3.13 NOISE

This section of the Program Environmental Impact Report (PEIR) describes the ambient noise characteristics in the SCAG region, identifies the regulatory framework with respect to laws and regulations that govern noise, and evaluates and discusses the potential impacts of the Connect SoCal Plan ("Connect SoCal"; "Plan"). In addition, this PEIR provides regional-scale mitigation measures as well as project-level mitigation measures to be considered by lead agencies for subsequent, site-specific environmental review to reduce identified impacts as appropriate and feasible.

3.13.1 ENVIRONMENTAL SETTING

3.13.1.1 Definitions

Terms and criteria used in the assessment of noise impacts are described below.

A-weighting: This is the method commonly used to quantify environmental noise that involves evaluation of all frequencies of sound, with an adjustment to reflect the constraints of human hearing. Because the human ear is less sensitive to low and high frequencies than to midrange frequencies, noise measurements are weighted more heavily within those frequencies of maximum human sensitivity in a process called A-weighting (dBA).

Ambient: Ambient is the total noise in the environment, excluding noise from the source of interest.

Community noise equivalent level (CNEL): CNEL represents the average daytime noise level during a 24- hour day, adjusted to an equivalent level to account for people's lower tolerance of noise during the evening and nighttime hours. Because community receptors are more sensitive to unwanted noise intrusion during the evening and night, an artificial decibel increment is added to quiet-time noise levels. Sound levels are increased by 5 dBA during the evening, from 7:00 p.m. to 10:00 p.m. and by 10 dBA during the nighttime, from 10:00 p.m. to 7:00 a.m. during this quiet time period.

Day-night equivalent level (L_{dn}): L_{dn} is a measure of the 24-hour average noise level at a given location. It is based on a measure of the L_{eq} noise level over a given time period. The L_{dn} is calculated by averaging the L_{eq} for each hour of the day at a given location after penalizing the "sleeping hours" (defined as 10:00 p.m. to 7:00 a.m.), by 10 dBA to account for the increased sensitivity of people to noises that occur at night. L_{dn} is also referred to as day-night average (DNL) sound level in some cases.

Decibel (dB): dB is a unitless measure of sound on a logarithmic scale that indicates the squared ratio of sound pressure amplitude to a reference sound pressure amplitude. The reference pressure is 20 micropascals.

Equivalent sound level (L_{eq}): L_{eq} is a term typically used to express time averages. It is a steady-state energy level that is equivalent to the energy content of a varying sound level over a stated period of time, which means that the L_{eq} represents the noise level experienced over a stated period of time averaged as a single noise level.

Frequency: Frequency is the number of cycles per unit of time (seconds), expressed in hertz (Hz).

Noise: Noise is any sound that annoys or disturbs humans or that causes or tends to cause an adverse psychological or physiological effect on humans. Any unwanted sound.

Noise level (L_N): Another measure used to characterize noise exposure, L_N is the variation in sound levels over time, measured by the percentage exceedance level. L_{10} is the A-weighted sound level that is exceeded for 10 percent of the measurement period, and L_{90} is the level that is exceeded for 90 percent of the measurement period. L_{50} is the median sound level. Additional statistical measures include L_{min} and L_{max}, the minimum and maximum sound levels, respectively, measured during a stated measurement period.

Peak Particle Velocity (PPV): Defined as the maximum instantaneous positive or negative peak of the vibration signal, usually measured in inches per second (in/sec).

Sound: A vibratory disturbance created by vibrating objects, which, when transmitted by pressure waves through a medium such as air, is capable of being detected by a receiving mechanism, such as the human ear or a microphone.

Sound Exposure Level (SEL): This metric represents all the acoustic energy (a.k.a. sound pressure) of an individual noise event as if that event had occurred within a one-second time period. SEL captures both the level (magnitude) and the duration of a sound event in a single numerical quantity, by "squeezing" all the noise energy from an event into one second. This provides a uniform way to make comparisons among noise events of various durations.

Vibration: Vibration is the mechanical motion of earth or ground, building, or other type of structure, induced by the operation of any mechanical device or equipment located upon or affixed thereto. For purposes of this report, the magnitude of the vibration shall be stated as the acceleration in "g" units (1 g is equal to 32.2 feet/second^2, or 9.81 meters/second^2).

Noise Fundamentals

Noise is defined as unexpected and unwanted sound. Unlike other linear measures, such as weight and time, noise levels are measured in decibels (dB) on a logarithmic scale. Thus, doubling a noise source, such as traffic volumes, does not double the noise level, but instead increases the resultant noise level by 3 dB.[1],[2] Conversely, reducing a noise source in half results in a 3 dB decrease.[3] Thus, due to the logarithmic scale of the decibel unit, sound levels are not added or subtracted arithmetically. Moreover, in cases where existing ambient noise levels are already relatively high, there will be a small change in overall noise levels when a newer and lesser noise source is added. For example, when 70 dB ambient noise levels are combined with a 60 dB noise source, the resulting noise level equals 70.4 dB.[4]

A significant challenge in managing and mitigating noise is that not every person or community perceives and responds to noise in the same way. From an individual to the neighborhood level, there are different thresholds and tolerances for sound. Furthermore, one community (e.g. urban environment) may deem a land use (e.g. airport expansion) acceptable within a certain noise level, while another (e.g. suburban) might not. Moreover, sensitive receptors, such as residential areas, convalescent homes, schools, auditoriums, and other similar land uses, may be affected to a greater degree by increased noise levels than industrial, manufacturing, or commercial facilities. The effects of noise can range from interference with sleep, concentration, and communication, to the causation of physiological and psychological stress, and at the highest intensity levels, hearing loss.[5]

The method commonly used to quantify environmental noise involves evaluation of all frequencies of sound, with an adjustment to reflect the constraints of human hearing. Since the human ear is less sensitive to low and high frequencies than to midrange frequencies, noise measurements are weighted more heavily within those frequencies of maximum human sensitivity in a process called "A-weighting," written as dBA.[6] In practice, environmental noise is measured using a sound level meter that includes an electronic filter corresponding to the A-weighted frequency spectrum. Typical examples can be used to

---

1 Federal Transit Administration, Office of Planning and Environment. 2018. *Transit Noise and Vibration Impact Assessment.* Washington, DC.

2 California Department of Transportation, Division of Environmental Analysis. 2013. *Technical Noise Supplement to the Traffic Noise Analysis Protocol.* Sacramento, CA.

3 Ibid.

4 Ibid.

5 U.S. Environmental Protection Agency, Office of Noise Abatement and Control. 1978. *Noise: A Health Problem.* Washington, DC.

6 California Department of Transportation, Division of Environmental Analysis. 2013. *Technical Noise Supplement to the Traffic Noise Analysis Protocol.* Sacramento, CA.

illustrate sound sources that correlate to measure A-weighted sound levels and the subjective loudness to a person (**Table 3.13-1, Common Sound Levels and Loudness**).

Table 3.13-1
Common Sound Levels and Loudness

Decibel (dB)	Subjective Loudness	Source of Sound
130	Threshold of pain	Military jet aircraft take-off from aircraft carrier with afterburner at 50 feet
120	Uncomfortably loud	Turbo-fan aircraft at takeoff power at 200 feet; rock band
110		
100	Very loud	Boeing 707 or DC-8 aircraft at 1 nautical mile (6,080 feet) before landing; jet flyover at 1,000 feet; Bell J-2A helicopter at 100 feet
90		Boeing 737 or DC-9 aircraft at 1 nautical mile before landing; power mower; motorcycle at 25 feet; car wash at 20 feet
80		High urban ambient sound; diesel truck at 40 mph at 50 feet; diesel train at 45 mph at 100 feet; passenger car at 65 mph at 25 feet; food blender; garbage disposal
70	Moderately loud	Living room music; radio or TV audio; vacuum cleaner
60		Air conditioning unit at 100 feet; dishwasher (rinse) at 10 feet; conversation
50	Quiet	Large transformers at 100 feet
40		Bird calls; lowest limit of urban ambient sound
30		
20		Quiet living room
10	Just audible	Average whisper
0	Threshold of hearing	

Source:
Adapted from: Federal Interagency Committee on Noise. August 1992. Federal Agency Review of Selected Airport Noise Analysis Issues. Table B.1. Washington, DC.
Adapted from: Cowan, James P. 1993. Handbook of Environmental Acoustics. Hoboken, NJ: John Wiley and Sons.

Vibration Measurement

Vibration is an oscillatory motion in terms of displacement, velocity, or acceleration. Vibration is typically measured as peak particle velocity (PPV) in inches per second. In this context, vibration refers to the minimum ground- or structure-borne motion that causes a normal person to be aware of the vibration by means such as, but not limited to, sensation by touch or visual observation of moving objects. The effects of ground-borne vibration include movements of the building floors that can be felt, rattling of windows, and shaking of items on shelves or hangings on the walls. In extreme cases, vibration can cause damage to buildings. The noise radiated from the motion of the room surfaces is called ground-borne noise (**Table 3.13-2, Typical Levels of Ground-Borne Vibration**). The vibration motion normally does not provoke the same adverse human reactions as the noise unless there is an effect associated with the shaking of the

building. In addition, the vibration noise can only occur inside buildings. Similar to the propagation of noise, vibration propagated from the source to the receptor depends on the receiving building (i.e., the weight of the building), soil conditions, layering of the soils, the depth of groundwater table, and so forth.

Table 3.13-2
Typical Levels of Ground-Borne Vibration

Response	Velocity Level*	Typical Sources (at 50 feet)
Minor cosmetic damage of fragile buildings	100	Blasting from construction projects
Difficulty with tasks such as reading a video display terminal (VDT) screen	90	Bulldozers and other heavy tracked construction equipment
Residential annoyance, infrequent events	80	Rapid transit, upper range
Residential annoyance, frequent events	70	High speed rail, typical
Approximate threshold for human perception	60	Bus or truck, typical
	50	Typical background vibration

Note:
** Root mean square (RMS) vibration velocity level in VdB relative to 10^{-6} inches/second*
Source:
Nelson, J.T., and H.J. Saurenman. December 1983. State-of-the-Art Review: Prediction and Control of Ground-Borne Noise and Vibration from Rail Transit Trains. U.S. Department of Transportation, Urban Mass Transportation Administration, Report Number UMTA-MA-06-0049-83-4, DOT-TSC-UMTA-83-3.

Ambient Noise Level

The 38,000-square-mile SCAG region includes 6 counties and 191 cities. It covers a diverse array of land uses that range from quiet, undeveloped rural areas to loud, dense, urban areas. Ambient noise levels for areas where sensitive receptors may be located can range from 46 dBA for a small town or quiet suburban area to greater than 87 dBA for an urban area next to a freeway.[7] Given the size of the SCAG region and the variation in sources, it is not useful to complete a detailed noise monitoring study for this PEIR.

7 U.S. Environmental Protection Agency, Office of Noise Abatement and Control. 1974. *Information on Levels of Environmental Noise Requisite to Protect Public Health with an Adequate Margin of Safety*. Available online at: https://nepis.epa.gov/Exe/ZyPDF.cgi/2000L3LN.PDF?Dockey=2000L3LN.PDF, accessed March 27, 2019.

Rather, this PEIR presents a discussion of noise levels associated with different noise sources, thereby allowing the reader to infer the noise level at different locations depending on the proximity of a location to a noise source. Since the range of ambient noise levels is so vast, a variety of land uses and locations was sampled in order to characterize their ambient noise levels. Six locations were selected within the SCAG region to represent the range of ambient noise conditions by land use types (**Table 3.13-3, Ambient Noise Sampling Data**).

Table 3.13-3
Ambient Noise Sampling Data

Location	Land Use	Peak Hour Noise Level (dBA, Leq)
City of Los Angeles (Mission Hills)	Cemetery	62
City of Los Angeles (Baldwin Hills)	Residential (Multi-Family/Industrial Adjacent)	60
City of Riverside	Institutional (University)	56
City of Pasadena	Mixed-Use (Multi-Family Residential and Retail)	63
City of Los Angeles (Del Rey)	Residential (Single Family)	63
City of Moorpark	Recreational (City Park)	48
City of Los Angeles (Boyle Heights)	Institutional (High School/Middle School Adjacent)	57

Source: Impact Sciences, 2019

The most common noise sources within the SCAG region is traffic on highways and on arterial roadways. Higher levels of noise from traffic are generally due to higher traffic volumes and faster travel speeds. Aircraft noise is also present in many areas of the SCAG region, with higher noise levels generated during takeoff and landing. Rail traffic and industrial and commercial activities also contribute to the noise level. Other contributors may also include construction, garbage collecting trucks, helicopters (news, police activity and tourism) and sporting/special events.

Transportation

Many principal noise generators within the SCAG region are associated with transportation (i.e., airports, freeways, arterial roadways, seaports, and railroads). However, local collector streets are not considered to be a significant source of noise since traffic volumes and travel speeds are generally much lower than for freeways and arterial roadways.

Airports and Aviation

The six-county SCAG region is home to an expansive multiple airport system that includes seven commercial airports with scheduled passenger service, seven government/military air fields, and more

than 30 reliever and general aviation airports. The seven commercial service airports in the region with scheduled passenger service are: Hollywood-Burbank (BUR), Imperial (IPL), Long Beach (LGB), Los Angeles (LAX), Ontario (ONT), Palm Springs (PSP), and Santa Ana (SNA). Sixteen of the airports in the region are designated by the Federal Aviation Administration (FAA) as reliever airports, which means that those airports could provide congestion relief for any of the commercial service airports in the region if needed. With such a large and versatile transportation system, the SCAG region airports support a significant amount of passenger and goods movement, and the subsequent volume of air traffic. See **Table 3.13-4, Major Commercial Airports within the SCAG Region**.[8]

Table 3.13-4
Major Commercial Airports within the SCAG Region

Airport	Location	Airport Land Use Plan	Noise Contour Available?
Bob Hope Airport	Burbank	Los Angeles County Airport Land Use Plan	Yes
Ontario International Airport	Ontario	LA/Ontario International Airport Land Use Compatibility Plan	Yes
Los Angeles International Airport	Los Angeles	Los Angeles County Airport Land Use Plan	Yes
Long Beach Airport	Long Beach	Los Angeles County Airport Land Use Plan	Yes
Palm Springs International Airport	Palm Springs	Riverside County Airport Land Use Compatibility Plan	Yes
John Wayne Airport	Santa Ana	Airport Environs Land Use Plan for John Wayne Airport	Yes
Imperial County Airport	Imperial	Airport Land Use Compatibility Plan for Imperial County Airports	Yes

Source:
Southern California Association of Governments. 2019. Connect SoCal: Aviation and Airport Ground Access Technical Report.

