3.13
NOISE

This section of the Program Environmental Impact Report (PEIR) describes the ambient noise characteristics of the SCAG region, discusses the potential impacts of the proposed 2016 Regional Transportation Plan/Sustainable Communities Strategy (2016 RTP/SCS, "Plan," or "Project") on ambient noise levels, identifies mitigation measures for the impacts, and evaluates the residual impacts. Noise was evaluated in accordance with Appendix G of the 2015 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 SCAG's 2012 RTP/SCS PEIR.[1,2,3,4,5,6,7,8,9]

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.

Definitions

The definitions for noise and ground-borne vibration are discussed in this section to provide context for the evaluation of noise.

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

2 Cowan, James P. 1993. *Handbook of Environmental Acoustics*. Hoboken, NJ: John Wiley and Sons.

3 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.

4 Governor's Office of Planning and Research. 2003. *State of California General Plan Guidelines*. Sacramento, CA.

5 California Department of Transportation. 18 June 2009. *Project Development Procedures Manual*. Chapter 30. Sacramento, CA.

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

7 California Department of Transportation. September 2013. *Technical Noise Supplement to the Traffic Noise Analysis Protocol*. Sacramento, CA.

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

9 California Department of Transportation, Division of Aeronautics. October 2011. *California Airport Land Use Planning Handbook*. Sacramento, CA.

Noise and Vibration Terminology

A list of noise terminology is included to facilitate the discussion of noise and its impacts.

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.

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 Measurement

Noise is defined as unwanted sound. The human response to environmental noise is subjective and varies considerably from individual to individual. 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.[10]

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. 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 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***).

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

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.

3.13.1 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.

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.

Title 40 of the Code of Federal Regulations (40 CFR 201, 40 CFR 205, 49 CFR 210)

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

Parts 201 and 210

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.

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).

Title 23 of the Code of Federal Regulations

Title 23 CFR § 772 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.

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.

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.

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 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.

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

The mission of 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 to be 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.

Federal Transit Administration Noise and Vibration Guidance

The Federal Transit Administration (FTA) has published the *Transit Noise and Vibration Impact Assessment*[11] report to provide guidance on procedures for assessing impacts at different stages of transit project development. The report covers both construction and operational noise impacts, and describes 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 3.13.1-1**). 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 3.13-3, *Construction Vibration Damage Criteria***).

TABLE 3.13-3
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:
Adapted from: Federal Transit Administration. May 2006. *Transit Noise and Vibration Impact Assessment*. Washington, DC.

[11] Federal Transit Administration. May 2006. *Transit Noise and Vibration Impact Assessment*. Washington, DC.

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*.[12] 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 3.13.1-1, *Noise Levels Defining Impact for High-Speed Train Projects***, and **Table 3.13.1-2, *Land Use Categories and Metrics for High-Speed Train Noise Impact Criteria***).

TABLE 3.13.1-1
NOISE LEVELS DEFINING IMPACT FOR HIGH-SPEED TRAIN PROJECTS

Existing Noise Exposure* $L_{eq}(h)$ or L_{dn} (dBA)	Project Noise Impact Exposure* $L_{eq}(h)$ or L_{dn} (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

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

TABLE 3.13.1-1
NOISE LEVELS DEFINING IMPACT FOR HIGH-SPEED TRAIN PROJECTS

Existing Noise Exposure* $L_{eq}(h)$ or L_{dn} (dBA)	Project Noise Impact Exposure* $L_{eq}(h)$ or L_{dn} (dBA)					
	Category 1 or 2 Sites			Category 3 Sites		
	No Impact	Moderate Impact	Severe Impact	No Impact	Moderate Impact	Severe Impact
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
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. Washington, DC.

TABLE 3.13.1-2
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 Leq(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.

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.

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.

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 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).

Noise Insulation Standards

The California Noise Insulation Standards found in Title 24 of the California Code of Regulations, California Health and Safety Code § 17922.6, set requirements 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.

California Streets and Highways Code

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. 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. For new roadway projects, Caltrans employs the NAC, promulgated by Title 40 of the Code of Federal Regulations (CFR), as administered by the FHWA.

Section 216

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 L_{eq} 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 L_{eq}. If the noise levels generated from freeway and non-freeway sources exceed 52 dBA L_{eq} 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.

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 3.13.1-3, *Land Use Guidelines***).[13] 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.

[13] Governor's Office of Planning and Research. 2003. *State of California General Plan Guidelines*. Sacramento, CA.

TABLE 3.13.1-3
LAND USE GUIDELINES

Land Use Category	Community Noise Exposure (L_{dn} or CNEL, dB) 55 60 65 70 75 80
Residential - Low Density Single-Family, Duplex, Mobile Homes	
Residential - 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:
Adapted from: Governor's Office of Planning and Research. 2003. *State of California General Plan Guidelines*. Appendix C, Noise Element Guidelines, Figure 2. Sacramento, CA.

