Chapter 13—Noise and Vibration

13.1 Introduction

This chapter describes the existing conditions (environmental and regulatory) relevant to noise and vibration for the 2020 Metropolitan Transportation Plan/Sustainable Communities Strategy (proposed MTP/SCS). Where necessary and feasible, mitigation measures are identified to reduce these impacts.

The information presented in this EIR chapter is based on review of existing and available information and is regional in scope. Data, analysis, and findings provided in this chapter were considered and prepared at a programmatic level. Noise impacts for people residing or working within an airport land use plan or within two miles of a public or public use airport are addressed in Chapter 10 – Hazards, Hazardous Materials, and Wildfire.

No comments addressing the noise or vibration impacts of the proposed MTP/SCS were received in response to the Notice of Preparation.

13.1.1 Noise Background

Describing Noise

Sound is defined as any pressure variation in air that the human ear can detect. If the pressure variations occur frequently enough (at least 20 times per second), they can be heard and hence are called sound. The number of pressure variations per second is called the frequency of sound, and is expressed as cycles per second, called hertz (Hz). Noise is often described as unwanted sound, and thus is a subjective reaction to characteristics of a physical phenomenon.

The decibel scale is used to measure and describe sound. The decibel (dB) scale uses the hearing threshold of 20 micropascals as a point of reference, defined as 0 dB. Other sound pressures are then compared to the reference pressure, and converted to a logarithmic scale to keep the numbers in a practical range. Another useful aspect of the decibel scale is that changes in levels correspond closely to human perception of relative loudness.

The perceived loudness of sounds is dependent upon many factors, including sound pressure level and frequency content. However, within the usual range of environmental noise, levels can be approximated by weighting the frequency response of a sound-level measurement device (called a sound level meter) by means of the standardized A-weighting network. There is a strong correlation between A-weighted sound levels (expressed as sound levels in dB) and community response to noise. For this reason, the A-weighted sound pressure level (dBA) has become the standard tool of environmental noise assessment. Because dBA is the scale used to assess noise impacts to humans, all references to dBs in this document are assumed to be representative of A-weighted sound pressure level.

Because noise is measured on a logarithmic scale, two sources of equal noise added together result in an increase of 3 dB. For example, 70 dB plus 70 dB yields a total noise level of 73 dB. An increase of 3 dB is also notable because changes of 3dB or more are perceptible to the human ear, while changes of less than 3 dB are only perceptible in laboratory settings. Figure 13-1 illustrates the typical dB associated with common sources.
Community noise is commonly described in terms of the ambient noise level, which is defined as the all-encompassing noise level associated with a given noise environment. It is the composite of sound from many sources in all directions with no particular sound being dominant. A common measure used to quantify the ambient noise level is the equivalent sound level (Leq), which corresponds to a steady-state sound level containing the same total energy as a time-varying signal over a given time period (usually one hour).
Noise in our daily environment fluctuates over time. Various noise descriptors have been developed to describe time-varying noise levels. The following are the noise descriptors used throughout this section.

- **Day-Night Average Sound Level (L\textsubscript{dn}):** L\textsubscript{dn} is based upon the average hourly L\textsubscript{eq} over a 24-hour day, with a 10-decibel weighting applied to nighttime (10:00 p.m. to 7:00 a.m.) L\textsubscript{eq} values. The nighttime penalty is based upon the assumption that people react to nighttime noise exposures as though they were twice as loud as daytime exposures.

- **Community Noise Equivalent Level (CNEL):** CNEL, like L\textsubscript{dn}, is based upon the weighted average hourly L\textsubscript{eq} over a 24-hour day, except that an additional 5-decibel penalty is applied to evening (7:00 p.m. to 10:00 p.m.) hourly L\textsubscript{eq} values. CNEL was developed for the California Airport Noise Regulations, and is most commonly used for airport and aircraft noise assessment. For this reason, the Ldn descriptor, rather than CNEL, is used for the assessment of transportation noise levels in the plan area of the proposed MTP/SCS.

- **Equivalent Noise Level (L\textsubscript{eq}):** L\textsubscript{eq} is the average noise level of a given period of time, typically one hour. It does not include any weighting factors.

- **Maximum Noise Level (L\textsubscript{max}):** L\textsubscript{max} is the highest sound pressure level measured during a given interval of time, typically one hour.

- **Noise Level Exceeded a Percentage of the Hour (L\textsubscript{n}):** L\textsubscript{n} represents the level exceeded “n” percent of the hour. For example, L\textsubscript{90} represents the level, which is exceeded 90 percent of the hour, whereas L\textsubscript{10} represents the noise level exceeded 10 percent of the hour.

Noise level standards provided in terms of L\textsubscript{n} are based on the duration of time during an hour in which the noise is being generated. More specifically, higher noise levels are allowed provided the noise is generated for shorter durations. While L\textsubscript{n}-based standards provide a more accurate representation of public reaction to non-transportation noise than the use of L\textsubscript{eq} and L\textsubscript{max} alone, the L\textsubscript{n} value for a given noise source can be very complex to determine, particularly when other noise sources are present.

**Effects of Noise on People**

Excessive noise in a community has often been cited as a health problem, not in terms of actual damage such as hearing impairment, but in terms of inhibiting general well-being and contributing to undue stress and annoyance. The health effects of excessive noise in the community arise from interference with human activities such as sleep, speech, recreation, and tasks demanding concentration or coordination. When community noise interferes with human activities or contributes to stress, public annoyance with the noise source increases, and the acceptability of the environment for people decreases. This decrease in acceptability and the threat to public well-being are the basis for land-use planning policies designed to prevent exposure of communities to excessive levels of noise.

Some land uses are considered more sensitive to ambient noise levels than others due to the amount of noise exposure (in terms of both exposure duration and insulation from noise) and the types of activities typically involved. Furthermore, it is important to delineate where the noise sensitivity exists for various land uses. For example, residential uses have noise sensitivity at both outdoor activity areas and interior spaces of the residence. School playgrounds are often noise-generating...
and, therefore, not considered noise sensitive. Interior spaces of school classrooms, however, are considered sensitive. Exterior areas of passive recreation parks are considered sensitive, whereas sensitivity of hospitals, libraries, and auditoriums occurs within the building (exterior areas of these uses are frequently parking lots). The noise-sensitive areas of residences, motels and hotels, schools, libraries, churches, hospitals, nursing homes, auditoriums, and parks are generally more sensitive to noise than are commercial and industrial land uses. Increases in noise near these sensitive receptors are more likely to cause an adverse community response.

**Noise Mitigation**

Noise has three basic elements: the noise source, a transmission path, and a receiver. The appropriate acoustical treatment for a given project should consider the nature of the noise source and the sensitivity of the receiver. Noise should be defined in terms of appropriate criteria (i.e., $L_{dn}$, $L_{eq}$, or $L_{max}$), the location of the sensitive receiver (i.e., inside or outside), and when the noise occurs (i.e., daytime, nighttime, or 24-hour average). Noise control techniques should be selected to provide an acceptable noise environment for the receiving property while remaining consistent with local aesthetic standards and practical structural and economic limits. Fundamental noise control techniques are described below.

**Use of Setbacks**

Noise exposure may be reduced by increasing the distance between the noise source and receiving use. The available noise attenuation from this technique is limited by the characteristics of the noise source, but is generally about 4.5 dB per doubling of distance from a roadway noise source, and approximately 6 dB per doubling of distance from fixed, or non-transportation noise source.

**Use of Barriers**

Shielding by barriers can be obtained by placing walls, berms or other structures, such as buildings, between the noise source and the receiver. The effectiveness of a barrier depends upon blocking line-of-sight between the source and receiver, and is improved with increasing the distance the sound must travel to pass over the barrier as compared to a straight line from source to receiver. The difference between the distance over a barrier and a straight line between source and receiver is called the “path length difference,” and is the basis for calculating barrier noise reduction.

Barrier effectiveness depends upon the relative heights of the source, barrier and receiver. In general, barriers are most effective when placed close to either the receiver or the source. An intermediate barrier location yields a smaller path-length-difference for a given increase in barrier height than does a location closer to either source or receiver.

For maximum effectiveness, barriers must be continuous and relatively airtight along their length and height. To ensure that sound transmission through the barrier is insignificant, barrier mass should be about 3-4 pounds (lbs) per square foot, although a lesser mass may be acceptable if the barrier material provides sufficient transmission loss. Satisfaction of the above criteria requires substantial and well-fitted barrier materials, placed to intercept line of sight to all significant noise sources. Earth, in the form of berms or the face of a depressed area, is also an effective barrier material.
There are practical limits to the noise reduction provided by barriers. For traffic noise, a 5- to 10-dB noise reduction may often be reasonably attained. A 15-dB noise reduction is usually difficult but sometimes possible to attain, but a 20-dB noise reduction is extremely difficult to achieve. Barriers usually are provided in the form of walls, berms, or berm/wall combinations. The use of an earth berm in lieu of a solid wall may provide additional attenuation over that attained by a solid wall alone due to the absorption provided by the earth. Berm/wall combinations offer slightly better acoustical performance than solid walls, and are often preferred for aesthetic reasons over solid barrier walls alone.

Noise barriers currently exist or are planned in many areas of the plan area of the proposed MTP/SCS that are adjacent to state highways, major arterial roadways, railroad tracks, and/or industries. In cases of new residential development adjacent to a major noise source in the plan area of the proposed MTP/SCS, the responsibility for noise mitigation is typically placed on the project developer. In such cases, noise barriers are commonly constructed within the project confines, rather than within public right-of-way. In some cases, local jurisdictions and the California Department of Transportation (Caltrans) have built barriers as part of roadway improvement projects or barrier retrofit programs.

Site Design

Buildings can be placed on a project site to shield other structures or areas, to remove them from noise-impacted areas, and to prevent an increase in noise level caused by reflections. The use of one building to shield another can significantly reduce overall project noise control costs, particularly if the shielding structure is insensitive to noise. As an example, carports or garages can be used to form or complement a barrier shielding adjacent dwellings or an outdoor activity area. Similarly, one residential unit can be placed to shield another so that noise reduction measures are needed only for the building closest to the noise source. Placement of outdoor activity areas within the shielded portion of a building complex, such as a central courtyard, can be an effective method of providing a quiet retreat in an otherwise noisy environment. Patios or balconies should be placed on the side of a building opposite the noise source and “wing walls” can be added to buildings or patios to help shield sensitive uses.

Another useful option in site design is the placement of relatively insensitive land uses, such as commercial uses, between the noise source and a more sensitive portion of the project. Examples include development of a commercial strip along a busy arterial to block noise affecting a residential area. If existing topography or development adjacent to the project site provides some shielding, as in the case of an existing berm, knoll, or building, sensitive structures or activity areas may be placed behind those features to reduce noise control requirements.

Building Design

When structures have been located to provide maximum noise reduction by site design or shielding, noise reduction measures may still be required to achieve an acceptable interior noise environment. The cost of such measures may be reduced by placement of interior dwelling unit features. For example, bedrooms, living rooms, family rooms, and other noise-sensitive portions of a dwelling can be located on the side of the unit farthest from the noise source.
Bathrooms, closets, stairwells, and food preparation areas are relatively insensitive to exterior noise sources and can be placed on the noisy side of a unit. When such techniques are employed, noise reduction requirements for the building facade can be significantly reduced, although the architect must take care to isolate the noise-impacted areas by the use of partitions or doors.

**Noise Reduction by Building Facades**

When interior noise levels are of concern in a noisy environment, noise reduction may be obtained through acoustical design of building facades. Standard residential construction practices provide 10- to 15-dB noise reduction for building facades with open windows, and approximately 25- to 30- dB noise reduction when windows are closed. Therefore, a 25-dB exterior-to-interior noise reduction can be obtained by the requirement that building design include adequate ventilation systems, allowing windows on a noise-impacted facade to remain closed under any weather condition.

Where greater noise reduction is required, acoustical treatment of the building facade is necessary. The greatest improvement in building façade noise reduction can typically be realized through specification of upgraded windows with higher Sound Transmission Class (STC) ratings.

