3.9 NOISE

This section describes the current noise and vibration levels of the SCAG region, discusses the potential construction and operational impacts of the 2012-2035 Regional Transportation Plan/Sustainable Communities Strategies (2013-2035 RTP/SCS or Plan), identifies mitigation measures for the impacts, and evaluates the residual impacts. Topics addressed include short-term construction and long-term operational noise and groundborne vibration. The following background information provides noise and vibration characteristics and effects.

Noise Characteristics and Effects

Characteristics of Sound. Sound is technically described in terms of the loudness (amplitude) and frequency (pitch) of the sound. The standard unit of measurement for sound is the decibel (dB). The human ear is not equally sensitive to sound at all frequencies. The "A-weighted scale," abbreviated dBA, reflects the normal hearing sensitivity range of the human ear. On this scale, the range of human hearing extends from approximately 3 to 140 dBA. **Figure 3.9-1** provides examples of A-weighted noise levels from common sounds.

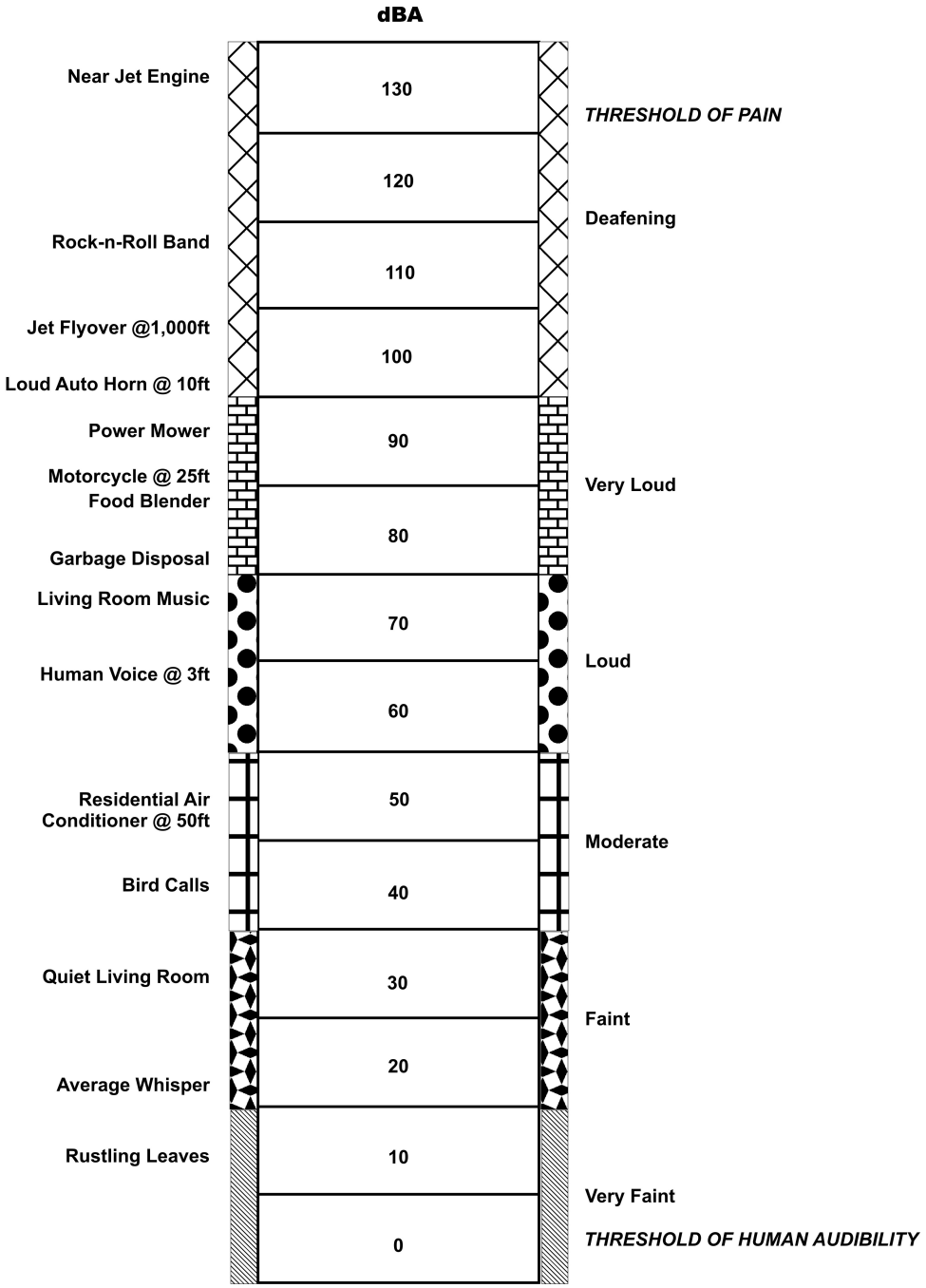
Noise Definitions. Environmental noise levels typically fluctuate across time of day; different types of noise descriptors are used to account for this variability, and different types of descriptors have been developed to differentiate between cumulative noise over a given period and single noise events. Cumulative noise descriptors include the energy-equivalent noise level (L_{eq}), Day-Night Average Noise Level (DNL), and Community Noise Equivalent Level (CNEL). The L_{eq} is the actual time-averaged, equivalent steady-state sound level, which, in a stated period, contains the same acoustic energy as the time-varying sound level during the same period. DNL and CNEL values result from the averaging of L_{eq} values (based on A-weighted decibels) over a 24-hour period, with weighting factors applied to different periods of the day and night to account for their perceived relative annoyance. For DNL, noise that occurs during the nighttime period (10:00 p.m. to 7:00 a.m.) is "penalized" by 10 dB. CNEL is similar to DNL, except that it also includes a "penalty" of approximately 5 dB for noise that occurs during the evening period (7:00 p.m. to 10:00 p.m.).

Individual noise events, such as train pass-bys or aircraft over-flights, are further described using single-event and cumulative noise descriptors. For single events, the maximum measured noise level (Lmax) is often cited, as is the Sound Exposure Level (SEL). The SEL is the energy-based sum of a noise event of given duration that has been "squeezed" into a reference duration of one second, and is typically a value five to ten dB higher than the Lmax.

Effects of Noise. Noise is generally defined as unwanted sound. The degree to which noise can impact the human environment range from levels that interfere with speech and sleep (annoyance and nuisance) to levels that cause adverse health effects (hearing loss and psychological effects). Human response to noise is subjective and can vary greatly from person to person. Factors that influence individual response include the intensity, frequency, and pattern of noise, the amount of background noise present before the intruding noise, and the nature of work or human activity that is exposed to the noise source.

Audible Noise Changes. Studies have shown that the smallest perceptible change in sound level for a person with normal hearing sensitivity is approximately 3 dBA. A change of at least 5 dBA would be noticeable and would likely evoke a community reaction. A 10-dBA increase is subjectively heard as a doubling in loudness and would cause a community response.

Figure 3.9-1: A-Weighted Decibel Scale



SOURCE: Cowan, James P., *Handbook of Environmental Acoustics*

Noise levels decrease as the distance from the noise source to the receiver increases. Noise generated by a stationary noise source, or "point source," will decrease by approximately 6 dBA over hard surfaces (e.g., reflective surfaces such as parking lots or smooth bodies of water) and 7.5 dBA over soft surfaces (e.g., absorptive surfaces such as soft dirt, grass, or scattered bushes and trees) for each doubling of the distance. For example, if a noise source produces a noise level of 89 dBA at a reference distance of 50 feet, then the noise level would be 83 dBA at a distance of 100 feet from the noise source, 77 dBA at a distance of 200 feet, and so on. Noise generated by a mobile source will decrease by approximately 3 dBA over hard surfaces and 4.8 dBA over soft surfaces for each doubling of the distance.