Caltrans Guidance

Traffic Noise. Chapter 30 of the Caltrans *Project Development Procedures Manual*[14] offers guidance on highway traffic noise abatement criteria (NAC), corresponding to various land use activity categories. 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 3.13.1-4, *Activity***

[14] California Department of Transportation. 18 June 2009. *Project Development Procedures Manual*. Chapter 30.

Categories and Noise Abatement Criteria).[15] 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*[16] 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. 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 3.13.1-4
ACTIVITY CATEGORIES AND NOISE ABATEMENT CRITERIA

Activity	$L_{eq}(h)$*	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. Sacramento, CA.

Railway. The *Transportation and Construction Vibration Guidance Manual* refers to the FTA *Transit Noise and Vibration Impact Assessment*[17] report for guidance on railways.

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

[16] California Department of Transportation. September 2013. *Technical Noise Supplement to the Traffic Noise Analysis Protocol*. Sacramento, CA.

[17] Federal Transit Administration. May 2006. *Transit Noise and Vibration Impact Assessment*. Washington, DC.

Airport Noise. The Caltrans Division of Aeronautics *California Airport Land Use Planning Handbook*[18] offers guidance on airport planning and developing compatible land use policies. It also provides suggested criteria for the CNEL values commonly used as the limit for acceptable residential noise exposure (**Table 3.13.1-5, *Noise Compatibility Criteria***).

TABLE 3.13.1-5
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. Sacramento, CA.

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.

[18] California Department of Transportation. October 2011. *California Airport Land Use Planning Handbook*. Sacramento, CA.

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.

Construction Vibration. The *Transportation and Construction Vibration Guidance Manual* presents a variety of criteria for vibration impacts based on previously completed studies.[19] 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.

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, some of the actions that airport proprietors have been allowed to take to address local community noise concerns include 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 proprietors may 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.

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.

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

3.13.2 EXISTING CONDITIONS

Ambient Noise Levels

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.[20] 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. 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 3.13.2-1, *Ambient Noise Sampling Data***).

TABLE 3.13.2-1
AMBIENT NOISE SAMPLING DATA

Location	Land Use	Peak Hour Noise Level (dBA, L_{eq})
City of Los Angeles	Recreation (Elysian Reservoir)	42
City of Los Angeles	Residential Area	51
City of Los Angeles	Industrial Area (Port)	67
City of Redlands	Freeway	65
City of Santa Monica	Residential Area	50
City of West Covina	Commercial Area	60

SOURCE:
Southern California Association of Governments. March 2012. *Program Environmental Impact for the 2012–2035 RTP/SCS.*

The most common noise sources within the SCAG region are motor vehicles traveling on highways and on arterial roadways. Higher levels of noise from motor vehicles 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, 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.

[20] U.S. Environmental Protection Agency. March 1974. *Information on Levels of Environmental Noise Requisite to Protect Public Health with an Adequate Margin of Safety*. Prepared by the U.S. Environmental Protection Agency Office of Noise Abatement and Control. Available at: http://www.fican.org/pdf/EPA_Noise_Levels_Safety_1974.pdf

Airports

The SCAG region contains 57 airports, with 12 major commercial airports serving the region[21] (**Table 3.13.2-2, *Major Commercial Airports within the SCAG Region***).

TABLE 3.13.2-2
MAJOR COMMERCIAL AIRPORTS WITHIN THE SCAG REGION

Airport	Location	Airport Land Use Plan	Noise Contour Available?
Palmdale Regional Airport	Palmdale	Los Angeles County Airport Land Use Plan	Yes
Southern California Logistics Airport	Victorville	Southern California Logistics Airport Comprehensive Land Use Plan	Yes
Oxnard Airport	Oxnard	Airport Comprehensive Land Use Plan for Ventura County	Yes
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
San Bernardino International Airport	San Bernardino	Not available	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
March Inland Port	March Air Reserve Base	March Air Reserve Base / Inland Port Airport Land Use Compatibility 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. December 2011. *2012–2035 Regional Transportation Plan / Sustainable Communities Strategy: Aviation and Airport Ground Access*. Los Angeles, CA.
Southern California Association of Governments. 7 January 2008. SCAG Commercial Airport System Map. Available at: http://www.scag.ca.gov/programs/Pages/ASA.aspx

Airport noise is generated primarily by aircraft takeoffs and landings, which will vary depending on the aircraft's weight and the number, type, and location of the engines. 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. Noise levels computed by these two methods typically differ by less

[21] Southern California Association of Governments. 7 January 2008. *SCAG Commercial Airport System Map*. Available at: http://www.scag.ca.gov/programs/Pages/ASA.aspx

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,[22] including residences, schools, hospitals, and childcare facilities.

Freeways, Highways, and Arterial Roadways

The SCAG region has nearly 21,000 centerline (route) miles and more than 65,000 lane-miles of roadways.[23] 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.

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. 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

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

[23] Southern California Association of Governments. April 2012. *2012–2035 Regional Transportation Plan*. Los Angeles, CA.

reduction and the cost would not exceed $35,000 per residential unit (1987 dollars).[24] A typical wall that interrupts the line of sight is capable of reducing noise levels by 10 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 3.13.2-3, *Reference Noise Levels for Various Rail Operations***).

