The cities of Del Mar and Oceanside have adopted 65 dBA 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 commonly applied to transportation noise sources. The assessment of nontransportation 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. Many noise ordinances provide separate standards to control noise from construction activities that typically include a combination of construction noise level limits and restrictions on the hours during which construction is permitted. Tables 4.13-12 and 4.13-13 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 4.13-14.

Table 4.13-12 Summary of Applicable Property Line Noise Level Limits

Jurisdiction	GLU Zone Residential Daytime	GLU Zone Residential Evening	GLU Zone Residential Nighttime	GLU Zone Commercial Daytime	GLU Zone Commercial Evening	GLU Zone Commercial Nighttime	GLU Zone Industrial Daytime	GLU Zone Industrial Evening	GLU Zone Industrial Nighttime
Carlsbad	55	—	45	55	—	45	55	—	45
Chula Vista	45–50	45–50	55–60	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[1]	60[1]	50[1]
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[2]	70–75[2]	70–75[2]
Imperial Beach[3]	—	—	—	—	—	—	—	—	—
La Mesa	60	55	55	65	60	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	45–50	45–50	65	65	60	70	70	65
Poway	50–55	50	45–50	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	60–65	50–55	50–55	55	55	65	60	60	65
Santee[4]	—	—	—	—	—	—	—	—	—
Solana Beach	50–55	50–55	45	60	60	55	70	70	60
Vista	50–55	45–50	45–50	60	60	55	70	70	70

Notes: GLU = General Land Use.

1 Light industrial/heavy industrial

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."

[4] The City of Santee noise ordinance does not contain quantifiable noise level limits at property lines but regulates noise based on that "which causes discomfort or annoyance to reasonable persons of normal sensitivity residing in the area."

Sources: City of Carlsbad 2015, City of Chula Vista 2025, City of Coronado 2025, City of Del Mar 2024, City of El Cajon 2024, City of Encinitas 2024, City of Escondido 2024, City of Imperial Beach 2024, City of La Mesa 2024, City of Lemon Grove 2024, City of National City 2024, City of Oceanside 2024, City of Poway 2024, City of San Diego 2024, County of San Diego 2024, City of San Marcos 2024, City of Santee 2025; City of Solana Beach 2025; City of Vista 2025.

Table 4.13-13 Summary of Local Construction Noise Standards

Jurisdiction	Municipal Code Chapter	Prohibited Hours of Construction	Construction Noise Level Limits
Carlsbad	8.48	After 6:00 p.m. on any day and before 7:00 a.m. Monday through Friday and before 8:00 a.m. on Saturday; Sundays; federal holidays	None
Chula Vista	17.24.040	10:00 p.m.–7:00 a.m. Monday Through Friday and 10:00 p.m.–8:00 a.m. Saturday and Sunday	None
Coronado	41.10.040	7:00 p.m.–7:00 a.m. Monday through Saturday; Sundays; legal holidays	75 dBA $L_{eq(1)}$ at any property zoned residential
Del Mar	9.20.050	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}
El Cajon	17.115.130	7:00 p.m.–7:00 a.m. within 500 feet from any residential zone	None
Encinitas	9.32.410	7:00 p.m.–7:00 a.m. Mondays through Saturdays; Sundays, federal holidays	75 dBA $L_{eq(8)}$
Escondido	17-234	6:00 p.m.–7:00 a.m. Monday through Friday and 5:00 p.m.–9:00 a.m. Saturdays, Sundays, and holidays	75 dBA $L_{eq(1)}$
Imperial Beach	9.32.020	7:00 p.m.–7:00 a.m. Monday through Friday and 5:00 p.m.–8:00 a.m. on Saturday; Sundays; federal holidays	None
La Mesa	10.80.100	10:00 p.m.–7:00 a.m. Monday through Saturdays; Sundays	None
Lemon Grove	9.24.120	7:00 p.m.–7:00 a.m. Monday through Saturday; Sundays; legal holidays	75 dBA $L_{eq(8)}$
National City	12.10.160	7:00 p.m.–7:00 a.m. Monday through Friday; Saturdays, Sundays, and holidays	60–75 dBA L_{max} at residential properties, 70–85 dBA L_{max} at semi-residential/commercial properties
Oceanside	38.15	Case-by-case basis	Case-by-case basis
Poway	8.08.100	5:00 p.m.–7:00 a.m. Monday through Saturday; Sundays; federal holidays	75 dBA $L_{eq(8)}$ at residences
San Diego, City	59.5.0404	7:00 p.m.–7:00 a.m. Monday through Saturday; specific legal holidays; Sundays	75 dBA $L_{eq(12)}$ at any property zoned residential
San Diego, County	36.408	7:00 p.m.–7:00 a.m. Monday through Saturday; Sundays; legal holidays	75 dBA $L_{eq(8)}$
San Marcos	10.24.020	6:00 p.m.–7:00 a.m. Monday through Friday and 5:00 p.m. – 8:00 a.m. on Saturdays; Sundays	None

Jurisdiction	Municipal Code Chapter	Prohibited Hours of Construction	Construction Noise Level Limits
Santee	5.04.090	7:00 p.m.–7:00 a.m. Mondays through Saturdays; Sundays; holidays	Construction equipment with a manufacturer's noise rating of 85 dBA L_{max} or greater may only operate at a specific location for 10 consecutive workdays. If work will involve more than 10 consecutive workdays, notice must be provided to all property owners and residents within 300 feet of the site.
Solana Beach	7.34.100	7:00 p.m.–7:00 a.m. Monday through Friday and before 8:00 a.m. or after 7:00 p.m. on Saturday; Sundays; nine holidays	75 dB $L_{eq(8)}$ at any property used in part or in whole for residential purposes
Vista	NA	None	None

Notes: L_{eq} = equivalent continuous sound level; L_{max} = maximum sound level; dBA = A-weighted decibels.

Sources: City of Carlsbad 2024, City of Chula Vista 2025, City of Del Mar 2024, City of El Cajon 2024, City of Encinitas 2024, City of Escondido 2024, City of La Mesa 2024, City of Lemon Grove 2024, City of National City 2024, City of Oceanside 2024, City of Poway 2024, City of San Diego 2024, County of San Diego 2024, City of San Marcos 2024, City of Santee 2025, City of Solana Beach 2025; City of Vista 2025.

Table 4.13-14 Summary of Local Vibration Standards

Jurisdiction	Municipal Code/General Plan	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	19.68.050	Vibration. Operating or permitting the operation of any device that creates a vibration which is above the vibration perception threshold of any individual at or beyond the property boundary of the source if on private property or at 150 feet from the source if on a public space or public right-of-way.
County of San Diego	General Plan Policy N-3.1	N-3.1 Groundborne Vibration. Use the Federal Transit Administration and Federal Railroad Administration guidelines, where appropriate, to limit the extent of exposure that sensitive uses may have to groundborne vibration from trains, construction equipment, and other sources.
El Cajon	17.115.130	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	It is unlawful to operate or permit the operation of any device that creates a vibration which exceeds the vibration perception threshold at or beyond the property boundary of the source originates on private property, or at a distance of one hundred fifty feet or more from the source if originating from a location on a public space or public right-of-way. Vibration that occurs as an incidental result of sound generation shall not be governed by this section only, but also by the prohibitions or restrictions applicable to the source of the sound.

Jurisdiction	Municipal Code/General Plan	Vibration Regulation
San Marcos	20.300.070	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.

Sources: City of Carlsbad 2024, City of Chula Vista 2025, County of San Diego 2011, City of El Cajon 2024, City of Encinitas 2024, City of Lemon Grove 2024, City of San Marcos 2024, City of Santee 2025.

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 2025). One of the SDCRAA responsibilities is to serve as the ALUC for San Diego and create, adopt, and update the airport land use compatibility plans (ALUCPs) for the region's 16 public-use and military airports in accordance with applicable state and federal laws, consisting of the following airports (with year of the latest update):

- Agua Caliente Springs Airport (2022),
- Borrego Valley Airport (2022),
- Brown Field (2010),
- Fallbrook Community Airpark (2022),
- Gillespie Field (2010),
- Jacumba Airport (2022),
- MCAS Camp Pendelton (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 (2022),
- Ramona Airport (2022), and
- San Diego International Airport (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. Checklist questions for noise and vibration are provided in Section XIII of the CEQA Guidelines Appendix G. The significance criteria specifically developed for this EIR are based on the checklist questions that address the criteria in CEQA Guidelines Appendix G. 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.

The analysis discloses impacts to noise and vibration. There is insufficient evidence to support a meaningful analysis of how the proposed Plan's noise and vibration impacts would be worsened by climate change. Therefore, a climate change analysis for noise and vibration impacts is not included in this section.

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 operations noise impacts of forecasted regional growth and land use change and planned transportation network improvements and programs. Due to the programmatic nature of the proposed Plan, the precise locations, construction techniques, extent of individual site development, and project timelines are currently unknown. Thus, for construction impacts this analysis uses reference noise levels associated with two of the loudest pieces (i.e., an impact pile driver and a bulldozer) of common construction equipment (Table 4.13-4) that could be used simultaneously during construction activities to model construction noise levels associated with the types of projects anticipated to be developed under the proposed Plan. The modeling results were used to assess potential short-term construction-related noise impacts. Construction source noise levels were determined based on methodologies, reference emission levels, and usage factors from the FTA manual (FTA 2018) and FHWA *Roadway Construction Noise Model User's Guide* (FHWA 2006). See Appendix L for detailed construction noise modeling inputs. Reference noise levels for specific equipment and activity types are well documented, and the usage thereof is common practice in the field of acoustics.

