4.13 Noise

This section evaluates noise and vibration impacts of the proposed 2018 RTP/SCS. Both temporary impacts relating to construction activities and long-term impacts associated with implementation of the planned transportation projects and the land use scenario envisioned in the 2018 RTP/SCS are discussed.

4.13.1 Setting

a. Overview of Noise and Vibration

The following discussion describes the characteristics of noise and vibration. These characteristics are used to assess potential impacts at sensitive land uses. Noise- and vibration-sensitive land uses include locations where people reside or where the presence of unwanted sound could adversely affect the use of the land. Residences, senior facilities, schools, hospitals, guest lodging, libraries and some passive recreation areas are examples of typical noise- and vibration-sensitive land uses.

Noise

Noise level (or volume) is generally measured in decibels (dB) using the A-weighted sound pressure level (dBA). The A-weighting scale is an adjustment to the actual sound power levels to be consistent with that of human hearing response, which is most sensitive to frequencies around 4,000 Hertz (about the highest note on a piano) and less sensitive to low frequencies (below 100 Hertz). In addition to the actual instantaneous measurement of sound levels, the duration of sound is important since sounds that occur over a long period of time are more likely to be an annoyance or cause direct physical damage or environmental stress. One of the most frequently used noise metrics that considers both duration and sound power level is the equivalent noise level (Leq). The Leq is defined as the single steady A-weighted level that is equivalent to the same amount of energy as contained in fluctuating levels of sound over a period of time. Typically, Leq is summed over a one-hour period.

Sound pressure is measured on a logarithmic scale with the 0 dB level based on the lowest detectable sound pressure level that people can perceive (an audible sound that is not zero sound pressure level). Based on the logarithmic scale, a doubling of sound energy is equivalent to an increase of 3 dB and a sound that is 10 dB less than the ambient sound level has no effect on ambient noise. Because of the nature of the human ear, a sound must be about 10 dB greater than the reference sound to be judged as twice as loud. In general, a 3 dBA change in community noise levels is noticeable, while 1-2 dBA changes generally are not perceived. Quiet suburban areas typically have noise levels in the range of 40 to 50 dBA, while noise levels along arterial streets are generally in the 50 to 60+ dBA range. Normal conversational levels are in the 60-65 dBA range and ambient noise levels greater than that can interrupt conversations.

Noise levels typically attenuate at a rate of 6 dBA per doubling of distance from point sources such as industrial machinery. Noise from roads typically attenuates at a rate of about 4.5 dBA per doubling of distance over absorptive ground surfaces (e.g., grass). Noise from roads typically attenuates at about 3 dBA per doubling of distance over reflective ground surfaces (e.g., pavement).

The actual time period in which noise occurs is also important since noise that occurs at night tends to be more disturbing than that which occurs during the daytime. To evaluate community noise on a 24-hour basis, the day-night average sound level was developed (Ldn). Ldn is the time average of all

A-weighted levels for a 24-hour period with a 10 dB upward adjustment added to those noise levels occurring between 10:00 PM and 7:00 AM to account for the general increased sensitivity of people to nighttime noise levels. The Community Noise Equivalent Level (CNEL) is identical to the Ldn with one exception. The CNEL adds 5 dB to evening noise levels (7:00 PM to 10:00 PM). Thus, both the Ldn and CNEL noise measures represent a 24-hour average of A-weighted noise levels with Ldn providing a nighttime adjustment and CNEL providing both an evening and nighttime adjustment.

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.

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.

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).

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 which is well below the threshold of perception for humans (human perception is around 65 RMS). Most perceptible 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.

b. Noise and Vibration Sources

Many principal noise generators within the SJCOG region are associated with transportation (i.e., airports, freeways, arterial roadways and railroads). Local collector streets are not considered significant noise sources as traffic volume and speeds are generally much lower than for freeways and arterial roadways. Generally, transportation-related noise is the dominant noise source within urban environments.

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 typically operate on major streets and can generate groundborne vibrations that vary depending on vehicle type, weight and pavement conditions. Nonetheless, vibration due to roadway traffic is typically not perceptible.

Motor Vehicle Traffic

Motor vehicles, including cars/light trucks, buses and various types of trucks, are the most substantial source of noise in most of the SJCOG region. This can be attributed to the network of major, primary and secondary arterials, as well as the large number of vehicle trips that occur each day. Within San Joaquin County, Interstate 5 and State Route 99 have the largest vehicle volumes and the highest noise levels, mostly notably State Route 99. In 2016, daily traffic volumes on State Route 99 ranged from 65,000 vehicles south of the Sacramento-San Joaquin County line to 129,000 vehicles between Milgeo Avenue and Jackton Road, near the southern County line (Caltrans 2016). Levels of highway noise typically range from 70 to 80 dB(A) at a distance of 50 feet from the highway (Federal Highway Administration [FHA] 2003).

Additionally, the SJCOG region has many arterial roadways. Typical arterial roadways have one or two lanes of traffic in each direction. Noise from these sources can be a substantial environmental concern where buffers (e.g., buildings, landscaping, etc.) are inadequate to reduce noise levels 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 can typically range from Ldn 65 to 70 dBA at a distance of 50 feet from the roadway centerlines (FHA 2003).