TABLE 3.13.2-3
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 2006. *Transit Noise and Vibration Impact Assessment*. 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.

[24] California Department of Transportation. Updated 13 October 2010. Soundwalls. Website. Available at: http://www.dot.ca.gov/dist07/resources/soundwalls/

The SCAG region is served by two Class I railroads: Union Pacific Railroad (UP) and Burlington Northern/Santa Fe Railway (BNSF).[25] 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 2010, UP and BNSF handled more than 4 million international and domestic containers and truck trailers. The SCAG Inland Empire Railroad Main Line Study suggest that the number of freight trains on most BNSF and UP lines will more than double between 2000 and 2025 in response to a tripling of container volume at the San Pedro Bay Ports. 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 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 209 grade-level street/rail crossings. 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. 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.[26] 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.

The SCRRA operates the Metrolink commuter rail system. This system currently includes 57 stations and 7 rail lines: Antelope Valley, Inland Empire–Orange County, Orange County, Riverside, San Bernardino, Ventura, and 91.[27] Noise levels generated by Metrolink are similar to those associated with Amtrak.

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[25] Southern California Association of Governments. December 2012. *On the Move: Southern California Delivers the Goods*. Summary Report. Los Angeles, CA.

[26] Amtrak. Accessed 25 August 2015. *California Train Routes*. Available at: http://www.amtrak.com/california-train-routes

[27] Metrolink. Accessed 25 August 2015. *Stations*. Available at: http://www.metrolinktrains.com/stations/

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 1,447-square-mile service area. Metro operates 86.1 miles of rail service on two subway lines (Purple and Red) and four light rail lines (Blue, Expo, Gold, and Green). 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 Culver City with 12 existing stations. The Gold Line extends from East Los Angeles to Pasadena with 21 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 Gardena with 10 existing stations.

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. At the ports, noise is 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. All sources affect the ambient noise levels in the port areas. Residential areas in San Pedro 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 2014, the Port of Los Angeles handled 176.4 million metric revenue tons (MMRT) of cargo,[28] Port of Long Beach handled 165.5 MMRT,[29] and Port of Hueneme handled 1.4 MMRT.[30] 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 almost 40 percent of the cargo volume in the country; the Port of Hueneme in Ventura County is a major shipping point for automobiles, fresh fruit, and produce.

[28] Port of Los Angeles. 2015. *Facts & Figures*.

[29] Port of Long Beach. 2015. *Comprehensive Annual Financial Report for the Fiscal Year Ended September 30, 2014.*

[30] Port of Hueneme. 2014. *Comprehensive Annual Financial Report: Fiscal Year Ended June 30, 2014 and 2013.*

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 have less effect on the local community.

Construction Noise

Noise from construction sites are characterized as stationary point sources of even though they may include mobile sources, such as graders. 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 3.13.2-4, *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. 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. 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.

TABLE 3.13.2-4
CONSTRUCTION EQUIPMENT NOISE LEVELS

Equipment	Typical Noise Level (dBA) at 50 feet from Source
Air Compressor	81
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	81
Grader	85
Impact Wrench	85
Jack Hammer	88
Loader	85
Paver	89
Pile-driver (Impact)	101
Pile-driver (Sonic)	96
Pneumatic Tool	85
Pump	76
Rail Saw	90
Rock Drill	98
Roller	74
Saw	76
Scarifier	83
Scraper	89
Shovel	82
Spike Driver	77
Tie Cutter	84
Tie Handler	80
Tie Inserter	85
Truck	88

SOURCE:
Federal Transit Administration. May 2006. *Transit Noise and Vibration Impact Assessment*. 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 (**Table 3.13.2-5, *Existing Noise Sensitive Land Uses***).

TABLE 3.13.2-5
EXISTING NOISE SENSITIVE LAND USES

Land Use	Acceptable Upper Noise Limit (CNEL, dB)	Number of Locations within SCAG Region
Residential	60 for single-family residential; 65 for multi-family residential and transient lodging	3,762,256
Schools	70	9,865
Libraries	70	520
Churches	70	8,118
Hospitals and Nursing Homes	70	2,590
Natural Areas, Parks, and Playgrounds	70	2,805

SOURCE:
SCAG data, 2015.

Sensitive land uses within the SCAG region were determined using two sources of data from SCAG. The first source of data was TomTom GIS points of particular feature types that fell into a sensitive land use category. The TomTom GIS points were reviewed for accuracy, and duplicate points and points that were not sensitive locations/land uses were removed to the greatest extent practicable. The second source of data was existing land use parcel data in the SCAG region. Because the TomTom data lacked residential locations, the existing land use parcel data where the land use was categorized as residential (i.e., single family residential, multi-family residential, mobile homes and trailer parks, mixed residential, or rural residential) was used to locate sensitive land uses within the SCAG region.