Generally, noise is most audible when traveling by direct line-of-sight. Barriers, such as walls, berms, or buildings, that break the line-of-sight between the source and the receiver greatly reduce noise levels from the source since sound can only reach the receiver by bending over the top of the barrier. Sound barriers can reduce sound levels by up to 20 dBA. However, if a barrier is not high or long enough to break the line-of-sight from the source to the receiver, its effectiveness is greatly reduced.

Decibels are logarithmic units. Two decibel levels cannot be added by ordinary arithmetic means. If one automobile produces a 70-dB noise level when it passes an observer, two cars passing simultaneously would not produce 140 dB. They would combine to produce a 73-dB noise level. As an example, consider a receptor located near the interchange of two freeways. One freeway generates a 72-dBA noise level and the other freeway generates a 66-dBA noise levels. The combined noise exposure from the freeways would be 73 dBA. Another example is a receptor located near a freeway and underneath an airport flight path. The noise levels at a receptor could be 75 dBA from aircraft noise and 72 dBA from freeway noise. The combined noise level from aircraft and freeway noise exposure would be 77 dBA.

Vibration Characteristics and Effects

Characteristics of Vibration. Vibration is an oscillatory motion through a solid medium in which the motion's amplitude can be described in terms of displacement, velocity, or acceleration. Vibration can be a serious concern, causing buildings to shake and rumbling sounds to be heard. In contrast to noise, vibration is not a common environmental problem. It is unusual for vibration from sources such as buses and trucks to be perceptible, even in locations close to major roads. Some common sources of vibration are trains, buses on rough roads, and construction activities, such as blasting, pile driving, and heavy earth-moving equipment.

Vibration Definitions. There are several different methods that are used to quantify vibration. The peak particle velocity (PPV) is defined as the maximum instantaneous peak of the vibration signal. The PPV is most frequently used to describe vibration impacts to buildings and is usually measured in inches per second. The root mean square (RMS) amplitude is most frequently used to describe the effect of vibration on the human body. The RMS amplitude is defined as the average of the squared amplitude of the signal. Decibel notation (Vdb) is commonly used to measure RMS. The decibel notation acts to compress the range of numbers required to describe vibration.[1]

Effects of Vibration. High levels of vibration may cause physical personal injury or damage to buildings. However, groundborne vibration levels rarely affect human health. Instead, most people consider groundborne vibration to be an annoyance that can affect concentration or disturb sleep. In addition, high levels of groundborne vibration can damage fragile buildings or interfere with equipment that is highly sensitive to groundborne vibration (e.g., electron microscopes).

Perceptible Vibration Changes. In contrast to noise, groundborne vibration is not a phenomenon that most people experience every day. The background vibration velocity level in residential areas is usually 50 RMS or lower, well below the threshold of perception for humans which is around 65 RMS. Most perceptible

[1]Federal Transit Administration, *Transit Noise and Vibration Impact Assessment*, May 2006.

indoor vibration is caused by sources within buildings, such as operation of mechanical equipment, movement of people, or slamming of doors. Typical outdoor sources of perceptible groundborne vibration are construction equipment, steel-wheeled trains, and traffic on rough roads. If the roadway is smooth, the vibration from traffic is rarely perceptible.

REGULATORY FRAMEWORK

Noise

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

Federal Highway Administration (FHWA). Federal regulations for railroad noise are contained in 40 CFR Part 201 and 49 CFR Part 210. The regulations set noise limits for locomotives and are implemented through regulatory controls on locomotive manufacturers.

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 passby noise standard is 80 dB at 15 meters from the vehicle pathway centerline. These controls are implemented through regulatory controls on truck manufacturers. The 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 (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 which 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 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 an increase in L_{eq} of 12 dB during the peak hour of traffic noise. 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. **Table 3.9-1** summarizes NAC corresponding to various land use activity categories. Activity categories and related traffic noise impacts are determined based on the actual land use in a given area.

TABLE 3.9-1: NOISE ABATEMENT CRITERIA

NAC, Hourly A-Weighted Noise Level	Description of Activities
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.
67 (Exterior)	Picnic areas, recreation areas, playgrounds, active sport areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals.
72 (Exterior)	Developed lands, properties, or activities not included in above.
52 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

SOURCE: Caltrans, *Technical Noise Supplement*, November 2009.

Federal Aviation Administration (FAA). Aircraft operated in the U.S. are subject to certain federal requirements regarding noise emissions levels. 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.

Although the National Environmental Policy Act (NEPA) does not establish specific noise standards, the noise impacts of projects are routinely considered as one of the potential environmental consequences of federal actions subject to NEPA.

Department of Housing and Urban Development (HUD). The mission of 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.

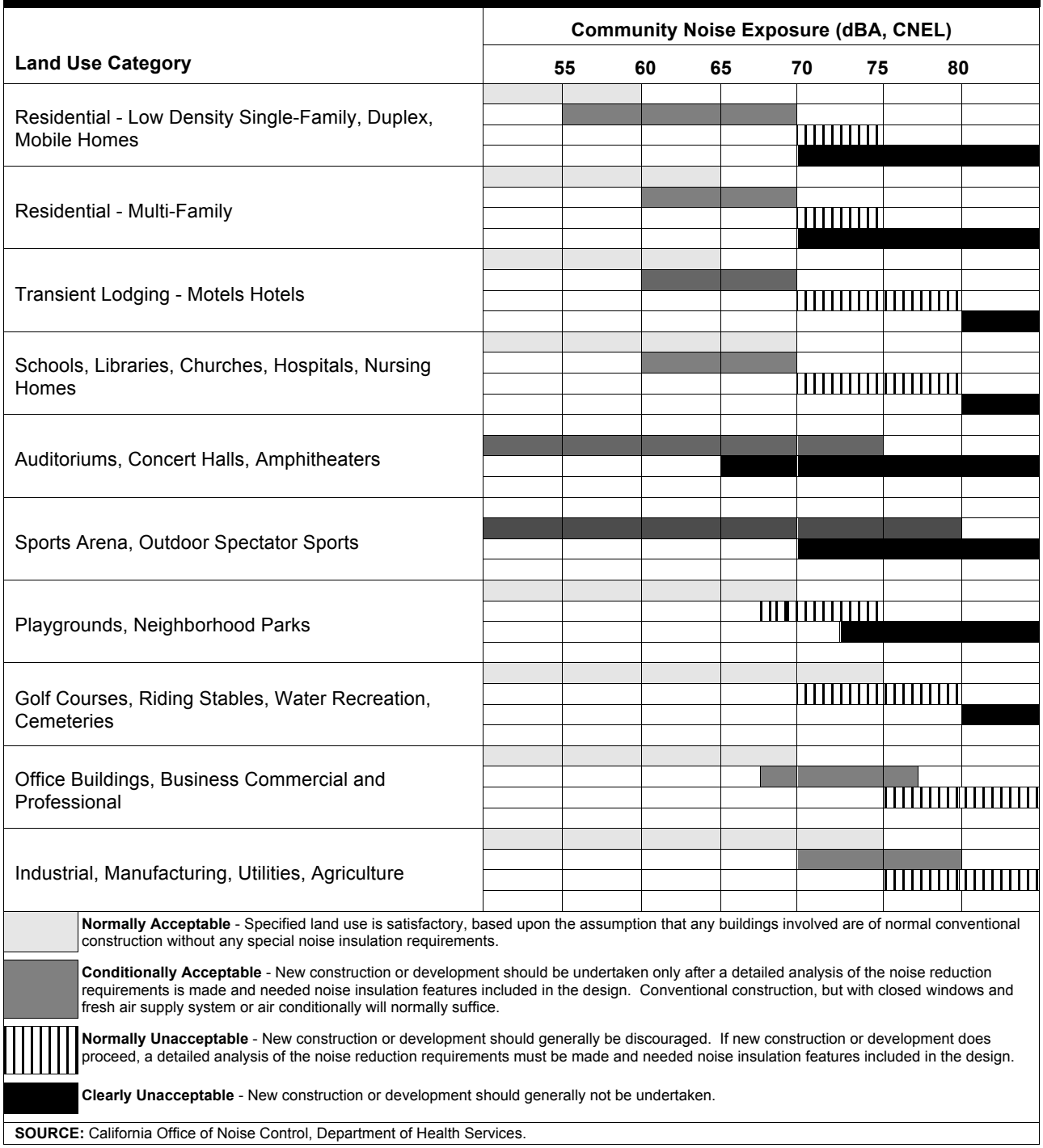
HUD's noise policy clearly requires noise attenuation measures be provided when proposed projects are to be located in high noise areas. Within the HUD Noise Assessment Guidelines, potential noise sources are examined for projects located within 15 miles of a military or civilian airport, 1,000 feet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

State

California Department of Health Services. The State has published guidance for locating land uses in areas compatible with the existing noise environment. These guidelines are shown in **Table 3.9-2**. 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.