Noise associated with aviation arise primarily from aircraft operations. Specifically, aircraft operations can generate substantial levels of noise exposure when one is in the immediate vicinity of airport runways, or when one is near the flight path of an aircraft departure or approach at lower altitudes. In addition to proximity to runways and departure/approach flight paths, other contributing factors to noise impacts include duration of noise exposure, the type of aircraft operated, number of aircraft operations (e.g. take-offs, landings, flyovers), altitude of the aircraft, and atmospheric conditions, which may influence the direction of aircraft operations and affect noise propagation.

8 Southern California Association of Governments. 2008. *SCAG Commercial Airport System Map*. Available at: http://www.scag.ca.gov/Documents/commercialairport_2008.pdf, accessed March 27, 2019.

Typically, most major public airports will have an airport land use plan that provides guidance on noise levels and land use in adjacent areas. The FAA measures airport-related noise in communities in terms of overall exposure rather than single events such as takeoffs and landings since overall exposure would account for the overall number of noise events and the time when these events occur. The day night average sound level (L_{dn}) is the standard federal (FAA and EPA) metric for this measurement; however, the FAA also accepts the CNEL when a state requires that metric to assess noise effects. The State of California Department of Transportation Division of Aeronautics adopted the CNEL as their methodology for describing airport noise exposure.[9] Noise levels computed by these two methods typically differ by less than 1 dBA. The resulting noise contour map identifies geographic areas that are exposed to various levels of impacts from airport noise. Areas that are within the noise contours of 65 dBA CNEL and above, associated with airport activities, are considered to be incompatible with certain land uses, including residences, schools, hospitals, and childcare facilities.[10]

Freeways, Highways, and Arterial Roadways

The SCAG region has more than 73,000 lane miles.[11] Regionally significant arterials provide access to the freeway system and often serve as parallel alternate routes; in some cases, they are the only major system of transportation available to travelers. Typical arterial roadways have one or two lanes of traffic in each direction, with some containing as many as four lanes in each direction. Traffic noise is generated primarily from vehicles and dominated by trucks. In general, higher traffic volumes, higher speeds, and greater numbers of trucks will increase the noise level. Vehicle noise comes from noises generated by the engine, exhaust, and tires, and is often exacerbated by vehicles in a state of disrepair, such as defective mufflers or struts.

There are also environmental factors that affect noise from highway and roads. The level of traffic noise can be reduced by distance, terrain, vegetation, and intervening obstructions. However, unlike construction noise, traffic noise is a line source, not a point source. Therefore, the attenuation with distance is not as great as for traffic noise. In comparison, a point source such as stationary construction equipment attenuates by 6 dB with every doubling of the distance, whereas a line source such as traffic attenuates only by 3 dB with every doubling of the distance.

---

9 California Department of Transportation. *Airport Noise Program*. Available online at: https://dot.ca.gov/programs/aeronautics/airport-noise-program, accessed September 4, 2019.

10 Federal Aviation Administration. 2007. *Environmental Desk Reference for Airport Actions*. Chapter 17, Noise. Washington, DC. October.

11 Southern California Association of Governments (SCAG). 2019. Model Output, September 10, 2019.

Traffic noise can therefore be a significant environmental concern where buffers (e.g., buildings, landscaping, etc.) are inadequate or where the distance to sensitive receptors is relatively short. Given typical daily traffic volumes of 10,000 to 40,000 vehicle trips, noise levels along arterial roadways typically range from L_{dn} 65 to 70 dB at a distance of 50 feet from the roadway centerlines.

In addition to distance, the line of sight also affects the extent to which traffic noise can affect sensitive receptors. Line of sight can be interrupted by roadways that are elevated above grade or depressed below grade; by intervening structures such as buildings, landscaping, and sound walls; or by terrain such as hills. For example, measurements show that depressing a freeway by approximately 12 feet yields a reduction in traffic noise relative to an at-grade freeway of 7 to 10 dB at all distances from the freeway due to the interrupted line of sight. Traffic noise from an elevated freeway is typically 2 to 10 dB less than the noise from an equivalent at-grade facility within 300 feet of the freeway, but beyond 300 feet, the noise radiated by an elevated and at-grade freeway (assuming equal traffic volumes, fleet mix, and vehicle speed) is the same because at short distances, the elevated structure of the freeway itself interrupts the line of sight between the traffic and the sensitive receptor, but that line of sight is reestablished at greater distances.[12] Caltrans also has an extensive sound wall program for areas with residential property built prior to the freeway or prior to a major widening and has hourly noise levels that exceed the 67-dB (L_{eq}) threshold, and where the wall would be able to achieve at least a 5-dB reduction and the cost would not exceed $35,000 per residential unit (1987 dollars).[13] A typical wall that interrupts the line of sight is capable of reducing noise levels by 10 dB to 15 dB.

Railroad Operations

Railroad operations generate high, relatively brief, intermittent noise events. These noise events are an environmental concern for sensitive receptors located along rail lines and in the vicinities of switching yards. Locomotive engines; the interaction of steel wheels and rails from rolling noise, impact noise when a wheel encounters a rail joint, turnout, or crossover, and squeal generated by friction on tight curves; and warning devices such as air horns and crossing bell gates are the primary sources of rail noise. Noise levels vary widely for different types of rail operations (**Table 3.13-5, Reference Noise Levels for Various Rail Operations**).

12 California Department of Transportation. 2013. *Technical Noise Supplement to the Traffic Noise Analysis Protocol.* September.

13 California Department of Transportation. 2010. *Soundwalls*. Website. Available online at: http://www.dot.ca.gov/dist07/resources/soundwalls/, accessed March 27, 2019.

Table 3.13-5
Reference Noise Levels for Various Rail Operations

Source/Type		Reference Condition	Reference Noise Level (SEL, dBA)
Commuter rail, at-grade	Locomotives	Diesel-electric, 3,000 horsepower	92
		Electric	90
	Diesel multiple unit	Diesel-powered, 1,200 horsepower	85
	Horns	Within one-quarter mile of grade crossing	110
	Cars	Ballast, welded rail	82
Rail transit		At-grade, ballast, welded rail	82
Transit whistles/warning devices		Within one-eighth mile of grade crossing	93
Automated guideway transit	Steel wheel	Aerial, concrete, welded rail	80
	Rubber tire	Aerial, concrete, guideway	78
Monorail		Aerial, straddle beam	82
Maglev		Aerial, open guideway	72

Source:
Federal Transit Administration. May 2018. Transit Noise and Vibration Impact Assessment Manual. Washington, DC.

Freight Trains

Locomotive engine noise and wheel-to-rail interactions are the primary source of noise generated by freight train pass-by events. Engine noise increases when the train is being pulled uphill. Wheel noise increases approximately 6 dB for each doubling of train velocity. A rail line supporting 40 freight trains per day generates approximately L_{dn} 75 dB at 200 feet from the tracks. Freight trains also generate substantial amounts of ground-borne noise and vibration in the vicinity of the tracks. Ground-borne noise and vibration is a function of both the quality of the track and the operating speed of the train.

The SCAG region is served by two Class I railroads: Union Pacific Railroad (UP) and Burlington Northern/Santa Fe Railway (BNSF).[14] BNSF rail lines extend south from switching yards in eastern Los Angeles to the Los Angeles and Long Beach ports complex and east to Arizona and points beyond via San Bernardino County. In addition, there are three Class III railroads (short lines) serving the region, the Pacific Harbor Line (which handles all rail coordination in the Ports of Los Angeles and Long Beach), the

14 Southern California Association of Governments. 2012. *On the Move: Southern California Delivers the Goods*. Summary Report. December.

Los Angeles Junction Railway (which provides switching service in the Vernon area for the two main line railroads), and the Ventura County Railroad (which serves the Port of Hueneme).

Completed in 2002, the Alameda Corridor provides a substantial long-term reduction in noise and vibration associated with rail operations in the vicinities of the Ports of Long Beach and Los Angeles by eliminating over 200 grade-level street/rail crossings.[15] The Alameda Corridor consolidates the operations of UP and BNSF on 90 miles of existing branch line tracks into one 20-mile corridor along Alameda Street. This corridor provides a direct connection between the ports of Long Beach and Los Angeles and the UP and BSNF switching yards in eastern Los Angeles. The project includes four overpasses and three underpasses at intersections south of SR-91 that allow vehicles to pass above the trains. North of SR-91, trains pass through a 10-mile, 33-foot-deep trench.[16] The construction of tracks in a below-grade trench, track construction on new base materials, and the use of continuous welded track reduce noise impacts on adjacent uses from trains associated with the ports. The project also includes sound walls in certain locations to mitigate vehicle noise along Alameda Street in residential neighborhoods and other sensitive areas.

Commuter Rail

In general, the noise generated by commuter rail facilities (powered by either diesel or electric locomotives) is from the locomotives themselves. In the SCAG region, there are two commuter and intercity passenger train operators: Amtrak and the Southern California Regional Rail Authority (SCRRA).

Amtrak operates five routes that travel through the SCAG region: Texas Eagle, Coast Starlight, Pacific Surfliner, Southwest Chief, and Sunset Limited. These routes serve Chicago, St. Louis, Dallas, San Antonio, Los Angeles, Portland, Seattle, San Luis Obispo, Santa Barbara, San Diego, Albuquerque, and New Orleans.[17] A typical Amtrak pass-by event generates SEL 107 dB at 50 feet; two such events during the daytime or evening periods generate approximately L_{dn} 61 dB at 50 feet and approximately L_{dn} 52 dB at 200 feet. Nine such events generate approximately L_{dn} 67 dB at 50 feet and 58 L_{dn} dB at 200 feet.

15 Alameda Corridor Transportation Authority. *Alameda Corridor Fact Sheet*. Available online at: http://www.acta.org/projects/projects_completed_alameda_factsheet.asp, accessed January 9, 2019.

16 Ibid.

17 Amtrak. *California Train Routes*. Available online at: http://www.amtrak.com/california-train-routes, accessed January 9, 2019.

The SCRRA operates the Metrolink commuter rail system. This system currently includes 59 stations and 7 rail lines: Antelope Valley, Inland Empire–Orange County, Orange County, Riverside, San Bernardino, Ventura, and 91.[18] Noise levels generated by Metrolink are similar to those associated with Amtrak.

Urban Rail Transit

This category includes both heavy and light rail transit. Heavy rail is generally defined as electrified rapid transit trains with dedicated guideways, and light rail as electrified transit trains that do not require dedicated guideways. In general, noise increases with speed and train length. Sensitivity to rail noise generally arises when there is less than 50 feet between the rail and sensitive receptors. Individual urban rail transit pass-by events generate substantially less noise than commuter rail events, but the aggregate noise impact for sensitive uses along the line can be similar or greater due to the much higher frequency of pass-by events. Complaints about ground-borne vibration from surface track are more common than complaints about ground-borne noise. A significant percentage of complaints about noise can be attributed to the proximity of switches, rough or corrugated track, or wheel flats.

In the SCAG region, the Los Angeles County Metropolitan Transportation Authority (Metro) provides urban rail transit for their 1,479-square-mile service area. Metro operates 98 miles of rail service on two subway lines (Purple and Red) and four light rail lines (Blue, Expo, Gold, and Green).[19] The Purple Line extends from downtown Los Angeles west to the Koreatown neighborhood with 8 existing stations. The Red Line extends from downtown Los Angeles west to the Koreatown neighborhood and then north to North Hollywood with 14 existing stations. The Blue Line extends from Long Beach to downtown Los Angeles with 22 existing stations. The Expo Line extends from downtown Los Angeles to Santa Monica with 19 existing stations. The Gold Line extends from East Los Angeles to Azusa with 27 existing stations. The Green Line extends from Norwalk west to El Segundo and south to Redondo Beach with 14 existing stations. In addition, Metro has two (Orange and Silver) bus rapid transit ways (BRTs). The Orange Line extends from North Hollywood, travels west to Woodland Hills, and then north to Chatsworth, with 18 existing stations. The Silver Line extends from El Monte west to downtown Los Angeles and then south to San Pedro with 11 existing stations.

---

18 Metrolink. *Experience Metrolink's History*. Available online at: https://www.metrolinktrains.com/about/agency/history-of-metrolink/, accessed January 9, 2019

19 Los Angeles County Metropolitan Transportation Authority. *Facts at a Glance.* Available online at: https://www.metro.net/news/facts-glance/, accessed January 7, 2019.

Port Operations

The three major ports in the SCAG region, Port of Los Angeles, Port of Long Beach, and Port of Hueneme in Ventura County, provide a major link between the United States and the Pacific Rim countries. Noise associated with port operations is typically generated from three sources: ships using the port facilities, equipment associated with cargo activity within the port, and truck and rail traffic that move cargo to and from the ports. These sources affect the ambient noise levels in the port areas. Residential areas in San Pedro, Wilmington, and West Long Beach are affected most by truck and rail traffic related to the ports.

Since 2000, the Port of Los Angeles has handled more container volume of cargo than any other port in the United States. In fiscal year 2017, the Port of Los Angeles handled 198 million metric revenue tons (MMRT) of cargo,[20] Port of Long Beach handled 168.1 MMRT,[21] and Port of Hueneme handled 1.4 MMRT.[22] When combined together, the Port of Los Angeles and the Port of Long Beach rank ninth in the world for container volume. The Ports of Los Angeles, Long Beach, and Hueneme are major regional economic development centers. The San Pedro Bay Ports, which include the Los Angeles and Long Beach Ports, currently handle approximately 32 percent of the cargo volume in the country;[23] the Port of Hueneme in Ventura County is a major shipping point for automobiles, non-automotive roll-on roll off cargo, project cargo, fresh produce, and liquid bulk.[24]

Industrial and Manufacturing Noise

Noise from industrial complexes and manufacturing plants are characterized as stationary point sources of noise even though they may include mobile sources such as forklifts. Local governments typically regulate noise from industrial and manufacturing equipment and activities through enforcement of noise ordinance standards and implementation of general plan policies. Industrial complexes and manufacturing plants are generally located away from sensitive land uses, and, as such, noise generated from these sources generally has less effect on the local community.