Noise transmitted through walls can be reduced by increasing wall mass (using stucco or brick in lieu of wood siding), isolating wall members by the use of double- or staggered-stud walls, or mounting interior walls on resilient channels. Noise control for exterior doorways is provided by reducing door area, using solid-core doors, and by acoustically sealing door perimeters with suitable gaskets. Roof treatments may include the use of plywood sheathing under roofing materials.

Whichever noise control techniques are employed, it is essential that attention be given to installation of weather-stripping and caulking of joints. Openings for attic or subfloor ventilation may also require acoustical treatment, while tight-fitting fireplace dampers and glass doors may be needed in aircraft noise-impacted areas.

**Use of Vegetation**

Trees and other vegetation are often thought to provide significant noise attenuation. However, approximately 100 feet of dense foliage (so that no visual path extends through the foliage) is required to achieve a 5-dB attenuation of traffic noise. Therefore, the use of vegetation as a noise barrier should not be considered a practical method of noise control unless large tracts of dense foliage are part of the existing landscape.

Vegetation can be used to acoustically “soften” intervening ground between a noise source and receiver, increasing ground absorption of sound and thus increasing the attenuation of sound with distance. Planting of trees and shrubs is also of aesthetic and psychological value, and may reduce adverse public reaction to a noise source by removing the source from view, even though noise levels will be largely unaffected.

In summary, the effects of vegetation upon noise transmission are minor, and are primarily limited to increased absorption of high frequency sounds and to reducing adverse public reaction to the noise by providing aesthetic benefits.
Noise-Reducing Paving Materials (i.e. Gap Graded and Rubberized Asphalt)

Studies conducted for the Sacramento County Planning and Environmental Review Department and Transportation Department to determine the noise reduction provided by rubberized asphalt have been completed in recent years. Those studies indicate that the use of rubberized asphalt on county roadways resulted in an average traffic noise level reduction of approximately 4 dB over that provided by conventional asphalt.

13.1.2 Vibration Background

According to the Federal Transit Administration (FTA) Noise and Vibration Impact Assessment Guidelines (FTA-VA-90-06), groundborne vibration can be a serious concern for nearby neighbors of a transit system route or maintenance facility, causing buildings to shake and rumbling sounds to be heard. Groundborne vibration caused by other sources (i.e., heavy industry, construction, agriculture, mineral extraction) can also be a source of concern for nearby sensitive receptors. In contrast to airborne noise, groundborne 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 groundborne vibration are trains, buses on rough roads, and construction activities such as blasting, pile-driving and operating heavy earth-moving equipment.

The effects of groundborne vibration include perceptible movement of building floors, rattling of windows, shaking of items on shelves or hanging on walls, and rumbling sounds. Rumbling is the noise radiated from the motion of the room surfaces. In essence, the room surfaces act like a giant loudspeaker causing what is called groundborne noise.

Groundborne vibration is rarely annoying to people who are outdoors. Although the motion of the ground may be perceived, without the effects associated with the shaking of a building, the motion does not provoke the same adverse human reaction. In addition, the rumble noise that usually accompanies the building vibration is perceptible only inside buildings. In extreme cases, the vibration can cause damage to buildings. Building damage is not a factor for normal transportation projects, with the occasional exception of blasting and pile-driving during construction. Annoyance from vibration often occurs when the vibration exceeds the threshold of perception by only a small margin. A vibration level that causes annoyance will typically be well below the damage threshold for normal buildings.

Vibration can be described in terms of acceleration, velocity, or displacement. An industry-standard practice is to monitor vibration measures in terms of peak particle velocities (inches/second). Table 13-1 shows expected responses to different levels of groundborne vibration.
### Table 13-1
**General Human and Structural Responses to Vibration Levels**

<table>
<thead>
<tr>
<th>Response</th>
<th>Peak Vibration Threshold (in/sec ppv)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structural damage to commercial structures</td>
<td>0.5</td>
</tr>
<tr>
<td>Structural damage to new residential structures</td>
<td>0.5</td>
</tr>
<tr>
<td>Structural damage to older residential structures</td>
<td>0.3</td>
</tr>
<tr>
<td>Distinctly perceptible to humans</td>
<td>0.04</td>
</tr>
<tr>
<td>Strongly perceptible to humans</td>
<td>0.1</td>
</tr>
</tbody>
</table>

Notes: in/sec ppv = inches per second peak particle velocity

¹ Values shown for continuous vibration events.
Source: Caltrans 2013

### 13.2 Environmental Setting

The noise environment in the plan area of the proposed MTP/SCS comprises two major categories of noise sources: transportation and non-transportation. Transportation noise sources include surface traffic on public roadways, railroad line operations, and aircrafts in flight. Non-transportation (or fixed) noise sources commonly consist of commercial, industrial, and active outdoor recreation activities, railroad yard activities, small mechanical devices (i.e., lawnmowers, leaf blowers, air conditioners, radios), and other non-transportation noise sources not included in the traffic, railroad, and aircraft category.

#### 13.2.1 Traffic Noise

The ambient noise environment in the plan area of the proposed MTP/SCS is defined by a wide variety of noise sources. The most pervasive source of noise in the region is traffic noise associated with use of thousands of miles of roadways throughout the region. Traffic noise exposure is mainly a function of the number of vehicles on a given roadway per day, the speed of those vehicles, the percentage of medium and heavy trucks in the traffic volume, and the receiver’s proximity to the roadway. Every vehicle passage on every roadway in the region radiates noise.

The existing traffic noise environment in the plan area of the proposed MTP/SCS has been characterized by using traffic noise modeling. Traffic noise modeling was conducted consistent with the Federal Highway Administration (FHWA) Traffic Noise Model (TNM) Version 2.5 using daily traffic volumes on major roadways in the plan area of the proposed MTP/SCS to characterize the traffic noise level at a fixed distance of 150 feet from each roadway. Noise analyses was performed on nearly 660 roadway locations throughout the plan area of the proposed MTP/SCS. The results indicated that existing (2016) ambient noise levels in the plan area of the proposed MTP/SCS vary between 36.0 dB and 84.5 dB, depending on the location, traffic volume, and Community Type.

#### 13.2.2 Rail Noise

The region is affected by noise from freight and passenger railroad operations and light-rail train operations. These operations are intermittent, and the tracks are dispersed throughout the region. These operations can generate considerable noise levels in the immediate vicinity of the tracks during train passages. All of these operations contribute to the overall ambient noise environment in the plan area of the proposed MTP/SCS.
13.2.3 Aircraft Noise

The plan area of the proposed MTP/SCS has many airports, including public, private, and military airports. In addition to the numerous daily aircraft operations that originate and terminate at these airports, aircraft travel emanating from other locations also frequently fly over the region. All of these operations contribute to the overall ambient noise environment in the plan area of the proposed MTP/SCS. The intensity of aircraft noise exposure depends on proximity to the aircraft flight path; the type, speed, and altitude of the airplane; and atmospheric conditions. The farther away the noise source, the more weather affects the sound propagation from source to receiver.

A map of airport noise contours provided in terms of CNEL is shown in Figure 13-2. Because noise levels described in terms of CNEL contain penalties for sound levels occurring during evening hours (5-dB penalty) and sound generated during nighttime hours (10-dB penalty), the CNEL contours reflect the greater sensitivity to noise during those evening and nighttime hours. For more information about airports in the region, see Chapter 10 – Hazards, Hazardous Materials, and Wildfire.

13.2.4 Construction Noise

The projected land use pattern and planned transportation improvements within the plan area of the proposed MTP/SCS would result in construction activities that create new sources of short-term noise. Construction typically occurs in discrete steps, each of which has a distinctive mix of equipment and, consequently, distinctive noise characteristics. These various sequential phases change the character of the noise generated on each site and, therefore, the noise levels surrounding these sites as construction progresses. Construction activities typically involve several vehicles and equipment operating at various times within a fixed area. Construction noise sources can be both stationary and mobile. Table 13-2 lists typical construction noise levels for various types of construction equipment.
Figure 13-2
Airport Noise Contour
### Table 13-2
Typical Construction Equipment Noise

<table>
<thead>
<tr>
<th>Equipment Description</th>
<th>Maximum Noise Level at 50 feet, dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Compressor</td>
<td>80</td>
</tr>
<tr>
<td>Backhoe</td>
<td>80</td>
</tr>
<tr>
<td>Ballast Equalizer</td>
<td>82</td>
</tr>
<tr>
<td>Ballast Tamper</td>
<td>83</td>
</tr>
<tr>
<td>Compactor</td>
<td>82</td>
</tr>
<tr>
<td>Concrete Mixer</td>
<td>85</td>
</tr>
<tr>
<td>Concrete Pump</td>
<td>82</td>
</tr>
<tr>
<td>Concrete Vibrator</td>
<td>76</td>
</tr>
<tr>
<td>Crane, Derrick</td>
<td>88</td>
</tr>
<tr>
<td>Crane, Mobile</td>
<td>83</td>
</tr>
<tr>
<td>Dozer</td>
<td>85</td>
</tr>
<tr>
<td>Generator</td>
<td>82</td>
</tr>
<tr>
<td>Grader</td>
<td>85</td>
</tr>
<tr>
<td>Impact Wrench</td>
<td>85</td>
</tr>
<tr>
<td>Jack Hammer</td>
<td>88</td>
</tr>
<tr>
<td>Loader</td>
<td>80</td>
</tr>
<tr>
<td>Paver</td>
<td>85</td>
</tr>
<tr>
<td>Pile-driver (Impact)</td>
<td>101</td>
</tr>
<tr>
<td>Pile-driver (Sonic)</td>
<td>95</td>
</tr>
<tr>
<td>Pneumatic Tool</td>
<td>85</td>
</tr>
<tr>
<td>Pump</td>
<td>77</td>
</tr>
<tr>
<td>Rail Saw</td>
<td>90</td>
</tr>
<tr>
<td>Rock Drill</td>
<td>95</td>
</tr>
<tr>
<td>Roller</td>
<td>85</td>
</tr>
<tr>
<td>Saw</td>
<td>76</td>
</tr>
<tr>
<td>Scarifier</td>
<td>83</td>
</tr>
<tr>
<td>Scraper</td>
<td>85</td>
</tr>
<tr>
<td>Shovel</td>
<td>82</td>
</tr>
<tr>
<td>Spike Driver</td>
<td>77</td>
</tr>
<tr>
<td>Tie Cutter</td>
<td>84</td>
</tr>
<tr>
<td>Tie Handler</td>
<td>80</td>
</tr>
<tr>
<td>Tie Inserter</td>
<td>85</td>
</tr>
<tr>
<td>Truck</td>
<td>84</td>
</tr>
</tbody>
</table>

Notes: dB = A-weighted decibel
Source: FTA 2018

#### 13.2.1 Industry and Other Non-Transportation Noise

A wide variety of industrial and other non-transportation noise sources are located in the plan area of the proposed MTP/SCS, including manufacturing operations, power plants, food packaging and processing facilities, lumber mills, aggregate mining and processing plants, race tracks, shooting ranges, amphitheaters, loading docks, and car washes. Noise generated by these sources varies widely, but in some cases can be a potentially significant contributor to the local ambient noise environment. Although non-transportation noise sources can define the ambient noise environment...
within a given distance to the noise source, the overall ambient noise environment is defined primarily by traffic. This is because traffic noise is pervasive throughout the plan area of the proposed MTP/SCS, whereas noise generated by an individual industry only affects a localized area in the immediate vicinity of the industrial noise source.

Non-transportation noise levels are difficult to quantify at the regional level, as noise levels can vary dramatically from location to location, even in the same Community Type. The types of land uses, the distance between noise sources, and the presence or absence of barriers can all greatly affect noise levels in a given area. Typically, ambient noise levels in a quiet residential area with light background traffic noise will range from 50 dB to 60 dB. In busy central business districts and mixed-use areas, ambient noise levels in the range of 60 to 70 or more dB are not uncommon. However, higher noise levels in mixed-use areas are becoming more acceptable as cities and counties strive to provide housing options in closer proximity to busy urban centers. At locations near freeways, ambient noise levels can reach 75 dB or higher. Similarly, industrial activity also has a widely varying range of noise outputs, depending on the type of activity taking place and whether the activity is indoors or outdoors.