Aircraft Operation

San Joaquin County has six public-use aviation airports, which include the following:

- Kingdon Executive
- Lodi
- Lodi Precissi Airpark
- New Jerusalem
- Stockton Metropolitan
- Tracy Municipal

Of these airports, only the Stockton Metropolitan Airport provides scheduled air carrier service. There are also seven private airports in the county, including hospital heliports and small agricultural airstrips. Currently, there are no operational military airfields in the county.

Stockton Municipal Airport is the only airport to offer commercial and cargo air carrier service in the County (SJCOG 2016). Most aircrafts using the facility are single-engine piston aircrafts; however, as the airport retains the longest runway in the County, a significant number of operations are performed by twin-engine turboprops and jets (SJCOG 2016).

The major private civilian facilities have potential for significant noise level impacts as urban development continues to encroach into the rural areas. San Joaquin County noise contour measurements and estimates for airports can be found in the 2009 San Joaquin County Airport Land Use Compatibility Plan (ALUCP) and 2016 Stockton Metropolitan Airport ALUCP.

Airport noise contours have been established for all airport facilities in the County and are consistent with the Federal Aviation Administration (FAA) Integrated Noise Model. In addition, noise contours for existing and future conditions at each of the airports are contained in plans or studies, including: Airport Master Plans, Airport Land Use Compatibility Plan, Comprehensive Airport Land Use Plans, Airspace Plans, and Airport Layout Plans, which are all incorporated by reference. Each of these plans or studies includes implementation goals, objectives, and policies and/or recommendations to lessen noise impacts.

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 near sidings and switching yards. Locomotive engines and the interaction of steel wheels and rails are one primary source of rail noise. The latter creates rolling noise which is caused by continuous rolling contact, impact noise when a wheel encounters a rail joint, turnout or crossover and squeal generated by wheel/rail friction on tight curves. For very high speed rail vehicles, air turbulence can be a significant source of noise. Air horns and crossing bell gates are another primary source of rail noise.

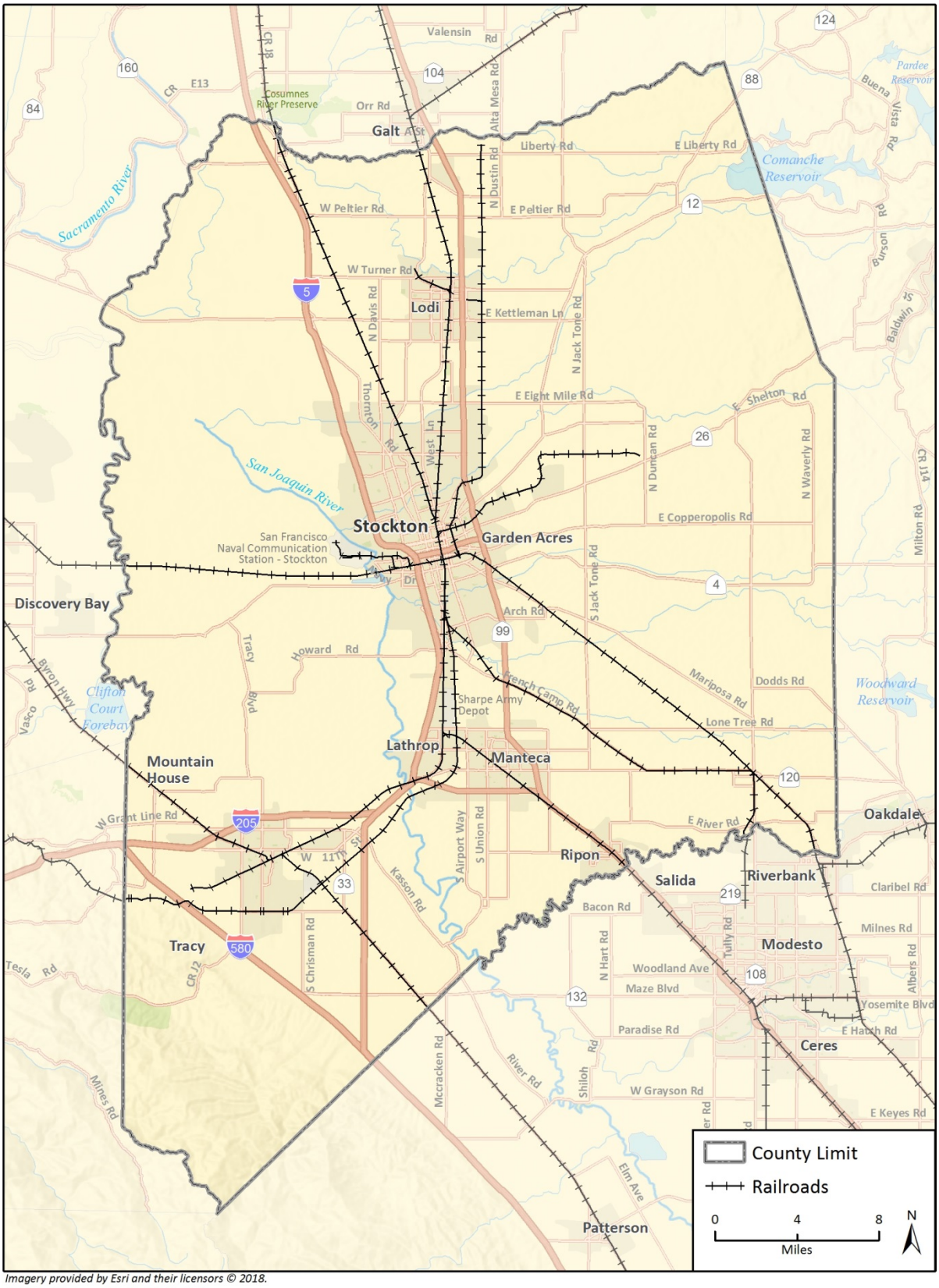
Rail operations generate varying noise levels depending on the type of rail activity. Heavier commuter or freight trains, which are diesel-powered, generate more noise than electrically-powered light-rail vehicles. According to the Federal Transit Administration (FTA), six commuter trains traveling at 50 miles per hour with a horn blowing generate a noise level of 81 dBA Leq at 50 feet. This same activity without a horn generates a noise level of 68 dBA Leq at 50 feet. In comparison, 12 light rail transit trains traveling 40 miles per hour generate a noise level of 65 dBA Leq at 50 feet. These same light rail transit trains generate a noise level of 57 dBA Leq at 20 miles per hour at 50 feet (FTA 2006).