The noise standards for sensitive land uses are more stringent than those for less sensitive uses, such as commercial and industrial. To protect various human activities and sensitive land uses (e.g., residences, schools, and hospitals) lower noise levels are needed. A noise level of L_{dn} 55 to 60 dB outdoors 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 published in September 2012 for a summary of construction effects on historic buildings. Using the most conservative values in that report, historic buildings may be damaged when a single vibration event exceeds 0.20 ppv or frequent 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.[31]

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

3.13.3 THRESHOLDS OF SIGNIFICANCE

The potential for the 2016 RTP/SCS to result in impacts related to noise was analyzed in relation to the six questions contained in Appendix G of the State CEQA Guidelines. The Plan would result in a significant impact related to noise if it would result in:

- Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies.
- Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels.
- A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project.
- A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.
- For a project located within 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.
- For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels.

Implementation of the 2016 RTP/SCS would result in temporary increases in noise levels during the construction of transportation projects and permanent increases in noise levels in areas where the traffic capacity has been increased. The analysis of these impacts is programmatic at the regional level. Project-specific impacts vary and appropriate mitigation measures would need to be developed on a project-by-project basis, as appropriate.

Methodology

This section summarizes the methodology used to evaluate the potential anticipated impacts from noise and vibration as a result of implementing the transportation projects and anticipated pattern of land use considered in the 2016 RTP/SCS.

Permanent increases in operational noise associated with highway traffic is dependent on a number of variables:

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

3.13.4 IMPACT ANALYSIS

The analysis of significant impacts from noise and vibration resulting from the 2016 RTP/SCS was based on the provided list of transportation projects located throughout the six counties and 38,000 square miles of the SCAG region. 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. Locations of major projects were analyzed in conjunction with sensitive land uses within 500 feet (**Table 3.13.4-1, *Noise Sensitive Land Uses within 500 Feet of Major Transportation Projects***).

TABLE 3.13.4-1
NOISE SENSITIVE LAND USES WITHIN 500 FEET OF MAJOR TRANSPORTATION PROJECTS

Land Use	Acceptable Upper Noise Limit (CNEL, dB)	Number of Locations within SCAG Region
Residential	60 for single-family residential; 65 for multi-family residential and transient lodging	152,671
Schools	70	857
Libraries	70	61
Churches	70	912
Hospitals and Nursing Homes	70	368
Natural Areas, Parks, and Playgrounds	70	129

SOURCE:
SCAG GIS analysis and data, 2015.

Sensitive land uses within 500 feet of major projects were determined by using a combination of the TomTom GIS points and the existing land use data from SCAG. A 500-foot buffer was placed on the major SCAG future projects (mixed flow lane, toll lane, HOT lane, HOV lane, freight corridor, bus rapid transit, and rail line) GIS line files to obtain an impact buffer for the analysis. The number of TomTom point data and existing land use residential parcels that fell within the impact buffer per sensitive land use category are included in **Table 3.13.4-1**.

IMPACT NOISE-1. 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.

Significant Impact

Implementation of transportation projects and land use strategies in the 2016 RTP/SCS 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, 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 potentially significant impact, requiring the consideration of mitigation measures.

Construction. There are 154,998 existing sensitive land uses within 500 feet of major transportation projects (**Table 3.13.4-1**). Impacts to sensitive receptors resulting from the construction of these major transportation improvement projects would depend on several factors, such as the type of project, adjacent land use, and duration and intensity of the construction activities. 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 policy forecast population, household, and employment would take a variety of forms, with a substantial fraction focused in and around high quality transit areas (HQTAs), 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. There are 154,998 existing sensitive land uses within 500 feet of major transportation projects (**Table 3.13.4-1**). Impacts to sensitive receptors resulting from the operation of these major transportation improvement projects 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. Similar to construction impacts, anticipated development to accommodate the policy forecast population, household, and employment would take a variety of forms, with a substantial fraction focused in and around HQTAs, existing urbanized areas, and opportunity areas. 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.

Implementation of transportation projects and land use strategies in the 2016 RTP/SCS 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.

IMPACT NOISE-2. Result in the exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels.

Significant Impact

Implementation of transportation projects and land use strategies in the 2016 RTP/SCS would result in the exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels, which constitutes a significant impact. Both construction and operation activities would expose people to excessive groundborne vibration or groundborne noise levels, constituting a potentially significant impact, thus requiring the consideration of mitigation measures.

Construction. Construction of transportation projects and development projects arising from the land use strategies in the 2016 RTP/SCS would result in the exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels. 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 (**Tables 3.13-2** and **3.13-3**). Pile drivers can generate vibrations in excess of 0.5 PPV at a distance of 25 feet (**Table 3.13.4-2, *Construction Equipment Vibration Levels***), which, as noted in **Table 3.13-3**, can result in damage to even reinforced concrete. Vibration levels generated by pile driving vary

depending 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."[32]

TABLE 3.13.4-2
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. May 2006. *Transit Noise and Vibration Impact Assessment*. Washington, DC.

Operation. Operation of transportation projects in the 2016 RTP/SCS would result in the exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels, constituting a significant impact. Operation-related vibration would be a source of annoyance to individuals who live or work near new infrastructure associated with heavy 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 that maximum traffic vibration levels from truck traffic drop below the threshold of perception at a distance of 42.5 meters or 140 feet from the source and that vibration levels 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.[33] There are 28,300 sensitive land uses located within 140 feet of new transportation infrastructure; therefore, it is anticipated that the operation activities would result in a significant impact related to the exposure of people to excess groundborne vibration or groundborne noise levels.