### 13.3 Regulatory Setting

#### 13.3.1 Federal Regulations

**The Federal Aviation Act of 1958 – Federal Aviation Administration**

The Federal Aviation Administration (FAA), which was created under the Federal Aviation Act, has authority to regulate and oversee all aspects of American civil aviation. FAA pursues a program of aircraft noise control in cooperation with the aviation community. Noise control measures include noise reduction at the source, i.e., development and adoption of quieter aircraft, soundproofing and buyouts of buildings near airports, operational flight control measures, and land use planning strategies. FAA defines significant aircraft noise exposure as being 65 dB L_{eq}.

**Urban Mass Transportation Act of 1964 – Federal Transit Administration**

FTA is an agency within the United States Department of Transportation (DOT) established by the Urban Mass Transportation Act, which created the Urban Mass Transportation Administration. The agency was charged with providing federal assistance for mass transit projects and renamed the FTA in 1991.

FTA procedures for the evaluation of noise from transit projects are specified in the document titled, “Transit Noise and Vibration Impact Assessment” (FTA 2018). The FTA Noise Impact Criteria categorizes noise-sensitive land uses into the following categories:

- Category 1 includes buildings or parks where quiet is an essential element of their purpose.
- Category 2 includes residences and buildings where people normally sleep. This includes residences, hospitals, and hotels where nighttime sensitivity is assumed to be of utmost importance.
- Category 3 includes institutional land uses with primarily daytime and evening use. This category includes schools, libraries, churches, and active parks.
L_{dn} is used to characterize noise exposure for residential areas (Category 2). For other noise-sensitive land uses, such as outdoor amphitheaters and school buildings (Categories 1 and 3), the maximum 1-hour L_{eq} during the facility’s operating period is used. Noise impacts are identified based on absolute predicted noise levels and increases in noise associated with the project.

DEPARTMENT OF TRANSPORTATION ACT OF 1966 – FEDERAL RAILROAD ADMINISTRATION

The Federal Railroad Administration (FRA) was created by the Department of Transportation Act to promulgate and enforce rail safety regulations, administer railroad assistance programs, conduct research and development in support of improved railroad safety and national rail transportation policy, and consolidate government support of rail transportation activities. FRA noise standards are the same as those specified by the FTA.

FEDERAL HIGHWAY ADMINISTRATION, 1966

FHWA regulations (23 Code of Federal Regulations [CFR] Section 772) specify procedures for evaluating noise impacts associated with federally-funded highway projects and for determining whether these impacts are sufficient to justify funding noise abatement actions. The FHWA noise abatement criteria are based on worst hourly L_{eq} sound levels, not L_{dn} or CNEL values. The worst-hour one-hour L_{eq} noise abatement criteria are listed in Table 13-3.

<table>
<thead>
<tr>
<th>Activity Category</th>
<th>Activity L_{eq}[h]</th>
<th>Evaluation Location</th>
<th>Description of Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>57</td>
<td>Exterior</td>
<td>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.</td>
</tr>
<tr>
<td>B</td>
<td>67</td>
<td>Exterior</td>
<td>Residential.</td>
</tr>
<tr>
<td>C</td>
<td>67</td>
<td>Exterior</td>
<td>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.</td>
</tr>
<tr>
<td>D</td>
<td>52</td>
<td>Interior</td>
<td>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.</td>
</tr>
<tr>
<td>E</td>
<td>72</td>
<td>Exterior</td>
<td>Hotels, motels, offices, restaurants/bars, and other developed lands, properties, or activities not included in A–D or F.</td>
</tr>
<tr>
<td>F</td>
<td>--</td>
<td>--</td>
<td>Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (i.e., water resources, water treatment, electrical), and warehousing.</td>
</tr>
<tr>
<td>G</td>
<td>--</td>
<td>--</td>
<td>Undeveloped lands that are not permitted.</td>
</tr>
</tbody>
</table>

1 The L_{eq} (h) activity criteria values are for impact determination only and are not design standards for noise abatement measures. All values are A-weighted decibels (dB).
2 Includes undeveloped lands permitted for this activity category.

Source: 23 Code of Federal Regulations 772
**Noise Control Act of 1972**

The federal Noise Control Act of 1972 (42 U.S. Code Section 4901 note) established a requirement that all federal agencies administer their programs to promote an environment that would not jeopardize public health or welfare. The U.S. Environmental Protection Agency (EPA) was given the responsibility for:

- providing information to the public regarding identifiable effects of noise on public health and welfare;
- publishing information on the levels of environmental noise that will protect the public health and welfare with an adequate margin of safety;
- coordinating federal research and activities related to noise control; and
- establishing federal noise emission standards for selected products distributed in interstate commerce.

In 1974, in response to the requirements of the federal Noise Control Act, EPA identified indoor and outdoor noise limits to protect public health and welfare (communication disruption, sleep disturbance, and hearing damage). Outdoor L_{day} limits of 55 dB and indoor L_{day} limits of 45 dB are identified as desirable to protect against speech interference and sleep disturbance for residential, educational, and healthcare areas. Sound-level criteria to protect against hearing damage in commercial and industrial areas are identified as 24-hour L_{eq} values of 70 dB (both outdoors and indoors). While these standards are characterized as desirable by EPA, higher noise levels in mixed-use areas are becoming more acceptable as cities and counties strive to provide housing options in closer proximity to busy urban centers, and noise attenuation is increasingly focused on indoor noise levels.

The Noise Control Act also directed that all federal agencies comply with applicable federal, state, interstate, and local noise control regulations. Although EPA was given a major role in disseminating information to the public and coordinating with other federal agencies, each federal agency retains authority to adopt noise regulations pertaining to agency programs. EPA can, however, require other federal agencies, such as those listed below, to justify their noise regulations in terms of Noise Control Act policy requirements.

- FHWA is responsible for noise standards for federally-funded highway projects.
- FTA is responsible for noise standards for federally-funded transit projects.
- FRA is responsible for noise standards for federally-funded rail projects.

### 13.3.2 State Regulations

**Title 24, California Code of Regulations – California Noise Insulation Standards**

Part 2, Title 24, of the California Code of Regulations (CCR), “California Noise Insulation Standards,” establishes minimum noise insulation standards to protect persons within new hotels, motels, dormitories, long-term care facilities, apartment houses, and dwellings other than single-family residences. Under this regulation, interior noise levels attributable to exterior noise sources cannot exceed 45 L_{day} in any habitable room. Where such residences are located in an environment
where exterior noise is 60 L_{dn} or greater, an acoustical analysis is required to ensure that interior levels do not exceed the 45 L_{dn} interior standard.

**STATE OF CALIFORNIA GENERAL PLAN GUIDELINES, 2017**

The State of California General Plan Guidelines (California Governor’s Office of Planning and Research 2017) provide the state’s recommendations for city and county general plan noise elements. The guidelines include a sound level and land-use compatibility chart that categorizes by land use, outdoor L_{dn} ranges in up to four categories (i.e., normally acceptable, conditionally acceptable, normally unacceptable, and clearly unacceptable). Compliance by the cities and counties is not required, and local jurisdictions may modify these guidelines for local applicability; however, many general plan noise elements are based on these guidelines as drafted by the state. For projects located within cities and counties with adopted general plans, the noise standards contained in those documents would apply.

The state noise element guidelines identify a normally acceptable range of sound for low-density residential uses as less than 60 dB, and a conditionally acceptable range as 55 to 70 dB. The normally acceptable range for high-density residential uses is identified as L_{dn} values below 65 dB, and the conditionally acceptable range is identified as 60 to 70 dB. For educational and medical facilities, L_{dn} values below 70 dB are considered normally acceptable, and L_{dn} values of 60 to 70 dB are considered conditionally acceptable. For office and commercial land uses, L_{dn} values below 70 dB are considered normally acceptable, and L_{dn} values of 67.5 to 77.5 are categorized as conditionally acceptable.

These overlapping L_{dn} ranges are intended to allow for local conditions (existing sound levels and community attitudes toward dominant sound sources) to be considered in evaluating land-use compatibility at specific locations. Because of the variation in noise environments and land use patterns within the plan area of the proposed MTP/SCS, city and county general plan noise elements often provide some flexibility for interpretation. For example, although a general plan may not include a specific category for mixed-use developments, the lead agency may choose to focus on achieving compliance with only the interior noise standards of residences constructed within mixed-use projects. This approach allows for consideration of noise-sensitivity within residential uses, and recognizes that elevated exterior noise environments will occur in urban environments, as a result of mixed uses and increased density and intensity of land uses.

**CALIFORNIA DEPARTMENT OF TRANSPORTATION TRAFFIC NOISE ANALYSIS PROTOCOL, JULY 2011**

The Caltrans Traffic Noise Analysis Protocol (Protocol) specifies the policies, procedures, and practices to be used by agencies that sponsor new construction or reconstruction projects. The noise abatement criteria specified in the Protocol are the same as those specified in 23 CFR Section 772. The Protocol defines a noise increase as substantial when the predicted noise levels with project implementation exceed existing noise levels by 12 dB. The Protocol also states that a sound level is considered to approach a Noise Abatement Criteria (NAC) level when the sound level is within 1 dB of the NAC identified in 23 CFR Section 772 (e.g., 66 dB is considered to approach the NAC of 67 dB, but 65 dB is not).
13.3.3 Local Regulations

Each of the six counties and 22 cities in the plan area of the proposed MTP/SCS has a general plan noise element. Some jurisdictions also have noise ordinances. The noise element and local noise ordinances are the two primary documents that local jurisdictions use to set noise standards in their community.

**GENERAL PLANS**

California Government Code Section 65300 requires that each planning agency shall prepare and the legislative body of each county and city shall adopt a comprehensive, long-term General Plan for the physical development of the county or city, and of any land outside its boundaries, which in the planning agency's judgment bears relation to its planning.

A noise element is a required component of each jurisdiction’s general plan. The noise element provides information on the current and future noise levels associated with local noise sources such as highways and freeways, major streets and arterials, rail operations, aviation activities, and local industrial plants. The noise element also includes planning policies and implementation measures for limiting the exposure of people to noise. Government Code Section 65302(f) requires that the local general plan include a noise element that identifies and appraises noise in the community. The noise element must analyze and quantify, to the extent practicable, as determined by the legislative body, current and projected noise levels for all of the following sources:

- Highways and freeways;
- Primary arterials and major local streets;
- Passenger and freight on-line railroad operations and ground rapid transit systems;
- Commercial, general aviation, heliport, helistop, and military airport operations, aircraft overflights, jet engine test stands, and all other ground facilities and maintenance functions related to airport operation;
- Local industrial plants, including, but not limited to, railroad classification yards; and
- Other ground stationary sources identified by local agencies as contributing to the community noise environment.

The noise elements of the cities and counties located within the plan area of the proposed MTP/SCS typically apply land-use compatibility criteria of 60 to 65 dB Ldn as being normally acceptable for new residential developments affected by transportation noise sources. The intent of these standards is to regulate the noise environment for outdoor activities. In addition, an interior noise level criterion of 45 dB Ldn is commonly applied to residential land uses. The intent of this standard is to provide a suitable environment for indoor communication and sleep.

Typical options for mitigation of excessive noise levels include the use of setbacks or buffer areas between the noise source and the proposed noise-sensitive land use, noise barriers, residential unit design, and improvements to building façade construction. Neither audibility of a new noise source nor an increase in noise levels within recognized acceptable limits is usually considered to be a significant noise impact, but these concerns should be addressed and considered in the planning and environmental review processes.
Where projects affected by, or including, non-transportation noise sources are proposed, the performance standards of the various city and county general plans or noise ordinances typically define acceptable noise exposure. For noise generated by new non-transportation noise sources, or noise-sensitive projects affected by non-transportation noise sources, hourly performance standards contained in general plan noise elements are commonly, but not universally, used within the plan area of the proposed MTP/SCS. In cases where hourly performance standards are used, they vary numerically and in terms of the specific noise metric used to evaluate non-transportation noise sources.