TABLE 3.9-2: LAND USE COMPATIBILITY FOR COMMUNITY NOISE ENVIRONMENTS



SOURCE: California Office of Noise Control, Department of Health Services.

California's Airport Noise Standards. 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.

California Department of Transportation (Caltrans). The State of California establishes noise limits for vehicles licensed to operate on public roads. For heavy trucks, the State passby standard is consistent with the federal limit of 80 dB. The State passby 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 Noise Abatement Criteria, discussed above in connection with FHWA.

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 nonfreeway 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 Noise Insulation Standards. The California Noise Insulation Standards found in Title 24 of the California Code of Regulations 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.

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.

Vibration

Federal

Federal Transit Administration (FTA). The FTA has published guidance relative to vibration impacts. According to the FTA, engineered concrete and masonry buildings can be exposed to groundborne vibration levels of 0.3 inches per second without experiencing structural damage. Buildings extremely susceptible to vibration damage can be exposed to groundborne vibration levels of 0.12 inches per second without experiencing structural damage.[2]

State

There are no adopted State policies or standards for ground-borne vibration. However, 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

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.

EXISTING SETTING

Noise

Many principal noise generators within the SCAG region are associated with transportation (i.e., airports, freeways, arterial roadways, seaports, and railroads). Additional noise generators include stationary sources, such as industrial manufacturing plants and construction sites. Local collector streets are not considered to be a significant source of noise since traffic volume and speed are generally much lower than for freeways and arterial roadways. Generally, transportation-related noise sources characterize the ambient noise environment of an area.

Airports. The SCAG region contains six established air carrier airports including Los Angeles International (LAX), Bob Hope (formerly Burbank), John Wayne, Long Beach, Ontario and Palm Springs. There are also four new and emerging air carrier airports in the Inland Empire and North Los Angeles County. These include San Bernardino International Airport (formerly Norton Air Force Base), March Inland Port (joint use with March Air Reserve Base), Southern California Logistics Airport (formerly George Air Force Base) and Palmdale Airport (joint use with Air Force Plant 42).

Freeways and Arterial Roadways. The region has more than 20,000 centerline (route) miles and more than 67,000 lane-miles of roadways, including one of the most extensive High-Occupancy Vehicle (HOV) lane systems in the country. Additionally, the region has a growing network of tolled lanes and High Occupancy Toll (HOT) lanes. 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.

[2]Federal Transit Administration, *Transit Noise and Vibration Impact Assessment*, May 2006.

The extent to which traffic noise levels along these roads affect sensitive land uses depends upon a number of factors. These include whether the roadway itself is elevated above grade or depressed below grade, whether there are intervening structures or terrain between the roadway and the sensitive uses, and the distance between the roadway and such uses. 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.[3]

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.[4]

Additionally, the region has an enormous number of arterial roadways. Typical arterial roadways have one or two lanes of traffic in each direction, with some containing as many as four lanes in each direction. Noise from these sources can be a significant environmental concern where buffers (e.g., buildings, landscaping, etc.) are inadequate or where the distance from centerline to sensitive uses is relatively small. Given typical daily traffic volumes of 10,000 to 40,000 vehicle trips, noise levels along arterial roadways typically range from DNL 65 to 70 dB at a distance of 50 feet from the roadway centerlines.

Railroad Operations. Railroad operations generate high, relatively brief, intermittent noise events. These noise events are an environmental concern for sensitive uses located along rail lines and in the vicinities of switching yards. Locomotive engines and the interaction of steel wheels and rails primarily generate rail noise. The latter source creates three types of noise: 1) rolling noise due to continuous rolling contact, 2) impact noise when a wheel encounters a rail joint, turnout or crossover, and 3) squeal generated by friction on tight curves. For very high speed rail vehicles, air turbulence can be a significant source of noise. In addition, use of air horns and crossing bell gates contribute to noise levels in the vicinity of grade crossings. **Table 3.9-3** provides reference noise levels in terms of Sound Exposure Levels for different types of rail operations.

TABLE 3.9-3: 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, throttle 5	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-eight 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: FTA, *Transit Noise and Vibration Impact Assessment*, May 2006.

Freight Trains. Noise levels generated by freight train passby events reflect locomotive engine noise and rail car wheel rail interaction. The former depends upon track grade conditions (i.e., uphill versus downhill) and is largely independent of speed whereas the latter is highly speed dependent, increasing approximately 6 dB for each doubling of train velocity.[5] In addition to noise, freight trains also generate substantial amounts

[3]Beranek, L. L. 1988. *Noise and vibration control* (pp. 182). New York: McGraw-Hill.
[4]*Ibid*.
[5]"Class I" railroads have annual gross revenues of $250 million or more.

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 vehicles.

The SCAG region has an extensive network of railroad lines belonging primarily to two major railroads: Union Pacific Railroad (UP) and Burlington Northern/Santa Fe Railway (BNSF).[6] SCAG's 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. A rail line supporting 40 freight trains per day generates approximately DNL 75 dB at 200 feet from the tracks. 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. BNSF generates approximately DNL 75 dB at a distance of 200 feet from the tracks.

Commuter and Inter-city Passenger Trains. 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 inter-city passenger train operators: Amtrak and the Southern California Regional Rail Authority (SCRRA). Amtrak operates trains with destinations in Seattle, Chicago, Orlando, San Diego, and San Luis Obispo. A typical Amtrak passby event generates SEL 107 dB at 50 feet[7]; two such events during the daytime or evening periods generate approximately DNL 61 dB at 50 feet and approximately DNL 52 dB at 200 feet. Nine such events generate approximately DNL 67 dB at 50 feet and 58 DNL dB at 200 feet.

The SCRRA operates the Metrolink commuter rail system. This system currently includes seven rail lines, and 55 stations with destinations in Ventura, Los Angeles, San Bernardino, Riverside, Orange, and San Diego Counties. Noise levels generated by Metrolink are similar to those associated with Amtrak.

Port Operations. The Ports of Long Beach, Los Angeles and Hueneme are major regional economic development centers. The San Pedro Bay Ports, which include the Los Angeles and Long Beach Ports, currently handle approximately 40 percent of the volume imported into the country and approximately 24 percent of the nation's exports, the Port of Hueneme in Ventura County is a major shipping point for automobiles, fresh fruit and produce. Approximately $7 billion in cargo travels through the Port of Hueneme annually, and trade-related activity generated by the Port contributes significantly to the local economy.

At the ports, noise is generated from four 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.

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. 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

[6]Two of the major railroads that historically have been associated with California, the Southern Pacific Railroad and the Atchison, Topeka and Santa Fe Railway, have merged into other railroad companies. In 1995, the Atchison Topeka and Santa Fe Railway merged with Burlington Northern to become Burlington Northern Santa Fe Railway. In the following year, the Southern Pacific Railroad merged with Union Pacific Railroad with the merged company retaining the Union Pacific name.