[32] California Department of Transportation. 20 February 2002. *Transportation Related Earthborne Vibrations*. Technical Advisory, Vibration: TAV-02-01-R9601. Sacramento, CA.

[33] California Department of Transportation. 20 February 2002. *Transportation Related Earthborne Vibrations*. Technical Advisory, Vibration: TAV-02-01-R9601. Sacramento, CA.

A Caltrans study conducted throughout California measured a peak train vibration level of 0.36 in/sec PPV at 3 meters or 10 feet.[34] 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 or 263 feet from the source. There are 13,088 sensitive land uses located within 263 feet of new transportation infrastructure; therefore, it is anticipated that the operation activities would result in a significant impact related to the exposure of people to excess groundborne vibration or groundborne noise levels. Furthermore, a vibration level of 0.36 in/sec PPV at 3 meters or 10 feet would potentially result in damage to historic buildings at a distance of 25 meters or 82 feet from the source.

Implementation of transportation projects in the 2016 RTP/SCS would result in the exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels, which constitutes a significant impact requiring the consideration of mitigation measures.

IMPACT NOISE-3. Result in a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project.

Significant Impact

Operational activities associated with transportation projects and land use strategies in the 2016 RTP/SCS would generate permanent increases in ambient noise levels in the project vicinity above levels existing without the project (2016 RTP/SCS), constituting a significant impact.

There are 154,998 noise-sensitive land uses located near these projects, including hospitals schools, nursing homes and senior centers (**Table 3.13.4-1**). At the regional scale, the noise impacts of new highways, highway widening, new HOV lanes, new transit corridors, and increased frequency along existing transit corridors are anticipated to exceed the significance criteria when they occur near sensitive receptors.

Highways. Noise would increase adjacent to major highway project. There are approximately 1,781 miles of major highway, mixed flow, and freight corridor projects.[35] The increase in traffic volume anticipated as a result of these projects would result in a permanent increase in ambient noise levels in the project vicinity above levels existing without the project.

Transit. Noise would increase adjacent to new bus and rail corridors. There are approximately 1,169 miles of new bus and rail corridors.[36] Crossings that use audible warning signals could also affect nearby residents. Increases in bus and rail traffic could also lead to more horns and/or whistles at crossings near residential areas, which is a source of annoyance, especially at night or in early morning or evening. The increase in noise anticipated as a result of these projects would result in a permanent increase in ambient noise levels in the project vicinity above levels existing without the project.

Freight and Passenger Rail. The 2016 RTP/SCS includes facilities and actions that encourage more efficient intermodal transportation of goods including roadways and train facilities. The number of

[34] California Department of Transportation. 20 February 2002. *Transportation Related Earthborne Vibrations*. Technical Advisory, Vibration: TAV-02-01-R9601. Sacramento, CA.

[35] SCAG GIS data, 2015.

[36] SCAG GIS data, 2015.

freight trains currently operating each day in the SCAG region is dependent on the demands of the industries using rail services and can vary greatly from day to day. The 2016 RTP/SCS includes proposed rail capacity improvements to reduce current passenger/freight rail bottlenecks and increase capacity for existing freight. The number of daily events might increase, and highest peak noise level would likely be increased relative to the existing condition and may expose people adjacent to rail corridors to higher noise levels relative to the existing condition. While increases in rail freight transport would increase the frequency of freight trains, these trains would likely operate on an as-needed basis and would not have a fixed schedule. Therefore, the noise levels and frequency of these trains would continue to vary from day to day. On some days, there may be no increase in freight train activity. However, an increase in train traffic would yield a consequent increase in noise in areas adjacent to rail corridors. The increase in noise anticipated as a result of the greater frequency in train traffic would result in a permanent increase in ambient noise levels in the project vicinity above levels existing without the project.

Land Use. Similarly, anticipated development projects influenced by land use strategies in the 2016 RTP/SCS have a potential to result in more compact and densified infill or mixed-used development in HQTAs and urbanized areas. As described in **Section 3.11, *Land Use and Planning***, the 2016 RTP/SCS would have the potential to change land use patterns in the region in order to accommodate the projected new growth that the region would experience in the next 25 years. The increase in noise anticipated as a result of the change in land use patterns would result in a permanent increase in ambient noise levels in the project vicinity above levels existing without the project.

Operational activities associated with transportation projects in the 2016 RTP/SCS would result in permanent increases in ambient noise levels in the project vicinity above levels existing without the project, which would constitute a significant impact requiring the consideration of mitigation measures.

IMPACT NOISE-4. Result in a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.

Significant Impact

Both construction and operation of transportation projects in the 2016 RTP/SCS and the associated changes in development patterns influenced by land use strategies would result in a substantial temporary or periodic increase in ambient noise levels in the project above levels existing without the project (2016 RTP/SCS), which constitutes a significant impact requiring the consideration of mitigation measures.