According to the FTA Transit Noise and Vibration Impact Assessment guidance document (2006), vehicle propulsion rail units generate the following noises: (1) whine from electric control systems and traction motors that propel rapid transit cars, (2) diesel-engine exhaust noise from locomotives, (3) air-turbulence noise generated by cooling fans and (4) gear noise. Additional noise of motion is generated by the interaction of wheels/tires with their running surfaces. The interaction of steel wheels and rails generates three types of noise: (1) rolling noise due to continuous rolling contact, (2) impact noise when a wheel encounters a discontinuity in the running surface, such as a rail joint, turnout or crossover and (3) squeal generated by friction on tight curves.

When comparing electric- and diesel-powered trains, speed dependence is strong for electric-powered transit trains because wheel/rail noise dominates, and noise from this source increases strongly with increasing speed. On the other hand, speed dependence is less for diesel-powered commuter rail trains, particularly at low speeds where the locomotive exhaust noise dominates. As speed increases, wheel-rail noise becomes the dominant noise source and diesel- and electric-powered trains will generate similar noise levels. For transit vehicles in motion, close-by sound levels also depend upon other parameters, such as vehicle acceleration and vehicle length, plus the type/condition of the running surfaces. For very high-speed rail vehicles, air turbulence can also be a significant source of noise. In addition, the guideway structure can also radiate noise as it vibrates in response to the dynamic loading of the moving vehicle.

Rail lines for goods movement (e.g., agricultural materials) are located throughout the SJCOG region. The Amtrak and Altamont Commuter Express (ACE) provide commuter passenger train service. Amtrak operates trains with destinations to Las Vegas, San Diego, and San Luis Obispo. The San Joaquin Amtrak passenger cars provide passenger service throughout the California's Central Valley with seven northbound and seven southbound trains every day. In addition, the County has an extensive network of railroad lines belonging primarily to two major railroads: Union Pacific (UP) and the BNSF Railway Company (BNSF). Figure 15 shows the location of the UP and BNSF lines, and the specific lines used by the commuter passenger trains. Both railroad main lines parallel the State Route (SR)-99 and Interstate (I)-5 in the northern portion of the County, while in the southern area, the UP main line parallels the SR-99 and the BNSF main line runs along the Mariposa

Figure 15 San Joaquin County Railroad Lines



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Additional data provided by FEMA, 2017.

Road/Santa Fe Road to the east and SR-4 to the west. Table 36 provides the CNEL for several segments of the primary UP and BNSF lines.

Table 36 Exterior Noise Exposure Adjacent to Nearby Rail Lines

		Noise Contour Distance (feet)		
Segment	Number of Trains	Ldn at 100 feet	65 dB Ldn	60 dB Ldn
Inland Rd. at SR 4 East of Holt	33	65	171	368
Woodward Rd. at Moffatt Blvd. South of Manteca	23	75	466	1,003
Lawrence Rd. & Arthur Rd. North of Escalon	47	72	305	657
South Lathrop	11	66	115	55

Source: 2009 San Joaquin County General Plan Update, Table 15.9

The data in Table 36 are examples of train noise exposure at specific locations in San Joaquin County, and do not represent all train noise exposure within the County. These examples illustrate the vast differences in the number of train operations and associated noise exposure at different areas of the County. The examples represent train noise exposure away from grade crossings; that is, they do not include significant contributions from train warning horns and crossing guard warning systems. At grade crossings, warning horns dominate train noise exposure, producing an average SEL as high as 110 dB at 100 feet from the tracks (San Joaquin County 2010).

The data presented in Table 36 illustrates the variability regarding train noise exposure within the County. Variables such as train speed, track construction/condition, grade, number of train locomotives, number of train cars, and location relative to a grade crossing make quantitative assessment of train noise exposure create challenges when trying to determine the impacts on surrounding communities. This information illustrates the importance of site-specific train noise assessment for projects identified as noise sensitive.