[7]County of Ventura. May 1988. Ventura County General Plan, Hazards Appendix. Ventura, CA: Author.

certain locations to mitigate vehicle noise along Alameda Street in residential neighborhoods and other sensitive areas.

Industrial, Manufacturing, and Construction. Noise from industrial complexes, manufacturing plants and construction sites are characterized as stationary, or point, sources of noise even though they may include mobile sources, such as forklifts and graders. Local governments typically regulate noise from industrial, manufacturing, and construction equipment and activities through enforcement of noise ordinance standards, implementation of general plan policies, and imposition of conditions of approval for building or grading permits.

Industrial complexes and manufacturing plants are generally located away from sensitive land uses, and, as such, noise generated from these sources generally has less effect on the local community. In contrast to industrial and manufacturing plants, construction sites are located throughout the region and are often located within, or adjacent to, residential districts. 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).[8]

Construction-related noise levels generally fluctuate depending on the construction phase, equipment type and duration of use, distance between noise source and receptor, and presence or absence of barriers between noise source and receptor. **Table 3.9-4** shows typical noise levels associated with various types of construction-related machinery. These noise levels, which correspond to a distance of 50 feet, decrease by approximately 6 dB with each doubling of distance from the construction site (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 facades.[9]

Steel Wheel Urban Rail Transit. This category includes both heavy and light rail transit. Heavy rail is generally defined as electrified rapid transit trains with dedicated guideway, and light rail as electrified transit trains that do not require dedicated guideway. 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. 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 Transit Authority (Metro) provides urban rail transit service on four lines within Los Angeles County. The Blue Line extends from Long Beach to the 7th Street Metro Center in downtown Los Angeles. The Red Line connects Union Station with North Hollywood via the Metro Center, the Gold Line connects Union Station with Pasadena, and the Green Line extends from Redondo Beach to Norwalk. Individual urban rail transit passby 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 number of events.

[8]County of Ventura. May 1988. Ventura County General Plan, Hazards Appendix. Ventura, CA: Author.

[9]Cornett, C.L. and Hina, C.E. 1979. Methods for predicting noise and vibration impacts. Washington, DC: United States Department of Transportation, Transportation Systems Center.

TABLE 3.9-4: DEMOLITION AND CONSTRUCTION EQUIPMENT SOURCE NOISE LEVELS	
Equipment	**Levels in dBA at 50 feet**
Front Loader	73-86
Trucks	82-95
Cranes (Moveable)	75-88
Cranes (Derrick)	86-89
Vibrator	68-82
Saws	77-82
Pneumatic Impact Equipment	83-88
Jackhammers	81-98
Pumps	68-72
Generators	71-83
Compressors	75-87
Concrete Mixers	75-88
Concrete Pumps	81-85
Back Hoe	73-85
Pile Driving (Peaks)	95-107
Tractor	77-98
Scraper/Grader	80-93
Paver	85-88
SOURCE: USEPA, *Noise From Construction Equipment and Operations, Building Equipment and Home Appliances, PB 206717*, 1971.	

Vibration

Similar to the environmental setting for noise, the vibration environment is typically dominated by traffic from nearby roadways and activity on construction sites. Heavy trucks can generate groundborne vibrations that vary depending on vehicle type, weight, and pavement conditions. Heavy trucks typically operate on major streets. Nonetheless, vibration levels adjacent to roadways are typically not perceptible.

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, auditoriums, natural areas, parks and outdoor recreation areas are generally more sensitive to noise than are commercial and industrial land uses. Consequently, 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 DNL 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 DNL 55 dB. Sporadic complaints associated with the DNL 55 to 60 dB range give way to widespread complaints and individual threats of legal action within the DNL 60 to 70 dB range. At DNL 70 dB and above, residential community reaction typically involves threats of legal action and strong appeals to local officials to stop the noise.

The SCAG region encompasses a large area with a wide variety of noise sources and noise levels. The ambient noise environment ranges from low levels associated with wilderness areas to high levels associated with airports and heavily trafficked roadways. 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 EIR. Rather this PEIR presents a discussion of noise levels associated with different noise sources and thereby allows the reader to infer the noise level at different locations depending on the proximity of a location to a noise source.

Tables 3.9-5 and **3.9-6** provide the reader with examples of existing noise levels by location and type of land use. The City of Los Angeles presumed ambient noise levels presented in **Table 3.9-5** are helpful for understanding ambient noise levels. These noise levels are sometimes lower than actual noise levels in residential and commercial areas since mobile source noise can add substantially to theses presumed levels.

TABLE 3.9-5: CITY OF LOS ANGELES PRESUMED AMBIENT NOISE LEVELS

Zone	Presumed Ambient Noise Level (dBA)	
	Day	Night
Residential	50	40
Commercial	60	55
Light Industrial	65	65
Heavy Industrial	70	70

SOURCE: City of Los Angeles, Chapter XI of the Noise Regulation, Section 111.03.

TABLE 3.9-6: NOISE MONITORING DATA

Location	Source	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: TAHA, 2011.

In addition, recent noise monitoring data collected at different points in the region have been aggregated in **Table 3.9-6** to show example noise levels. These data indicate that noise levels vary greatly depending on the location and the source.

THRESHOLDS OF SIGNIFICANCE

The 2012-2035 RTP/SCS would have a significant impact related to noise if it would:

- Expose persons or generate noise in levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies;
- Expose people to or generate excessive groundborne vibration or groundborne noise levels;
- Result in a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project; and/or
- Result in a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.

Methodology

This section summarizes the methodology used to evaluate the expected impacts of implementation of the 2012-2035 RTP/SCS on noise.[10]

Cumulative Analysis

The 2012-2035 RTP/SCS addresses transportation projects and land use distribution patterns, including land use scenarios. These land use distribution patterns identify growth distribution and anticipated land use development to accommodate growth projections. The Regional Travel Demand Model (RTDM) used for this analysis captures pass-through traffic that does not have an origin or destination in the region, but does impact the region, so that too is included in the project analysis. Although a similar level of development is anticipated even without the 2012-2035 RTP/SCS, this Plan would influence growth, including distribution patterns, throughout the region. To address this, the analysis in the PEIR covers overall impacts of all transportation projects and land development described in the 2012-2035 RTP/SCS. In addition, this PEIR considers cumulative impacts from other regional plans (e.g., the South Coast Air Quality Management Plan), which could result in additional impacts inside and outside the region.

Comparison with the No Project Alternative

The analysis of noise includes a comparison between the expected future conditions with the Plan and the expected future conditions if no Plan were adopted. This evaluation is not included in the determination of the significance of impacts (which is based on a comparison of future conditions with the Plan to today); however, it provides a meaningful perspective on the effects of the 2012-2035 RTP/SCS.

Determination of Significance

Noise associated with highway traffic is dependent on a number of variables including:

- Traffic volume
- Motor vehicle speed
- Motor vehicle fleet mix (cars, trucks, etc.)
- Location of the roadway with respect to sensitive receptors

In order to assess potential noise impacts, roadways in the region were assessed to determine where:

1. Traffic volume is anticipated to increase 100 percent from existing conditions,
2. Truck (medium and heavy-duty) volume is anticipated to increase 130 percent from existing conditions; and
3. Truck (medium and heavy-duty) volume is anticipated to increase by 100 percent with an increase in other vehicles of 50 percent.

All roadways identified to meet any of these criteria would be anticipated to have a potential significant impact on noise if sensitive receptors are located adjacent to the facilities.

Roadways with speeds less than 17 miles per hour were excluded as well as those with a volume to capacity ratio of greater than 1.0 (vehicle speeds less than 30 miles per hour) were excluded as such roadways would be anticipated to have a noise level of less than 66 dBA – the FHWA threshold for significant impact to adjacent sensitive receptors.

[10]The Environmental Justice section of the Plan and associated appendix contains substantial analysis of potential noise impacts to low income, minority and other protected groups. See Environmental Justice Appendix of the 2012-2035 RTP/SCS. However, the PEIR does not rely on this analysis as it addresses noise impacts to the community as a whole.