There are 154,998 existing sensitive land uses within 500 feet of major transportation projects (**Table 3.13.4-1**). Impacts to sensitive receptors resulting from the construction of these major transportation improvement projects would depend on several factors, such as the type of project, adjacent land use, and duration and intensity of the construction activities. 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. Additionally, construction noise of these major transportation projects, although they are temporary or periodic in nature, would depend on when these projects would be implemented. These transportation projects are within the responsibility and implementing authority of county transportation commissions. SCAG does not implement or build these transportation projects. Subject to subsequent environmental

reviews and decision of their respective lead agencies, major transportation projects may be implemented periodically at any point in time during the next 25 years. Hence, transportation projects included in the 2016 RTP/SCS would have a potential to result in a substantial temporary or periodic increase in ambient noise levels in the vicinity above levels existing without it.

Anticipated development from the land use strategies of the 2016 RTP/SCS may also have a potential to result in a substantial temporary or periodic increase in ambient noise levels in the vicinity above levels existing. As more compact development is anticipated to accommodate the region's new population growth, there would be higher densified development in HQTAs and urbanized areas. Similar to the transportation projects, SCAG does not implement or build development projects. Development projects are within jurisdiction of local governments. Subject to their environmental review process and decision by their respective decision-makers, anticipated development projects may be built at any point in time during the lifetime of the 2016 RTP/SCS. Hence, land use strategies included in the 2016 RTP/SCS would have a potential to result in a substantial temporary or periodic increase in ambient noise levels in the vicinity above levels existing without it.

IMPACT NOISE-5. For a project located within 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, result in the exposure of people residing or working in the project area to excessive noise levels.

Less than Significant Impact

Implementation of transportation projects in the 2016 RTP/SCS would result in less than significant impacts related to projects located within an airport land use plan or, where such a plan has not been adopted, within 2 miles of a public airport or public use airport, that would expose people residing or working in the project area to excessive noise levels.

The SCAG region contains 57 airports, with 12 major commercial airports serving the region (Table 3.13.2-2).[37,38] There are approximately 41 linear miles of major projects and 10,785 acres of HQTAs within the 65 dBA CNEL of the 12 major airports.[39] According to the 2012 RTP/SCS, the regional passenger demand forecast is 145.9 million annual passengers (MAP) in 2035.[40] According to the August 6, 2015, Staff Report to SCAG Transportation Committee, the 2016 RTP/SCS has a regional passenger demand forecast of 136.2 MAP in 2040, which is a decrease of approximately 7 percent at the regional level.[41] Furthermore, major public airports have an airport land use plan that provides guidance on noise levels and land use in adjacent areas. Therefore, impacts would be less than significant, and the consideration of mitigation measures is not required.

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37 Southern California Association of Governments. December 2011. *2012–2035 Regional Transportation Plan / Sustainable Communities Strategy: Aviation and Airport Ground Access*. Los Angeles, CA.

38 Southern California Association of Governments. 7 January 2008. SCAG Commercial Airport System Map. Available at: http://www.scag.ca.gov/programs/Pages/ASA.aspx

39 SCAG GIS data, 2015.

40 Southern California Association of Governments. April 2012. 2012–2035 Regional Transportation Plan / Sustainable Communities Strategy. Los Angeles, CA.

41 Southern California Association of Governments. 6 August 2015. Staff Report to Transportation Committee. Los Angeles, CA. Available at: http://www.scag.ca.gov/programs/Pages/ASA.aspx

IMPACT NOISE-6. For a project within the vicinity of a private airstrip, result in the exposure of people residing or working in the project area to excessive noise levels.

Less than Significant Impact

Implementation of transportation projects in the 2016 RTP/SCS would result in less than significant impacts related to projects within the vicinity of a private airstrip that would expose people residing or working in the project area to excessive noise levels.

The SCAG region includes 14 private airstrips, 3 of which are within 1 mile of an HQTA.[42] As described above, the 2012 RTP/SCS had forecasted the regional passenger demand forecast of 145.9 MAP in 2035.[43] According to the August 6, 2015, Staff Report to SCAG Transportation Committee, the 2016 RTP/SCS has a regional passenger demand forecast of 136.2 MAP in 2040, which is a decrease of approximately 7 percent.[44] Therefore, at the regional level, impacts would be less than significant, and the consideration of mitigation measures is not required.

3.13.5 CUMULATIVE IMPACTS

IMPACT NOISE-1. 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.

Significant Impact

Implementation of the 2016 RTP/SCS would result in significant cumulative impacts from the 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. Grading and construction activities would generate temporary increases in noise levels, and operational activities resulted from implementation of transportation projects and anticipated land use development 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.

[42] SCAG GIS data, 2015.

[43] Southern California Association of Governments. April 2012. 2012–2035 Regional Transportation Plan / Sustainable Communities Strategy. Los Angeles, CA.

[44] Southern California Association of Governments. 6 August 2015. Staff Report to Transportation Committee. Los Angeles, CA. Available at: http://www.scag.ca.gov/programs/Pages/ASA.aspx

IMPACT NOISE-2. Result in the exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels.