Industrial and Manufacturing

Noise from industrial complexes and manufacturing plants are characterized as stationary or point sources even though they may include mobile sources like heavy equipment. 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.

In general, in the SJCOG region and throughout California, industrial complexes and manufacturing plants are located away from sensitive land uses and, as such, noise generated from these sources has less of an effect on surrounding properties. In contrast to industrial and manufacturing facilities, construction sites are located throughout the SJCOG region and often within, or adjacent to, residential areas.

Construction Noise and Vibration

Noise and vibration from construction sites are characterized as stationary or point sources even though heavy construction equipment is often mobile. Construction activities typically generate high, intermittent noise and vibration on and adjacent to construction sites and related noise and vibration impacts are short-term, occurring primarily on week days and during daylight hours. The

dominant source of noise from most construction equipment is their diesel engine. During pile driving or pavement breaking events, impact noise is the dominant source and equipment produces the highest vibration levels. Construction equipment operates in two modes, stationary and mobile. Stationary equipment operates in one location for one or more days at a time and can generate a constant noise level (e.g., pumps, generators and air compressors) or variable noise levels (e.g., pile drivers and pavement breakers). Mobile equipment moves around the construction site (e.g., dozers, tractors). Noise levels vary depending on the power cycle being used. Mobile equipment such as trucks, move to and from the site using adjacent streets/roads.

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.

San Joaquin County 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 County and the variation in sources, it is not useful to complete a detailed noise monitoring study for this Program EIR. Rather this Program EIR 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.

c. Regulatory Setting

Various federal agencies have set standards for transportation-related noise and vibration sources that participate in interstate commerce, such as aircraft, locomotives and trucks. The State sets noise standards for those noise sources that are not preempted from regulation, such as automobiles, light trucks and motorcycles. Noise and vibration sources associated with industrial, commercial and construction activities are generally subject to local control through noise ordinances and general plan policies.

Federal

Relevant federal regulations include those established by the FHWA, FTA, Federal Aviation Administration (FAA) and Department of Housing and Urban Development (HUD).

Federal Highway Administration

TRAFFIC NOISE

Traffic noise impacts, as defined in 23 CFR § 772.5, occur when the predicted noise level in the design year approach or exceed the Noise Abatement Criteria (NAC) specified in 23 CFR § 772, or a predicted noise level substantially exceeds the existing noise level (a “substantial” noise increase). A "substantial increase” is defined as an increase of 12 dB Leq during the peak hour of traffic. For sensitive uses, such as residences, schools, churches, parks and playgrounds, the NAC for interior and exterior spaces is Leq 57 and 66 dB, respectively, during the peak hour of traffic noise. Table 37 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 37 Noise Abatement Criteria

Activity Category	Hourly Leq	Hourly L10[1]	Analysis Location	Description of Activity Category
A	57	60	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose
B	67	70	Exterior	Residential
C	67	70	Exterior	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails and trail crossings
D	52	55	Interior	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools and television studios
E	72	75	Exterior	Hotels, motels, offices, restaurants/bars and other developed lands, properties or activities not included in A-D or F
F				Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical) and warehousing
G				Undeveloped lands that are not permitted

[1] L10 is the level of noise exceeded for 10% of the time.
Source: FHWA 2017

RAILROAD NOISE

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 pass-by 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 NAC.

AIRCRAFT NOISE

Aircraft operated in the U.S. are subject to 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.

FEDERAL AND FEDERAL-AID HIGHWAY PROJECTS

Title 23 of the Code of Federal Regulations (23 CFR § 772) provides procedures for preparing operational and construction noise studies and evaluating noise abatement 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, 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 as well as noise impacts for which no apparent solution is available.

Federal Transit Administration

The FTA has developed guidance to evaluate noise impacts from operation of surface transportation modes (i.e. passenger cars, trucks, buses and rail) in the 2006 FTA *Transit Noise Impact and Vibration Assessment* (FTA 2006). All mass transit projects receiving federal funding must use these guidelines to predict and assess potential noise and vibration impacts. As ambient levels increase, smaller increments of change are allowed to minimize community annoyance related to transit operations.

Department of Housing and Urban Development

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 safety and comfort can be compromised by excessive noise. 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 that 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 Ldn noise levels or less are acceptable for residential land uses and noise levels exceeding 75 dBA Ldn 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 focused on achieving that goal. It is assumed that with standard construction methods and materials, any building will provide sufficient attenuation so that if the exterior level is 65 dBA Ldn or less, the interior level will be 45 dBA Ldn or less.

State

Relevant state noise regulations include those are discussed below. There are no adopted State policies or standards for groundborne vibration.

Governor's Office of Planning and Research

The Governor's Office of Planning and Research is required to adopt and periodically revise guidelines for the preparation and content of local general plans. The 2017 General Plan Guidelines (Governor's Office of Planning and Research, 2017) establish land use compatibility guidelines. Where a noise level range is denoted as "normally acceptable" for the given land use, the highest noise level in that range should be considered the maximum desirable for conventional construction that does not incorporate any special acoustic treatment. The acceptability of noise environments classified as "conditionally acceptable" or "normally unacceptable" will also depend on the anticipated amount of time that will normally be spent outside the structure and the acoustic treatment to be incorporated in structural design.