**Community Noise Control Ordinances**

To abate noise and resolve noise-related conflict with existing land uses, many jurisdictions have adopted community noise-control ordinances.

Community noise-control ordinances are generally designed to control noise on a short-term basis (usually by means of hourly noise-level criteria), rather than on the basis of 24-hour or annual cumulative noise exposures.

Regulation of noise emitted from traffic on public roadways, railroad operations, or aircraft in flight occurs at the federal level. While vehicle noise regulations are established at the federal level, there are a number of these regulations that can be enforced by local authorities through state law requirements, including Sections 23130, 23130.5, 27150, 27151 and 38275 of the California Vehicle Code (OPR General Plan Guidelines, Appendix C, page 249) which allow for local control of on-road mobile sources of noise.

### 13.4 Impacts and Mitigation Measures

#### 13.4.1 Methods and Assumptions

This program-level analysis evaluates potential noise impacts from implementation of the proposed MTP/SCS based on the projected land use pattern and planned transportation improvements relative to the existing ambient noise conditions within the plan area of the proposed MTP/SCS.

By 2040, implementation of the proposed MTP/SCS would result in a land use pattern and transportation network that is different from existing conditions. Unless otherwise stated, “existing conditions” in the proposed MTP/SCS refers to conditions in the baseline year of 2016. The proposed MTP/SCS uses 2016 because it is the most recent year for which comprehensive land use, demographic, traffic count, and VMT data are available for the SACOG region. Chapter 1 – Introduction includes a more detailed discussion of the baseline for the proposed MTP/SCS.

For each impact, implementation of the proposed MTP/SCS is assessed on three levels. First, impacts are assessed at the regional level for the entire plan area. Second, impacts are assessed for the plan area’s five Community Types: Center and Corridor Communities, Established Communities, Developing Communities, Rural Residential Communities, and Lands Not Identified for Development. And third, implementation of the proposed MTP/SCS is assessed in terms of its impacts to the region’s High Frequency Transit Areas (HFTAs). Refer to Chapter 2 – Project Description for a full description of the Community Types and HFTAs and the projected land use pattern and planned transportation improvements within these areas.
For this noise analysis, traffic modeling was performed using guidance from the FHWA Traffic Noise Model TNM 2.5 model using traffic data for approximately 660 major roadways within the plan area of the proposed MTP/SCS. These roadway segments do not include each individual roadway noise source in the region; rather, they constitute a representative sample of typical roadway noise sources seen throughout the plan area of the proposed MTP/SCS. Locations where noise analyses were performed are displayed in Figure 13-3.

The noise analysis identifies the noise impact of the project by comparing predicted traffic noise levels under the proposed MTP/SCS to the 2016 baseline condition. For purposes of these comparisons, all values are calculated at a fixed distance of 150 feet from each roadway centerline. The evaluation does not consider whether there are sensitive receptors located adjacent to the freeways and arterials but evaluates all roadways equally, as if they were located adjacent to sensitive receptors. The analysis assumes implementing agencies will ensure noise and vibration are treated in accordance with applicable federal, state and local laws and regulations as part of project planning, design and engineering.

The modeling of existing ambient noise values does not account for existing sound barriers (i.e., sound walls, berms) and is therefore overly conservative. For roadways that do have existing sound barriers, actual noise levels would be lower at sensitive receptor locations, which are shielded by such barriers. This analysis does not attempt to quantify the dB of attenuation provided by sound walls and, by assuming no attenuation for existing soundwalls, the baseline values identified in Impact NOI-1 are conservative. It is likely that if the locations of sound walls were included, existing baseline ambient noise would be less.

Certain types of transportation improvement projects, (e.g., road widenings, HOV lanes, transition lanes, road extensions, new interchanges) would require project-specific noise analyses. In locations where such transportation improvements are proposed as part of the proposed MTP/SCS, it is possible that noise impacts would be mitigated as part of the individual project and that noise barriers may be identified as a mitigation option. However, because SACOG cannot require lead agencies to implement mitigation, it is not guaranteed that such mitigation would be implemented. In locations where no specific project is included in the proposed MTP/SCS, but where a “lump sum” funding included in the proposed MTP/SCS would fund re-pavement or re-construction of roadways, opportunities for re-paving with rubberized asphalt or “quiet pavement” exist which could mitigate noise impacts in other, unknown locations. Due to these uncertainties, this analysis conservatively does not apply offsets to the modeled existing or future traffic noise levels to account for either noise barriers or noise-reducing pavement.

In order to analyze the noise effects of implementation of the proposed MTP/SCS, SACOG developed noise thresholds for each Community Type. These thresholds are shown in Table 13-4. The thresholds were developed based on the California General Plan Guidelines (discussed above in the regulatory setting) and local jurisdiction general plan thresholds. Because the California General Plan Guidelines are suburban in nature, SACOG used the high end of the guidelines for Center and Corridor Communities and Established Communities, the middle of the range for Developing Communities, and the low end of the range for Rural Residential Communities. Lands Not Identified for Development in the proposed MTP/SCS, are not necessarily either noise-sensitive or noise-generating, and a “neutral” noise standard was applied accordingly. SACOG’s thresholds are comparable to other urban jurisdictions in the region.

This analysis assumes that implementing agencies will ensure groundborne noise and vibration are treated in accordance with applicable, federal, state, and local laws and regulations.
Figure 13-3
Traffic Noise Locations
Table 13-4
Noise Thresholds by Community Type (CNEL)

<table>
<thead>
<tr>
<th>Geography</th>
<th>Noise Threshold</th>
<th>Increase Threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Region</td>
<td>NA(^1)</td>
<td>N/A(^1)</td>
</tr>
<tr>
<td>Center and Corridor Communities</td>
<td>75 dB</td>
<td>1.5 dB</td>
</tr>
<tr>
<td>Established Communities</td>
<td>65 dB</td>
<td>3.0 dB</td>
</tr>
<tr>
<td>Developing Communities</td>
<td>60 dB</td>
<td>3.0 dB</td>
</tr>
<tr>
<td>Rural Residential Communities</td>
<td>55 dB</td>
<td>3.0 dB</td>
</tr>
<tr>
<td>Lands Not Identified for Development</td>
<td>60 dB</td>
<td>3.0 dB</td>
</tr>
</tbody>
</table>

\(^1\) Noise impacts are experience at the localized level. Therefore, one regional noise threshold cannot reflect the varied noise environments found in the proposed plan area of the proposed MTP/SCS.

Note: Because transit priority areas (HFTAs) may overlap multiple Community Types, each roadway segment in a HFTA was analyzed according to the noise threshold for the Community Type in which it is located.

Source: Data compiled and provided by SACOG in 2019

13.4.2 Criteria for Determining Significance

For the purposes of this EIR, SACOG has determined that adoption and/or implementation of the proposed MTP/SCS would result in significant impacts under CEQA, if any of the following would occur:

**NOI-1** Result in permanent operational noise levels that exceed the Community Type CNEL thresholds identified in Table 13-4 or increase noise levels at locations currently in exceedance of the CNEL thresholds more than 1.5 dB for Center and Corridor Communities or more than 3 dB over baseline conditions for the other Community Types.

**NOI-2** Result in excessive vibration and groundborne noise during operation of projects included in the proposed MTP/SCS.

**NOI-3** Result in construction impacts that would increase noise levels above the Community Type CNEL thresholds identified in Table 13-4, result in increases of more than 1.5 dB for Center and Corridor Communities or more than 3 dB over baseline conditions for the other Community Types; or result in excessive levels of vibration and groundborne noise.

Segments that, under existing conditions, do not exceed CNEL thresholds but would exceed them as a result of implementation of the proposed MTP/SCS were identified as potentially significant.

CNEL thresholds are developed in consideration of acceptable levels of noise depending on the land use and community character. For segments that, under existing conditions, exceed the CNEL thresholds and would result in a substantial increase in noise (i.e., the increase thresholds identified in Table 13-4 above) were additionally considered potentially significant for noise impacts. This approach excludes segments that, under existing and existing plus project conditions, do not exceed CNEL standards but do not result in a substantial noise increase (i.e., 1.5 dB or 3 dB).
13.4.3 Impacts and Mitigation Measures

**IMPACT NOI-1: Result in noise levels that exceed the Community Type CNEL thresholds identified in Table 13-4 or increase noise levels more than 1.5 dB at locations currently in exceedance of the CNEL thresholds for Center and Corridor Communities or more than 3 dB at locations currently in exceedance of the CNEL thresholds over baseline conditions for the other Community Types.**

Regional Impacts

As noted in Table 13-4, noise impacts are experienced locally and cannot be quantified at a regional level. Land uses support various noise environments depending on multiple factors. For example, urban environments tend to be louder than suburban environments due to denser, multi-use land use patterns. Urban environments also typically support higher volumes of traffic as well as other transportation modes that generate sound such as trains, light rail, and buses. Suburban environments, where land uses are often more segregated, have more moderate noise levels. Agricultural areas also have a unique noise environment as compared to urban and suburban environments. Agricultural operations require the use of heavy-duty equipment (e.g., mechanized plows, tractors) that produce high noise levels. However, because agricultural areas are sparsely populated, noise generally does not have the same adverse effect on surrounding land uses and may be protected by right-to-farm regulations or other local land use policies.

Of the 660 transportation segments analyzed, 38 segments exceeded the noise thresholds in Table 13-4 or increased noise levels over baseline conditions by a significant level. However, as explained above, different noise environments experience transportation noise in different ways. Because of the nature of noise impacts (noise dissipates with distance from the source), new transportation operations may cause noise impacts, and those impacts may exceed applicable noise thresholds for determining significance within a localized area, but those impacts cannot be quantified at a regional level. Therefore, regional noise impacts related to the projected land use pattern and planned transportation improvements from implementation of the proposed MTP/SCS are considered less than significant (LS) for Impact NOI-1. No mitigation is required.

**Table 13-5**

<table>
<thead>
<tr>
<th>Geography</th>
<th>Potentially Significant Locations Pre-Mitigation</th>
<th>Total Locations Analyzed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Center and Corridor Communities</td>
<td>5</td>
<td>176</td>
</tr>
<tr>
<td>Established Communities</td>
<td>17</td>
<td>342</td>
</tr>
<tr>
<td>Developing Communities</td>
<td>4</td>
<td>26</td>
</tr>
<tr>
<td>Rural Residential Communities</td>
<td>12</td>
<td>115</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>38</strong></td>
<td><strong>659</strong></td>
</tr>
<tr>
<td>Placer County High Frequency Transit Areas</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>Sacramento County High Frequency Transit Areas</td>
<td>2</td>
<td>75</td>
</tr>
<tr>
<td>Yolo County High Frequency Transit Areas</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td><strong>High Frequency Transit Areas</strong></td>
<td><strong>2</strong></td>
<td><strong>86</strong></td>
</tr>
</tbody>
</table>

Source: Modeling performed by Ascent Environmental in 2019.
Localized Impacts

Center and Corridor Communities

Urban areas experience noise from a number of sources associated with living in proximity to other people and among different land uses. Typical community noise sources include small mechanical devices (e.g., lawn mowers, leaf blowers), parks and playgrounds, restaurants and bars, commercial uses, events, and industrial plants. Traffic and other transportation-related noise is also a dominant noise source in this Community Type. Light rails, passenger trains, and other forms of public transit generate noise from the contact of wheels on railways as well as loud bells that signal to cars, cyclists, and pedestrians of their arrival. The Center and Corridor Community Types currently experience higher levels of noise than the other Community Types, and noise is generally expected to be an element of this Community Type’s character.