Significant Cumulative Impact

Implementation of the 2016 RTP/SCS , when taken into consideration with all other infrastructure and development project that may occur in the region between 2016 and 2040, would result in significant cumulative impacts from the exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels. Both construction and operation activities would expose people to excessive groundborne vibration or groundborne noise levels, constituting a significant impact, requiring the consideration of mitigation measures.

IMPACT NOISE-3. Result in a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project.

Significant Cumulative Impact

Operational activities associated with the implementation of the 2016 RTP/SCS would result in significant cumulative impacts from the generation of permanent increases in ambient noise levels, when taken into consideration with all other transportation infrastructure and development projects that may occur in the region between 2016 and 2040, in the vicinity above levels existing without the Plan due to the presence of 154,998 noise-sensitive land uses located near these projects (**Table 3.13.4-1**), constituting a significant impact requiring the consideration of mitigation measures.

IMPACT NOISE-4. Result in a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.

Significant Cumulative Impact

Implementation of the 2016 RTP/SCS would result in significant cumulative impacts from the generation of a substantial temporary or periodic increase in ambient noise levels in the vicinity above levels existing without the Plan), when taken into consideration with all other transportation and ancillary infrastructure and development projects that may occur in the region between 2016 and 2040, due to the presence of 154,998 noise-sensitive land uses located near these projects (**Table 3.13.4-1**), constituting a significant impact requiring the consideration of mitigation measures.

IMPACT NOISE-5. For a project located within 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, result in the exposure of people residing or working in the project area to excessive noise levels.

Less than Significant Cumulative Impact

Implementation of the 2016 RTP/SCS would result in significant cumulative impacts related to projects located within an airport land use plan or, where such a plan has not been adopted, within 2 miles of a public airport or public use airport, which would expose people residing or working in the project area to excessive noise levels. 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.[45] There are approximately 23,082 locations of incompatible land uses and approximately 41 linear miles of major projects within the 65 dBA CNEL of the 12 major airports.[46] The implementation of the 2016 RTP/SCS would add both construction and operation noise to an area that is already at the threshold for significant impact. Implementation of mitigation measures, as described below, would reduce impacts, but may not reduce impacts to below the level of significance in all instances. Therefore, cumulative impacts would remain significant and unavoidable.

IMPACT NOISE-6. For a project within the vicinity of a private airstrip, result in the exposure of people residing or working in the project area to excessive noise levels.

Less than Significant Impact

Implementation of the 2016 RTP/SCS would be anticipated to result in less than significant cumulative impacts related to projects within the vicinity of a private airstrip that would expose people residing or working in the project area to excessive noise levels. Airport noise is generated primarily by aircraft takeoffs and landings, which will vary depending on the aircraft's weight and the number, type, and location of the engines. Typically, most private airstrips will have a lower volume of air traffic and smaller planes that result in a lower noise level than major airports. Furthermore, in the SCAG region, there are only 3 private airstrips within a 1-mile radius of major transportation projects.[47] The consideration of mitigation measures is not required.

3.13.6 MITIGATION MEASURES

Mitigation measures as they pertain to each CEQA question related to noise are described below. Mitigation measures are categorized into two categories: SCAG mitigation and project-level mitigation measures. SCAG mitigation measures shall be implemented by SCAG over the lifetime of the 2016

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

[46] SCAG GIS data, 2015.

[47] SCAG GIS data, 2015.

RTP/SCS. Project-level mitigation measures can and should be implemented by the Lead Agencies for transportation and development projects, as applicable and feasible.

IMPACT NOISE-1. 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.

SCAG Mitigation Measures

MM-NOISE-1(a): SCAG shall coordinate with member agencies as part of SCAG's outreach and technical assistance to local governments under Toolbox Tuesday Training series to encourage projects involving residential and commercial land uses to be developed in areas that are normally acceptable or conditionally acceptable, consistent with the Governor's Office of Planning and Research Noise Element Guidelines.

Project-Level Mitigation Measures

MM-NOISE-1(b): Consistent with the provisions of Section 15091 of the State CEQA Guidelines, SCAG has identified mitigation measures capable of avoiding or reducing the significant effects of noise impacts that are in the jurisdiction and responsibility of public agencies and/or Lead Agencies. Where the Lead Agency has identified that a project has the potential for significant effects, the Lead Agency can and should consider mitigation measures to ensure consistency with the Federal Noise Control Act, California Government Code Section 65302, the Governor's Office of Planning and Research Noise Element Guidelines, and the noise ordinances and general plan noise elements for the counties or cities where projects are undertaken, Federal Highway Administration and Caltrans guidance documents and other health and safety standards set forth by federal, state, and local authorities that regulate noise levels, as applicable and feasible. Such measures may include the following or other comparable measures identified by the Lead Agency:

- Install temporary noise barriers during construction.
- Include permanent noise barriers and sound-attenuating features as part of the project design.
- Schedule construction activities consistent with the allowable hours pursuant to applicable general plan noise element or noise ordinance Where construction activities are authorized outside the limits established by the noise element of the general plan or noise ordinance; notify affected sensitive noise receptors and all parties who will experience noise levels in access of the allowable limits for the specified land use, of the level of exceedance and duration of exceedance; and provide a list of protective measures that can be undertaken by the individual, including temporary relocation or use of hearing protective devices.
- Limit speed and/or hours of operation of rail and transit systems during the selected periods of time to reduce duration and frequency of conflict with adopted limits on noise levels.
- 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.