---

20 Port of Los Angeles. 2018. *Facts & Figures [2018].* Available online at: https://kentico.portoflosangeles.org/getmedia/fe3515ee-309e-47b3-83ad-b09d58edec67/2018-facts-figures, accessed August 28, 2019.

21 The Harbor Department, an Enterprise Fund of the City of Long Beach, California. 2017. *Comprehensive Annual Financial Report for the Fiscal Year Ended September 30, 2017.*

22 Port of Hueneme. 2017. *Comprehensive Annual Financial Report: Fiscal Year Ended June 30, 2017.* November.

23 Port of Los Angeles. 2018. *Facts & Figures [2018].* Available online at: https://kentico.portoflosangeles.org/getmedia/fe3515ee-309e-47b3-83ad-b09d58edec67/2018-facts-figures, accessed August 28, 2019.

24 Port of Hueneme. 2017. *Comprehensive Annual Financial Report: Fiscal Year Ended June 30, 2017.* November.

Construction Noise

Noise from construction sites are characterized as stationary point sources of even though they may include mobile sources, such as graders, they generally move slowly. Local governments typically regulate noise from construction equipment and activities through enforcement of noise ordinance standards and imposition of conditions of approval for building or grading permits.

Construction noise related to transportation projects is typically addressed in each project's noise analysis report and related environmental document. Most projects will not require modeling or any form of analysis associated with construction-related noise. Some projects may require basic noise calculations. For projects that require compliance with local ordinances, more detailed analysis techniques may be required.

Construction-related noise levels generally fluctuate depending on the construction phase, equipment type and duration of use, distance between noise source and receptor, and line of sight between the noise source and the receptor (temporary barriers can block the line of sight to reduce noise levels). The Federal Transit Administration has established typical noise levels associated with various types of construction-related machinery (**Table 3.13-6, Construction Equipment Noise Levels**). In contrast to industrial and manufacturing plants, construction sites are located throughout the region and are often located within, or adjacent to, residential districts and other sensitive receptors. While individual construction sites come and go (as buildings are constructed and completed), there is generally on-going construction activity in the region.

In general, construction activities generate high noise levels intermittently on and adjacent to the construction sites, and the related noise impacts are short-term in nature for individual sites but on-going throughout the region. The dominant source of noise from most construction equipment is the engine, usually a diesel engine, with inadequate muffling. In a few cases, however, such as impact pile driving or pavement breaking, noise generated by the process dominates. Construction equipment can be considered to operate in two modes, stationary and mobile. Stationary equipment operates in one location for one or more days at a time, with either a fixed-power operation (pumps, generators, compressors) or a variable noise operation (pile drivers, pavement breakers). Mobile equipment moves around the construction site with power applied in cyclic fashion (bulldozers, loaders), or movement to and from the site (trucks). The noise levels of these point sources decrease by approximately 6 dB with each doubling of distance from the noise source (e.g., noise levels from excavation might be approximately 83 dB at 100 feet from the site, and about 77 dB at 200 feet from the site). Interior noise levels from construction are approximately 10 dB (open windows) to 20 dB (closed windows) less than exterior noise levels due to the attenuation provided by building walls.

Construction projects often create activities that extend beyond project limits. These can include activities such as trucks supplying material (stone, concrete, steel, etc.) to a project, trucks hauling soil and/or demolition materials from a project site, activity associated with off-site operations such as materials storage areas, and effects of detoured or rerouted traffic due to construction activities. Haul routes may be specifically designated for use by construction-related traffic when supplying and hauling excess material from the project site, potentially creating a high source of noise depending on the number and frequency of trucks utilizing the route.

Table 3.13-6
Construction Equipment Noise Levels

Equipment	Typical Noise Level (dBA) at 50 feet from Source
Air Compressor	80
Backhoe	80
Ballast Equalizer	82
Ballast Tamper	83
Compactor	82
Concrete Mixer	85
Concrete Pump	82
Concrete Vibrator	76
Crane, Derrick	88
Crane, Mobile	83
Dozer	85
Generator	82
Grader	85
Impact Wrench	85
Jack Hammer	88
Loader	80
Paver	85
Pile-driver (Impact)	101
Pile-driver (Sonic)	95
Pneumatic Tool	85
Pump	77
Rail Saw	90
Rock Drill	95
Roller	85
Saw	76
Scarifier	83
Scraper	85
Shovel	82
Spike Driver	77
Tie Cutter	84

Equipment	Typical Noise Level (dBA) at 50 feet from Source
Tie Handler	80
Tie Inserter	85
Truck	84

Source:
Federal Transit Administration. September 2018. Transit Noise and Vibration Impact Assessment Manual. Washington, DC.

Sensitive Receptors

Some land uses are considered more sensitive to ambient noise levels than others due to noise exposure (in terms of both exposure time and "insulation" from noise) and the types of activities typically involved. Residences, motels, and hotels; schools; libraries; churches; hospitals; nursing homes and senior centers; and natural areas, parks, and outdoor recreation areas are generally more sensitive to noise than are commercial and industrial land uses. The 38,000-square-mile SCAG region contains a large number of these sensitive land uses. The noise-sensitive areas of residences, schools, libraries, churches, hospitals, nursing homes, natural areas, and parks are generally more sensitive to noise than are commercial and industrial land uses. Increases in noise near these sensitive receptors are more likely to cause an adverse community response.

As such, the noise standards for sensitive land uses are more stringent than those for less sensitive uses. To protect various human activities and sensitive land uses (e.g., residences, schools, and hospitals) lower noise levels are needed. An exterior noise level of L_{dn} 55 to 60 dB is the upper limit for intelligible speech communication inside a typical home. In addition, social surveys and case studies have shown that complaints and community annoyance in residential areas begin to occur at L_{dn} 55 dB. Sporadic complaints associated with the L_{dn} 55 to 60 dB range give way to widespread complaints and individual threats of legal action within the L_{dn} 60 to 70 dB range. At L_{dn} 70 dB and above, residential community reaction typically involves threats of legal action and strong appeals to local officials to stop the noise.

Sensitive receptors for vibration are the same as for noise, with one exception. Historic structures are potentially sensitive to excessive vibration because ground vibration will excite building structures, and if the vibration levels are high, there is a potential for structural damage. The Caltrans Transportation and Construction Vibration Manual references the National Cooperative Highway Research Program report for a summary of construction effects on historic buildings.[25] Using the most conservative values in the report, historic buildings may be damaged when a single vibration event exceeds 0.20 ppv or frequent

25 Caltrans. 2013. *Transportation and Construction Guidance Manual*. Page 26. September.

vibration events exceed 0.13 ppv, whereas extremely fragile historic buildings may be damaged when a single vibration event exceeds 0.12 ppv or frequent vibration events exceed 0.08 ppv.[26]

3.13.2 REGULATORY FRAMEWORK

The federal government sets noise standards for transportation-related noise sources that are closely linked to interstate commerce, such as aircraft, locomotives, and trucks; and, for those noise sources, the state government is preempted from establishing more stringent standards. The state sets noise standards for those transportation noise sources that are not preempted from regulation, such as automobiles, light trucks, and motorcycles. Noise sources associated with industrial, commercial, and construction activities are generally subject to local control through noise ordinances and general plan policies.

3.13.2.1 Federal

Noise Control Act of 1972

The Noise Control Act of 1972, as codified in 42 U.S. Code §4901 et seq., establishes a means for effective coordination of federal research and activities in noise control, authorizes the establishment of federal noise emission standards for products distributed in commerce, and provides information to the public with respect to the noise emission and noise reduction characteristics of such products.[27]

Noise Emission Standards for Interstate Rail Carriers, Motor Carriers, Construction Equipment, and Medium and Heavy Duty Trucks (Title 40 of the Code of Federal Regulations Parts 201, 202, 204, and 205)

The Federal Highway Administration sets federal regulations related to noise limits for locomotives, and medium and heavy trucks, and standards for noise studies and studies for federal and federal-aid highway projects.

Part 201

Federal regulations for railroad noise are contained in Title 40 of the Code of Federal Regulations (CFR) Part 201 and 49 CFR Part 210. The regulations set noise limits for locomotives and are implemented through regulatory controls on locomotive manufacturers.[28,29]

---

26 National Cooperative Highway Research Program. 2012. *Current Practices to Address Construction Vibration and Potential Effects to Historic Buildings Adjacent to Transportation Projects*. Table 1. September.

27 U.S. Environmental Protection Agency. 2017. *Summary of the Noise Control Act, 42 U.S.C §4901 et seq. (1972)*

28 Code of Federal Regulations. 2018. *Title 40 Protection of the Environment, Parts 190 to 259*.

Part 202

Federal regulations regarding motor carriers engaged in interstate commerce are contained in Title 40 of the CFR Part 202. The regulations set noise limits for motor carriers engaged in interstate commerce, including setting standards for highway operations.[30]

Part 204

Title 40 of the CFR Part 204 sets noise emission standards for construction equipment. The regulations set noise standards and requirements as well as testing, for construction equipment including air compressors.[31]

Part 205

Federal regulations also establish noise limits for medium and heavy trucks (more than 4.5 tons, gross vehicle weight rating) under 40 CFR Part 205, Subpart B. The federal truck pass-by noise standard is 80 decibels (dB) at 15 meters from the vehicle pathway centerline. These controls are implemented through regulatory controls on truck manufacturers. The Federal Highway Administration (FHWA) regulations for noise abatement must be considered for federal or federally funded projects involving the construction of a new highway or significant modification of an existing freeway when the project would result in a substantial noise increase or when the predicted noise levels approach or exceed the Noise Abatement Criteria (NAC).[32]

Abatement of Highway Traffic Noise and Construction Noise (Title 23 of the Code of Federal Regulations Part 772)

Title 23 CFR § 772.1 *et seq.* provides procedures for preparing operational and construction noise studies and evaluating noise abatement considered for federal and federal-aid highway projects. Under 23 CFR §772.7, projects are categorized as Type I or Type II projects. FHWA defines a Type I project as a proposed federal or federal-aid highway project for the construction of a highway on a new location, or the physical alteration of an existing highway that significantly changes either the horizontal or vertical alignment, or increases the number of through-traffic lanes. A Type II project is a noise barrier retrofit project that involves no changes to highway capacity or alignment.

---

29 Code of Federal Regulations. 2018. *Title 49 Transportation, Parts 200 to 299*.

30 Code of Federal Regulations. 2018. *Title 40 Protection of the Environment, Parts 190 to 259*.

31 Ibid.

32 Code of Federal Regulations. 2018. *Title 40 Protection of the Environment, Volume 27*.

Type I projects include those that create a completely new noise source, as well as those that increase the volume or speed of traffic or move the traffic closer to a receiver. Type I projects include the addition of an interchange, ramp, auxiliary lane, or truck-climbing lane to an existing highway, or the widening an existing ramp by a full lane width for its entire length. Projects unrelated to increased noise levels such as striping, lighting, signing, and landscaping projects are not considered Type I projects.

Under Title 23 CFR § 772.11, noise abatement must be considered for Type I projects if the project is predicted to result in a traffic noise impact. In such cases, 23 CFR § 772 requires that the project sponsor consider noise abatement before adoption of the environmental document. This process involves identification of noise abatement measures that are reasonable, feasible, and likely to be incorporated into the project, and of noise impacts for which no apparent solution is available.

Traffic noise impacts, as defined in 23 CFR § 772.5, occur when the predicted noise level in the design year approaches or exceeds the NAC specified in 23 CFR § 772, or a predicted noise level substantially exceeds the existing noise level (a substantial noise increase). Under these regulations, an impact could result unrelated to the plan if existing noise levels already exceed the NAC. A substantial increase is defined as when an increase in L_{eq} of 12 dB during the peak hour of traffic noise occurs. For sensitive uses, such as residences, schools, churches, parks, and playgrounds, the NAC for interior and exterior spaces is L_{eq} 57 and 66 dB, respectively, during the peak hour of traffic noise.[33]

Aircraft Noise Standards (Title 14 Code of Federal Regulations, Part 36)

The Federal Aviation Administration (FAA) has federal regulatory authority over noise emissions levels by aircraft operated in the United States. These requirements are set forth in Title 14 CFR, Part 36. Part 36 establishes maximum acceptable noise levels for specific aircraft types, taking into account the model year, aircraft weight, and number of engines. Pursuant to the federal Airport Noise and Capacity Act of 1990, the FAA established a schedule for complete transition to Part 36 "Stage 3" standards by year 2000. This transition schedule applies to jet aircraft with a maximum takeoff weight in excess of 75,000 pounds, and thus applies to passenger and cargo airlines, but not to operators of business jets or other general aviation aircraft.[34]

Airport Noise Compatibility Planning (Title 14 Code of Federal Regulations Part 150)

Part 150 applies to airport noise compatibility planning and provides the procedures, standards, and methodology governing the development, submission, and review of airport noise exposure maps and

33 Code of Federal Regulations. 2018. *Title 23 Highways*.

34 Code of Federal Regulations. 2018. *Title 14 Aeronautics and Space Parts 1 to 59*.

airport noise compatibility programs, including the process for evaluating and approving or disapproving those programs. It provides guidance for measuring noise at airports and surrounding areas and for determining exposure of individuals to noise from the operations of an airport. Part 150 also identifies land uses that are normally compatible with various levels of exposure to noise by individuals. It provides guidance on the preparation and execution of noise compatibility planning and implementation programs.[35]

Noise Abatement and Control (Title 24 Code of Federal Regulations, Part 51, Subpart B)

The mission of the Department of Housing and Urban Development (HUD) includes fostering "a decent, safe, and sanitary home and suitable living environment for every American." Accounting for acoustics is intrinsic to this mission, as an environment's safety and comfort can be compromised by excessive noise. In order to facilitate the creation of suitable living environments, HUD has developed a standard for noise criteria. The basic foundation of the HUD noise program is set out in the noise regulation 24 CFR Part 51 Subpart B, Noise Abatement and Control.

HUD's noise policy clearly requires noise attenuation measures be provided when proposed projects are located in high noise areas. Within the HUD Noise Assessment Guidelines, potential noise sources are examined for projects located within 15 miles of a military or civilian airport, 1,000 feet from a road, or 3,000 feet from a railroad.