Implementation of the proposed MTP/SCS is likely to increase the amount of noise experienced in Center and Corridor Communities because of the increased density in these areas as well as from improved transportation infrastructure. Growth in the Center and Corridor Communities would be substantial over the life of the proposed MTP/SCS (2016–2040) and would introduce new non-transportation sources of noise that could introduce a 1.5 dB increase resulting in an exceedance of the 75 CNEL threshold. However, the extent of new stationary noise cannot be quantified at the time of writing this Draft EIR as the magnitude and location of specific sources are not known and any estimate would be speculative.

Heavy rail improvements would increase the number of passenger and freight trains in the region. This may increase noise along rail corridors based on site specific conditions. It is unknown if future increases in rail activity would result in exceedance in noise thresholds.

Light rail improvements would include improvements to existing corridors and the addition of new corridors. In general, the proposed transit improvements along existing corridors would occur in developed urban areas where noise levels are already high from existing transportation and transit systems. In areas that do not currently have light rail operations, implementation of the proposed MTP/SCS could increase noise levels above 75 dB CNEL and increase daily noise (CNEL) by more than 1.5 dB relative to baseline conditions for Center and Corridor Communities.

Increases in operational mobile source noise from the projected land use pattern and planned transportation improvements would result in new vehicles trips to existing roadways generating increases in noise. Table 13-6 shows the five locations where noise would exceed the CNEL threshold of 75 dB following the implementation of the proposed MTP/SCS resulting in a significant noise impact.

The roadway segments identified in Table 13-6 as projected to experience a significant increase in transportation-related noise may currently have site-specific noise attenuation in the form of sound walls or berms. Also, planned transportation improvements in the proposed MTP/SCS may result in sound walls or berms along these roadways in the future. Effective noise barriers can reduce noise levels by 10 to 15 dB while modest noise barriers can achieve a 5-dB reduction. It is foreseeable that the noise levels projected on the identified roadway segments in Table 13-6 would be lower than currently modeled if a noise barrier or other attenuation were present. While soundwalls can be effective attenuation tools, there are instances where they are rejected at the local level due to
concerns regarding community connectivity and aesthetics. This analysis takes a conservative approach and analyzes noise without barriers in place.

Table 13-6
Location of Potentially Significant Transportation Noise Impacts in Center and Corridor Communities before and after Implementation of the Proposed MTP/SCS

<table>
<thead>
<tr>
<th>Location</th>
<th>Noise Threshold: 75 dB and 1.5 dB above 2016 Noise Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2016 Noise Level</td>
</tr>
<tr>
<td>Street</td>
<td>Cross Street</td>
</tr>
<tr>
<td>State Route 99</td>
<td>North of Twin Cities Road</td>
</tr>
<tr>
<td>Interstate 5 / American River Crossing</td>
<td>American River</td>
</tr>
<tr>
<td>US 50</td>
<td>East of Bradshaw Road</td>
</tr>
<tr>
<td>US 50</td>
<td>East of 15th/16th Street</td>
</tr>
<tr>
<td>US 50</td>
<td>West of Stockton Boulevard</td>
</tr>
<tr>
<td>Total</td>
<td></td>
</tr>
</tbody>
</table>

Source: Modeling performed by Ascent Environmental in 2019.

Therefore, the operational, transportation-related increases as a result of the projected land use pattern and planned transportation improvements associated with implementation of the proposed MTP/SCS in Center and Corridor Communities would exceed the applicable CNEL thresholds and are considered potentially significant (PS) for Impact NOI-1. Mitigation is required. Mitigation Measure NOI-1 is described below.

Established Communities
Similar to Center and Corridor Communities, Established Communities already have a significant amount of urban development, but these areas are generally not as dense as Center and Corridor Communities and are projected to experience less housing growth from 2016 to 2040 as compared to the Center and Corridor Communities. While Established Communities would accommodate additional population, housing, and employment, the growth rate would be relatively modest when compared to Center and Corridor Communities and Developing Communities, which are projected to experience higher rates of growth.

Urban areas experience noise from a number of sources associated with living in proximity to other people and among different land uses. Typical community noise sources include small mechanical devices (e.g., lawn mowers, leaf blowers), parks and playgrounds, restaurants and bars, commercial uses, events, and industrial plants. Traffic and other transportation-related noise is also a dominant noise source in this Community Type. Light rails, passenger trains, and other forms of public transit generate noise from the contact of wheels on railways as well as loud bells that signal to cars, cyclists, and pedestrians of their arrival. Noise is generally expected to an element of this Community Type’s character.

Implementation of the proposed MTP/SCS would likely increase the amount of noise experienced in Established Communities because of the increased density in these areas. Although the rate of growth is not as fast as in Center and Corridor Communities and Developing Communities,
Established Communities would still add over one fifth of a million people by 2040. This growth has the potential to increase noise levels above 65 dB CNEL and increases in noise levels of more than 3 dB in locations already in exceedance of the dB CNEL threshold. However, the extent of new stationary noise from these sources cannot be quantified at the time of writing this Draft EIR as the magnitude and location of specific sources are not known and any estimates would be speculative.

As with Center and Corridor Communities, Established Communities would see a variety of planned transportation improvements by 2040 that would also introduce new sources of noise in the region, including new HOV lanes, auxiliary lanes, roadway widenings, bicycle and pedestrian infrastructure improvements, transit facilities, increased transit service, and roadway maintenance and rehabilitation projects.

Heavy rail improvements would increase the number of passenger and freight trains in the region. Because of the number of existing passenger and freight trains that use the existing heavy rail tracks, additional trains are not expected to increase daily noise (CNEL) along any given track by more than 3 dB relative to baseline conditions. Light rail improvements will include increasing frequency on and making improvements to existing corridors and adding new corridors. In general, the proposed transit improvements along existing corridors will occur in developed urban areas where noise levels are already high from existing sources.

In areas that do not currently have light rail operations, implementation of the proposed MTP/SCS could increase noise levels above 65 dB CNEL and increase daily noise (CNEL) by more than 3 dB relative to baseline conditions.

Increases in operational mobile source noise from the projected land use pattern and planned transportation improvements would result in new vehicles trips on existing roadways generating increases in noise. Table 13-7 shows the 17 locations where noise would exceed the CNEL threshold of 65 dB following the implementation of the proposed MTP/SCS resulting in a significant noise impact.

The roadway segments identified in Table 13-7 as projected to experience a significant increase in transportation-related noise may currently have site-specific noise attenuation in the form of sound walls or berms. Also, planned transportation improvements in the proposed MTP/SCS may result in sound walls or berms along these roadways in the future. Effective noise barriers can reduce noise levels by 10 to 15 dB while modest noise barriers can achieve a 5-dB reduction. It is foreseeable that the noise levels projected on the identified roadway segments in Table 13-7 would be lower than currently modeled if a noise barrier or other attenuation were present. While sound walls can be effective attenuation tools, there are instances where they are rejected at the local level due to concerns regarding community connectivity and aesthetics. This analysis takes a conservative approach and analyzes noise without barriers in place.

Therefore, operational, transportation-related increases in noise from the projected land use pattern and planned transportation improvements associated with implementation of the proposed MTP/SCS in Established Communities would exceed the applicable CNEL threshold and are considered potentially significant (PS) for Impact NOI-1. Mitigation is required. Mitigation Measure NOI-1 is described below.
Table 13-7
Location of Potentially Significant Transportation Noise Impacts in Established Communities before and after Implementation of the Proposed MTP/SCS

<table>
<thead>
<tr>
<th>Street</th>
<th>Location</th>
<th>County</th>
<th>2016 Noise Level</th>
<th>MTP/SCS Noise Level (2040)</th>
<th>Change from 2016 to MTP/SCS (2040)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roseville Pkwy</td>
<td>East of Pleasant Grove Boulevard</td>
<td>Placer</td>
<td>65.0</td>
<td>66.0</td>
<td>0.9</td>
</tr>
<tr>
<td>Blue Oaks Blvd</td>
<td>West of Foothills Boulevard</td>
<td>Placer</td>
<td>64.2</td>
<td>66.2</td>
<td>2.0</td>
</tr>
<tr>
<td>Pleasant Grove Blvd</td>
<td>West of Foothills Boulevard</td>
<td>Placer</td>
<td>63.2</td>
<td>65.2</td>
<td>2.0</td>
</tr>
<tr>
<td>Foothills Blvd</td>
<td>South of Blue Oaks Boulevard</td>
<td>Placer</td>
<td>62.8</td>
<td>65.9</td>
<td>3.1</td>
</tr>
<tr>
<td>US 50</td>
<td>East of W. Capital</td>
<td>Yolo</td>
<td>64.9</td>
<td>67.2</td>
<td>2.3</td>
</tr>
<tr>
<td>Auburn-Folsom Road</td>
<td>North of Auburn Dam Road</td>
<td>Sacramento</td>
<td>64.8</td>
<td>65.9</td>
<td>1.1</td>
</tr>
<tr>
<td>State Route 49</td>
<td>North of Bell Road</td>
<td>Placer</td>
<td>64.3</td>
<td>65.2</td>
<td>0.9</td>
</tr>
<tr>
<td>Base line Rd</td>
<td>East of Pleasant grove Road</td>
<td>Placer</td>
<td>61.6</td>
<td>65.1</td>
<td>3.5</td>
</tr>
<tr>
<td>Grant Line Rd</td>
<td>East of East Stockton Road</td>
<td>Sacramento</td>
<td>64.4</td>
<td>66.2</td>
<td>1.8</td>
</tr>
<tr>
<td>Grant Line Rd</td>
<td>East of SH 99</td>
<td>Sacramento</td>
<td>64.0</td>
<td>65.8</td>
<td>1.9</td>
</tr>
<tr>
<td>State Route 65</td>
<td>North of I-80</td>
<td>Placer</td>
<td>63.2</td>
<td>67.0</td>
<td>3.8</td>
</tr>
<tr>
<td>State Route 20 / Feather River</td>
<td>East of Sutter Street</td>
<td>Placer</td>
<td>64.4</td>
<td>65.5</td>
<td>1.1</td>
</tr>
<tr>
<td>State Route 99</td>
<td>at Feather River Crossing</td>
<td>Sutter</td>
<td>64.7</td>
<td>65.4</td>
<td>0.7</td>
</tr>
<tr>
<td>State Route 99</td>
<td>South of Barry Avenue</td>
<td>Sutter</td>
<td>64.6</td>
<td>65.1</td>
<td>0.5</td>
</tr>
<tr>
<td>State Route 99/Live Oak Blvd</td>
<td>North of Encinal Road</td>
<td>Sutter</td>
<td>64.8</td>
<td>65.4</td>
<td>0.6</td>
</tr>
<tr>
<td>I-5</td>
<td>South of I-80</td>
<td>Sacramento</td>
<td>71.2</td>
<td>74.2</td>
<td>3.0</td>
</tr>
<tr>
<td>I-5</td>
<td>North of I-80</td>
<td>Sacramento</td>
<td>72.5</td>
<td>75.5</td>
<td>3.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>17</td>
</tr>
</tbody>
</table>

Source: Modeling performed by Ascent Environmental in 2019.

Developing Communities
Developing Communities are expected to include a high rate of growth during the proposed MTP/SCS plan period. Developing Communities would see the highest growth rate of any of the Community Types and would experience substantial increases in their proportional share of population, housing, and to a lesser extent employment.

Because Developing Communities may not have existing developed land uses, the introduction of new noise sources associated with the projected land use pattern would likely increase the perceived loudness in this Community Type. While the exact magnitude of increased noise from the introduction of new land uses is speculative, it is foreseeable that in certain locations, the noises associated with residential, commercial, and potentially industrial land uses under the projected land use pattern could introduce a level of noise that could exceed an acceptable noise standard. The increased noise from mechanical systems, industrial operations, and other stationary sources of community noise could be exposure Developinig Communities to noise in excess of 60 CNEL and increases greater than 3 dB in locations currently exceeding the 60 CNEL threshold. However, the extent of new stationary noise...
cannot be quantified at the time of writing this Draft EIR as the magnitude and location of specific sources is not known and any estimate would be speculative.