A comprehensive review of construction noise standards established by cities and counties within the proposed Plan area was conducted. As shown in Table 4.13-13, some noise ordinances contain performance standards for construction equipment relative to the surrounding land use and time of day (e.g., National City Municipal Code Section 12.10.160), and some establish limitations for consecutive construction workdays after which notice must be provided to surrounding property owners and residents (i.e., City of Santee Municipal Code Section 5.04.090). Most jurisdictions establish restrictions on construction-related activities during certain hours of the day. In addition, as shown in Table 4.13-13, most jurisdictions in the region that established a construction noise level limit set this limit at 75 dBA L_{eq}, and thus this noise level is used in this analysis as a threshold to evaluate the potential effects of construction noise associated with development implementing regional growth and land use changes under the proposed Plan. Projects under the proposed Plan would have a significant impact if associated construction noise exceeded 75 dBA L_{eq}, measured at the property line of the nearest sensitive receptor, or as otherwise determined by the local jurisdiction.

Projects under the proposed Plan with federal involvement or located on the state highway system would be required to comply with specific noise standards of the respective agency (i.e., FTA, Caltrans). Caltrans establishes a construction noise production limit of 86 dBA L_{max} at 50 feet from the jobsite (Caltrans 2020b); thus, construction noise resulting from implementation of the proposed Plan is also evaluated using this noise level as the threshold above which construction noise associated with transportation network improvements would be considered significant, as measured at the nearest receptor. FTA limits the total noise increase from existing noise levels and FHWA suggests that a 5 to 15 dBA increase could be considered substantial (FHWA 2011). In this analysis, a substantial increase in ambient noise from construction activities is defined as an increase in 5 dBA or more above ambient levels, as this is generally perceived as a distinctly noticeable noise increase (Caltrans 2013: 2-10). However, because the exact locations of projects associated with the proposed Plan are currently unknown, in this analysis, compliance with FTA and FHWA substantial noise increase standards is assessed qualitatively.

Local operations noise standards, determined at the project level, may apply to regional growth and land use change, as well as to local transportation network improvements and programs. As outlined under "Local Laws, Regulations, Plans, and Policies," these local standards are typically supplied by the local noise element (noise/land use compatibility) and municipal code. A comprehensive review of noise standards established by jurisdictions within the proposed Plan area was conducted. As shown in Table 4.13-12, residential daytime noise standards typically range from 45 to 60 dBA L_{eq}. As stated above, the County of San Diego and all the cities in the San Diego region, apart from Del Mar and Oceanside, have adopted the 2017 OPR Noise and Land Use Compatibility Guidelines as their land use compatibility noise standards, including the 60 dBA CNEL "normally acceptable" noise level for residential uses. The cities of Del Mar and Oceanside have adopted 65 dBA CNEL as the maximum noise level compatible with residential land uses (City of Del Mar 1985; City of Oceanside 2002). Local jurisdictions do not typically provide impact thresholds to guide CEQA analysis of construction and operations noise impacts that would cause temporary or permanent increases in ambient noise levels at sensitive receptors. Rather, the noise levels are considered substantial when they exceed the applicable regulatory standard.

In addition, certain project types would be subject to the requirements or guidelines of other (regional, state, or federal) agencies including:

- Caltrans/FHWA traffic noise criteria for federal and federally funded highway projects;
- Caltrans 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 criteria (for construction and operations noise) for federal or federally funded, rail, high-speed rail, and other transit projects; and
- ALUCP or AICUZ criteria for public-use and military airports (discussed under threshold NOI-3, below).

Detailed quantitative analyses of potential impacts associated with implementation of the proposed Plan are not practical given the programmatic nature of the proposed Plan and the lack of specific project details. Therefore, the analysis of construction and operations noise impacts is largely qualitative and, where possible, is supplemented with published data or sample calculations to illustrate the points discussed in the analysis.

Impact Analysis

2035

Regional Growth and Land Use Change

As shown in Table 2-1 in Section 2.0, "Project Description," of this Draft EIR, from 2022 to 2035, the region is forecasted to increase by 117,056 people (3.6%), 137,242 housing units (11.1%), and 67,297 jobs (4.2%). The 2035 regional SCS land use pattern is shown in Figure 2-4. Approximately 93.3% of the forecasted regional population increases between 2022 and 2035 are in the cities of San Diego (51.3%), Chula Vista (26.1%), and San Marcos (15.8%). Those same three jurisdictions would accommodate approximately 71.4% of new housing units in the region between 2022 and 2035, while the cities of San Diego, San Marcos, and Oceanside would accommodate more than 69.5% of new jobs in the region between 2022 and 2035. To accommodate regional growth by 2035, new development, including housing units, commercial areas, industrial centers, and civic facilities, would be constructed. New development would occur throughout the region and could result in new or increased temporary and operations noise at nearby land uses. Noise effects 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.

Construction noise is an unavoidable result of planned growth within a given location, and implementation of the proposed Plan's forecasted land use growth would be expected to generate short-term noise increases during construction. Short-term construction noise levels would fluctuate depending on the type, quantity, and duration of usage of the various types of heavy-duty equipment. Because of the regional scale of the proposed Plan and the programmatic level of this analysis, specific construction-related details (e.g., location, schedule) for individual land use projects are not available. Construction of projects under the proposed Plan would require the use of conventional construction equipment (e.g., bulldozers, graders, backhoes) that generate noise in the immediate vicinity of the source, often resulting in temporary noise levels that are substantially higher than existing conditions. In addition to the use of conventional construction equipment, depending on the soil type and development height, some projects under the proposed Plan could require the use of high impact construction equipment, such as pile drivers. As discussed above in Section 4.13-1, "Existing Conditions," noise levels, including construction-related noise, dissipate rapidly from the source. Thus, sensitive land uses closest to construction activities are typically of greatest concern when evaluating construction noise. However, when the use of high-impact equipment (e.g., for pile driving or rock drilling) is necessary, a temporary increase in noise would occur at nearby development as well as at land uses farther away.

Table 4.13-4 summarizes typical construction noise levels for various construction activities. As shown in Table 4.13-4, construction equipment noise levels range from 70 dBA L_{eq} (generator more than 25 kilovolt amps [kVA]) to 94 dBA L_{eq} (impact pile driver) at 50 feet (FHWA 2006). As described above under "Analysis Methodology," the simultaneous operation of two of the loudest pieces of construction equipment (i.e., an impact pile driver and a bulldozer) that could be used simultaneously during construction activities are assumed. As shown in Table 4.13-13, most jurisdictions in the region establish a construction noise level limit of 75 dBA L_{eq}. Therefore, this noise level is used as a threshold to evaluate potential construction noise effects associated with land use growth. Noise levels associated with the simultaneous operation of a bulldozer and impact pile driver would attenuate to 75 dBA L_{eq} at 71 feet and 446 feet, respectively (see Appendix L for detailed modeling inputs). Thus, depending on the proximity to existing sensitive land uses, duration of construction activities, and types of equipment required, construction-related noise levels could exceed applicable local construction-related noise standards and thresholds.

In addition to short-term construction noise, regional growth and land use change could result in new operations noise sources and increased operations noise levels. As shown in Table 4.13-12, residential daytime noise standards established by jurisdictions within the region range from 45 to 60 dBA L_{eq}, and nighttime noise standards range from 40 to 50 dBA L_{eq}. As previously described, the effects of operations noise would be variable and dependent on the types of sources (e.g., loading docks, HVAC equipment), noise levels generated by such sources, distances to noise-sensitive receptors, the presence of shielding (e.g., existing structures) between the sources and receiver, and the existing ambient noise levels. However, the extent of new stationary noise from these land uses cannot currently be quantified because the quantity, magnitude, and specific location of specific stationary noise sources are unknown. Development projects associated with the proposed Plan would be required to adhere to local standards pertaining to setbacks, permissible hours of operation, and noise, which could limit the exposure of existing sensitive receptors to excessive noise levels or substantial (e.g., 5+ dBA) increases in noise. Although adherence to applicable noise standards could reduce noise exposure at nearby sensitive receptors, in certain locations, noise associated with new stationary noise sources could exceed an acceptable noise standard or result in a permanent substantial (e.g., 5+ dBA) noise increase in noise at nearby land uses.

As discussed in Section 4.13.2, "Regulatory Setting," federal, state, and local regulations exist that reduce the potential for noise impacts during construction and operations of new land uses by establishing noise standards specific to the noise source, limiting construction and operations activities during sensitive times of day (i.e., evening and nighttime), and requiring the implementation of measures, when necessary, to reduce adverse effects from increased noise. Several local jurisdictions have adopted allowable noise limits specifically for construction activities (e.g., City of Coronado, City of Encinitas), and almost all jurisdictions limit construction activities to times when noise would have the least effect on nearby land uses (i.e., during the daytime). Adherence to applicable noise regulations would be required during construction and operations to minimize the potential for adverse effects from increased noise. Although adherence to applicable regulations would be required and would reduce noise impacts associated with land use growth, construction and operations noise levels could exceed applicable thresholds, and could substantially increase from ambient levels. Therefore, impacts of regional growth and land use change as they relate to noise would be significant.

Transportation Network Improvements and Programs

Major transportation network improvements by 2035 include new Managed Lanes and Managed Lane Connectors on SR 15, SR 52, SR 78, I-5, I-15, and I-805. The proposed Plan also includes Reversible Managed Lane improvements on SR-75, improvements to rural corridors on SR-67, SR 76, SR 79, SR 94, and I-8, as well as interchange and arterial operational improvements on SR 94 and SR 125. In addition, the proposed Plan includes increased roadway and transit connections to the United States–Mexico border, as well as tolling equipment and Regional Border Management System investments on SR 11. Upgrades at certain locations on the Los Angeles–San Diego–San Luis Obispo (LOSSAN) Rail Corridor would be implemented during this period. Other major network improvements include grade separations at certain locations on the SPRINTER, Green line, Blue Line, and Orange Line. Double-tracking is also proposed on the SPRINTER.