With regard to noise-sensitive residential uses, the recommended exterior noise limits are 60 dBA CNEL for single-family residences and 65 dBA CNEL for multi-family residences. The recommended maximum interior noise level is 45 dBA CNEL, which could normally be achieved using standard construction techniques if exterior noise levels are within the levels described above.

California Department of Transportation

Caltrans establishes noise limits for vehicles licensed to operate on public roads (Caltrans 2013). 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 uses the NAC discussed above in connection with FHWA. In addition, Caltrans has published the *Traffic Noise Analysis Protocol* guidelines for assessing noise levels associated with roadway projects (Caltrans 2011).

California Streets and Highways Code

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

Airport Noise Standards and Compatibility Planning

The State of California has the authority to establish regulations requiring airports to address aircraft noise impacts near airports. The State of California's Airport Noise Standards, found in Title 21 of the California Code of Regulations, identify a noise exposure level of 65 dB CNEL 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 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 45 dB Ldn 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 60 dB Ldn.

California Aeronautics Act

The State Aeronautics Act (Public Utilities Code, Section 21670 et seq.) requires the establishment of Airport Land Use Commissions (ALUCs), which are responsible for developing airport land use compatibility plans (ALUCPs) for noise-compatible land uses in the immediate proximity of a commercial or public airport (Section 21675). ALUCs have two major roles: preparation and adoption of airport land use compatibility plans, which address policies for both noise and safety and review of certain local government land use actions and airport plans for consistency with the land use compatibility plan

The ALUCP is the major tool for ALUC land use regulation. The intent of the ALUCP is to encourage compatibility between airports and the various land uses that surround them. ALUCPs typically include the development of noise contours to identify excessive airport-related noise levels and measures to reduce noise levels. For example, Monterey Regional Airport encourages noise abatement procedures related to quiet departure techniques.

The Aeronautics Division of the California Department of Transportation has published the *California Airport Land Use Planning Handbook* (Caltrans 2011). The purpose of the *California Airport Land Use Planning Handbook* is to provide guidance for conducting airport land use compatibility planning. This handbook includes a section related to noise and states, "The basic strategy for achieving noise compatibility in the vicinity of an airport is to prevent or limit

development of land uses that are particularly sensitive to noise. Common land use strategies are ones that either involve few people (especially people engaged in noise-sensitive activities) or generate significant noise levels themselves (such as other transportation facilities or some industrial uses)."

Regional and Local

San Joaquin County Airport Land Use Compatibility Plan (ALUCP)

The Airport Land Use Compatibility Plan (ALUCP) was adopted by SJCOG in 2009 and to satisfy the state's aviation law requirements. The ALUCP provides for the orderly growth of each public use airport over a 20-year span and minimizes land use conflicts over height and noise with the surrounding area. The ALUCP includes building height restrictions, specify allowable land uses, and determine building standards within all airports within the County are required to be consistent with the measures set forth in the ALUCP.

City and County General Plans

To identify, appraise, and remedy noise problems in local communities, the County and each city in the County 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).

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.

Local Vibration Regulations

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.

4.13.2 Impact Analysis

a. Methodology and Significance Thresholds

The analysis of noise impacts considers the effects of both temporary construction-related noise and long-term noise associated with proposed transportation system improvements. Temporary construction noise was estimated based upon levels presented in the FTA *Transit Noise and Vibration Impact Assessment*. Long-term traffic-related noise was estimated using a modification of the Federal Highway Traffic Noise Model (TNM).

Appendix G of the State CEQA Guideline identifies the following criteria for determining whether a project's impacts would have a significant impact related to noise:

1. 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;
2. Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels;
3. A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project;
4. A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.
5. For a project located in 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, exposure of people residing or working in the project area to excessive noise levels; and/or
6. For a project within the vicinity of a private airstrip, exposure of people residing or working in the project area to excessive noise levels.

Thresholds 5 and 6 are discussed in Section 4.16, *Less than Significant Environmental Factors.* The following analysis of potential impacts includes an assessment of all applicable standards, including those established by local jurisdictions, counties, the State of California and federal agencies, where appropriate.

b. Project Impacts and Mitigation Measures

This section describes generalized impacts associated with some of the projects anticipated in the 2018 RTP/SCS. Due to the programmatic nature of the 2018 RTP/SCS, a precise, project-level analysis of the specific impacts associated with individual transportation and land use projects is not possible. In general, however, implementation of proposed transportation improvements and future projects under the land use scenario envisioned by the 2018 RTP/SCS could result in noise impacts as described in the following sections.

Threshold 1:	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
Threshold 3:	A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project
Threshold 4:	A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project

Impact N-1 CONSTRUCTION AND OPERATIONAL ACTIVITIES FROM THE PROPOSED TRANSPORTATION IMPROVEMENT PROJECTS AND THE LAND USE SCENARIO ENVISIONED IN THE 2018 RTP/SCS WOULD CREATE TEMPORARY AND PERMANENT NOISE LEVEL INCREASES THAT EXCEED APPLICABLE THRESHOLDS IN LOCATIONS THROUGHOUT THE SJCOG REGION. IMPACTS WOULD BE SIGNIFICANT AND UNAVOIDABLE.