Implementation of the MTP/SCS would result in the construction of transportation improvement projects. However, Developing Communities would not necessarily see the same mix of planned transportation improvements as Center and Corridor Communities and Established Communities. Developing Communities will see more road widening projects and newly constructed road projects to serve the new residential and employment land uses under the projected land use pattern that would be built by 2040. These areas would see road maintenance and rehabilitation projects; however, as these areas support less transportation infrastructure to begin with, the scale of transportation improvements would not be as great as compared to the Center and Corridor Communities and Established Communities. Under existing conditions, Developing Communities are generally not served by transit, but, consistent with the objectives of the proposed MTP/SCS, new transit services may be added incrementally to align with the completion of new housing and employment centers. Pedestrian and bicycle infrastructure would similarly be phased in over the life of the proposed MTP/SCS.

Heavy rail improvements would include increasing the number of passenger and freight trains in the Developing Communities. Because of the number of existing passenger and freight trains that use the existing heavy rail tracks, additional trains are not expected to increase daily noise (CNEL) along any given track by more than 3 dBA relative to baseline conditions.

Light rail improvements would include increasing frequency on existing corridors. Because improvements along existing corridors would not double the number of daily trains along the corridors, these improvements are not expected to increase daily noise (CNEL) along these corridors by more than 3 dBA relative to baseline conditions.

Increases in operational mobile-source noise from the projected land use pattern and planned transportation improvements would introduce new vehicle trips to existing roadways within the Developing Communities producing increases in noise. Table 13-8 shows the four locations where noise is projected to exceed the CNEL threshold of 60 dB following the implementation of the proposed MTP/SCS.

<table>
<thead>
<tr>
<th>Location</th>
<th>Noise Threshold: 60 dBA and 3 dBA above 2016 noise levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Noise Level</td>
</tr>
<tr>
<td>Street</td>
<td>Cross Street</td>
</tr>
<tr>
<td>Baseline Road</td>
<td>West of Watt Avenue</td>
</tr>
<tr>
<td>State Route 193</td>
<td>East of Sierra College Boulevard</td>
</tr>
<tr>
<td>Riego Road</td>
<td>East of State Highway 99</td>
</tr>
<tr>
<td>Fiddyment Road</td>
<td>South of West Sunset Boulevard</td>
</tr>
<tr>
<td>Total</td>
<td></td>
</tr>
</tbody>
</table>

Source: Noise Impact modeling performed by Ascent Environmental in 2019.
The roadway segments identified in Table 13-8 as projected to experience a significant increase in transportation-related noise may currently have site-specific noise attenuation in the form of sound walls or berms. Also, planned transportation improvements in the proposed MTP/SCS may result in sound walls or berms along these roadways in the future. Effective noise barriers can reduce noise levels by 10 to 15 dB while modest noise barriers can achieve a 5-dB reduction. It is foreseeable that the noise levels projected on the identified roadway segments in Table 13-8 would be lower than currently modeled if a noise barrier or other attenuation were present. While sound walls can be effective attenuation tools, there are instances where they are rejected at the local level due to concerns regarding community connectivity and aesthetics. This analysis takes a conservative approach and analyzes noise without barriers in place.

Therefore, operational, transportation-related increases in noise from the projected land use pattern and planned transportation improvements associated with implementation of the proposed MTP/SCS in Developing Communities would exceed the applicable CNEL threshold and are considered potentially significant (PS) for Impact NOI-1. Mitigation is required. Mitigation Measure NOI-1 is described below.

Rural Residential Communities
Rural Residential Communities are very low-density communities with mostly residential development and some small-scale farming. These communities are expected to have very limited growth by 2040, or two percent of the regional growth. This Community Type is expected to have the lowest rate of growth and would have a decreasing share of regional population, housing units, and employment.

As with Developing Communities, Rural Residential Communities have even fewer sources of existing stationary noise sources than Center and Corridor Communities and Established Communities. Although these areas would experience some growth over the proposed MTP/SCS planning period (i.e., 2040), growth is expected to be minimal and resemble the character of existing land uses. While the new growth and projected land use pattern in this Community Type would be similar to that of existing land uses, increases in development of any kind could result in the introduction of new stationary sources of noise that could result in an increase in ambient noise. However, given the limited amount of land uses proposed under the projected land use pattern proposed for the Rural Residential Communities, it is unlikely that the small amount of growth in these areas would expose Rural Residential Communities to noise in excess of 55 dB CNEL and increase noise levels by more than 3 dBA in locations currently in exceedance of the 55 dB CNEL threshold.

Existing transportation infrastructure in rural communities consists primarily of roads serving automobile traffic with some very limited transit service in a few places in the region. Implementation of the proposed MTP/SCS would result in the construction of roadway improvements, including road maintenance and rehabilitation, roadway widenings, newly constructed roadways, and freeway improvements. Within the timeframe of the proposed MTP/SCS, limited improvements to transit service could also occur.

Heavy rail improvements would include increasing the number of passenger and freight trains in the region. Because of the number of existing passenger and freight trains that use the existing heavy rail tracks, additional trains would not be expected to increase daily noise (CNEL) along any given track
by more than 3 dB relative to baseline conditions. The proposed MTP/SCS does not propose improvements to light rail in Rural Residential Communities.

Increases in operational mobile-source noise from the projected land use pattern and planned transportation improvements would introduce new vehicle trips to existing roadways within the Rural Residential Communities producing increases in noise. Table 13-9 shows the 12 locations where noise would exceed the CNEL threshold of 55 dB following the implementation of the proposed MTP/SCS resulting in a significant noise impact.

Table 13-9
Location of Potentially Significant Transportation Noise Impacts in Rural Residential Communities
Before and After Implementation of the Proposed MTP/SCS

<table>
<thead>
<tr>
<th>Location</th>
<th>Noise Threshold: 55 dBA and 3 dBA above 2016 noise levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Street</td>
<td>Cross Street</td>
</tr>
<tr>
<td>Fiddyment Road</td>
<td>North of Athens Avenue</td>
</tr>
<tr>
<td>Green Valley Road</td>
<td>West of Lotus Road</td>
</tr>
<tr>
<td>Dillard Road</td>
<td>South of SR 16 / Jackson Highway</td>
</tr>
<tr>
<td>Sorento Road</td>
<td>North of Elverta Road</td>
</tr>
<tr>
<td>Rio Linda Boulevard</td>
<td>North of Elverta Road</td>
</tr>
<tr>
<td>Twin Cities Road (County Road 104)</td>
<td>Sacramento/Amador County Line</td>
</tr>
<tr>
<td>Franklin Boulevard</td>
<td>South of Hood Franklin Rd</td>
</tr>
<tr>
<td>Franklin Boulevard</td>
<td>North of Twin Cities Road</td>
</tr>
<tr>
<td>Plumas-Arboga Road</td>
<td>East of SR 70</td>
</tr>
<tr>
<td>Hood Franklin Road</td>
<td>West of Franklin Boulevard</td>
</tr>
<tr>
<td>White Rock Road</td>
<td>West of Grant Line Road</td>
</tr>
<tr>
<td>Bradshaw Road</td>
<td>South of SR 16 / Jackson Highway</td>
</tr>
</tbody>
</table>

Total | 12 |

Source: Noise Impact modeling performed by Ascent Environmental in 2019.

The roadway segments identified in Table 13-9 as projected to experience a significant increase in transportation-related noise may currently have site-specific noise attenuation in the form of sound walls or berms. Also, planned transportation improvements in the proposed MTP/SCS may result in sound walls or berms along these roadways in the future. Effective noise barriers can reduce noise levels by 10 to 15 dB while modest noise barriers can achieve a 5-dB reduction. It is foreseeable that the noise levels projected on the identified roadway segments in Table 13-9 would be lower than currently modeled if a noise barrier or other attenuation were present. While sound walls can be effective attenuation tools, there are instances where they are rejected at the local level due to concerns regarding community connectivity and aesthetics. This analysis takes a conservative approach and analyzes noise without barriers in place.
Therefore, operational, transportation-related increases in noise from the projected land use pattern and planned transportation improvements associated with implementation of the proposed MTP/SCS in Rural Residential Communities would exceed the applicable CNEL threshold and are considered potentially significant (PS) for Impact NOI-1. Mitigation is required. Mitigation Measure NOI-1 is described below.

Lands Not Identified for Development in the Proposed MTP/SCS

Although some housing and employment growth, consistent with historical trends, may occur in this Community Type within the MTP/SCS planning period, the proposed MTP/SCS does not proposed any land uses changes in these areas by 2040.

Although some housing and employment growth, consistent with historical trends, may occur in this Community Type within the MTP/SCS planning period, the proposed MTP/SCS does not forecast any development in these areas by 2040. The proposed MTP/SCS would make a limited number of planned transportation improvements in this Community Type by 2040. The planned transportation improvements in these areas would manifest as road maintenance, safety enhancements, other roadway operational improvements, and targeted capacity improvements to existing facilities that accommodate increased travel between urban areas.

The projected land use pattern and planned transportation improvements in the Lands Not Identified for Development Community Type is expected to result in very small, if any, increases in traffic on roadways. Because of this, implementation of the proposed MTP/SCS is not expected to result in significant noise impacts along existing roadways or transit routes and is not expected to result in significant noise impacts associated with new roadways, bridges, and transit facilities.

Based on the traffic study and noise modeling performed for the proposed MTP/SCS, no roadways were identified that would experience a notable dB increase that would cause an existing roadways currently below 60 dB CNEL to exceed 60 dB CNEL, nor introduce noise to a roadway currently in exceedance of 60 dB CNEL.

Therefore, operation, transportation-related increase in noise from the projected land use pattern and planned transportation improvements associated with implementation of the proposed MTP/SCS in Lands Not Identified for Development would not exceed the applicable CNEL threshold and are considered less than significant (LS) for Impact NOI-1. No mitigation is required.

High Frequency Transit Area Impacts

Placer County High Frequency Transit Areas

The Placer County HFTAs include portions of Roseville, Rocklin, and Auburn (around the Amtrak station), in areas that are already developed with urban uses. This area is generally more densely developed than surrounding areas. Noise is an inevitable part of urban living. Urban areas experience noise from any number of sources associated with living in proximity to other people and among different land uses. Typical community noise sources include small mechanical devices (e.g., lawn mowers, leaf blowers), parks and playgrounds, restaurants and bars, commercial uses, and industrial plants. Traffic and transportation-related noise is also a dominant noise source in this HFTA. The noise impacts of transportation are discussed below. The Placer County HFTAs already experience higher levels of noise than other areas in the region, and noise is an expected part of life.
in these areas. Implementation of the proposed MTP/SCS is likely to increase the amount of noise experienced in the Placer County HFTAs because of the increased density in these areas.

The compact nature of development is likely to expose the Placer County HFTAs to noise levels in excess of the noise thresholds identified in Table 13-4 and increases in noise levels of more than 3 dBA over baseline conditions.

Therefore, the noise impacts as a result of more dense and compact development related to the projected land use pattern from implementation of the proposed MTP/SCS in the Placer County HFTAs are considered potentially significant (PS) for Impact NOI-1. Mitigation Measure NOI-1 is described below.

Placer County HFTAs would see a variety of transportation improvements by 2040, including new HOV lanes, auxiliary lanes, roadway widenings, bicycle and pedestrian infrastructure improvements, transit facilities, increased transit service, and roadway maintenance and rehabilitation projects. Transit service will include increased frequency on local fixed route buses, but the majority of transit service increases will be commuter service to downtown Sacramento.

As noted in Table 13-5 above, implementation of the proposed MTP/SCS would result in 0 roadway segments in the Placer County HFTAs that increase noise levels to potentially significant levels.

Heavy rail improvements will include increasing the number of passenger and freight trains in the region. Because of the number of existing passenger and freight trains that use the existing heavy rail tracks, additional trains are not expected to increase daily noise (Ldn) along any given track by more than 3 dBA relative to baseline conditions. The proposed MTP/SCS does not include any improvements to light rail in the Placer County HFTAs.