Transportation network improvements by 2035 would include arterial improvements, development of circulator routes, highway intersection improvements, and multimodal corridor improvements. Upgrades to certain locations on the LOSSAN Rail Corridor would be implemented during this period. Other major network improvements include grade separations at certain locations on the SPRINTER, Green line, Blue Line, and Orange Line. Double-tracking is also proposed on the SPRINTER.

The construction of transportation network improvements would require the use of heavy construction equipment (e.g., bulldozers, graders, backhoes) and high-impact equipment (e.g., pile drivers, rock drilling equipment). Transportation improvement projects typically progress in a linear fashion (i.e., along the right-of-way), and thus elevated noise levels would occur only temporarily in the location where the construction occurs before moving along the right-of-way. However, construction is sometimes required during evening and nighttime hours to accommodate time-sensitive activities (e.g., concrete pours) or to minimize traffic congestion during peak travel periods. Therefore, construction activities could affect nearby sensitive receptors for shorter periods of time as construction moves along the linear right-of-way but could result in greater disturbance if construction were to occur during evening and nighttime hours.

As described above, most jurisdictions in the region establish a construction noise level limit of 75 dBA L_{eq}. To determine the effects of construction noise generated by transportation improvement projects, two of the loudest pieces of construction equipment (i.e., an impact pile driver and a bulldozer) that could be used simultaneously during construction activities are assumed. Noise levels associated with the simultaneous operation of a bulldozer and impact pile driver would attenuate to 75 dBA L_{eq} within 71 feet and 446 feet, respectively (see Appendix L for detailed modeling inputs). Thus, construction-related noise levels could exceed local construction-related noise standards depending on proximity to existing land uses and duration of construction activities. Transportation network improvement projects with federal involvement or located on the state highway system would be required to comply with the specific noise standards of the respective agency. As detailed in Section 4.13.2, "Regulatory Setting," Caltrans establishes a construction noise production limit of 86 dBA L_{max} at 50 feet from the jobsite. Noise levels associated with the operation of a bulldozer and impact pile driver would attenuate to 86 dBA L_{max} within 32 feet and 281 feet, respectively (see Appendix L for detailed modeling inputs).

FTA construction noise criteria define a substantial noise increase based on existing noise levels. Although specific construction-related details (e.g., location, schedule, equipment) for individual projects under the proposed Plan are unknown, construction activity could result in a substantial (e.g., 5+ dBA) increase over existing noise levels. Projects under the proposed Plan that meet the definition of a Type I project (as defined in Section 4.13.1), such as a federal or federally funded highway project that involves the widening of an existing highway, would be subject to the requirements of 23 CFR 772. In addition to outlining procedures for analyzing traffic and construction noise impacts, 23 CFR 772 establishes requirements for developing and implementing noise abatement measures to reduce traffic noise impacts on federal or federally funded highway projects. If a project were to meet the definition, it would require noise analysis regardless of any federal nexus.

As discussed above, adherence to federal, state, and local regulations would be required. While adherence to regulations would reduce noise impacts, depending on the proximity to existing sensitive land uses, duration of construction activities, and types of equipment required, construction-related noise levels could exceed applicable construction-related noise standards and thresholds, and impacts could exceed levels of significance.

Extension of rail transit, as well as increases in transit frequency, could result in increased noise levels that exceed applicable local, state, or federal thresholds. Similar to construction noise, operations 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. In addition, the severity of new transit network improvement projects would depend upon the type (diesel or electric powered),frequency of rail pass-by events and the existing ambient noise level at the existing receptor. For example, a doubling of sound energy (e.g., doubling of passenger trains from double-tracking) would result in a 3 dBA increase in sound and would generally be perceived as barely detectable.

As discussed in Section 4.13.2, "Regulatory Setting," federal, state, and local agencies have established noise standards, developed requirements for evaluating noise impacts, and put forth guidance for developing measures to reduce noise impacts and protect public health. Transportation network projects with federal involvement or located on the state highway system would be required to comply with 23 CFR 772, which establishes standards for the analysis and abatement of highway traffic noise, and state (Caltrans) guidance, which outlines policies and procedures for applying 23 CFR 772 in California (Caltrans 2020b). In addition, federal or state requirements for noise reduction could be required dependent on the type of project and the presence of a federal action or nexus. Examples of noise abatement measures include the construction of noise barriers, which shield receptors from noise sources and traffic management measures (e.g., traffic control devices, time-use restrictions, speed limit modifications), which would reduce traffic noise by slowing vehicles down or limiting the use of specific roadways during sensitive hours (Caltrans 2020b). Although the exact noise reduction associated with implementation of such abatement measures would vary, in accordance with 23 CFR 772, for noise abatement to be considered acoustically feasible, it must provide at least a 5 dBA minimum reduction at an impacted receptor (Caltrans 2020b: 3-8). Therefore, adherence to federal or state requirements for noise abatement would result in at least a 5 dBA noise reduction. However, there could be instances where a 5 dBA reduction from implementation of abatement measures would not be sufficient to reduce noise to an acceptable level. Many local jurisdictions have established noise compatibility standards in their municipal codes or general plans which limit sensitive development within incompatible zones and establish noise standards to ensure that sensitive land uses are not exposed to excessive transportation noise levels. Compliance with these regulations would minimize the potential for adverse transportation noise impacts that could result from implementation of the proposed Plan. Although adherence to regulations would reduce noise impacts, noise impacts may not be reduced to below levels of significance.

2035 Conclusion

Between 2022 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 that exceed applicable standards or represent substantial increases in ambient noise levels. Therefore, this impact (NOI-1) in 2035 would be significant.

2050

Regional Growth and Land Use Change

As shown in Table 2-1 in Section 2.0, "Project Description," of this Draft EIR, from 2036 to 2050, the regional population is forecast to decrease by 4,112 people (-0.1%), while housing units are projected to increase by 65,577 (4.8%) and jobs by 103,460 (6.2%). The 2050 regional SCS land use pattern is shown in Figure 2-5. The majority of the forecasted regional population decrease between 2036 and 2050 is attributed to the unincorporated jurisdictions, the City of Carlsbad, and the City of El Cajon. Approximately 78.8% of new housing units would be developed in the City of San Diego (51.6%), City of Chula Vista (17.1%), and unincorporated jurisdictions.

As described in the 2035 analysis, construction of new land use development could result in temporary noise levels that exceed applicable thresholds or result in a temporary substantial (e.g., 5+ dBA) increase in noise. According to the noise levels in Table 4.13-4, construction equipment noise levels would range from 70 (generator more than 25 kVA) to 94 dBA L_{eq} (impact pile driver) at 50 feet. As described above and shown in Table 4.13-13, most jurisdictions in the region establish a construction noise level limit of 75 dBA L_{eq}, and thus, this noise level is used to evaluate potential construction noise effects associated with land use growth. Noise levels associated with the operation of a bulldozer and impact pile driver would attenuate to 75 dBA L_{eq} within 71 feet and 446 feet, respectively (see Appendix L for detailed modeling inputs). The severity of construction noise effects would vary depending on the existing noise levels, proximity to sensitive uses, and presence of barriers that attenuate noise. As discussed in the 2035 analysis, adherence to applicable regulations (e.g., limited construction hours or operational standards) related to construction noise would be required. Although adherence to regulations would reduce noise impacts, depending on the proximity to existing sensitive land uses, duration of construction activities, and types of equipment required, construction-related noise levels could exceed applicable local construction-related noise standards and thresholds.

In addition to short-term construction noise, regional growth and land use change could result in new operations noise sources and increased operations noise levels. As discussed above in the 2035 analysis, the proposed Plan development pattern would result in new land uses that include stationary noise sources (e.g., HVAC equipment). While the exact magnitude of increased noise from the introduction of new land uses is speculative, certain locations, noise associated with new stationary noise sources could exceed an acceptable noise standard or result in a permanent increase in noise at nearby land uses. In addition, because of the anticipated growth within the region, an absolute increase in roadway traffic volumes is anticipated. Noise increases would be variable and depend upon the location of improvements relative to land uses, the presence of shielding between the sources and receiver, and the existing ambient noise level from other nearby noise sources. However, traffic noise associated with development in this time horizon could exceed an acceptable noise standard or result in a permanent substantial (e.g., 5+ dBA) increase in noise at nearby land uses.

Federal, state, and local regulations described in Section 4.13.2, "Regulatory Setting," reduce the potential for noise impacts during construction and operations of new land uses by establishing noise standards to limit excessive noise levels, limiting construction and operations activities during sensitive times of day (i.e., evening and nighttime), and requiring the implementation of measures, when necessary, to reduce adverse effects from increased noise. Adherence to applicable noise policies and procedures would be required during construction and operations. In addition, federal or state requirements for noise reduction may be required depending on the type of development and the presence of a federal action or nexus. Although adherence to applicable regulations would be required and would reduce temporary and long-term noise impacts associated with land use growth, construction and operations noise levels could exceed applicable thresholds, and ambient noise could substantially increase. Therefore, impacts of regional growth and land use change as they relate to noise would be significant.

Transportation Network Improvements and Programs

Major transportation network improvements by 2050 include new Managed Lanes and Managed Lane connectors on SR 52, SR 56, SR 75, SR 94, SR 125, SR 163, I-15, and I-805, several of which will be a continuation of improvements from 2035. In addition, the proposed Plan includes increased roadway and transit connections to the United States–Mexico border, as well as expansion of and improvements to existing port of entry facilities, which will continue during this period. Upgrades at certain locations on the LOSSAN Rail Corridor would continue during this period. Grade separations on the SPRINTER, Blue Line, Green Line, and Orange Line, as well as double-tracking on the SPRINTER would also continue during this period.