HUD exterior noise regulations state that 65 dBA DNL noise levels or less are acceptable for residential land uses and noise levels exceeding 75 dBA DNL are unacceptable. HUD's regulations do not contain standards for interior noise levels. Rather, a goal of 45 dBA is set forth, and the attenuation requirements are geared toward achieving that goal. It is assumed that, with standard construction, any building will provide sufficient attenuation so that if the exterior level is 65 dBA DNL or less, the interior level will be 45 dBA DNL or less.[36]

Federal Transit Administration Noise and Vibration Guidance

The Federal Transit Administration (FTA) has published the Transit Noise and Vibration Impact Assessment Manual to provide guidance on procedures for assessing impacts at different stages of transit project development.[37] The report covers both construction and operational noise impacts, and describes

---

35 Code of Federal Regulations. 2018. *Title 14 Aeronautics and Space, Parts 110 to 199*.

36 Code of Federal Regulation. 2018. *Title 24 Housing and Urban Development, Parts 0 to 199*.

37 Federal Transit Administration. 2018. *Transit Noise and Vibration Impact Assessment Manual*. September.

a range of measures for controlling excessive noise and vibration. The specified noise criteria are an earlier version of the criteria provided by the Federal Railroad Administration's High-Speed Ground Transportation Noise and Vibration Impact Assessment (**Table 3.13-8, Construction Vibration Damage Criteria**). In general, the primary concern regarding vibration relates to potential damage from construction. The guidance document establishes criteria for evaluating the potential for damage for various structural categories from vibration (**Table 3.13-8, Construction Vibration Damage Criteria**).

Table 3.13-8
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

Source:
Federal Transit Administration. September 2018. Transit Noise and Vibration Impact Assessment Manual.

Railroad Noise Guidance

The Federal Railroad Administration provides implementation procedures for predicting and assessing noise and vibration impacts of high-speed trains within their *High-Speed Ground Transportation Noise and Vibration Impact Assessment*.[38] The document provides three levels of analysis, including a preliminary impact screening, a general assessment, and a detailed analysis, as well as a range of mitigation measures for dealing with adverse noise and vibration impacts. The report also includes noise criteria for potential impacts (**Table 3.13-9, Noise Levels Defining Impact for High-Speed Train Projects**, and **Table 3.13-10, Land Use Categories and Metrics for High-Speed Train Noise Impact Criteria**).

38 Federal Railroad Administration. 2012. *High-Speed Ground Transportation Noise and Vibration Impact Assessment*. Final Report. Washington, DC. September.

Table 3.13-9
Noise Levels Defining Impact for High-Speed Train Projects

Existing Noise Exposure* Leq(h) or Ldn (dBA)	Project Noise Impact Exposure* Leq(h) or Ldn (dBA)					
	Category 1 or 2 Sites			Category 3 Sites		
	No Impact	Moderate Impact	Severe Impact	No Impact	Moderate Impact	Severe Impact
<43	< Ambient+10	Ambient + 10 to 15	>Ambient+15	<Ambient+15	Ambient + 15 to 20	>Ambient+20
43	<51.6	51.6–57.6	>57.6	<56.6	56.6–62.6	>62.6
44	<51.8	51.8–58.6	>58.6	<56.8	56.8–63.6	>63.6
45	<52.0	52.0–58.6	>58.6	<57.0	57.0–63.6	>63.6
46	<52.2	52.2–58.7	>58.7	<57.2	57.2–63.7	>63.7
47	<52.5	52.5–58.9	>58.9	<57.5	57.5–63.9	>63.9
48	<52.7	52.7–59.1	>59.1	<57.7	57.7–64.1	>64.1
49	<53.0	53.0–59.3	>59.3	<58.0	58.0–64.3	>64.3
50	<53.4	53.4–59.5	>59.5	<58.4	58.4–64.5	>64.5
51	<53.7	53.7–59.7	>59.7	<58.7	58.7–64.7	>64.7
52	<54.1	54.1–60.0	>60.0	<59.1	59.1–65.0	>65.0
53	<54.4	54.4–60.4	>60.4	<59.4	59.4–65.4	>65.4
54	<54.9	54.9–60.7	>60.7	<59.9	59.9–65.7	>65.7
55	<55.3	55.3–61.1	>61.1	<60.3	60.3–66.1	>66.1
56	<55.7	55.7–61.5	>61.5	<60.7	60.7–66.5	>66.5
57	<56.2	56.2–61.9	>61.9	<61.2	61.2–66.9	>66.9
58	<56.7	56.7–62.3	>62.3	<61.7	61.7–67.3	>67.3
59	<57.2	57.2–62.8	>62.8	<62.2	62.2–67.8	>67.8
60	<57.8	57.8–63.3	>63.3	<62.8	62.8–68.3	>68.3
61	<58.4	58.4–63.8	>63.8	<63.4	63.4–68.8	>68.8
62	<58.9	58.9–64.4	>64.4	<63.9	63.9–69.4	>69.4
63	<59.6	59.6–64.9	>64.9	<64.6	64.6–69.9	>69.9
64	<60.2	60.2–65.5	>65.5	<65.2	65.2–70.5	>70.5
65	<60.8	60.8–66.1	>66.1	<65.8	65.8–71.1	>71.1
66	<61.5	61.5–66.7	>66.7	<66.5	66.5–71.7	>71.7
67	<62.2	62.2–67.4	>67.4	<67.2	67.2–72.4	>72.4
68	<62.9	62.9–68.0	>68.0	<67.9	67.9–73.0	>73.0
69	<63.6	63.6–68.7	>68.7	<68.6	68.6–73.7	>73.7
70	<64.4	64.4–69.4	>69.4	<69.4	69.4–74.4	>74.4
71	<65.0	65.0–70.1	>70.1	<70.0	70.0–75.1	>75.1
72	<65.0	65.0–70.8	>70.8	<70.0	70.0–75.8	>75.8
73	<65.0	65.0–71.6	>71.6	<70.0	70.0–76.6	>76.6
74	<65.0	65.0–72.3	>72.3	<70.0	70.0–77.3	>77.3
75	<65.0	65.0–73.1	>73.1	<70.0	70.0–78.1	>78.1
76	<65.0	65.0–73.9	>73.9	<70.0	70.0–78.9	>78.9

Existing Noise Exposure* Leq(h) or Ldn (dBA)	Project Noise Impact Exposure* Leq(h) or Ldn (dBA)					
	Category 1 or 2 Sites			Category 3 Sites		
	No Impact	Moderate Impact	Severe Impact	No Impact	Moderate Impact	Severe Impact
77	<65.0	65.0–74.7	>74.7	<70.0	70.0–79.7	>79.7
>77	<65.0	65.0–75.0	>75.0	<70.0	70.0–80.0	>80.0

Note:
** L_{dn} is used for land use where nighttime sensitivity is a factor; L_{eq} during the hour of maximum transit noise exposure is used for land use involving only daytime activities.*
Source:
Federal Railroad Administration. September 2012. High-Speed Ground Transportation Noise and Vibration Impact Assessment. Final Report. Table 3-1.

Table 3.13-10
Land Use Categories and Metrics for High-Speed Train Noise Impact Criteria

Land-Use Category	Noise Metric (dBA)	Description of Land-Use Category
1	Outdoor L_{eq}(h)*	Tracts of land where quiet is an essential element in their intended purpose. 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 use. Also included are recording studios and concert halls.
2	Outdoor L_{dn}	Residences and buildings where people normally sleep. This category includes homes, hospitals, and hotels where a nighttime sensitivity to noise is assumed to be of utmost importance.
3	Outdoor L_{eq}(h)*	Institutional land uses with primarily daytime and evening use. 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, and museums can also be considered to be in this category. Certain historical sites, parks, campgrounds, and recreational facilities are also included.

Note:
** L_{eq} for the noisiest hour of transit-related activity during hours of noise sensitivity.*
Source:
Federal Railroad Administration. September 2012. High-Speed Ground Transportation Noise and Vibration Impact Assessment. Final Report. Table 3-2. Washington, DC.

3.13.2.2 State

California Government Code Section 65302

Section 65302 of California Government Code provides a framework for general plans and their content. It requires that the noise element include implementation measures and possible solutions that address

existing and foreseeable noise problems, if any. The adopted noise element shall serve as a guideline for compliance with the state's noise insulation standards. The noise element shall also identify and appraise noise problems in the community, analyze and quantify current and projected noise levels for (a) highways and freeways; (b) primary arterials and major local streets; (c) passenger and freight online railroad operations and ground rapid transit systems; (d) commercial, general aviation, heliport, helistop, and military airport operations, aircraft overflights, jet engine test stands, and all other ground facilities and maintenance functions related to airport operation; (e) local industrial plants, including, but not limited to, railroad classification yards; and (f) other ground stationary noise sources, including, but not limited to, military installations, identified by local agencies as contributing to the community noise environment.

Section 65302 also specifies that noise contours be shown for all of the above listed sources and be stated in terms of community noise equivalent level (CNEL) or day-night average level (L_{dn}). The noise contours shall be prepared on the basis of noise monitoring or following generally accepted noise modeling techniques for the various sources identified above. The noise contours shall be used as a guide for establishing a pattern of land uses in the land use element that minimizes the exposure of community residents to excessive noise.[39]

California Noise Control Act of 1973

The California Noise Control Act (California Health and Safety Code, Division 28, § 46000 et seq), as found in the California Health and Safety Code, Division 28, § 46000 et seq., declares that excessive noise is a serious hazard to public health and welfare, and establishes the Office of Noise Control with responsibility to set standards for noise exposure in cooperation with local governments or the state legislature.[40]

Airport Noise Standards (Title 21, CCR Section 5000 et seq.)

The State of California has the authority to establish regulations requiring airports to address aircraft noise impacts on land uses in their vicinities. The State of California's Airport Noise Standards, found in Title 21 of the California Code of Regulations, identify a noise exposure level of CNEL 65 dB as the noise impact boundary around airports. Within the noise impact boundary, airport proprietors are required to

39 California Legislative Information. *Article 5. Authority for and Scope of General Plans [65300-65303.4], Section 65302*.

40 California Legislative Information. *Division 28. Noise Control Act, 46000-46080*.

ensure that all land uses are compatible with the aircraft noise environment or the airport proprietor must secure a variance from the California Department of Transportation (Caltrans).[41]

Noise Insulation Standards (Health & Safety Code § 17922.6)

California Health and Safety Code § 17922.6 requires noise insulation standards for new multi-family residential units, hotels, and motels that may be subject to relatively high levels of transportation-related noise. For exterior noise, the noise insulation standard is DNL 45 dB in any habitable room and requires an acoustical analysis demonstrating how dwelling units have been designed to meet this interior standard where such units are proposed in areas subject to noise levels greater than DNL 60 dB.[42]

Freeway Noise Attenuation (Streets and Highways Code, Article 6 **and** *Vehicle Code, Article 2.5)*

The State of California establishes noise limits for vehicles licensed to operate on public roads. For heavy trucks, the state pass-by standard is consistent with the federal limit of 80 dB.[43] The state pass-by standard for light trucks and passenger cars (less than 4.5 tons gross vehicle rating) is also 80 dB at 15 meters from the centerline.[44] Additionally, for a motor vehicle weighing more than 5 tons the pass-by standard is 88dB at 15 feet from the centerline of the vehicle.[45] For new roadway projects, Caltrans employs the NAC, promulgated by Title 40 of the Code of Federal Regulations (CFR), as administered by the FHWA.[46]

Section 216 of the California Streets and Highways Code relates to the noise effects of a proposed freeway project on public and private elementary and secondary schools. Under this code, a noise impact occurs if, as a result of a proposed freeway project, noise levels exceed 52 dBA Leq in the interior of public or private elementary or secondary classrooms, libraries, multipurpose rooms, or spaces. If a project results in a noise impact under this code, noise abatement must be provided to reduce classroom noise to a level that is at or below 52 dBA Leq. If the noise levels generated from freeway and non-freeway sources exceed 52 dBA Leq prior to the construction of the proposed freeway project, then noise abatement must be provided to reduce the noise to the level that existed prior to construction of the project.[47]

---

41 California Code of Regulations. *21 CCR § 5012. Airport Noise Standard*.

42 California Legislative Information. *Chapter 2. Rules and Regulations [17920-17928], Section 17922.6*.

43 California Legislative Information. *Vehicle Code, Article 2.5 Noise Limits [27200-27207].*

44 Government Publishing Office. *40 CFR 205, Subpart B Medium and Heavy Trucks.*

45 California Legislative Information. *Vehicle Code, Article 2.5 Noise Limits [27200-27207].*

46 Government Publishing Office. 2019. *Electronic Code of Federal Regulations, §202.20 Standards for highway operations*.

47 California Legislative Information. *Article 6. Freeway Noise Attenuation [215.5-216.5], Section 216*.

Section 215.5 of the Streets and Highways Code implements a priority system to determine the need for the installation of noise attenuation barriers (i.e. soundwalls) along freeways and expressways. The highest consideration is given to residential areas developed prior to the opening of the freeway or where alterations have been made to the freeway which resulting in a significant increase in ambient noise levels. Other criteria for determining priorities includes the existing and future sound intensity generated by the freeway, the increase in traffic flow since the freeway originally opened, the cost of constructing a soundwall related to expected noise reduction, and the number of nearby residents included whether they lived there prior to the opening of the freeway.[48] Pursuant to Section 215.6, a city or county can accelerate the priority of a noise attenuation project by contributing at least 33 percent of the estimated cost of a soundwall project. [49]

California Department of Health Services Land Use Guidelines for Community Noise Exposure

The state has published guidance for locating land uses in areas compatible with the existing noise environment (**Table 3.13-11, Community Noise Exposure**).[50] For example, it would normally be acceptable for a single-family residence to be located in an area with an existing noise level of 60 dBA CNEL or less.

48 California Legislative Information. *Streets and Highways Code, Article 6. Freeway Noise Attenuation [215.5-216.5].*

49 *Ibid.*

50 Governor's Office of Planning and Research. 2017. *State of California General Plan Guidelines*.

Table 3.13-11
Community Noise Exposure

Land Use Category	Community Noise Exposure (dB, Ldn or CNEL) 55 60 65 70 75 80
Residential - Low Density Single-Family, Duplex, Mobile Homes	
Residential - Multi-Family	
Transient Lodging - Motels Hotels	
Schools, Libraries, Churches, Hospitals, Nursing Homes	
Auditoriums, Concert Halls, Amphitheaters	
Sports Arena, Outdoor Spectator Sports	
Playgrounds, Neighborhood Parks	
Golf Courses, Riding Stables, Water Recreation, Cemeteries	
Office Buildings, Business Commercial and Professional	
Industrial, Manufacturing, Utilities, Agriculture	

Normally Acceptable - Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction without any special noise insulation requirements.