Since this document analyzes noise impacts on a program level only, project-level analysis of impacts will also be necessary. Moreover, all mitigation measures should be included in project-level analysis as appropriate. The project proponent or local jurisdiction shall be responsible for ensuring adherence to the mitigation measures prior to construction. For regionally significant projects, SCAG shall be provided with documentation of compliance with mitigation measures through its Intergovernmental Review Process in which all regionally significant projects, plans, and programs must be consistent with regional plans and policies.

IMPACTS

Impact 3.9-1: Grading and construction activities associated with the proposed freeway, arterial, transit, and rail projects, identified in the 2012-2035 RTP/SCS, as well as development anticipated by the Plan would intermittently and temporarily generate noise and vibration levels above ambient background levels. Noise and vibration levels in the immediate vicinity of the construction sites would increase substantially sometimes for extended duration. Therefore, without mitigation, the Plan would result in a significant impact related to construction noise and vibration.

Noise

Freeway and arterial projects proposed in the Plan include the widening of existing freeways and the construction of new interchanges. A few projects would involve constructing new freeway segments, including auxiliary capacity enhancement facilities and mixed flow connectors. The Plan also includes transit, passenger and high-speed rail (including the California High Speed Train (HST), and grade separation projects.

Development to accommodate the forecast population and employment would take a variety of forms, with a substantial fraction focused around High Quality Transit Areas (HQTAs). Because development would be focused in HQTAs, residents in those areas would be subject to high levels of construction as well as operational noise and vibration as compared to existing conditions.

Table 3.9-7 shows existing sensitive receptors within 0.25 miles of No Project and Plan transportation projects.

TABLE 3.9-7: SENSITIVE RECEPTORS WITHIN 0.25 MILES OF PLAN PROJECTS

	No Project	2012-2035 RTP/SCS
Colleges	15	58
Hospitals	6	45
K-12 Schools	147	541
Nursing Homes	37	186
Senior Centers	6	47
Urgent Care Centers	4	36

SOURCE: Environmental Justice Appendix, Exhibit 35, p. 138; SCAG, 2011.

Construction activities associated with the Plan would result in temporary noise increases at nearby sensitive receptors. **Table 3.9-8** presents the different types of freeway, transit and goods movement projects which typically emit noise during construction. The table also shows the relative duration of construction noise created by project type. The table does not include development types since the variety and duration of such projects is infinite resulting in a wide variety of noise levels and durations. Impacts to sensitive receptors resulting from transportation and development projects would depend on several factors, such as the type of project proposed, adjacent land use, and duration of proposed construction activities. Construction noise

levels would fluctuate depending on construction phase, equipment type, and duration of use; distance between noise source and receptor; and presence or absence of barriers between noise source and receptor.

TABLE 3.9-8: TYPES AND DURATION OF NOISE PRODUCED BY PROPOSED PROJECTS

	Noise Levels			Duration		
Project Type	**High**	**Medium**	**Low**	**Extended**	**Medium**	**Short**
FREEWAYS AND ARTERIALS						
Arterials/Interchanges	X			X		
Expressway	X			X		
Freeway – Mixed-flow	X			X		
HOV Connector	X			X		
Reconfigure Ramp	X			X		
Replace Overcrossing	X			X		
Capacity Enhancement Facilities	X			X		
Widen Underpass (4-6 lanes)	X			X		
Auxiliary Lanes		X			X	
Climbing Lanes		X			X	
HOT Lanes		X			X	
Interchange Addition		X			X	
Bikeways		X				X
Capacity Enhanced Arterial		X				X
Interchange Improvement		X			X	
Park & Ride		X				X
Roadway Operations & Maintenance			X			X
Smart Street Improvements			X			X
TRANSIT						
Commuter Rail	X			X		
High Speed Rail	X			X		
Inter-city Rail	X			X		
Transit Center		X			X	
Grade Crossing			X			X
Intelligent Transportation Systems			X			X
Light Rail	X			X		
Rail Improvement	X			X		
Rail Tunnel Improvement	X			X		
GOODS MOVEMENT						
Port Rail Access Improvements	X			X		

Note: Project-specific impacts depend on location and location of sensitive receptors. This table provides a general assessment of noise-generated by different types of impacts irrespective of the relationship to sensitive receptors.
SOURCE: TAHA, 2011.

Sensitive receptors could be affected by projects involving the construction of new systems (new facilities, capacity enhancement facilities, rail corridors, interchanges, underground rail lines, etc.), and development projects located within the vicinity of the receptor. Generally, construction related noise impacts would be short-term and localized in nature. Implementation of Mitigation Measures **MM-NO1** through **MM-NO5** would reduce construction noise impacts; however, impacts would remain significant.

Vibration

Construction-related vibration has the potential to damage structures, cause cosmetic damage (e.g., crack plaster), or disrupt the operation of vibration sensitive equipment. Vibration can also be a source of annoyance to individuals who live or work close to vibration-generating activities. Heavy construction operations can cause substantial vibration in close proximity to the source. As shown in **Table 3.9-9**, the highest impact or heaviest equipment, such as pile drivers or large bulldozers, can generate vibrations of 1.518 to 0.089 inches per second PPV at a distance of 25 feet.

TABLE 3.9-9: CONSTRUCTION EQUIPMENT VIBRATION LEVELS

Equipment		PPV at 25 feet (Inches per Second)	Approximate Vdb at 25 feet
Pile Driver (Impact)	Upper Range	1.518	112
	Typical	0.644	104
Pile Driver (Sonic)	Upper Range	0.734	105
	Typical	0.170	93
Vibratory Roller		0.210	95
Clam Shovel Drop (Slurry Wall)		0.202	94
Hydrol Mill (Slurry Wall)	In Soil	0.008	66
	In Rock	0.017	75
Large Bulldozer		0.089	87
Caisson Drilling		0.089	87
Loaded Trucks		0.076	86
Jackhammer		0.035	79
Small Bulldozer		0.003	58

SOURCE: Federal Transit Administration, *Transit Noise and Vibration Impact Assessment*, 2006.

Typical project construction activities, such as the use of jackhammers, other high-power or vibratory tools, compactors, and tracked equipment, may also potentially generate substantial vibration (i.e., greater than 0.2 inches per second PPV) in the immediate vicinity, typically within 15 feet of the equipment. However, building construction does not typically have these larger sources of vibration and is, therefore, not anticipated to be a source of substantial vibration. By use of administrative controls, such as scheduling, typical construction activities would be restricted to hours with least potential to affect nearby properties. Thus, perceptible vibration can be kept to a minimum and not result in human annoyance or structural damage.

Some specific construction activities result in higher levels of vibration. Pile driving has the potential to generate the highest vibration levels and is the primary concern for structural damage when it occurs within 50 feet of structures. Vibration levels generated by pile driving activities would vary depending on project conditions, such as soil conditions, construction methods, and equipment used. Pile driving activities may result in short-term annoyance. Depending on the proximity of existing structures to each construction site, the structural soundness of the affected buildings, 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 be perceptible within 100 feet and may be high enough to damage existing structures within 50 feet.

Light industrial and commercial operations have, on occasion, been known to utilize equipment or processes in the manufacture and distribution of materials that have a potential to generate vibration. However, vibrations found to be excessive for human exposure that are the result of a manufacturing process or industrial machinery are generally addressed from an occupational health and safety perspective. The

residual vibrations from industrial processes or machinery are typically of such low amplitude that they quickly dissipate into the surrounding soil and are rarely perceivable at the surrounding land uses.

Distribution of materials to and from industrial and commercial land uses can have the potential to generate more substantial levels of vibration than that of the mechanical equipment. Heavy trucks used for delivery and distribution of materials to and from industrial and commercial sites generally operate at very low speeds while on the industrial or commercial site. Therefore, the vibration induced by heavy truck traffic at industrial or commercial land uses is not anticipated to be perceptible at distances greater than 25 feet (typical distance from roadway centerline to edge of roadway right-of-way for a single-lane road). Implementation of Mitigation Measures **MM-NO6** and **MM-NO7** would reduce construction vibration impacts; however, impacts would remain significant.