Therefore, the noise impacts related to transportation improvements from implementation of the proposed MTP/SCS in the Placer County HFTAs are considered less than significant (LS) for Impact NOI-1. No mitigation is required.

Sacramento County High Frequency Transit Areas

The Sacramento County HFTAs include the majority of the City of Sacramento and portions of Rancho Cordova, Folsom, and Citrus Heights. The Sacramento County HFTAs will include approximately 29 percent of the region’s new housing units and 28 percent of the region’s new jobs. As discussed in the Placer County HFTA analysis, noise is an inevitable part of urban living. The Sacramento County HFTAs already experience higher levels of noise than the other areas in the region, and noise is an expected part of life in these areas. Implementation of the proposed MTP/SCS is likely to increase the amount of noise experienced in the Sacramento County HFTAs because of the increased density in these areas. The compact nature of development is likely to expose HFTAs to noise levels in excess of the Community Type noise thresholds identified in Table 13-4 and increases in noise levels of more than 3 dBA over baseline conditions in established and developing communities.

Therefore, the noise impacts as a result of more dense and compact development related to the projected land use pattern from implementation of the proposed MTP/SCS in the Sacramento
County HFTAs are considered potentially significant (PS) for Impact NOI-1. Mitigation Measure NOI-1 is described below.

Sacramento County HFTAs would see a variety of transportation improvements by 2040, including new HOV lanes, auxiliary lanes, roadway widenings, bicycle and pedestrian infrastructure improvements, transit facilities, increased transit service, and roadway maintenance and rehabilitation projects. Transit service will include increased frequency on local fixed route buses, major increases in light rail service, new streetcar service, and more express bus service.

As noted in Table 13-5 above, implementation of the proposed MTP/SCS will result in five Sacramento County HFTA roadway segments that increase noise levels to potentially significant levels, of which four will occur in Established Communities, and one will occur in Developing Communities. However, as explained in the methods and assumptions section above, some segments that initially were projected to have significant noise impacts may be reduced to less than significant levels after considering existing soundwalls or future MTP projects. After these considerations, all five locations may be mitigated to less than significant noise levels. More detail about these locations is given in Table 13-9.

Heavy rail improvements will include increasing the number of passenger and freight trains in the region. Because of the number of existing passenger and freight trains that use the existing heavy rail tracks, additional trains are not expected to increase daily noise (L_{dn}) along any given track by more than 3 dBA relative to baseline conditions.

Light rail improvements will include increasing the frequency of and making improvements to existing corridors and adding new corridors. In general, the proposed transit improvements along existing corridors will occur in developed urban areas where noise levels are already high from existing transportation systems. Because improvements along existing corridors would not double the number of daily trains along the corridors, these improvements are not expected to increase daily noise (L_{dn}) along these corridors by more than 3 dBA relative to baseline conditions. However, in areas that do not currently have light rail operations, implementation of the proposed MTP/SCS could increase noise levels above acceptable Community Type noise levels (as identified in Table 13-4) and increase daily noise (L_{dn}) by more than 3 dBA relative to baseline conditions.

Therefore, the potential noise impacts as a result of increased automobile, and light rail traffic related to transportation improvements from implementation of the proposed MTP/SCS in the Sacramento County HFTAs are considered potentially significant (PS) for Impact NOI-1. Mitigation Measure NOI-1 is described below.

<table>
<thead>
<tr>
<th>Location</th>
<th>Noise Threshold: 60-70 dBA and 3 dBA above 2016 noise levels</th>
<th>2016 Noise Level</th>
<th>MTP/SCS Noise Level (2040)</th>
<th>Change from 2016 to MTP/SCS (2040)</th>
</tr>
</thead>
<tbody>
<tr>
<td>US 50 East of 15th/16th Street Sacramento</td>
<td></td>
<td>74.4</td>
<td>76.2</td>
<td>2.2</td>
</tr>
<tr>
<td>US 50 West of Stockton Boulevard Sacramento</td>
<td></td>
<td>74.4</td>
<td>76.6</td>
<td>2.2</td>
</tr>
</tbody>
</table>

Source: Noise Impact modeling performed by Ascent Environmental in 2019.
Yolo County High Frequency Transit Areas
The Yolo HFTAs include the majority of West Sacramento and Davis, and some portions of Yolo County. The area has relatively balanced growth in residential and employment, bolstering the existing jobs centers in downtown West Sacramento and UC Davis. As discussed in the Placer County HFTA analysis, noise is an inevitable part of urban living. The Yolo County HFTAs already experience higher levels of noise than the other Community Types, and noise is an expected part of life in these areas. Implementation of the proposed MTP/SCS is likely to increase the amount of noise experienced in the Yolo County HFTAs because of the increased density in these areas. The compact nature of development is likely to expose HFTAs to noise levels in excess of the Community Type noise thresholds identified in Table 13-4 and increases in noise levels of more than 3 dBA over baseline conditions.

Therefore, the noise impacts as a result of more dense and compact development related to the projected land use pattern from implementation of the proposed MTP/SCS in the Yolo County HFTAs are considered potentially significant (PS) for Impact NOI-1. Mitigation Measure NOI-1 is described below.

Yolo County HFTAs will see a variety of transportation improvements by 2040, including new HOV lanes, auxiliary lanes, roadway widenings, bicycle and pedestrian infrastructure improvements, transit facilities, increased transit service, and roadway maintenance and rehabilitation projects. Transit service will include increased frequency on local fixed route buses, new streetcar service in West Sacramento, and increased express service to downtown Sacramento.

As noted in Table 13-5 above, implementation of the proposed MTP/SCS will result in zero Yolo County HFTA roadway segments that increase noise levels to potentially significant levels.

Heavy rail improvements will include increasing the number of passenger and freight trains in the region. Because of the number of existing passenger and freight trains that use the existing heavy rail tracks, additional trains are not expected to increase daily noise (Ldn) along any given track by more than 3dBA relative to baseline conditions. The proposed MTP/SCS does not include any improvements to light rail in the Yolo County HFTAs.

The noise impacts related to transportation improvements from implementation of the proposed MTP/SCS in the Yolo County HFTAs are considered less than significant (LS) for Impact NOI-1.

Mitigation Measures

SACOG does not have authority to require the implementing agencies to adopt the identified mitigation measures; the mitigation measures are within the responsibility and jurisdiction of another public agency. However, implementation of the following mitigation measure at a project level would reduce the impacts from noise, and agencies with jurisdiction to adopt these measures can and should do so (PRC Section 21081).

Mitigation Measure NOI-1: Employ measures to reduce noise from new land uses and transportation projects.

For projects that have not undergone previous noise study and that exceed acceptable noise thresholds, the implementing agency shall require a project-level evaluation of noise impacts in
accordance with applicable federal, state, and local noise standards. Where significant impacts are
identified, applicable mitigation measures shall be implemented, to reduce noise to be in compliance
with applicable noise standards. Mitigation designed to reduce noise impacts would apply to
construction and operation of new development within the projected land use pattern as well as
planned transportation improvements. Measures that shall be implemented, where feasible and
necessary to address site-specific impacts include, but are not limited to, the following:

- constructing barriers in the form of outdoor barriers, sound walls, buildings, or earth berms
to attenuate noise at adjacent sensitive uses;
- make mechanical modifications, operational modifications, or other changes to transit
systems to improved soundproofing and minimize unwanted noise, particularly during
sensitive times/hours.
- using land use planning measures, such as zoning, restrictions on development, site design,
and buffers to ensure that future development is compatible with adjacent transportation
facilities and land uses;
- constructing roadways so that they are depressed below-grade of the existing sensitive land
uses to create an effective barrier between new roadway lanes, roadways, rail lines, transit
centers, park-n-ride lots, and other new noise generating facilities;
- maximizing the distance between noise-sensitive land uses and new noise-generating facilities
and transportation systems;
- improving the acoustical insulation, window quality, and/or other soundproofing of dwelling
units (existing or proposed) where setbacks and sound barriers do not sufficiently reduce
noise; and
- using rubberized asphalt or “quiet pavement” to reduce road noise for new roadway
segments, roadways in which widening or other modifications require re-pavement, or
normal reconstruction of roadways where re-pavement is planned.

Significance After Mitigation

If the implementing agency adopts this mitigation measure, Impact NOI-1 would be reduced to a
less than significant level (LS). Projects taking advantage of CEQA Streamlining provisions of SB
375 (PRC Sections 21155.1, 21155.2, and 21159.28) must apply the mitigation measure described
above to address site-specific conditions, resulting in impacts that are less than significant (LS).
However, because SACOG cannot require the implementing agency to adopt this mitigation
measure, and it is ultimately the responsibility of a lead agency to determine and adopt project-
specific mitigation, this impact remains significant and unavoidable (SU).


Regional Impacts

The projected land use pattern has been classified into five general categories in the proposed
MTP/SCS:

- Residential: Residential uses include single-family and multi-family housing of all densities
and types.
- **Office and Commercial**: This category includes commercial uses that offer goods for sale to the public (retail) and service and professional businesses housed in offices. Office and commercial businesses include those that service neighborhood needs, community or regional needs. Government office buildings are included in this category.

- **Industrial**: The industrial category includes a mix of manufacturing and light industrial uses, some of which are found in business, research, and development parks. Light industrial activities include warehousing and some types of assembly work. Wholesaling and warehousing are also included in this category.

- **Public**: Non-office government buildings, public corporation yards, water and wastewater treatment plants, public utilities, libraries, schools, and other public institutions are found in this category. Hospitals are also included in this category.

- **Mixed-Use (vertical)**: Residential and commercial uses mixed within one building are included in this category.

Land uses generate different amounts of vibration and groundborne noise. For example, industrial uses and certain public buildings generate substantially more vibration and groundborne noise than residential and commercial uses as industrial land uses often operate machinery and other vibration-inducing equipment.

Similarly, transportation infrastructure projects generate varying levels of vibration and groundborne noise. Traffic, especially heavy truck traffic, can be a source of vibration and groundborne noise. Rail operations, including freight and light rail trains, can also be a source of vibration. Table 13-11 contains reference to vibration levels associated with heavy-duty equipment.

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Peak Particle Velocity at 25 feet</th>
<th>Approximate Lv at 25 feet, dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pile Driver – Impact</td>
<td>0.64</td>
<td>104</td>
</tr>
<tr>
<td>Pile Driver - Sonic</td>
<td>0.170</td>
<td>93</td>
</tr>
<tr>
<td>Vibratory Roller</td>
<td>0.210</td>
<td>94</td>
</tr>
<tr>
<td>Bulldozer</td>
<td>0.09</td>
<td>87</td>
</tr>
<tr>
<td>Loaded Trucks</td>
<td>0.08</td>
<td>86</td>
</tr>
<tr>
<td>Jackhammer</td>
<td>0.04</td>
<td>79</td>
</tr>
</tbody>
</table>

Source: Transit Noise and Vibration Impact Assessment, FTA-VA-1003-06

As explained above, portions of the plan area of the proposed MTP/SCS would experience transportation vibration in different ways. Because of the nature of vibration (vibration dissipates with distance from the source), new transportation operations would generate vibration, that could exceed thresholds for determining significance. However, such potentially significant vibration impacts would be confined to specific geographies and therefore cannot be evaluated from a regional perspective.
Localized Impacts

Center and Corridor Communities, Established Communities, Developing Communities, and Rural Residential Communities

Normal operation of residential, office and commercial, and mixed-use buildings are unlikely to generate substantial vibration or groundborne noise. Industrial and public buildings could generate vibration and groundborne noise during operations that involve the use of machinery or other vibration-inducing equipment. However, the amount of vibration produced is not anticipated to be excessive, as workplace vibration is typically addressed from an occupational health and safety perspective. As with noise, vibration dissipates with distance from the source, therefore surrounding land uses would unlikely be affected. Table 13-11 indicates that, even at close distances, vibration levels for most heavy-duty equipment are below 0.1 inches per second.

Therefore, the vibration and groundborne noise impacts related to the projected land use pattern from implementation of the proposed MTP/SCS in Center and Corridor Communities, Established Communities, Developing Communities, and Rural Residential Communities are considered less than significant (LS) for Impact NOI-2. No mitigation is required.