Conditionally Acceptable - New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply system or air conditioning will normally suffice.

Normally Unacceptable - New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.

Clearly Unacceptable - New construction or development should generally not be undertaken.

Source: California Office of Planning and Research "General Plan Guidelines, Noise Element Guidelines (Appendix D)", 2017.

Caltrans Guidance

Traffic Noise. Chapter 30 of the *Caltrans Project Development Procedures Manual* offers guidance on highway traffic noise abatement criteria (NAC), corresponding to various land use activity categories.[51] However, the NAC in Chapter 30 has been superseded by the Caltrans *Traffic Noise Analysis Protocol for New Highway Construction, Reconstruction, and Retrofit Barrier Projects* (**Table 3.13-12, Activity Categories and Noise Abatement Criteria**).[52] Activity categories and related traffic noise impacts are determined based on the actual land use in a given area. The Caltrans *Technical Noise Supplement to the Traffic Noise Analysis Protocol* provides additional details on noise analysis procedures, practices, and other useful technical background information related to the analysis and reporting of highway and construction noise impacts and abatement.[53] It supplements and expands on concepts and procedures referred to in the *Traffic Noise Analysis Protocol for New Highway Construction, Reconstruction, and Retrofit Barrier Projects*.

Table 3.13-12
Activity Categories and Noise Abatement Criteria

Activity Category	Hourly A-Weighted Sound Level, Leq(h)*	Evaluation Location	Description of Activities
A	57	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**	67	Exterior	Residential.
C**	67	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	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	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: The $L_{eq}(h)$ activity criteria values are for impact determination only and are not design standards for noise abatement measures. All values are A-weighted decibels (dBA). ** Includes undeveloped lands permitted for this activity category.*
Source: California Department of Transportation, Division of Environmental Analysis. May 2011. Traffic Noise Analysis Protocol for New Highway Construction, Reconstruction, and Retrofit Barrier Projects. Table 1.

51 California Department of Transportation. *Project Development Procedures Manual*. Chapter 30. May 2019.

52 California Department of Transportation, Division of Environmental Analysis. *Traffic Noise Analysis Protocol for New Highway Construction, Reconstruction, and Retrofit Barrier Projects*. May 2011.

53 California Department of Transportation. *Technical Noise Supplement to the Traffic Noise Analysis Protocol*. September 2013.

Airport Noise. The Caltrans Division of Aeronautics California Airport Land Use Planning Handbook offers guidance on airport planning and developing compatible land use policies.[54] It also provides suggested criteria for the CNEL values commonly used as the limit for acceptable residential noise exposure **(Table 3.13-13, Noise Compatibility Criteria**).

Table 3.13-13
Noise Compatibility Criteria

CNEL (dB)	Criteria	Suggested Applicability
65	Set by the FAA and other federal agencies as the level above which residential land uses may be incompatible if not acoustically treated. Established by California state regulations as the maximum normally acceptable noise level for residential and certain other land uses at county-designated noise-problem airports.	Generally not appropriate for most new development. May be acceptable in noisy urban locations and/or in hot climates where most buildings are air conditioned.
60	The contour within which California Building Code (Section 1207.11) requires an acoustical analysis of proposed residential structures, other than detached single-family dwellings. Suggested by the California Governor's Office of Planning and Research General Plan Guidelines as the maximum "normally acceptable" noise exposure for residential areas. [Note: Individual noise events will occasionally cause significant interference with residential land use activities, particularly outdoor activities, in quiet suburban/rural communities.]	Suitable for new development around most airports. Particularly appropriate in mild climates where windows are often open.
55	Identified by the EPA as the level below which "undue interference with activity and annoyance" will not occur. [Note: Individual noise events will seldom significantly interfere with residential land use activities (e.g., interference with speech). In urban areas, aircraft contribution to this noise level may be less than that of other noise sources.]	Suitable for airports in quiet, rural locations.

Note:
When setting criteria for a specific airport, other characteristics of the airport and its environs also need to be considered.
Source::
California Department of Transportation. October 2011. California Airport Land Use Planning Handbook. Table 4B.

Construction Noise. Section 14-8.02, Noise Control, of Caltrans standard specifications provides guidance on preventing construction noise impacts. The specification states:

- Do not exceed 86 dBA at 50 feet from the job site activities from 9 p.m. to 6 a.m.
- Equip an internal combustion engine with the manufacturer recommended muffler. Do not operate an internal combustion engine on the job site without the appropriate muffler.

If adverse construction noise impacts are anticipated, project plans and specifications must identify abatement measures that would minimize or eliminate adverse construction noise impacts on the community.

54 California Department of Transportation. *California Airport Land Use Planning Handbook*. October 2011.

Construction Vibration. The *Transportation and Construction Vibration Guidance Manual* presents a variety of criteria for vibration impacts based on previously completed studies.[55] Caltrans recommends that extreme care be taken when sustained pile driving occurs within 7.5 meters (25 feet) of any building and 15 to 30 meters (50 to 100 feet) of a historic building or a building in poor condition.

3.13.2.3 Local

To identify, appraise, and remedy noise problems in local communities, each county and city in the SCAG region is required to adopt a noise element as part of its General Plan. Each noise element is required to analyze and quantify current and projected noise levels associated with local noise sources, including, but not limited to, highways and freeways, primary arterials and major local streets, rail operations, air traffic associated with the airports, local industrial plants, and other ground stationary sources that contribute to the community noise environment. Beyond statutory requirements, local jurisdictions are free to adopt their own goals and policies in their noise elements, although most jurisdictions have chosen to adopt noise/land use compatibility guidelines that are similar to those recommended by the state. The overlapping DNL ranges indicate that local conditions (existing noise levels and community attitudes toward dominant noise sources) should be considered in evaluating land use compatibility at specific locations.

In addition to regulating noise through noise element policies, local jurisdictions regulate noise through enforcement of local ordinance standards. These standards generally relate to noisy activities (e.g., use of loudspeakers and construction) and stationary noise sources and facilities (e.g., air conditioning units and industrial activities). Three cities in the SCAG region, Los Angeles, Long Beach, and Port Hueneme, operate port facilities. Noise from the Ports of Los Angeles, Long Beach, and Hueneme are regulated by the noise ordinances and noise elements of the Los Angeles, Long Beach, and Port Hueneme General Plans.

In terms of airport noise, airport operators have addressed local community noise concerns through a variety of methods changes including runway use and flight routing changes, aircraft operational procedure changes, and engine run-up restrictions. These actions generally are subject to approval by the FAA, which has the authority and responsibility to control aircraft noise sources, implement and enforce flight operational procedures, and manage the air traffic control system. Airport operators also consider limitations on airport use, but such restrictions can be overridden by the Federal Aviation Administration if it is determined that they unjustly discriminate against any user, impede the federal interest in safety and management of the air navigation system, or unreasonably interfere with interstate commerce. In

55 California Department of Transportation. 2013. *Transportation and Construction Vibration Guidance Manual*. Sacramento, CA. September.

addition airport operators have addressed community concerns by retrofitting homes under flight paths to provide additional noise insulation.

Some local jurisdictions regulate vibration through enforcement of local ordinance standards. These standards generally relate to preventing perceptible vibration from being generated past the property line of the source location.

3.13.3 ENVIRONMENTAL IMPACTS

3.13.3.1 Thresholds of Significance

The impacts related to noise from the Plan would be considered significant if they would exceed the following significance criteria, in accordance with Appendix G of the *State CEQA Guidelines*:

- 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;
- Generation or excessive groundborne vibration or groundborne noise levels;
- For a project 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, would the project expose people residing or working in the project area to excessive noise levels.

3.13.3.2 Methodology

This section evaluates the potential impacts of the proposed Connect SoCal Plan on ambient noise levels, identifies mitigation measures for the impacts, and evaluates the residual impacts in accordance with Appendix G of the 2019 State California Environmental Quality Act (CEQA) Guidelines. Noise within the SCAG region was evaluated at the programmatic level of detail, in relation to federal noise and vibration impacts guidelines; *State of California General Plan Guidelines for Noise Elements*; California Department of Transportation guidance documents; the general plans of the six counties and 191 cities within the SCAG region; and a review of related literature germane to the SCAG region, as well as a review of Connect SoCal.[56,57,58,59,60,61,62,63,64,65,66,67]

---

56 Federal Interagency Committee on Noise. 1992. *Federal Agency Review of Selected Airport Noise Analysis Issues.* August.

57 Cowan, James P. 1993. *Handbook of Environmental Acoustics*.

Ambient noise levels in the SCAG region vary widely as a function of the dramatic physical environment, land use, and density of people. Noise levels for various areas are identified according to the use of the area. Maximum allowable noise levels associated with various sensitive land uses are provided. Exposure of people to noise levels and ground borne vibration from transportation and transit infrastructure varies in relation to noise level at the source, density of the source, distance from the source, and sound modulating or attenuating structures between the source and the receptor.

The methodology for determining the significance of noise and vibration impacts compares the existing conditions to the conditions as a result of implementing the transportation projects and growth under the Plan.[68]

Permanent increases in operational noise associated with highway traffic is dependent on several variables:

- Traffic volume (the greater the number of vehicles passing through an area within a specified period result in greater noise)
- Vehicle speed (greater speed results in greater noise from tire and aerodynamic noise)

---

58 Nelson, J.T., and H.J. Saurenman. 1983. *State-of-the-Art Review: Prediction and Control of Ground-Borne Noise and Vibration from Rail Transit Trains*. U.S. Department of Transportation, Urban Mass Transportation Administration, Report Number UMTA-MA-06-0049-83-4, DOT-TSC-UMTA-83-3.

59 Governor's Office of Planning and Research. 2017. *State of California 2017 General Plan Guidelines.*

60 California Department of Transportation. 2009. *Project Development Procedures Manual*. Chapter 30.

61 California Department of Transportation, Division of Environmental Analysis. 2011. *Traffic Noise Analysis Protocol for New Highway Construction, Reconstruction, and Retrofit Barrier Projects.*

62 California Department of Transportation. 2013. Technical Noise Supplement to the Traffic Noise Analysis Protocol. September.

63 California Department of Transportation, Division of Environmental Analysis. 2013. *Transportation and Construction Vibration Guidance Manual.*

64 Federal Railroad Administration. 2012. *High-Speed Ground Transportation Noise and Vibration Impact Assessment*.

65 California Department of Transportation, Division of Aeronautics. 2011. *California Airport Land Use Planning Handbook*.

66 U.S. Department of Transportation, Federal Transit Administration. 2006. *Transit Noise and Vibration Assessment.*

67 U.S. Department of Transportation, Federal Highway Administration. 2006. *FHWA Highway Construction Noise Handbook.*

68 Note that ambient noise from the existing transportation network, including freeways, are generally not considered impacts under CEQA unless the project exacerbates the existing environmental conditions. *See* Cal. Building Industry Assn. v. Bay Area Air Quality Management District (2015) 62 Cal.4th 369 (California Supreme Court ruled that agencies subject to CEQA generally are not required to analyze the impact of existing environmental conditions on a project's future users or residents unless the proposed project risks exacerbating those environmental hazards or conditions that already exist.); *see also* Cal. Building Industry Assn. v. Bay Area Air Quality Management District (2016) 2 Cal.App.5th 1067.

- Vehicle types such as cars, trucks, and motorcycles (different engine and exhaust combinations, different tires, and different aerodynamic profiles result in different noise levels)

- Location of the roadway with respect to sensitive receptors (distance and intervening objects or topography will reduce noise levels).

The noise impacts analysis was based on the Project List (See **Appendix 2.0, Connect SoCal Project List**) located throughout the six counties and 38,000 square miles of the SCAG region.[69] Project types range from projects with substantial ground disturbance such as rail projects, mixed flow lane projects, and grade separation projects, to operations and maintenance projects with minimal ground disturbance such as traffic signal synchronization or lane-restriping projects.[70]

The mitigation measures in the PEIR are divided into two categories: SCAG mitigation and project-level mitigation measures. SCAG mitigation measures shall be implemented by SCAG over the lifetime of the Plan. For projects proposing to streamline environmental review pursuant to SB 375, SB 743, or SB 226 (as described in **Section 1.0, Introduction**), or for projects otherwise tiering off this PEIR, the project-level mitigation measures described below (or comparable measures) can and should be considered and implemented by Lead Agencies and Project Sponsors during the subsequent, project- or site-specific environmental reviews for transportation and development projects as applicable and feasible. However, SCAG cannot require implementing agencies to adopt mitigation, and it is ultimately the responsibility of the implementing agency to determine and adopt project-specific mitigation.

3.13.3.3 Impacts and Mitigation Measures

Impact NOISE-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.**

Significant and Unavoidable Impact – Mitigation Required.

Implementation of transportation projects and development projects anticipated to occur under the Plan would likely result in exposure of persons to or generation of noise levels in excess of standards

69 SCAG. 2019. *Connect SoCal Transportation System Project List Technical Report.* November.

70 Note that as discussed in **Section 3.15.3, Public Services – Schools**, CEQA review of school construction generally does require an evaluation of the effects of existing air quality exposure on pupils, and to the extent the health risk is unacceptable, the school would not be built. CEQA also provides limited protection and requires analysis of impacts of the existing environment on certain housing development projects exercising exemptions under Pub. Res. Code § 21096.

established in the local general plan or noise ordinance, or applicable standards of other agencies, constituting a significant impact. Grading and construction activities would generate temporary increases in noise levels, and operational activities would generate permanent increases in noise levels in excess of standards established in the local general plan or noise ordinance, constituting a significant impact, requiring the consideration of mitigation measures.