Impact 3.9-2: Noise-sensitive land uses could be exposed to operational noise in excess of normally acceptable noise levels and/or could experience substantial increases in noise as a result of; a) the operation of expanded or new transportation facilities (i.e., new or increased traffic resulting from new highways, addition of highway lanes, roadways, ramps, goods movement facilities, grade separations and new transit facilities, etc.); and/or b) increased vehicle activity (autos, trucks, buses, planes, trains, etc.) from increased activity associated with development resulting in increased ambient noise next to transportation facilities. Without mitigation, the Plan would result in a significant impact related to land use compatibility.

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 generally expected to exceed the significance criteria when they occur near sensitive receptors. Many noise-sensitive land uses are located near Plan projects, including hospitals schools, nursing homes and senior centers. In addition, as discussed in Chapter 2.0 Project Description, the Plan would result in concentration of development in HQTAs. These HQTAs are located adjacent to transit and frequently located near other transportation facilities. Therefore under the Plan more sensitive receptors would be located adjacent to transportation facilities and would therefore be exposed to transportation-related noise. It is estimated that in 2035, 3,235 acres of low, medium, and rural density residential land uses would be within 150 feet of, and could be affected by, major transportation projects in the 2012-2035 RTP/SCS. Many more acres would be within 0.25 miles of affected transportation facilities.

Noise impacts would be expected adjacent to transportation facilities including highways, freeways, rail transit, toll-ways, truck-climbing lanes, freeway interchanges, and passenger and high-speed rail projects. It is anticipated that each of the projects included in the Plan would be subject to project-specific environmental review as part of the design and approval process for each facility.

Similarly individual development projects would be subject to project specific environmental review as appropriate. Some development projects would be so small as to not require environmental review, some projects may receive streamlined environmental review as a result of SB 375 or other legislation. For these projects that would not receive project-specific review it is anticipated that they would comply with local ordinances designed to reduce impacts and/or they would comply with mitigation measures included in this EIR or other environmental documents as may be appropriate (such as General Plan or Specific plan environmental documents). Many development projects especially larger projects would receive project-specific environmental review.

Freeways and Freight Corridors

As noted above, in order to assess potential noise impacts, roadways in the region were assessed to determine where:

1. Traffic volume is anticipated to increase 100 percent from existing conditions;

2. Truck (medium and heavy-duty) volume is anticipated to increase 130 percent from existing conditions; and
3. Truck (medium and heavy-duty) volume is anticipated to increase by 100 percent with an increase in other vehicles of 50 percent.

Modeling of regional traffic has shown that 92 to 100 percent of regional freeways miles and 10 to 24 percent of arterial/collector streets in the SCAG region currently exceed this criterion at adjacent land uses. The percentage of freeways exceeding this criterion would remain approximately the same in 2035 and the percentage of arterials/collectors would increase from 18 to 35 percent.[11] The criterion is only applicable if sensitive receptors are located adjacent to the freeways and collectors/arterials.

Changes in the percentage of miles of noise affected freeways and arterials are a direct result of increases and decreases in the traffic volumes, changes in fleet mix, and speeds assigned to each roadway in each county and additional interstate facilities proposed with the alternatives. In addition to changes to existing roadways (see Appendix B for the full list of RTP projects), the following new facilities would be constructed:

- High Desert Corridor (Los Angeles and San Bernardino Counties); approximately 75 miles
- I-710 North Gap Closure (Los Angeles County); approximately 4 miles
- East-West Freight Corridor (Los Angeles and San Bernardino Counties); approximately 42 miles from I-710 to I-15
- SR-241 (Orange County); approximately 15 miles

Figure 3.9-2 shows roadways in the SCAG region adjacent to which noise impacts could occur as a result of increased auto and/or truck traffic. Implementation of Mitigation Measures **MM-NO8** through **MM-NO14** would reduce freeway and freight corridor noise impacts; however, impacts would remain significant.

Transit

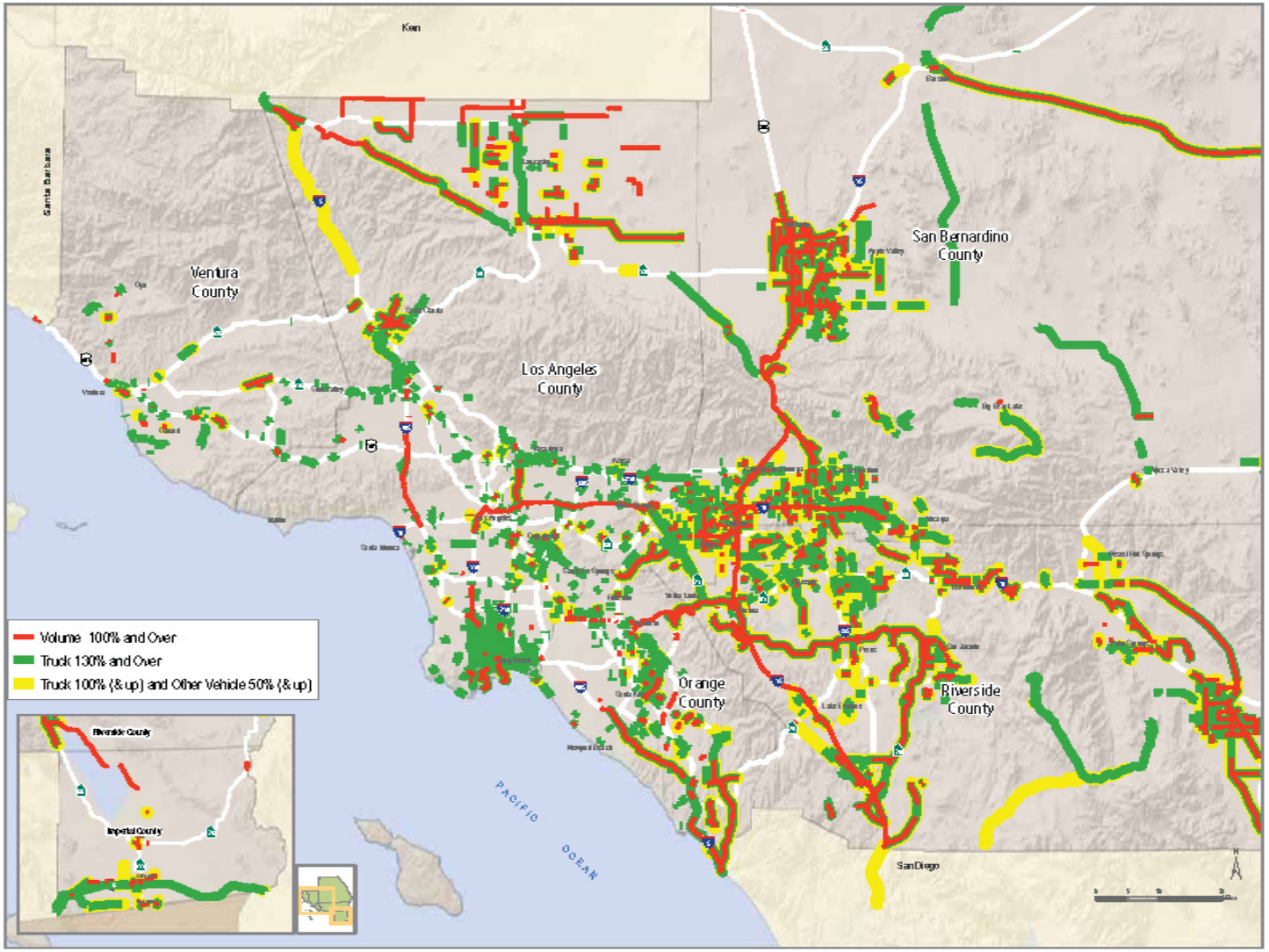
The Plan includes significant investments in urban rail, commuter rail, intercity passenger rail, and the eventual implementation of the HST. This plan lays out an investment strategy of incremental speed and capacity improvements to existing Amtrak and Metrolink service to provide interim high speed service within the SCAG region, while building towards an eventual connection to the statewide high speed network. A series of grade separations, grade closures, track expansions, station improvements, earthen works, and other improvements will allow more and faster service in the Los Angeles to San Diego (LOSSAN) Rail Corridor and Antelope Valley Corridors.