Similar to the 2035 analysis, construction and operations of transportation network improvements during the 2050 horizon year could result in new or increased noise at nearby land uses. The construction of transportation network improvements would require the use of heavy construction equipment (e.g., bulldozers, graders, backhoes) and high-impact equipment (e.g., pile drivers, rock drilling equipment). Noise levels associated with the operation of a bulldozer and impact pile driver would attenuate to 75 dBA L_{eq} within 71 feet and 446 feet, respectively (see Appendix L for detailed modeling inputs).

Transportation network improvement projects with federal involvement or located on the state highway system would be required to comply with the specific noise standards of the respective agency. Caltrans establishes a construction noise production limit of 86 dBA L_{max} at 50 feet from the jobsite. Noise levels associated with the operation of a bulldozer and impact pile driver would attenuate to 86 dBA L_{max} within 32 feet and 281 feet, respectively (see Appendix L for detailed modeling inputs). Thus, if construction of transportation network improvements were to occur within these distances of a sensitive receptor, construction could exceed Caltrans-recommended noise levels. In addition, according to the modeling conducted, construction-related noise levels could exceed FTA construction noise criteria, which limit the total noise increase based on existing noise levels. Projects that meet the definition of a Type I project (as defined in Section 4.13.1) would be subject to the requirements of 23 CFR 772, which outlines procedures for analyzing traffic and construction noise impacts on federal or federally funded highway projects. If a project associated with the proposed Plan met the definition, it would require additional noise analysis.

Similar to the 2035 analysis, transportation improvement projects could result in increased noise levels that exceed applicable local, state, or federal thresholds. 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 analyzing noise impacts and developing noise abatement measures to reduce any adverse impacts to sensitive receptors. In addition, federal or state requirements for noise reduction could be required dependent on the type of project and the presence of a federal action or nexus. Examples of noise abatement measures include the construction of noise barriers, which shield receptors from noise sources, and traffic management measures (e.g., traffic control devices, time-use restrictions, speed limit modifications), which would reduce traffic noise by slowing vehicles down or limiting the use of specific roadways during sensitive hours (Caltrans 2020b). Although the exact noise reduction associated with implementation of such abatement measures would vary, in accordance with 23 CFR 772, for noise abatement to be considered acoustically feasible, it must provide at least a 5 dBA minimum reduction at an impacted receptor (Caltrans 2020b: 3-8). Therefore, adherence to federal or state requirements for noise abatement would result in at least a 5 dBA noise reduction. However, there could be instances where a 5 dBA reduction from implementation of abatement measures would not be sufficient to reduce noise to an acceptable level. Transportation improvement projects would be subject to applicable local, state, and federal regulations for assessing and abating transportation noise impacts. However, noise impacts from the implementation of all transportation improvement projects and programs could exceed levels of significance.

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, this impact (NOI-1) is significant.

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.

2035, 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, local jurisdictions and transportation project sponsors can and should, and SANDAG shall, 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 consist of, 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, to substantially lessen the exposure of noise-sensitive receptors to construction noise levels from pile driving or other activities generating noise levels greater than 90 dBA L_{eq} at 50 feet during construction of development projects or transportation network improvements, local jurisdictions and other transportation project sponsors can and should, and SANDAG shall, implement noise reduction measures to achieve applicable noise standards or prevent substantial increases in noise levels. These measures should consist of, but are not limited to, the following.

- Erect temporary noise barriers around the noise-generating activities, particularly adjacent to residential buildings. When installed properly, acoustic barriers can reduction construction noise levels by approximately 8 to 10 dBA (EPA 1971).
- Implement "quiet" pile-driving technology (such as predrilling 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 operations noise-reduction measures to substantially lessen the exposure of noise-sensitive receptors to noise levels to achieve applicable noise standards or prevent substantial permanent increases in noise levels. These measures should consist of, but are not limited to, the following.

- Utilize techniques such as grade separation, buffer zones, landscaped berms, 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 consist of, 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.
- 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, consisting of, 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

2035, 2050

Mitigation Measure NOI-1a would provide substantial reductions in construction noise levels by ensuring proper equipment use, locating equipment away from sensitive receptors, and requiring the use of enclosures and noise barriers. Implementation of these noise-reduction measures could reduce construction noise levels by up to approximately 10 dBA (NCHRP 1999; EPA 1971). Mitigation Measures NOI-1b and NOI-1c would reduce exposure of sensitive receptors to excessive transportation and stationary noise levels through site design and building construction, based on site-specific parameters, though the noise reduction would vary depending on the specific measure. For example, the implementation of vehicle skirts for rail projects under Mitigation Measure NOI-1b could result in a 6 to 10 dBA noise reduction (FTA 2018: 97) and shielding from intervening buildings under Mitigation Measure NOI-1c could reduce noise by up to 10 dBA (FTA 2018: 49). Mitigation measures NOI-1a, NOI-1b, and NOI-

1c would substantially reduce significant noise impacts caused by exceedances of noise standards. However, because project-specific information, such as the presence and proximity of sensitive receptors, are currently unknown, implementation of these measures does not guarantee that all future project-level impacts could 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 operations vibration impacts of forecasted regional growth and land use change and planned transportation network improvements in comparison to the applicable standards and guidelines. Construction activities could potentially expose nearby buildings to ground-vibration levels that result in structural damage or negative human response. Buildings containing vibration-sensitive uses (e.g., residential, research and development, institutional) could be exposed to disturbing vibration levels if located in proximity to major operations vibration sources (e.g., rail, bus transit centers).

Typical construction activities associated with the proposed Plan would include the use of bulldozers, graders, and loaded trucks. In addition, some construction activity could require the use of high-impact equipment (e.g., pile drivers, crack-and-seat breakers, vibratory rollers). Pile drivers are often used in the construction of bridges and multistory buildings and could be required depending on the soil type. Crack-and-seat operations are used to repair roadways and involve impact breaker equipment to crack the roadway and then heavy rollers to compact and install new overlays. Crack-and-seat operations and pile driving activities generate the highest vibration levels associated with construction equipment.

As shown in Table 4.13-14, several counties and cities within the region establish guidance related to operations vibration sources. However, few of the local jurisdictions (cities and county) provide quantitative vibration criteria; therefore, in this analysis, guidance and criteria from FTA and Caltrans were used. Specifically, to evaluate the effects of construction vibration, the Caltrans threshold of 0.04 in/sec PPV for distinctly perceptible vibration effects from continuous/frequent intermittent sources (Table 4.13-11) is used to evaluate human annoyance and the Caltrans thresholds of 0.1 in/sec PPV and 0.3 in/sec PPV for structural damage to fragile buildings and older residential structures, respectively, are used (Table 4.13-10). These two thresholds were selected to represent the types of buildings generally found throughout the plan area (i.e., fragile buildings, older buildings, older residential buildings, and newer residential and commercial buildings). Construction vibration contour distances for structural damage and human annoyance were modeled based on reference vibration levels for construction equipment that could be used and would generate the greatest levels of ground vibration and were based on methodologies and usage factors from the FTA's *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018). To evaluate the effects of operational vibration associated with transportation improvement projects, the FTA screening distances for vibration are used (Table 4.13-5).

FTA's screening distances (Table 4.13-5) for major vibration sources (e.g., rail, bus transit centers) were applied for evaluating the potential for exposure from these sources to sensitive land uses.

Vibration impacts (NOI-2) are considered significant if they exceed the criteria provided by FTA and Caltrans (as applicable, depending on the project type) for human disturbance or structural damage. Detailed quantitative analyses of potential impacts are 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

2035

Regional Growth and Land Use Change

As identified in Table 2-1 in Section 2.0, "Project Description," of this Draft EIR, from 2022 to 2035, the region is forecasted to increase by 117,056 people (4%), 137,242 housing units (11%), and 67,297 jobs (4%). The 2035 regional SCS land use pattern is shown on Figure 2-4. To accommodate regional growth by 2035, new development including new housing units, commercial areas, industrial centers, and civic uses would be developed.

Construction activities associated with additional development and redevelopment could include site preparation, excavation, grading, building construction, and other related construction activities. These types of construction activities require the use of heavy-duty construction equipment (e.g., backhoes, jackhammers) that typically generate significant amounts of vibration in the immediate vicinity (e.g., exceed the FTA threshold for structural damage to non-engineered timber and masonry buildings of 0.20 in/sec PPV [FTA 2018] within 15 feet) of the source.

Reference vibration levels are shown in Table 4.13-6 for various equipment types. According to these reference levels, crack-and-seat operations, used for repairing roadways, generate the highest levels of vibration.

Development projects may require the use of vibration-intensive construction equipment, such as crack-and-seat operations (which could be used for roadway repairs), pile drivers (which could be used for multistory development), and vibratory rollers (which could be used for foundation work or roadway construction). The effects of vibration generated by construction activities depend on several factors, including the duration and type of construction activities and the distance between source and receptor.