- 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.
- Hold a preconstruction meeting with the job inspectors and the general contractor/on-site project manager to confirm that noise measures and practices (including construction hours, neighborhood notification, posted signs, etc.) are completed.
- Designate an on-site construction complaint and enforcement manager for the project.
- Ensure that construction equipment are properly maintained per manufacturers' specifications and fitted with the best available noise suppression devices (e.g., mufflers, silencers, wraps). All intake and exhaust ports on power equipment shall be muffled or shielded.
- Ensure that impact tools (e.g., jack hammers, pavement breakers, and rock drills) used for project construction are hydraulically or electrically powered 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 can and should be used. External jackets on the tools themselves can and should be used, if such jackets are commercially available and this could achieve a reduction of 5 dBA. Quieter procedures can and should be used, such as drills rather than impact equipment, whenever such procedures are available and consistent with construction procedures.
- Ensure that construction equipment are not idle for an extended time in the vicinity of noise-sensitive receptors.
- Locate fixed/stationary equipment (such as generators, compressors, rock crushers, and cement mixers) as far as possible from noise-sensitive receptors.
- Locate new roadway lanes, roadways, rail lines, transit-related passenger station and related facilities, park-and-ride lots, and other new noise-generating facilities away from sensitive receptors to the maximum extent feasible.
- Where feasible, eliminate noise-sensitive receptors by acquiring freeway and rail rights-of-way.
- Use noise barriers to protect sensitive receptors from excessive noise levels during construction.
- Construct sound-reducing barriers between noise sources and noise-sensitive receptors to minimize exposure to excessive noise during operation of transportation improvement projects, including but not limited to earth-berms or sound walls.
- 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.
- Where feasible, improve the acoustical insulation of dwelling units where setbacks and sound barriers do not provide sufficient noise reduction.
- 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.

IMPACT NOISE-2. Result in the exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels.

SCAG Mitigation Measures

MM-NOISE-1(a).

Project-Level Mitigation Measures

MM-NOISE-1(b).

MM-NOISE-2(b): Consistent with the provisions of Section 15091 of the State CEQA Guidelines, SCAG has identified mitigation measures capable of avoiding or reducing the significant effects of vibration impacts that are in the jurisdiction and responsibility of public agencies and/or Lead Agencies. Where the Lead Agency has identified that a project has the potential for significant effects, the Lead Agency can and should consider mitigation measures to ensure compliance with the Federal Transportation Authority and Caltrans guidance documents, county or city transportation commission, noise and vibration ordinances and general plan noise elements for the counties and cities where projects are undertaken and other health and safety regulations set forth by federal state, and local authorities that regulate vibration levels, as applicable and feasible. Such measures may include the following or other comparable measures identified by the Lead Agency:

- 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.
- 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.
- 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.
- For projects where pile driving would be necessary for construction due to geological conditions, utilize quiet pile driving techniques such as the use of more than one pile driver to shorten the total pile driving duration.

IMPACT NOISE-3. Result in a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project.

SCAG Mitigation Measures

See **MM-NOISE-1(a)**.

Project-Level Mitigation Measures

MM-NOISE-1(b).

IMPACT NOISE-4. Result in a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.

SCAG Mitigation Measures

MM-NOISE-1(a).

Project-Level Mitigation Measures

MM-NOISE-1(b).

3.13.7 Level of Significance after Mitigation

IMPACT NOISE-1. 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.

Implementation of Mitigation Measures **MM-NOISE-1(a)** and **MM-NOISE-1(b)** may not reduce noise levels to below the level established in the local general plan or noise ordinance, or applicable standards of other agencies in all cases; therefore, direct, indirect, and cumulative impacts would remain significant and unavoidable.

IMPACT NOISE-2. Result in the exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels.

Implementation of Mitigation Measures **MM-NOISE-1(a)**, **MM-NOISE-1(b)**, and **MM-NOISE-2(a)** may not reduce vibration levels to below the level of significance in all cases; therefore, direct, indirect, and cumulative impacts would remain significant and unavoidable.

IMPACT NOISE-3. Result in a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project.

Implementation of Mitigation Measures **MM-NOISE-1(a)** and **MM-NOISE-1(b)** may not reduce noise levels to below the level of significance in all cases; therefore, direct, indirect, and cumulative impacts would remain significant and unavoidable.

IMPACT NOISE-4. Result in a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.

Implementation of Mitigation Measures **MM-NOISE-1(a)** and **MM-NOISE-2(b)** may not reduce noise levels to below the level of significance in all cases; therefore, direct, indirect, and cumulative impacts would remain significant and unavoidable.