A phased HST implementation strategy, in accordance with the 2012 California High Speed Rail Authority Business Plan, will provide initial high-speed train service to the San Fernando Valley, being extended south to Los Angeles Union Station and the Anaheim Regional Transportation Intermodal Center by 2035. As these efforts are still in the initial stages of planning and analysis, alignment and schedule details are subject to change.

Improvements, additions and extension of transit corridors, specifically associated with bus rapid transit, light rail, passenger rail and high-speed rail activity, would expose existing and future noise-sensitive land uses to high levels of noise generated by high-volume transit corridors. Noise levels would increase along bus and rail corridors where speeds are increased, trains are double-tracked and/or the number of trains increases as a result of physical and/or programmatic changes. The Plan also emphasizes development in High Quality Transit Areas (HQTA) that would increase the number of people exposed to noise from transit.

[11] SCAG, *2008 Regional Transportation Plan Final EIR*, April 2008.

Figure 3.9-2: SCAG Region Roadway Noise (2035 Plan from Existing Conditions)



SOURCE: SCAG Transportation Modeling, 2011

Noise would also increase adjacent to new bus and rail corridors where there were previously no buses or trains. Increased noise levels would only be relevant where adjacent sensitive receivers are located along existing or proposed corridors. Crossings also use audible warning signals that could impact 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. Implementation of Mitigation Measures **MM-NO15** through **MM-NO17** would reduce transit noise impacts; however, impacts would remain significant.

Goods Movement

The Plan includes facilities and actions that encourage more efficient intermodal transportation of goods including roadways and train facilities. The number of freight trains currently operating each day in the SCAG region is dependent upon the demands of the industries using rail services and can vary greatly from day to day. The Plan includes proposed rail capacity improvements to reduce current passenger/freight rail bottlenecks and increase capacity for existing freight. While increases in rail freight transport would increase the number of freight trains, these trains would likely operate on an as-needed basis and would not have a fixed schedule. Therefore, noise levels and frequency of passbys would continue to vary greatly from day to day. On some days there may be no increase in freight train activity. Overall, however, an increase in train traffic would yield a consequent increase in noise in areas adjacent to rail corridors. Implementation of Mitigation Measures **MM-NO15** and **MM-NO16** would reduce goods movement noise impacts; however, impacts would remain significant. Emphasis on development in HQTAs may have some related increase in exposure of noise to people from freight rail, particularly where regional transit operates on the same corridor (e.g., LOSSAN and portions of Metrolink).

Impact 3.9-3: Vibration-sensitive land uses could be exposed to vibration in excess of normally acceptable levels and/or could experience substantial increases in vibration as a result of the operation of expanded or new transportation facilities. Without mitigation, the Plan would result in a significant impact related to vibration.

The primary vibration sources associated with transportation system operations include heavy truck and bus traffic along roadways and train traffic along rail lines. However, vehicle traffic, including heavy trucks traveling on a highway, rarely generates vibration amplitudes high enough to cause structural or cosmetic damage, except in rare cases (for example where heavy truck traffic passes in close proximity to fragile older buildings). Heavy trucks traveling over potholes or other discontinuities in the pavement can cause vibration high enough to result in complaints from nearby residents, which typically can be addressed by smoothing the roadway surface.[12] Caltrans conducted several transportation-related vibration analyses that determined traffic rarely generates vibration amplitudes high enough to cause structural or cosmetic damage. Based on vibration measurements throughout California, worst-case traffic vibrations were shown to drop below the threshold of perception at distances of 150 feet or greater. Given that sensitive receptors are located within 150 feet of facilities that would be impacted by increased truck traffic it is anticipated that the Plan would result in a significant impact related to vibration associated with truck traffic. It is estimated that in 2035, 3,235 acres of low, medium, and rural density residential land uses would be within 150 feet of, and could be affected by, major transportation projects in the 2012-2035 RTP/SCS.

While Caltrans in not usually involved in rail projects, on occasion the effects of train activity on a Caltrans facility has been of concern. Thus, Caltrans conducted several measurements of train activity throughout the State and measured a peak vibration level of 0.36 inches per second PPV at ten feet from the track. Based on this reference vibration level, vibrations from train activity would drop below the threshold of perception at distances greater than 250 feet.

[12]Caltrans, *Transportation- and Construction-Induced Vibration Guidance Manual*, 2004.

The Plan includes the development of additional railway facilities along existing tracks. Thus, the number of daily events would increase, and the highest peak vibration level would be increased relative to the existing condition. In general, additional trains passing at the same point would show up as higher peaks that may expose local sensitive receptors to vibration to a substantial increase in vibration levels relative to the existing condition. Implementation of Mitigation Measure **MM-NO18** would reduce vibration impacts; however, impacts would remain significant.

Cumulative Impact 3.9-4: The Plan would contribute to cumulative ambient noise and vibration levels in areas outside the region as a result of the operation of expanded or new transportation facilities (i.e., increased traffic resulting from new highways, addition of highway lanes, roadways, ramps, and new use of new transit and rail facilities as well as increased use of existing transit and rail facilities, etc.). Therefore, the Plan would contribute to a cumulatively considerable noise impact in these areas.

The 2012-2035 RTP/SCS could have a significant impact on noise and vibration outside the region. Cumulative transportation noise would increase outside the region partially as a result of increased activity resulting from the Plan. This ambient noise increase could be related to aircraft overflights, port noise, ship horns, railroads, as well as freeway, arterial and transit noise. Implementation of Mitigation Measures **MM-NO1** and **MM-NO18** would reduce vibration impacts; however, impacts would remain significant.

MITIGATION MEASURES

Mitigation Measures **MM-NO1** through **MM-NO18** can and should be implemented by project sponsors (for both development and transportation projects) as applicable. Project-specific environmental documents may adjust these mitigation measures as necessary to respond to site-specific conditions. Projects taking advantage of CEQA Streamlining provisions of SB 375 can and should apply mitigation measures as appropriate to site-specific conditions.

MM-NO1: To reduce noise impacts due to construction, project sponsors can and should require construction contractors to implement a site-specific noise reduction program, subject to the Lead Agency (or other appropriate government agency) review and approval, which includes the following measures:

- Equipment and trucks used for project construction can and should utilize the best available noise control techniques (e.g., improved mufflers, equipment redesign, use of intake silencers, ducts, engine enclosures and acoustically-attenuating shields or shrouds, wherever feasible).
- Except as may be exempted by the Lead Agency (or other appropriate government agency), impact tools (e.g., jack hammers, pavement breakers, and rock drills) used for project construction can and should be 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 should be used; this muffler can lower noise levels from the exhaust by up to about 10 dBA. External jackets on the tools themselves should be used, if such jackets are commercially available and this could achieve a reduction of 5 dBA. Quieter procedures should be used, such as drills rather than impact equipment, whenever such procedures are available and consistent with construction procedures.
- Stationary noise sources can and should be located as far from adjacent sensitive receptors as possible and they should be muffled and enclosed within temporary sheds, incorporate insulation barriers, or use other measures as determined by the Lead Agency (or other appropriate government agency) to provide equivalent noise reduction.