As shown in Table 4.13-6, of the construction equipment that would likely be used during land use development, pile driving generates the highest vibration levels (i.e., 0.65 in/sec PPV at 25 feet) and can be necessary in the construction of multistory buildings depending on the soil type and building structure. In addition, less-intensive impact equipment, such as a vibratory roller, could be used during construction activities. As detailed above under "Analysis Methodology," although some local jurisdictions have established operations vibration regulations, local quantitative vibration standards related to construction do not exist. Therefore, in this analysis, the Caltrans-recommended vibration thresholds for structural damage (i.e., 0.1 in/sec PPV for fragile buildings and 0.3 in/sec PPV for older residential structures) and human annoyance to continuous/frequent intermittent sources (i.e., 0.04 in/sec PPV) are used. According to FTA-recommended procedures for applying a propagation adjustment to these reference levels, vibration levels from impact pile driving could exceed the recommended level for structural damage to fragile buildings (i.e., 0.10 in/sec PPV) within 88 feet of equipment operation and the recommended threshold for structural damage to older residential buildings (i.e., 0.30 in/sec PPV) within 42 feet (see Appendix L for detailed modeling inputs). Vibration levels from a vibratory roller could exceed the recommended level for structural damage to fragile buildings (i.e., 0.10 in/sec PPV) within 42 feet of equipment operation and the recommended threshold for older residential buildings (i.e., 0.30 in/sec PPV) within 20 feet (see Appendix L for detailed modeling inputs). As shown in Table 4.13-6, an impact pile driver would exceed the threshold of 0.04 in/sec PPV for distinctly perceptible vibration effects from continuous/frequent intermittent sources within 316 feet, and a vibratory roller would exceed the threshold of 0.04 in/sec PPV for distinctly perceptible vibration effects from continuous/frequent intermittent sources within 113 feet of operation.

Because the proposed Plan promotes development in areas with access to public transit and other sustainable transportation choices, (including ones that exist now and in the future), most projected development would likely occur in developed areas; thus, the likelihood exists for impact pile driving to occur within 88 feet of a fragile building and within 42 feet of older residential buildings, potentially posing structural damage issues. In addition, the likelihood exists for impact pile driving and other intensive construction activities (e.g., vibratory rolling) to occur within 316 feet of an existing vibration-sensitive land use. Therefore, construction of development projects associated with regional growth and land use change under the proposed Plan could exceed recommended vibration thresholds for structural damage and adverse human response.

New development, such as residential, commercial, and civic land uses, generally do not produce noticeable levels of vibration; operational vibration from these land uses is generally associated with vehicles such as trucks accessing local roadway networks which rarely produce a cumulative increase in ground vibration (Caltrans 2020b). These sources generally do not produce noticeable levels of vibration and thus are not expected to exceed applicable thresholds for structural damage or adverse human response. In addition, new development associated with the proposed Plan would occur in accordance with adopted land use plans and zoning ordinances of the cities and counties in the Plan area, which typically prohibit vibration-intensive land use (e.g., industrial) within incompatible (e.g., residential) zones. Because vibration decreases rapidly with distance (Caltrans 2020b), separating vibration-intensive land uses from sensitive land uses (e.g., residential) can minimize annoyance-related vibration impacts. For these reasons, operations vibration associated with regional growth and land use change is not expected to create a significant vibration impact.

Transportation Network Improvements and Programs

Major transportation network improvements by 2035 include new Managed Lanes and Managed Lane Connectors on SR 15, SR 52, SR 78, I-5, I-15, and I-805. The proposed Plan also includes Reversible Managed Lane improvements on SR-75, improvements to rural corridors on SR-67, SR 76, SR 79, SR 94, and I-8, as well as interchange and arterial operational improvements on SR 94 and SR 125. In addition, the proposed Plan includes increased roadway and transit connections to the United States–Mexico border, as well as tolling equipment and Regional Border Management System investments on SR 11. Upgrades at certain locations on the Los Angeles–San Diego–San Luis Obispo (LOSSAN) Rail Corridor would be implemented during this period. Other major network improvements include grade separations at certain locations on the SPRINTER, Green line, Blue Line, and Orange Line. Double-tracking is also proposed on the SPRINTER.

Construction of transportation network improvements under the proposed Plan could result in temporary increases in vibration associated with the use of vibration-intensive equipment. As shown in Table 4.13-6, of the construction equipment that would likely be used during transportation network improvements, crack-and-seat operations generate the highest vibration levels (i.e., 2.40 in/sec PPV at 25 feet). Crack-and-seat operations can be necessary for roadway repairs and thus are of greatest concern when evaluating construction-related vibration impacts associated with implementation of the proposed Plan. Pile driving generates the second highest vibration levels (i.e., 0.65 in/sec PPV at 25 feet) and can be necessary in the construction or repair of bridges and roadways. In addition, less-intensive impact equipment such as a vibratory roller could be used during construction activities. Construction-related vibration impacts from transportation project implementation would be similar to those described above for land use change. Crack-and-seat operations could exceed the recommended thresholds for structural damage to fragile buildings (i.e., 0.10 in/sec PPV) within 210 feet of equipment operation and the recommended threshold for structural damage to older residences (i.e., 0.30 in/sec PPV) within 100 feet (see Appendix L for detailed modeling inputs). In addition, crack-and-seat operations, an impact pile driver, and a vibratory roller would exceed the threshold of 0.04 in/sec PPV for distinctly perceptible vibration effects from continuous/frequent intermittent sources within 1,034 feet, 316 feet, and 113 feet of operation, respectively (Table 4.13-6). Because most projected transportation network improvement projects would occur in developed areas, the likelihood exists for crack-and-seat operations to occur within 210 feet of a fragile building and within 100 feet of older residential buildings. In addition, the likelihood exists for crack-and-seat operations and other intensive construction activities (i.e., impact pile driving and vibratory rolling) to occur within 1,034 feet, 316 feet, and 113 feet, respectively, of an existing land use, and therefore could result in human annoyance.

Transportation projects (e.g., roadway expansion) typically progress in a linear fashion (i.e., along the right-of-way); thus, construction activities could affect individual receptors for shorter periods of time as elevated vibration levels would occur only temporarily in the location where the construction occurs before moving along the right-of-way. However, transportation network improvement projects are sometimes required to occur during the night to minimize traffic congestion during peak travel periods and therefore, could result in greater disturbance (e.g., sleep disruption) to nearby sensitive receptors if construction were to occur during evening and nighttime hours. For these reasons, construction of transportation improvement projects associated with the proposed Plan could exceed recommended vibration thresholds for structural damage and adverse human response.

Transportation network improvements under the proposed Plan include new Managed Lanes and Managed Lane connectors, double-tracking at certain locations on the LOSSAN Rail Corridor along with increases in COASTER frequencies, and new *Rapid* bus routes. These improvements could result in exposure of nearby land uses to new or increased levels of vibration. In addition, groundborne vibration associated with construction and operation of improvement projects in proximity to coastal bluffs could result in adverse impacts if vibration from construction equipment or transportation are significant enough to contribute to erosion. However, vibration levels and the degree of impacts would vary greatly depending on the type of transit facility, geologic factors such as soil type, and proximity to existing sensitive land uses (FTA 2018). For example, the geologic profile of San Diego County's coastline ranges from low bluffs or cliffs cut into uplifted marine terraces typically consisting of erosion-prone Tertiary sedimentary rocks, to high relief, steep-cliffed outcrops and headlands such as Point Loma that typically consist of older, harder and more erosion-resistant rock types (National Research Council 1999.) The likelihood of vibration from Project improvements adversely impacting coastal bluffs would vary based on location-specific factors affecting efficiency of vibration propagation, such as soil stiffness and internal damping (FTA 2018). FTA's *Transit Noise and Vibration Impact Assessment Manual* includes a screening distance tool that identifies distances to different land uses at which vibration would generally attenuate to below impact levels. According to the screening distances shown in Table 4.13-5, residential land uses within 200 feet of rail rapid transit, within 150 feet of light rail transit, or within 50 feet of bus projects would be exposed to vibration exceeding the recommended thresholds for human annoyance and structural damage. Transportation improvement projects associated with the proposed Plan that are located outside the screening distances would likely not generate vibration levels that exceed applicable thresholds for structural damage or adverse human response at nearby land uses. However, because the proposed Plan emphasizes compact development within developed communities, some improvement projects could be located close to vibration-sensitive land uses, including coastal bluffs. Transportation improvement projects would be required to adhere to local, state, and federal requirements, which typically prohibit vibration-intensive projects within incompatible (e.g., residential) zones. However, vibration impacts from the implementation of all transportation improvement projects and programs could exceed levels of significance for structural damage and adverse human response.

2035 Conclusion

Improvements associated with regional growth and land use changes and transportation network improvements could generate substantial increases in ground vibration or groundborne noise levels during construction and operations. Although adherence to local, state, and federal regulations and standards which typically prohibit vibration-intensive projects within incompatible zones would be required, vibration impacts associated with the proposed Plan could exceed applicable thresholds and thus be excessive. Therefore, this impact (NOI-2) in 2035 would be significant.

<u>2050</u>

Regional Growth and Land Use Change

As identified in Table 2-1 in Section 2.0, "Project Description," of this Draft EIR, from 2036 to 2050, the regional population is forecast to decrease by 4,112 people (-0.1%), while housing units are projected to increase by 65,577 (4.8%) and jobs by 103,460 (6.2%). The 2050 regional SCS land use pattern is shown in Figure 2-5. The majority of the forecasted regional population decrease between 2036 and 2050 is attributed to the unincorporated jurisdictions, the City of Carlsbad, and the City of El Cajon. Approximately 78.8% of new housing units would be developed in the City of San Diego (51.6%), City of Chula Vista (17.1%), and unincorporated jurisdictions. Similarly, these same three jurisdictions would accommodate approximately 70.3% of new jobs between 2036 and 2050. To accommodate regional growth by 2050, new development would include new housing units, services, commercial areas, industrial centers, schools, and civic facilities.