Construction

The operation of equipment during the construction of roadway infrastructure, as well as infill development projects near transit and other land use development envisioned in the 2018 RTP/SCS, would result in temporary increases in noise in the immediate vicinity of individual construction sites. As shown in Table 38, average noise levels associated with the use of heavy equipment at construction sites can range from about 76 to 89 dBA at 50 feet from the source, depending upon the types of equipment in operation at any given time and the phase of construction. The highest noise levels generally occur during excavation and foundation development, which involve the use of equipment such as backhoes, bulldozers, shovels, and front-end loaders.

Table 38 Typical Construction Noise Levels (dBA)

Equipment	Typical Level 25 Feet from the Source	Typical Level 50 Feet from the Source	Typical Level 100 Feet from the Source	Typical Level 200 feet from the Source	Typical Level 800 Feet from the Source
Air Compressor	87	81	75	69	57
Backhoe	86	80	74	68	56
Concrete Mixer	91	85	79	73	61
Grader	91	85	79	73	61
Paver	95	89	83	77	65
Saw	82	76	70	64	52
Scraper	95	89	83	77	65
Truck	94	88	82	76	64

Source: Federal Transit Administration, Transit Noise and Vibration Impact Assessment, May 2006.

Noise generated by construction activity would be variable depending on the project and intensity of equipment used. Roadway widening and new roadway projects would likely require the operation of many pieces of heavy-duty equipment that generate high noise levels. Alternatively, pedestrian trail improvements would typically generate less noise, requiring minimal use of heavy equipment. However, there are instances where activities that typically generate lower noise levels could generate relatively high noise levels. For example, a pedestrian trail improvement may include bridge pilings or require heavy equipment to clear vegetation. This conservative analysis assesses construction noise based on the operation of heavy-duty equipment. Noise levels from point

sources such as construction sites typically attenuate at a rate of about six (6) dBA per doubling of distance. Therefore, areas within 800 feet of construction site within heavy-duty equipment may be exposed to noise levels exceeding 67 dBA. Mitigation is required to reduce impacts from construction-related noise to a less-than-significant level.

Operation

Overall traffic levels on highways and roadways in the SJCOG region are projected to increase as a result of regional growth through the year 2042 (refer to Section 4.14, *Transportation*). The 2018 RTP/SCS includes projects that would potentially increase traffic noise by increasing traffic volumes along and in the vicinity of affected facilities. Such projects include: construction of new interchanges, roadway widening, roadway extensions, new roadway construction, and improvements to roads that would allow increased traffic volumes. Roadway improvement projects would not in themselves introduce new traffic, but rather are intended to relieve current or projected future traffic congestion or unacceptable safety conditions. However, widening projects, roadway extensions, and new roadway construction would accommodate additional traffic volumes and/or relocate noise sources closer to receptors. In addition, the anticipated number of annual vehicle miles traveled (VMT) in 2042 would be increased from approximately 6.5 billion under existing conditions (2015) to approximately 8.5 billion VMT in 2042 under the 2018 RTP/SCS, an increase of approximately two billion VMT annually, or approximately 30.3 percent. As compared to the No Project scenario, VMT under the 2018 RTP/SCS would increase by approximately 140 million annually (1.7 percent). Although many areas along freeway and roadway corridors area at least partially shielded from traffic noise by topography, buildings, walls, and other barriers, an increase in VMT and new and extended roadways would result in higher traffic noise levels as compared to existing conditions. Mitigation is required to reduce noise impacts to sensitive receptors to less-than-significant levels.

The 2018 RTP/SCS includes airport improvements at the Stockton Metro Airport and the Tracy Municipal Airport. Proposed airport projects include runway improvements, pavement maintenance, reconstruction of aviation aprons, and reconstruction of runways and taxiways. Most of the proposed projects serve to improve or repair existing facilities and would not change aircraft activity and flight patterns and associated noise impacts. However, one project included in the 2018 RTP/SCS, the installation of a helicopter pad at the Tracy Municipal Airport, could potentially introduce an increase in helicopter traffic that could increase associated noise levels. Specific project details are not known at this time and thus the potential noise increase associated with increased helicopter traffic cannot be determined. Mitigation is necessary to reduce or minimize noise exposure impacts from aircraft operations.

The 2018 RTP/SCS also includes investments in passenger rail and train service, such as the construction of a double main track between Escalon and Stockton, construction of track connections and a new intercity passenger rail facility in Stockton, extension of existing services at various facilities, and maintenance activities at various facilities. The FTA has developed a screening procedure to identify locations where a rail project may cause a noise impact. The screening distances for requiring noise assessments for various types of projects are presented in Table 39.

Rail transit projects included in the 2018 RTP/SCS would be located in urban areas to facility ridership. Sensitive land uses would be located within proximity to new and expanded rail corridors, and would potentially be exposed to noise levels that exceed acceptable standards. Mitigation is necessary to reduce or minimize impacts from rail noise by requiring detailed project-specific assessments, and, if necessary, the identification and implementation of local mitigation measures.

The 2018 RTP/SCS also includes new or extended facilities that encourage more efficient intermodal transport using rail. The number of freight trains currently operating each day is dependent upon the demands of the industries using rail services and can vary greatly from day to day. While increases in freight rail transport would increase the number of freight trains, these trains would likely operate as-needed rather than on a fixed schedule. Therefore, noise levels and frequency of pass-by trips would continue to vary daily. Overall, however, an increase in train volumes would cause an increase in noise levels adjacent to rail corridors. Mitigation is required to reduce or minimize impacts from freight rail noise.