As noted above, noise impacts are experienced locally and cannot be quantified at a regional level. Land uses support various noise environments depending on multiple factors. For example, urban environments tend to be louder than suburban environments due to denser, multi-use land use patterns. Urban environments also typically support higher volumes of traffic as well as other transportation modes that generate sound such as trains, light rail, and buses. Suburban environments, where land uses are often more segregated, have more moderate noise levels. Agricultural areas also have a unique noise environment as compared to urban and suburban environments. Agricultural operations require the use of heavy-duty equipment (e.g., mechanized plows, tractors) that produce high noise levels. However, because agricultural areas are sparsely populated, noise generally does not have the same adverse effect on surrounding land uses and may be protected by right-to-farm regulations or other local land use policies.

Construction. Impacts to sensitive receptors resulting from the construction of transportation projects as well as the implementation of land use strategies would depend on several factors, such as the type of project, adjacent land use, and duration and intensity of the construction activity. Construction noise levels would fluctuate depending on how the construction is phased, the equipment mix, the distance between the construction and the nearest sensitive receptor, and the presence of intervening objects. Furthermore, anticipated development to accommodate the forecast population, household, and employment would take a variety of forms, with a substantial number (60 percent of housing units and 73 percent of jobs) focused in Growth Priority Areas including in and around high-quality transit areas (HQTAs), as well as development in existing urbanized areas, and opportunity areas. Because development would be focused in HQTAs and urbanized areas, residents in and around those areas would be subject to increased frequency of construction noise.

Operations. Impacts to sensitive receptors resulting from the operation of transportation projects as well as increases in traffic due to anticipated development projects under the Plan would depend on several factors, such as the type of project and adjacent land use. Operational noise levels would fluctuate depending on traffic volume, vehicle speed, vehicle mix, location and distance of the roadway with respect to sensitive receptors, and the presence of intervening objects. A doubling of traffic generally corresponds to a 3 dB increase in noise level, which is only just perceptible to the human ear. Most major facilities do not have the capacity to allow a doubling of traffic and therefore this increase is generally not

expected.

Similar to construction impacts, anticipated development to accommodate the forecast population, household, and employment growth would take a variety of forms, with a substantial fraction focused in and around HQTAs, existing urbanized areas, and opportunity areas as reflected under Connect SoCal's land use strategies. As traffic volumes increase, the duration of the peak hour noise levels extend as well. Operation of transportation and transit projects in these HQTAs, existing urbanized areas, and opportunity areas would have the potential to increase noise level in excess of standards established in county and city general plans and noise ordinances.

Heavy rail would increase the number of passenger and freight trains in the region. Because of the number of existing passenger and freight trains that use the existing heavy rail tracks, additional trains are not expected to increase daily noise (CNEL) along any given track by more than 3 dB relative to baseline conditions. Light rail improvements will include increasing frequency on and making improvements to existing corridors and adding new corridors. In general, the proposed transit improvements along existing corridors will occur in developed urban areas where noise levels are already high from existing sources. In areas that do not currently have light rail operations, implementation of the Plan could increase noise levels above 65 dB CNEL and increase daily noise (CNEL) by more than 3 dB relative to baseline conditions. Increases in operational mobile source noise from the projected land use pattern and planned transportation improvements would result in new vehicles trips on existing roadways generating increases in noise. In locations where noise would exceed the CNEL threshold of 65 dB following the implementation of the Plan, a significant noise impact would occur.

Land use strategies in the Plan would encourage development in HQTA's and other urbanized areas. Urban areas experience noise from a number of sources associated with living in proximity to other people and among different land uses. Typical community noise sources include small mechanical devices (e.g., lawn mowers, leaf blowers), parks and playgrounds, restaurants and bars, commercial uses, events, and industrial plants. Traffic and other transportation-related noise is also a dominant noise source in urban areas. Light rails, passenger trains, and other forms of public transit generate noise from the contact of wheels on railways as well as loud bells that signal to cars, cyclists, and pedestrians of their arrival. Implementation of the Plan is likely to increase the amount of noise experienced in HQTAs because of the increased density in these areas as well as from improved transportation infrastructure.

In suburban and rural areas, noise sources are fewer and the addition of new stationary or mobile noise sources could result in an increase in ambient noise. As the Plan is expected to result in the conversion of 41,546 greenfield acres, there is the potential for increased ambient noise in suburban and rural areas.

Because of the nature of noise impacts (noise dissipates with distance from the source), new transportation operations may cause noise impacts, and those impacts may exceed applicable noise thresholds for determining significance within a localized area, but those impacts cannot be quantified at a regional level. Therefore, implementation of transportation projects and land use strategies in Connect SoCal would result in exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies, which constitutes a significant impact requiring the consideration of mitigation measures.

Mitigation Measures

SCAG Mitigation Measures

SMM-NOISE-1: SCAG shall coordinate with CTCs and member agencies as part of SCAG's outreach and technical assistance to local governments to encourage transportation projects and projects involving residential and commercial land uses to mitigate noise and vibration or be developed in areas that are normally acceptable or conditionally acceptable, consistent with applicable guidelines (i.e, OPR, Caltrans, etc.).

Project Level Mitigation Measures

PMM NOISE-1: In accordance with provisions of sections 15091(a)(2) and 15126.4(a)(1)(B) of the *State CEQA Guidelines*, a Lead Agency for a project can and should consider mitigation measures to reduce substantial adverse effects that physically divide a community, as applicable and feasible. Such measures may include the following or other comparable measures identified by the Lead Agency:

a. Install temporary noise barriers during construction.

b. Include permanent noise barriers and sound-attenuating features as part of the project design. Barriers could be in the form of outdoor barriers, sound walls, buildings, or earth berms to attenuate noise at adjacent sensitive uses.

c. Schedule construction activities consistent with the allowable hours pursuant to applicable general plan noise element or noise ordinance

d. Post procedures and phone numbers at the construction site for notifying the Lead Agency staff, local Police Department, and construction contractor (during regular construction hours and off-hours), along with permitted

construction days and hours, complaint procedures, and who to notify in the event of a problem.

e. Notify neighbors and occupants within 300 feet of the project construction area at least 30 days in advance of anticipated times when noise levels are expected to exceed limits established in the noise element of the general plan or noise ordinance.

f. Designate an on-site construction complaint and enforcement manager for the project.

g. Ensure that construction equipment are properly maintained per manufacturers' specifications and fitted with the best available noise suppression devices (e.g., improved mufflers, equipment redesign, use of intake silencers, ducts, engine enclosures, and acoustically attenuating shields or shrouds silencers, wraps). All intake and exhaust ports on power equipment shall be muffled or shielded.

h. Use hydraulically or electrically powered tools (e.g., jack hammers, pavement breakers, and rock drills) for project construction to avoid noise associated with compressed air exhaust from pneumatically powered tools. However, where use of pneumatic tools is unavoidable, an exhaust muffler on the compressed air exhaust should be used; this muffler can lower noise levels from the exhaust by up to about 10 dBA. External jackets on the tools themselves should be used, if such jackets are commercially available, and this could achieve a further reduction of 5 dBA. Quieter procedures should be used, such as drills rather than impact equipment, whenever such procedures are available and consistent with construction procedures.

i. Where feasible, design projects so that they are depressed below the grade of the existing noise-sensitive receptor, creating an effective barrier between the roadway and sensitive receptors.

j. Where feasible, improve the acoustical insulation of dwelling units where setbacks and sound barriers do not provide sufficient noise reduction.

k. Using rubberized asphalt or "quiet pavement" to reduce road noise for new roadway segments, roadways in which widening or other modifications

require re-pavement, or normal reconstruction of roadways where re-pavement is planned

l. Projects that require pile driving or other construction noise above 90 dBA in proximity to sensitive receptors, should reduce potential pier drilling, pile driving and/or other extreme noise generating construction impacts greater than 90 dBA; a set of site-specific noise attenuation measures should be completed under the supervision of a qualified acoustical consultant.

m. Use land use planning measures, such as zoning, restrictions on development, site design, and buffers to ensure that future development is compatible with adjacent transportation facilities and land uses;

n. Monitor the effectiveness of noise reduction measures by taking noise measurements and installing adaptive mitigation measures to achieve the standards for ambient noise levels established by the noise element of the general plan or noise ordinance.

o. Use equipment and trucks with the best available noise control techniques (e.g., improved mufflers, equipment redesign, use of intake silencers, ducts, engine enclosures, and acoustically attenuating shields or shrouds, wherever feasible) for project construction.

p. Stationary noise sources can and should be located as far from adjacent sensitive receptors as possible and they should be muffled and enclosed within temporary sheds, incorporate insulation barriers, or use other measures as determined by the Lead Agency (or other appropriate government agency) to provide equivalent noise reduction.

q. Use of portable barriers in the vicinity of sensitive receptors during construction.

r. Implement noise control at the receivers by temporarily improving the noise reduction capability of adjacent buildings (for instance by the use of sound blankets), and implement if such measures are feasible and would noticeably reduce noise impacts.

s. Monitor the effectiveness of noise attenuation measures by taking noise measurements.

t. Maximize the distance between noise-sensitive land uses and new roadway lanes, roadways, rail lines, transit centers, park-and-ride lots, and other new noise-generating facilities.

u. Construct sound reducing barriers between noise sources and noise-sensitive land uses.

v. Stationary noise sources can and should be located as far from adjacent sensitive receptors as possible and they should be muffled and enclosed within temporary sheds, incorporate insulation barriers, or use other measures as determined by the Lead Agency (or other appropriate government agency) to provide equivalent noise reduction.

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

x. Locate transit-related passenger stations, central maintenance facilities, decentralized maintenance facilities, and electric substations away from sensitive receptors to the maximum extent feasible.

Level of Significance after Mitigation

As discussed above, regulations and polices would reduce impacts but given the regional scale of the analysis in this PEIR, it is not possible to determine if all impacts would be fully mitigated by existing regulations and policies. Therefore, this EIR identifies project-level mitigation measures consistent with applicable regulations and polices designed to reduce impacts. Lead Agencies may choose to include project-level mitigation measures in environmental documents as they determine to be appropriate and feasible. However, because of the regional nature of the analysis and lack of project-specific detail, including the inability to quantify noise impacts at the regional level, and SCAG's lack of authority to impose project-level mitigation measures, this PEIR finds impacts related to substantial temporary or permanent increases in ambient noise levels in excess of standards established in local general plans or noise ordinances, or applicable standards of other agencies, to be significant and unavoidable even with implementation of mitigation.

Impact NOISE-2 Generation of excessive groundborne vibration or groundborne noise levels.

Significant and Unavoidable Impact – Mitigation Required.

Implementation of the transportation projects and the construction of land use development projects anticipated to occur under the Plan would generate varying levels of vibration and groundborne noise. As noted above, urban environments tend to be louder than suburban environments due to denser, multi-use land use patterns. Urban environments also typically support higher volumes of traffic as well as other transportation modes that generate groundborne vibration and sound such as trains, light rail, and buses. Suburban environments, where land uses are often more segregated, have more moderate noise levels. Agricultural areas also have a unique noise environment as compared to urban and suburban environments. Agricultural operations require the use of heavy-duty equipment (e.g., mechanized plows, tractors) that produce high noise levels. However, because agricultural areas are sparsely populated, noise generally does not have the same adverse effect on surrounding land uses and may be protected by right-to-farm regulations or other local land use policies.

Traffic, especially heavy truck traffic, can be a source of vibration and groundborne noise. Rail operations, including freight and light rail trains, can also be a source of vibration. **Table 3.13-14** contains reference to vibration levels associated with heavy-duty equipment.

Construction. Transportation projects and development anticipated to occur under the Plan could result in temporary noise and vibration impacts from grading, paving, clearing, landscaping, staging, excavation, earthmoving, and other related construction activities. Such construction activities would require the use of heavy construction equipment (e.g., pile drivers, back hoes, jackhammers) and vehicles that generate significant amounts of noise and vibration in the immediate vicinity of the source, often resulting in noise and vibration levels substantially higher than existing conditions. **Table 3.13-14, Construction Equipment Source Noise Levels**, summarizes typical construction noise levels for various construction activities.

Table 3.13-14
Construction Equipment Source Noise Levels

Equipment	Levels in dB(A) at 50 feet
Front Loader	73-86
Trucks	82-95
Cranes (Moveable)	75-88
Cranes (Derrick)	86-89
Vibrator	68-82
Saws	77-82
Pneumatic Impact Equipment	83-88
Jackhammers	81-98
Pumps	68-72
Generators	71-83
Compressors	75-87
Concrete Mixers	75-88
Concrete Pumps	81-85
Back Hoe	73-85
Pile Driving (Peaks)	95-107
Tractor	77-98
Scraper/Grader	80-93
Paver	85-88

Source: US Environmental Protection Agency, Noise From Construction Equipment and Operations, Building Equipment and Home Appliances, PB 206717, 1971.

Noise impacts from construction activities depend on several factors including the types of surrounding land uses, duration and type of construction activities, distance between source and receptor, and the presence or absence of barriers between source and receptor. Construction impacts are considered temporary and localized in nature, as they are limited to the time during which the project is being constructed and confined to areas adjacent to the construction site. After construction is completed, all construction equipment and vehicles are removed. In urban areas, where most of the development takes place, construction is a frequent occurrence, and although construction can be a nuisance, it may not result in a significant impact. In rural and suburban areas, where ambient noise levels are lower, it may rise to the level of an impact. However, land uses are also further apart, thereby reducing the potential for conflicts. Further, many local jurisdictions have policies specifically dealing with construction noise including restrictions on hauling and hours of construction.

Transportation projects and anticipated development projects under the Plan have the potential to result in construction-related impacts that increase noise levels above the noise thresholds identified in **Table 3.13-14** and substantially increase noise levels in locations currently in exceedance of a CNEL threshold;

as well as the potential to result in excessive levels of vibration and groundborne noise from increased traffic and congestion, at the local level (see **Section 3.17, Transportation, Traffic and Safety,** for further discussion of how the Plan affects the transportation network). Although construction noise is short-term for individual project sites, it can nonetheless result in substantial increases in ambient noise levels in the immediate vicinity of each construction site. Construction activities would occur in accordance with applicable city or county standards. Most such standards address acceptable hours of operation, while some standards address allowable noise levels. If sensitive receptors are in the immediate vicinity of construction activities, they could be temporarily adversely affected. Land use strategies which would encourage more dense development near a sensitive receptor would result in increased temporary construction noise for those receptors. Construction activity, and associated groundborne vibration or noise levels, is a routine part of the urban environment. While construction of individual projects is considered to have a less than significant impact, construction activities are likely to be ongoing throughout the region and therefore impacts are considered significant.