As described in the 2035 analysis, construction of new land use developments could result in temporary vibration impacts that exceed applicable thresholds. According to the vibration levels in Table 4.13-6, of the construction equipment that would likely be used during land use development, impact pile driving generates the highest vibration levels (i.e., 0.65 in/sec PPV at 25 feet). According to FTA-recommended procedures for applying a propagation adjustment to these reference levels, vibration levels from an impact pile driver could exceed the recommended level for structural damage to fragile buildings (i.e., 0.10 in/sec PPV) within 88 feet of equipment operation and the recommended threshold for older residential buildings (i.e., 0.30 in/sec PPV) within 42 feet (see Appendix L for detailed modeling inputs). Vibration levels from a vibratory roller could exceed the recommended level for structural damage to fragile buildings (i.e., 0.10 in/sec PPV) within 42 feet of equipment operation and the recommended threshold for older residential buildings (i.e., 0.30 in/sec PPV) within 20 feet (see Appendix L for detailed modeling inputs). As shown in Table 4.13-6, vibration from an impact pile driver and a vibratory roller would exceed the threshold of 0.04 in/sec PPV for distinctly perceptible vibration effects from continuous/frequent intermittent sources within 316 feet and 113 feet of operation, respectively.

By 2050, areas throughout the region would likely be more developed, thus increasing the likelihood for construction activities to occur near sensitive receptors as compared to 2035. Specifically, because the proposed Plan promotes more development in areas with access to public transit and other sustainable transportation choices, the likelihood exists for impact pile driving to occur within 88 feet of a fragile building and within 42 feet of older residential buildings. In addition, the likelihood exists for impact pile driving and other intensive construction activities (e.g., vibratory rolling) to occur within 316 feet and 113 feet, respectively, of an existing land use. Therefore, construction of development projects associated with regional growth and land use change under the proposed Plan could exceed recommended vibration thresholds for structural damage and adverse human response.

New development, such as residential, commercial, and civic land uses, generally do not produce noticeable levels of vibration; operations vibration from these land uses is generally associated with vehicles such as trucks accessing local roadway networks which rarely produce a cumulative increase in ground vibration (Caltrans 2020b). These sources generally do not produce noticeable levels of vibration and thus are not expected to exceed applicable thresholds for structural damage or adverse human response. In addition, new development associated with the proposed Plan would occur in accordance with adopted land use plans and zoning ordinances of the cities and counties in the Plan area, which typically prohibit vibration-intensive projects within incompatible (e.g., residential) zones. Because vibration decreases rapidly with distance (Caltrans 2020b), separating vibration-intensive land uses from sensitive land uses (e.g., residential) can minimize annoyance-related vibration impacts. For these reasons, operational vibration associated with regional growth and land use change is not expected to create a significant vibration impact.

Transportation Network Improvements and Programs

Major transportation network improvements by 2050 include new Managed Lanes and Managed Lane connectors on SR 52, SR 56, SR 75, SR 94, SR 125, SR 163, I-15, and I-805, several of which will be a continuation of improvements from 2035. In addition, the proposed Plan includes increased roadway and transit connections to the United States–Mexico border, as well as expansion of and improvements to existing port of entry facilities, which will continue during this period. Upgrades at certain locations on the LOSSAN Rail Corridor would continue during this period. Grade separations on the SPRINTER, Blue Line, Green Line, and Orange Line, as well as double-tracking on the SPRINTER would also continue during this period. See Tables 2-7 through 2-10 for a full list of proposed projects by subregion.

By 2050, areas throughout the region would likely be more developed (e.g., there would be more housing units as compared to 2035), thus increasing the likelihood for construction activities to occur near sensitive receptors as compared to 2035. Similar to the 2035 analysis, construction and operations of transportation network improvements during the 2050 horizon year could result in new or increased vibration levels at nearby land uses. The construction of transportation network improvements would require the use of heavy construction equipment (e.g., bulldozers, graders, backhoes) and high-impact equipment (e.g., crack-and-seat operations, pile drivers, rock drilling). As shown in Table 4.13-6, of the construction equipment that would likely be used during transportation network improvements, crack-and-seat operations generate the highest vibration levels (i.e., 2.40 in/sec PPV at 25 feet). Crack-and-seat operations can be necessary for roadway repairs and thus are of greatest concern when evaluating construction-related vibration impacts associated with implementation of the proposed Plan. Pile driving generates the second highest vibration levels (i.e., 0.65 in/sec PPV at 25 feet) and can be necessary in the construction or repair of bridges and roadways. In addition, less-intensive impact equipment such as a vibratory roller could be used during construction activities. Construction-related vibration impacts from transportation project implementation would be similar to those described above for land use change. Crack-and-seat operations could exceed the recommended thresholds for structural damage to fragile buildings (i.e., 0.10 in/sec PPV) within 210 feet of equipment operation and the recommended threshold for structural damage to older residences (i.e., 0.30 in/sec PPV) within 100 feet (see Appendix L for detailed modeling inputs). Vibration levels from an impact pile driver could exceed the recommended level for structural damage to fragile buildings (i.e., 0.10 in/sec PPV) within 88 feet of equipment operation and the recommended threshold for older residential buildings (i.e., 0.30 in/sec PPV) within 42 feet (see Appendix L for detailed modeling inputs). Vibration levels from a vibratory roller could exceed the recommended level for structural damage to fragile buildings (i.e., 0.10 in/sec PPV) within 42 feet of equipment operation and the recommended threshold for older residential buildings (i.e., 0.30 in/sec PPV) within 20 feet (see Appendix L for detailed modeling inputs). In addition, as shown in Table 4.13-6, crack-and-seat operations would exceed the threshold of 0.04 in/sec PPV for distinctly perceptible vibration effects from continuous/frequent intermittent sources within 1,034 feet; and an impact pile driver and a vibratory roller would exceed the threshold of 0.04 in/sec PPV for distinctly perceptible vibration effects from continuous/frequent intermittent sources within 316 feet and 113 feet of operation, respectively.

Because most projected transportation network improvement projects would occur in developed areas, the likelihood exists for crack-and-seat operations to occur within 210 feet of a fragile building and within 100 feet of older residential buildings. In addition, the likelihood exists for pile driving and other intensive construction activities (i.e., impact pile driving and vibratory rolling) to occur within 1,034 feet, 316 feet, and 113 feet, respectively, of an existing land use. Therefore, construction of transportation improvement projects associated with the proposed Plan could exceed recommended vibration thresholds for structural damage and adverse human response.

Transportation network improvements under the proposed Plan could result in exposure of nearby land uses to new or increased levels of vibration. In addition, vibration associated with improvement projects in proximity to coastal bluffs could result in adverse impacts, as discussed above. However, vibration levels would vary greatly depending on the type of transit facility and proximity to existing sensitive land uses. As detailed above, FTA establishes screening distances to evaluate impacts from transportation vibration. According to the screening distances shown in Table 4.13-5, residential land uses within 200 feet of rail rapid transit, within 150 feet of light rail transit, or within 50 feet of bus projects would be exposed to vibration exceeding the recommended thresholds for human annoyance and structural damage. Transportation improvement projects associated with the proposed Plan that are located outside the screening distances would likely not generate vibration levels that exceed applicable thresholds for structural damage or adverse human response at nearby land uses. However, because the proposed Plan emphasizes compact development within developed communities, some improvement projects could be located close to vibration-sensitive land uses, including coastal bluffs. Transportation improvement projects would be required to adhere to local, state, and federal requirements, which typically prohibit vibration-intensive projects within incompatible (e.g., residential) zones. However, vibration impacts from the implementation of all transportation improvement projects and programs could exceed levels of significance for structural damage and adverse human response.

2050 Conclusion

Regional growth, land use development, and transportation network improvements would increase by 2050. Improvements associated with regional growth and land use changes and transportation network improvements could generate substantial increases in ground vibration or groundborne noise levels during construction and operation. Although adherence to local, state, and federal regulations and standards which typically prohibit vibration-intensive projects within incompatible zones, would be required, vibration impacts associated with the proposed Plan could exceed applicable thresholds and thus be excessive. Therefore, this impact (NOI-2) in 2050 would be significant.

MITIGATION MEASURES

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

2035, 2050

NOI-2a Implement Construction Groundborne Vibration and Noise Reduction Measures.
SANDAG shall, and other public agencies and transportation project sponsors can and should, implement measures during design, project-level CEQA review, and construction of transportation network improvements and development projects, to reduce groundborne vibration and noise levels generated by on site construction equipment consisting of, but not limited to, the following:

- Where feasible, use soil mix wall for excavation.
- Incorporate a comprehensive construction vibration specification into all construction bid documents.
- Require a contractor to assess the potential for damage to buildings within 88 feet of areas where excavation requires the use of driven piles either by impact or vibratory methods.
- To prevent structural damage, minimum setback requirements for different types of ground vibration-producing activities (e.g., pile driving) for the purpose of preventing damage to nearby structures shall be established based on the proposed activities and locations, once determined. Factors to be considered shall include the specific nature of the vibration-producing activity (e.g., type and duration of pile driving), the proximity of existing structures, and the fragility/resiliency of nearby structures. Established setback requirements can be breached if a project-specific, site-specific vibration analysis is conducted by a qualified geotechnical engineer or ground vibration specialist that indicates that no structural damage would occur at nearby buildings or structures.
- If crack-and-seat operations, pile driving, or other vibration-generating construction activities are to occur within 210 feet of a fragile building (e.g., based on building/structural category under Caltrans Guideline Vibration Damage Potential Threshold Criteria [Caltrans Transportation and Construction Vibration Guidance Manual, Table 19]) that would likely be damaged by exceeding the applicable vibration threshold, implement measures to reduce vibration, consisting of, 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 fragile structure, and design construction methods to not exceed the thresholds.
  - Require groundborne-vibration monitoring of nearby fragile 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.
- To prevent disturbance to sensitive land uses associated with construction activity within the impact distances shown in Table NOI-2a below, the following measures shall be implemented:
  - Alternatives to impact pile driving (e.g., sonic pile driving, jetting, cast-in-place or auger cast piles) shall be considered and implemented where feasible to reduce vibration levels.
  - Phase pile driving and other high-impact activities (i.e., equipment or activity with a reference PPV of 0.20 in/sec at 25 feet or higher, the FTA threshold for structural damage to non-engineered timber and masonry buildings) so as not to occur simultaneously with other construction activities, to the extent feasible, to reduce total vibration from construction sources.
  - Construction operations that include high-impact activities (i.e., the use of equipment or activity with a reference PPV of 0.20 in/sec at 25 feet or higher) shall be limited to daytime hours, with daylight hours being defined by the applicable jurisdiction or agency.