Table 39 Screening Distances for Noise Assessments – Rail Transit Projects

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

Source: Federal Transit Administration, Transit Noise and Vibration Impact Assessment, May 2006

Furthermore, the 2018 RTP/SCS includes projects to expand transit bus services, such as constructing improvements at existing transit centers, purchasing of replacement buses, fleet maintenance, and constructing bus stop improvements. Transit services along new routes may expose sensitive receptors to bus noise. The FTA has developed a screening procedure to identify locations where a bus project may cause a noise impact. The screening distances for requiring noise assessments for various types of projects are presented in Table 40.

Table 40 Screening Distances for Noise Assessments – Bus Transit Projects

Type of Project		Screening Distance (Feet)	
		Unobstructed	Intervening Buildings
Busway		500	250
BRT on Exclusive Roadway		200	100
Bus Facilities	Access Roads	100	50
	Transit Center	225	150
	Storage and Maintenance	350	225
	Park and Ride Lots with Buses	225	150

Source: Federal Transit Administration, Transit Noise and Vibration Impact Assessment, May 2006

Increase frequency of bus service along existing corridors would also increase noise exposure. However, the addition of local buses and shuttles is unlikely to increase noise by significant levels as bus routes would be in urban areas with high ambient noise levels. Overall, however, sensitive land uses would be located within close proximity to new bus activity, and would potentially be exposed to noise levels that exceed acceptable standards. Mitigation is therefore required to reduce or minimize impacts from bus noise by requiring detailed project-specific assessments, and, if necessary, local mitigation measures.

In addition, the 2018 RTP/SCS is based on a land use and transportation scenario which defines a pattern of future growth and transportation system investment for the region emphasizing an infill approach near transit and other transportation facilities such as bicycle networks. Population and job growth is allocated principally within existing urban areas near public transit and existing transit corridors. New noise-sensitive development in infill areas could be exposed to noise levels exceeding the 67 dBA standard for residential land uses. Potential sources of noise exposure include traffic, rail and/or bus operations, commercial activity, and industrial activity. New development in infill areas near transit may also expose existing noise-sensitive uses to noise levels exceeding local noise thresholds. Mitigation would be required to reduce impacts to a less-than-significant level. . Even with the inclusion of these measures, noise impacts under N-1 would be potentially significant.

Mitigation Measures

For transportation projects under their jurisdiction, SJCOG shall implement, and transportation project sponsor agencies can and should implement, the following mitigation measure developed for the 2018 RTP/SCS program. Municipalities in the SJCOG region can and should implement this measure, where relevant to projects implementing the 2018 RTP/SCS.

N-1 Noise Reduction Practices

Project sponsors shall assess and mitigate to the extent feasible short- and long-term noise impacts in accordance with applicable regulations and to implement site-specific noise reduction measures. Reduction measures include, but are not limited to, the following:

- Equipment and trucks used for project construction shall 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 shall 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 dB(A). External jackets on the tools themselves should be used, if such jackets are commercially available and this could achieve a reduction of 5 dB(A). 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 shall 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.
- 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.
- 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.
- Use of portable barriers in the vicinity of sensitive receptors during construction.
- Projects that require pile driving or other construction noise above 90 dB(A) in proximity to sensitive receptors, should reduce potential pier drilling, pile driving and/or other extreme noise generating construction impacts greater than 90dB(A), a set of site-specific noise attenuation measures should be completed under the supervision of a qualified acoustical consultant.
- 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.
- Monitor the effectiveness of noise attenuation measures by taking noise measurements.
- Strategically place material stockpiles between the operation and the affected dwelling to minimize noise generated from any rock-crushing or screening operations performed within 3,000 feet of any occupied residence.
- 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.

- Construct sound reducing barriers between noise sources and noise-sensitive land uses.
- 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.
- Maximize the distance of new route alignments from sensitive receptors.
- Locate transit-related passenger stations, central maintenance facilities, decentralized maintenance facilities, and electric substations away from sensitive receptors to the maximum extent feasible.
- Airport projects shall conform and implement all applicable noise reduction strategies as listed in their applicable Airport Land Use Compatibility Plan.

Significance After Mitigation

Implementation of the above mitigation measure could reduce potential impacts to a less than significant level. However, even with implementation of Mitigation Measure N-1, noise impacts from buildout of the 2018 RTP/SCS may continue to be excessive. Impacts would remain significant and unavoidable. No additional mitigation measures to reduce this impact to less-than-significant levels are feasible.

Threshold 2: Expose people or generate excessive groundborne vibration

Impact N-2 CONSTRUCTION AND OPERATIONAL ACTIVITIES, AS WELL AS INCREASED TRANSIT ACTIVITY FROM THE PROPOSED TRANSPORTATION IMPROVEMENT PROJECTS AND THE LAND USE SCENARIO ENVISIONED IN THE 2018 RTP/SCS, WOULD GENERATE SUBSTANTIAL VIBRATION LEVELS THROUGHOUT THE SJCOG REGION. IMPACTS WOULD BE SIGNIFICANT AND UNAVOIDABLE.