As previously discussed, there are sensitive receptors such as residences, schools, libraries, churches, hospitals, nursing homes, natural areas, and parks in the SCAG region that could be affected by construction or operation of Plan projects. As such, impacts are considered significant.

Construction-related vibration has the potential to damage structures and be a source of annoyance to individuals who live or work near these construction activities. Pile drivers can generate vibrations in excess of 0.5 PPV at a distance of 25 feet, see **Table 3.13-15, Construction Equipment Vibration Levels**, which can result in damage to reinforced concrete. Vibration levels generated by pile driving vary depending on soil conditions, construction methods, and equipment used. Depending on the proximity of existing structures to the pile driving, the structural condition of the existing structures, and the methods of construction used, vibration levels caused by pile driving or other foundation work with a substantial impact component such as blasting, rock or caisson drilling, and site excavation or compaction may be high enough to damage existing structures. A vibration analysis completed by Caltrans indicated that "extreme care must be taken when sustained pile driving occurs within 7.5 m (25 ft) of any building, and 15–30 m (50–100 ft) of a historical building or building in poor condition."[71]

71 California Department of Transportation. 2002. *Transportation Related Earthborne Vibrations*. Available online at: http://www.vibrationdata.com/tutorials_alt/caltrans_earth.pdf, accessed September 30, 2019.

Tables 3.13-15
Construction Equipment Vibration Levels

Equipment		PPV at 25 feet
Pile Driver (impact)	Upper Range	1.518
	Typical	0.644
Pile Driver (Sonic)	Upper Range	0.734
	Typical	0.170
Vibratory Roller		0.210
Clam Shovel		0.202
Hydrol Mill	In Soil	0.008
	In Rock	0.017
Large Bulldozer		0.089
Caisson Drilling		0.089
Loaded Trucks		0.076
Jackhammer		0.035
Small Bulldozer		0.003

Source:
Adapted from: Federal Transit Administration. September 2018. Transit Noise and Vibration Impact Assessment Manual. Washington, DC

Operation. Normal operation of residential, office and commercial, and mixed-use buildings are unlikely to generate substantial vibration or groundborne noise. Industrial and public buildings could generate vibration and groundborne noise during operations that involve the use of machinery or other vibration-inducing equipment. However, the amount of vibration produced is not anticipated to be excessive, as workplace vibration is typically addressed from an occupational health and safety perspective. As with noise, vibration dissipates with distance from the source, therefore surrounding land uses would unlikely be affected. **Table 3.13-15** indicates that, even at close distances, vibration levels for most heavy-duty equipment are below 0.1 inches per second.

Traffic, especially heavy truck traffic, can be a source of vibration and groundborne noise. However, such vibration is rarely high enough to cause annoyance to surrounding uses, as vehicles are supported on spring suspensions and pneumatic tires, which reduce the amount of vibration and groundborne noise generated from vehicular traffic. Rail operations, including freight and light rail trains, can also be a source of vibration. Under the Plan there would be increases in both heavy rail and light rail. Existing and future growth and development near existing or planned light rail or heavy rail lines could result in excessive levels of vibration and groundborne noise as compared to existing conditions.

Impacts associated with transportation strategies such as complete streets and TSM would be minimal and they would generally improve overall traffic flow and would not be expected to increase noise or

vibration. Land use strategies would encourage compact development which would encourage more people in urbanized areas where vibration impacts would occur. Operation-related vibration would be a source of annoyance to individuals who live or work near new infrastructure associated with heavy duty truck and bus traffic along roadways and train traffic along rail lines. The amplitude of vibration generated by heavy trucks, buses, or trains has the potential to result in structural or cosmetic damage if the route is adjacent or in close proximity to fragile older buildings.

Based on vibration measurements throughout California, Caltrans determined the maximum traffic vibration levels from truck traffic drop below the threshold of perception at a distance of 42.5 metes (140 feet) from the source and that vibration level from truck traffic are unlikely to cause architectural damage to fragile historic buildings unless the building was adjacent or within 5 meters or 17 feet from the source.[72] Therefore, it is anticipated that operational activities would result in a significant impact related to the exposure of people to excess groundborne vibration or groundborne noise levels.

Furthermore, Caltrans measured a peak train vibration level of 0.36 in/sec PPV at 3 meters (10 feet).[73] A vibration level of 0.36 in/sec PPV at 3 meters or 10 feet would fall below the threshold of perception at a distance of 80 meters (263 feet) from the source. Therefore, it is anticipated that operational activities would result in a significant impact related to the exposure of people in excess groundborne vibration or groundborne noise levels.

As a result, implementation Connect SoCal would result in the exposure of persons to generation of excessive groundborne vibration or groundborne noise levels, which constitutes a significant impact requiring the consideration of mitigation measures.

Mitigation Measures

SCAG Mitigation Measure

See **SMM NOISE-1.**

72 Ibid.

73 Ibid.

Project Level Mitigation Measures

See **PMM-NOISE-1.**

PMM NOISE-2: In accordance with provisions of sections 15091(a)(2) and 15126.4(a)(1)(B) of the *State CEQA Guidelines*, a Lead Agency for a project can and should consider mitigation measures to reduce substantial adverse effects related to violating air quality standards. Such measures may include the following or other comparable measures identified by the Lead Agency:

a. For projects that require pile driving or other construction techniques that result in excessive vibration, such as blasting, determine the potential vibration impacts to the structural integrity of the adjacent buildings within 50 feet of pile driving locations.

b. For projects that require pile driving or other construction techniques that result in excessive vibration, such as blasting, determine the threshold levels of vibration and cracking that could damage adjacent historic or other structure, and design means and construction methods to not exceed the thresholds.

c. For projects where pile driving would be necessary for construction due to geological conditions, utilize quiet pile driving techniques such as predrilling the piles to the maximum feasible depth, where feasible. Predrilling pile holes will reduce the number of blows required to completely seat the pile and will concentrate the pile driving activity closer to the ground where pile driving noise can be shielded more effectively by a noise barrier/curtain.

d. Restrict construction activities to permitted hours in accordance with local jurisdiction regulation.

e. Properly maintain construction equipment and outfit construction equipment with the best available noise suppression devices (e.g., mufflers, silences, wraps).

f. Prohibit idling of construction equipment for extended periods of time in the vicinity of sensitive receptors.

Level of Significance after Mitigation

As discussed above, regulations and policies would reduce impacts but given the regional scale of the analysis in this PEIR, it is not possible to determine if all impacts would be fully mitigated by existing regulations and policies. Therefore, this EIR identifies project-level mitigation measures consistent with applicable regulations and polices designed to reduce impacts. Lead Agencies may choose to include project-level mitigation measures in environmental documents as they determine to be appropriate and feasible. However, because of the regional nature of the analysis and lack of project-specific detail, including project locations, and SCAG's lack of authority to impose project-level mitigation measures, this PEIR finds impacts related to excessive groundborne vibration or groundborne noise levels to be significant and unavoidable even with implementation of mitigation.

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

Significant and Unavoidable – Mitigation Required.

Implementation of transportation projects and development anticipated to occur under the Plan may result in exposure of persons to or generation of significant noise levels from aircrafts and other airport activity (including ground transportation) constituting a significant impact.

The SCAG region contains an expansive multiple airport system with seven commercial airports, seven government/military fields, and more than 30 reliever and general aviation airports. California's Airport Noise Standards identify a noise exposure level of CNEL 65 dB as the noise impact boundary around airports. Airport proprietors are required to ensure all land uses are compatible with the aircraft noise environment or secure a variance from the California Department of Transportation.

Note that SCAG has no authority over airport development. Rather SCAG includes aviation planning information within each RTP/SCS in order to facilitate ground transportation access planning. Development authority of airports rests with each airport (i.e. airport sponsors retain authority over planning and development decisions) and the Federal Aviation Administration (FAA), which makes airport funding decisions based on national priorities. Moreover, airports are not required to incorporate MPO planning recommendations into their capital plans, and FAA funding decisions are not necessarily tied to MPO RTP recommendations.

Despite some downturns, air passenger traffic in the region has increased at a steady rate over the past two decades, with a particularly high growth rate in recent years. In 2017, the six-county SCAG region was one of the most active and fastest growing regions for air passenger traffic in the United States. In 2017, at 110.17 million annual passengers, SCAG was second only to the New York/New Jersey region for air passenger traffic. The SCAG region saw a passenger growth rate of 5.12 percent from 2012 to 2017.[74]

As noted above, SCAG does not have any regulatory, developmental, operational, or planning authority over the airports. Rather, SCAG is primarily a regional surface transportation planning agency that maintains a list of airport ground access projects and a consultative relationship with the airports. Therefore, SCAG is focused on air and passenger cargo activity from the perspective of how the traffic coming and going from the airports affects the region's roads, highways, and transit system. SCAG also prepares an Aviation Technical Report to the Plan.

The Connect SoCal Aviation Technical Report references a comprehensive review of various forecasts for aviation growth in the SCAG region:[75]

- Regional air passenger transportation is anticipated to grow by an average of 2.1% annually; from 110.17 MAP in 2017 to 197.1 MAP in 2045
- Regional air cargo transportation is anticipated to grow by an average of 3.3% annually, from 3.14 million in 2017 to 7.77 million tons in 2045
- Total regional aircraft operations are not anticipated to grow as fast as passenger and/or cargo growth. Regional aircraft operations are anticipated to grow by an average of 0.74% annually, from 3.7 million operations in 2017 to 4.58 million operations in 2045

As mentioned above, LAX is the only regional large-hub primary airport, and the operational data listed for each regional airport indicates most regional airport operations are associated with LAX. Recent statistics show that while passenger traffic has increased by approximately 1% in 2019, aircraft operations have reduced by approximately 2%. The LAWA department of the City of Los Angeles is currently constructing an Automated People Mover (APM) electric train to reduce ground traffic congestion, accommodate future operational growth, and provide a direct rail connection to Los Angeles and adjacent cities.[76] The APM is planned to open for passenger services in 2023, and APM operation will reduce ground traffic and could incrementally reduce associated ground traffic noise.

---

74 Connect SoCal. 2019. *Aviation and Airport Ground Access Technical Report*.

75 Ibid.

76 https://www.lawa.org/en/connectinglax/automated-people-mover; 8/30/2019

The following information was obtained from the Airport Noise Overview Technical Report prepared as part of the PEIR. The full report is provided in **Appendix 3.13**. Region-wide growth between 2017 to mid-year 2019 is estimated to be up to approximately 2% for air passengers and less than 0.5% for aircraft operations. For the purposes of assessing regional noise impacts from aviation, the above bulleted forecasts reasonably approximate the 2019 to 2045 time period.

As noted above, the aircraft operations growth forecast is significantly smaller than the air passenger and air cargo percentages. This is anticipated because newer aircraft carry a higher volume of passengers and carriers are running at a higher load factor than in the past. When the airlines carry more passengers per flight, the flights are more profitable and fewer flights are needed to carry the same volume of passengers to a specific location. This allows the airlines to schedule some of these flights to other locations and/or reduce their airport operations.

The noise from airports is directly related to the number of aircraft operations as well as the size, aircraft type, and number and type of engines, with additional contributions from other airport activities and ground transportation (noise from ground transportation is as part of the overall transportation projects in the Plan).

In general, if the mix of aircraft remains constant, the aviation noise contours grow larger or shrink smaller as the operations increase or decrease. Noise levels do not increase algebraically as the noise sources increase but increase in a logarithmic fashion. For example, two noise sources each emitting a noise level of 60 dB add together to produce noise of 63 dB, not 120 dB. Doubling the number of noise sources increases the overall noise level by 3 dB and doubling the number of aircraft operations would also increase the overall airport noise level by 3 dB and expand the area inside the noise contours, assuming all other factors such as aircraft type, engines, flight tracks, etc., remain the same.

Considering the growth in airport operations from 3.7 million to 4.58 million, if all aircraft types and operational characteristics were to remain equal, the forecasted increase in noise would equate to 0.9 decibels. However, this average increase in aircraft operations would not occur at all airports, as different airports will experience different changes and noise contours may grow or shrink independently. Airport noise levels are expected to increase at the busiest airports such as LAX, ONT, PSP and BUR, while noise levels at airports with noise and/or operations constraints would not be expected to increase as much. The details needed to model airport noise level changes over the forecast period are not available to provide specific changes. Additionally, airports across the nation have received an increase in noise complaints since implementation in 2015 of FAA's *NextGen* program to modernize the nation's air

transportation system.[77] One aspect of *NextGen* utilizes satellite navigation that precisely direct aircraft flight tracks for more efficient performance, reducing fuel costs and associated carbon emissions, and to increase overall flight capacity.[78] Aircraft flight track changes in some cases moved flights over areas that previously did not experience overflights or concentrated aircraft over areas that already experienced overflights, and airport noise complaints increased.[79] As the FAA and airports such as LAX and BUR[80] wrestle with the contending issues of an efficient airspace and noise complaints, it is unclear whether aircraft flight tracks will remain constant, further complicating the details needed for forecasting airport noise level changes over the lifetime of the Plan.

Technological changes also play a role in understanding airport noise impacts. The aircraft industry continues to develop aircraft with higher capacity, lower fuel consumption, and lower carbon emissions, but as it does, the industry must also comply with FAA and international aircraft compliance requirements regarding noise. Aircraft noise is classified into various Stages, with current Stage 3 and 4 aircraft operating quieter than previously used Stage 2 aircraft. Stage 3 aircraft measure between 7 and 20 EPNdB (Effective Perceived Noise Level, decibels) quieter than State 2 aircraft, while Stage 4 aircraft are an additional 10 EPNdB quieter than Stage 3 aircraft. Stage 2 aircraft no longer fly in the U.S., with some exceptions for lighter weight aircraft, taking the noisiest aircraft out of service. As airlines replace older and noisier Stage 3 aircraft with quieter Stage 4 aircraft, the aircraft fleet becomes quieter. As a recent example, American Airlines retired the last of its Stage 3 compliant McDonnell Douglas MD-80 aircraft in September 2019 and looks to replace the aircraft with more fuel-efficient aircraft with lower maintenance costs.[81] Even as newer aircraft have more powerful engines, the requirements to comply with the quieter Stage 4 noise levels will result in a quieter fleet overall. In 2018, the FAA adopted regulations requiring newly designed aircraft to meet even quieter Stage 5 requirements with a reduction of 7 EPNdB,[82] and as these aircraft come into service (and some aircraft currently in operation already meet this standard), this will lower the aircraft noise level further.