Table NOI-2a Construction Equipment Vibration Levels and Impact Distances[1]

Equipment Item	Reference PPV (in/sec) at 25 feet	Distance to Human Response (feet), Distinctly Perceptible Threshold[2]
Crack-and-seat operations	2.4	1,034
Impact pile driver	0.65	316
Vibratory pile driver	0.65	316
Hydraulic breaker	0.24	128
Vibratory roller	0.21	113
Large bulldozer	0.089	52
Caisson drilling	0.089	52
Jackhammer	0.035	23
Small bulldozer	0.003	3

Notes: PPV = peak particle velocity; in/sec = inches per second.

[1] Distances are calculated using the Reference PPV (PPV_{ref}) at 25 feet. The equation used to calculate these distances is $PPV = PPV_{ref} * (25/D)^n$ (Caltrans 2020a).

[2] Caltrans threshold of 0.04 in/sec PPV applied as distinctly perceptible threshold.

Sources: Caltrans 2020a; FTA 2018.

NOI-2b Implement Groundborne-Vibration and Noise Reduction 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, consisting of, 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 FTA vibration guidelines (FTA 2018) during the planning, design, project-level CEQA review, construction, and operation of rail projects, consisting of, but not limited to, the following:

- Conduct rail grinding on a regular basis to keep tracks smooth.
- Conduct wheel truing to recontour 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
  - tail suspended fastener system
  - isolated slab track system
  - floating slab track system

SIGNIFICANCE AFTER MITIGATION

2035, 2050

Implementation of Mitigation Measure NOI-2a would reduce construction vibration impacts by ensuring proper actions (e.g., setbacks, vibration monitoring, limiting construction hours) are taken to prevent structural damage to nearby buildings and to minimize disturbance to sensitive uses. Mitigation Measure NOI-2b would require the implementation of vibration-reduction measures, such as providing special track support systems and ballast mats, to ensure transportation projects meet FTA vibration guidelines. Mitigation measures NOI-2a and NOI-2b would substantially reduce significant vibration impacts caused by exceedances of groundborne vibration criteria.

However, all future project-level impacts may not be mitigated to a less-than-significant level by NOI-2a and 2b. 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 from aircraft noise. “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. For example, based on FAA guidelines, residential land uses within the existing 65 CNEL or greater noise contours are not compatible with the aircraft noise exposure unless the residence has sound attenuation features that reduce interior noise to requisite levels (SDCRAA 2022b).

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 and is supplemented with published data or simple calculations where possible to illustrate the points discussed in the analysis.

Impact Analysis

<u>2035</u>

Regional Growth and Land Use Change

As shown in Table 2-1 in Section 2.0, “Project Description,” of this Draft EIR, from 2022 to 2035, the region is forecasted have an increase of 117,056 people (3.6%), 137,242 housing units (11.1%), and 67,297 jobs (4.2%). The 2035 regional SCS land use pattern is shown in Figure 2-4. Approximately 93.3% of the forecasted regional population increases between 2022 and 2035 are in the cities of San Diego (51.3%), Chula Vista (26.1%), and San Marcos (15.8%). Those same three jurisdictions would accommodate approximately 71.4% of new housing units in the region between 2022 and 2035, while the cities of San Diego, San Marcos, and Oceanside would accommodate more than 69.5% of new jobs in the region between 2022 and 2035. To accommodate regional growth by 2035, new development would include new housing units, services, commercial areas, industrial centers, schools, and civic facilities.

As indicated in Section 4.13.1, “Existing Conditions,” there are 16 public-use and military airports in the San Diego region. The regional growth plans would not result in operations 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 within ALUCP or AICUZ traffic zones. Because the locations of new development are unknown, if new development were to occur in areas close to other public or military airports or in flight, people residing or working in the area could be exposed to excessive noise levels.

To prevent incompatible uses in areas with higher aircraft noise, ALUCPs and AICUZs establish land use policies and criteria (e.g., noise compatibility zones) to limit future incompatible uses in certain areas to minimize noise impacts to people living and working within the ALUCP or AICUZ. In addition, many local jurisdictions’ general plans include land use compatibility guidelines that designate acceptable levels of noise based on the type of development. As described in Sections 4.13.1 and 4.13.2, SDCRAA, the ALUC for the San Diego region, is required to assist local agencies in ensuring compatible land uses in the vicinity of existing or proposed airports; to coordinate planning at state, regional, and local levels; to review plans or regulations submitted by local agencies; and to review and make recommendations regarding the land uses (SDIA 2025). The ALUC would identify the land use compatibility standards that apply to the project and determine whether the project is compatible, incompatible subject to specific conditions, or incompatible.

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. Regional growth and land use change could result in new developments close to public, private, or military airports. However, new development would be required to comply with existing regulations, including land use compatibility policies established in ALUCPs and AICUZs. Compliance with such standards would ensure that people working at or living in new developments would not be exposed to excessive noise from public or military airfields or private airstrips. Therefore, impacts would be less than significant.

Transportation Network Improvements and Programs

Major transportation network improvements by 2035 include new Managed Lanes and Managed Lane Connectors on SR 15, SR 52, SR 78, I-5, I-15, and I-805. The proposed Plan also includes Reversible Managed Lane improvements on SR-75, improvements to rural corridors on SR-67, SR 76, SR 79, SR 94, and I-8, as well as interchange and arterial operational improvements on SR 94 and SR 125. In addition, the proposed Plan includes increased roadway and transit connections to the United States–Mexico border, as well as tolling equipment and Regional Border Management System investments on SR 11. Upgrades at certain locations on the Los Angeles–San Diego–San Luis Obispo (LOSSAN) Rail Corridor would be implemented during this period. Other major network improvements include grade separations at certain locations on the SPRINTER, Green line, Blue Line, and Orange Line. Double-tracking is also proposed on the SPRINTER.

Transportation network improvements would include arterial improvements, development of circulator routes, highway intersection improvements, and multimodal corridor improvements. The transportation network improvement projects could potentially be located within areas close to existing airports or airstrips; however, they would not consist of habitable structures and are not considered noise-sensitive development. Therefore, no sensitive receptors would be exposed to excessive noise levels generated by nearby aircraft, and this impact would be less than significant.

2035 Conclusion

By 2035, increased development would occur near public, private, or military airports. To prevent incompatible uses in areas with higher aircraft noise, ALUCPs and AICUZs establish land use policies and criteria (e.g., noise compatibility zones) to limit future incompatible uses in certain areas to minimize noise impacts to people living and working within the ALUCP or AICUZ. Adherence to the regulations and land use compatibility standards within ALUCPs and AICUZs would ensure that residents and workers occupying noise-sensitive land uses are not exposed to noise levels that exceed applicable standards. Therefore, this impact (NOI-3) in the year 2035 would be less than significant.

2050

Regional Growth and Land Use Change

As shown in Table 2-1 in Section 2.0 “Project Description,” of this Draft EIR, from 2036 to 2050, the region is forecasted to decrease by 4,112 people (-0.1%), increase by 65,577 housing units (4.8%), and increase by 103,460 jobs (6.2%). The 2050 regional SCS land use pattern is shown in Figure 2-5. The majority of the forecasted regional population decrease between 2036 and 2050 is attributed to the unincorporated jurisdictions, the City of Carlsbad, and the City of El Cajon. Approximately 78.8% of new housing units would be developed in the City of San Diego (51.6%), City of Chula Vista (17.1%), and unincorporated jurisdictions. Similarly, these same three jurisdictions would accommodate approximately 70.3% of new jobs between 2036 and 2050. As described in the 2035 analysis, a portion of this growth would occur near public-use or military airports, particularly those located near existing urban development. ALUCPs and AICUZs establish land use policies and criteria (e.g., noise compatibility zones) that discourage incompatible uses in certain areas to minimize noise impacts on people living and working within the ALUCP or AICUZ. In addition, many local jurisdictions' general plans include land use compatibility guidelines that designate acceptable levels of noise based on the type of development. Adherence to these regulations and programs would ensure that people working at or living in new developments would not be exposed to excessive noise from public or military airfields, or private airstrips. Therefore, impacts would be less than significant.

Transportation Network Improvements and Programs

Major transportation network improvements by 2050 include new Managed Lanes and Managed Lane Connectors on SR 52, SR 56, SR 75, SR 94, SR 125, SR 163, I-15, and I-805, several of which will be a continuation of improvements from 2035. In addition, the proposed Plan includes increased roadway and transit connections to the United States–Mexico border, as well as expansion of and improvements to existing port of entry facilities, which will continue during this period. Upgrades at certain locations on the LOSSAN Rail Corridor would continue during this period. Grade separations on the SPRINTER, Blue Line, Green Line, and Orange Line, as well as double-tracking on the SPRINTER would also continue during this period. See Tables 2-7 through 2-10 for a full list of proposed projects by subregion.

Similar to the 2035 analysis, the transportation network improvement projects implemented during this time horizon could potentially be located in areas close to existing airports or airstrips; however, they would not consist of habitable structures and are not considered noise-sensitive development. Therefore, no sensitive receptors would be exposed to excessive noise levels generated by nearby aircraft, and this impact would be less than significant.