MM-NO2: Prior to the issuance of a building permit, along with the submission of construction documents, each project sponsor can and should submit to the Lead Agency (or other government agency as appropriate) a list of measures to respond to and track complaints pertaining to construction noise. These measures should include:

- A procedure and phone numbers for notifying the Lead Agency staff and local Police Department; (during regular construction hours and off-hours);
- A sign posted on-site pertaining with permitted construction days and hours and complaint procedures and who to notify in the event of a problem. The sign should also include a listing of both the Lead Agency and construction contractor's telephone numbers (during regular construction hours and off-hours);
- The designation of an on-site construction complaint and enforcement manager for the project;
- Notification of neighbors and occupants within 300 feet of the project construction area at least 30 days in advance of extreme noise generating activities about the estimated duration of the activity; and
- A preconstruction meeting can and should be held 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.

MM-NO3: Project sponsor can and should implement use of portable barriers in the vicinity of sensitive receptors during construction including construction of subsurface barriers, debris basins, and storm water drainage facilities.

MM-NO4: For projects that require pile driving or other construction noise above 90 dBA in proximity to sensitive receptors, to further reduce potential pier drilling, pile driving and/or other extreme noise generating construction impacts greater than 90dBA, a set of site-specific noise attenuation measures can and should be completed under the supervision of a qualified acoustical consultant. Prior to commencing construction, a plan for such measures should be submitted for review and approval by the Lead Agency (or other appropriate government agency) to ensure that maximum feasible noise attenuation will be achieved. This plan should be based on the final design of the project. A third-party peer review, paid for by the project sponsor, may be required to assist the Lead Agency in evaluating the feasibility and effectiveness of the noise reduction plan submitted by the project sponsor. The criterion for approving the plan should be a determination that maximum feasible noise attenuation will be achieved. The noise reduction plan can and should include, but not be limited to, an evaluation of implementing the following measures. These attenuation measures can and should include as many of the following control strategies as applicable to the site and construction activity:

- Erect temporary plywood noise barriers around the construction site, particularly along on sites adjacent to residential buildings;
- Implement "quiet" pile driving technology (such as pre-drilling of piles, the use of more than one pile driver to shorten the total pile driving duration), where feasible, in consideration of geotechnical and structural requirements and conditions;

- Utilize noise control blankets on the building structure as the building is erected to reduce noise emission from the site;
- Evaluate the feasibility of noise control at the receivers by temporarily improving the noise reduction capability of adjacent buildings by the use of sound blankets for example and implement such measure if such measures are feasible and would noticeably reduce noise impacts**;** and
- Monitor the effectiveness of noise attenuation measures by taking noise measurements.

MM-NO5: Noise generated from any rock-crushing or screening operations performed within 3,000 feet of any occupied residence can and should be mitigated by the project sponsor by strategic placement of material stockpiles between the operation and the affected dwelling or by other means approved by the local jurisdiction.

MM-NO6: Where feasible, pile holes can and should be pre-drilled to reduce potential noise and vibration impacts.

MM-NO7: As necessary, each project sponsor can and should retain a structural engineer or other appropriate professional to determine threshold levels of vibration and cracking that could damage any adjacent historic or other structure subject to damage, and design means and construction methods to not exceed the thresholds.

MM-NO8: Project sponsors can and should comply with all local sound control and noise level rules, regulations, and ordinances.

MM-NO9: As part of the appropriate environmental review of each project, a project specific noise evaluation can and should be conducted and appropriate mitigation identified and implemented.

MM-NO10: Project sponsors can and should employ, where their jurisdictional authority permits, land use planning measures, such as zoning, restrictions on development, site design, and use of buffers to ensure that future development is compatible with adjacent transportation facilities.

MM-NO11: As a last resort, project sponsors can and should eliminate noise-sensitive receptors by acquiring freeway and rail rights-of-way. This would ensure the effective operation of all transportation modes.

MM-NO12: Project sponsors can and should, to the extent feasible and practicable, maximize the distance between noise-sensitive land uses and new roadway lanes, roadways, rail lines, transit centers, park-and-ride lots, and other new noise-generating facilities.

MM-NO13: Project sponsors can and should construct sound reducing barriers between noise sources and noise-sensitive land uses. Sound barriers can be in the form of earth-berms or soundwalls. Constructing roadways so as appropriate and feasible that they are depressed below-grade of the existing sensitive land uses also creates an effective barrier between the roadway and sensitive receptors.

MM-NO14: Project sponsors can and should, to the extent feasible and practicable, improve the acoustical insulation of dwelling units where setbacks and sound barriers do not sufficiently reduce noise.

MM-NO15: The project sponsors can and should implement, to the extent feasible and practicable, speed limits and limits on hours of operation of rail and transit systems, where such limits may reduce noise impacts.

MM-NO16: To reduce noise impacts, maximize distance of new route alignments from sensitive receptors. For example, if a transit project were constructed along the center of a freeway (as opposed to a new route or along the side of the freeway), operational noise impacts would be reduced by the increase in distance to the noise sensitive sites and the masking effects of the freeway traffic noise.

MM-NO17: Transit-related passenger stations, central maintenance facilities, decentralized maintenance facilities, and electric substations can and should be located away from sensitive receptors to the maximum extent feasible.

MM-NO18: Local jurisdictions or agencies can and should, as practical and feasible, adhere to published local, state and federal guidelines concerning groundborne vibration impacts.

SIGNIFICANCE OF IMPACTS AFTER MITIGATION

Construction Noise and Vibration

Mitigation Measures **MM-NO1** through **MM-NO7** may not reduce noise levels to below significance in all cases. Therefore, the Plan would result in a significant impact related to construction noise and vibration.

Land Use Compatibility (Impact 3.9-2)

Mitigation Measures **MM-NO8** through **MM-NO17** may not reduce noise levels to below significance in all cases. Therefore, the Plan would result in a significant impact related to land use compatibility.

Vibration (Impact 3.9-3)

Mitigation Measure **MM-NO18** may not reduce noise levels to below significance in all cases. Therefore, the Plan would result in a significant impact related to vibration.

Cumulative Effects (Impact 3.9-4)

Mitigation Measures **MM-NO1** through **MM-NO18** may not reduce noise and vibration levels to below significance in all cases. Therefore, the Plan would contribute to cumulatively considerable noise and vibration impacts outside the region.

COMPARISION WITH THE NO PROJECT ALTERNATIVE

Through the construction of transportation projects, and increases in traffic volume and speed, the 2012-2035 RTP/SCS projects would create substantially more noise than the No Project Alternative. The same level of population, household and job growth is anticipated under the No Project Alternative as under the Plan, so similar amounts of development are anticipated. However, under the Plan uses are anticipated to be more compact (more multi-family as compared to single-family housing), therefore resulting in more intense areas of development and higher noise levels in the HQTAs. By not implementing the Plan the levels of cumulative ambient noise would be less than with the Plan as a result of fewer sources and reduced speeds.

Development construction noise would be less dispersed, but higher and of longer duration in HQTAs. Transportation noise would similarly be concentrated in HQTAs as compared to the No Project Alternative.

Direct Impacts

Under the No Project Alternative, no new transportation investments would be made, beyond those that are currently programmed. As a result, fewer transportation projects would be built resulting in less construction noise and fewer sensitive receptors would be exposed to construction noise. In addition, without the Plan, speeds would be reduced resulting in reduced noise levels. **The Plan impacts would be greater than the No Project Alternative impacts for Impacts 3.9-1 and 3.9-2.**

Indirect Impacts

The Plan includes transportation and land use strategies that focus growth along existing corridors and in urbanized areas (HQTAs), rather than allowing development of vacant, open space/recreation and agricultural lands. This compact development pattern included in the Plan would concentrate population in urban areas that already generally have higher ambient noise levels; the Plan would result in additional construction and operational noise in these areas. The Plan also includes increased transit (bus, rail) in urban areas that would contribute to the overall increase in noise levels. **The Plan impacts would be greater than the No Project Alternative impacts for Impacts 3.9-3.**