It is possible that in the long term, as aircraft operations grow over the next 25 years, the lower noise levels of aircraft will offset the increased operations to maintain or even reduce the aircraft noise contour

---

77 https://www.faa.gov/nextgen/. 9/20/2019

78 https://www.faa.gov/nextgen/how_nextgen_works/; 9/20/2019

79 https://www.washingtonpost.com/local/trafficandcommuting/advances-in-airport-technology-mean-sleepless-nights-for-some/2016/03/04/7b8eb936-e098-11e5-9c36-e1902f6b6571_story.html; 9/20/2019

80 https://www.latimes.com/california/story/2019-09-16/hollywood-burbank-airport-noise-rattles-residents-who-want-flights-spread-over-wider-area; 9/20/2019

81 https://www.nbcsandiego.com/news/california/American-Airlines-Retires-the-Last-of-Its-Iconic-MD-80-Jets-560489551.html; 9/20/2019

82 Federal Aviation Administration, Stage 5 Airplane Noise Standards, published October 4, 2017. Accessible: https://www.federalregister.gov/documents/2017/10/04/2017-21092/stage-5-airplane-noise-standards

footprints around airports, as this has been the general trend in aviation noise over the previous 40 years. It may also be possible that the growth in operations at some airports may overtake the trend toward a quieter aircraft fleet and cause aircraft noise and the noise contours to increase.

In addition, most major public airports have an airport land use plan that provides guidance on safety and land use in adjacent areas. State law mandates the creation of an Airport Land Use Compatibility Plan. The Airport Land Use Commissions (ALUC) coordinates planning for areas that surround public use airports. The ALUC is tasked with preparing airport land use plans to protect the public by minimizing their exposure to excessive noise and safety hazards within these areas.

Furthermore, the development of Airport Land Use Plans are guided by three federal regulations and two state codes:

- Title 14 Code of Federal Regulations, Part 36, establishes maximum acceptable noise levels for specific aircraft types.
- Title 14 Code of Federal Regulations, Part 150, provides guidance for measuring noise at airports and surrounding areas, determining exposure of individuals to noise from the operations of an airport, identifying land uses that are normally compatible, and preparing and executing noise compatibility planning and implementation programs.
- As part of Title 24 Code of Federal Regulations, Part 51, Subpart B, the HUD exterior noise regulations state that noise levels of 65 dBA DNL or less are acceptable for residential land uses and noise levels exceeding 75 dBA DNL are unacceptable.
- California Government Code Section 65302 specifies that noise contours be shown for all facilities related to airport operations and be stated in terms of CNEL or Ldn. These noise contours are intended to guide how patterns of land uses are established in the land use element in order to minimize the exposure of community residents to excessive noise.
- Title 21, California Code of Regulations Section 5000 et seq., identifies a noise exposure level of CNEL 65 dB as the noise impact boundary around airports. Within this noise impact boundary, airport proprietors are required to ensure that all land uses are compatible with the aircraft noise environment or the airport proprietor must secure a variance from Caltrans.

Additionally, each county and city in the SCAG region is required to adopt safety and noise elements as part of their General Plans. It is expected that local jurisdictions would conduct environmental review for projects that are within or near sensitive airport zones, and are expected to implement best management

practices and mitigation measures on a project-by-project basis, to minimize potential noise risks associated with air traffic.

Nevertheless, due to the regional scale of aviation operations and because the noise profiles of future aircraft types and their engines are unknown, as is the timeframe for phasing out older aircraft and replacing them with newer aircraft, impacts cannot be accurately determined at this time. Conservatively it is assumed sensitive receptors may experience greater noise impacts than at present in the vicinity of airports resulting in significant impacts.

Mitigation Measures

SCAG Mitigation Measures

See **SMM NOISE-1.**

Project Level Mitigation Measures

See **PMM NOISE-1.**

Level of Significance after Mitigation

As discussed above, regulations and polices would reduce impacts but given the regional scale of the analysis in this PEIR, it is not possible to determine if all impacts would be fully mitigated by existing regulations and policies. Therefore, this EIR identifies project-level mitigation measures consistent with applicable regulations and polices designed to reduce impacts. Lead Agencies may choose to include project-level mitigation measures in environmental documents as they determine to be appropriate and feasible. However, because of the regional nature of the analysis and lack of project-specific detail, the unknown noise profiles of future aircraft types and their engines and the timeframe for phasing out older aircraft and replacing them with newer aircraft, and SCAG's lack of authority to impose project-level mitigation measures, this PEIR finds impacts related to aviation noise to be significant and unavoidable even with implementation of mitigation.

3.13.4 SOURCES

Alameda Corridor Transportation Authority. *Alameda Corridor Fact Sheet*. Available online at: http://www.acta.org/projects/projects_completed_alameda_factsheet.asp, accessed January 9, 2019.

Amtrak. *California Train Routes*. Available online at: http://www.amtrak.com/california-train-routes, accessed January 9, 2019.

California Code of Regulations. *21 CCR § 5012. Airport Noise Standard*. Available online at: https://govt.westlaw.com/calregs/Document/ICD224160D45011DEB97CF67CD0B99467?viewType=FullText&originationContext=documenttoc&transitionType=CategoryPageItem&contextData=(sc.Default), accessed August 28, 2019.

California Department of Consumer Affairs. *State of California Laws and Regulations Pertaining to Automotive Repair Dealers, Smog Check Stations and Technicians, Official Lamp and Brake Adjusting Stations and Adjusters.* 2014. Section 27204. Available online at: https://www.bar.ca.gov/pdf/Laws_and_Regs_Manual_2014_LegReg_20140718.pdf. Accessed November 1, 2019.

California Department of Transportation. *Airport Noise Program*. Available online at: https://dot.ca.gov/programs/aeronautics/airport-noise-program, accessed September 4, 2019.

California Department of Transportation, Division of Aeronautics. 2011. *California Airport Land Use Planning Handbook*.

California Department of Transportation, Division of Environmental Analysis. 2011. *Traffic Noise Analysis Protocol for New Highway Construction, Reconstruction, and Retrofit Barrier Projects.*

California Department of Transportation, Division of Environmental Analysis. 2013. Transportation and Construction Vibration Guidance Manual.

California Department of Transportation, Division of Environmental Analysis. 2013. Technical Noise Supplement to the Traffic Noise Analysis Protocol. Sacramento, CA.

California Department of Transportation. 2010. Soundwalls. Website. Available online at: http://www.dot.ca.gov/dist07/resources/soundwalls/, accessed March 27, 2019.

California Department of Transportation. Project Development Procedures Manual. Chapter 30. May 2019.

California Legislative Information. *Article 5. Authority for and Scope of General Plans [65300-65303.4], Section 65302*. Available online at: https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=GOV&sectionNum=65302, accessed August 28, 2019.

California Legislative Information. *Article 6. Freeway Noise Attenuation [215.5-216.5], Section 216*. Available online at: https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=SHC&sectionNum=216., accessed August 28, 2019.

California Legislative Information. *Chapter 2. Rules and Regulations [17920-17928], Section 17922.6*. Available online at: https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?sectionNum=17922.6&lawCode=HSC, accessed August 28, 2019.

California Legislative Information. *Division 28. Noise Control Act, 46000-46080*. Available online at: https://leginfo.legislature.ca.gov/faces/codes_displayexpandedbranch.xhtml?tocCode=HSC&division=28.&title=&part=&chapter=&article=, accessed August 28, 2019.

California Legislative Information. *Streets and Highways Code, Article 6. Freeway Noise Attenuation [215.5-216.5].* Available online at: http://leginfo.legislature.ca.gov/faces/codes_displayText.xhtml?lawCode=SHC&division=1.&title=&part=&chapter=1.&article=6., accessed November 18, 2019.

Code of Federal Regulations. 2018. *Title 14 Aeronautics and Space Parts 1 to 59*. Available online at: https://www.govinfo.gov/content/pkg/CFR-2018-title14-vol1/pdf/CFR-2018-title14-vol1.pdf, accessed August 28, 2019.

Code of Federal Regulations. 2018. *Title 14 Aeronautics and Space, Parts 110 to 199*. Available online at: https://www.govinfo.gov/content/pkg/CFR-2018-title14-vol3/pdf/CFR-2018-title14-vol3.pdf, accessed August 28, 2019.

Code of Federal Regulations. 2018. *Title 23 Highways*. Available online at: https://www.govinfo.gov/content/pkg/CFR-2018-title23-vol1/pdf/CFR-2018-title23-vol1.pdf, accessed August 28, 2019.

Code of Federal Regulation. 2018. *Title 24 Housing and Urban Development, Parts 0 to 199*. Available online at: https://www.govinfo.gov/content/pkg/CFR-2018-title24-vol1/pdf/CFR-2018-title24-vol1.pdf, accessed August 28, 2019.

Code of Federal Regulations. 2018. *Title 40 Protection of the Environment, Parts 190 to 259*. Available online at: https://www.govinfo.gov/content/pkg/CFR-2018-title40-vol27/pdf/CFR-2018-title40-vol27.pdf, accessed August 28, 2019.

Code of Federal Regulations. 2018. *Title 40 Protection of the Environment, Volume 27*. Available online at: https://www.govinfo.gov/content/pkg/CFR-2018-title40-vol27/pdf/CFR-2018-title40-vol27.pdf, accessed August 28, 2019.

Code of Federal Regulations. 2018. *Title 49 Transportation, Parts 200 to 299*. Available online at: https://www.govinfo.gov/content/pkg/CFR-2018-title49-vol4/pdf/CFR-2018-title49-vol4.pdf, accessed August 28, 2019.

Cowan, James P. 1993. *Handbook of Environmental Acoustics*.

Federal Aviation Administration. 2007. *Environmental Desk Reference for Airport Actions*. Chapter 17, Noise. Washington, DC. October.

Federal Aviation Administration, Stage 5 Airplane Noise Standards, published October 4, 2017. Accessible: https://www.federalregister.gov/documents/2017/10/04/2017-21092/stage-5-airplane-noise-standards

Federal Interagency Committee on Noise. 1992. *Federal Agency Review of Selected Airport Noise Analysis Issues.* August.

Federal Railroad Administration. 2012. *High-Speed Ground Transportation Noise and Vibration Impact Assessment*.

Federal Railroad Administration. 2012. *High-Speed Ground Transportation Noise and Vibration Impact Assessment*. Final Report. Washington, DC. September.

Federal Transit Administration. September 2018. *Transit Noise and Vibration Impact Assessment Manual*. Washington, DC.

Federal Transit Administration, Office of Planning and Environment. 2018. *Transit Noise and Vibration Impact Assessment.* Washington, DC.

Governor's Office of Planning and Research. 2017. *State of California 2017 General Plan Guidelines*

Government Publishing Office. 2019. *Electronic Code of Federal Regulations, §202.20 Standards for highway operations*. Available online at: https://www.ecfr.gov/cgi-bin/text-idx?SID=253c20b841de78b34cfdf69afe316a6f&mc=true&node=se40.27.202_120&rgn=div8, accessed November 18, 2019.

Government Publishing Office. *40 CFR 205, Subpart B Medium and Heavy Trucks*. Available online at: https://www.govinfo.gov/content/pkg/CFR-2012-title40-vol26/pdf/CFR-2012-title40-vol26-part205-subpartB.pdf, accessed November 18, 2019.

Los Angeles County Metropolitan Transportation Authority. *Facts at a Glance.* Available online at: https://www.metro.net/news/facts-glance/, accessed January 7, 2019.

Metrolink. *Experience Metrolink's History*. Available online at: https://www.metrolinktrains.com/about/agency/history-of-metrolink/, accessed January 9, 2019

National Cooperative Highway Research Program. 2012. *Current Practices to Address Construction Vibration and Potential Effects to Historic Buildings Adjacent to Transportation Projects*. Table 1. September.

Nelson, J.T., and H.J. Saurenman. 1983. *State-of-the-Art Review: Prediction and Control of Ground-Borne Noise and Vibration from Rail Transit Trains*. U.S. Department of Transportation, Urban Mass Transportation Administration, Report Number UMTA-MA-06-0049-83-4, DOT-TSC-UMTA-83-3.

Port of Hueneme. 2017. *Comprehensive Annual Financial Report: Fiscal Year Ended June 30, 2017.* November.

Port of Los Angeles. 2018. *Facts & Figures [2018].* Available online at: https://kentico.portoflosangeles.org/getmedia/fe3515ee-309e-47b3-83ad-b09d58edec67/2018-facts-figures, accessed August 28, 2019.

Southern California Association of Governments. 2008. *SCAG Commercial Airport System Map*. Available at: http://www.scag.ca.gov/Documents/commercialairport_2008.pdf, accessed March 27, 2019.

Southern California Association of Governments. 2012. *On the Move: Southern California Delivers the Goods*. Summary Report. December.

Southern California Association of Governments (SCAG). 2015. *2016 Regional Transportation Plan/ Sustainable Communities Strategy PEIR*. November.

Southern California Association of Governments (SCAG). 2019. *Connect SoCal Aviation and Airport Ground Access Technical Report*.

The Harbor Department, an Enterprise Fund of the City of Long Beach, California. 2017. *Comprehensive Annual Financial Report for the Fiscal Year Ended September 30, 2017.*

U.S. Department of Transportation, Federal Highway Administration. 2006. *FHWA Highway Construction Noise Handbook.*

U.S. Department of Transportation, Federal Transit Administration. 2006. *Transit Noise and Vibration Assessment.*

U.S. Department of Transportation, Federal Transit Administration. 2018. *Transit Noise and Vibration Assessment Manual.*

U.S. Environmental Protection Agency, Office of Noise Abatement and Control. 1978. *Noise: A Health Problem*. Washington, DC.

U.S. Environmental Protection Agency, Office of Noise Abatement and Control. 1974. *Information on Levels of Environmental Noise Requisite to Protect Public Health with an Adequate Margin of Safety*. Available online at: https://nepis.epa.gov/Exe/ZyPDF.cgi/2000L3LN.PDF?Dockey=2000L3LN.PDF, accessed March 27, 2019.

U.S. Environmental Protection Agency. 2017. *Summary of the Noise Control Act, 42 U.S.C §4901 et seq. (1972)*