Construction and Operation

Noise and vibration impacts from the construction and operation of transportation projects and development of the surrounding area could generate excessive groundborne vibration and noise levels. 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.

Typical project construction activities, such as the use of jackhammers, other high-power or vibratory tools, compactors, and tracked equipment, could also generate substantial vibration (i.e., greater than 0.2 inch 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 the least potential to affect nearby properties. Thus, perceptible vibration can be kept to a minimum and not result in human annoyance or structural damage.

Specific construction activities such as pile driving, could 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 could be high enough to be perceptible within 100 feet and may be high enough to damage existing structures within 50 feet.

In addition to pile driving activities, 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).

Transit

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 generate vibration amplitudes high enough to cause structural or cosmetic damage, except in rare cases (e.g., where heavy truck traffic passes near fragile older buildings). Heavy trucks traveling over potholes or other pavement irregularities can cause vibration high enough to result in complaints from nearby residents. These conditions are commonly addressed by smoothing the roadway surface. Based on vibration measurements throughout California by Caltrans, worst-case traffic vibrations were shown to drop below the threshold of perception at distances of 150 feet or greater (Caltrans 2013). Given that sensitive receptors are located within 150 feet of transportation facilities within the SJCOG region, and that 2018 RTP/SCS transportation projects include roadway expansion and construction of new highways, significant impacts related to vibration associated with truck traffic could occur.

Rail activity is also a source of vibration. Caltrans conducted measurements of vibration levels associated with train activity throughout the State and found a peak vibration level of 0.36 inches per second PPV at ten feet from the track (Caltrans 2004). Based on this vibration level reference, vibrations from train activity drop below the threshold of perception at distances greater than 250 feet. The 2018 RTP/SCS includes the development of additional railway facilities along existing tracks, extension of existing railways and construction of new rail lines, as well as the purchasing of new rail cars. This would potentially increase rail activity along existing lines and also introduce rail activity to new areas. These changes may expose nearby sensitive receptors and fragile buildings to a substantial increase in vibration levels relative to the existing condition. Impacts would be significant because excessive groundborne vibration or groundborne noise levels could be generated. Mitigation measures are available to reduce vibration noise to the extent feasible, and are discussed below. Even with the inclusion of these measures, noise impacts under N-2 would be potentially significant.

Mitigation Measures

For transportation projects under their jurisdiction, SJCOG shall implement, and transportation project sponsor agencies, can and should implement the following mitigation measure developed for the 2018 RTP/SCS program. Municipalities in the SJCOG region can and should implement this measure, where relevant to projects implementing the 2018 RTP/SCS.

N-2 Vibration Mitigation for Transportation Projects

Project sponsors of 2018 RTP/SCS projects shall comply with all applicable local vibration and groundborne noise standards, or in the absence of such local standards, comply with guidance provided by the FTA in *Transit Noise and Vibration Impact Assessment* (FTA 2006) to asses impacts to buildings and sensitive receptors and reduce vibration and groundborne noise. FTA recommended thresholds shall be used except in areas where local standards for groundborne noise and vibration have been established. Methods that shall be implemented to reduce vibration and groundborne noise impacts include, but are not limited to:

- Rail Traffic
  - Maximizing the distance between tracks and sensitive uses
  - Conducting rail grinding on a regular basis to keep tracks smooth
  - Conducting wheel truing to re-contour wheels to provide a smooth running surface and removing wheel flats
  - Providing special track support systems such as flating slabs, resiliently supported ties, high-resilience fasteners and ballast mats
  - Implementing operational changes such as limiting train speed and reducing nighttime operations
- Bus and Truck Traffic
  - Constructing noise barriers
  - Use noise reducing tires and wheel construction on bus wheels
  - Use vehicle skirts (partial enclosure around each wheel with absorptive treatment) on freight vehicle wheels

Significance After Mitigation

Implementation of the above mitigation measure could reduce potential impacts to a less than significant level. However, even with implementation of Mitigation Measure N-2, vibration from buildout of the 2018 RTP/SCS may continue to be excessive. Impacts would remain significant and unavoidable. No additional mitigation measures to reduce this impact to less-than-significant levels are feasible.

c. Cumulative Impacts

The 2018 RTP/SCS includes transportation projects and land use strategies that would shape the region over the next 25 years. These changes would include the extension of transportation and related infrastructure that would result in additional noise sources. Planned projects would connect with projects outside the region facilitating and potentially inducing construction of transportation infrastructure outside the region. This additional infrastructure outside the County could lead to development outside the region. Although construction noise and vibration impacts are generally

site specific, to the extent that the 2018 RTP/SCS would induce growth outside the region, it could result in construction noise outside the region. The 2018 RTP/SCS could facilitate movement in other regions, which would increase noise levels outside the County. The proposed 2018 RTP/SCS encompasses all development (both transportation and land use changes) that would occur in the region through 2042. The 2018 RTP/SCS could contribute to a cumulatively considerable increase in noise and vibration outside the region as a result of increased activity resulting from the RTP (increased travel outside the region and/or induced growth outside the region). This activity would include aircraft overflights, railroads, as well as freeway, arterial and transit noise. As a result, the 2018 RTP/SCS could result in a cumulatively considerable increase in noise and vibration.