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

Therefore, the vibration and groundborne noise impacts related to planned transportation improvements from implementation of the proposed MTP/SCS in Center and Corridor Communities, Established Communities, Developing Communities, and Rural Residential Communities are considered potentially significant (PS) for Impact NOI-2. Mitigation is required. Mitigation Measure NOI-2 is described below.

Lands Not Identified for Development in the Proposed MTP/SCS

Although some housing and employment growth, consistent with historical trends, may occur in this Community Type within the MTP/SCS planning period, the proposed MTP/SCS does not forecast any development in these areas by 2040. Therefore, the vibration and groundborne noise impacts related to the projected land use pattern associated with implementation of the proposed MTP/SCS in Lands Not Identified for Development are considered less than significant (LS) for Impact NOI-2. No mitigation is required.

The proposed MTP/SCS would make a limited number of planned transportation improvements in the Lands Not Identified for Development. The focus for transportation improvements in these areas is on road maintenance, safety enhancements, other roadway operational improvements, and targeted capacity improvements to existing facilities that accommodate increased travel between urban areas. Traffic, especially heavy truck traffic, can be a source of vibration and groundborne noise. However, such vibration rarely occurs at a substantial level to cause annoyance to surrounding uses, as vehicles are supported on spring suspensions and pneumatic tires, which reduce the amount
of vibration and groundborne noise generated from vehicular traffic. Rail operations can also be a source of vibration. However, the proposed MTP/SCS does not forecast investments in new freight, commuter, or light rail projects in Lands Not Identified for Development. Therefore, no increased rail activity would occur in this community type as a result of the proposed MTP/SCS.

Therefore, the vibration and groundborne noise impacts related to the planned transportation improvements associated with implementation of the proposed MTP/SCS in Lands Not Identified for Development are considered less than significant (LS) for Impact NOI-2. No mitigation is required.

**High Frequency Transit Area Impacts**

*Placer County, Sacramento County, and Yolo County High Frequency Transit Areas*

The HFTA impacts associated with implementation of the proposed MTP/SCS are the same in each of the HFTAs as described above in the localized impacts discussion for Center and Corridor Communities, Established Communities, Developing Communities, and Rural Residential Communities.

Therefore, the impacts on vibration and groundborne noise related to the projected land use pattern associated with implementation of the proposed MTP/SCS in HFTAs are considered less than significant (LS) for Impact NOI-2. No mitigation is required.

The impacts on vibration and groundborne noise related to planned transportation improvements associated with implementation of the proposed MTP/SCS in HFTAs are considered potentially significant (PS) for Impact NOI-2. Mitigation is required. Mitigation Measure NOI-2 is described below.

**Mitigation Measures**

SACOG does not have authority to require the implementing agencies to adopt the identified mitigation measures; the mitigation measures are within the responsibility and jurisdiction of another public agency. However, implementation of the following mitigation measure at a project level would reduce the impacts from vibration and groundborne noise, and agencies with jurisdiction to adopt these measures can and should do so (PRC Section 21081).

**Mitigation Measure NOI-2: Employ vibration-reducing measures on new and expanded rail systems.**

The implementing agency can and should require project proponents to undertake a detailed evaluation of vibration and groundborne noise impacts and identify project-specific mitigation measures, as necessary to reduce vibration to a level that is in compliance with applicable local standards or FTA standards. Measures that can and should be implemented, where feasible and necessary to address site-specific conditions to minimize the effects of vibration and groundborne noise from rail operations include, but are not limited to, the following:

- complying with all applicable local vibration and groundborne noise standards, or in the absence of such local standards, comply with FTA vibration and groundborne noise standards;
- 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 floating slabs, resiliently supported ties, high-resilience fasteners, and ballast mats; and
- implementing operational changes such as limiting train speed and reducing nighttime operations.

**Significance after Mitigation**

If the implementing agency adopts this mitigation measure, Impact NOI-2 would be reduced to less than significant (LS). Projects taking advantage of CEQA Streamlining provisions of SB 375 (PRC Sections 21155.1, 21155.2, and 21159.28) must apply the mitigation measure described above to address site-specific conditions, resulting in impacts that are less than significant (LS). However, because SACOG cannot require the implementing agency to adopt this mitigation measure, and it is ultimately the responsibility of a lead agency to determine and adopt project-specific mitigation, this impact remains significant and unavoidable (SU).

**Impact NOI-3: Result in construction impacts that would increase noise levels above the Community Type CNEL thresholds identified in Table 13-4, result in increases of more than 1.5 dB at locations currently in exceedance of the CNEL thresholds for Center and Corridor Communities or more than 3 dBA at locations currently in exceedance of the CNEL thresholds over baseline conditions for the other community types; or result in excessive levels of vibration and groundborne noise.**

**Regional Impacts**

As noted in Table 13-4, there are no numeric regional thresholds for noise and vibration. The projected land use pattern and planned transportation improvements contribute different noise and vibration levels to the environment. Because of the nature of noise and vibration impacts (noise and vibration dissipate with distance from the source), construction associated with the projected land use pattern and planned transportation improvements would have noise and vibration impacts, but such potentially significant impacts would be confined to specific geographies and therefore cannot be evaluated from a regional perspective.

Localized impacts are discussed below in the Community Type and HFTA discussions.

**Localized Impacts**

- **Center and Corridor Communities, Established Communities, Developing Communities, and Rural Residential Communities**

  Construction of new developments or transportation improvements could result in temporary noise and vibration impacts from grading, paving, clearing, landscaping, staging, excavation, earthmoving, and other related construction activities. Such construction activities would require the use of heavy-duty construction equipment (e.g., pile drivers, back hoes, jackhammers) and vehicles that generate significant amounts of noise and vibration in the immediate vicinity of the source, often resulting in noise and vibration levels substantially higher than existing conditions. Tables 13-2 and 13-10 summarize typical construction noise and vibration levels for various construction activities. Noise
and vibration impacts from construction activities depend on several factors including the types of surrounding land uses, duration and type of construction activities, distance between source and receptor, and the presence or absence of barriers between source and receptor.

Construction impacts are considered temporary and localized in nature, as they are limited to the time during which the project is being constructed and confined to areas adjacent to the construction site. After the project is completed, all construction equipment and vehicles are removed. Any noise or vibration impacts associated with the structure itself, once fully completed and operational, are covered in Impact NOI-1 and NOI-2.

The projected land use pattern and transportation improvements have the potential to result in construction-related impacts that increase noise levels above the Community Type CNEL thresholds identified in Table 13-4 and substantially increase noise levels in locations currently in exceedance of a CNEL threshold; or result in excessive levels of vibration and groundborne noise from regional growth and new and expanded transportation infrastructure. Although construction noise is short-term, it can nonetheless result in substantial increases in ambient noise levels in the immediate vicinity of the construction site. Construction activities would occur in accordance with an applicable city or county standard related to acceptable hours of operation; however, if sensitive receptors are located in the immediate vicinity of construction activities, they could be adversely affected.

Therefore, the construction-related noise and vibration impacts related to the projected land use pattern and planned transportation improvements associated with implementation of the proposed MTP/SCS in Center and Corridor Communities, Established Communities, Developing Communities, and Rural Residential Communities are considered potentially significant (PS) for Impact NOI-3. Mitigation is required. Mitigation Measure NOI-3 is described below.

**Lands Not Identified for Development in the Proposed MTP/SCS**

Although some housing and employment growth, consistent with historical trends, may occur in this Community Type within the MTP/SCS planning period, the proposed MTP/SCS does not forecast any development in these areas by 2040. Therefore, the construction-related noise and vibration impacts related to the projected land use pattern associated with implementation of the proposed MTP/SCS in Lands Not Identified for Development are considered less than significant (LS) for Impact NOI-3. No mitigation is required.

The proposed MTP/SCS would make a limited number of planned transportation improvements in this Community Type by 2040. The focus for investments in these areas is on road maintenance, safety enhancements, other roadway operational improvements, and targeted capacity improvements to existing facilities that accommodate increased travel between urban areas. The localized impacts associated with implementation of the proposed MTP/SCS are the same as described in the Community Types discussion above. Transportation improvements in Lands Not Identified for Development have the potential to result in construction-related impacts that increase noise levels above the Community Type CNEL thresholds identified in Table 13-4 and increase noise levels by more than 3 dB in locations currently in exceedance of a CNEL threshold; or result in excessive levels of vibration and groundborne noise from regional growth and new and expanded transportation facilities.
Therefore, the construction-related noise and vibration impacts related to the planned transportation improvements from implementation of the proposed MTP/SCS in Lands Not Identified for Development are considered potentially significant (PS) for Impact NOI-3. Mitigation is required. Mitigation Measure NOI-3 is described below.

**High Frequency Transit Area Impacts**

*Placer County, Sacramento County, and Yolo County High Frequency Transit Areas*

Construction within HFTAs could result in temporary noise and vibration impacts from grading, paving, clearing, landscaping, staging, excavation, earthmoving, and other related construction activities. Such construction activities will require the use of construction equipment (e.g., pile drivers, jackhammers) and vehicles that generate significant amounts of noise and vibration in the immediate vicinity of the source, often resulting in noise and vibration levels substantially higher than existing conditions. Table 13-2 shows typical construction noise levels for various construction activities. Noise and vibration impacts from construction activities depend on several factors including the types of surrounding land uses, duration and type of construction activities, distance between source and receptor, and the presence or absence of barriers between source and receptor.

The impacts associated with implementation of the proposed MTP/SCS are the same in each of the HFTAs as described above in the localized impacts discussion for Center and Corridor Communities, Established Communities, Developing Communities, and Rural Residential Communities. The projected land use pattern and planned transportation improvements in all of the HFTAs have the potential to result in construction impacts that would increase noise levels above the Community Type CNEL thresholds identified in Table 13-4 and increase noise levels by more than 3 dBA in locations currently in exceedance of an applicable CNEL threshold; or result in excessive levels of vibration and groundborne noise from regional growth and new and expanded transportation infrastructure.

Therefore, the construction-related noise and vibration impacts related to the projected land use pattern and the planned transportation improvements from implementation of the proposed MTP/SCS in each of the HFTAs are considered potentially significant (PS) for Impact NOI-3. Mitigation is required. Mitigation Measure NOI-3 is described below.

**MITIGATION MEASURES**

SACOG does not have authority to require the implementing agencies to adopt the identified mitigation measures; the mitigation measures are within the responsibility and jurisdiction of another public agency. However, implementation of the following mitigation measures at a project-level would reduce the impacts from construction vibration and noise, and agencies with jurisdiction to adopt these measures can and should do so (PRC Section 21081).

**Mitigation Measure NOI-3: Reduce noise, vibration, and groundborne noise generated by construction activities.**

Measures that can and should be implemented to reduce noise, vibration, and groundborne noise generated by construction activities, where feasible and necessary to address site-specific considerations include, but are not limited to, the following:
▪ restrict construction activities to permitted hours in accordance with local jurisdiction regulations;

▪ properly maintain construction equipment and outfit construction equipment with the best available noise suppression devices (e.g., mufflers, silencers, wraps);

▪ prohibit idling of construction equipment for extended periods of time in the vicinity of sensitive receptors;

▪ locate stationary equipment such as generators, compressors, rock crushers, and cement mixers as far from sensitive receptors as possible; and

▪ predrill pile holes to the maximum feasible depth, provided that pile driving is necessary for construction.

**Significance After Mitigation**

If the implementing agency adopts this mitigation measure, Impact NOI-3 would be reduced to a less than significant (LS) level. Projects taking advantage of CEQA Streamlining provisions of SB 375 (PRC Sections 21155.1, 21155.2, and 21159.28) must apply the mitigation measure described above to address site-specific conditions, resulting in impacts that are less than significant (LS). However, because SACOG cannot require the implementing agency to adopt this mitigation measure, and it is ultimately the responsibility of a lead agency to determine and adopt project-specific mitigation, this impact remains significant and unavoidable (SU).