2050 Conclusion

By 2050, increased development would occur near public, private, or military airports. To prevent incompatible uses in areas with higher aircraft noise, ALUCPs and AICUZs establish land use policies and criteria (e.g., noise compatibility zones) to limit future incompatible uses in certain areas to minimize noise impacts to people living and working within the ALUCP or AICUZ. Adherence to regulations and land use compatibility standards within ALUCPs and AICUZs would ensure that residents and workers occupying noise-sensitive land uses are not exposed to noise levels that exceed applicable standards. Therefore, this impact (NOI-3) is less than significant for this period.

MITIGATION MEASURES

No mitigation measures are required for this impact.

4.13.5 Cumulative Impacts Analysis

C-NOI-1 MAKE A CUMULATIVELY CONSIDERABLE CONTRIBUTION TO ADVERSE EFFECTS RELATED TO NOISE AND VIBRATION

This section discusses the cumulative effects of past, present, and reasonably foreseeable future projects and the contribution of regional growth and land use change and transportation network improvements and programs included in the proposed Plan to these effects. The geographic scope for the cumulative noise and vibration analysis is the Southern California and Northern Baja California region. Transportation networks, including the regional roadway/interstate networks, rail lines, and airports, are prominent sources of environmental noise in the region. Development, growth, population increase, and land use change can contribute to an increase in ambient noise and vibration directly related to the type of development, increased use of transportation facilities, and the general introduction of new sources of noise and vibration.

Generally, the geographic scope of the cumulative impact analysis for noise and vibration is limited to the area immediately surrounding the project site. However, increases in ambient noise and vibration can occur on regional roadway and interstate networks, rail lines, and airports as a result of growth, population increase, or land use change. Thus, consideration of the Southern California and Northern Baja California region is appropriate.

This cumulative impact assessment considers and relies on the impact analysis within this EIR for the proposed Plan; the EIR for Connect SoCal 2024, the current RTP/SCS for the SCAG region (SCAG 2024); and the EIR for the

2019 SDIA Development Plan (SDCRAA 2019). Other plans with applicable information but no associated environmental analysis include the California-Baja California Border Master Plan (SANDAG 2021).

Impacts of the Proposed Plan

Regional growth and land use change and the transportation network improvements associated with the proposed Plan would generate construction and operations noise levels that would expose noise-sensitive receptors (e.g., residences, churches, hospitals) to noise levels that exceed applicable noise standards. In addition, construction and operations of projects associated with the proposed Plan could result in substantial increases in ambient noise levels. This exposure of people to, or generation of, noise levels exceeding applicable noise standards established by local jurisdictions or other agencies is considered a significant and unavoidable impact in horizon years 2035 and 2050 (Impact NOI-1).

Regional growth land use change and transportation network improvements under the proposed Plan in horizon years 2035 and 2050 would also result in conditions where construction of new development and transportation network improvements could also expose vibration-sensitive receptors (e.g., residences, churches, hospitals) to vibration levels that exceed applicable standards. This exposure of people to, or generation of, vibration levels exceeding applicable noise standards established in state and federal guidance is considered a significant and unavoidable impact in horizon years 2035 and 2050 (Impact NOI-2).

Future development under the proposed Plan would likely occur near public-use or military airports and private airstrips or helipads; however, compliance with existing aviation regulations, procedures, and ALUCPs and AICUZ policies would ensure project compatibility with public-use or military airports and private airstrips or helipads. Therefore, the impact of exposing people to excessive aviation noise would be less than significant in 2035 and 2050 (Impact NOI-3).

Due to the distribution characteristics of sound and vibration, construction and operational noise and vibration are generally limited to the vicinity of individual project sites. As discussed in this section, the effects of noise and vibration associated with implementation of the proposed Plan would vary depending on project- and site-specific conditions. When required, mitigation measures would reduce the noise and vibration impacts associated with projects under the proposed Plan. However, because it cannot be assured that applicable noise standards would be met, implementation of the proposed Plan would result in a substantial increase in noise and vibration within the region and thus would result in considerable contribution to a cumulatively significant impact.

Impacts of Related Projects

Other related regional transportation improvement projects, such as the California High-Speed Rail project, could have localized construction and operational noise impacts along the project alignment. Land development projects throughout the region would also generate localized construction and operations noise impacts. All regional projects would be required to adhere to existing regulations discussed in Section 4.13.2, “Regulatory Setting,” and to implement mitigation measures if noise and vibration levels exceed applicable thresholds. However, if these projects were to occur in close proximity to one another and within the same time frame, they could combine to create cumulative impacts.

Impacts of Projections in Adopted Plans

The SCAG Connect SoCal 2024 Program EIR found that implementation of Connect SoCal 2024 could result in exposure of persons to, or generation of, noise levels in excess of applicable noise standards established in general plans, noise ordinances, or applicable standards of other agencies. Thus, Connect SoCal 2024 would contribute to substantial noise impacts in the region. The SCAG Connect SoCal 2024 Program EIR also determined that Connect SoCal 2024 could result in the exposure of people to excessive vibration and groundborne noise levels. Thus, SCAG Connect SoCal 2024 would contribute to significant vibration impacts in the region. Finally, the SCAG Connect SoCal 2024 Program EIR determined that Connect SoCal 2024 had the potential to expose people to excessive aviation-related noise (SCAG 2024).

The 2019 SDIA Development Plan EIR considered potential aviation, surface transportation, construction, and cumulative noise impacts associated with the Airport Development Plan and its alternatives. The EIR found that the Airport Development Plan's cumulative noise impact would be cumulatively considerable in combination with operational aircraft and roadway noise exposure levels. Construction noise changes due to the Airport Development Plan were found to be less than significant (SDCRAA 2019).

The California-Baja California Border Master Plan is a binational comprehensive approach to coordinate planning and delivery of projects at land ports of entry and transportation infrastructure serving those ports of entry in the California-Baja California region (SANDAG 2021). The Master Plan does not have an associated environmental analysis document; however, it is reasonable to assume that projects included in the Master Plan could have adverse impacts related to noise and vibration levels that exceed applicable thresholds or result in a substantial increase above existing ambient levels as result of the expansion of existing transportation facilities and the development of new transportation facilities.

Cumulative Impacts and Impact Conclusions

2035

A significant cumulative impact in 2035 would result if the combined impacts of the proposed Plan, impacts of cumulative projects, and impacts of projections from adopted plans within the Southern California and Northern Baja California region were significant when considered together, even if not independently significant. As described above, future development and transportation network improvements associated with the proposed Plan would cause exceedances of noise standards and result in the exposure of sensitive receptors to substantial short-term and permanent noise increases. Future development and transportation network improvements associated with the proposed Plan would also cause vibration impacts that could exceed applicable thresholds and thus be excessive.

Significant noise and vibration impacts have been identified in other environmental analysis documents for cumulative projects and adopted plans. The combination of the direct noise and vibration impacts from the proposed Plan and other cumulative projects adopted plans that would affect the San Diego and Northern Baja California region would, therefore, result in significant cumulative noise and vibration impacts based on exposure to, or generation of, noise levels that exceed applicable standards, substantial temporary and permanent increases in noise levels, and excessive vibration and groundborne noise. Because the proposed Plan's noise and vibration impacts are significant, the proposed Plan would contribute to cumulatively considerable noise and vibration impact in 2035 (Impact C-NOI-1).

As described above, future development and transportation network improvements forecasted in the proposed Plan would occur near public airports and private airstrips, but residents and workers would not be exposed to excessive noise levels. As discussed above, while the 2019 SDIA Development Plan EIR identified a cumulative aircraft-induced noise exposure due to the Airport Development Plan (SDCRAA 2019), the proposed Plan's impacts related to aircraft noise would continue be less than significant because residents and workers would continue not be exposed to excessive noise levels. Therefore, cumulative aircraft noise exposure impacts would not be significant, and the proposed Plan would not result in a cumulatively considerable contribution to aircraft noise exposure.

2050

The cumulative analyses presented above for the horizon year 2035 would be applicable to 2050. Because cumulative noise and vibration impacts throughout the San Diego and Northern Baja California region would be significant by 2050 and because the proposed Plan's noise and vibration impacts are significant, the proposed Plan would contribute to a cumulatively considerable noise and vibration impact in 2050 (Impact C-NOI-1). As described for 2035, the proposed Plan would not result in a cumulatively considerable contribution to aircraft noise exposure.

MITIGATION MEASURES

C-NOI-1 MAKE A CUMULATIVELY CONSIDERABLE CONTRIBUTION TO ADVERSE EFFECTS RELATED TO NOISE AND VIBRATION

Mitigation Measure NOI-1a calls for construction noise reduction measures to meet local standards and reduce temporary noise levels during construction, and Mitigation Measures NOI-1b and NOI-1c call for operations noise-reduction measures to be implemented to meet local standards and reduce permanent noise levels during operations for transportation network improvements and development projects, respectively. As discussed previously, mitigation measures would reduce noise impacts but would not guarantee reduction of all projects associated with the proposed Plan to below applicable levels of significance. Therefore, the proposed Plan's contributions to cumulative noise impacts in 2035 and 2050 would remain cumulatively considerable with mitigation.

Mitigation Measure NOI-2a calls for groundborne vibration-reduction and groundborne noise-reduction measures to be implemented during construction activities, and Mitigation Measure NOI-2b requires groundborne vibration- reduction and groundborne noise-reduction measures for operations. As discussed above, mitigation measures would reduce significant increases in vibration and groundborne noise for some projects; however, they would not guarantee that vibration associated with all future projects would be reduced to a less-than-significant level. Therefore, the proposed Plan's contributions to cumulative vibration and groundborne noise in 2035 and 2050 would remain cumulatively considerable with mitigation.

2035, 2050

For the reasons discussed above, the proposed Project's contribution to cumulative noise and vibration impacts in 2035 and 2050 would remain cumulatively considerable with mitigation.

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